STATE OF CALIFORNIA -- NATURAL RESOURCES AGENCY EDMUND G. BROWN, JR., *Governor*

CALIFORNIA COASTAL COMMISSION
SOUTH CENTRAL COAST AREA
89 SOUTH CALIFORNIA ST., SUITE 200
VENTURA, CA 93001
(805) 585-1800

W 4.5a

ADDENDUM

Click here to go
to the original staff report.

DATE: August 7, 2012

TO: Commissioners and Interested Parties

FROM: South Central Coast District Staff

SUBJECT: Agenda Item W4.5a, Application No. R-4-07-098 (Malibu Lagoon), Wednesday, August 8, 2012

The purpose of this addendum is to respond to a request by Marcia Hanscom to suspend the coastal permit for Malibu Lagoon pending the outcome of the revocation request, to respond to additional assertions from the parties requesting revocation, and to attach correspondence from interested parties.

1.) Commission staff received an email from Marcia Hanscom on July 31, 2012 (Attachment 1), requesting the Executive Director to suspend CDP 4-07-098 for Malibu Lagoon while the revocation request is pending.

Pursuant to Section 13106 of the California Code of Regulations, when a revocation request is received, the Executive Director is required to review the stated grounds for revocation and, unless the request is patently frivolous and without merit, shall initiate revocation proceedings. Here, upon reviewing the subject request, and comparing it to the administrative record, the Executive Director found the revocation request to be indisputably without merit. Specifically, the Executive Director has determined that, in this case, in accord with Section 13106, no grounds exist for revocation of the permit. Nevertheless, because some familiarity with the record is necessary in order to demonstrate the lack of merit of this particular revocation request, and to maximize the opportunity for the revocation requester and the public to be heard, the Executive Director determined it would be prudent to set a hearing for an examination of the request and the record.

Furthermore, pursuant to Section 13107 of Title 14 of the California Code of Regulations, where the Executive Director determines, in accord with Section 13106, that grounds exist for revocation of a permit, the operation of the permit shall be suspended. In this case, the Executive Director did not suspend Coastal Development Permit 4-07-098, pending outcome of the subject revocation request, because the Executive Director has determined that, in accord with Section 13106, no grounds exist for revocation of the permit.

In her July 31, 2012 email, Ms. Hanscom incorrectly asserts that, for the past 20 years, it has been the practice of the Executive Director to place "a [hold] on the project in order to preserve the 'status quo'" pending a hearing on the revocation request. The assertion that every permit has been placed on hold pending every revocation request in the past 20 years is false. Revocation requests are evaluated on an individual case-by-case basis pursuant to Sections 13106 and 13107 of the Commission's regulations. In the past, the Executive Director has not always suspended permits pending a hearing on the revocation request, as asserted by Ms. Hanscom. For example, the Executive Director <u>did not</u> suspend the permit in the following recent revocation requests: R-A-3-SLO-09-055/069 (Los Osos Wastewater Project, San Luis Obispo Co., June 2012 hearing), R2-E-06-013 (Poseidon Resources Corp., San Diego Co., 2010 hearing), R-5-05-020 (Hearthside Homes/Signal Landmark, Bolsa Chica, 2008 hearing), R-A-3-MRB-06-064 (Colmer-Black Hill Villas, Morro Bay, 2008 hearing), R-4-00-147-R (Parker, Los Angeles, Co., 2007 hearing), R-5-06-042 (Pacific Jewish Center, 2007 hearing), R-4-01-145 (Hessami, 2004 hearing), and R-4-96-167 (Simon T., Los Angeles Co., 2003 hearing). Moreover, in 2005, CLEAN, a party requesting revocation in the present case, submitted a revocation request for CDP 5-03-478 (Playa Capital Company, LLC, Playa Del Rey), which was not suspended by the Executive Director pending the revocation request hearing. Thus, in the present case, it is not out of the ordinary that the permit was not suspended pending the outcome of the revocation request.

2.) An email was received by Commission staff on August 6, 2012, with a letter attached, dated August 3, 2012, from the parties requesting revocation, Wetlands Defense Fund and CLEAN. The email included five attached documents, included with this addendum. The letter asserts additional grounds for revocation pursuant to Section 13105(a) of Title 14 of the California Code of Regulations, asserting that: 1) the Final EIR was not finalized by the appropriate entity, 2) the General Plan was not updated for Malibu Lagoon State Park, 3) the size of the berm was not revealed to the Commission, and 4) misinformation was presented about public access.

<u>Assertions that EIR was not properly finalized:</u>

The first test in the review of the revocation grounds is whether the applicant included inaccurate, erroneous or incomplete information in connection with the subject coastal development permit application. The revocation request asserts that the Final EIR was not finalized by the appropriate entity, the State Park and Recreation Commission, and that the Commission relied on the document as if it were finalized. The statement that the Park and Recreation Commission was responsible for certifying the Final EIR is incorrect. The Department, not the Park and Recreation Commission, is responsible for approval of individual State Parks projects. The Park and Recreation Commission does certify EIRs for amendments to general development plans, but no such amendment was involved here (See Attachment 6, Letter from Kathryn Tobias to Chair Shallenberger, dated 8/7/12). The CEQA document (Malibu Lagoon Restoration and Enhancement Plan Final EIR SCH # 2005101123) was in fact properly certified by the California Department of Parks and Recreation in March 2006. In addition, the Commission's action was not dependent upon whether State Parks had formally certified the EIR. Thus, the request fails to establish that allegedly complete and accurate information would have caused the Commission to take a different action, also does not apply. Thus, this allegation does not raise a ground for revocation.

Furthermore, it is noted that the Coastal Commission has its own CEQA responsibilities. As explained in the Commission's 9/29/10 Staff Report and Recommendation (Section I.), Sections 13096(a) and 13057(c) of the Commission's administrative regulations require Commission approval of a Coastal Development Permit application to include findings supporting the conclusion that the approval of the application, as conditioned by any conditions of approval, is consistent with any applicable requirements of the California Environmental Quality Act (CEQA), Cal. Pub. Res. Code ("PRC") §§ 21000 *et seq.*, including specific findings evaluating the conformity of the development with the requirements of PRC section 21080.5(d)(2)(A). The 9/29/10 Commission Staff Report and Recommendation for CDP 4-07-098 contains findings that, as conditioned, there are no feasible alternatives or feasible mitigation measures available, beyond those required, which would substantially lessen any significant adverse impact that the activity may have on the environment. Therefore, the Commission found that the proposed project, as conditioned to mitigate the identified impacts, would be consistent with the requirements of the Coastal Act to conform to CEQA.

Assertions that a General Plan update was required:

Next, the August 3, 2012 letter asserts that the project required a general plan update that was not prepared by State Parks and that approval of contracts related to this project were not properly agendized, considered, and voted on by the State Park and Recreation Commission. This allegation is unrelated to the Commission's approval of CDP 4-07-098 and does not assert that inaccurate, erroneous, or incomplete information was provided in connection with the permit because no such plan amendment would be required; thus, this assertion does not raise any ground for revocation. Because the first test pursuant to Section 13105(a) of the Commission's regulations has not been met and there is no evidence that the applicant provided inaccurate, erroneous, or incomplete information in connection with the permit application regarding the assertions above, the second test, whether the information was submitted intentionally, does not apply. Similarly, the third test, whether complete and accurate information would have caused the Commission to take a different action, also does not apply.

Assertions regarding berm size and public access:

Further, the August 3, 2012 letter raises questions about the size of the berm and states that "it was never revealed in the record prior to the October 2010 Commission decision that the size of the berm would be sufficient to accommodate large trucks and heavy equipment traversing it." The incorrect assertion that the applicant provided inaccurate, erroneous, or incomplete information regarding the proposed berm was raised in the June 14, 2012 revocation request and addressed in the July 27, 2012 staff report (Section E.1.). Lastly, the same issues that we raised in the June 14, 2012 revocation request regarding public access are again raised in the August 3, 2012 letter. The issues raised regarding public access were fully addressed in the July 27, 2012 staff report (Section E.1.).

Attachments:

1.) Email from Marcia Hanscom to Commission staff, dated July 31, 2012
2.) Emailed documents from Marcia Hanscom to Commission staff, dated August 6, 2012 (with attachments)
3.) Letter from Chuck Almdale, Santa Monica Bay Audubon Society, to Commission staff, dated August 1, 2012
4.) Letter from Chuck Bragg, President, Santa Monica Bay Audubon Society, to Commission staff, dated August 2, 2012
5.) Statement of Support for the Malibu Lagoon Restoration Project from Santa Monica Bay Audubon Society, dated August 3, 2012
6.) Letter from Kathryn Tobias, Senior Staff Counsel, California State Parks, to Chair Shallenberger, dated August 7, 2012

-----Original Message-----
From: Marcia Hanscom [mailto:wetlandact@earthlink.net]
Sent: Tuesday, July 31, 2012 11:54 AM
To: Lester, Charles@Coastal; Hudson, Steve@Coastal; Ainsworth, John@Coastal
Cc: Anne Soble - #1; Suzanne Guldimann; Jessica Davis; Knowles Adkisson; Tony Barboza; Hillel Aron; jill.stewart@laweekly.com; Jeff Gottlieb
Subject: Malibu Lagoon - matter of urgency

Dr. Lester, Steve, Jack -

We are grateful you have granted a revocation hearing for Malibu Lagoon.

Every time I've witnessed a revocation hearing having been granted at the Coastal Commission in the past 20 years - the executive director placed a HOLD on the project in order to preserve "the status quo" so that further damage would not be done in case the commission approves the revocation.

I realize your staff report strongly defends the project's approval. Still, this is the Commission's decision.

Even state parks [former] director Ruth Coleman in her July 5 letter to you intimated that the project could be on hold for a few weeks without harming the contractor's schedule. (although the contractor's schedule really is irrelevant in this proceeding.)

In addition, there will be testimony and evidence the Commission will consider the day of the hearing.

AND we have just have found some additional serious omissions that state parks failed to reveal to your staff re: the EIR.

The deep digging which is beginning on site could alter things irreversibly.

Please ask Suzanne Goode and Mark Abramson to stop the project until the revocation hearing can be completed. At least honor the process your predecessor did, Dr. Lester.

Thank you for your consideration.

Speaking for Nature ~
Marcia Hanscom
Wetlands Defense Fund

Attachment 1

Geraghty, Amber@Coastal

From:	Marcia Hanscom [wetlandact@earthlink.net]
Sent:	Monday, August 06, 2012 2:04 PM
To:	Ainsworth, John@Coastal; Hudson, Steve@Coastal; Lester, Charles@Coastal; Geraghty, Amber@Coastal
Cc:	Roy van de Hoek
Subject:	Malibu Lagoon - Comments re: Revocation request
Attachments:	COMMENTS-Staff report REVOCATIONrequestMalibuLagoon.pdf; StateParkandRecCommission10-21-11minutes.pdf; 1978 SPC Minutes Malibu Lagoon Approval.pdf; 548 MALIBU PARK PLAN.pdf; 12-095.Malibu Lagoon Restoration Project.CSP Logo.Davis.072712-resp.pdf; resolution 28-2008 - ano nuevo sp gp - 10-31-08 - final-attest(1)-1.pdf

Jack, Charles, Steve, Amber ~

I never heard back from any of you as to the deadline for submitting information to the Commission, and while I know such information can be submitted at the hearing, I've compiled this information, along with our comments to staff report and NEW INFORMATION to be considered at the Malibu Lagoon revocation hearing together as quickly as possible and am sending to you electronically. I can also fax the actual letter to you this evening, but I will simply send the attachments along with this letter via this email message. Please consider all of this information in the record.

Thank you.

Marcia Hanscom
Wetlands Defense Fund

attachments, besides our NEW COMMENTS, dated August 3, 2012
1. State Park and Recreation Commission minutes 10.21.11 - includes excerpts in the letter we've submitted today, as stated by staff, counsel
2. 1978 SPCommission minutes - showing previous approval by the Commission (of #3 below)
3. Malibu Lagoon State Beach (Park) Plan, 1978; Edmund G. Brown, Jr., Governor; Huey D. Johnson, Secretary of Resources (the plan that required amendment and/or update for the current lagoon project)
4. Letter of July 27, 2012, from State Parks counsel
5. A resolution for a general plan and EIR review for Ano Nuevo State Park -
which includes relevant information about "independent judgment" that the State Park and Recreation Commission obviously realized in 2008 it needed to exercise.

Received
AUG 06 2012
California
Coastal Commission

Attachment 2

Wetlands Defense Fund
Protecting wetlands
the cradle of life

CLEAN
COASTAL LAW ENFORCEMENT ACTION NETWORK

Wetlands Defense Fund
protecting wetlands, the cradle of life
322 Culver Blvd., # 317
Playa del Rey, CA 90293
(310) 821-9045

<u>SENT BY FACSIMILE ON AUG 6.12</u>
<u>TO VENTURA OFFICE of CCC</u>
<u>& BY EMAIL TO COMMISSION ED & CHAIR</u>

Coastal Law Enforcement Action Network
enforcing laws protecting the California coast
181 Culver Blvd., Ste. C
Playa del Rey, CA 90293
(310) 877-2435

August 3, 2012

The Honorable Mary Shallenberger, Chair, California Coastal Commission
and Honorable Coastal Commissioners
& Staff, c/o Dr. Charles Lester, Executive Director
c/o Ventura office – sent via facsimile (805) 641-1732
89 South California Street, Suite 200
Ventura, CA 93001-2801

<u>Re: Request to Consider Revocation of Coastal Development Permit (CDP) # 4-07-098</u>
<u>"Malibu Lagoon Restoration & Enhancement Plan" – Comments Reply to Staff Report</u>

Dear Commission Chair Shallenberger, Commissioners and staff:

We write to reply to the staff report related to our request to revoke the permit #4-07-098 that provides permission under the California Coastal Act for the Santa Monica Bay Restoration Foundation, California State Parks and the Resource Conservation District of the Santa Monica Mountains to proceed with what is referred to in the record as the "Malibu Lagoon Restoration & Enhancement Plan." We respectfully ask that you revoke this permit for the reasons stated in this letter and also those included in the record for this request.

We are grateful for the scheduling of this hearing, and wish to clarify our concerns, respond to issues raised in the staff report and **additionally provide you with new information we have just uncovered that makes for an even more compelling case and solid grounds for revoking this permit that, if left in place, will continue with the grave damage already done to this coastal wetland ecosystem**

and will likely alter irreversibly habitat that we are discovering increasingly is crucial for numerous imperiled species.

We invoke the following law to request this hearing, as we believe the facts support grounds for revocation of permit accordingly:

> Section 13105(a) of the California Code of Regulations, which states the following grounds for revocation of a CDP:
>
> intentional inclusion of inaccurate, erroneous or incomplete information in connection with a coastal development permit application, where the commission finds that accurate and complete information would have caused the commission to require additional or different conditions on a permit or deny an application (14 CCR §13105).

Several issues rise to this standard.

Perhaps the most important one relates to information we recently discovered in terms of the underlying documents relied on by this Commission (the one that was sitting and hearing this issue in October, 2010) and your staff. This issue was discovered subsequent to our initial request and submission for a revocation hearing.

COASTAL COMMISSION'S RELIANCE ON FINAL CEQA APPROVAL

One of the most important documents that was relied on for approval of the Coastal Development Permit was the alleged completion of a Final Environmental Impact Report (FEIR) as required by the California Environmental Quality Act (CEQA.) The federal version of this process, under NEPA (National Environmental Policy Act), was also not followed properly – i.e., a Finding of No Significant Impact (FONSI) was determined by the US Army Corps of Engineers, in spite of the need for consultation under the Endangered Species Act and significant impacts to wetlands in the coastal zone**, but the Coastal Commission particularly relied on the EIR having been properly considered and approved, which it was not.**

The staff report from the Coastal Commission approval of October, 2010, counts the EIR as one of its substantive file documents, on pages 8 & 9, including its state clearinghouse #, yet this document was never approved by the decisionmaking body, as required by CEQA. To underscore this reliance on the EIR, the October, 2010 staff report specifically states on page 27 that:

> "All mitigation measures required in the Malibu Lagoon Restoration and Enhancement Plan Final Environmental Impact Report SCH #2005101123 applicable to the proposed project are hereby incorporated by reference as special conditions of the subject permit unless specifically modified by any additional special conditions set forth herein."

The problem is this: The decisionmaking body for State Parks never approved the Final EIR.

Additionally, on page 40 of the staff report, this erroneous statement (apparently CCC relying on the erroneous information provided by the applicant and its agent), clearly states:

> "A Final Environmental Impact Report was completed for this project dated March 2006."

To the Commissioners (and presumably to staff), this statement likely meant that all final approvals, including the required consideration and approval by the State Park and Recreation Commission, had been completed. But this is not the case.

Another important location in the October 2010 staff report where the Coastal Commission and its staff heavily relied on the approval of a Final EIR (which never happened) is on page 56:

> Excerpt:
> "According to the March 2006 Final Environmental Impact Report, lagoon habitats do not support many mammal or reptile species because most of the available scrub habitat is very dense at ground level and the coastal salt marsh is almost entirely covered with jaumea with little ground exposed…."

The excerpt goes on to detail only some of the construction impacts to the biological resources – others of which might have been revealed had the public been notified of a hearing and had the opportunity to review the Final EIR at a hearing with a decisionmaking body, which is required in order to finalize an EIR. For example, Dr. Travis Longcore, a biologist who has studied historical ecology of the region has expressed concern to us that the EIR did not include an adequate review of mammals or reptiles. Had this FEIR been properly before the State Park and Recreation Commission, his view and those of others would have had the opportunity to have been considered.

The conclusion from this excerpt above is even more revealing now that the project has been underway for the last two months, as the facts have shown a different reality. For example, dozens of reptiles were trapped just prior to and during the entrance to the project site of heavy construction equipment.

Additionally, a rare mammal species – the South Coast Marsh Vole *(Microtus californicus stephensi)* has been documented as having been on site (in significant part due to the observation and photography by naturalist Jonathan Coffin and due to observation, scientific analysis and research by biologist Robert van de Hoek), with two known carcasses having been delivered to the Los Angeles Natural History Museum for identification; the rare species has now been verified. There are reports that as many as fifty (50) of these rare voles were trapped and/or otherwise removed from the project site during construction. Scientists who know this species and its habitat requirements have opined that it is highly unlikely that the "moving" or "relocation" of this species would be successful, especially since most of the suitable habitat for the species has now been removed from the site.

Had this EIR been afforded a full hearing at the State Park and Recreation Commission, as was the duty of the State Parks Department to insure would occur, scientists familiar with the species which reside in coastal wetlands such as Malibu Lagoon would have had the opportunity to correct the inaccurate statement that "lagoon habitats do not support many mammal or reptile species…." – and perhaps even a State Parks Commissioner might have been aware of this inaccurate statement and been able to vote to approve or disapprove the EIR accordingly.

Page 56 of the October 2010 staff report also cites and relies on the bird species present at Malibu Lagoon, ignoring totally birds like the Virginia Rail and Sora, which are species that reside in the Tule Reeds which were completely decimated at the project site in the first few weeks of construction. Thus, no mitigation measures were ever considered for these species. Page 58 cites the FEIR again where it states:

> "Additionally, according to the Final Environmental Impact Report (FEIR) for the project, no work will be done in the main lagoon channel that the California Least tern uses for roosting habitat…."

Further citations from the FEIR are included in this October 2010 staff report when documenting information about other bird species, fish, lagoon vegetation and cultural resources.

Finally, the October 2010 Coastal Commission staff report re-states in its own CEQA determination that:

> "As noted above, the project was also evaluated in the Malibu Lagoon Restoration and Enhancement Plan Final Environmental Impact Report (EIR), SCH# 2005101123, adopted by the California Department of Parks and Recreation, dated March 2006. All of the mitigation measures required in the EIR have been considered and incorporated as conditions of this project approval."

While the Coastal Commission has its own independent duty to approve a project in accordance with CEQA, this particular CEQA approval was relying on a much more substantive document that was represented to have been fully circulated to the public and heard before an authorized decisionmaking body, in this case, the State Park and Recreation Commission, which is charged with such deliberations for California State Parks. The State Park and Recreation Commission, however, did not ever notice, hear, consider or approve this project, its EIR or any general plan update or amendment, as is their duty.

Besides the strong reliance on a perceived-to-be-final EIR approval in the October 2010 staff report, there were numerous statements made on the record during the Oceanside, October 2010 hearing of the Coastal Commission. Here are some relevant excerpts from the transcript that reflect that reliance:

- "And secondly, we have heard a lot about less environmentally damaging alternatives today, and you know, ***we had a very long EIR process.*** We did a lot of notifications. We had a very long stakeholder participation process prior to that, and we believe we fully vetted the alternatives – we had multiple alternatives, and this was the most preferable alternative, and I think the staff report also supports that." (Kara Kemmler (Pera Kumler [sic]), State Coastal Conservancy, beginning at line 20, p. 126, transcript, ***emphasis added***)

- "Well, to begin with the EIR was never challenged in the original CEQA proceeding that the lead agency undertook, so ***that CEQA process is considered final*** and the Commission doesn't have any role in challenging that process once it has been completed…..***The CEQA process, with regards to the lead agency, however, is complete***." (CCC Chief Counsel Hope Schmeltzer, beginning at line 23, page 123, transcript, ***emphasis added***)

• "We would think that the CEQA process hasn't even occurred yet. Of course it had, ***it was completed in 2006.***" (Mark Gold, project supporter, Heal the Bay who was awarded several grants from the State Coastal Conservancy to plan the Malibu Lagoon project, beginning at line 6, page 79. ***emphasis added***)

• "I will quickly say the Conservancy has been involved and has supported a public planning process for 20 years, and that process has included a lot of people involvement, and it has been, in this ***project before you today has been entirely consistent….with the EIR that was adopted. And there are no significant effects in this project that weren't analyzed in the EIR document***, so we hope that you will approve it today." (Mary Small, State Coastal Conservancy, one of the funders and primary managers of the project, beginning at line 10, page 84 ***emphasis added***)

Was the EIR "adopted" as Mary Small from the State Coastal Conservancy claimed? It was not.

DERELICTION OF DUTIES: STATE PARK AND RECREATION COMMISSION – CEQA PROJECT APPROVAL AND GENERAL PLAN UPDATE APPROVAL: NEITHER WAS DONE

The EIR was "certified" by staff but was never approved by any deliberative body. State Parks staff "certified" the EIR, or at least it seems they did, as State Parks Ecologist Suzanne Goode registered a NOD (Notice of Determination) on the State Clearinghouse site, and there is a line for signature by State Parks Deputy Director of Operations Ted Jackson on the FEIR, although the only version of the "Final" EIR we have seen does not include his signature. **Still, there is no record of the State Park and Recreation Commission having approved the project under consideration and described by the EIR, which is their duty as a "responsible agency" according to CEQA.**

This alleged "approval" by State Parks would be akin to a Coastal Development Permit (CDP) being "approved" by the staff for the Coastal Commission. Staff does not have that authority. The body that was supposed to approve the EIR, which was heavily relied on by the Coastal Commission in granting the project a CDP on October, 2010, was the State Park and Recreation Commission.

To illustrate and underscore the fact that State Parks – whose project application was approved by the Coastal Commission on October, 2010, KNOWS that it was the duty of the State Park and Recreation Commission to approve this Malibu Lagoon project, and especially to perform their duty as a "responsible agency," this excerpt from the minutes from the October, 2011, meeting of the Commission is helpful:

http://www.parks.ca.gov/pages/843/files/10-21-11minutes.pdf

ITEM 5B: Consideration and possible action on the Department recommendation to Adjust the classifications of Lake Valley State Recreation Area and Washoe Meadows State Park to restore the Upper Truckee River and floodplain by relocating a portion of Lake Tahoe Golf Course out of the river, which involves a transfer of more environmentally sensitive land from Lake Valley State Recreation Area to Washoe Meadows State Park and the transfer of less sensitive land from Washoe Meadows State Park to Lake Valley State Recreation Area

ITEM 5C: ***Consideration and possible action on the Department recommendation to review and consider the Final Environmental Impact Report*** for Upper Truckee River Restoration and ***adoption of the general plan amendment*** for Lake Valley State Recreation Area. (***emphasis added)***

FROM THE MINUTES:

> "In conclusion, Mr. Ray reiterated that the proposal before the Commission would allow for the restoration of the Upper Truckee River while affecting only about 5% of the park property, allowing the continued operation of an 18-hole golf course, and providing additional recreation opportunities. Mr. Ray informed commissioners that the environmental impact report (EIR) for the proposal had been certified by State Parks Director Ruth Coleman, and ***he requested that the Commission consider the EIR as they perform their decisions as a responsible agency.***
>
> Commissioner Kogerman and Ms. Tobias engaged in a brief conversation concerning the noticing requirements for Commission actions such as this and the process for noticing. Ms. Tobias explained that the action currently before the Commission was somewhat unique. She explained that the Commission had no jurisdiction over the proposed project, but that it did have the authority to approve classifications and general plan amendments. She explained that the proposed project therefore required approval of the park unit classifications and general plan amendment to proceed. ***Ms. Tobias noted that the California Environmental Quality Act (CEQA) process was separate from approval of the project. She explained that California State Parks was the "lead agency" for the purposes of CEQA and the Commission a "responsible agency." A final environmental impact report (EIR) which had been certified by the Director of California State Parks was being brought to the Commission, which then, as a responsible agency, must make a decision to allow the project to proceed.*** If approved by the Commission, authority to approve the project would then be made by the Director of California State Parks. Commissioner Kogerman and Kathryn Tobias also discussed whether or not there existed any legal impediment to the Commission making a decision at this time. Ms. Tobias stated that she did not believe any such impediment existed. (***emphasis added)***

Clearly, the State Parks staff knows what the duty is of the State Park and Recreation Commission is relative to the approval of a final EIR, such as the one for the Malibu Lagoon "Restoration and Enhancement Project."

As a reader can easily see, it was the Department's practice as late as this past October to bring an agenda item to the State Park and Recreation Commission for "***consideration and possible action on the Department recommendation to review and consider a Final Environmental Impact Report"*** and to adopt a general plan amendment for a project restoration. In addition, according to page 9 of these minutes, 61 individuals were afforded the opportunity to speak on this item and to have their concerns considered as part of the deliberations by the State Park and Recreation Commission.

Had the public known this fact, and had this situation been brought to light at the October, 2010, hearing, we are certain that the California Coastal Commission and its staff would have realized this egregious departure from procedure and established law and asked that the final EIR be sent

to the State Park and Recreation Commission for proper consideration prior to the determination being made on a CDP by the Coastal Commission.

To clarify further, as stated in CEQA Guidelines section 15090, subdivision (a) (***emphases added)***:

> "(a) Prior to approving a project the lead agency shall certify that:
>
> (1) The final EIR has been completed in compliance with CEQA;
>
> (2) The final EIR was presented to the ***decisionmaking body*** of the lead agency and that the decisionmaking body reviewed and considered the information contained in the final EIR ***prior to*** approving the project; and
>
> (3) The final EIR reflects the lead agency's independent judgment and analysis."

See also CEQA § 21061 (***emphasis added)***:

> "An environmental impact report is an informational document which, when its preparation is required by this division, shall be considered by every public agency ***prior to*** its approval or disapproval of a project."

Finally, please note CEQA Guidelines § 15025 (***emphases added)***:

> "(a) A public agency may assign specific functions to its staff to assist in administering CEQA. Functions which may be delegated include but are not limited to:
>
> (1) Determining whether a project is exempt.
>
> (2) Conducting an initial study and deciding whether or prepare a draft EIR or negative declaration.
>
> (3) Preparing a negative declaration or EIR.
>
> (4) Determining that a negative declaration has been completed within a period of 180 days.
>
> (5) Preparing responses to comments on environmental documents.
>
> (6) Filing of notices.
>
> (b) The ***decisionmaking body of a public agency shall not delegate*** the following functions:
>
> (1) ***Reviewing and considering a final EIR*** or approving a negative declaration prior to approving a project.

(2) The making of findings as required by Sections 15091 and 15093."

After an exhaustive search of minutes from the State Park and Recreation Commission minutes, as well as after review of a Public Records Act reply that was received by citizen John Davis from State Parks counsel (see attachment A to this letter), we are persuaded that the decisionmaking body for State Parks, i.e., the State Park and Recreation Commission, was derelict in its duties to review or consider approving a final EIR and in making findings of that EIR.

While there is a set of findings that can be found, there is no evidence that these findings were ever considered or approved by the decisionmaking body for State Parks, i.e., the State Park and Recreation Commission.

Had the public known these facts, and had this situation been brought to light at the October, 2010, hearing, and had Commissioners properly considered these facts along with the requirements of the law, we believe that the California Coastal Commission and its staff would have realized this egregious departure from procedure and established law and asked that the final EIR be sent to the State Park and Recreation Commission for proper consideration prior to the determination being made on a CDP by the Coastal Commission.

GENERAL PLAN UPDATE TO MALIBU LAGOON STATE PARK ALSO NOT APPROVED

Besides approving the "project" that was the subject of the EIR, the State Park and Recreation Commission was also required to consider and approve an update to the General Plan for this particular park unit, the Malibu Lagoon State Park.

Following is an excerpt from the Public Resources Code which covers the responsibilities of the State Park and Recreation Commission related to the General Plan.

CAL. PRC. CODE § 5002.2: California Code – Section 5002.2

(a) Following classification or reclassification of a unit by the State Park and Recreation Commission, and ***prior to the development of any new facilities in any previously classified unit***, ***the department shall*** prepare a general plan or ***revise any existing plan***, as the case may be, for the unit.

The general plan shall consist of elements that will evaluate and define the proposed land uses, facilities, concessions, operation of the unit, ***any environmental impacts,*** and the management of resources, and shall serve as a guide for the future development, management, and operation of the unit.

The general plan constitutes a report on a project for the purposes of Section 21100. ***The general plan for a unit shall be submitted by the department to the State Park and Recreation Commission for approval.***

(emphases added.)

The code goes on to explain what exemptions there might be for such a general plan revision or update, and clearly this project does not fall into those allowed exemptions. The added amphitheatre, bird blinds and other interpretive exhibits, as well as the complete re-contouring of the wetland area itself all point to the need for a general plan update, which was never prepared by the State Parks staff nor considered or approved by the State Park and Recreation Commission. **In addition, approval of contracts related to this project development should have been properly agendized, considered and voted on by the State Park and Recreation Commission. They were not.**

PROJECT TIMING, CRITICAL HABITAT DESIGNATIONS

While we still have grave concerns about the project timing and critical habitat designations, staff has outlined places in the record which appear to show that these concerns were, indeed, before the Commission when it made its decision, albeit a decision that did not take into consideration the important needs of the species which have had their habitat harmed and altered, in some cases irretrievably. Still, there is at least one specific concern related to these imperiled species issues which was only brought to light at the beginning of construction for the project.

Specifically, we do not think **the size of the berm** that was placed atop and nearby the habitat where Tidewater Goby *(Eucyclogobius newberryi)* breeding was shown to have been taking place in the 2005 surveys **was going to be as wide or intrusive into the main lagoon as it is.** It was never revealed in the record prior to the October 2010 Coastal Commission decision that the size of this berm would be sufficient to accommodate large trucks and heavy equipment traversing it.

Repeatedly, in the record, it is claimed that no work will be done in the main lagoon or the main channel, and so it was likely inferred by the Commission and its staff, as it was by the public, that the breeding areas of the Tidewater Goby that have been historically characterized as being in the "main lagoon" or the "main channel" would not have been harmed by a berm of inconsequential size. However, as the berm was being constructed, we were horrified to see that the berm was a big and wide as it is and is indeed exactly where one of the prime breeding areas for Tidewater Goby was identified in the 2005 Swift & Dagit survey.

PUBLIC ACCESS

Despite the replies in the staff report to our public access concerns, we still maintain that during the public hearing for the Coastal Commission permit for this project, it was repeatedly stated that public access would not be impeded during construction and that access to the beach would be open. It is easy to believe that the permit would never have been granted otherwise.

At no time during the permit approval process did the public understood or been informed, nor was the Coastal Commission itself informed that public access to Surfrider Beach's 3rd point would be atop a constructed dike or berm that is wide enough for large construction trucks and heavy equipment to traverse over. Concerns re: ADA compliance, wheelchair accessibility, stroller accessibility and other safety concerns were never vetted or addressed.

Given the continued reassurances by project proponents that the "Malibu Lagoon Restoration & Enhancement Plan" that public access WOULD NOT BE IMPEDED, it is shocking and completely unacceptable that public access provisions to an area that is one of southern California's most popular beach destinations – in the height of summer tourism season – is being treated so cavalierly by the state agencies that are carrying out this plan. Those who participated in the October, 2010, hearing on this issue are convinced that this permit would never have been granted had such egregious blocking of public access from this important coastal region during heavy summer use were known and understood at the time.

This issue would likely have also had further sunlight shining on it had the State Park and Recreation Commission and its State Parks employees not abandoned its duties by avoiding the requirement to approve this project as required by law.

<u>TEST FOR REVOCATION:</u>

Beginning on page 13 of the Coastal Commission's staff report for this revocation hearing, the grounds are laid out as follows, with our conclusions based on these stated tests and the information presented above and attached.

Re: Test #1 – your staff report states:

> "Grounds for revocation under Section 13105(a) of the Commission's regulations can be reduced to three elements or tests, all of which must be satisfied for the Commission to grant revocation:
>
>> Test 1: Did the application for Coastal Development Permit 4-07-098 (California Department of Parks and Recreation) include inaccurate, erroneous or incomplete information in connection with its application?"

The information provided earlier in this letter is sufficient to show that, yes, indeed, State Parks and its agents (including Santa Monica Bay Restoration Foundation, Heal the Bay and State Coastal Conservancy) erroneously represented (or provided incomplete information) about the "final" nature of the EIR, and whether or not the project and its planning documents (including EIR and General Plan amendments/ updates) were properly or legally approved.

Re: Test #2 – your staff report states:

> "Test 2: If the applicant included inaccurate, erroneous or incomplete information, was the inclusion of such information intentional?
>
> Neither the Coastal Act nor the Coastal Commission regulations define the term "intent" for purposes of determining whether an applicant has intentionally submitted inaccurate, erroneous or incomplete information to the Commission. In general, the Commission may conclude that there was intent based on "the sort of evidence on which responsible persons are accustomed to rely in the conduct of serious affairs." (14 C.C.R. Section 13065). The law related to fraudulent misrepresentation, however, explores the definition of intent in the context of misrepresentation of facts, which is what is at issue in a revocation hearing. As a result, this area is instructive to the Commission when it considers a revocation request.
>
> One element of a claim for fraudulent misrepresentation is the intent to defraud or induce reliance. *Cicone v. URS Corporation* 183 Cal. App.3d 194, 200 (1986). In establishing this element, "the only intent by a defendant necessary to prove a case of fraud is the intent to *induce reliance*. Moreover, liability is affixed not only where the plaintiff's reliance is intended by the defendant but also where it is *reasonably expected* to occur." *Lovejoy v. AT&T Corp.* (2001) 92 Cal. App. 4th 85, 93, (2001). (emphasis in original.) Thus, a defendant may be liable for fraud even for unanticipated reliance by a plaintiff. *Id.* at p. 94. In addition, a party's intent to induce reliance may be inferred from his or her failure to disclose facts as required by statute. *Lovejoy v. AT&T Corp.* 119 Ca. App. 4th 151 (2004). ***Thus, the Commission may infer that the applicant intentionally submitted inaccurate, erroneous or incomplete information if it finds that the applicant failed to disclose facts as required by the Coastal Act." (emphasis added)***

It is clear in the repeated testimony from the October 2010 Coastal Commission hearing cited above that the applicant and its partners and agents **intended to induce reliance on the EIR** – an EIR that was not ever approved or relied on it approval of a project, contract approvals or general plan amendments or updates by the appropriate responsible agency, the State Park and Recreation Commission – and that information – that the State Park and Recreation Commission did not ever take such action was part of the "erroneous, inaccurate or incomplete information" that, by definition, was not considered when this CDP was approved.

In other words, State Parks **failed to disclose the facts** that the State Park and Recreation Commission failed to perform its duties under the numerous Public Resource Codes stated outlined in this letter. Therefore, the answer to Test #2 is "yes."

Re: Test #3 – your staff report states:

> "Test 3: If the answers to both Test 1 and Test 2 are yes, would accurate and complete information have caused the Commission to require additional or different conditions or to deny the application?"

Given such complete and strong reliance on what was represented to be a "completed," "approved" and "final" EIR, including reliance on its many mitigation measures, it is a no-brainer to determine that – had this information been before the California Coastal Commission prior to its decision on October 2010 - **the Commission would have required that the EIR be sent back to the State Park and Recreation Commission for consideration, proper hearing and approval, and also would have likely required as a condition of approval that additional approvals of financial contracts and general plan amendments and/or updates be considered and approved prior to the Coastal Development Permit being issued.** Therefore, the answer to Test #3 is also a "yes."

DUE DILIGENCE:

Because this is all new information, only coming to light that the information was not revealed by the applicant - since the start of the project the first week of June, about:

• the size and breadth of the berm being constructed in the Tidewater Goby habitat considered part of the "main lagoon" or "main channel";

• the new information about public access being diverted to the berm:

as well as the most egregious of these facts being considered under this revocation hearing (only discovered during research of the past few recent weeks)

• that there was a complete dereliction of duties by State Parks and its decisionmaking body, the State Park and Recreation Commission, in terms of project, general plan and EIR approvals, the issues we are asking you to consider now were filed with complete due diligence and as quickly as possible to compile the appropriate information.

Legally, you must approve the revocation of this permit and require the State Park and Recreation Commission cure its dereliction of duties.

From a practical standpoint, we recognize that the project has already begun and had already brought substantial damage to the resources of Malibu Lagoon State Park. We also recognize and believe, based on the opinions of several expert biologists with whom we have conferred, that additional damage to the ecosystem and the surfing waves that are the essence of Malibu Surfrider Beach could be avoided if the project were stopped and agencies, advocates, community leaders and biological & hydrology experts were to be called together to determine what is best for the project site in light of the new science (see Dr. Longcore's letter), the habitat needs of rare and imperiled species and the current circumstances.

Due to all of the facts presented herein, and according to the provisions of the law, we ask that the Commission revoke the permit for this project, order a stop of the project, and call the interested parties together as quickly as possible for a mediation to determine what is acceptable to go forward in order to minimize damage to coastal resources and to public access, while insuring that the public's due process rights are respected and that State Parks is held accountable for its severe departure from its required duties and compliance with the law.

Sincerely,

Marcia Hanscom /s/

Marcia Hanscom
Executive Director
WETLANDS DEFENSE FUND
Protecting wetlands ~ the cradle of life
322 Culver Blvd., Ste. 317
Playa del Rey, CA 90293
(310) 821-9045

Robert van de Hoek/s/

Robert van de Hoek
President & Wildlife Biologist
COASTAL LAW ENFORCEMENT ACTION NETWORK (CLEAN)
181 Culver Blvd.,Ste. C
Playa del Rey, CA 90293
(310) 877-2435

cc: The Law Offices of James Birkelund

CALIFORNIA STATE PARK and RECREATION COMMISSION

Clubhouse of the Lake Tahoe Golf Course at Lake Valley State Recreation Area
2500 Emerald Bay Road
South Lake Tahoe, California

Minutes of the Meeting · Friday, October 21, 2011

COMMISSIONERS PRESENT

Caryl Hart, CHAIR
Maurice Johannessen
William "Bill" Kogerman, VICE CHAIR
Tommy Randle
Paul Junger Witt
Elva Yanez

COMMISSIONERS ABSENT

Alice Huffman

CALIFORNIA STATE PARKS STAFF

Ruth Coleman, DIRECTOR
Matt Green, ACTING SUPERINTENDENT, SIERRA DISTRICT
Jim Luscutoff, CHIEF, CONCESSIONS, RESERVATIONS, AND FEES DIVISION
Ann Malcolm, CHIEF COUNSEL
Louis Nastro, ASSISTANT TO THE STATE PARK AND RECREATION COMMISSION
Dan Ray, CHIEF, PLANNING DIVISION
Roy Stearns, DEPUTY DIRECTOR, COMMUNICATIONS
Kathryn Tobias, SENIOR STAFF COUNSEL
Cyndie Walck, PROJECT MANAGER, UPPER TRUCKEE RIVER RESTORATION & GOLF COURSE RECONFIGURATION

SPEAKERS REGISTERED/REPRESENTING

Jenny Albanese/Self
Lori Allessio/Self
Laurel Ames/Self
Bob Anderson/Tahoe Area Sierra Club
Harold Anino/Self
Patricia Ardavany/Self
Elizabeth Baker/The Council of Elders
Doug Bigelow/Self
Stew Bittman/Self
Casey Blann/Self and Tahoe Chamber.org
Mike Bradford/Self
Jay Brazil/Self
Carol Chaplin/Self
Theresa Cody/USDA Forest Service-Lake Tahoe Basin Management Unit
Darrel Cruz/Washoe Tribe of Nevada & California
Taylor Currier/California Trout
John Dayberry/Self

Hillary Dembroff/Self
Jerry Dion/Self
Janet Domas/Self (registered but did not speak)
Carl Fair/Self
Jack Francis/Self (registered but did not speak)
John Gooding/Self
Kim Gorman/Self
Nancy Graalman/Defense of Place
Patricia Handal/Self
Jim Hildinger/Self
Rick Hopkins/Self
Deb Howard/Self
Huey D. Johnson/Resource Renewal Institute
Brian Judge/Tahoe Regional Planning Agency
John Klimaszewski/Self
Monica Kohs/Self
Robert Larson/Lahontan Water Board
Joann Marchetta/Tahoe Regional Planning Agency (registered but did not speak)
Nancy McDermid/Self
Gary Mennel/Self
Jeff Miner/Self and Washoe Meadows Community
Karen Miner/Self
Patrick Moeszinger/California Department of Fish & Game
Steve Noll/Self
Lisa O'Daly on behalf of Darren Johnson
Lynne Paulson/Self
Joe Pepi/California Tahoe Conservancy
Jeff Perry/American Golf Corporation
JoAnn Robbins/Self
Doug Ross/Self (registered but did not speak)
Glen Russell/Self (registered but did not speak)
Krissi Russell/Self
Norma Santiago/El Dorado County Supervisors (registered but did not speak)
Emily Sefelo/Self
Kathy Strain/Self
Rachel Swain/Self
North Swanson/Tahoe Area Naturists
Linda Thompson/Self
Keith Wagner/Washoe Meadows Community
Dr. Ken Weitzman/Self
Neil Wolf/Self
Holli Wright/Self
Daunelle Wulstein/Self
Katarina Wulstein/Self
Nicole Zaborsky/Self

CALL TO ORDER

Legal notice having been given, Commission Chair Caryl Hart called this meeting of the California State Park and Recreation Commission to order at 9:05 a.m. The Chair thanked everyone attending the meeting and then introduced the commissioners and California State Parks staff who were present.

AGENDA ITEM 1:

APPROVAL OF MINUTES OF THE JULY 8, 2011 MEETING IN SACRAMENTO

Chair Hart asked if there were any changes to the draft minutes of the Commission's July 8, 2011 meeting in Sacramento. There being none, the Chair noted that reading of the minutes would be waived and the draft minutes hereby approved by the Commission.

REPORT FROM CLOSED SESSION OF OCTOBER 20, 2011 AT D.L. BLISS STATE PARK

California State Parks' Chief Counsel Ann Malcolm reported that during the Commission's October 20, 2011 closed session meeting, which was conducted at D.L. Bliss State Park pursuant to California Government Code Section 11126(e)(2)(b), there were no reportable items and no action had been taken by the Commission.

AGENDA ITEM 2:

CHAIR'S REPORT, COMMISSIONER REPORTS/COMMENTS, RECOGNITIONS

The Chair explained that this agenda item provided an opportunity for commissioners to comment on matters of interest, conduct committee business, and provide recognitions. Chair Hart asked if the Commissioners had any matters to discuss or report. There were no comments or reports.

Chair Hart then asked Commissioner Tommy Randle to read the list of employees who had recently retired from careers with California State Parks. This list, representing retirements announced since the Commission's July 8, 2011 meeting, represented over 547 years of service to the citizens of California:

Jeanne Akin, San Diego Coast District	33 years, 6 months
Laurel Belton, Acquisition & Development Division	21 years, 8 months
Lynda Burman, Central Valley District	4 years, 9 months
Karen Call, Santa Cruz District	11 years, 11 months
Danny Collier, Sierra District	7 years, 1 month
Charles Edgemon, Santa Cruz District	30 years, 6 months
Wayne Fiske, San Luis Obispo Coast District	13 years
Matalie Jackson, Contracts & Assessments	24 years, 10 months
Sheryl Lawton, Diablo Vista District	27 years, 6 months
Diane McGrath, San Luis Obispo Coast District	31 years, 4 months
Dennis McSweeney, Russian River/Mendocino District	12 years, 6 months
Mark Michalski, American River District	26 years, 7 months
Steven Nestor, Orange Coast District	11 years, 7 months
Alphonso Pepito, Angeles District	29 years, 1 month
Rita Perry, Sierra District	3 years, 6 months
Jeanette Pinion, San Luis Obispo Coast District	16 years, 3 months
Joyce Sathre, Headquarters	32 years, 9 months
Joan Schneider, Colorado Desert District	12 years, 10 months
Wallace Schwab, Tehachapi District	10 years, 7 months
William Soule, Office of Historic Preservation	34 years, 3 months
Deborah Viney, Grants & Local Services Division	21 years, 10 months
Gary Waldron, Northern Service Center	26 years, 8 months
Paul Walsh, San Luis Obispo Coast District	9 years, 6 months
Scott Wassmund, Northern Field Division	31 years, 4 months
Suzanne Westover, Russian River Sector	26 years, 9 months
Warren Westrup Jr., Northern Service Center	35 years, 4 months

Commissioner Randle and Chair Hart expressed their gratitude to these employees for their service.

AGENDA ITEM 3:
APPROVAL OF SPECIAL REDWOOD GROVES

Chair Hart asked Commissioner Maurice Johannessen to read the requests that had been made to establish special redwood groves in California State Park System units. Commissioner Johannessen read the following grove requests and made a motion to approve these groves, the motion was seconded by Commissioner Paul Junger Witt:

As requested by Save the Redwoods League:

Louis Agassiz and Inez Greene Test Grove
in Humboldt Redwoods State Park
the estate of Frederick H. Test, donor

Sue Ann, Joy and Donald Rhynard Grove
in Butano State Park
Donald and Joy Rhynard, donors

The commissioners voted unanimously to adopt the resolutions establishing these special redwood groves.

AGENDA ITEM 4:
DIRECTOR'S REPORT

Chair Hart introduced California State Parks Director Ruth Coleman to present her Director's Report. Director Coleman explained that as each of the commissioners had received a written copy of her report, she would be using this time to provide an update on State Parks' budget situation.

Director Coleman referred the commissioners to her written Director's Report which included a list of park units where successful efforts would keep these parks open despite significant budget reductions.The Director explained that 14 park units that had been slated for closure could be kept open through partnership agreements established with private citizens, cooperating associations, cities, counties, and the National Park Service. She added that given the busy summer season and already-reduced staffing these results had been obtained through efforts that had only been made in earnest since Labor Day 2011. Director Coleman noted that State Parks was particularly pleased with the National Park Service and several counties, including Sonoma County, that had expressed willingness to assist California State Parks.

The Director also explained that Governor Jerry Brown had recently signed legislation (AB42) that provided State Parks with a new tool that permitted operating agreements with non-profit entities. She added that State Parks had created an interdisciplinary team to review the legal, administrative, and other questions that would arise during the creative development of operating agreements to keep parks open.

Director Coleman next explained how the employee layoff process could be implemented at California State Parks. She explained that the first step was to identify positions that could be eliminated. The Director noted that while the process was a slow-moving one it was believed that significant savings would be achieved from the elimination of positions. Director Coleman added that it was expected that in the following year position eliminations would impact all park units. She noted that these position eliminations would be a painful, difficult process, heavily regulated through the state Department of Personnel Administration. Director Coleman added that it was especially challenging for State Parks staff to address potential employee layoffs while at the same time working to develop alternatives to park closures. She called the commissioners' attention to the variety of park closure alternatives included in the written Directors Report, and explained that each park unit required a unique approach. The Director added that while State Parks staff were organizing to address these challenges, it remained a difficult time to be in state service.

Director Coleman noted that State Parks' staff were extraordinary and highly dedicated, as the commissioners had undoubtedly noted. Staff were developing new, innovative strategies to create a revolving fund for investments that could generate additional revenue to parks. The Director also explained that staff were looking at that development of new special events and other aspects of park operation, including alternative fee schedules and new types of pay machines, that could generate additional revenue.

The Director pointed out that today's California State Parks was much more reliant on revenue generation that it had been in the past. She explained while the 2012-2013 State Parks budget depended on the state's general fund for 28% of its funding, over 90% of the department's budget was supplied by the general fund when Governor Brown was first governor in the late 1970s to early 1980s. Director Coleman noted that in 2011 Governor Brown had inherited a department that is much more heavily dependent on revenue than it had been, even though State Parks received some funds from taxes on gasoline for off-highway vehicles. The Director closed her presentation and asked if there were any questions from commissioners.

Chair Caryl Hart asked if there were any questions. There being none, the Chair acknowledged the terrific work and the incredibly difficult challenges that State Parks staff throughout the state had faced and would continue to face for the foreseeable future. Chair Hart stated that in park closures the department was facing the most difficult challenge of its existence, and she expressed her appreciation to the National Park Service for taking on the management duties of some State Park System units. She added that the time had come to develop new, innovative models for partnerships, as well as creating new ways of conducting all State Parks business.

AGENDA ITEM 5:
PUBLIC HEARING

Chair Caryl Hart opened the public hearing portion of the meeting at 9:20 a.m. The Chair explained the speaker registration process and noted that given the large number of speakers who had already registered it was her desire that individuals restrict their comments to two minutes each. The Chair also requested that speakers state their names before they begin. Chair Hart added that the Commission was very interested in what everyone had to say.

ITEM 5A:
Consent Items

Noting that agenda items 5A I, II, and III related to concessions operations were being presented to the Commission on consent, the Chair asked California State Parks Director Ruth Director Coleman to provide additional information on agenda item 5A-II.

Director Coleman explained that in anticipation of park unit closures, California State Parks was seeking to obtain authority to enable the department to consider operation by private concessionaires of as many as 29 State Park System units currently listed for closure. The Director stated that this did not mean that the department would be adopting concessions for all 29 of the listed parks, but only that the authority to do so would make this possible should it be determined that such arrangements were appropriate. She also explained that the park units could be operated individually or bundled together as necessary. Director Coleman also explained that no decisions had been made to actually enter into concession contracts for any of the 29 units, as state law required that the Commission first make a determination that the concessions were compatible with park unit classifications and general plans, and that such proposals also be approved by the state Public Works Board. She referred the commissioners to the staff report they had received on this agenda item, and noted that the Commission's Concessions, Enterprise, & Fiscal Committee – Commissioners Bill Kogerman and Paul Junger Witt – had determined that concessionaires should be considered as possible operators of some park units that were slated for closure, and that they had already approved this item, which allowed the item to be presented to the full Commission on consent.

Director Coleman clarified that the reason the department was are able to make a compatibility determination now, before proposals for specific concessions had been submitted, was that only concessions that were consistent with current park operations would be considered. She provided the example of parks that currently offered a visitor center and camping; concessions for such units would only be considered if they provided for the continued operations of these facilities. The Director stated that if a concession proposal involved a change in operation of the unit and a total investment or estimated annual gross sales in excess of $500,000.00 that project would be brought to the Commission for a separate compatibility determination.

Director Coleman noted that California State Parks had developed a multidisciplinary team to prepare Requests for Proposals (RFPs) that would allow a variety of entities – including cities, counties, and non-profit organizations – to submit proposals to operate elements of a park and groups of park units. She also explained that California State Parks already employed operating agreements that allowed cities and counties to operate units of the State Park System.

The Director stated that through this proposal and other efforts California State Parks was attempting to provide itself the largest variety of opportunities that would keep park units open and available to the public. She concluded by noting that if the Commission approved this item it would be taken to the state Public Works Board in the following month, after which the department would begin developing RFPs.

Chair Caryl Hart thanked Director Coleman and noted that she would be pulling agenda concessions item 5A-II from consent to permit further discussion. The Chair then announced that the Commission would now consider agenda items 5A, I and III.

ITEM 5A-I:

Concurrence on the Director's appointments of Donald Kraemer, Ron Smith, Judy Teunissen, Alan Washburn, and Pati Weir to the board of the California Citrus State Historic Park Non-Profit Management Corporation

ITEM 5A-III:

Determination of compatibility of the concession contract for the operation of the statewide reservation system in accordance with Public Resources Code Sections 5010.1, 5080.03, 5080.20, and 5080.23

There being no registered or unregistered speakers for these items, Chair Hart asked for a motion from the Concessions, Enterprise, & Fiscal Committee to approve items 5A, I and III. Commissioner Paul Witt made a motion for approval. The motion was seconded by Commissioner Bill Kogerman. The commissioners voted unanimously to approve agenda items 5A-I and 5A-II as described above.

ITEM 5A-II:

Determination of compatibility of concession contracts for the operation of multiple state park units slated for closure effective July 1, 2012 in accordance with Public Resources Code Sections 5080.03, 5080.16, and 5080.20

Chair Caryl Hart asked if commissioners wished to comment on agenda item 5A, II. There being no comments or questions, Chair Hart stated that given the importance of this matter she had pulled this item from consent so that the Commission could obtain further information. She explained that this proposal created the potential for concessionaires to manage State Park System units, something that had not been done in the past. The Chair asked State Parks Director Ruth Coleman to comment on the status of negotiations with non-profit organizations in developing operating agreements for parks, and to provide information on how this fit into the larger plan to develop concession proposals for the operation of park units.

Director Ruth Coleman explained that the department was only in the early stages of this process and that the situation varied considerably from park unit to park unit. She noted that while at some parks there already existed well-organized, high-performing non-profit organizations that had demonstrated their capacity to manage a park, other units had no such arrangements. Director Coleman also noted that she wished to make clear that while this proposal was not typical, there had been precedents for the operation of State Park System units by concessionaires. She cited the examples of Lime Kiln State Park, Gray

Whale Cove State Beach, and Turlock Lake State Recreation Area as parks where campgrounds and virtually entire park units had been operated by a concessionaire. Director Coleman added that such operations had not previously been attempted on as large a scale as suggested in the current proposal.

Director Coleman continued that some of California State Parks' existing non-profit organizations appeared to be capable of operating specific parks. She stated that other opportunities with the Central Valley parks slated for closure, for example, did not have existing, organized non-profit partners. The Director explained that a competitive bid process was being developed to find operators for these units. She added that the process would include the encouragement of partnerships between non-profit and for-profit entities, in the hope of taking advantage of their respective strengths. Director Coleman emphasized that the situation at each park unit was different and would be considered on a case-by-case basis. Chair Hart thanked Director Coleman for providing this information.

Again noting the importance of this matter, Chair Hart stated that she wished to appoint an ad hoc committee to consider issues related to the closure of State Parks System units. The Chair announced that she would represent Northern California and that Commissioner Elva Yanez would represent Southern California on this committee. She added that Commissioner Yanez's significant experience in parks, open space, and environmental issues made her uniquely qualified for this appointment. The Chair asked for Commission approval of the establishment of this committee, but was reminded by State Parks Chief Counsel Ann Malcolm that the Commission Chair possessed authority to create committees, meaning that Commission approval was not required to establish such a committee.

Chair Hart stated that she wished to encourage discussion of this matter and recognized Commissioner Bill Kogerman. Commissioner Kogerman requested clarification of the new committee's role. He added that the Commission's Concessions, Enterprise, & Fiscal Committee had already considered the matter of concessions as they related to the operation of State Park System units and recommended that the proposal be approved in order to provide the Director of California State Parks maximum flexibility in establishing contracts for the operation of State Park System units by entities outside of the department.

Chair Hart explained that the ad hoc committee would address issues pertaining to the broader issue of park closures. She added that the committee and the Commission would provide an interface between the commissioners, the public, and the department to ensure that discussion of this subject continued to involve the Commission.

Chief Counsel Ann Malcolm noted that any findings, recommendations or actions of the new committee would need to be brought back to the Commission for approval, as was the case with the Commission's Concessions, Enterprise, & Fiscal Committee.

Chair Hart provided an example: Should it be suggested that the Commission conduct hearings throughout the state on the issue of park closure, the ad hoc committee would work with the department to determine the necessity and appropriateness of such a proposal. The Chair also explained that the committee could work with the department on the development of operating agreements or concession contracts for park operation. Chair Hart stated that she intended the ad hoc committee to provide a mechanism for continuous conversation between the department and the Commission.

There being no further discussion on the ad hoc committee, Chair Hart recommended that the Commission approve agenda item 5A-II, with the understanding that related items would be brought back to the Commission for further discussion of the department's intentions and next steps once approval of the state Public Works Board had been obtained. The Chair asked for a motion confirming this action.

A motion to approve agenda item 5A-II was made by Commissioner Elva Yanez, and seconded by Commissioner Tommy Randle.

Commissioner Bill Kogerman asked for clarification as to whether or not the proposal before the Commission had not already been addressed in this agenda item as approved by the Concessions, Enterprise, & Fiscal Committee.

Chief Counsel Ann Malcolm stated that the item, as presented to the Commission on consent, would have allowed the department to bring the matter to the state Public Works Board and to negotiate potential concession contracts. Ms. Malcolm stated that she understood that after Public Works Board approval, individual proposals would be brought back to the Commission for consideration.

At this point Chair Caryl Hart clarified that her proposal was that once Public Works Board approval had been obtained for these projects, the department would then return to the Commission and present their plans for moving forward. Chair Hart stated that she wished to be informed of the status of Requests for Proposals and operating agreements, adding that it was her intention to encourage communication between the department and the Commission, thereby providing a mechanism to enhance communication with the public on the subjects of park closures, potential concessions, and operating agreements.

Commissioner Elva Yanez noted that it was vitally important to assess the capacity of potential partners as concession and operating agreements move forward. The Commissioner explained that everyone involved should be highly aware of partners' ability to manage the proposed concessions, and that their capacity to do so should be a matter or record. Commissioner Yanez added that the current major budget reductions had a far-reaching affect, and that there should not be unreasonable expectations of partners' abilities; that partner organizations' capacity to manage park units should be continually identified and documented.

Chair Hart stated that the commissioners appeared to be in agreement as to the action on this item. She reminded the commissioners that a motion had been made by Commissioner Elva Yanez, and seconded by Commissioner Tommy Randle. The Chair called for a vote. The commissioners voted unanimously to approve agenda item 5A-II as described above, on the condition that such matters be returned to the Commission once approval had been obtained from the state Public Works Board.

ITEM 5B:

Consideration and possible action on the Department recommendation to Adjust the classifications of Lake Valley State Recreation Area and Washoe Meadows State Park to restore the Upper Truckee River and floodplain by relocating a portion of Lake Tahoe Golf Course out of the river, which involves a transfer of more environmentally sensitive land from Lake Valley State Recreation Area to Washoe Meadows State Park and the transfer of less sensitive land from Washoe Meadows State Park to Lake Valley State Recreation Area

ITEM 5C:

Consideration and possible action on the Department recommendation to review and consider the Final Environmental Impact Report for the Upper Truckee River Restoration and Golf Course Relocation Project and adoption of the general plan amendment for Lake Valley State Recreation Area

Chair Hart stated that in addition to the briefing and materials provided to the commissioners in advance of today's meeting they would now hear a short presentation on this agenda item from California State Parks Planning Division Chief Dan Ray. The Chair added that she wished to have commissioners hold their questions and comments until after all of the public speakers had addressed the Commission.

Mr. Ray described Lake Valley State Recreation Area and Washoe Meadows State Park and the relationship between these two units. He provided background on the parks' long and varied history of development and use. Mr. Ray explained how the properties had been used by the Washoe peoples, and how in more recent times portions of the property had been logged, operated as a dairy farm, and how ranches had been established in the meadow areas. He described how the Upper Truckee River had been straightened to permit more efficient transportation of logs, and how the meadows had been drained and areas quarried for sand and gravel. A strip for automobile drag racing had once occupied a portion of the park, and residential subdivisions separated the park property from adjacent national forest lands.

Mr. Ray further explained that the entire site had been proposed for development in the 1970s, and he described how it was only through the process of settling litigation that the State of California came to purchase the property, which was then transferred to California State Parks. He also described how the property's existing golf course led to the division of the unit into units classified as state recreation area and state park. The purpose identified for Lake Valley State Recreation Area included keeping the 18-hole golf course available to the public as well as providing year-round recreation while restoring the Upper Truckee River and providing a balance between recreation and heightened environmental protection.

Mr. Ray provided statistics related to recreation in the South Lake Tahoe area, noting that approximately 30 thousand rounds of golf were played annually, about two-thirds of these enjoyed by visitors from outside the Tahoe area. He listed details of the recreational opportunities provided by the parks, noting that the cost of an 18-hole round of golf at the Lake Valley State Recreation Area course was presently only around $80.00 compared to approximately $200.00 at the nearby privately-owned golf courses.

He further described the resources and attributes of the portion of the property that had been established as Washoe Meadows State Park. Mr. Ray noted that this park's purpose was to preserve and protect the wet meadows around Angora Creek and the Upper Truckee River, adding that the purpose statement for the park also acknowledged the common lodgepole pine forests that surround the meadows, as well as the archeological and historic sites and the recreational uses of the park. He noted that while a general plan had been adopted for Lake Valley State Recreation Area, no general plan existed for Washoe Meadows State Park. Mr. Ray explained that this was not unusual, in that most of the State Park System units in the Lake Tahoe Basin did not have general plans; he added that was this was not an indication of a park's importance.

Mr. Ray provided details on the proposal to adjust the classification of Lake Valley State Recreation Area and Washoe Meadows State Park to allow some of the golf course holes to be moved, thereby permitting restoration of the Upper Truckee River. He provided details related to the environmental conditions and explained how the restoration project planned for State Parks' property was one of five components of a comprehensive program to restore the Upper Truckee River. He specified that the adjustment of classifications involved only around 40 acres of the park property; approximately 5% of the total acreage. Mr. Ray also explained that the proposal was consistent with established goals for these parks that had existed since the property was acquired. He provided details of the science that had been employed, and he listed specifics of changes to the two parks, including the additional recreation opportunities and public access that would be provided by the restoration of the Upper Truckee River. Mr. Ray also described the archeological sites and cultural resources on the park properties, and the plans for protecting these resources.

In conclusion, Mr. Ray reiterated that the proposal before the Commission would allow for the restoration of the Upper Truckee River while affecting only about 5% of the park property, allowing the continued operation of an 18-hole golf course, and providing additional recreation opportunities. Mr. Ray informed the commissioners that the environmental impact report (EIR) for the proposal had been certified by State Parks Director Ruth Coleman, and he requested that the Commission consider the EIR as they perform their decisions as a responsible agency.

Commission Chair Caryl Hart thanked Mr. Ray and reminded the Commission that they were being asked to consider two actions: The adjustment of the classifications of Lake Valley State Recreation Area and Washoe Meadows State Park, and a general plan amendment for Lake Valley State Recreation Area. She asked if there were any questions for staff before introducing public comment; there were no questions. The Chair then explained that the Commission would hear public comment on both agenda items 5B and 5C together, and she proceeded to call the 61 persons who had registered to speak on these items (see pages 1 and 2 of these minutes for a complete list of registered speakers).

After the last registered speaker Chair Hart asked if there were any unregistered speakers. There being none, the Chair closed public comment on agenda items 5B and 5C at 12:24 p.m. Chair Hart thanked the speakers and then asked if staff would like to respond to public comment at this time. There being no staff response at this time, the Chair asked each commissioner in turn to share their comments.

Commissioner Elva Yanez thanked the community members and staff that had participated in this project. She noted that the commissioners faced a difficult decision, and she asked staff to explain the costs of the river restoration project, how it would be funded, and how the phases of the project would proceed.

State Parks Planning Division Chief Dan Ray responded that it was his understanding that the estimated cost of the Upper Truckee River restoration project was approximately $5 million, and that the project would be funded through the Tahoe Restoration Program and other sources that could not otherwise be used for park purposes. He added that the reconstruction of a portion of the golf course would be funded by the concessionaire that operated the course, and that this funding would be a condition of any new contract for operation of the facility. Mr. Ray also explained that new golf course holes would be constructed prior to the river restoration so that 18-hole play would not be interrupted. This would be followed by excavation of the restored river channels, and the filling-in of the current, altered river channels.

Commissioner Yanez then asked about federal requirements for Total Maximum Daily Load (TMDL) as required by the U.S. Clean Water Act, relating to the value of the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. Mr. Ray asked one of the public speakers, Robert Larson of the Lahontan Water Board, to address Commissioner Yanez's question.

Robert Larson replied that the restoration of the Upper Truckee River was a component of meeting the federal mandate of the TMDL requirements. Mr. Larson added that the section of the Upper Truckee River that ran through the state park property was one of the most degraded portions of the river, and that State Parks' restoration plan was an important and critical implementation measure for TMDL.

A brief discussion concerning the legal consequences of not completing the river restoration project took place amongst Commissioner Yanez, Chair Hart, Planning Chief Dan Ray, and Robert Larson of the Lahontan Water Board. They reached no conclusion as to the legal consequences of not completing the restoration, though Dan Ray noted that future degradation of the Upper Truckee River could subject State Parks to enforcement action and penalties. Mr. Ray added that grant funds were currently available to aid in the implementation of the restoration, and such funds may not be available at a later time.

Commissioner Tommy Randle stated that he was surprised to hear so many comments suggesting that the subject was still be debated even though discussions of this project had continued through five years and approximately 30 public workshops. The Commissioner added that he would like to see the community completely satisfied with whatever decision was made. He expressed his awareness of the importance of making a decision that the community, those that live nearby, would find acceptable.

Commissioner Bill Kogerman noted that while he understood his concern would be addressed at project-level and not at today's meeting, he opposed the idea of using a single bridge over the restored river. He added that he thought it would be valuable to have a respected golf professional consult on the final design of the reconstructed course to ensure a world-class result. Commissioner Kogerman also asked if equestrian use was currently prohibited in Washoe Meadows State Park. Sierra District Superintendent Matt Green replied that Public Resources Code required a district superintendent's order to allow equestrian use in a state park, and that no such order was currently in place for Washoe Meadows State Park.

Commissioner Kogerman stated that one of the public speakers had commented that staff had not adequately responded to comments. The Commissioner noted that he had read each of approximately 2,300 pages of related documents, and that he believed if anything staff had "gone overboard" in responding to the many letters and comments received. Commissioner Kogerman then asked staff to respond to the legal challenge made by speaker Keith Wagner, representing the Washoe Meadows Community. State Parks Senior Staff Counsel Kathryn Tobias responded.

Ms. Tobias stated in response to Mr. Wagner's comments about the resolutions the Commission would be considering that these had been made available for public review. She added that the resolutions served essentially as a guide to illustrate findings that have been made, and that if there were issues still being addressed at the time of the Commission meeting – as was the case – resolutions would not necessarily be available for review well in advance of the meeting. Ms. Tobias explained that Commission resolutions were not required to be noticed to the public in the way an environmental impact report would be noticed.

Commissioner Kogerman and Ms. Tobias engaged in a brief conversation concerning the noticing requirements for Commission actions such as this and the process for noticing. Ms. Tobias explained that the action currently before the Commission was somewhat unique. She explained that the Commission had no jurisdiction over the proposed project, but that it did have the authority to approve classifications and general plan amendments. She explained that the proposed project therefore required Commission approval of the park unit classifications and general plan amendment to proceed. Ms. Tobias noted that the California Environmental Quality Act (CEQA) process was separate from approval of the project. She explained that California State Parks was the “lead agency” for the purposes of CEQA and the Commission a “responsible agency.” A final environmental impact report (EIR) which had been certified by the Director of California State Parks was being brought to the Commission, which then, as a responsible agency, must make a decision to allow the project to proceed. If approved by the Commission, authority to approve the project would then be made by the Director of California State Parks. Commissioner Kogerman and Kathryn Tobias also discussed whether or not there existed any legal impediment to the Commission making a decision at this time. Ms. Tobias stated that she did not believe any such impediment existed.

Commissioner Kogerman thanked speaker Huey Johnson for providing copies of publications to the commissioners. The Commissioner then asked if there were sites within the park that were eligible for the National Register of Historic Places. Planning Division Chief Dan Ray explained that 18 of the 22 known archeological sites would remain with the property classified as state park, and that for this reason not all of the sites had been evaluated for their eligibility to the National Register; only the three sites involved in the classification adjustment had been evaluated, and these were determined to be eligible.

Commissioner Kogerman noted the one speaker’s comment that the proposal before the Commission would double the amount of golf course along the river was incorrect, and that in fact the proposal reduced the length of riverside fairways from over 6,000 feet to just over 800 feet.

Commissioner Kogerman also thanked by name several of the public speakers and those who had submitted written comments for their time and insightful observations.

Commissioner Maurice Johannessen stated that his opinions on the decisions before the Commission were conflicted. The Commissioner discussed his concerns regarding the restoration of the Upper Truckee River, noting that he was in favor of this. He added that he was conflicted when it came to classifying portions of Washoe Meadows State Park to allow golf course holes to be constructed there. The Commissioner stated that he hoped those listening would understand the conflict of which he was speaking.

Commissioner Paul Junger Witt thanked all of the meeting attendees for participating. The Commissioner noted that he had heard that some park neighbors believed a decision had already been made, and he assured everyone that this was not the case. He added that the commissioners came to this meeting and the proposals before them with open minds, and that their decisions would be carefully weighed with the knowledge that it was impossible to make everyone happy. Commissioner Witt also talked about the use of environmentally sustainable fertilizer on golf courses, and how State Parks should insist that this and environmentally sensitive construction techniques be employed in the realization of the proposed project.

Chair Hart noted that Commissioner Elva Yanez wished to make additional comments. Commissioner Yanez noted that prior to visiting the park site she had been skeptical of the proposals before the Commission. She thanked the public speakers and representatives of public agencies that addressed the Commission. Commissioner Yanez reminded all that the properties in question had been acquired and had become State Park System units as the result of a development dispute, and that this decision had been made long in the past. She expressed her concern for the archeological sites and the continued protection and access to these sites by Native California Indians. The Commissioner noted that this was a difficult decision to make, but in considering the revenue generated by the golf course, the need to keep the golf course 18 holes to ensure its survival, and the necessary restoration of the river, the matter before the Commission should be thought of as what had been called the "triple bottom line" – the environment, economic factors, and the social fabric of the community. Commissioner Yanez stated that she wished to honor the hard work and commitment of the community members, State Parks staff, and scientists who played a role in the process that resulted in the proposals before the Commission today.

Commission Chair Caryl Hart asked for clarification regarding funding for the golf course project. Planning Division Chief Dan Ray replied that State Parks would not be loaning funds to the golf concessionaire, and that changes to the golf course would be funded by the concessionaire. State Parks Director Ruth Coleman added that State Parks would prepare a Request For Proposals (RFP) that would concession the operation of the golf course for a specific length of time that would allow the operator to amortize their investment. Director Coleman explained that taxpayers did not pay for developments like this in state parks, rather the state entered into agreements with concessionaires that allowed amortization of investment; at the conclusion of these contracts the state owned the asset – restaurant, golf course, etcetera.

Chair Hart stated that when developing RFPs for concessions such as this any interested party could submit a proposal; such proposals would not be limited to the current golf course operator.

Chair Hart continued her comments, noting that for many years she lived in the Lake Tahoe area, so she was quite familiar with the area and with the proposals before the Commission. The Chair stated that she was very appreciative of those who had been involved in the process to develop these proposals and to those who participated in today's meeting. She also stated that the commissioners did not merely follow staff proposals, but that they invested considerable time in the consideration of the actions brought before them. She noted that it would have made more sense for the meadow areas, now part of the state recreation area, to be part of the state park, adding that if the science and vision available today had existed when the park was established this would have been the situation when the parks were established. Chair Hart noted that California Trout, the U.S. Forest Service, the California Department of Fish and Game, and the Tahoe Regional Planning Agency all supported the proposals before the Commission. She added that it was unfortunate that park neighbors were in conflict with State Parks over aspects of this matter. The Chair stated that she believed the golf course provided important recreation to the area, and that she supported the compelling proposals before the Commission.

Commissioner Maurice Johannessen asked if the river restoration project could be separated from the golf course proposal. Commissioner Johannessen, Chair Hart, and Dan Ray discussed this matter. Mr. Ray noted that any future RFP for the golf course would come before the Commission for a determination that the concession was consistent with the park classification and general plan. Chair Hart noted that the Commission's decision was only one step in a process that required additional approvals in order to proceed, and that the proposal's "Alternative 3" provided for river restoration with a reduced, 9-hole golf course. Commissioner Johannessen stated that though State Parks could face legal challenges once a positive decision was made, staff believed that the proposals before the Commission presented the best available option. Mr. Ray confirmed that this was California State Parks' position on the matter.

Chair Caryl Hart noted that she would now ask for action on agenda items 5B and 5C. She read aloud agenda item 5B, the proposal to adopt the resolution before the Commission adjust the classifications of Lake Valley State Recreation Area and Washoe Meadows State Park to restore the Upper Truckee River and floodplain by relocating a portion of Lake Tahoe Golf Course out of the river, which involves a transfer of more environmentally sensitive land from Lake Valley State Recreation Area to Washoe Meadows State Park and the transfer of less sensitive land from Washoe Meadows State Park to Lake Valley State Recreation Area. The Chair asked for a motion on item 5B. Motion Commissioner Kogerman, second Commissioner Paul Junger Witt. The commissioners voted unanimously to approve the motion.

Chair Hart then moved to agenda item 5C. The Chair read the item, noting that as a responsible agency the Commission had reviewed and considered the Final Environmental Impact Report for the Upper Truckee River Restoration and Golf Course Relocation Project, and to adopt the resolution before the Commission to approve the general plan amendment for Lake Valley State Recreation Area. The Chair asked for a motion. Motion Commissioner Kogerman, second Commissioner Witt. The commissioners voted unanimously to approve the motion.

The Chair noted that this concluded the hearing on agenda items 5B and 5C. Unidentified members of the audience began shouting questions at the dais. Chair Hart replied that State Parks legal counsel would attempt to address these questions outside of the meeting, which needed to move to its next agenda item.

ITEM 5D:

Consideration and possible action to adopt a revised Commission policy on alcoholic beverages

Chair Hart explained that this item had been thoroughly reviewed by the Commission's Concessions, Enterprise, and Fiscal Committee, Commissioners Bill Kogerman and Paul Witt. The Chair then asked State Parks Concessions Reservations, and Fees Division Chief Jim Luscutoff to introduce this item.

Concessions Chief Jim Luscutoff explained that the Commission had previously approved a related agenda item concerning Topanga State Park at its May 2010 meeting in Fresno. Mr. Luscutoff stated that in conjunction with that decision, staff had been directed to evaluate the department policy on alcohol sales. He noted that the action before the Commission today was the resulting revised policy on alcohol sales that, if approved, would provide the department with the ability to offer wine and alcohol sales in locations that were not "...historically locations for sale of alcohol..." as required by current policy. Mr. Luscutoff provided the example of a proposed wine tasting concession at Old Town San Diego State Historic Park, where alcohol sales were not permitted in one building but were allowed in another because no evidence could be found to establish that alcohol sales took place in a precise location. He noted that the revised policy being presented to the Commission provided the department with direction as to the authorization of alcohol sales, but also provided the Director of California State Parks with the ability to approve alcohol sales for previously restrictive situations like the wine tasting example at Old Town San Diego State Historic Park. Mr. Luscutoff added that the revised policy also required the Director to consult with the Deputy Director of Park Operations when making alcohol sales decisions, and that it also required that a report of such actions be provided to the Commission.

Chair Hart thanked Mr. Luscutoff and asked if Committee members Kogerman or Witt had anything to add. Commissioner Bill Kogerman read a letter from the Hearst Corporation which the commissioners had each received. The letter stated that the Hearst Corporation had discussed the revised alcohol policy with California State Parks staff. The Hearst Corporation expressed support for the adoption of the revised policy and noted that such a policy would provide new revenue generating opportunities for California State Parks. The letter was signed by Martin Cepkauskas of the Hearst Corporation.

Chair Hart asked if there were any other comments from commissioners. Commissioner Maurice Johannessen asked if the revised policy provided an opportunity for the Director of State Parks to act as gatekeeper, making decisions related to alcohol sales. Director Ruth Coleman replied that this was correct.

Commissioner Elva Yanez asked about liability issues as they related to concessionaires and providing responsible beverage service. Concessions Chief Jim Luscutoff replied that liability was addressed within concessions contracts, and that State Parks concessionaires were liable and required to provide insurance. The Commissioner and Mr. Luscutoff also discussed training in responsible beverage service for concessionaires. Mr. Luscutoff replied that while concessionaires were obligated to meet all requirements of the California Department of Alcoholic Beverage Control (ABC) he did not know if these requirements included training. Commissioner Yanez stated that she would like to see training be a requirement of future concessions contracts.

Commissioner Yanez noted that she had previously worked for many years in alcohol policy development. The Commissioner proposed that in the revised policy, the statement "...enhance public enjoyment of certain units to serve the interest of park visitors..." be changed to "...broaden the appeal of concession services at certain units..." Commissioner Bill Kogerman, Commissioner Yanez, and Director Ruth Coleman discussed the suggested change and the process by which the Concessions, Enterprise, and Fiscal Committee had approved the draft revised policy. They agreed to revise the language as requested by Commissioner Yanez and to at this time present the policy to the Commission in this form.

Chair Caryl Hart then asked for a motion to approve the revised policy. Motion Commissioner Kogerman, second Commissioner Yanez. Chair Hart then asked if there were any speakers on this agenda item. There being none she called for a vote. The commissioners voted unanimously to approve the revised Commission policy on alcoholic beverages as amended by Commissioner Yanez.

AGENDA ITEM 6:
OPEN PUBLIC COMMENT

Chair Hart opened the Open Public Comment portion of the meeting at 1:28 p.m. She proceeded to call the single registered speaker:

- North Swanson, representing Tahoe Area Naturists, concerning the designation of clothing optional areas at California State Park System units.

There being no other registered or unregistered speakers, Chair Caryl Hart closed Open Public Comment at 1:30 p.m.

AGENDA ITEM 7:
ADJOURNMENT

There being no further comments or questions, Chair Hart adjourned the meeting at 1:30 p.m.

ATTEST: These minutes were approved by the California State Park and Recreation Commission on January 27, 2012, at its duly-noticed public meeting in Brentwood, California.

By: ORIGINAL SIGNED BY Date: 1-27-12

Louis Nastro
Assistant to the Commission
For Ruth Coleman, Director, California Department of Parks and Recreation
Secretary to the Commission

Meeting of the
CALIFORNIA STATE PARK AND RECREATION COMMISSION
Clubhouse of the Lake Tahoe Golf Course, 2500 Emerald Bay Road
South Lake Tahoe, California
Friday, October 21, 2011 - 9:00 a.m.

REVISED AGENDA of the MEETING

1. Approval of minutes of the July 8, 2011 meeting in Sacramento.
2. Chair's Report, Commissioner reports/comments, Recognitions.
3. Approval of Special Redwood Groves – as requested by Save the Redwoods League.
4. Director's Report.
5. Public Hearing
   A. Consent Items** *(reflecting staff recommendations)*
      I. Concurrence on the Director's appointments of Donald Kraemer, Ron Smith, Judy Teunissen, Alan Washburn, and Pati Weir to the board of the California Citrus State Historic Park Non-Profit Management Corporation.
      II. Determination of compatibility of concession contracts for the operation of multiple state park units slated for closure effective July 1, 2012 in accordance with Public Resources Code Sections 5080.03, 5080.16, and 5080.20.
      III. Determination of compatibility of the concession contract for the operation of the statewide reservation system in accordance with Public Resources Code Sections 5010.1, 5080.03, 5080.20, and 5080.23.

   B. Consideration and possible action on the Department recommendation to Adjust the classifications of Lake Valley State Recreation Area and Washoe Meadows State Park to restore the Upper Truckee River and floodplain by relocating a portion of Lake Tahoe Golf Course out of the river, which involves a transfer of more environmentally sensitive land from Lake Valley State Recreation Area to Washoe Meadows State Park and the transfer of less sensitive land from Washoe Meadows SP to Lake Valley SRA.

   C. Consideration and possible action on the Department recommendation to review and consider the Final EIR for the Upper Truckee River Restoration and Golf Course Relocation Project and adoption of the general plan amendment for Lake Valley State Recreation Area.

   D. Consideration and possible action to adopt a revised Commission policy on alcoholic beverages.
6. Open Public Comment (on subjects other than the above agenda items).
7. Adjourn.

Copies of this agenda and the public notice of the meeting are available on the Internet
at www.parks.ca.gov/default.asp?page_id=936

** The Commission may approve consent items all at once without discussion. Any person requesting an opportunity to be heard with regard to consent items must complete a Speaker Registration Form (names are not required) prior to the announcement at the meeting of agenda item 5A, Consent Items. If such a request is made, the item(s) in question shall be pulled from the consent list for discussion and/or public comment.

Minutes of the
CALIFORNIA STATE PARK AND RECREATION COMMISSION
Department of Water and Power Building
111 North Hope Street
Los Angeles, California
September 15, 1978

ATTENDANCE

COMMISSIONERS PRESENT

Mrs. Victoria Gibson, Chairman
Mrs. Victoria Araujo, Vice-Chairman
Miss Michelle Egizi
Mrs. Ida Berk
Mrs. Helen Reddy Wald
Mrs. Vivien Hailstone
Mrs. Sally Altick

COMMISSIONER ABSENT

Dr. Loren Lutz

STAFF PRESENT

Russell W. Cahill, Director of Parks and Recreation, Secretary to the Commission
Alice Wright-Cottingim, Chief Deputy Director
Ross Henry, Assistant Director, Assistant Secretary to the Commission
Heather Fargo, Administrative Assistant
Casey Buchter, Staff Counsel
Al Tjaden, Assistant Landscape Architect
Jack Hiehle, State Park Wildlife Ecologist
James P. Tryner, Chief Resource Preservation and Interpretation Division
Richard May, Chief, Development Division
Todd Neiger, Manager, Concessions Section
Napoleon Lopez, Concessions Specialist
Lee Warren, Supervising Landscape Architect
Bill Dillinger, Chief, Information Office
Richard Felty, Assistant Director
Margo Woods, Recording Secretary
Herbert Heinze, Superintendent, District 5
Ed. D. Wilson, District 5
Carl Wilson, District 5

ALSO PRESENT: ATTENDANCE

State of California

Susan Ellis, California Department of Fish and Game

Others

Joseph Chesler, Los Angeles County Beaches
C. W. Carson, Malibu Canyon Property Owners
Giles Welch, Malibu Township Council
Mrs. Tru V. Cruise, Malibu Little League
Margot Feuer, Santa Monica Mountains Task Force and the Sierra Club
Jill Swift, Sierra Club
John C. Horan, El Pueblo de Los Angeles State Historic Park
Jane Pisano, Los Angeles 200 Committee
Enrique C. Barrios, Olvera Street Merchants Association
Bill Burkhart, Associated Historical Societies of Los Angeles County
Jean Bruce Poole, El Pueblo de Los Angeles State Historical Park
Magdalene Lona, Senator Garcia
Susan Nelson, Friends of the Santa Monica Mountains
J. M. Gallighen, Seaview Concessions
James E. Park, Los Angeles County Parks and Recreation

Notice having been duly given, the meeting of the State Park and Recreation Commission was called to order at 9:12 a.m., at the Department of Water and Power Building, 111 North Hope Street, Los Angeles, California on September 15, 1978.

APPROVAL OF THE MINUTES July 14, 1978

It was moved by Commissioner Hailstone, seconded by Commissioner Altick and carried unanimously that the minutes of the July 14, 1978 meeting be adopted as corrected.

DIRECTOR'S REPORT

Director Cahill expressed pleasure in meeting with the Park and Recreation Commission again. He reported on several matters of interest to the Commissioners. Some highlights of his presentation were:

Proposition 13

1. As the latest update on the results and impacts of Proposition 13, Director Cahill reported the Department's budget had been cut and all of the Divisions have been affected. There has been a reduction in personnel

services, 12 Headquarters and 75 seasonals. (Personnel cutbacks are based on seniority.) Operating expenses have been reduced - funding for many proposed projects have been lost. $10 million has been cut in the Roberti/Z'berg Urban Grant Program. A hiring freeze has been imposed necessitating the Department to rely very heavily on the volunteerism programs. Visitor attendance for the 1977/78 fiscal year is going to be up about 5.7 million from the 1976/77 fiscal year amounting to approximately a nine percent increase.

Proposition 13

Roberti/Z'berg Urban Grant Program

2. As of this date, the transfer of Prairie Creek Redwoods State Park, Jedediah Smith Redwoods State Park and Del Norte Redwoods State Park to the National Park Service is on schedule. Of the 19 permanent employees, 13 have elected to transfer to the National Park Service, three are waiting for the final decision and the others have options of transferring anywhere in the State Park System.

Prairie Creek Redwoods SP
Jedediah Smith Redwoods SP
Del Norte Redwoods SP

National Park Service

3. A legal action has been filed against the State by James Martin Prager asking that a writ and injunction be issued to prevent the demolition of the MTA Building in El Pueblo de Los Angeles State Historic Park. The Department is trying to get an extension or an agreement which would allow more time to find funding for the project. Possibly the California Conservation Coorp could be used as labor with some minor amounts of funds to get the job done properly.

MTA Building
El Pueblo de Los Angeles SHP

California Conservation Corp

4. The Director called upon Ken McClellan, Chief of the Division of Administration, to speak about the future financing of park acquisitions and development. Ken McClellan explained that traditionally park acquisition and development monies are acquired from bond issues; current bond funds are committed and there can be no bond issues until 1980. At the present time, there is money for immediate projects, but for 1981, what should be the Department's posture in terms of funding future programs? It was suggested that the Department needs to establish a planning program funded from the General Fund to so long-range projections and continue an orderly program for Park and Recreation facilities for future years.

The cost of bond funding for current programs amounts to $18 million per year. For the total $740 million authorized, interest will cost $40 million annually. Rather than issue more bonds, an alternative to consider is General Fund financing for capital outlay projects. This whole situation is a serious problem which must be considered.

Commissioner Gibson requested a copy of Ken McClellan's presentation. The Director stated the Department is preparing a detailed paper on this subject for the Legislature which will be shared with the Commission.

This concluded the Director's Report.

Commissioner Altick expressed the Commission's desire to save money for the budget by cooperating with the selection of the meeting locations and possibly doubling up in private sleeping rooms.

Commissioner Gibson stated according the last report at the previous Commission meeting regarding the transfer of the three redwood parks (Prairie Creek Redwoods State Park, Jedediah Smith Redwoods State Park and Del Norte Redwoods State Park), the Department will be overseeing the parks and will retain the right to review plans for development. Some of the Department's personnel will still be there.

Prairie Creek Redwoods SP
Jedediah Smith Redwoods SP
Del Norte Redwoods SP

National Park Service

Commissioner Gibson inquired whether the Park and Recreation Commission will be able to review any proposed development plans for the three redwood parks. Director Cahill answered the Redwood National Park law requires a plan that will be completed in the first year for the Secretary of the Interior. If that General Development Plan applies to areas owned by the State, it must come before the Commission for approval.

LEGISLATIVE REPORT

SB 2058

SB 174

Chief Deputy Director Alice Wright-Cottingim passed out copies of the Legislative Report. She pointed out that SB 2058 allows up to 25 percent of SB 174 funds to be used for operations and maintenance expenses by local entities who have applied for or obtained funds for acquisition and development under the Grant Program.

SB 1892

SB 1892 was a Department sponsored Bill. The new Section 5002.2 combines the Resource Management Plan and General Development Plan into a single document to be called a General Plan. This General Plan will consist of several elements including a development element, a resource element and others. In response to questions from the Sierra Club about the Bill, the Department stated that amendments to the Administration Code will assure that the Resource Management element will be prepared and circulated for public comment before the other elements are completed. Copies of SB 1892 were passed out at the meeting. Commissioner Altick inquired about the suggested wording for changes in Title 14. Alice Wright-Cottingim responded that the wording will be prepared by staff and will be sent to the Commission before the November meeting.

Title 14

Director Cahill commended Alice Wright-Cottingim for her dedication and her work at the Legislature.

Congressman Phillip Burton's Omnibus Park Bill is the largest park bill ever considered by Congress. A great amount of time has been spent working on this legislation. As a result, California's share of the Land and Water Conservation Fund for State and local government projects will probably be larger this year. It appears the Urban Parks Recovery Act is going to pass. The largest proposal is the Santa Monica Mountains proposal. The Department feels the Senate is going to concur with the House and come in with $125 million in Federal funds for purchasing land in the Santa Monica Mountains and $30 million in grant funds.

Congressman Phillip Burton's Omnibus Park Bill

Urban Parks Recovery A

Commissioner Altick inquired whether Congressman Burton's Omnibus Bill would require management of the State Parks in the Santa Monica Mountains by the National Park Service. The Director responded the Department will continue to acquire, develop and operate the State Parks as usual. However, the National Park Service is persistent in their attempts acquire Mount Tamalpais State Park and Angel Island State Historic Park.

Mount Tamalpais SP
Angel Island SHP

Commissioner Berk inquired, what is the substance of the Urban Parks Recovery Act? Director Cahill responded, the substance will be in the amount of $50 million to assist older park systems in repairs. For instance, 75 year old swimming pools can be reconstructed and landscaping in older city parks can be repaired. This money is primarily for urban areas with a population over 50,000.

Urban Parks Recovery Act

Commissioner Berk further asked when it will be possible to see an acquisition and development report which will project what may happen in 1981 as a result of there being no bond issue this year. Alice Wright-Cottingim hopes to have an issue paper ready for the next Commission meeting. Commissioner Berk requested that there be a study session regarding this issue. The Chairman concurred and requested a list of program cutbacks necessitated by the Legislative cutbacks for the current fiscal year.

The presentation of the Golden Bear Award to former Commissioner John Starkey was deferred until the next meeting in October.

Golden Bear Award
John Starkey

Chairman Gibson introduced the Commissioners and Margo Woods, the recording secretary, to the audience. Director Cahill introduced Ross Henry and Casey Buchter. Ross Henry introduced Dick May, Lee Warren, Jim Tryner, Dick Felty, Bill Dillinger, Todd Neiger, Napoleon Lopez, Jack Hiehle, Al Tjaden, Heather Fargo, Herb Heinze, Ed Wilson, Carl Wilson, Wayne Keithley, Ken McClellan and the other Rangers.

Notice having duly been given, the Chairman declared the public hearing open for review and discussion of the Resource Management Plan, General Development Plan, and Environmental Impact Report for Malibu Lagoon State Beach at 10:20 a.m. Jack Hiehle, Resource Preservation and Interpretation Division and Al Tjaden, Development Division, gave oral presentations and showed slides of the project.

PUBLIC HEARING, Malibu Lagoon State Beach, GDP, RM & EII Contd.

Chairman Gibson thanked staff for their outstanding presentation.

Joseph Chesler, Los Angeles County Beaches, also thanked staff for their involvement and their fine work on the project. He looked forward to a wonderful recreation experience in the future.

C. W. Carson, Malibu Canyon Property Owners Association, complimented the staff's fine work. The Association supported the Plan but had some concerns about its implementation of additional parking and trails which would destroy the natural habitat. An asphalt jungle would not be desirable.

Giles Welch, Malibu Township Council, expressed appreciation for the complete plan but stressed these particular points:

1) The Adamson home should be maintained as it is---a residence for tours---like a miniature San Simeon.

2) A State Park Ranger should reside on the property.

3) The Chumash burial sites should remain undisturbed.

4) A Chumash museum should be established and maintained in the outbuildings of the Adamson home.

5) The State should purchase and maintain a trail for guided tours from the Malibu Lagoon to the Malibu Creek State Park.

6) The State should purchase Connolly's Hill as a viewsite for the Malibu Lagoon State Park.

Mrs. Tru V. Cruise, Malibu Little League, Association, appeared before the Commission approving the Plan and offering any assistance to its progress. She also commented the Little League would be moving to another location.

Margo Feuer, Santa Monica Mountains Task Force, addressed the Commission stating that the task force extended its heartiest, sincere appreciation and congratulations on the excellent Plan. Most sensibly drawn up, it reflects the concern of the

PUBLIC HEARING,
Malibu Lagoon State Beach, GDP, RM & EIR Contd.

public and protection of the natural resources. She was concerned about the discharge from the Las Virgenes Water District, and stated the issue of tide and circulation of effluent has not been properly researched. Ms. Feuer encouraged the Department to watchdog the testing effort.

Two photographs of the algae conditions should be taken every week. Whenever conditions fall under an acceptable standard, respond to it immediately. She further recommended that there be some kind of a trail system on the west side of the lagoon that goes under the bridge and connects with a boardwalk system. This will be part of a continuing trail system that will be part of the Malibu Creek State Park Lagoon. She also recommended that the Department look into alternative parking lot sites.

Al Tjaden answered there is room to get a trail on the west side, but one of the problems occurring today is bird watchers tend to use the area.

Commissioner Gibson stated the Department was aware of the problems created by the effluent released into Malibu Creek by the Los Virgenes Water District and she referred to the strong conditions on Pages 12 and 24 of the Plan. Director Cahill commented the Department should expand its role in the testing process.

The Chairman closed the public hearing for the review and discussion of the Resource Management Plan, General Development Plan and Environmental Impact Report for Malibu Lagoon State Beach at 10:50 a.m.

Commissioner Altick commended staff on their excellent presentation especially the idea of trails connecting the Adamson House to self-guided nature trails on the Coast Highway. She requested there be a bridge connecting the west side to the east side of the park in order that the trail could end up at the lagoon.

Jim Tryner stated that a bridge would be possible although it is not in the Plan at the present time.

Commissioner Altick pointed out there were many artifacts that were left to the Adamson House provided it is operated as a house museum. She felt this was a better idea than a display type museum. She requested additional wording be inserted on Page 25, in the second paragraph, following the second sentence, "and be operated as a house museum".

PUBLIC HEARING, Malibu Lagoon State Beach, GDP, RM & EIR Contd.

Director Cahill stated he would like to leave some of the wording in the Plan to the Interpretive Planners but had no problems with designating the unit as a house museum. Jim Tryner pointed out the reference to house museum at the bottom of Page 25.

Commissioner Altick stated her main objection was to the possibility of using display cases, and she withdrew her previous request.

Commissioner Hailstone commended the Plan for its excellence.

Commissioner Berk encouraged the Department to make some sort of arrangements with the public transportation system to allow people to use the beach area, particularly on weekends.

Lee Warren explained that during the planning process the Department looked at alternate parking areas and the possibility of a shuttle service. The problem is limited funding.

Commissioner Egizi approved of the Plan. She also suggested instead of closing the Adamson House on weekends due to the limited parking, tours be provided for groups on a reservation basis. She further suggested a picture be put on the fence which would caution people about the sensitive lagoon environment. There have been problems with Las Virgenes Water District and the Department should test the water. She was also concerned about the displays in the Adamson House.

Commissioner Wald felt the Plan was excellent and also inquired where the Little League players will be relocated.

Director Cahill stated the Little League Association has been most cooperative. They will be moved somewhere close and it does not have to be done for two years.

Commissioner Gibson questioned whether the Chumash area on the other side of the highway would be of the quality to warrant establishing it as a cultural preserve under the new law, SB 1892. Jim Tryner answered it appears to be a suitable place to consider establishing a cultural preserve but as of right now there is not a resource inventory ready.

It was moved by Commissioner Altick, and seconded by Commissioner Egizi to approve the following resolution:

WHEREAS the Director of the Department of Parks and Recreation has presented to this Commission for approval the proposed Resource Management Plan, General Development Plan and Environmental Impact Report for Malibu Lagoon State Beach; and

WHEREAS this reflects the long-range development plan as to provide for the optimum use and enjoyment of the unit as well as the protection of its quality;

PUBLIC HEARING, Malibu Lagoon State Beach, GDP, RM & EIR Contd.

NOW, THEREFORE, BE IT RESOLVED that the State Park and Recreation Commission approves the Department of Parks and Recreation's "Resource Management Plan and General Development Plan for Malibu Lagoon State Beach," Preliminary dated April 1978, subject to such environmental changes as the Director of Parks and Recreation shall determine advisable and necessary to implement carrying out the provisions and objectives of said plan.

The Chairman called for a roll call vote. Commissioners Altick, Araujo, Egizi, Berk, Wald, Hailstone and Gibson voted AYE; the motion carried unanimously.

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PUBLIC HEARING, Los Encinos State Historic Park

Notice having been duly given, the Chairman declared the public hearing open for the review and discussion of the Los Encinos State Historic Park Resource Management Plan at 12:00 p.m.

Jill Swift, Sierra Club, congratulated staff on the marvelous Resource Management Plan that came before the General Development Plan. She hopes this procedure will be adhered to in the future. She inquired about the possibility of a public meeting in the evening to accommodate those people who work during the day.

Susan Nelson, Friends of the Santa Monica Mountains, appeared before the Commission and complimented the Resource Management Plan. She felt there was not proper recognition of the Native American Heritage in the Plan. Further study should be done to determine the name of the tribe in the area and information on them should be at the park. She recommended that the Department contact a John Caughey who is very knowledgeable person on Indians in the area.

The Chairman declared the public hearing for the review and discussion of the Los Encinos State Historic Park Resource Management Plan closed at 12:10 p.m.

Chairman Gibson paid tribute to the Los Encinos Historical Society, who has been of great help to this park.

Commissioner Altick stated the Commission was very pleased with the efforts of the local historical society who gave them a tour of the museum the previous day. She encouraged the Department to use volunteerism and to use the house museum in a monumental way. The home was an excellent display of lifestyle during the early Mexican period. The great number of artifacts was impressive. She wanted to see the Native American display representing a 5,000 year period in another area.

PUBLIC HEARING, Los Encinos State Historic Park, RM Contd.

Commissioner Hailstone expressed disappointment with the Native American display. Indians, who have lived in the area thousands of years, deserve more than a small table display. Their story should be expanded telling tribal names and more about their culture.

Commissioner Berk stated she had problems with static pieces of history; just telling the story of somebody's life does not particularly impress her. She is personally more impressed with the living conditions of life.

Commissioner Egizi commented she would like to see more creative and fascinating techniques used to capture people's interest in this history. The Native American display needs more attention.

Director Cahill felt the project should be a living history. The value of the hot springs can be interpreted. Perhaps the Native American story has not been adequately told. The story that is told there now may not be perfectly accurate, but before the docents, there was no story. More research can be done.

Commissioner Araujo also commended the ladies from the historical society who presented the tour of the home the previous day. She acknowledged that if it were not for their work, that unit would not be there. The docents are short of help, and the Department will be turning towards more volunteers.

Commissioner Wald felt the fencing around the pond was very unattractive and asked what was its purpose.

Jim Tryner answered that the fence around the ponds was placed there to prevent people from falling in the water. It was his opinion that the fence was unnecessary but there was a drowning in 1914. Mr. Tryner suggested that it be removed and replaced with a more aesthetic fence. Commissioner Wald concurred.

Chairman Gibson agreed with the sentiments that suggested enlarging and improving the display of Native American resources in the area. Something should be done to improve the appearance of the fence. There is a need for more parking space and the Department should continue to pursue the possibility of obtaining use of space on the adjoining private land.

It was moved by Commissioner Altick and seconded by Commissioner Araujo to adopt the following resolution:

WHEREAS the Director of the Department of Parks and Recreation has presented to this Commission for approval the proposed Resource Management Plan for Los Encinos State Historic Park; and

PUBLIC HEARING, Los Encinos State Historic Park, RM Contd.

WHEREAS this reflects the long-range development plan as to provide for the optimum use and enjoyment of the unit as well as the protection of its quality;

NOW, THEREFORE, BE IT RESOLVED that the State Park and Recreation Commission approves the Department of Parks and Recreation's "Resource Management Plan for Los Encinos State Historic Park," Preliminary dated July 1978, subject to such environmental changes as the Director of Parks and Recreation shall determine advisable and necessary to implement carrying out the provisions and objectives of said plan.

The Chairman called for a roll call vote. Commissioners Altick, Araujo, Egizi, Berk, Wald, Hailstone and Gibson voted AYE; the motion carried unanimously.

It was moved by Commissioner Berk, seconded by Commissioner Hailstone and carried unanimously to adopt the following resolution:

WHEREAS Los Encinos State Historic Park provides the State an opportunity to make available to the public for their enjoyment a site portraying the late Mexican and early American life styles in California; and

WHEREAS Los Encinos had been threatened with development; and

WHEREAS through the efforts of Mrs. Maria Stewart funds were raised to acquire Los Encinos for public ownership;

THEREFORE BE IT RESOLVED that the Park and Recreation Commission commends Mrs. Stewart for her dedication to the Los Encinos project and her many years of active participation in helping to preserve and interpret this project.

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Chairman Gibson recognized Gloria Heer of the Los Angeles County Park and Recreation Commission in the audience and thanked her in behalf of the State Park and Recreation Commission for the hospitality extended the previous evening.

Notice having been duly given, the Chairman declared the public hearing open for the review and discussion of the El Pueblo de Los Angeles State Historic Park Resource Management Plan at 2:00 p.m.

PUBLIC HEARING, El Pueblo de Los Angeles SHP, RI

PUBLIC HEARING,
El Pueblo de
Los Angeles SHP, RM
Contd.

Jim Tryner, Chief of the Resource Preservation and Interpretation Division, gave a slide and oral presentation on the project.

Chairman Gibson pointed out that the Resource Management Plan, prepared by the Department, is the only matter before the Commission today and that approval of the Resource Management Plan is not to be construed as approval of any part of the several development Plans which have been prepared for El Pueblo by the City or its agencies in years past. She stated that the next step will be for the State and City planning staffs to work together to prepare a new Development Plan which will be consistent with the Resource Management Plan and which will be brought before this Commission for approval.

John C. Horan, General Manager of the El Pueblo de Los Angeles State Historic Park appeared before the Commission recommending that the Resource Management Plan be approved and that El Pueblo de Los Angeles State Historic Park and State staff work together on another plan which will include the A.C. Martin Plan, usable portions of the earlier Master Plan, and other Plans, that have been utilized in the past.

Mr. Horan asked that the following corrections be made to the Plan.

<u>Page</u>	<u>Change</u>
Facing Page 1	Upper photograph should read: Church c. 1857 - Photograph taken from Judge Benjamin Hayes' diary. Novices processing towards Sisters of Charity school were painted in later. Lower photograph should read: Plaza Church in 1869, showing unrestored Plaza, facing northwest.
Page 1	Third paragraph should read: The original site of the pueblo is unknown, but is said to have been near the village of Yang-Na.
Page 2	Paragraph 5 should show the Plaza Firehouse date as 1883 (not 1883-4). Paragraph 8 should show the Masonic Lodge (1858).
Page 3	Pico House and Plaza in 1871, looking to the northeast. The Sisters of Charity school is in the background and Judge Agustin Olvera's adobe fronts on the Plaza on the same side.

PUBLIC HEARING,
El Pueblo de
Los Angeles SHP, RM
Contd.

Page 7 — Paragraph 2, Item (23) should show Vickrey (not Vickery) or Brunswig Building. Item (26) should indicate that the Plaza was laid out sometime between 1818 and 1825.

Page 9 — In the last paragraph, change "After 1900, El Pueblo began to decline" to "by 1900, El Pueblo was in a state of decline." Also change "Sequeiros" to "Siqueiros".

Page 11 — The bottom paragraph on Early Hispanic (Spanish) Era should state: "...although the plaza has only been at its present location since sometime after 1818[4], the site relates significantly to the early Spanish period."

Footnote 4 regarding the Plaza should state: "The Plaza was apparently laid out sometime between 1818 and 1825, as the final location of the pueblo that was originally established in 1781."

Page 12 — The sentence in the first paragraph, "Serious consideration must be given to acquisition of the Church of the Nuestra Senora, which dates from 1822" should be deleted. This is sanctified ground which the Church would not consider relinquishing.

In the third paragraph, the sentence beginning, "A significant problem is the lack of knowledge concerning the historical ethnic populations..." should be deleted. The next sentence should read: "Efforts should be made to acquire greater understanding of the historic ethnic populations which were so important to El Pueblo, through archival, oral historical, and archeological investigations."

The Statement of Purpose should be reviewed to determine if it is in conflict with a similar statement in the Joint Powers Agreement.

Page 15 — In paragraph 3, the Prime Period should be from 1818 (not 1815) to 1932.

Page 16 — The fourth paragraph should change from 1815 to 1818.

Page 17	The fifth paragrph should change from 1815 to 1818.
Several Pages	Several historic maps should be revised for inaccuracies.
Flow-of-History	Several statements, footnotes and the bibliography should be revised.

The Resource Management Plan should specifically state that the merchants of Olvera Street are a human resource. This statement should appear in an introductory paragraph, if possible, or otherwise in the Resource Summary. Mr. Horan's staff prepared the following statement for use in an introduction, or for insertion in the first paragraph in the "Olvera Street Block" item on page 8, after the words "the much larger Olvera Street Block."

> "The pleasant atmosphere of Olvera Street as a Hispanic/Mexican tourist and shopping attraction is primarily responsible for the success of the entire park; for the funding of its operations; and for originally having saved the entire Olvera Street area from demolition (as an undesirable slum) 50 years ago. That atmosphere results directly from the character of its merchants--a significant human resource."

The Resource Management Plan should specifically acknowledge that most of the park's cultural events were created by the merchants of Olvera Street. Mr. Horan's staff also recommended that the following statement be inserted in the first paragraph of the "recreation" item on page 8, after the word "Christmas":

> "These events comprise a total of 26 days and nights of fiestas throughout the year. Most of them were originated by the Olvera Street merchants, whose continued participation is essential to their success, and all of them are filled with the flavor and color of Olvera Street."

Jane Pisano, Los Angeles 200 Committee, appeared before the Commission stating the city will be commemorating its bicentennial anniversary on September 4, 1980. Therefore, her Committee is very much interested in the development and restoration of El Pueblo de Los Angeles State Historic Park since it is the birthplace of the city. She supported the Plan.

Enrique Barrios, President, Olvera Street Merchants Association, addressed the Commission urging it is of utmost importance that the Olvera Street merchants and their Mexican-Hispanic enterprises be listed as a prime human resource that must be protected fully, enthusiastically and with ethnic sensitivity. Any radical changes of the business operations as they are now conducted, could cause a failure of the entire operation.

PUBLIC HEARING, El Pueblo de Los Angeles SHP, RM Contd.

Chairman Gibson asked him to prepare a list of the Olvera Street families that had been merchants for two, three or four generations. He agreed to do this.

Bill Burkhart, Associated Historical Societies of Los Angeles County, stated this was a marvelous and comprehensive Plan. He was pleased, too, that the interpretive era was being expanded and all archeology features are going to be considered.

The Chairman called on Jean Bruce Poole and stated she was responsible for the excellent "Flow of History" report in the Plan. Jean Bruce Poole, El Pueblo de Los Angeles Historical Society, thanked the Commission for visiting the park the previous day. She also thanked staff for doing a good job on the Plan. She presented copies to the Director and Chairman of the "Guide to Historical Places in Los Angeles" which was prepared by the City Bicentennial Committee.

The Chairman closed the public hearing for the review and discussion of the El Pueblo de Los Angeles State Historic Park Resource Management Plan at 3:00 p.m.

Commissioner Altick thought the Plan was excellent and the timing truly fitting. She urged rapid completion of the General Development Plan in order to get restoration underway before the 200th birthday of El Pueblo de Los Angeles State Historic Park.

Commissioner Hailstone stated she believed the "Flow of History" should begin with the Native Americans. She liked the pleasant atmosphere, the streets, the foods and the presentations she had seen in the park.

Commissioner Egizi concurred with the previous comments of the other Commissioners and commended everyone who worked on the Plan, especially Mrs. Poole. She noticed there were not any credits on the inside cover of the preliminary copy of the Plan. When the final Plan comes out, appropriate credits should be on it. She requested that the reference to "Ultimate Boundary" be changed to "Zone of Interests" on Page 25.

PUBLIC HEARING, El Pueblo de Los Angeles SHP, RM Contd.

Commissioner Araujo offered much praise for the Plan. That evening the Mexican community would be celebrating its Fourth of July, Mexican Independence Day; therefore, this would be a most appropriate time to approve this Plan. There was an incorrect word use in the Plan. She requested that any reference to "Nigger Alley" should be changed to "Calle de los Negros".

In answer to a previous question from Commissioner Gibson, John Horan stated there were 80 merchants in the park.

Commissioner Gibson stated the Plan was splendidly done. She requested the following revised wording under the "Declaration of Purpose" on Page 12: The purpose of El Pueblo de Los Angeles State Historic Park, in the City of Los Angeles, is to preserve and, where appropriate, restore and reconstruct for the enlightenment and enjoyment of the public forever, the remaining features of one of the three official Spanish pueblos of Alta California, as well as structures and other features characteristic of the flow of history and diverse populations associated with the development of the Pueblo and the City of Los Angeles. Emphasis will be on the span from the Spanish Era through the Mexican and American Eras_ 1818-1932.

The Director stated the Department was in full concurrence with all of the amendments.

It was moved by Commissioner Araujo and seconded by Commissioner Egizi to adopt the following resolution:

WHEREAS the Director of the Department of Parks and Recreation has presented to this Commission for approval the proposed Resource Management Plan for El Pueblo de Los Angeles State Historic Park; and

WHEREAS this reflects the long-range development plan as to provide for the optimum use and enjoyment of the unit as well as the protection of its quality;

NOW, THEREFORE, BE IT RESOLVED that the State Park and Recreation Commission approves the Department of Parks and Recreation's "Resource Management Plan for El Pueblo de Los Angeles State Historic Park", Preliminary, dated July 1978, subject to such environmental changes as the Director of Parks and Recreation shall determine advisable and necessary to implement carrying out the provisions and objectives of said plan.

PUBLIC HEARING, El Pueblo de Los Angeles SHP, RM Contd.

There was a suggestion to delete the second paragraph of the resolution because of its reference to "development plan", there being no development plan before the Commission at this time. It was moved by Commissioner Araujo and seconded by Commissioner Wald to adopt the following amended resolution:

WHEREAS the Director of the Department of Parks and Recreation has presented to this Commission for approval the proposed Resource Management Plan for El Pueblo de Los Angeles State Historic Park; and

NOW, THEREFORE, BE IT RESOLVED that the State Park and Recreation Commission approves the Department of Parks and Recreation's "Resource Management Plan for El Pueblo de Los Angeles State Historic Park," Preliminary dated July 1978, subject to such environmental changes as the Director of Parks and Recreation shall determine advisable and necessary to implement carrying out the provisions and objectives of said plan.

The Chairman called for a roll call vote. Commissioners Egizi, Wald, Hailstone, Araujo, Altick, Berk and Gibson voted AYE; the motion carried.

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POLICY NO. 28

Chairman Gibson stated, "This matter of a possible change in Policy #28 comes before us at this time because of a pending application for approval of a hard liquor license for restaurant premises to be constructed on a pier at San Buenaventura State Beach.

Our present statewide Policy #28 permits us to consider applications for beer and wine licenses at appropriate premises in all units of the State Park System. But our present Policy #28 does not permit applications for hard liquor licenses to be considered for any unit of the State Park System except State Historic Parks and State Recreation Areas--and a State Beach is not included in these exceptions. For that reason on the advice of the Attorney General we refused to consider the San Buenaventura restaurant application at our meeting in San Jose, in December 1977.

The application was temporarily withdrawn for correction of certain unrelated legal problems. These problems have apparently been corrected and the applicant for a hard liquor license has again requested a place on the agenda. Relying on the Attorney General's opinion we notified the applicant that the Commission could not consider his application unless it

POLICY NO. 28
Contd.

first amended its present policy. Following our normal procedure, Mrs. Araujo, Chairman of the Policy Committee, called a meeting of the Policy Committee to consider what action was appropriate and she is ready to make her report. The Chair wishes to point out that the merits of the particular restaurant project are not before us today. Nor, is the full Commission expected to make a decision today on whether a change in statewide policy is warranted.

The Commission will hear the report of the Policy Committee today and may want to schedule a meeting on the subject to hear public testimony at our next meeting."

Commissionor Araujo stated, "The Policy Committee believes there are sound reasons for limiting hard liquor licenses in the State Park System to State Historic Parks and State Recreation Areas and does not recommend changes in the present wording of Policy #28 at this time.

Inasmuch as this is a matter of statewide concern affecting more than 68 State Beaches the Policy Committee recommends that the full Commission should have the opportunity to hear as many viewpoints as possible before making a decision. The Policy Committee recommends that this matter be placed on the October agenda in Los Angeles and that public comment be invited.

The Policy Committee further recommends the exploration of one additional solution: We request the Department of Parks and Recreation to explore fully the possibility of transferring title to the land at the entrance to the pier to the city or county of Ventura."

Commissioner Altick commented she would like the Department to explore other avenues that might enable the Commission to make an exception in this case without passing a policy amendment affecting all State Beaches.

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GIFTS
Save-the-Redwoods League

The Save-the-Redwoods League requested approval of the following redwood groves:

STANDISH-HICKEY STATE RECREATION AREA

Name of Grove	Total Cost	Donor's Cost	Donor
Sedalia Ray Grove	$20,000	$10,000	Mr. and Mrs. Charles H. Ray Mr. and Mrs. William D. Taber

It was moved by Commissioner Egizi, seconded by Commissioner Wald and unanimously carried to adopt the following resolution:

GIFTS CONTD.
Save-the-Redwoods League

WHEREAS the State Park and Recreation Commission has been requested by the Save-the-Redwoods League to approve the establishment of a living grove in Standish-Hickey State Recreation Area, to be known as the Sedalia Ray Grove; and

WHEREAS said grove is possible through the generous donation of Mr. and Mrs. Charles H. Ray and Mr. and Mrs. William D. Taber;

NOW, THEREFORE, BE IT RESOLVED that the California State Park and Recreation Commission hereby approves the establishment of the Sedalia Ray Grove in Standish-Hickey State Recreation Area, and gratefully acknowledges the generosity of Mr. and Mrs. Charles H. Ray and Mr. and Mrs. William D. Taber.

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PRAIRIE CREEK REDWOODS STATE PARK

Name of Grove	Total Cost	Donor's Cost	Donor
Edgar Garfield Harkness Grove	$20,000	$10,000	Mrs. Doris Blake Harkness (By Request)

It was moved by Commissioner Wald, seconded by Commissioner Egizi and carried unanimously to adopt the following resolutions:

WHEREAS the State Park and Recreation Commission has been requested by the Save-the-Redwoods League to approve the establishment of a living grove in Prairie Creek Redwoods State Park, to be known as the Edgar Garfield Harkness Grove; and

WHEREAS said grove is possible through the generous donation of Mrs. Doris Blake Harkness;

NOW, THEREFORE, BE IT RESOLVED that the California State Park and Recreation Commission hereby approves the establishment of the Edgar Garfield Harkness Grove in Prairie Creek Redwoods State Park, and gratefully acknowledges the generosity of Mrs. Doris Blake Harkness.

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PRAIRIE CREEK REDWOODS STATE PARK

Name of Grove	Total Cost	Donor's Cost	Donor
Joy-Laton Grove	$30,000	$15,000	Mrs. Anita D. Laton

It was moved by Commissioner Wald, seconded by Commissioner Egizi and carried unanimously to adopt the following resolutions:

GIFTS CONTD.
Save-the-Redwoods League

WHEREAS the State Park and Recreation Commission has been requested by the Save-the-Redwoods League to approve the establishment of a living grove in Prairie Creek Redwoods State Park, to be known as the Joy-Laton Grove; and

WHEREAS said grove is possible through the generous donation of Mrs. Anita D. Laton;

NOW, THEREFORE, BE IT RESOLVED that the California State Park and Recreation Commission hereby approves the establishment of the Joy-Laton Grove in Prairie Creek Redwoods State Park, and gratefully acknowledges the generosity of Mrs. Anita D. Laton.

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PRAIRIE CREEK REDWOODS STATE PARK

Name of Grove	Total Cost	Donor's Cost	Donor
Eleanor and Fred Berke Grove	$20,000	$10,000	Mrs. Eleanor Berke

It was moved by Commissioner Wald, seconded by Commissioner Egizi and carried unanimously to adopt the following resolutions:

WHEREAS the State Park and Recreation Commission has been requested by the Save-the-Redwoods League to approve the establishment of a living grove in Prairie Creek Redwoods State Park, to be known as the Eleanor and Fred Berke Grove; and

WHEREAS said grove is possible through the generous donation of Mrs. Eleanor Berke;

NOW, THEREFORE, BE IT RESOLVED that the California State Park and Recreation Commission hereby approves the establishment of the Eleanor and Fred Berke Grove in Prairie Creek Redwoods State Park, and gratefully acknowledges the generosity of Mrs. Eleanor Berke.

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PRAIRIE CREEK REDWOODS STATE PARK

Name of Grove	Total Cost	Donor's Cost	Donor
James Holms Barr. M.D. and Hedwick T Barr Grove	$20,000	$10,000	Mrs. Barbara B. Kline (By Request)

It was moved by Commissioner Wald, seconded by Commissioner Egizi and carried unanimously to adopt the following resolutions:

GIFTS CONTD.
Save-the-Redwoods League

WHEREAS the State Park and Recreation Commission has been requested by the Save-the-Redwoods League to approve the establishment of a living grove in Prairie Creek Redwoods State Park, to be known as the James Holmes Barr, M.D. and Hedwick T. Barr Grove; and

WHEREAS said grove is possible through the generous donation of Mrs. Barbara B. Kline;

NOW, THEREFORE, BE IT RESOLVED that the California State Park and Recreation Commission hereby approves the establishment of the James Holmes Barr, M.D. and Hedwick T. Barr Grove in Prairie Creek Redwoods State Park, and gratefully acknowledges the generosity of Mrs. Barbara B. Kline.

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PRAIRIE CREEK REDWOODS STATE PARK

Name of Grove	Total Cost	Donor's Cost	Donor
David Z. Gardner Memorial Grove	$20,000	$10,000	Mr. William D. Gardner

It was moved by Commissioner Wald, seconded by Commissioner Egizi and carried unanimously to adopt the following resolutions:

WHEREAS the State Park and Recreation Commission has been requested by the Save-the-Redwoods League to approve the establishment of a living memorial grove in Prairie Creek Redwoods State Park, to be known as the David Z. Gardner Memorial Grove; and

WHEREAS said grove is possible through the generous donation of Mr. William D. Gardner;

NOW, THEREFORE, BE IT RESOLVED that the California State Park and Recreation Commission hereby approves the establishment of the David Z. Gardner Memorial Grove in Prairie Creek Redwoods State Park, and gratefully acknowledges the generosity of Mr. William D. Gardner.

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PRAIRIE CREEK REDWOODS STATE PARK

Name of Grove	Total Cost	Donor's Cost	Donor
Marjorie B. Johnston Memorial Grove	$50,000	$25,000	Mrs. J. Marshall Evans

GIFTS CONTD.
Save-the-Redwoods League

It was moved by Commissioner Wald, seconded by Commissioner Egizi and carried unanimously to adopt the following resolutions:

WHEREAS the State Park and Recreation Commission has been requested by the Save-the-Redwoods League to approve the establishment of a living memorial grove in Prairie Creek Redwoods State Park, to be known as the Marjorie B. Johnston Memorial Grove; and

WHEREAS said grove is possible through the generous donation of Mrs. J. Marshall Evans;

NOW, THEREFORE, BE IT RESOLVED that the California State Park and Recreation Commission hereby approves the establishment of the Marjorie B. Johnston Memorial Grove in Prairie Creek Redwoods State Park, and gratefully acknowledges the generosity of Mrs. Marshall Evans.

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PRAIRIE CREEK REDWOODS STATE PARK

Name of Grove	Total Cost	Donor's Cost	Donor
Orville C. Fox Memorial Grove	$20,000	$10,000	Mr. Richard O. Fox Fox Manufacturing Co.

It was moved by Commissioner Wald, seconded by Commissioner Egizi and carried unanimously to adopt the following resolutions:

WHEREAS the State Park and Recreation Commission has been requested by the Save-the-Redwoods League to approve the establishment of a living memorial grove in Prairie Creek Redwoods State Park, to be known as the Oroville C. Fox Memorial Grove; and

WHEREAS said grove is possible through the generous donation of Mr. Richard O. Fox;

NOW, THEREFORE, BE IT RESOLVED that the California State Park and Recreation Commission hereby approves the establishment of the Oroville C. Fox Memorial Grove in Prairie Creek Redwoods State Park, and gratefully acknowledges the generosity of Mr. Richard O. Fox.

Commissioner Egizi expressed her appreciation to the Save-the-Redwoods League.

Chairman Gibson asked that the Department consider having a field trip Wednesday afternoon, October 11, 1978 to Otterbein State Recreation Area or the alternative is that the Commissioners could make special arrangements to get there before the October meeting.

The Commissioners agreed to eliminate their December meeting in order to save money and to combine it with the regular January meeting. Commissioner Altick requested that it go on record that the Commission should try to meet in a hotel adjacent to the airport as an economy measure.

Future Meetings

The next meetings will be October 13, 1978 in Los Angeles and November 17, 1978 in the San Francisco area.

The meeting adjourned at 4:05 p.m.

Respectfully submitted,

Margo Woods

for Russell W. Cahill
Director

0-0341C

UNIT 548

MALIBU LAGOON STATE PARK

GENERAL DEVELOPMENT PLAN

September 1978

Malibu Lagoon State Beach

Resource Management Plan, General Development Plan, and Environmental Impact Report

PRELIMINARY

APRIL 1978

State of California — The Resources Agency
DEPARTMENT OF PARKS & RECREATION

This report was prepared by:

Albert Tjaden . . . . Assistant Landscape Architect
Jean Roberts . . . . Park Interpretive Specialist
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Under the supervision of:

Jack Harrison . . . . Chief, Development Division
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Sam Amar . . . . Delineator

Malibu Lagoon State Beach

RESOURCE MANAGEMENT PLAN
GENERAL DEVELOPMENT PLAN
ENVIRONMENTAL IMPACT REPORT

April 1978

EDMUND G. BROWN JR.
Governor

HUEY D. JOHNSON
Secretary for Resources

RUSSELL W. CAHILL
Director

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
P.O. Box 2390
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STATE OF CALIFORNIA - RESOURCES AGENCY
DEPARTMENT OF PARKS AND RECREATION
STATE PARK AND RECREATION COMMISSION
P.O. BOX 942896, SACRAMENTO, CA 94296-0001

EXCERPTS FROM THE MINUTES OF SEPTEMBER 1978
Malibu Lagoon State Beach
Resource Management Plan and General Development Plan

It was moved by Commissioner Altick, and seconded by Commissioner Egizi to approve the following resolution:

WHEREAS the Director of the Department of Parks and Recreation has presented to this Commission for approval the Proposed Resource Management Plan, General Development Plan and Environmental Impact Report for Malibu Lagoon State Beach; and

WHEREAS this reflects the long-range development plan as to provide for the optimum use and enjoyment of the unit as well as the protection of its quality;

NOW, THEREFORE, BE IT RESOLVED that the State Park and Recreation Commission approves the Department of Parks and Recreation's "Resource Management Plan and General Development Plan for Malibu Lagoon State Beach," Preliminary dated April 1978, subject to such environmental changes as the Director of Parks and Recreation shall determine advisable and necessary to implement carrying out the provisions and objectives of said plan.

The Chairman called for a roll call vote. Commissioners Altick, Araujo, Egizi, Berk, Wald, Hailstone and Gibson voted AYE; the motion carried unanimously.

***

Errata

1. Acknowledgement is made to the following for their research that provided data on which this General Plan rests: Frank Lortie, historian; George Stammerjohan, historian; and Jack Hiehle, wildlife ecologist, all of whom worked under the supervision of James P. Tryner, Chief, Resource Preservation and Interpretation Division.

2. On page 4, in paragraph 1, the 7000 year time span for Chumash occupation refers to the Chumash and their ancestors throughout the area generally, most specifically at Malibu Lagoon. All other general statements about the Chumash in the first three paragraphs of page 4 also refer generally to the former inhabitants of the Malibu Lagoon site.

3. On page 4, paragraph 6, "livestock" refers to new kinds of animals.

4. On page 5, it is recognized that a certain amount of artistic freedom is taken with the illustrations, particularly the whole hunting scene; the Chumash were not whale hunters, and the boat is inaccurate.

Contents

INTRODUCTION 1

Purpose of Plan 3
Project Description 3
Historical Background 4

RESOURCE MANAGEMENT PLAN 7

General 9
Resource Objectives 9
Resource Use, Management and Protection Concepts and Philosophies 11
Resource Evaluation 13
Natural Values 13
Cultural Resources 16
Declaration of Purpose 17
Declaration of Resource Management Policy 17

GENERAL DEVELOPMENT PLAN 19

Introduction 21
Land Use Analysis 21
Existing Land Use 21
Proposed Land Use 21
Proposed Developments 21
West Side 21
North Side 23
Utilities 24
Special Considerations 24
Interpretive Prospectus-Summary 24
Interpretive Periods 25
Interpretive Themes 25
Interpretive Methods and Facilities 25
Problem Areas 26
Rapid Transit 26
Trails 26
Fire Control 26

DRAFT ENVIRONMENTAL IMPACT REPORT 27

APPENDIXES 33

RESPONSE TO COMMENTS

The preliminary plan for Malibu Lagoon State Beach; Resource Management Plan (RMP), General Development Plan (GDP), and Draft Environmental Impact Report (DEIR) was circulated to the State Clearinghouse (15 copies), Southern California Association of Governments (SCAG), Los Angeles County Regional Planning Commission and Sierra Club State Park Task Force.

Comments on the preliminary plan were received from the California Regional Water Quality Control Board, Los Angeles Region; the California Department of Fish and Game, the California Department of Transportation, SCAG and Los Angeles County.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

Specific concern cannot be addressed adequately. The EIR on page 28 states:

> "The General Development Plan for Malibu Lagoon State Beach is broad in scope; therefore, the EIR is also a broad assessment of the potential impacts. Whenever a specific phase of the overall plan is budgeted and proposed for implementation, a more detailed and specific environmental assessment will be prepared for that particular project, as part of the budget package."

In general your comments can be addressed as follows:

1. Excavation and regrading in the marsh adjacent to the lagoon will be done in such a manner as to minimize turbidity and water pollution.
2. The water drainage from the Pacific Coast Highway will be investigated for high lead content and other pollutants.
3. Breaching the sandbar will be done so as to minimize turbidity.
4. The Department of Parks and Recreation would be interested in the results obtained from the one-year study of waste discharged into Malibu Creek from the Tapia Wastewater Reclamation Plant. We agree that the effects of a year-round discharge from the plan on the proposed restoration and enlargement of the salt water marsh adjacent to Malibu Lagoon should be reevaluated when the study is complete. The Department of Parks and Recreation will coordinate with your agency regarding specific proposals as the project progresses.

CALIFORNIA DEPARTMENT OF FISH AND GAME

1. The upstream portion of the project, or that north of Highway 1, will be protected and only minimally developed with trails.
2. No additional acquisitions are proposed at this time. If additional acquisitions are proposed, marsh restoration on these lands will be studied to see if it would be feasible to restore them.
3. The Department of Parks and Recreation will work closely with the Department of Fish and Game in order to insure the perpetuation, enhancement and utilization of the steelhead fishery in Malibu Creek. The Department of Fish and Game

will be notified and an agreement will be made prior to the commencement of streambed alteration.

CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)

The Department of Parks and Recreation will consult with CALTRANS pursuant to the Resources Agency guidelines for implementation of the California Environmental Quality Act. The specific phase of the development plan which would interact with the highway will be coordinated with CALTRANS.

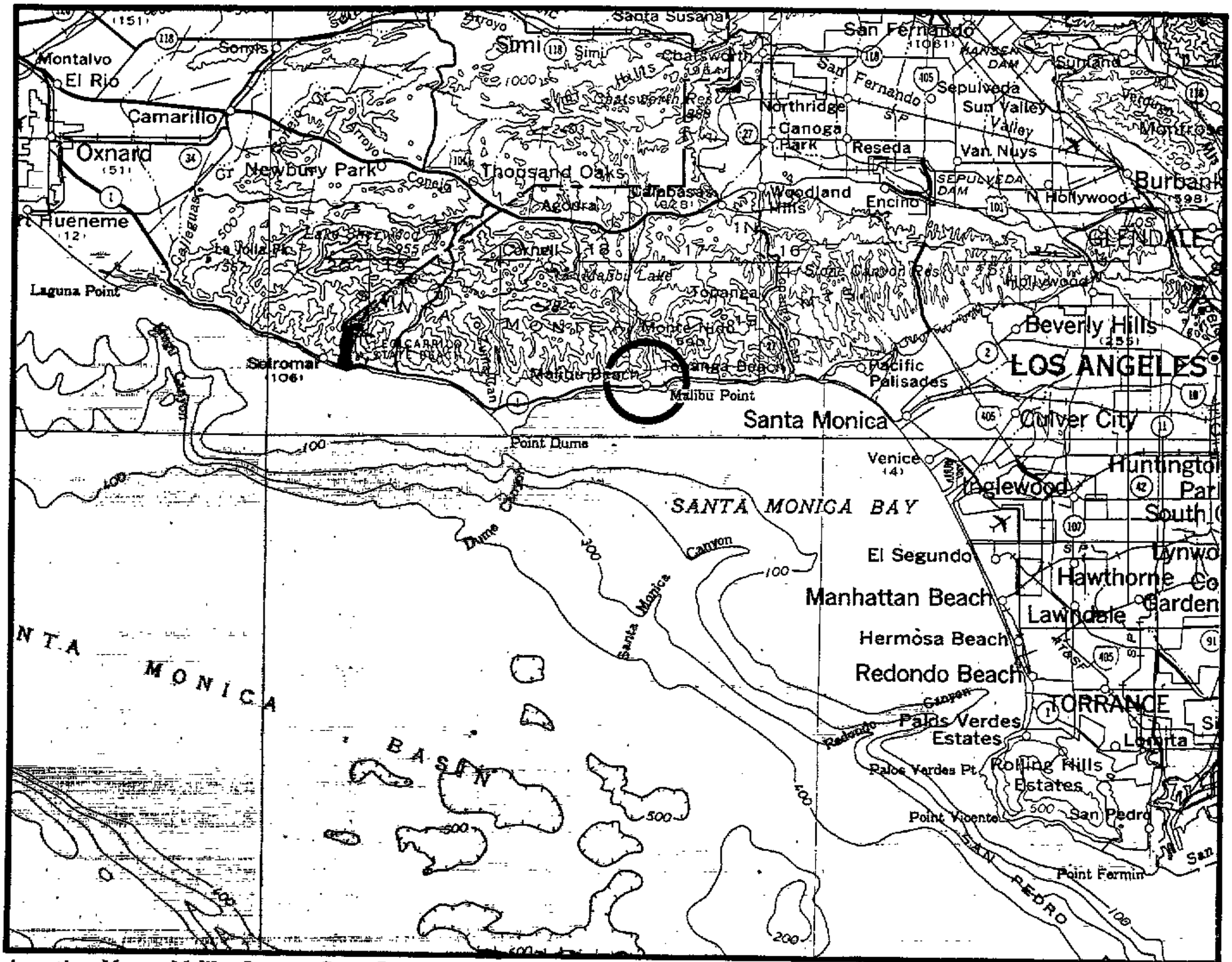
SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS (SCAG)

Southern California Association of Governments indicated that the preliminary Malibu Lagoon State Beach Resource Management Plan, General Development Plan and Draft Environmental Impact Report is consistent with its adopted Conservation and Open Space Plan. The Department of Parks and Recreation will coordinate with the appropriate local agencies.

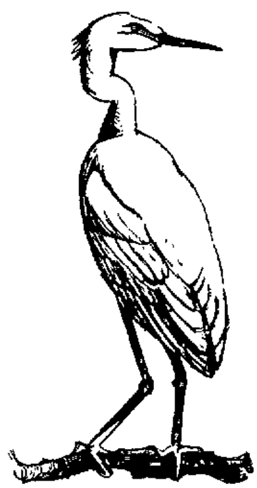
COUNTY OF LOS ANGELES DEPARTMENT OF REGIONAL PLANNING

These comments do not need a response.

Introduction



Location Map – Malibu Lagoon State Beach



Snowy egret

INTRODUCTION

Purpose of Plan

The purpose of the Malibu Lagoon State Beach Resource Management and General Development Plans is to provide policies for preservation, interpretation, and public use of natural and cultural resource values within the unit.

Throughout the planning for development of this unit, citizen participation and interagency cooperation have been encouraged. An extensive study of the related land sytems and adjacent environments of this park unit have formed the foundation for development guidelines. As a result, the general approach has been to preserve and restore as much of the natural landscape and biotic communities as possible, while providing facilities to make the outstanding resource values found here available to the public for its enjoyment.

It must further be understood that this proposed plan for Malibu Lagoon State Beach is in agreement with the guidelines and recommendations set forth by the California Coastal Plan.

Project Description

Malibu Lagoon State Beach forms part of the coastal portion of the Santa Monica Mountains chain, one of the transverse mountain ranges of southern California. These ranges run in an east/west direction, perpendicular to the major mountain ranges of the state.

The Santa Monica Mountains span a distance of 74.02 kilometers (46 miles), from Point Mugu to Griffith Park. The mountain range averages about 11.26 kilometers (7 miles) across, and contains about 80,800 hectares (200,000) acres.

Malibu Lagoon State Beach is located in Los Angeles County, where Malibu Creek meets the Pacific Ocean, and contains a total of 30.67 hectares (75.79) acres. The state beach is at the southern base of the Santa Monica Mountains, about 54 kilometers (34 miles) west of the Los Angeles metropolitan complex.

Most of the area consists of an alluvial fan formed by an antecedent stream, now called Malibu Creek, which originates deep in the Santa Monica Mountains.

The lagoon is about 2 hectares (5 acres) in size, and constitutes one of the few remaining migratory bird sanctuaries in Los Angeles County. The ocean along the beach has worldwide recognition as a surfing spot.

The park is bisected by Highway 101. North of the highway along Malibu Creek lies a parcel, 9.7 hectares (23.98 acres) in size, which was recently acquired.

Acquisition of 3.7 hectares (9.14 acres) west of the lagoon is now being considered.

Historical Background

The area around Malibu Lagoon State Beach has been occupied for more than 7,000 years, based on data derived from archeological work at the Native American site located in this unit. Unfortunately, there is little information about the earliest residents. Artifacts extracted from the earliest occupation levels are primarily grinding implements. These levels have been dated to 5,500 years B.C.

Researchers have interpreted from the archaeological data that these early inhabitants led a sedentary life. From 1,500 to 500 B.C., however, substantial changes took place in the lifestyles of the occupants; new and varied artifacts were created, and food resources were exploited in newer and more intensive ways.

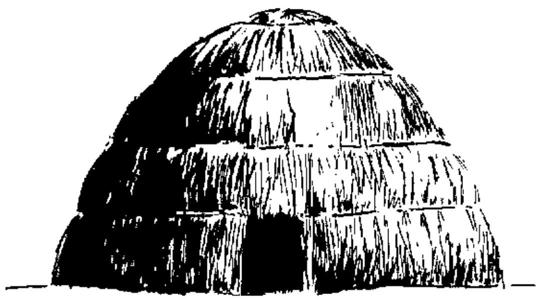
In contrast to the earlier inhabitants, the Chumash had a more complex culture and society, relying mainly on an economy based on marine fishing and hunting, and on inter-village trade. A sedentary people, the Chumash had a hierarchial social structure, and a considerable degree of craft and task specialization. Their ocean-going plank canoes, basketry, shell decorated implements, use of shell beads for currency, and extensive system of trade reflected exceptional skill and adaptive ability.

The first contact of Europeans with the Chumash in the Malibu area probably occurred at the very end of the 18th century. By 1802, Bartolome Tapia had received a concession for the Rancho Topanga Malibu Sequit, and had built a corral, several outbuildings, and an adobe residence in Malibu Canyon, not far from the lagoon. He (and later, his son Tiburcio), raised cattle, and were active in the political and economic life of the Los Angeles pueblo.

After Tiburcio died in 1848, the rancho was owned first by a Frenchman, Leon Victor Prudhomme, who had married Tiburcio's daughter, and later by a wealthy man named Matthew Keller. Keller eventually sold the rancho in 1891, to the grandfather of the women from whom the state acquired the property. This man was Frederick H. Rindge.

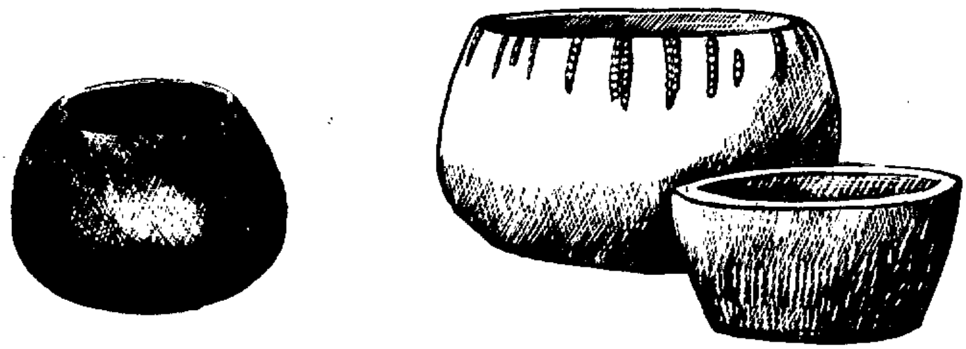
Rindge, a member of an old, wealthy Massachusetts family, was an energetic capitalist, investing in and managing many business and agricultural concerns in the Los Angeles area and in northern California. He improved the ranch significantly, adding livestock to the cattle and sheep herds, and building a beautiful mansion not far from the site of the Tapia adobe. In 1903, most of the ranch structures, including all those in Malibu Canyon, were destroyed by a fire.

After Rindge's death in 1905, the Malibu ranch was run by his widow, May Rindge. She was a woman of notable ability, with a reputation for contentiousness and fierce determination. As the population in the Los Angeles area increased sharply after 1900, and the number of homesteading farmers increased on the northern borders of the ranch, demands on the ranch property intensified. In order to provide the homesteaders and others with access to



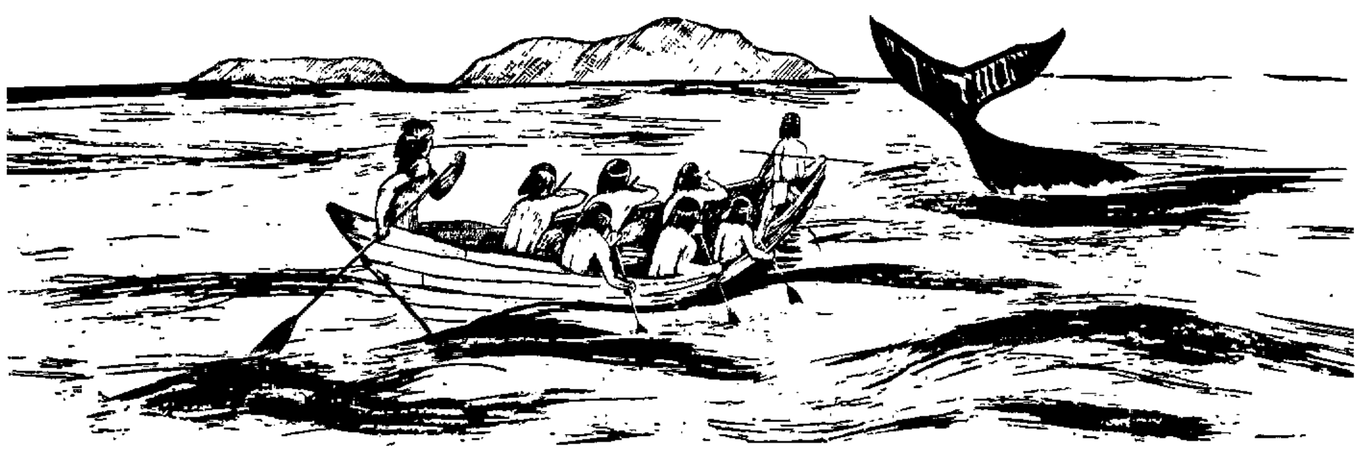
Chumash dwelling

Malibu Canyon was the southern boundary of Chumash territory in Southern California.



Above: Steatite (soapstone) bowls were made by Chumash craftsmen.

Below: Ocean-going plank canoes were made watertight with asphalt caulking.



Los Angeles, the county demanded a right-of-way for a road. Then, the state made a similar demand, for a highway to cross the ranch. May Rindge fought the right-of-way condemnations in the courts (she took four cases to the State Supreme Court, and two to the U.S. Supreme Court) and at the ranch itself. Confrontations between Mrs. Rindge's armed ranch hands, riding on fence patrols, and homesteaders, surveyors, and county officials attracted much public attention. In 1919, the state courts finally decided for the county; in 1925, the courts gave a right-of-way to the state for that part of the Roosevelt Highway which was to cross the ranch.

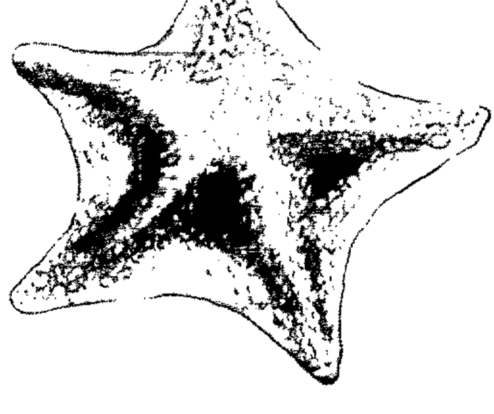
There had been no family residence on the ranch since the 1903 fire. In the late 1920s, Mrs. Rindge decided to build a forty room "castle" on the hill, just above the site of the first Rindge mansion. This massive structure was left unfinished, since financial pressures increased sharply after 1925, especially in the Great Depression. In 1926, a long strip of beach was put up for lease, and many Hollywood movie stars constructed beach houses there, becoming the nucleus of today's famous Malibu colony. By the mid-1930s, the Marblehead Land Company, which was the legal owner of the Malibu Ranch, and which was created and controlled by May Rindge, faced bankruptcy. Land, livestock, and other assets were liquidated, but by 1940, the ranch could not be saved, and the entire property was put up for sale.

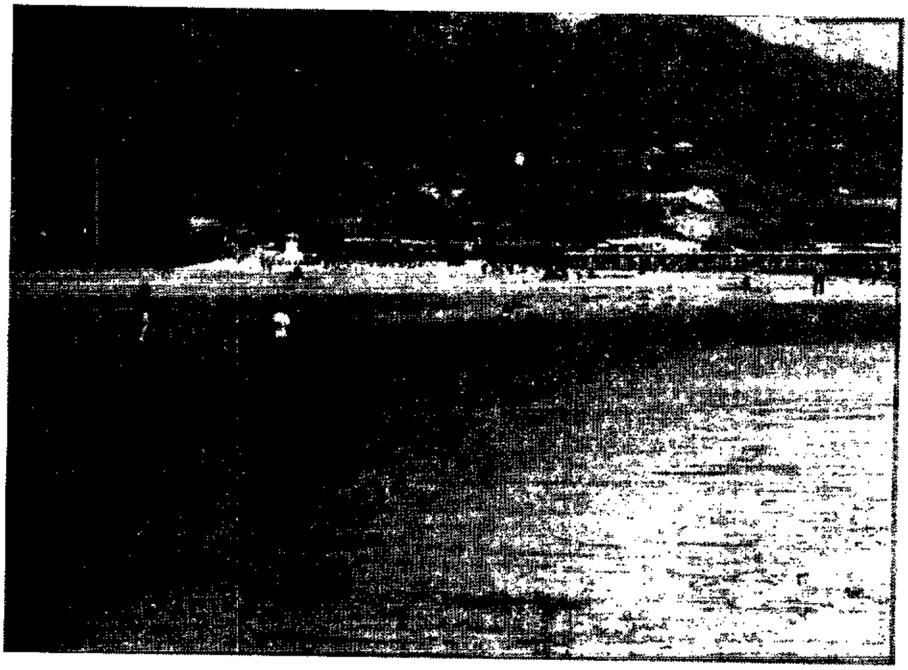
It was sometime in the 1920s when May Rindge's daughter, Rhoda Rindge Adamson, acquired from the ranch the property around Malibu Lagoon. In 1929, construction was completed on the house that is now part of Malibu Lagoon State Beach. Designed by the famous Los Angeles architect, Stiles Clement, of Morgan, Walls, and Clement, the home is a beautiful and unique example of Spanish, Moorish, and Mediterranean styles. The striking use of custom-made tile and the richly painted decorations and murals in the interior make the Adamson home truly one of a kind.

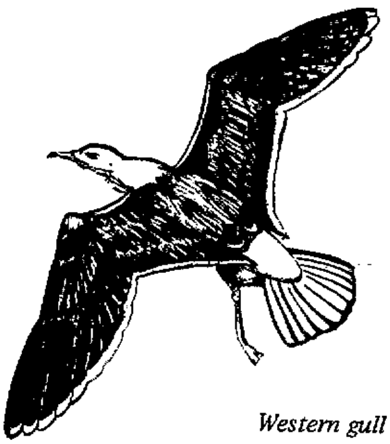
With her husband, Merritt H. Adamson, Rhoda Adamson launched the Adohr Dairy in 1916. By the time their Malibu home was finished, the dairy was one of the biggest in southern California. Adamson was president of the Adohr Corporation, and his wife was secretary (Adohr is Rhoda spelled backward). While managing this and other businesses and investments, which kept the Adamsons busy, they spent as much time as they could at the Malibu home, improving its garden and grounds. They owned several homes, but this was their main residence. Mrs. Adamson remained here after her husband died, and the Adamson presence at Malibu was continued after her death in 1962, when her daughter, Mrs. Sylvia Adamson Neville, moved there.

The State of California acquired the thirteen acres containing the Adamson home and grounds in April 1968. The state had problems providing personnel for the unit, so it was leased back to the Adamson family. From 1968 to 1971, the Adamsons maintained the property, and hired security guards to protect it. Pepperdine University leased the unit in March 1971, using the Adamson residence as a home and office for the Chancelor of the university, Dr. Norvel Young. The lease was renewed in 1975, and is still in effect.

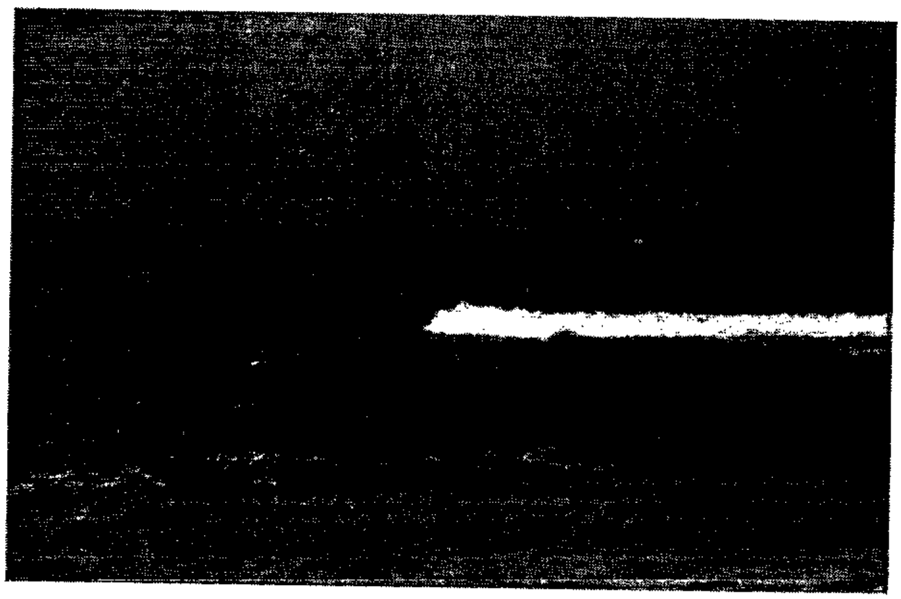
Resource Management Plan







Western gull



RESOURCE MANAGEMENT PLAN

General

The Malibu Lagoon area has been classified as a state beach by the State Park and Recreation Commission, under authorization of Section 5001.5 of the Public Resources Code.

A state beach is a category of state recreation unit. The Public Resources Code defines a state recreation unit and state beach as follows:

> "(d) State recreation units, ... consist of areas selected, developed and operated to provide outdoor recreational opportunities. Such units shall be designated by the State Park and Recreation Commission by naming, in accordance with the provisions of this article relating to classification.
>
> In the planning of improvements to be undertaken within state recreation units, consideration shall be given to compatibility of design with the surrounding scenic and environmental characteristics ....
>
> 4. State beaches, (consisting) of areas with frontage on the ocean or bays designed to provide swimming, boating, fishing and other beach-oriented recreational activities. Coastal areas containing ecological, geological or scenic resources of significant value shall be preserved within state wildernesses, state reserves, state parks or natural preserves."

Malibu Lagoon State Beach has a number of significant features which set it aside from many other southern California beaches. It is considered to be one of the better surfing beaches in the southland, and is commonly known as "Surfrider's Beach." The area has enough drainage to support a stream that flows nearly year-round. It has a marsh and estuarine condition, mainly of saltwater but with a freshwater riparian habitat at the stream's mouth. The area also contains Humaliwu, one of the largest remaining southern Chumash archeological sites; it has been protected over the years because it is on private property. The Adamson House, a representative sample of affluent beach residences of the 1920s and 1930s, is also on the property. The village site and the house are on the National Register of Historic Places.

Resource Objectives

To maintain, perpetuate, and protect Malibu Lagoon State Beach and its resources at a high level of usefulness and productivity, and to keep it esthetically pleasing, the resource objectives shall be as follows:

1. To reserve the beach sand area for day-use beach activities, rather than for parking or other supportive uses.

2. To recognize the lagoon and associated marsh areas as a very important link in the habitat essential to maintaining a native resident and migratory bird population in southern California. This habitat has been greatly depleted in this area. It is a managment objective to restore some of the marsh area that was lost by previous filling. This will also provide a scenic open-space area, in a location that is already highly developed.

3. To partially restore the marsh area, it will be necessary to excavate and regrade, so the entire marsh area will drain into the main lagoon. This includes drainage from adjacent lands, such as the Pacific Coast Highway. This will reduce, if not eliminate, much of the present mosquito breeding problem, that results largely from potholes and poor drainage.

4. To adequately protect the ecological values of the marsh and lagoon area, it is recommended that the Park and Recreation Commission be requested to classify that area as a natural preserve.

5. To further protect the fragile salt marsh and its environment, foot traffic should be prevented from crossing any part of the marsh for access to the beach. If an arm or portion of the marsh must be crossed to get proper trail alignment, the trail should be on a bridge.

6. To manage the water level of the lagoon through periodically breaching the sandbar, so the undesirable effects of the ponding lagoon waters will be held to a minimum, and the desirable effects enhanced. The undesirable effects include: a high water table with resulting mosquito breeding; flooding of the Malibu colony and its septic tank drain fields; maintaining too high a water level in the lagoon, covering the mud flats and reducing the feeding areas of water birds; warming of the lagoon waters; proliferation of algae and subsequent algae and marine life die-off, resulting in obnoxious smells; lack of flushing of the lagoon; and an unbalanced condition between fresh and salt water, which could be harmful to the saltwater marsh and the marine plants and animals.

   Desirable effects include: the interchange of saltwater, which would provide an intertidal feeding area for water-associated birds; some control of the amount of freshwater algae; partial elimination of the mosquito problem; providing enough saltwater to keep the marsh plants in a healthy and thriving condition; helping to provide a saltwater habitat for those organisms which need it; and keeping the water quality at a much higher level, to prevent stagnation.

7. To encourage native species, except in the Adamson House gardens, and to discourage and/or eliminate aggressive non-native species. Native species that may proliferate and cause undesirable results, such as certain algae of the lagoon, should also be controlled.

8. To restore and maintain the natural environment needed to sustain a healthy native animal population.

9. To protect, manage, maintain, and interpret the cultural values of the area, particularly (but not limited to) those concerning the Adamson House and the evidences of Native American occupation.

Resource Use, Management and Protection concepts and Philosophies

The use concept of the beach is to make this area available for any day-use activities appropriate to a sandy beach with a cobble intertidal area. The waves at this beach make it a prime surfboard-riding location, and it attracts many surfers. It is not considered to be a good swimming beach, although many people use it for this purpose. Some fishing also takes place here, but this tends to be a minor use. Sunbathing, picnicking, and general sightseeing are major uses.

The marsh area has been treated more as an obstacle to cross in getting to the beach than as an ecological habitat. School groups visit it quite frequently, and bird watchers are often present. Since marsh areas are a disappearing habitat, especially in southern California, every effort should be made to enhance this habitat, and to prevent uses of it that would destroy its value. To a large extent, this means keeping visitors and domestic animals out of the marsh proper; use by visitors should be on the periphery, or on prepared trails leading to observation points.

The lagoon water levels must be controlled by breaching the sandbar. A management program for water level control is now in the experimental stage, to determine when the sandbar should be breached. Its purpose is: to determine how best to manage water levels, so minimum damage is done to the environment; to keep the flora and fauna flourishing; to keep the water quality from degrading; and to hold undesirable effects and resultant complaints to a minimum. As of now, the plan is to open the sandbar when the height of the lagoon reaches 1.07 meters (3.5 feet) above sea level, or when algae growth in the upper lagoon starts to proliferate, which may occur before that elevation is reached. Adjustments to the height of the water in the lagoon are also to be made, if observations deem this is warranted.

Proposals for acquisitions of land as additions to Malibu Lagoon State Beach should be evaluated in relation to the recreational, cultural, and natural resources of the unit, and public use and enjoyment of those resources. The relationship of this unit to the values in Malibu Canyon, and to Malibu Creek State Park farther upstream, should be considered carefully in any acquisition proposals.

The important historic Chumash village site at Malibu Lagoon State Beach must be preserved. Any adverse effect, whether by human or natural causes, must be mitigated by professional archeological procedures, in consultation with local people who have been selected by the Chumash to act as the tribe's representatives.

The Adamson House and the surrounding gardens are to be preserved, and a reasonable adaptive use of the structure and outbuildings will be found. The buildings and grounds should be open to the public.

The Department of Parks and Recreation is not opposed to year-round discharge of treated effluent into Malibu Creek by the Las Virgenes Water District, as long as the following conditions are met:

1. The water quality of the discharge must be equal to or better than water quality requirements of the State Water Resources Control Board.

2. The water quality of the discharge must be equal to or better than requirements of the state and county public health departments for water contact sports (free from contaminants and disease).

3. The water must not be enriched to the extent that it causes an excessive algae bloom in the receiving waters of the stream and lagoon.

4. If the year-round discharge causes added expense to breach the bar at the mouth of Malibu Creek, the Las Virgenes Municipal Water District should be responsible for funding this additional cost, or for conducting the breaching action.

Malibu Creek

Resource Evaluation

Malibu Lagoon State Beach now consists of 30.67 hectares (75.79 acres), including 899.16 meters (2,950 feet) of ocean frontage. It is in the southern part of the Coastal Landscape Province. The Resource Inventory is available in the department's Resource Preservation and Interpretation Division, 1220 K Street, Sacramento.

Natural Values

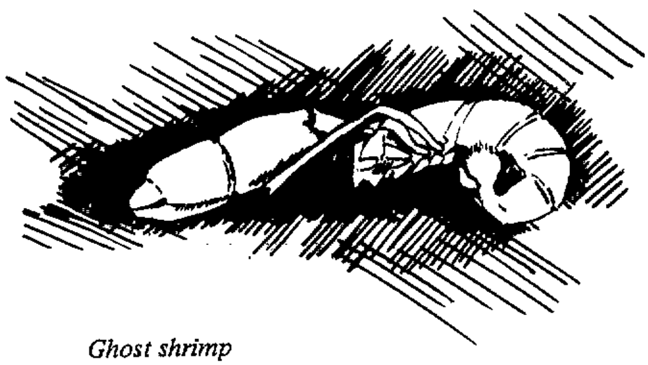
1. Pristine Conditions

   Malibu Beach was formed from the discharge of Malibu Creek. The deposition of sand, gravel, and cobbles from the mouth of the creek formed the projection of land that juts out into the ocean at this point. As this buildup occurred, a delta formed, with some low places, which when inundated by high tides, formed a saltwater marsh and lagoon. The saltwater marsh area was once much larger than it is today.

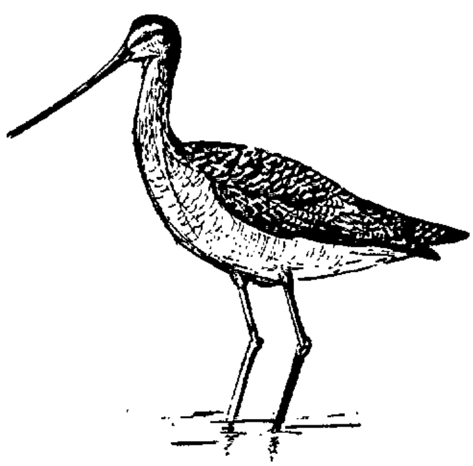
   Indians settled at the mouth of the creek in this area, which was rich in foods. The cobble area produced good clams, as well as numerous other invertebrates that could be eaten. The beach sands also produced clams. The salt marsh was a food-gathering area for numerous animals, particularly birds. The ocean itself offered a good source of fish. Inland, the mountains and the vegetative habitat provided additional sources of food, both animal and vegetable. The creek itself provided water and additional fishing for fish that stayed in the stream, as well as anadromous fish that came up the creek to spawn. The creek, in the very early days, probably flowed year-round, since the sources of the stream waters were not used as they are today.

   Mosquito problems were probably much worse than they are today, and were tolerated by the Indians as a condition of life to be expected.

   Vegetation types originally present included a much larger coastal strand, a possible sand dune area, a riparian community along the shores of the upper part of the lagoon and along the creek, a saltwater (salicornia) marsh, and coastal sage scrub on the hills at either side of the creek. Except for the sand dune community, all of the habitats exist today, but they are greatly reduced in size, and include many introduced species of plants.



Ghost shrimp



Long-billed curlew

2. Current Conditions

Malibu Point and Malibu Beach have probably been altered somewhat, by directing Malibu Creek straight out to the ocean. This has resulted in concentrating the deposition of any sediments coming out of the canyon at this location. In pristine times, this deposition occurred in a much wider fan, which included all of the area occupied by the current Malibu Colony. It is difficult to determine historically the number of large fires in the watershed of the creek, which in turn influenced the amount and frequency of flooding, resulting in stream deposition.

The rocky and cobbly intertidal area tends to have few invertebrates; it is suspected that they are picked over by visitors, even though it is illegal to take most invertebrates.

Sand dunes that might have existed in the early days may have been flattened out with development of the Malibu Colony. It is not believed that these dunes were large or extensive in area, since there is not much evidence of sand deposits inland from the colony. There are no dunes now present.

The marsh area surrounding the lagoon has been greatly modified by developments in the area, and represents only a very small part of the marsh that once existed. Much of the marshland upcoast from the present location of the creek has been reclaimed and developed. The most recent part of the marsh to be destroyed was that portion between the Coast Highway and the Malibu colony. This remnant of the marsh, with its low places, was a good breeding area for mosquitos. The owners probably welcomed any fill they could get, so the land would become suitable for development, and would appreciate in value. As a result, this area has been reclaimed by filling, and the original flora and fauna have largely disappeared. In their places, many invading weeds and exotics have become established. In spite of the filling, there are some low places left that fill with rainwater, runoff from adjacent properties, or ground water, when the water table rises as the lagoon becomes filled. These become mosquito breeding areas, and require treatment from the local mosquito abatement district. Part of the filled area has been made into a Little League baseball field.

Some of the remaining marsh area also has low places that become good breeding spots for mosquitos. These mosquitos can carry encephalitis. Although low places in a marsh are quite natural, they cause problems when surrounding areas are developed with housing. Complaints of mosquitos come in, and these areas are treated by the mosquito abatement district. The treated areas are sprayed with a mixture of 80% diesel oil and 20% pesticide (Golden Bear 1111). The equipment carrying the spray material, the hoses, and the spray itself all do some damage to the marsh ecosystem.

It is believed that by regrading the marsh area so it properly drains into the lagoon, most of the mosquito control work could be eliminated. In one place in back of the Adamson House, there is a freshwater seep, probably drainage from the garden, which creates a place where freshwater mosquitos breed. Dredging of this area, creating a condition similar to when the boat dock was in operation, would eliminate this freshwater mosquito habitat.

When the water in the lagoon is down, visitors going toward the beach trail that crosses the marsh areas cause damage to the fragile marsh plants, disturb nesting birds, and create tracks that result in unsightly scarring of the marsh. Deeper channels, carrying water from the marsh to the lagoon, would discourage crossing the marsh.

The marsh vegetation has some introduced exotics, but if the marsh is maintained under proper conditions, natural marsh plants will dominate.

The lagoon and its water level are largely regulated by a number of constantly changing factors. The size of the lagoon is controlled by the width and depth of the channel, the porosity of the bottom and sides, and the amount of water reaching the lagoon. The width and depth of the lagoon are largely regulated by the amount of scouring and the amount of deposition of sediment. This changes from year to year, but without floods, the basin tends to silt up, and the capacity is reduced. A major flood occurred in 1969.

The deposition of decomposing vegetation on the bottom of the lagoon, along with fine silt, results in reduction in the porosity of the underlying sand and gravels, so less water seeps through the bottom and sides. A good flushing periodically will remove some of this material, which will increase the porosity. Here again, a large flow of water is necessary, to scour the bottom.

The amount of water reaching the lagoon is another factor in its size. Although summer discharges from the Tapia Treatment Plant directly to Malibu Creek are prohibited, much treated water gets into the lagoon through percolation to the underground aquifer. In the summer, .166 cu. meters per second (3,800,000 gallons per day) are discharged in the Malibu Creek watershed, of which .044 cu. meters per second (1 million gallons per day) are used to irrigate 80.9 hectares (200 acres) of crops, .105 cu. meters per second (2,400,000 gallons per day) are used to spray fields, and .017 cu. meters per second (400,000 gallons per day) are put in percolation ponds. In addition to this souce of water, there is natural rainfall and runoff of domestic water. A large amount of water is taken up by plants, and transpiration by the plants gets much of this water into the atmosphere. Evaporation accounts for more water entering the atmosphere. The remainder goes into surface and underground storage and flow. In the summer, surface flows have not been recorded at Cross Creek Road immediately upstream from the lagoon, but the lagoon does fill up with water. Some of this could be coming from the ocean through the sand, but most of it is believed to be coming from the upstream watershed underground.

The natural channel of the creek as it enters the ocean tends to be on the downcoast side of the point. The waves at this location tend to move the sand downcoast, rather than pushing it up and forming a bar. In the summertime, when the sandbar is breached to let water out of the lagoon, the bar is opened straight out from the bridge. This is done so the beach is not cut in half by a stream. However, the breached sandbar tends to close much more quickly in this location than it would on the more natural downcoast side.

As has been mentioned before, the marsh and lagoon are a very important habitat for migratory water-associated birds. The upper reaches of the lagoon and creek (when it is present) provide habitat for birds preferring freshwater habitats, while the lower parts of the lagoon, the tidal mudflats, and the saltwater marsh provide the habitat needed for birds needing brackish or saltwater environments. When the creek flows through the sandbar to the ocean, as it often does in the wintertime, the tides keep an interchange of water coming into the lagoon. This tidal action keeps a biota of invertebrates viable, which provides good feeding for many of the migratory birds. It also keeps the fishery in the lagoon in good condition. Some of the migratory birds are fish eaters.

The saltwater marsh is marginal for mammals and birds, since its size is small, and there is a great deal of foot traffic through it, causing too much disturbance. Upstream areas not now state-owned, although once well landscaped and maintained, have reverted to a wild condition, with dense cover that makes them favorable for many bird and mammal species.

Cultural Resources

Themes and eras of California history have been identified in the California History Plan. The primary cultural resources of Malibu Lagoon State Beach are the Adamson House and its artifacts. They are related generally to the American era of architecture after the turn of the 20th century, and specifically to the Spanish colonial revival of 1915-1930. A second theme of the American era is the cultural development of drama, as witnessed by the advent of the motion picture industry. A third theme deals with the era of the California Indian, by examining the culture and technology of Indians of the southern California area.

Interpretation of the cultural parts of the unit will emphasize the lifestyles of the Chumash before European occupation, and the lifestyles of the Euroamericans who constructed the Adamson House.

This overall interpretive approach accommodates the flow-of-history concept, which addresses human use of the area.

The California History Plan indicates deficiencies in interpretation of these various themes. Public interest in the themes has grown steadily during the past several decades, while a fascination with the movie industry has remained high since before the First World War (1917-1918).

The unit's cultural resources are primarily located in the area east and northeast of the lagoon, in the forms of a large, rich Indian midden site and the buildings and grounds of the Adamson House (see Zone of Cultural Sensitivity Map, p. 37). They are significant to the prehistoric and historic story of the region.

Declaration of Purpose

The primary purposes of Malibu Lagoon State Beach are: to provide a place for beach-oriented recreation activities on the sandy beach fronting the ocean; to preserve and interpret the marsh and lagoon habitat so as to perpetuate the many species of animals that require this diminishing resource for survival; to provide a permanent scenic and open-space environment for an area that is rapidly growing and becoming heavily developed; and to preserve, maintain, mitigate, and interpret the Adamson House and other cultural resources of the area.

Declaration of Resource Management Policy

Natural Values

Management policy in relation to the scenic and natural values will be to enhance and perpetuate them, while providing for appropriate public use and enjoyment in such a way that these values will not be diminished or impaired.

1. The sandy beach frontage may be fully used for beach-oriented recreation activities.

2. The saltwater marsh and lagoon shall be reserved for a wildlife sanctuary, primarily to perpetuate this disappearing habitat and the species that use this area. Visitor use within this area shall be restricted to designated locations and observation points, so the habitat will not be destroyed or the animals disturbed. Domestic animals should not be allowed in this area. The Little League baseball field is an intrusion, and should be relocated.

3. Native plants should be encouraged in natural areas, and aggressive exotic plants should be removed if they restrict the growth of native plants.

4. The lagoon water level shall be controlled through adoption of a management program that will determine how and when the lagoon shall be opened to the sea. This plan shall be based on solving problems associated with the lagoon water levels, to the best interests of all people concerned.

5. The area should be managed so that it remains a beautiful and scenic open-space unit.

Cultural Values

1. Before any development that may affect cultural resources, a thorough study will be conducted. The correct construction and use period of each structure will be determined, both as an individual entity and as it relates to the total cultural environment. Research and archeological investigation will be parts of this study.

2. Buildings which directly relate to the Adamson House should be preserved and stabilized. If stabilization is required to prevent loss or deterioration, it will be undertaken only in ways that will not threaten archeological, historical, or related environmental values.

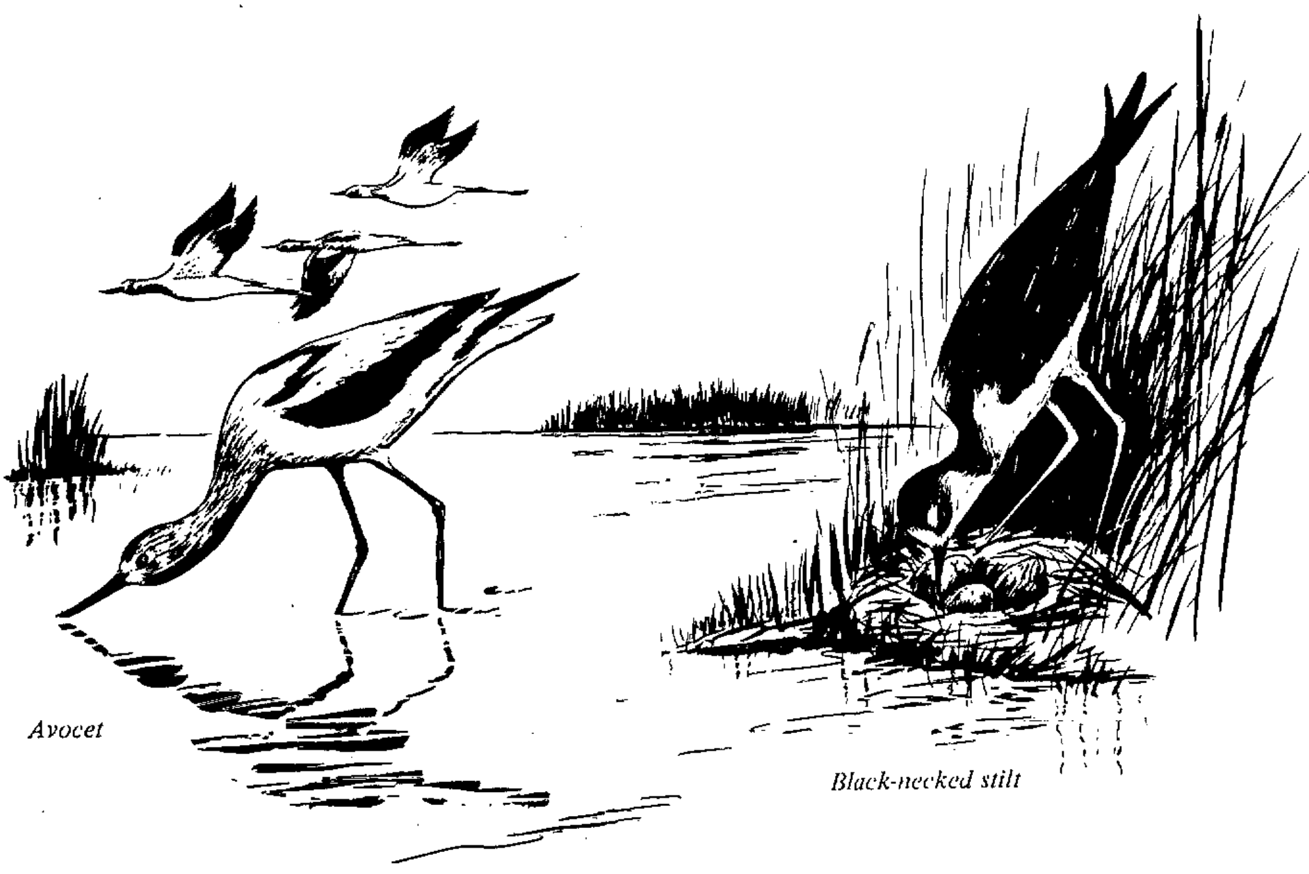
3. Certain buildings within the zone of cultural significance are well suited for interpretive use. The Adamson House and its immediate gardens, pool, and bath house should be viewed as one unit. However, the pool (if opened to the public) and the garage section of the pool house could be used for interpretive displays not directly related to the house and grounds. The exterior integrity of the pool house and garage should remain compatible to the overall Adamson House theme. The "Doll House" could likewise be used for interpretation, as long as the frontal view is not disturbed. Preservation priorities should be determined in part by both the esthetic quality of the grounds and the need for such facilities as a house museum or visitor center.

4. The prehistoric site (CA:LAN:264) and the historic site are one and the same. The prehistoric site is of vast significance, and careful study of the site may produce needed information in defining the lifestyles of the Chumash Indians. Proper care and sensitivity to the site must be demonstrated at all times. Any future sites which are discovered on existing State Park System property, or which are subsequently acquired, shall be carefully recorded and protected.

5. At units with cultural resources, there is often a deficiency in artifacts to interpret those resources. There are large collections of artifacts from this site in local institutions, and private offers have been made to donate items useful to interpretation of the unit. The department should acquire all items available, and should include them in the presentation and use of the house and grounds.

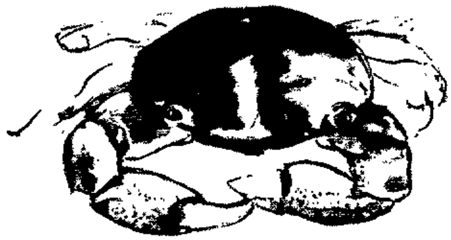
6. Historic intrusions dominate the prehistoric sites. Removal of modern intrusions, such as the Little League diamonds, should be conducted with the utmost care, because of the significance of the sites on which they are located.

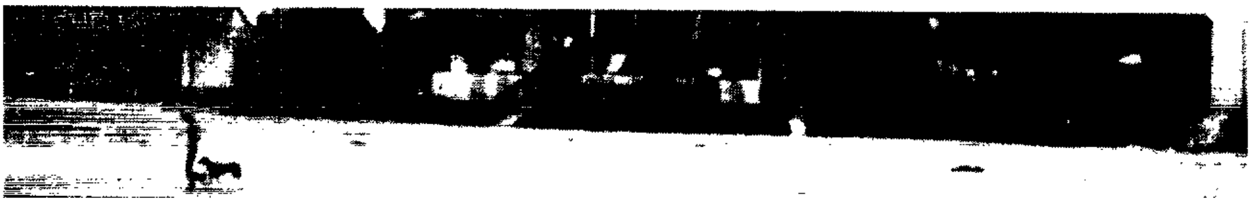
General Development Plan



Avocet

Black-necked stilt





GENERAL DEVELOPMENT PLAN

Introduction

The development of Malibu Lagoon State Beach is planned to provide interpretation and recreation opportunities that will complement and preserve the natural and cultural resources found here.

Land Use Analysis

Existing Land Use

Malibu Lagoon State Beach is located near the middle of the Santa Monica Mountain Range along Highway 1, where Malibu Creek enters the Pacific Ocean.

Malibu Canyon-Las Virgenes Road provides access from the Ventura Freeway to the west; the Santa Monica Freeway provides access from the east.

Malibu Lagoon State Beach has always been open for public use. The sandy beach totals about 54,870 centiares (590,000 square feet), and is used by surfers, sunbathers, fishers, and bird watchers.

When the existing highway was rerouted, part of it was converted into a 98-car parking lot. The Adamson house is occupied by a caretaker, while scheduled tours give visitors a taste of early 20th-century living on the site.

Proposed Land Use

No development is proposed for the beach, but maintaining a controlled water level in the lagoon remains a problem. The proposed development in this plan is minimal, and includes an interpretive facility, trails, restoration, and preservation and enhancement of the lagoon area.

Beach improvements include safety and sanitary equipment.

Proposed Developments

The General Development Plan Map shows the various areas in which development is proposed, and lists the planned facilities for each area.

West Side

Interpretive Facility

The interpretive facility will be made up of display panels and bulletin boards, which explain the ecosystems and functions of the lagoon.

Before any improvements, landscape rehabilitation must take place by removing the Little League baseball diamonds and reshaping the existing highway fill. This fill could be used for landscape construction, in lieu of removing it from the park premises, as originally suggested.

A site next to the lagoon was selected for outdoor interpretation and other support features.

Study and scientific data have shown that the proposed development will have minimal or no effects on the biological processes of the lagoon and marshlands. The intent is to preserve these wetlands; this plan also proposes to restore them, and to enhance their wildlife potential and qualities.

The interpretive facility will also function as an orientation point. Its design theme is further explained in the Interpretive Prospectus Summary for this plan (p. 24). From the facility, trails are extended that lead to an overlook platform, a peripheral walk partly around the lagoon, and self-guided trails.

Visitor use of the proposed facilities will be further accommodated by a 50-car controlled parking lot and two bus parking areas. Parking surfaces will be of a crushed rock base; asphalt will not be used.

Landscaping will be accomplished with compatible native plantings, in a manner that will blend with the local surroundings.

A peripheral unpaved road will serve for fire access and ranger patrol.

Lagoon

It has long been recognized that the lagoon systems are not functioning properly under current conditions. Human and other uses not conducive to maintenance of marsh environments have resulted in the disappearance of certain wildlife and plant species. It is for this reason that alterations to the marsh environment are proposed.

Drainage improvements would include restoring and enlarging the saltwater marsh. Tidal waters will be allowed to penetrate deeper into the backlands, by means of graded-out channels. Pickleweed (salicornia) is to be planted or replanted in appropriate locations. A 1.2 meter (4-foot)-high restraining fence could further control human penetration through these wetlands; compatible native plantings would make its presence less obvious.

The department further recommends that the area be classified a natural preserve within the proposed boundaries.

Adamson House

The main house would be used for historic and architectural interpretation, complemented by guided tours. Further details are in the interpretive prospectus summary (p. 24).

A state-owned parking lot directly north of the house contains 98 spaces; the lot is frequently filled to capacity by the vehicles of surfers and other beach users during the summer months and weekends. It is anticipated that increased parking will be needed once the Adamson House is opened for public viewing. One possible solution is to limit visitor use of the Adamson House to weekdays only.

The gatehouse offers excellent accommodations for a ranger residence. This would further help to fulfill a long-felt need for site patrol of the area.

Beach Improvements

The improvements will include one additional lifeguard tower, four portable restrooms, and trash bins less susceptible to vandalism and strong winds.

Motorized maintenance equipment of a tractor type must be sufficient in nature to mechanically breach the sand bar between ocean and lagoon, at designated times. It is desired that this piece of machinery have attachments capable of screen-cleaning beach sand, and performing other maintenance-related tasks.

North Side

A levee along the east bank of the state-owned lands protects the area from minor flooding.

The stream banks are densely covered with willows and other species typical of this kind of riparian habitat. Tall London plane trees and heavy undergrowth in most places make this an excellent wildlife sanctuary.

The plan proposes self-guided nature trails and two portable restrooms; most of this area will be left in its natural state. Rest areas with appropriate park furniture will be part of the trail system.

Beach Entrance

At least two entrances provide access into Malibu Lagoon State Beach. The official entrance provides access to the state-owned parking lot via Highway 1. With the proposed addition of interpretive attractions to the Adamson House, it will be necessary to improve the left-turn lane and to construct (by striping) a right-turn deceleration lane.

The second entrance is located directly opposite Cross Creek Road, and is now used by Little League members only. Traffic light and street lane improvements must be made, once the proposed interpretive facility is completed and made available for public use.

Utilities

Domestic water is supplied by the Los Angeles Metropolitan Water District, and is available on the site.

Southern California Edison Company power lines are located along Highway 101, and will provide adequate power for all proposed developments in the plan.

Since there is no local sewer system, portable, pump-out restroom facilities will be provided.

Special Considerations

1. It is recommended that a study be conducted:

   a) To identify all potential and non-polluting inflow sources to Malibu Creek.

   b) To explain what effects these combined inflow sources have on lagoon ecology.

   c) To identify what effects secondary treated effluent has on lagoon ecology.

   d) To lead to recommendations in order to establish an optimum lagoon environment.

2. It is recommended that the state acquire a right-of-way along Malibu Canyon, to provide trail access to other park lands in the Santa Monica Mountains.

3. It is recommended that local government and public transportation officials establish bus routes to Malibu Lagoon and the Santa Monica Mountains parks, to increase regional recreation and awareness, and to discourage use of individudal automobiles.

Interpretive Prospectus - Summary

The goal of interpretation at Malibu Lagoon State Beach is to provide visitors with awareness and appreciation of the significant recreational, natural, and cultural resources of the unit. The scope of interpretation should include the variety of visitor interests.

There are three categories of interpretation suitable for Malibu Lagoon: the beach (for recreational interpretation); the lagoon (for environmental interpretation); and the Adamson House and grounds (for historical interpretation).

Many visitors to Malibu Lagoon are surfers. Once the Adamson House is opened to the public and an interpretive program is developed for the lagoon, other segments of the public will be attracted to the unit.

The Adamson House should introduce visitors to the area's local history. Environmental interpretation should encourage use of the unit as a nature study area. Beach interpretation should stress items of practical interest to surfers and other beach users.

Details of interpretation at the unit are found in the department's Interpretive Prospectus, on file with the Resource Preservation and Interpretation Division.

Interpretive Periods

The primary interpretive period should stress the formation of the unit's topographical features, from their origin to the present.

Secondary periods should be: (1) 1804 to 1968; from the original concession of Rancho topanga Malibu Sequit, through acquisition of the rancho by Rindge, to acquisition of the Adamson House and grounds by the department in 1968 (2) 0 AD to the late 1600s; emphasizing the significant Native American history of the area.

Interpretive Themes

These include:

Primary
1. Beach and ocean dynamics, and recreational uses of the unit.
2. The ecology of Malibu Lagoon.

Secondary
1. The periods of Spanish and Rindge/Adamson ownership.
2. The Chumash and earlier inhabitants.

Interpretive Methods and Facilities

Interpretive panels on the beach should be located so a minimum of beach space is used, and preferably in a central area. The lagoon's fragility must be taken into account in placement of interpretive aids, such as a peripheral nature trail. Interpretive aids in the picnic grounds should remain very simple (a kiosk or outdoor panel), and should not call undue attention to archeological deposits in the area. The Adamson House is well suited for a house museum; the garages should be used to interpret the unit's primary and secondary themes.

Problem Areas

Certain specific problem areas were discovered during the planning stage. The primary problem is making this state beach more accessible to inner-city residents; others include the need for trails and fire control.

Rapid Transit

Expansion by the Southern California Rapid Transit Distrct (RTD) to serve state parks and beaches in the Santa Monica Mountains area could become an important concept incorporated in this plan.

An ever-increasing need for this kind of service is apparent, when the heavy traffic burdens along major access arteries, and declining energy resources, are considered.

While an existing bus route traverses Highway 101, it does not emphasize recreation transportation.

Trails

Plans are in progress to link three major state parks in the Santa Monica Mountains (Point Mugu, Malibu Creek, Topanga) by means of the Backbone Trail. This trail will not be paved; it will have steep gradients, and will be used primarily for hiking and horseback riding.

Malibu Creek Canyon offers an excellent opportunity to expand the trail network, linking the Backbone Trail with Malibu Lagoon State Beach.

Sound judgment must be exercised where new trails are proposed, to prevent adverse impacts on watershed lands.

Fire Control

There is an exceptionally high fire danger in the Santa Monica Mountains; it is greatly increased when the Santa Ana winds are blowing.

The department is committed to constant monitoring, close cooperation with local fire officials, and continuous updating of fire management plans, to adjust them to current technology and an improved fire danger rating system.

Of special consideration is the creek canyon, with dense chaparral and riparian growth along its course. A continuous water supply in Malibu Creek itself would greatly benefit firefighting strategy, in case of a forest fire.

Environmental Impact Report

DRAFT ENVIRONMENTAL IMPACT REPORT

The Environmental Impact Report (EIR) is divided into three major sections: (1) description of project; (2) description of environmental setting; and (3) environmental impact. The degree of specificity of the latter two chapters is not in detail, due to the general, broad nature of the project description.

The General Development Plan for Malibu Lagoon State Beach is broad in scope; therefore, the EIR is also a broad assessment of the potential impacts. Whenever a specific phase of the overall plan is budgeted and proposed for implementation, a more detailed and specific environmental assessment will be prepared for that particular project, as part of the budget package.

Description of Project

Location: See Project Description, p. 3.

Objectives: See Purpose of Plan, p. 3.

Project description: See General Development Plan, p. 21.

Description of Environmental Setting

Existing environment: See Resource Evaluation, p. 14.

Regional considerations: See General Development Plan, p. 21.

Environmental Impact

The Significant Environmental Effects of the Proposed Project:

The left column in Table 1, page 29, lists the proposals in the General Development Plan. Each of these was assessed, with environmental factors listed across the top. It was determined that there would be no significant environmental effects from the proposed actions. The interactions were all found either not to interact, to be beneficial, or to have a non-significant effect. Most of the proposed planning objectives will have a beneficial effect on the environment when they are implemented.

Short-Term Effects: During development of the proposed facilities as described in the General Development Plan, there will be several non-significant effects, including increased levels of noise and consumption of energy.

Long-Term Effects: Most long-term effects will be beneficial. The proposed action will result in improved protection, preservation, and interpretation of recreational, natural, and cultural resources.

TABLE 1

ENVIRONMENTAL IMPACT OF PROPOSED FACILITIES

FACTORS

	Factors
GEOLOGIC	Seismicity; Landslide; Mudflow; Mineral Resources; Faulting; Sand and Gravel Resources
SOIL	Slump and/or Creep; Subsidence; Erosion; Stream Siltation; Topography
ENERGY	Efficient Use; Consumption; Distribution
BIOTIC	Rare and/or Endangered Species; Historically Important Trees; FEATURES: Riparian, Chaparral, Woodlands, Grasslands; FLORA DIVERSITY AND/OR PRODUCTIVITY: Trees, Shrubs, Grasses, Microflora, Aquatic Plants; FAUNA DIVERSITY AND/OR PRODUCTIVITY: Birds, Reptiles, Amphibians, Mammals, Fish Shellfish, Microfauna, Insects; Intro. of Non-native Plants or Animals; Wildlife Migration Patterns
FIRE	Hazard
WATERSHED	Quality; Consumption; Stream Flow Capacity; Surface Water Runoff; Ground Water Contamination; Percolation Rates; Fresh Water Currents
AIRSHED	Air Movement; Precipitation; Temperature; Microclimate; POLLUTION GENERATION: Thermal, Hydrocarbon, Particulates, NO_x and/or SO_x
NOISE	
LIGHT AND GLARE	
ULTRA-HAZARDS	
LAND USE	Scenic Vistas, Corridors or Highways; Zoning Regulations and/or Policy; Federal, State and/or Local Plans; Housing Availability; Open Space; Character of Surrounding Area
TRANSPORTATION	Road Capacity; Vehicular Circulation
CULTURAL	Archeological Sites; Historical Sites; Paleontological Sites; Recreational Opportunities; Aesthetics
PUBLIC SERVICE	Gas, Water and/or Electric Utilities; Police and/or Fire Services; Public Transit; Schools; Parks; Hospitals; Sanitation Facilities
HUMAN COMMUNITY	Population Density; Distribution; Residential Privacy; Relocation of Persons or Businesses

North Side

Self-guided trails
10 benches
2 portable restrooms

East Side

One lifeguard tower
4 portable restrooms

Adamson House

Interpretive facility

Lagoon

Marsh restoration
Wildlife observation area

West Side

Entrance
Interpretive facility
50-car parking
2-bus parking and turnaround
Patrol access
Remove baseball diamonds
Landscape rehabilitation
Trail to beach
2 portable restrooms
Signs

These Factors were Individually Accessed and No Significant Effects Are Anticipated from the Proposed Actions

No rare or endangered species of plants or animals are present in the area.

The following non-significant structures will be demolished:

1. Little League baseball fields.

Any significant environmental effects which cannot be avoided if the proposal is implemented:

This section is not applicable, since there are no anticipated significant environmental effects.

Mitigation measures proposed to minimize the significant effects.

This section is not applicable, since it has been determined the proposed project will not create significant environmental effects. Precautions will be taken as outlined in the Resource Management Plan, to avoid possible significant effects on the environment.

Alternatives to the proposed action:

No change: The unit would continue to operate under the current conditions, but problems outlined in the General Development Plan and Resource Management Plan would continue, and would possibly increase.

Other alternative action: There are a myriad of project alternatives resulting from combinations of possible individual actions.

Alternative actions could include fewer or greater actions than the proposed plan. For example, the lagoon could be restored more extensively than proposed. Another alternative might be camping facilities, instead of the proposed day use only facilities.

The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity:

Implementation of the proposed General Development Plan and Resource Management Plan would protect and improve the unit's resources, and would increase facilities for the public. The public should be able to enjoy the area for many years.

Any significant irreversible environmental changes that would be involved in the proposed action should it be implemented:

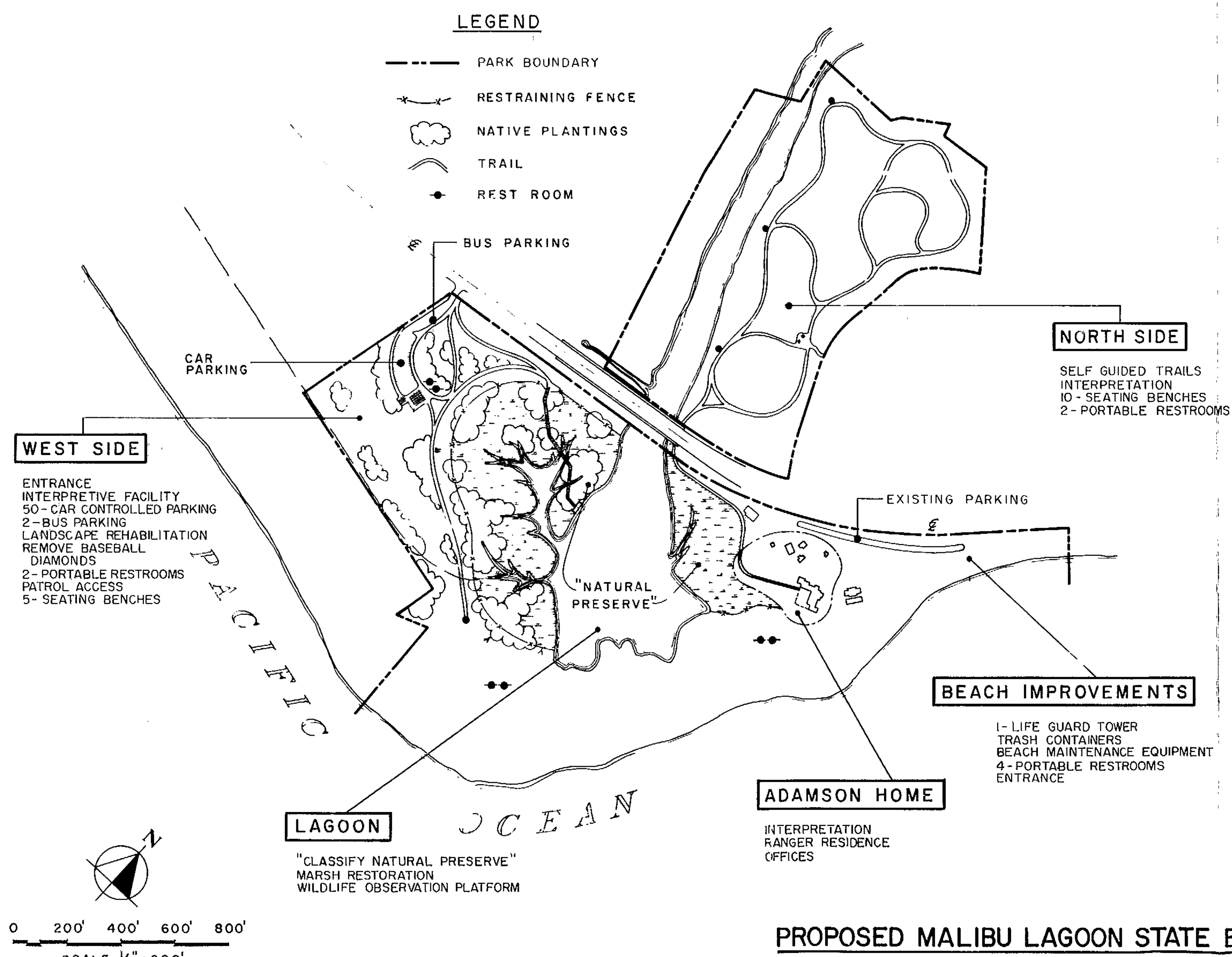
None of the proposed environmental changes would be irreversible.

The growth-inducing impact of the proposed action:

The proposed plan will not have a significant effect on the growth of the area.

Appendix

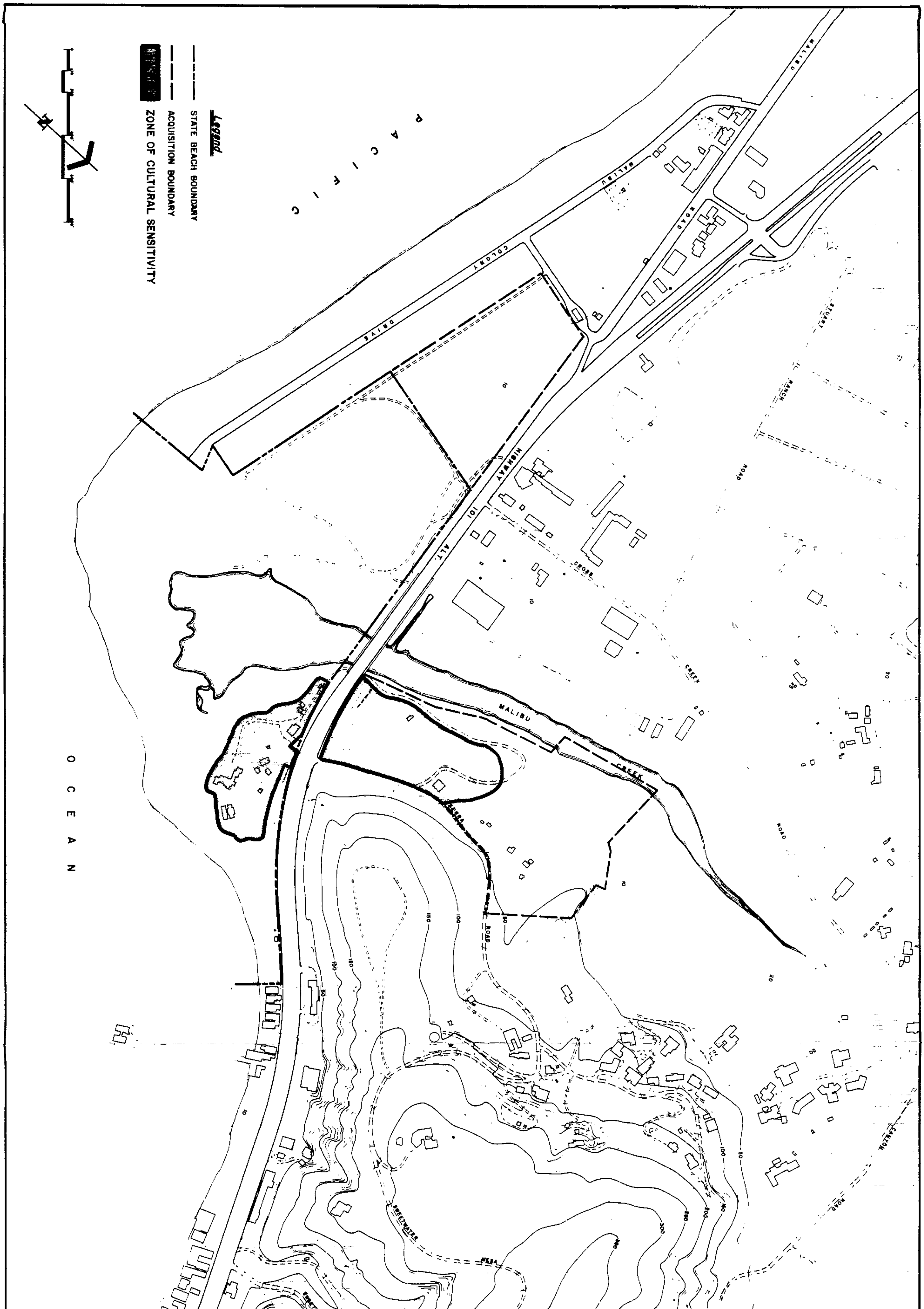
Maps:	General Development Plan	35
	Zone of Cultural Sensitivity	37
	50-Year Storm Hydrology	39
	Geology	40
Diagrams:	Ocean Wave Exposure	41
	Sand Spit Building	42
	Section Through Beach	43
	Section Through Lagoon, North - South	44
	Section Through Lagoon, East - West	45
	Beach Parking Analysis	46
	Existing Beach Parking Relationship	47
	Existing Beach Activities	48



PROPOSED MALIBU LAGOON STATE BEACH GENERAL PLAN

2/78

MALIBU LAGOON STATE BEACH GENERAL DEVELOPMENT PLAN	RESOURCES AGENCY OF CALIFORNIA DEPARTMENT OF PARKS AND RECREATION APPROVED ___ DATE	REVISIONS ___ DATE	DESIGNED DRAWN 12-77 CHECKED	DRAWING No 16109 SHEET No 1 OF 1



SHEET NO.	DRAWING NO.			REVISIONS	DATE	
1 OF 1	16217	MALIBU LAGOON STATE BEACH ZONE OF CULTURAL SENSITIVITY	RESOURCES AGENCY OF CALIFORNIA DEPARTMENT OF PARKS AND RECREATION APPROVED .... DATE			DESIGNED DRAWN FEB. 1978 CHECKED

LEGEND

- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- LACFCD MAJOR STREAMCOURSE
- NATURAL STREAM
- HYDROLOGIC DRAINAGE BOUNDARY
- Q — WATER FLOW IN CUBIC FEET PER SECOND BASED ON A 50 YEAR RAINFALL CURVE
- MALIBU LAGOON STATE BEACH BOUNDARY
- ACQUISITION BOUNDARY

2000 0 2000 4000
SCALE IN FEET

TOT. DRAINAGE — 67,000 AC.
OR 14.7 SQ. MI.

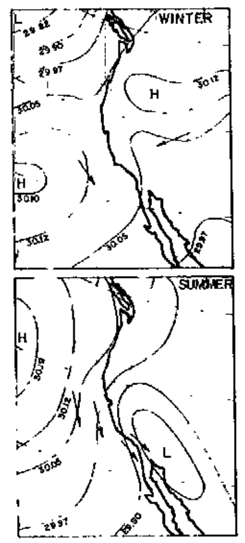
SHEET NO. 1 OF 10	DRAWING NO. 15880	MALIBU LAGOON STATE BEACH 50 YEAR STORM HYDROLOGY MAP	RESOURCES AGENCY OF CALIFORNIA DEPARTMENT OF PARKS AND RECREATION APPROVED ________ DATE ________	REVISIONS	DATE	DESIGNED DRAWN July 1977 CHECKED

SHEET No. 2 OF 10	DRAWING No.	MALIBU LAGOON STATE BEACH GEOLOGY MAP	RESOURCES AGENCY OF CALIFORNIA DEPARTMENT OF PARKS AND RECREATION APPROVED ________ DATE ________	REVISIONS	DATE	DESIGNED A.TJADEN DRAWN S.AMAR 8-77 CHECKED

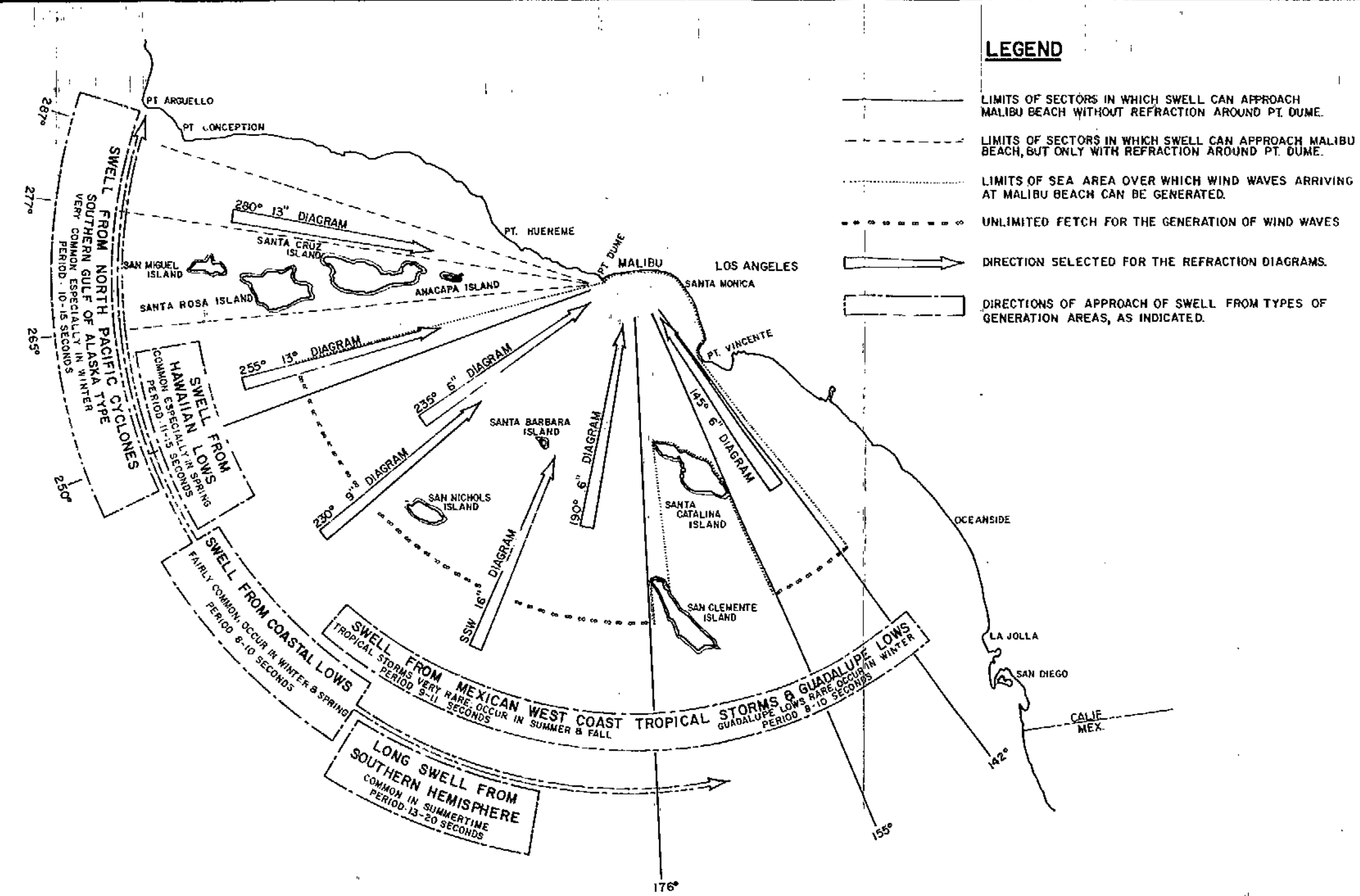
	DIRECTION O OF WIND	CONSTANCY OF WIND	FORCE IN BEAUFORT SCALE	% OF DAYS FORCE EXISTS	RESULTANT WINDS DIRECTION	RESULTANT WINDS FORCE	AVERAGE WIND VELOCITY IN KNOTS	FREQUENCY OF CALMS AT NOON GREENWICH	FREQ OF WINDS > BEAUFORT VII, NOON GREENWICH	FREQUENCY OF WINDS > VIII	DIRECTION OF WINDS > VIII
JAN.	NW	M	≦ III	60	NW	I	8	10	1+	1	NW
FEB.	NW	M	≦ III	70	NW	I	8	10	1+	1	NW
MAR.	NW	M	≦ III	65	NW	I	8	5	1+	1	NW
APR.	NW	F	≦ III	65	NW	I	8	5	1+	1	NW
MAY	NW	F	≦ III	65	NW	II	8	5	1+	0	NW
JUN.	NW	F+	≦ III	70	NW	I-II	8+	5	1+	0+	NW
JUL.	NW	F	≦ III	65	NW	I+	8+	5	1±	0+	NW
AUG	NW	F	≦ III	60	NW	I	8+	5	0+	0+	NW
SEP.	NW	F	≦ III	70	NW	II	8	5	1	0+	NW
OCT.	NW	F	≦ III	70	NW	I	8	5	1±	0+	NW
NOV.	NW	M	≦ III	80	NW	I	8	5	1	0+	NW
DEC.	NW	M	≦ III	70	NW	I	8	10	1	1	NW

Relative Consistancy: C = 81 + % of all winds from the quarter indicated
F = 61-80% " " " " " "
M = 41-60% " " " " " "
P = 25-40% " " " " " "

SUMMARY OF WIND DATA OF MONTHS FOR OCEANIC SECTOR BETWEEN MAINLAND AND 30° N. LAT. & 120° W. LONG.



Winter and summer position of the East Pacific High Pressure Area



LEGEND

LIMITS OF SECTORS IN WHICH SWELL CAN APPROACH MALIBU BEACH WITHOUT REFRACTION AROUND PT. DUME.

LIMITS OF SECTORS IN WHICH SWELL CAN APPROACH MALIBU BEACH, BUT ONLY WITH REFRACTION AROUND PT. DUME.

LIMITS OF SEA AREA OVER WHICH WIND WAVES ARRIVING AT MALIBU BEACH CAN BE GENERATED.

UNLIMITED FETCH FOR THE GENERATION OF WIND WAVES

DIRECTION SELECTED FOR THE REFRACTION DIAGRAMS.

DIRECTIONS OF APPROACH OF SWELL FROM TYPES OF GENERATION AREAS, AS INDICATED.

DIAGRAMMATIC MAP OF WAVES APPROACHING MALIBU BEACH

0 5 10 20 30
SCALE IN NAUTICAL MILES

NOTE
BEARINGS IN DEGREES CLOCKWISE FROM TRUE NORTH

OCEANIC WAVE EXPOSURE AT MALIBU LAGOON

WAVES FROM WIND

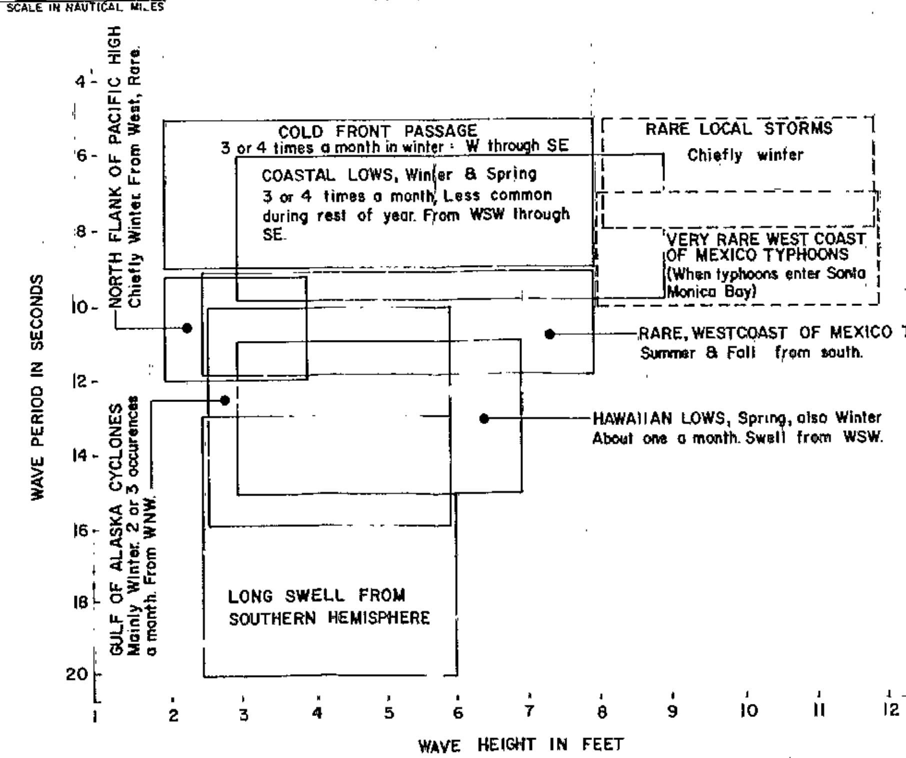
WIND SOURCE: LOCAL) OFFSHORE THERMAL LOWS, SANTA ANA, LAND AND SEA BREEZE FROM THERMAL AIR LAYERING, ONSHORE WINDS TO CAUSE WAVES TO ± 2'.

N.W. WINDS: CAUSED BY S.W. DESERT LOWS AND NORTHERN OFFSHORE HIGHS.

WAVES FROM SWELLS

MAXIMUM EXPOSURE LIMITS OF WAVE SPECTRUM BETWEEN 176° - 250°.

OFFSHORE ISLANDS WITHIN SPECTRUM HAVE LITTLE IMPORTANCE IN PROTECTING MALIBU BEACH.



CHARACTERISTICS OF WAVES ARRIVING AT MALIBU BEACH FROM THE GENERATION AREAS INDICATED

DESIGNED A. TJADEN	DRAWN SAMAR 8-77
CHECKED	

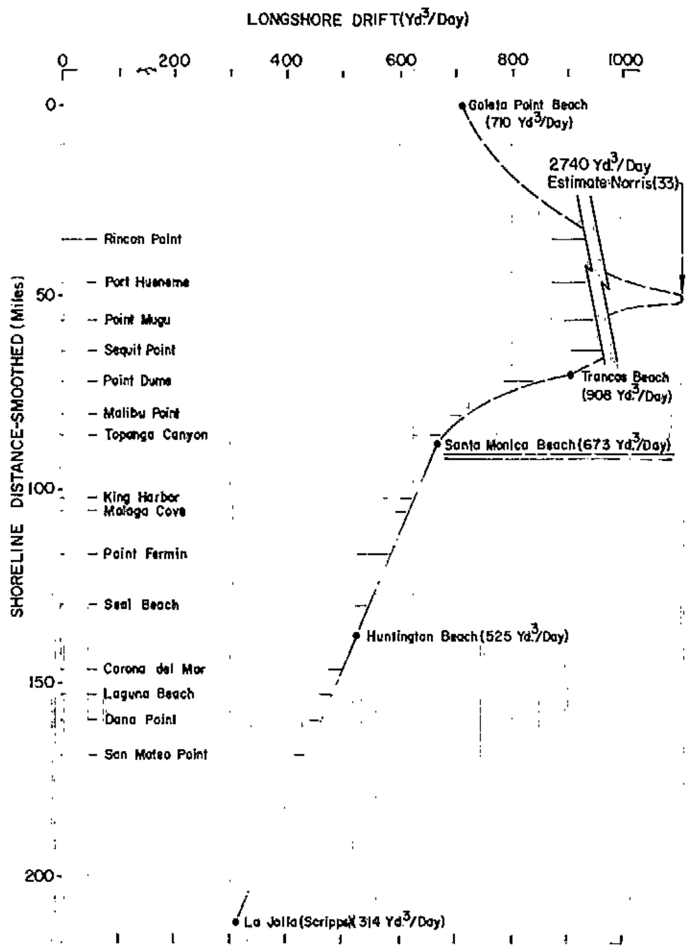
REVISIONS | DATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
APPROVED ______ DATE ______

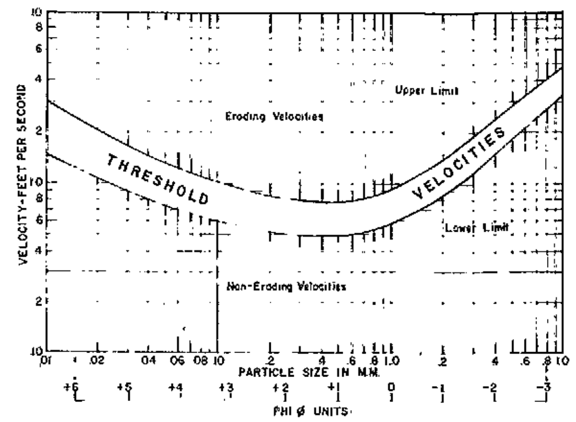
MALIBU LAGOON STATE BEACH
OCEAN WAVE EXPOSURE

DRAWING NO.

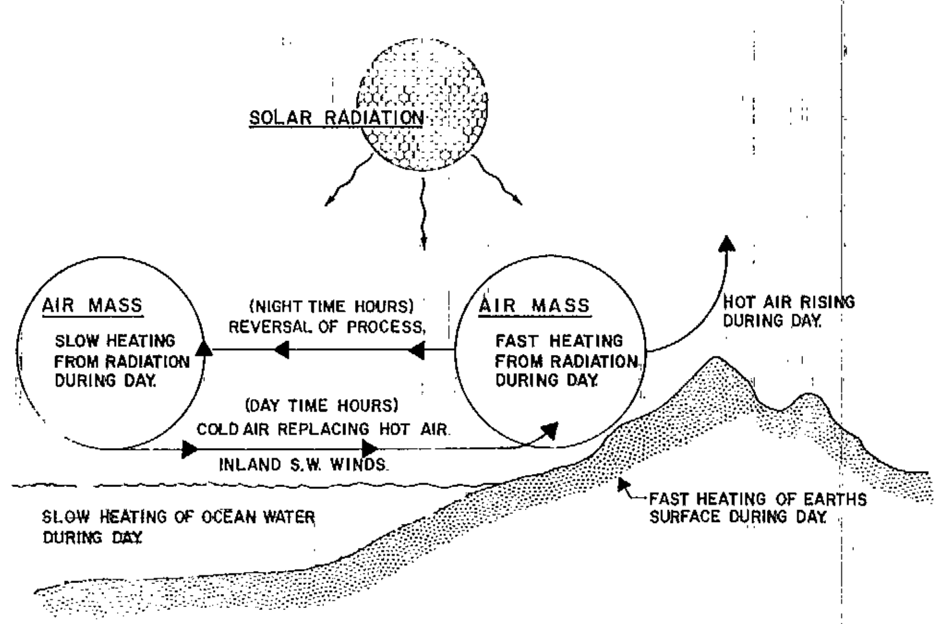
SHEET NO. 3 OF 10



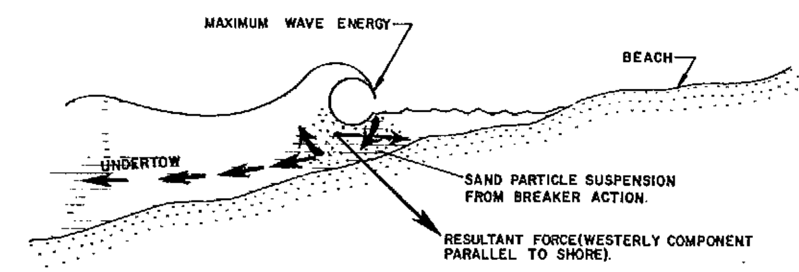
LONGSHORE DRIFT
FROM GOLETA POINT TO LAJOLLA



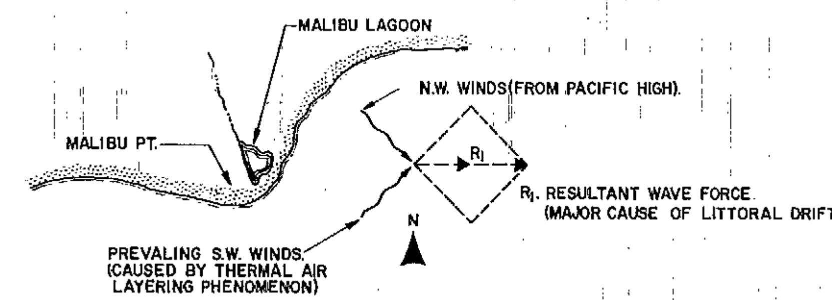
MEAN VELOCITIES REQUIRED TO
ERODE SAND



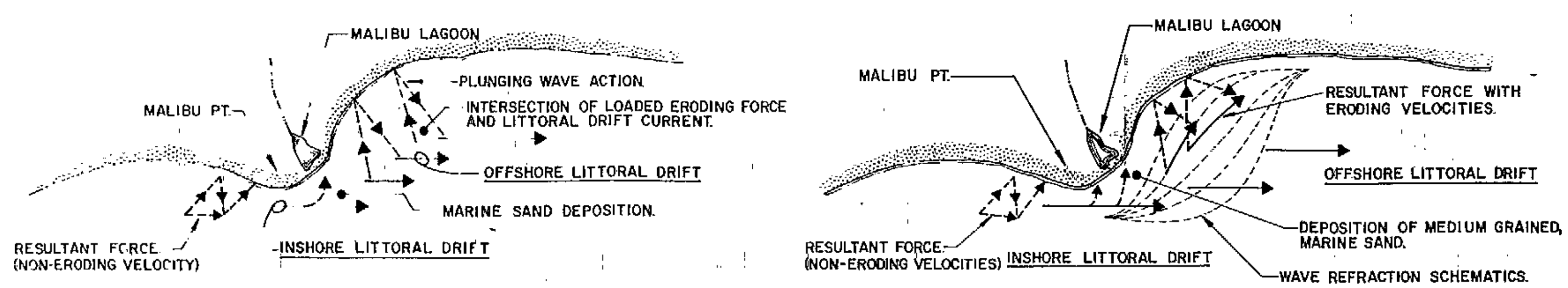
THERMAL AIR LAYERING PHENOMENON



WAVE ENERGY EXPANSION



LITTORAL DRIFT GENERATION



THEORETICAL ANALYSIS OF BEACH BUILDING & BEACH EROSION

DESIGNED A. TJADEN	DRAWN S. AMAR 8-77
CHECKED	

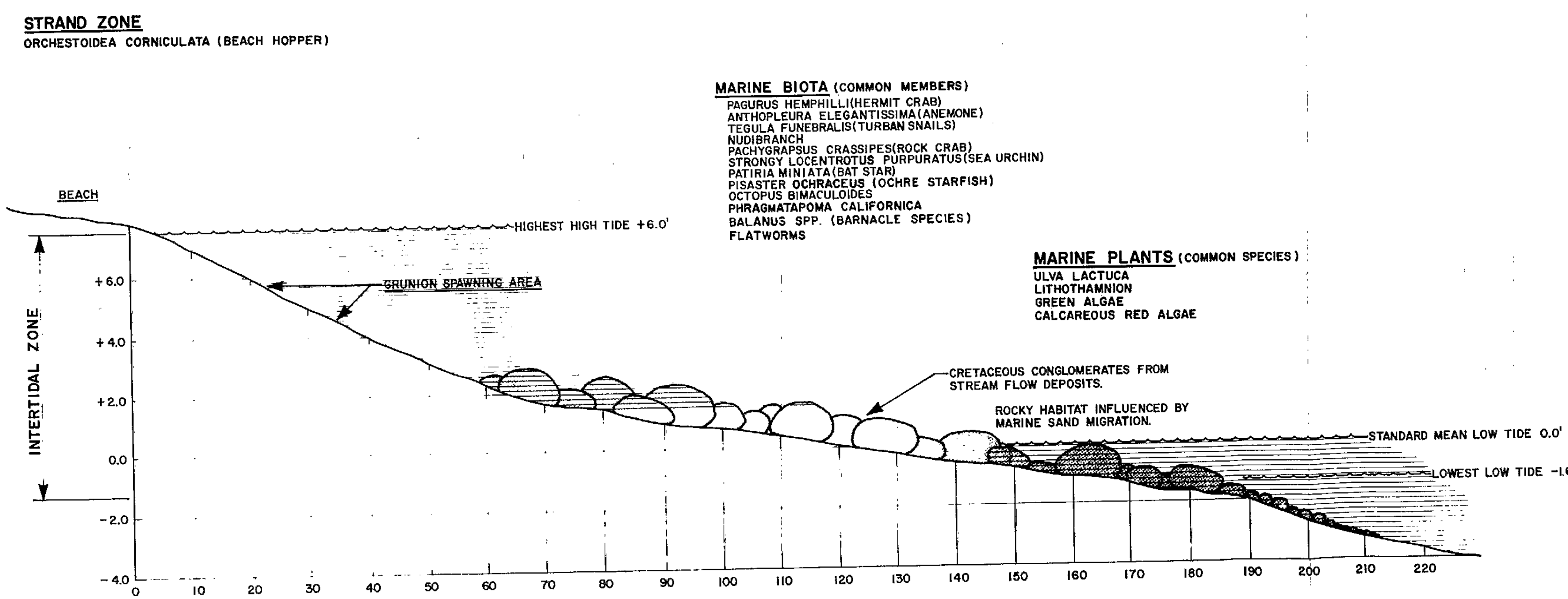
REVISIONS	DATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
APPROVED ______ DATE ______

MALIBU LAGOON STATE BEACH
SAND SPIT BUILDING

DRAWING No.

SHEET No. 4 OF 10



TYPICAL SECTION THROUGH MALIBU BEACH

SCALE:
HORIZ. 1" = 10'
VERT. 1" = 2'

(CRETACEOUS ROCK NOT TO SCALE)

DESIGNED	DRAWN	CHECKED
A TJADEN	S AMAR 8-77	

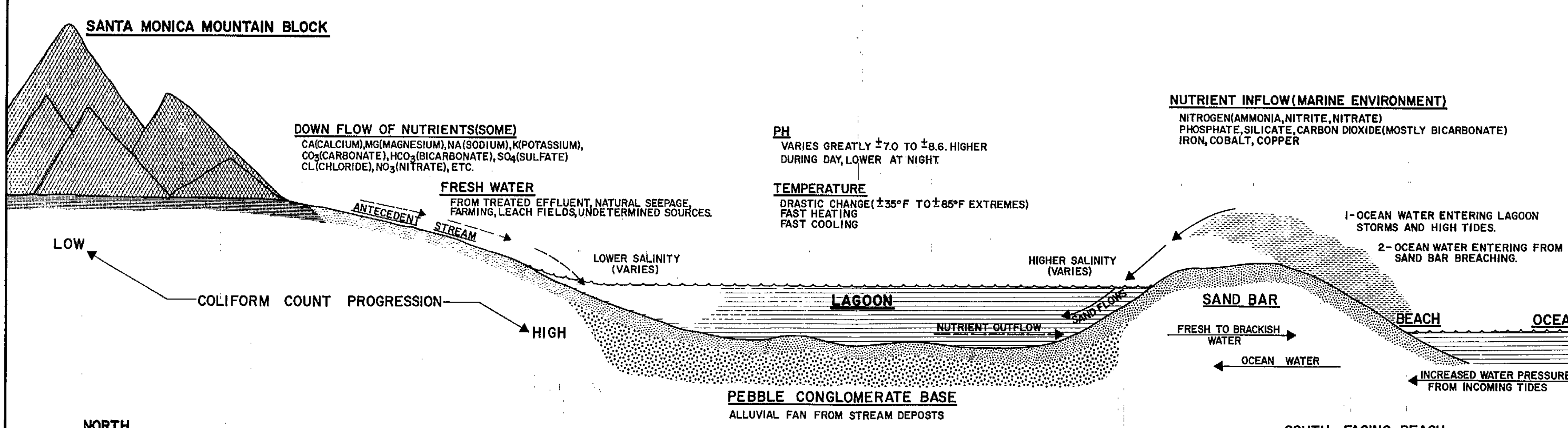
REVISIONS	DATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
APPROVED ______ DATE ______

MALIBU LAGOON STATE BEACH
SECTION THROUGH BEACH

DRAWING NO.

SHEET No. 5 OF 10



STUDY SECTION THROUGH MALIBU LAGOON
(NORTH-SOUTH)

Not to Scale

DESIGNED A.TJADEN	DRAWN S.AMAR 8-77	CHECKED

REVISIONS	DATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
APPROVED ______ DATE ______

MALIBU LAGOON STATE BEACH
SECTION THROUGH LAGOON

DRAWING No.

SHEET No. 6 OF 10

BIRD LIFE

MIGRATORY: PRIMARILY A RESTING AREA FOR MANY & VARIED SPECIES. MUD FLATS OFFER SOME SECURITY FROM LAND PREDATORS & LOCAL DOGS. LIMITED FOOD SUPPLY. (LIST & WESTERN FOUND. OF VERTEBR. ZOOLOGY)

RESIDENT: MANY SIGNIFICANT SPECIES. MOST SPECIES HAVE DISAPPEARED DUE TO HUMAN PENETRATION.

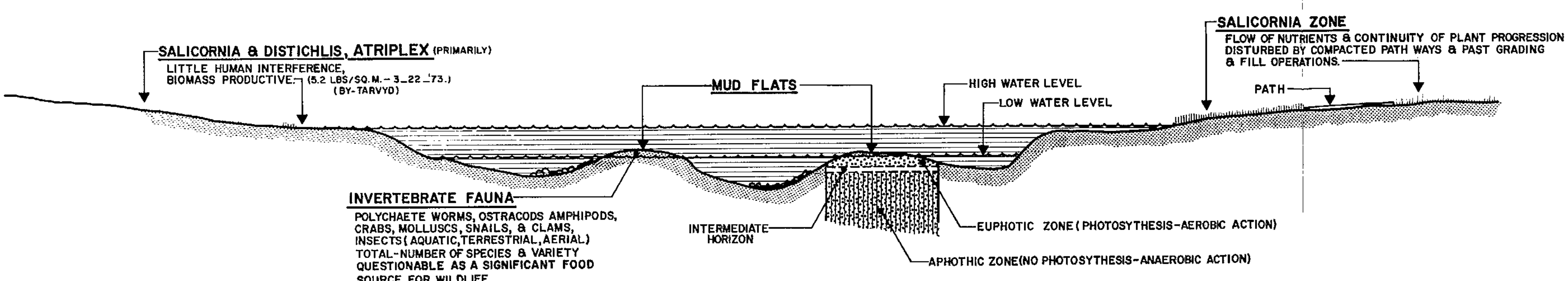
AQUATIC PLANTS

DUCKWEED, GREEN ALGAE
ENTEROMORPHA, SPIROGYRA

FISHES

MIGRATORY: SALMO GAIRDNERII (STEELHEAD)
ATHERINOPS AFFINIS (TOPSMELT)
MUGIL CEPHALUS (STRIPED MULLET)
PLATICHTHYS STELLATUS (STARRY FLOUNDER)
CYMATOGASTER AGGREGATA (SHINER PERCH)

RESIDENT: FUNDULUS PARVIPINNIS (CALIFORNIA KILLIFISH)
GAMBUSIA AFFINIS (MOSQUITO FISH)
LEPTOCOTTUS ARMATUS (STAGHORN SCULPIN)
ENGRAULIS MORDAX (NORTHERN ANCHOVY)



ODOR PHENOMENON-
CAUSE: DECOMPOSITION OF PLANT & ANIMAL SPECIES
LIBERATION OF SULFUR CONTAINING AMINO ACIDS SO_4-FORM H_2S (HYDROGEN SULFIDE).
INTERFACE: H_2S & O_2
$2H_2S + O_2 \longrightarrow S_2 + 2H_2O$ + 80K. CAL.
$S_2 + 3O_2 + 2H_2O \longrightarrow 2H_2SO_4$ + 240K. CAL.
SULPHURICATION E. USED TO REDUCE CO_2 TO CARBOHYDRATES.

STUDY SECTION
THROUGH MALIBU LAGOON (EAST TO WEST)

NOT TO SCALE

DESIGNED	DRAWN	CHECKED
A TJADEN	S AMAR 8-77	

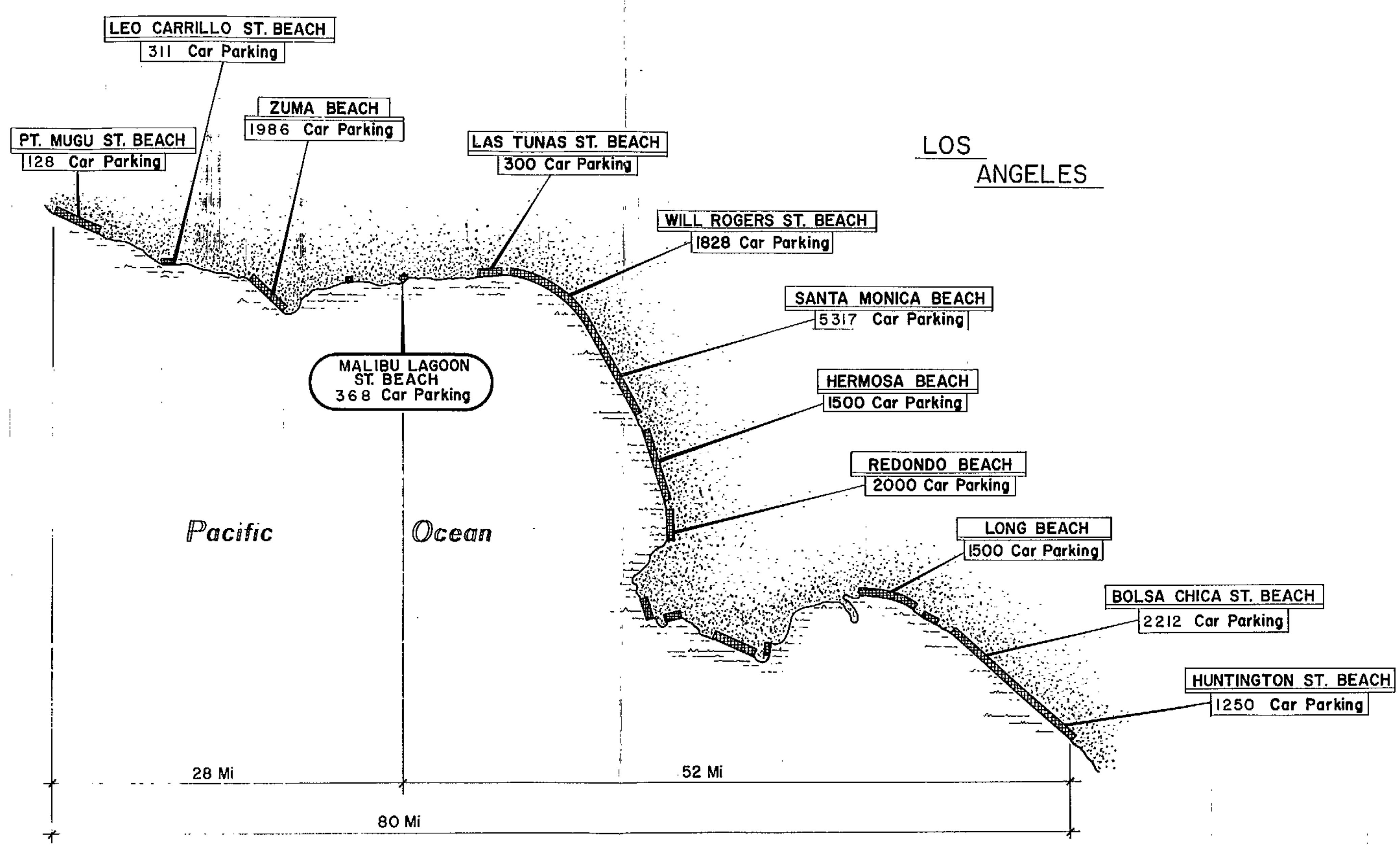
REVISIONS | DATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
APPROVED ______ DATE ______

MALIBU LAGOON STATE BEACH
SECTION THROUGH LAGOON

DRAWING NO.

SHEET NO. 7 OF 10



DESIGNED	DRAWN	CHECKED

DATE	REVISIONS

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION

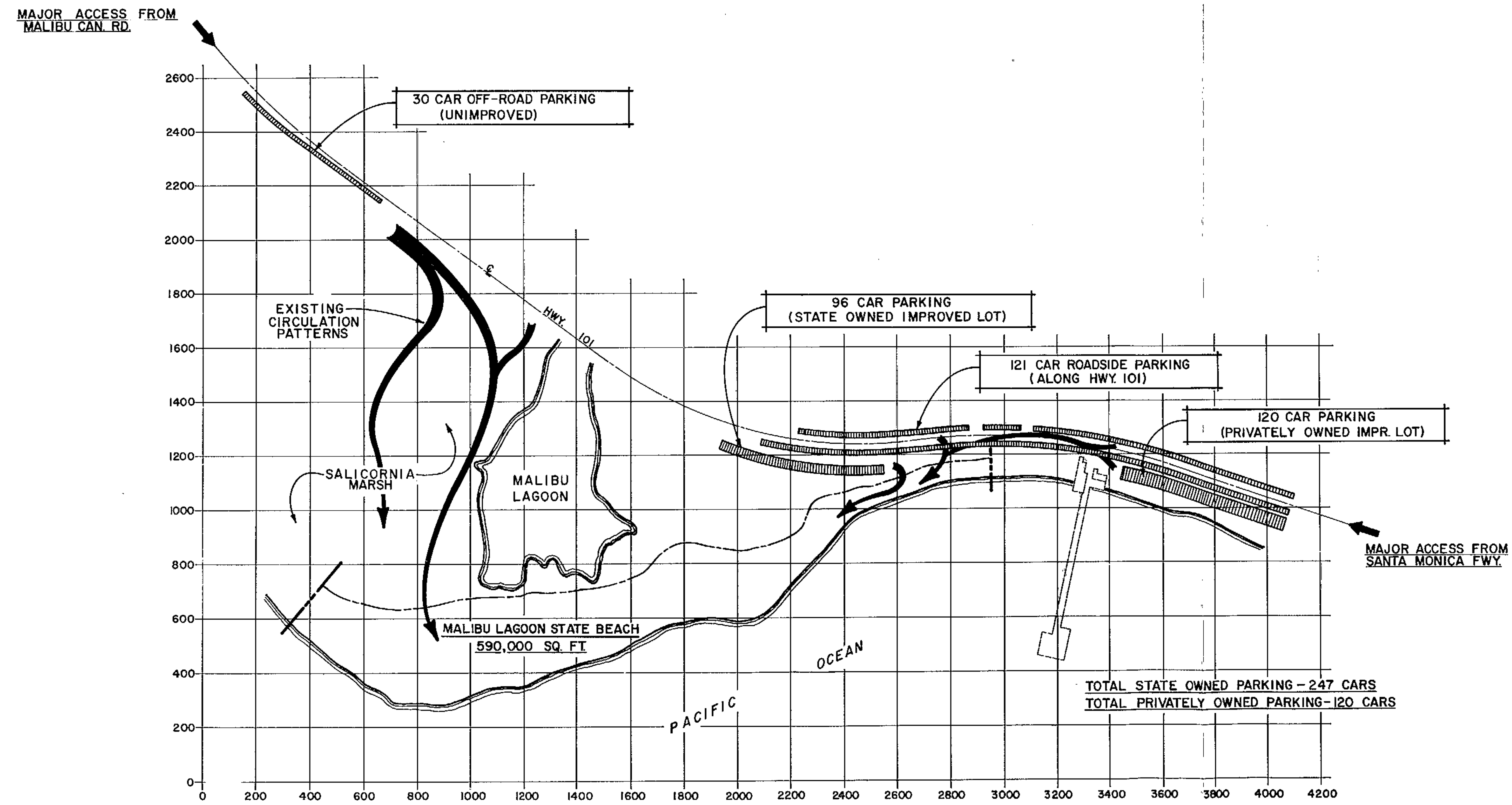
APPROVED ______ DATE ______

MALIBU LAGOON STATE BEACH

BEACH PARKING ANALYSIS

DRAWING No.

SHEET No. 8 OF 10



SCALE: 1" = 200'

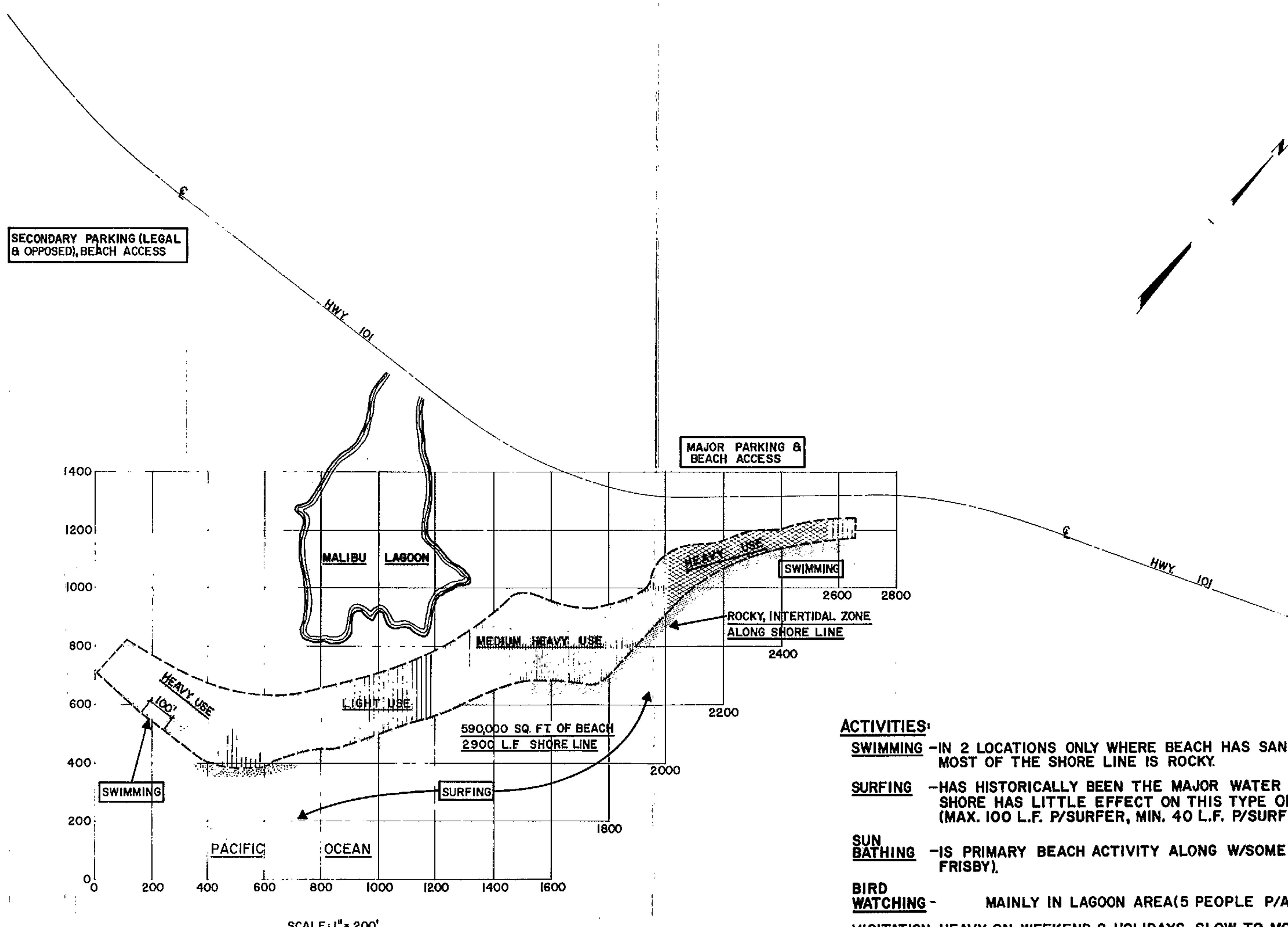
REVISIONS	DATE	DESIGNED
		DRAWN OCT. 1977
		CHECKED

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
APPROVED __________ DATE __________

MALIBU LAGOON STATE BEACH
EXISTING BEACH PARKING RELATIONSHIP

DRAWING NO.

SHEET NO. 9 OF 10



ACTIVITIES:

SWIMMING – IN 2 LOCATIONS ONLY WHERE BEACH HAS SANDY INTERTIDAL ZONE. MOST OF THE SHORE LINE IS ROCKY.

SURFING – HAS HISTORICALLY BEEN THE MAJOR WATER ACTIVITY. ROCKY SHORE HAS LITTLE EFFECT ON THIS TYPE OF RECREATION. (MAX. 100 L.F. P/SURFER, MIN. 40 L.F. P/SURFER)

SUN BATHING – IS PRIMARY BEACH ACTIVITY ALONG W/SOME GAMES (VOLLEY BALL, FRISBY).

BIRD WATCHING – MAINLY IN LAGOON AREA (5 PEOPLE P/ACRE).

VISITATION – HEAVY ON WEEKEND & HOLIDAYS, SLOW TO MODERATE OTHERWISE.

WATER QUALITY – QUESTIONABLE, DUE TO HIGH COLIFORM COUNT AT CERTAIN TIMES OF YEAR.

DESIGNED	DRAWN S. AMAR 10-77	CHECKED

REVISIONS	DATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
APPROVED ______ DATE ______

MALIBU LAGOON STATE BEACH

EXISTING BEACH ACTIVITIES

DRAWING No.

SHEET No. 10 OF 10

July 27, 2012

Via Electronic Mail Only:
jd@johnanthonydavis.com

John Davis
Post Office Box 10152
Marina del Rey, California 90295

Dear Mr. Davis:

Re: Public Records Act Request – Malibu Lagoon Restoration Project

California State Parks' (CSP) received your most recent PRA request via electronic mail on July 17, 2012. CSP's Legal Office responds below.

1. "Please provide any and all public records that demonstrate that the State Parks Commission, in accordance with Public Resources Code 5080.03(c), approved the Final Environmental Impact Report for Malibu Lagoon State Park which is being utilized for the current "restoration project", referenced on the home page of the Agency at (http://www.parks.ca.gov)."

   CSP has no records responsive to this request.

2. "Please provide any and all records held by the State Agency that regard the following internet domain to which the aforesaid Agency homepage links to at (http://www.restoremalibulagoon.com), which is a private non-state website registered to and which displays the official California State Parks logo:

   DOMAIN PRIVACY SERVICE
   70 BLANCHARD ROAD
   BURLINGTON, MASSACHUSETTS, 01803
   UNITED STATES
   PHONE 1.866.642.4678"

   CSP has no records responsive to this request.

3. "Please provide any and all public records that demonstrate that the California Department of Parks and Recreation authorized a private party to display the California State Parks Logo on its website at (http://www.restoremalibulagoon.com)."

   CSP has no records responsive to this request.

If you have any questions, I can be reached at (916) 651-8454.

Sincerely,

Kelli McDowell

Kelli McDowell
Administrative Assistant

cc: Tara E. Lynch, Acting Chief Counsel

Resolution 28-2008
Adopted by the
CALIFORNIA STATE PARK AND RECREATION COMMISSION
at its regular meeting in Pescadero, California
October 31, 2008

General Plan and Environmental Impact Report for Año Nuevo State Park

WHEREAS, the Director of California State Parks has presented to this Commission for approval the proposed General Plan and Environmental Impact Report (“Plan”) for Año Nuevo State Park (“Park”); and

WHEREAS, the Plan proposes to incorporate the state-owned properties west of State Highway 1 currently named and classified as Año Nuevo State Natural Reserve into the Año Nuevo State Park located inland of State Highway 1; and

WHEREAS, the Plan provides conceptual parameters and guidelines for the long-term management, development, operations, and future public use and enjoyment of the combined units as Año Nuevo State Park as well as the protection of its unique quality, resources, and diversity; and

WHEREAS, the Plan includes an Environmental Impact Report (EIR) as a part of a General Plan, pursuant to Public Resources Code Section 5002.2 and the California Code of Regulations (CCR) Section 15166 (CEQA Guidelines), providing discussion of the probable impacts of future development, establishing goals, policies and objectives, and addressing all the requirements of an EIR; and

WHEREAS, the Plan is subject to the California Environmental Quality Act (CEQA) and functions as a “tiered EIR” pursuant to Public Resources Code Section 21093, covering general goals and objectives of the Plan, and that the appropriate level of CEQA review will be conducted for each project relying on the Plan;

NOW, THEREFORE BE IT RESOLVED: That this Commission has reviewed and considered the information and analysis in the Plan prior to approving the Plan, and this Commission finds and certifies that the Plan reflects the independent judgment and analysis of this Commission and has been completed in accordance with the California Environmental Quality Act; and be it

RESOLVED: In connection with its review of the General Plan prior to approval, this Commission independently finds that the environmental conclusions contained in the Environmental Analysis Section of the Plan are supported by facts therein and that each fact in support of the findings is true and is based on substantial evidence in the record and that mitigation measures or other changes or alterations have been incorporated into the Plan which will avoid or substantially lessen the potential impacts identified in the Plan; and be it

CONTINUED ON PAGE 2

CONTINUED FROM PAGE 1

RESOLVED: The location and custodian of the Plan and other materials which constitute the record of proceedings on which the Commission's decision is based is: State Park and Recreation Commission, P.O. Box 942896, Sacramento, California 94296-0001, Phone 916/653-0524, Facsimile 916/653-4458; and be it

RESOLVED: That the California State Park and Recreation Commission hereby approves the Department of Parks and Recreation's General Plan dated March 2008 and Final Environmental Impact Report prepared for Año Nuevo State Park; and be it

FURTHER RESOLVED; That a Notice of Determination will be filed with the Office of Planning and Research within five days of this approval.

Attest: This Resolution was duly adopted by the California State Park and Recreation Commission on October 31, 2008 at the Commission's duly-noticed public meeting at Pescadero, California.

By: *ORIGINAL SIGNED BY* Date: *10-31-08*

Louis Nastro
Assistant to the Commission
For Ruth Coleman, Director
California State Parks
Secretary to the Commission

A. Amber Geraghty
Coastal Program Analyst
California Coastal Commission
89 South California Street
Ventura, Ca. 93001

August 1, 2012

Re: Application No. R-4-07-098 Revocation Request

Dear Ms. Geraghty,

I am a board member of Santa Monica Bay Audubon Society (SMBAS), which has always and continues to support the Malibu Lagoon Restoration Project. We voted for the project when it was originally decided locally and we wrote a letter to Jack Ainsworth on 10/12/10 to reiterate our support of the project.

However, I am writing this as an individual to protest the errors, some mentioning me, which were communicated to Jack Ainsworth, Steve Hudson, and Charles Lester, by Marcia Hanscom in her 7/13/12 email communication – Subject: SENDING AGAIN: Western Snowy Plover - IMMEDIATE and URGENT concern.

This document can be found on pgs. 690-91 of: http://documents.coastal.ca.gov/reports/2012/8/W4.5a-8-2012.pdf

The short version of my remarks is this: Ms. Hanscom's statements concerning me, the Snowy Plovers and the relationship of the project to the plovers are unsupported and contrary to my experience of thirty years of watching the birds at Malibu Lagoon.

Immediately below is a copy of a portion of Ms. Hanscom's email concerning Western Snowy Plovers [Numbers in parentheses - (1), (2), etc. - are keyed to my comments following this copy]:

> "Given this NEW CONSULTATION between ACOE and USFWS re: Western Snowy Plover - it seems to me that this is yet ANOTHER reason to stop the project and at LEAST to not allow discharge of waters from the lagoon on the area of sand where it has been proposed. As you might know, this bird species uses the sandy beach and it also uses the area of the shoreline between the ocean water and the sand **(1)** - for food! And the pipe for the dewatering is scheduled to be going 24/7 - which will impact this species **(2)**.
>
> "In addition, the current fenced area for the Western Snowy Plover has been moved **(3)** (by State Parks or other project managers?) and is NOT in the area **(4)** where it has been in past years. It seems to be being used more as a way to keep the public away **(5)** from shooting photos of the lagoon construction project **(6)** rather than to protect the Western Snowy Plover. Chuck Almdale from Santa Monica Audubon recently commented **(7)** on this change in position for the fenced area in a blog.
>
> "Still the most important fact is that this bird species is likely on its way back **(8)** in migration soon, and usually **(9)** there would be a really good fenced off area....and, since, of course, the fenced in area does NOT mean this bird species only stays in the fenced-in area **(10)**, but is simply a way to keep the public away from some of these sensitive and imperiled birds, the dewatering discharge pipe **(11)** is a problem for the time periods during which this species may be on the beach....Freshwater flowing out in the amounts and at the velocity planned would be a severe impact."**(12)**

Her specific errors are:
(1) The ocean water breaks directly onto the sand, so I'm not sure where the area "between the ocean water and sand" is located. Relative to her other errors, this is minor.

Attachment 3

(2) The location of the dewatering facility, the pipe and the discharging of the water will not affect the Snowy Plovers, as they do not utilized this area of the beach or inter-tidal zone. The discharge flow is low enough so as to mix sufficiently with the sea water before traveling far.

(3) The "current fenced area" has NOT been moved by anyone since it was erected on 3/15/12 by ***Jamie King*** of California State Parks, ***Stacey Vigellon*** of Los Angeles Audubon Society Snowy Plover project, ***myself***, and two other people. Here is a blog I wrote on the creation of the enclosure: http://smbasblog.wordpress.com/2012/03/18/snowy-plover-symbolic-fence-enclosure-erected-at-malibu-lagoon/

(4) The fence was placed where, according to Stacy Vigellon who checked the area earlier, the plovers were roosting at that time. The birds were actually all out foraging for food at the time the fence was erected. Jamie (Ca. State Parks employee) and I followed her advice. The fence can ***never*** stay in the same location, especially year-to-year for these reasons: the birds occasionally shift their roosting location slightly; they leave for breeding elsewhere and return months later; the beach shape changes; high creek flows from heavy rains blows straight through the beach; winter storms wash out the beach; high lagoon water breaches the beach; the breach location drifts eastward over weeks or months.

(5) The location of the fence had nothing to do with the project, which didn't start until 2 1/2 months later.

(6) Photos of the project are easily taken from *many* points surrounding the project. Placement of the *3-sided* plover enclosure (unfenced on the lagoon side) does ***not*** interfere with photography. The enclosure is only a *symbolic fence*: a line of metal posts spaced about 10 yds. apart, connected by a single rope about 4 ft. above the sand, with small signs on the posts. Known project opponents have been witnessed walking through the enclosure. We have no problem taking photos of the project; a slideshow on our chapter blog project page has 100 photos of the area, dated from 5/27/12 - 7/24/12. If you want to see how it looks, see the slideshow. New photos are added weekly: http://smbasblog.wordpress.com/malibu-lagoon-project/

(7) The ***only*** comment I've made on any blog about moving the enclosure is that we ***might*** move it in the near future to surround the area where the plovers are currently roosting, which is about 100 yds. east (away from the project) of the enclosure. Moving the enclosure is not easy, so we want to make sure the plovers are staying put before we do it. If we do move it, it would be relocated *further away* from the project. The enclosure and project have nothing to do with one another.

(8) The birds are on the beach now. We counted 22 birds on 7/22/12 and 30 on 7/29/12. None had bands. The birds will be on the beach all winter, the last ones leaving in April or early May for their breeding grounds farther north.

(9) In prior years, we ***never*** had an enclosure erected before the birds arrived. There was no point in doing so, for all the reasons stated in #4 above. We intentionally erected the enclosure in March this year, and *left it up*, in order to educate the public as to the presence of the plovers, and get them used to seeing the enclosure and staying out of it.

(10) The birds always leave the enclosure (assuming the enclosure actually surrounds their roosting location) in order to feed. They do this shortly after the high tide, when the *wrack* (washed-up sea vegetation, their primary foraging location), is fresh. They also feed on the wet sand uncovered by the retreating tide or near the edge of the lagoon.

(11) This isn't good reasoning even if Ms. Hanscom had the facts straight, which she doesn't. The presence of the pipe by its mere existence would not automatically present a problem for the Snowy Plovers. The dewatering facility, the location of discharge pipe, and the water discharged are ***not*** problems for the birds. Their roosting and feeding locations are well east of the pipe. In over 30 years of censusing birds at this

beach and lagoon, I have ***never*** seen them in the location of the pipe. Snowy Plovers stay ***very*** close to their roosting sites. Even a few hundred yards is farther from their roosts than they like to be. There are seven roosts in Los Angeles County: of approximately 75 miles of sandy beach, the plovers confine themselves to less than 1.2 linear miles.

(12) Again, for all the reasons previously mentioned, an unsupported, untrue statement.

Frankly, when I find this many errors in a relatively short statement concerning matters of which I do have personal knowledge, I have to wonder if the writer is equally unreliable about matters where I do not have personal knowledge.

I recently completed a 7-part blog series on the Western Snowy Plovers, focusing on the Surfrider Beach roost. Here's a link to part 1: http://malibu.patch.com/blog_posts/western-snowy-plovers-on-surfrider-beach

An additional comment on the USFWS creation of additional "critical habitat" (102% range-wide expansion) for the Western Snowy Plover:
In general, I am all in favor of expanding such critical habitat, assuming that actual protection of the habitat and education of the local beach going public (by far the greatest danger to the birds) will follow. However, at Malibu Lagoon/Surfrider Beach, USFWS personnel apparently weren't paying very close attention when they drew the Critical Habitat boundaries on their map, as they included a large portion of completely unsuitable habitat consisting of brush-covered fill dirt and open channel, areas where the plovers never go. While designating this habitat as *critical* to the plovers would not normally be a significant problem (the plovers don't use it and neither do any other important animals, except humans walking to the beach) it did make a problem at this particular point in time because of the restoration project which has to run its pipe somewhere. The pipes current location - right next to the fence of Malibu Colony - is the only one that doesn't run right through the newly designated Critical Habitat. Running it anywhere else would result in a far longer pipe, greater disturbance to the beach and greater potential disturbance to the plovers as well as the human beach users.

Final comment on the restoration project in general:
SMBAS remains in favor of the project. Right now, the area is an unsightly landscape of mud and water, like any surgical operation 1/4th of the way through. Stopping it now would leave a large unsightly scar on the land, and would accomplish nothing beyond the personal gratification of a very few of the remaining opponents.

Feel free to contact me at any time if you have any questions.

Sincerely yours,
Chuck Almdale
15737 Tuba St.
North Hills, Ca. 91343
818-894-2541
Santa Monica Bay Audubon Society Field Trip Chairperson

August 2, 2012

California Coastal Commission
Attn: Jack Ainsworth
South Central Coast Senior Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801

Re: Application No. 4-07-098, Application of California Dept. of Parks and Recreation to restore and enhance Malibu Lagoon

Dear Mr. Ainsworth:

On October 12, 2010, Santa Monica Bay Audubon Society wrote you stating our support for the Malibu Lagoon Restoration Project. This project finally began in June, 2012 and is now well underway. We are closely watching the project and we see no reason whatsoever for it to be halted or have its permit revoked. The best thing for the lagoon would be to continue the project without hindrance, thereby minimizing the period of time that it is unattractive and incomplete.

SMBAS is a non-profit organization established in 1976 to serve the Santa Monica Bay area of which Malibu Lagoon is a central part. We have led a monthly public bird walk at the lagoon for almost thirty years; these walks will continue throughout the period of restoration. We do a monthly census of all the birds at the lagoon. In June and July, 2012, total birds and species diversification counts were well within their normal range above and below their ten-year averages, indicating that the project was having no noticeable effect upon the birds. We can supply you with our documentation if you desire.

In addition to our bird walk and census activity, SMBAS also: monitors and counts the Snowy Plovers monthly, checks for banded birds and reports our results to Pt. Reyes Bird Observatory. Also, we provide the site captains and organization for the Annual Coastal Cleanup at the lagoon.

SMBAS cares very much about Malibu Lagoon and feels that this project will provide needed enhancements to the lagoon and provide for its long term health.

Sincerely yours,

Chuck Bragg
President, Santa Monica Bay Audubon Society
(310) 454-9662

Attachment 4

SANTA MONICA BAY AUDUBON SOCIETY
STATEMENT OF SUPPORT FOR
THE MALIBU LAGOON RESTORATION PROJECT
August 3, 2012

The Board of Directors of Santa Monica Bay Audubon Society (SMBAS) supports the Malibu Lagoon Restoration Project. This is not a new position for us. Members of SMBAS began attending the Malibu Lagoon Task Force (MTLF) meetings in the 1990's. We took part in the numerous MLTF discussions, and our suggestion to add ornithological expert Kimball Garrett to the Lagoon Technical Advisory Committee was accepted. At the conclusion of the planning phase, we voted in favor of the MTLF final recommendations. In October 2010, we sent a statement to the California Coastal Commission affirming our support for the project; we now reiterate our continuing support.

Over the past two months we have observed the progress of the project and have witnessed nothing unexpected, unplanned or dangerous. We continue to hold monthly bird walks at the lagoon as we have done for almost thirty years. We continue our monthly censusing of the birds at the lagoon and of the Western Snowy Plovers at their winter roost on the beach. Our results indicate that as yet the project has had no affect on the lagoon's birdlife, either in species diversification or total bird numbers; both quantities are varying within their usual ranges for the most recent ten-year period. Western Snowy Plovers, a threatened species which roosts on Surfrider Beach adjacent to the lagoon, are similarly unaffected.

Based on our observations, bird population in the channels average approximately five percent of that in the main lagoon. Our understanding is that low oxygen and high bacteria levels in the channels severely limited invertebrate populations in the mud substrate, leaving little for the birds to eat.

We continue to support the plan: to remove the fill dirt placed there decades ago, redesign the channels to create better water circulation and increase ground area subject to water level fluctuation, replant the area with native plants appropriate to a brackish wetland, and redesign the pathway to the beach.

The Board of Santa Monica Bay Audubon Society
Charles G. Bragg, President

Attachment 5

August 7, 2012

Commission Chair Mary K. Shallenberger
California Coastal Commission
45 Fremont Street
San Francisco, California 94105-2219

Dear Chairwoman Shallenberger:

The California Department of Parks and Recreation (CSP) has recently received inquiries regarding the authority of the State Parks and Recreation Commission (SPRC) to review and approve projects such as the Malibu Lagoon Restoration and Enhancement Project (Malibu Lagoon Restoration Project). CSP provides the following in an effort to fully inform any member of the public interested in the SPRC's responsibility as it relates to the Malibu Lagoon Restoration Project.

The authority for the SPRC is generally addressed in Public Resources Code sections 530 et seq. Specifically, the SPRC must report annually to the Governor, through the Director, on existing programs and the needs of the state (PRC section 535), establish general policies for the guidance of the director in the administration and protection and development of the state park system (PRC section 539), and recommend to the Director a comprehensive recreational policy for the State (PRC section 540). Under PRC section 5002.2, the SPRC approves general plans for state park units following classification or reclassification of a unit.

While the SPRC has specific responsibilities identified in the law, the department is managed by the executive officer known as the Director of CSP. (PRC section 501.) Specific projects, such as the Malibu Lagoon Restoration Project, and CEQA compliance, are approved by the Executive Director. The SPRC has no authority over individual projects.

If you have any questions, please call me at (916) 651-8772.

Sincerely,

Kathryn J. Tobias

Kathryn J. Tobias
Senior Staff Counsel

Attachment 6

CALIFORNIA COASTAL COMMISSION
SOUTH CENTRAL COAST AREA
89 SOUTH CALIFORNIA ST., SUITE 200
VENTURA, CA 93001
(805) 585-1800

W4.5a

Submitted: 6/14/12
Staff: A.G.
Staff Report: 7/27/12
Hearing Date: 8/8/12

STAFF REPORT: REVOCATION REQUEST

Application No.:	**R-4-07-098**
Applicant:	**California Department of Parks and Recreation**
Agent:	**Mark Abramson, Santa Monica Bay Restoration Foundation**
Project Location:	**Malibu Lagoon State Beach, City of Malibu, Los Angeles County**
Project Description:	**Implementation of a Wetland Habitat Restoration and Enhancement Plan for Malibu Lagoon to improve the function of the lagoon ecosystem by recontouring/reconfiguring the lagoon slopes and channels to increase hydrologic flow involving 88,700 cu. yds. of grading (51,200 cu yds. excavation and 37,500 cu. yds. fill); revegetation with native wetland and upland plant species and removal of non-native plant species; construction of a public access trail around lagoon with new interpretive public informational/educational improvements; and implementation of a long-term lagoon monitoring plan.**
Revocation Requested By:	**Marcia Hanscom, Wetlands Defense Fund and Robert van de Hoek, Coastal Law Enforcement Action Network (CLEAN)**
Motion & Resolution:	**Page 4**

SUMMARY OF STAFF RECOMMENDATION

Staff recommends that the Commission **deny** the proposed request for revocation on the basis that no grounds have been shown to exist for revocation under Section 13105 of Title 14 of the

California Code of Regulations. The party requesting revocation contends that grounds for revocation exist solely pursuant to Section 13105(a), because, they contend, the applicant submitted inaccurate, erroneous and incomplete information to the Commission in connection with coastal development permit application 4-07-098. The request for revocation does not assert that grounds for revocation in Section 13105(b) exist.

No evidence was presented showing that the applicant submitted inaccurate, erroneous, or incomplete information of the sort alleged (i.e., information regarding project construction timing, tidewater goby critical habitat, public access, or dewatering), much less that they did so intentionally, as required by Section 13105(a). In addition, Section 13105(a) requires that the party requesting revocation show that, had the Commission had correct and complete information, it would have acted differently. Because the Commission had the correct information, this cannot be shown. Moreover, even if the additional information cited in the revocation request had been known to the Commission, there is no reason to believe it would have caused the Commission to act differently. Finally, the revocation request was not filed with due diligence, as required by the Commission's regulations.

Pursuant to Section 13106 of the California Code of Regulations[1], when a revocation request is received, the Executive Director is required to review the stated grounds for revocation and, unless the request is patently frivolous and without merit, shall initiate revocation proceedings. Upon reviewing the subject request, and comparing it to the administrative record, the Executive Director found the revocation request to be indisputably without merit. Specifically, the Executive director has determined that in this case, in accord with Section 13106, **no** grounds exist for revocation of the permit. Nevertheless, because some familiarity with the record is necessary in order to demonstrate the lack of merit of this particular revocation request, and to maximize the opportunity for the revocation requester and the public to be heard, the Executive Director determined it would be prudent to set a hearing for an examination of the request and the record.

[1] All further numerical section references are to the Commission's regulations in Title 14 of the California Code of Regulations.

Table of Contents

I. MOTION AND RESOLUTION 4

II. FINDINGS AND DECLARATIONS 5

A. PROJECT DESCRIPTION AND BACKGROUND 5
B. PAST COMMISSION ACTION 6
C. REVOCATION REQUEST CONTENTIONS 8
1. Project Timing 8
2. Tidewater Goby Critical Habitat 9
3. Public Access 10
4. Dewatering Concerns 10
5. Unknown Contentions- Additional Materials Submitted on June 15, 2012 and July 13, 2012. 10
D. APPLICABLE STANDARDS OF REVIEW 11
E. ANALYSIS OF ASSERTED GROUNDS FOR REVOCATION 13
1. Analysis of Revocation Request Contentions with Respect to Section 13105(a) 13
2. Section 13105(b) of the California Code of Regulations 26
3. Conclusion 26
F. SECTION 13108(D) OF THE CALIFORNIA CODE OF REGULATIONS 27

EXHIBITS

Exhibit 1. June 14, 2012 Revocation Request Submittal
Exhibit 2. Dr. Travis Longcore report
Exhibit 3. Sixty Day Notice of Intent to Sue letter, dated May 30, 2012
Exhibit 4. Enforcement Request Letter, dated June 14, 2012
Exhibit 5. CCC Enforcement Response Letter, dated June 22, 2012
Exhibit 6. CDP 4-07-098 9/29/10 Commission Staff Report
Exhibit 7. Letter from Wetlands Defense Fund and CLEAN, dated October 13, 2010
Exhibit 8. Letter from State Parks to CCC Executive Director, dated July 5, 2012
Exhibit 9. Email from Marcia Hanscom, dated July 13, 2012
Exhibit 10. October 13, 2010 Commission Hearing Transcript

PROCEDURAL NOTE: STANDARD OF REVIEW

The California Code of Regulations, Title 14, Section 13105 states that the grounds for the revocation of a coastal development permit are as follows:

Grounds for revocation of a permit shall be:

a) Intentional inclusion of inaccurate, erroneous or incomplete information in connection with a coastal development permit application, where the Commission finds that accurate and complete information would have caused the Commission to require additional or different conditions on a permit or deny an application;

b) Failure to comply with the notice provisions of Section 13054, where the views of the person(s) not notified were not otherwise made known to the Commission and could have caused the Commission to require additional or different conditions on a permit or deny an application.

I. MOTION AND RESOLUTION

The staff recommends that the Commission adopt the following resolution:

Motion:

> *I move that the Commission grant revocation of Coastal Development Permit No. 4-07-098.*

Staff recommends a **NO** vote on the motion. Following this staff recommendation will result in denial of the request for revocation and adoption of the following resolution and findings. The motion passes only by affirmative vote of a majority of Commissioners present.

Resolution:

> *The Commission hereby denies the request for revocation of the Commission's decision on coastal development permit no. 4-07-098 on the grounds that there was no:*
>
> *(a) intentional inclusion of inaccurate, erroneous or incomplete information in connection with a coastal development permit application, where the Commission finds that accurate and complete information would have caused the Commission to require additional or different conditions on a permit or deny an application; OR*
>
> *(b) failure to comply with the notice provisions of § 13054, where the views of the person(s) not notified were not otherwise made known to the Commission and could have caused the Commission to require additional or different conditions on a permit or deny an application.*

II. FINDINGS AND DECLARATIONS

The Commission hereby finds and declares:

A. PROJECT DESCRIPTION AND BACKGROUND

The coastal development permit that is the subject of this revocation request was approved by the Commission on October 13, 2010. The Commission approved a comprehensive restoration and enhancement plan to improve the wetland habitat and function of Malibu Lagoon. The project includes dewatering the western 12-acre portion of the lagoon and recontouring slopes and channels within the western portion of the lagoon, including 51,200 cu. yds. of excavation and 37,500 cu. yds. of fill with 13,700 cu. yds. export of excavated material to improve circulation, increase tidal flow, and enhance habitat diversity. The project includes implementation of a restoration and planting plan to remove non-native plant species and revegetate all disturbed areas with an appropriate mix of native plant species, including low marsh, mid-high marsh, high marsh transitional, and coastal scrub plantings. A north-south oriented temporary earthen berm was approved in order to temporarily separate the western lagoon area where restoration will occur from the main portion of Malibu Lagoon in order to allow dewatering of the restoration area. A small area adjacent to the Adamson House will be deepened and replanted. All excavated material will be temporarily stockpiled in designated areas on site, including the parking lot and appropriate erosion control measures are proposed to ensure that uncontrolled runoff does not occur and that there is no potential increase in sedimentation of the lagoon. The approved project includes detailed plans for management of erosion during construction, a habitat planting plan, a public access, education, and interpretation plan, and a detailed long-term monitoring program for habitat (flora and fauna), water quality, sediment quality, and lagoon topography/bathymetry. (See pages 30-38 of the Staff Report, attached as **Exhibit 5**, for a complete detailed project description.)

Malibu Lagoon covers a 31-acre area located at the terminus of the Malibu Creek Watershed, which is the second largest watershed that drains into Santa Monica Bay. The tidally influenced area covers approximately 24 acres. The lagoon drains into the Santa Monica Bay at Surfrider Beach in the City of Malibu. Malibu Lagoon State Beach is managed and operated by the California Department of Parks and Recreation (“State Parks”). It is bordered to the north by the Pacific Coast Highway (PCH), to the west by a gated residential community (“The Colony”), “and to the south by a finger of the Malibu Colony (south of the western portion) and the Pacific Ocean (south of the main lagoon). The lagoon is ecologically significant because it is one of the last remaining wetlands within Santa Monica Bay and hosts a variety of avian and aquatic species of statewide and regional significance. The lagoon waters seasonally fluctuate between a freshwater, brackish water, and saltwater environment depending on the flow regime in Malibu Creek, the height of the beach barrier, and the diurnal tides of the ocean. The current lagoon configuration does not provide an adequate and fully functional lagoon habitat regime that historically naturally existed at this site mainly because of poor circulation. The proposed project will re-contour the 12-acre western portion of the lagoon to restore tidal complexity, improve the hydraulic circulation and enhance aquatic habitat structure and diversity.

The lagoon mouth is either open or closed depending on the height of the barrier beach. When the lagoon mouth is open, the hydraulics are dominated by freshwater creek flows during flood events and during low tides, and by the inflow of saltwater during high tides. When the lagoon mouth is open, the lagoon can drain to an elevation of 0 ft. above mean sea level (MSL) and match the lowest daily tide. During a majority of the season when the mouth is open (winter season), the barrier beach is naturally maintained at an elevation of 3 ft above MSL. Tides enter the lagoon twice a day and flood the project area to an average elevation of 6 ft. above MSL, with the extreme high tides reaching approximately 8 ft. MSL. When the lagoon mouth is closed, the lagoon stores water flowing from Malibu Creek, runoff from PCH, runoff from the adjacent neighborhood, groundwater seepage, and maintains an elevation of approximately 9 ft. above MSL. Water quality in the lagoon during the closed condition is generally poor and contaminants exceed the maximum levels that are consistent with the achievement of water quality standards set by the Regional Water Quality Control Board for the Santa Monica Bay.

The Commission's approval of CDP 4-07-098 included seventeen special conditions regarding: Construction, Timing, and Sensitive Species Surveys, Erosion Control Plans, Timing, Operations, and Maintenance Responsibilities, Final Dewatering Plan, Final Hydrological Monitoring Plan , Habitat (Plant Communities) Vegetation, Restoration Monitoring and Reporting Plan, Final Aquatic Vegetation, Benthos, Fish and Avian Monitoring Plan, Plans Conforming to Engineer's Recommendations, Herbicide Use Restriciton, Final Public Access Program, Required Approvals, Assumption of Risk, Discharge Requirements, Mitigation Measures, Archaeological Resource Monitoring, Removal of Excavated Material, and New Zealand Mud Snail Measures. As some of these conditions had to be satisfied prior to issuance of the permit, the permit was issued on May 21, 2012.

B. PAST COMMISSION ACTION

Malibu Lagoon has been significantly altered from its historic condition. The existing 31 acre lagoon contains only a small portion of its historic reach. In 1929, the California Department of Transportation used the site as a dumping ground during construction of the Pacific Coast Highway. Since that time, urban development has surrounded the lagoon, including an adjacent housing development (Malibu Colony) and construction of the Pacific Coast Highway bridge to the north through the lagoon. Further, a large portion of the lagoon was filled in during the 1940's and 1950's and baseball fields were constructed.

On August 13, 1979, the Commission granted Coastal Development Permit No. P-79-5515 to State Parks for a "General Development Plan for Malibu Lagoon Beach". The CDP authorized 60,000 cu. yds. of excavation of sediment material for the purpose of marsh restoration, of which 50,000 cu. yds. of the excavated material was disposed of offsite at Malibu Creek State Park, approximately 6 miles away. The project included creation/restoration of approximately 7 acres of area (the "western lagoon complex") that was historically part of the lagoon but filled in by the California Department of Transportation in 1969 and preceding years as a result of highway construction. The restoration included 3.5 acres of permanent lagoon, 6 acres of tidal marsh, and 3.5 acres of upper marsh. Additionally, a 50-car parking lot adjacent to the marsh area, chemical restroom facilities, a perimeter road, and an elevated walkway over the marsh were also approved. This CDP approval was challenged by the Malibu Little League who received a Superior Court order temporarily suspending the permit and requiring the Commission to review the Executive Director's determination of compliance with a condition that State Parks provide assistance to the Little League organization (who had used the property since 1970) to find an alternative site for ball fields. A permit extension was subsequently approved by the Commission on August 25, 1982, whereupon the CDP was reissued as CDP No. 5-81-135E and the lagoon restoration took place in 1983.

In 1986, the Commission approved additional development at the site, including a 1,000 linear ft. walkway, viewing deck, two stairways, ramp, and underground utilities. (CDP No. 5-86-143) Various other projects have been approved at Malibu Lagoon State Beach by the Commission, including restoring 0.60 acres of wetland and creating salt marsh and dune habitat (CDP No. 5-87-689), breaching the sand berm at the mouth of the lagoon as a one-time emergency measure to remediate flooding (CDP No. 4-95-242-G), installing temporary symbolic fencing for the threatened snowy plover (CDP No. 4-08-015-W and 4-08-085-W), and redirecting the mouth of the Malibu Creek using a tractor to close the channel in order to direct the flow upcoast as a one-time emergency measure to remediate flooding (CDP 4-06-051-G). Another partial restoration project within the lagoon occurred in 1996, pursuant to the Commission approval of Coastal Development Permit 5-90-1066. This restoration project was implemented by the California Department of Transportation (CalTrans) and coordinated by State Parks and the Resource Conservation District of the Santa Monica Mountains. The restoration was implemented as mitigation for impacts to Malibu Lagoon from construction during the PCH Bridge Replacement Project. That restoration program included a tidewater goby habitat enhancement project and a revegetation program.

In the late 1990's, the California Coastal Conservancy funded a study by the University of California, Los Angeles to identify restoration goals for the Malibu Lagoon task force. This led to the preparation of the Malibu Lagoon Restoration Feasibility Study and Final Alternatives Analysis (*see* Substantive File Documents). In 2005, the California Department of Parks and Recreation completed the Malibu Lagoon Restoration Feasibility Study and Final Alternatives Analysis to assess further restoration of Malibu Lagoon. This effort involved coordination meetings between the California Department of Parks and Recreation (State Parks), the California State Coastal Conservancy, Heal the Bay, the Lagoon Restoration Working Group, and the Malibu Lagoon Technical Advisory Committee to determine the most ecologically beneficial restoration design with the least amount of harmful impacts to the lagoon ecosystem, focusing on long-term habitat and water quality benefits. A Final Environmental Impact Report was completed for this project dated March 2006 without challenge. Subsequently, the applicant obtained preliminary permit approvals for the project from the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the Army Corps of Engineers (ACOE) and permit approvals from the Regional Water Quality Control Board (RWQCB).

The State Coastal Conservancy secured funding from the State Water Resources Control Board to complete "Phase I" of the Malibu Lagoon Restoration and Enhancement Plan, the parking lot relocation, which was completed in 2008. The City of Malibu approved a Coastal Development Permit Application by the California Department of Parks and Recreation (CDP NO. 07-012) for "Phase I" of the Malibu Lagoon Restoration and Enhancement Plan in 2007 to relocate the parking lot for Malibu Lagoon State Beach. The City of Malibu simultaneously approved Variance No. 07-024 allowing the parking facilities to be located within the front yard setback and within a public open space. The City's CDP authorized the relocation and redesign of the previously existing parking to allow for additional habitat to be restored in "Phase 2" of the

Malibu Lagoon Restoration and Enhancement Plan, the currently proposed project. The new parking lot includes permeable pavement, landscaping, and a stormwater treatment system to treat runoff before it flows to the lagoon. The CDP also authorized a public use area adjacent to the parking lot with various forms of seating, the relocation of the vehicular entryway and pedestrian pathway (the primary pedestrian and vehicle entryway from Pacific Coast Highway), and a new pedestrian footpath and bridge allowing entry to Surfrider Beach approximately 300 ft. to the southeast.

C. Revocation Request Contentions

At the Commission hearing on June 14, 2012, Marcia Hanscom submitted a revocation request for CDP 4-07-098 on behalf of herself, as Executive Director of Wetlands Defense Fund, and Robert van de Hoek, President and Wildlife Biologist of Coastal Law Enforcement Action Network (CLEAN) (**Exhibit 1**). On June 15, 2012, in an email to Commission staff, Marcia Hanscom requested that three additional documents be included with the official revocation request: (1) a report from Dr. Travis Longcore (undated), (2) an enforcement request letter dated June 14, 2012, and (3) a Sixty Day Notice of Intent to Sue letter to the Army Corps of Engineers under Section 7 of the Endangered Species Act, from Wetlands Defense Fund and CLEAN, dated May 30, 2012 (**Exhibits 2-4**).

The request for revocation contends that grounds for revocation in Section 13105(a) of the Commission's regulation exist because the applicant intentionally submitted inaccurate, erroneous and incomplete information to the Commission in conjunction with the coastal development permit application with regard to the following grounds: (1) project timing, (2) construction impacts on tidewater goby, (3) public access, and (4) dewatering. The letter also suggests that the Commission should "place the project on hold" due to alleged "permit compliance problems."

1. Project Timing

The parties requesting revocation make various assertions regarding misinformation relating to the applicant's proposed construction work timeframe. The primary claim in this regard is that that the applicant provided inaccurate information suggesting the presence of steelhead trout within Malibu Lagoon during the winter months in order to justify a summer construction timeframe, rather a winter construction timeframe. The revocation request cites to a Biological Assessment prepared by Jones and Stokes stating that no Southern Steelhead were found in Malibu Lagoon during environmental surveys. The revocation request also notes an email communication between Commission staff and the project applicant in which staff requests clarification from the applicant regarding project timing because of a USFWS statement suggesting a concern about conducting the project between May and November. Further, the revocation request also states that a representative of the applicant, at the October 13, 2010 Commission hearing, provided inaccurate information to the Commission that steelhead were present during winter months. The revocation request asserts that if accurate information would have been considered by the Commission regarding steelhead (specifically that no steelhead were present in Malibu Creek), then the Commission would have changed the project timing to allow work to occur during the winter months and would have not allowed work to occur during the summer breeding season of tidewater goby. The revocation request asserts that this information "might have also led the Commission to a denial or at least of the postponement of the project in order to harmonize these extremely disparate and inaccurate assertions and conclusions put forth by the project applicant, agent, and proponents."

Additionally, the revocation request asserts that, after the permit was approved, the applicant "admitted" that they wanted to work during the summer because it would have been too expensive to operate heavy machinery in the winter months and, thus, they intentionally misrepresented the necessary project timeframe to the Coastal Commission.

2. Tidewater Goby Critical Habitat

Critical Habitat Designation and Presence of Tidewater Goby

The revocation request states that project applicants did not reveal to the Commission that Malibu Lagoon was designated as critical habitat for the tidewater goby on January 31, 2008. The revocation request also asserts that the applicants concealed the extent of the project, and the associated extent of the impacts on the tidewater goby (and other sensitive species), as described in a declaration prepared for the California Court of Appeal by Robert van de Hoek. The parties requesting revocation assert that this information about the tidewater goby would have contributed to a different decision by the Coastal Commission regarding project timing to not allow work during the summer tidewater goby breeding season. The request speculates that this additional information might have led the Commission to a denial or a postponement.

Availability of Project Plans and 2005 Dagit & Swift Fish Sampling Report

The revocation request asserts that project proponents did not reveal the proposed temporary dam location to Commissioners and that "construction documents" were inappropriately withheld from Commissioners when they made their decision. Further, the revocation request also asserts that information from the 2005 Dagit & Swift fish sampling report, containing information about the presence of breeding tidewater goby in the proposed temporary berm location, was not made available to Commissioners. The revocation request asserts:

> *The placement of the dam was not revealed during the October 2010 hearing to be one the primary breeding areas where the breeding activity of Tidewater Goby had been documented in 2005. While those construction documents were not available to Commissioners when they made their decision, it is reasonable to believe that the project managers knew exactly where they were going to construct the temporary dam that would facilitate dewatering of the western lagoon. Had the information from the 2005 fish sampling report combined with the dam location match-up been made available to the Commissioners, it is likely a different decision about the project would have been made- either a decision for different conditions about dam placement, timing of the project or even an outright project denial or postponement that would be used to work out the problems of these plans.*

Thus, the revocation request states that the Commission would have likely come to a different decision about conditions related to the "dam" placement, project timing, or would have denied or postponed their decision had information in the 2005 Dagit and Swift fish sampling report and the project plans been available to Commissioners.

Nearby Enforcement Action

The revocation request refers to a “nearby enforcement action” that “was not considered by the Commission in any cumulative effects analysis.” The revocation request alleges that the project agent, Mark Abramson, “was aware of and was one of the chief proponents of removal of the rip-rap at a location further upstream in Malibu Creek (north of Highway 1) by the Adamson family’s business, which is the entity which was required and permitted by the Commission to remove the rip rap.”

3. Public Access

The revocation request asserts that the applicant did not accurately characterize public access to Surfrider Beach during construction. The revocation request states: “[d]uring the public hearing for the Coastal Commission permit for this project, it was repeatedly stated that public access would not be impeded during construction and that access to the beach would be open.” The revocation request asserts that: “[a]t no time during the permit approval process did the public understood (sic) or been informed (sic), nor was the Coastal Commission itself informed that public access to Surfrider Beach’s 3rd point would be atop a sandbag constructed dike that has not been engineered as of yet.” The request asserts that concerns regarding ADA compliance, wheelchair accessibility, stroller accessibility, and other safety concerns have not been vetted nor addressed. Further, the request claims that access is only available sporadically, and that the dewatering pipe will directly block emergency access to lifeguards and as secondary emergency access from Colony residential homes.

4. Dewatering Concerns

The revocation request raises three separate concerns related to lagoon dewatering. The revocation request claims that the applicant withheld the fact that chlorinated water will be discharged into tide pools from dewatering operations and will harm the tide pools and kill the biota within them. The revocation letter states that the Petitioners “believe that the project proponents had access to and knew of the studies related to MRSA and other toxic contaminants that lay dormant in the sand at Surfrider Beach,” which Petitioners assert will be resuspended by the dewatering, causing a public health hazard, but that they did not reveal these facts. Additionally, the revocation letter raises concerns over rip-rap being placed in the tidal area and that “such a plan was not considered or approved by the Commission.” Petitioners assert that if these issues related to dewatering were known, the Commission would not have granted the permit.

5. Unknown Contentions- Additional Materials Submitted on June 15, 2012 and July 13, 2012

Three documents were submitted by the parties requesting revocation, including: a report from Dr. Travis Longcore, submitted on June 15, 2012, an enforcement request letter by the parties requesting revocation, dated June 14, 2012, and a Sixty Day Notice of Intent to Sue letter from the parties requesting revocation to the Army Corps of Engineers under Section 7 of the Endangered Species Act, dated May 30, 2012 (**Exhibits 2-4**). These three documents were submitted at the Commission hearing, on June 14, 2012, by Marcia Hanscom and later requested by Ms. Hanscom, in an email to Commission staff on June 15, 2012, that these documents be "included along with the official revocation request." None of these additional three documents raise any grounds for revocation nor did the parties requesting revocation submit an accompanying explanation of how any of these documents relate to the grounds asserted in the original revocation request, dated June 14, 2012, or assert any of the grounds of a revocation request required pursuant to Section 13105(a) of Title 14 of the California Code of Regulations.

Specifically, the enforcement request letter, dated June 14, 2012, on its face, does not constitute grounds for revocation. Because of the impacts on an applicant, the grounds for revocation are necessarily narrow. Although Commission staff confirmed that no Coastal Act violations had occurred on site (see Enforcement Response Letter, **Exhibit 5**), it should be noted that a violation of the Coastal Act or the terms and conditions of a permit or an allegation that a violation has occurred are not grounds for revocation under the California Code of Regulations. The grounds for revocation are, of necessity, confined to information in existence at the time of the Commission's action. Further, the document provided by Dr. Travis Longcore, prepared after the Commission's October 13, 2010 approval, is a biological assessment of the project that disagrees with the approved project without asserting any grounds for revocation (**Exhibit 2**). Similarly, the letter from the parties requesting revocation addressed to the Army Corps of Engineers (ACOE) informing the ACOE that they intend to sue them, clearly fail to identify or raise any grounds for revocation of a CDP pursuant to Section 13105(a) of the California Code of Regulations (**Exhibit 3**).

Lastly, on July 13, 2012, an additional email was submitted to the Commission from Marcia Hanscom regarding a new critical habitat designation at Malibu Lagoon State Park for snowy plover (**Exhibit 9**). The email does not state how this information raises any grounds for revocation of a CDP pursuant to Section 13105(a) of the California Code of Regulations and does not allege that the applicant intentionally included inaccurate, erroneous, or incomplete information. Further, information relating to this new critical habitat designation is unrelated to the permit action and was not in existence at the time of the Commission's action on October 13, 2010 (the new critical habitat designation was not issued until June 19, 2012).

D. APPLICABLE STANDARDS OF REVIEW

The following Coastal Act policies and Commission regulations in Title 14 of the California Code of Regulations are relevant to the consideration of this revocation request.

ARTICLE 16. REVOCATION OF PERMITS

§ 13105. Grounds for Revocation.

Grounds for revocation of a permit shall be:
(a) Intentional inclusion of inaccurate, erroneous or incomplete information in connection with a coastal development permit application, where the commission finds that accurate and complete information would have caused the commission to require additional or different conditions on a permit or deny an application;
(b) Failure to comply with the notice provisions of Section 13054, where the views of the person(s) not notified were not otherwise made known to the commission

and could have caused the commission to require additional or different conditions on a permit or deny an application.

§ 13106. Initiation of Proceedings.

Any person who did not have an opportunity to fully participate in the original permit proceeding by reason of the permit applicant's intentional inclusion of inaccurate information or failure to provide adequate public notice as specified in Section 13105 may request revocation of a permit by application to the executive director of the commission specifying, with particularity, the grounds for revocation. The executive director shall review the stated grounds for revocation and, unless the request is patently frivolous and without merit, shall initiate revocation proceedings. The executive director may initiate revocation proceedings on his or her own motion when the grounds for revocation have been established pursuant to the provisions of Section 13105.

§ 13107. Suspension of Permit.

Where the executive director determines in accord with Section 13106, that grounds exist for revocation of a permit, the operation of the permit shall be automatically suspended until the commission votes to deny the request for revocation. The executive director shall notify the permittee by mailing a copy of the request for revocation and a summary of the procedures set forth in this article, to the address shown in the permit application. The executive director shall also advise the applicant in writing that any development undertaken during suspension of the permit may be in violation of the California Coastal Act of 1976 and subject to the penalties set forth in Public Resources Code, Sections 30820 through 30823.

§ 13108. Hearing on Revocation.

(a) At the next regularly scheduled meeting, and after notice to the permittee and any persons the executive director has reason to know would be interested in the permit or revocation, the executive director shall report the request for revocation to the commission with a preliminary recommendation on the merits of the request.
(b) The person requesting the revocation shall be afforded a reasonable time to present the request and the permittee shall be afforded a like time for rebuttal.
(c) The commission shall ordinarily vote on the request at the same meeting, but the vote may be postponed to a subsequent meeting if the commission wishes the executive director or the Attorney General to perform further investigation.
(d) A permit may be revoked by a majority vote of the members of the commission present if it finds that any of the grounds specified in section 13105 exist. If the commission finds that the request for revocation was not filed with due diligence, it shall deny the request.

E. Analysis of Asserted Grounds For Revocation

Pursuant to Title 14 of the California Code of Regulations (14 C.C.R.) Section 13108(d), the Commission has the discretion to grant or deny a request to revoke a coastal development permit if it finds that either of the grounds specified in 14 C.C.R. Section 13105 exist. 14 C.C.R. Section 13105 establishes that the grounds for revoking a permit are: (1) the intentional inclusion of inaccurate, erroneous or incomplete information in connection with a permit application where accurate and complete information would have caused the Commission to act differently; or (2) that there was a failure to comply with the notice provisions of Section 13054, where the views of the person(s) not notified were not otherwise made known to the Commission and could have caused the Commission to act differently.

Pursuant to Section 13106 of the California Code of Regulations, when a revocation request is received, the Executive Director is required to review the stated grounds for revocation and, unless the request is patently frivolous and without merit, shall initiate revocation proceedings. Upon reviewing the subject request, and comparing it to the administrative record, the Executive Director found the revocation request to be indisputably without merit. Specifically, the Executive director has determined that in this case, in accord with Section 13106, no grounds exist for revocation of the permit. Nevertheless, because some familiarity with the record is necessary in order to demonstrate the lack of merit of this particular revocation request, and to maximize the opportunity for the requester and the public to be heard, the Executive Director determined it would be prudent to set a hearing for an examination of the request and the record.

1. Analysis of Revocation Request Contentions with Respect to Section 13105(a)

A revocation request for CDP 4-07-098 was submitted by Marcia Hanscom, Executive Director of Wetlands Defense Fund and by Robert van de Hoek, President and Wildlife Biologist of Coastal Law Enforcement Action Network (CLEAN) on June 14, 2012, at the Commission hearing (**Exhibit 1**). On June 15, 2012, Marcia Hanscom requested three additional documents to be included with the official revocation request: (1) a report from Dr. Travis Longcore, (2) an enforcement request letter dated June 14, 2012, and (3) a Sixty Day Notice of Intent to Sue letter to the Army Corps of Engineers under Section 7 of the Endangered Species Act (**Exhibits 2-4**).

The request for revocation contends that grounds for revocation in Section 13105(a) exist because the applicant intentionally submitted inaccurate, erroneous and incomplete information to the Commission in conjunction with the coastal development permit application with regard to the following grounds: (1) project timing, (2) construction impacts on tidewater goby, (3) public access, and (4) dewatering.

Grounds for revocation under Section 13105(a) of the Commission's regulations can be reduced to three elements or tests, all of which must be satisfied for the Commission to grant revocation:

> <u>Test 1</u>: Did the applicant for Coastal Development Permit 4-07-098 (California Department of Parks and Recreation) include inaccurate, erroneous or incomplete information in connection with its application?

> Test 2: If the applicant included inaccurate, erroneous or incomplete information, was the inclusion of such information intentional?
>
>> Neither the Coastal Act nor the Coastal Commission regulations define the term "intent" for purposes of determining whether an applicant has intentionally submitted inaccurate, erroneous or incomplete information to the Commission. In general, the Commission may conclude that there was intent based on "the sort of evidence on which responsible persons are accustomed to rely in the conduct of serious affairs." (14 C.C.R Section 13065). The law related to fraudulent misrepresentation, however, explores the definition of intent in the context of misrepresentation of facts, which is what is at issue in a revocation hearing. As a result, this area of law is instructive to the Commission when it considers a revocation request.
>>
>> One element of a claim for fraudulent misrepresentation is the intent to defraud or induce reliance. *Cicone v. URS Corporation* 183 Cal. App. 3d 194, 200 (1986). In establishing this element, "the only intent by a defendant necessary to prove a case of fraud is the intent to *induce reliance*. Moreover, liability is affixed not only where the plaintiff's reliance is intended by the defendant but also where it is *reasonably expected* to occur." *Lovejoy v. AT&T Corp.* (2001) 92 Cal. App. 4th 85, 93 (2001). (emphasis in original). Thus, a defendant may be liable for fraud even for unanticipated reliance by a plaintiff. *Id.* at p. 94. In addition, a party's intent to induce reliance may be inferred from his or her failure to disclose facts as required by statute. *Lovejoy v. AT&T Corp.* 119 Cal. App. 4th 151 (2004). Thus, the Commission may infer that the applicant intentionally submitted inaccurate, erroneous or incomplete information if it finds that the applicant failed to disclose facts as required by the Coastal Act.
>
> Test 3: If the answers to both Test 1 and Test 2 are yes, would accurate and complete information have caused the Commission to require additional or different conditions or to deny the application?

The following analysis addresses each of the four grounds for revocation asserted in the June 14, 2012 revocation request, including: (1) project timing, (2) construction impacts on tidewater goby, (3) public access, and (4) dewatering. The revocation request is provided as **Exhibit 1** of this staff report.

It is noted that the applicant provided the Commission with various studies and documents to support the CDP application. All of the studies and documents referenced as part of the "substantive file documents" (listed on pages 8-9 of the 9/29/10 Commission Staff Report, attached as **Exhibit 6**) were provided by the applicant except the "Memorandum Regarding the Malibu Lagoon Restoration and Enhancement Plan, Phase 2 Project," dated September 22, 2010, which was prepared by the Commission's Staff Ecologist, Dr. Jonna Engel. The information and data in the September 29, 2010 Commission staff report, repeatedly referred to below, is based on those studies and reports provided by the applicants.

Revocation Request Ground 1: Project Timing

Assertions Regarding Inaccurate and Incomplete Information Regarding the Presence of Steelhead in Malibu Lagoon:

The parties requesting revocation make various assertions regarding information relating to the applicant's proposed construction work timeframe. The revocation request asserts that inaccurate information was provided by the applicant regarding the presence of steelhead trout during the winter months in order to justify a summer construction timeframe. The revocation request cites to a Biological Assessment prepared by Jones and Stokes that no Southern Steelhead were found in Malibu Lagoon during environmental surveys at that time. The revocation request also notes an email communication between Commission staff and the project applicant in which staff requests clarification from the applicant regarding project timing. Further, the revocation requests also states that a representative of the applicant, at the October 13, 2010 Commission hearing, provided inaccurate information to the Commission that steelhead were present during winter months. The revocation request asserts that if accurate information would have been considered by the Commission regarding steelhead (specifically that no steelhead were present in Malibu Creek), then the Commission would have changed the project timing to allow work to occur during the winter months and would have not allowed work to occur during the summer breeding season of tidewater goby. The revocation request asserts that this information "might have also led the Commission to a denial or at least of the postponement of the project in order to harmonize these extremely disparate and inaccurate assertions and conclusions put forth by the project applicant, agent, and proponents."

The first test in the review of the revocation grounds is whether the applicant included inaccurate, erroneous or incomplete information in connection with the subject coastal development permit application.

The revocation request includes excerpts of emails between Commission staff and the applicant that clarify the proposed project timeframe approved by the US Fish and Wildlife Service. However, the revocation request does not assert that any information provided in the emails by the applicant was inaccurate, erroneous, or incomplete. The apparent purpose in citing the e-mails in the revocation request is to show that the USFWS had concerns about scheduling the project for the period between May and November, but they acknowledge that the applicant clarified that there was a typographical error in the USFWS Biological Opinion (BO) that listed that concern, and they do not assert that there was any inaccuracy in that statement by the applicant. Moreover, subsequent to the BO, the US Fish and Wildlife Service specifically approved a project timeframe of June 1st-October 15th, consistent with the timeframe authorized by the Commission, in a USFWS Biological Opinion *Amendment*, dated January 8, 2010. (9/29/10 staff report, Local Agency Reviews and Approvals, **Exhibit 6**). In fact, this winter avoidance timeframe was also approved the National Marine Fisheries Service.[2]

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[2] United States Fish and Wildlife Service Biological Opinion for the Malibu Lagoon Restoration and Enhancement Project (CON-1-8-08-F-4), dated August 26, 2009; United States Fish and Wildlife Service letter to Daniel P. Swenson, Chief, U.S. Army Corps of Engineers, Biological Opinion Amendment, dated January 8, 2010; National Marine Fisheries Service, Endangered Species Act Section 7 Informal Consultation Letter, dated August 18, 2008 to US Army Corps of Engineers.

Further, the revocation request also states that a representative of the applicant, at the October 13, 2010 Commission hearing, provided inaccurate information to the Commission that steelhead were known to be present within the project area during winter months. Commission staff has reviewed the hearing transcript for the October 13, 2010, Commission hearing and confirmed that no such statement was made by any representative of the applicant. Moreover, at the hearing, a representative of the applicant, Mary Small, Deputy Director of the Coastal Conservancy, made the construction timing clear. Ms. Small stated that “[i]t is a limited construction schedule of June to October 15 and that is consistent with the biological opinion from the Fish and Wildlife Service.” (October 13, 2010 Hearing Transcript, p.83). Additionally, in a letter from State Parks to the Executive Director of the Coastal Commission (**Exhibit 8**), State Parks denies that it ever provided misinformation regarding timing.

The revocation request refers to a Biological Assessment prepared by Jones and Stokes, which found no steelhead in Malibu Creek, but the request does not explain how this study relates to or is evidence of inaccurate, erroneous, or incomplete information provided by the applicant regarding steelhead. Presumably, the parties requesting revocation are asserting that there was no need to avoid the winter for project operations. Based on studies provided as part of the permit application, the applicant did acknowledge that no steelhead trout were found in the fish surveys of Malibu Lagoon. However, the applicant also provided accurate evidence that steelhead are nevertheless known to occur upstream within Malibu Creek, as described in detail below. Moreover the applicant correctly noted that Malibu Lagoon is designated critical habitat for steelhead. The information provided by the applicant regarding the proposed timeframe, June 1st- October 15th, was complete, accurate, and consistent throughout the application process, and at no time did the applicant change or misrepresent this proposed timing or information related to project timing.

The information provided by the applicant in connection with the coastal development permit application regarding project timing included various studies and approvals, including studies reporting that no steelhead were found during surveys of Malibu Lagoon. These reports were listed in the substantive file documents section of the Commission’s October 29, 2010 staff report, was relied upon in the staff report, and was utilized by Commission staff in the development of its staff recommendation. The Commission’s findings in the staff report for CDP 4-07-098 explicitly state and acknowledge that no steelhead trout were found in fish surveys at Malibu Lagoon, based on studies provided the record. However, despite that no steelhead were found during project surveys in 2005, the staff report explains, based on evidence in the record provided by the applicant, that steelhead are known to occur upstream within Malibu Creek. The staff report further explains that: “Malibu Lagoon is within the endangered Southern California Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*) and is designated critical habitat for the species.” (9/29/10 Staff Report, p.62) Further, at the October 13, 2012 Commission hearing, Commission staff ecologist, Dr. Engel, recognized that there have been low numbers of steelhead found in the creek, but that steelhead do inhabit the area **(Exhibit 10** , 10/13/10 Hearing Transcript, p. 129). Thus, the applicants did not provide any inaccurate, erroneous, or incomplete information regarding the presence of steelhead trout.

In addition, the revocation request also calls into question whether information relating to the 2005 fish survey report, prepared by Dagit and Swift, was considered by the Commission at the October 2010 hearing relative to the presence of tidewater goby. However, the revocation request does not assert that inaccurate, erroneous, or incomplete information was submitted by the applicant regarding this report or the presence of tidewater goby in the Malibu Lagoon. Nevertheless, it should be noted that this specific 2005 Dagit and Swift study, as well as other studies relating to the tidewater goby, were provided by the applicant as part of the permit application file and included as substantive file documents (9/29/10 Staff Report, Substantive File Documents). Moreover, as clearly stated in the staff report for CDP 4-07-098, tidewater goby would be present during construction activities during the project timeframe. The staff report explained that areas on the west side of the lagoon both upstream and downstream of the Pacific Coast Highway bridge consistently host gobies year round, with size classes and densities varying seasonally year round. (9/29/10 Staff Report, p. 62). The project description (as proposed by the applicant) and special conditions (required by the Commission in its approval of CDP 4-07-098) incorporated detailed protective measures to exclude tidewater gobies and other sensitive aquatic species from the project construction area, as explained in detail on pages 62-63 of the 9/29/10 staff report. Therefore, the applicants did not provide inaccurate, erroneous, or incomplete information with regard to the presence of tidewater gobies. Thus, in regard to this issue, the parties requesting revocation fail to provide any evidence that the applicant provided information in connection with the coastal development permit application that was inaccurate, erroneous or incomplete.

In conclusion, in regard to the issue of facts related to steelhead habitat and related project timing restrictions, the parties requesting revocation fail to provide any evidence to support their assertion that the information provided by the applicant in connection with the coastal development permit application was inaccurate, erroneous or incomplete. Because the first test pursuant to Section 13105(a) of the Commission's regulations has not been met (i.e., there is no evidence that the applicant provided inaccurate, erroneous, or incomplete information in connection with the permit application regarding construction timing), test 2 (whether they did so intentionally) does not apply. Similarly, test 3 (whether complete and accurate information would have caused the Commission to take a different action) also does not apply. Moreover, it is also worth noting that, regardless of what the applicant indicated regarding the USFWS, in the end, the Commission did have accurate information about the USFWS's position, further rendering test 3 inapplicable.

Further, not only were the documents referenced by the revocation request part of the administrative record, the parties requesting revocation, Marcia Hanscom, Executive Director of Wetlands Defense Fund, and Robert van de Hoek, President and Wildlife Biologist, CLEAN, had specific reason to know that these documents were part of the record. Wetlands Defense Fund and CLEAN challenged the Commission's approval of CDP 4-07-098 in court and, during that challenge, the administrative record was prepared and filed with the court.

<u>Assertions Regarding Applicant's Underlying Intentions for Project Timing</u>:

The revocation request asserts that, after the permit was approved, the applicant later "admitted" that they wanted to work during the summer because it would have been too expensive to operate heavy machinery in the winter months and, thus, they intentionally misrepresented the necessary project timeframe to the Commission. The persons requesting revocation have provided no evidence to support this assertion, other than the claim that such admissions occurred in "several public settings" which are not identified in any way, and the Commission finds this claim to be unsubstantiated. No information is provided as to what statements the parties are referencing or in what public setting the statements were made. Moreover, even if it is true that State Parks had financial motives for preferring to perform the work outside of the winter, those motives would be irrelevant to the Commission's review, and thus, failing to reveal those motives would not constitute the withholding of relevant information (test 1), and knowing of those motives would not have changed the Commission's action (test 3), since the Commission's approval was based on the consistency of the project (including its timing) with the Malibu LCP and the public access and recreation provisions of the Coastal Act, not whether State Parks' proposal was independent of financial considerations.

Thus, in regards to the above assertions regarding project timing, the Commission finds that the first test pursuant to Section 13105(a) of the Commission's regulations has not been met, in that the parties requesting revocation have not demonstrated that the applicant provided inaccurate, erroneous, or incomplete information in connection with the permit application regarding construction timing. Accordingly, test 2 and 3 will not apply. As described above, all information relating to project timing and potential impacts to sensitive species that was provided by the applicant was complete and accurate. The evidence in the permit file, the staff report, and the hearing testimony shows that the applicant did not make any misrepresentations about project construction timing or species impacts, nor did the applicant present any inaccurate or erroneous information at any time during the permit application process or at the hearing. Finally, the parties requesting revocation have not pointed to any evidence that, in the end, the Commission was under any misimpression about the facts or that it lacked any relevant information, even independent of whether the applicant was responsible for it. This constitutes yet another reason why test 3 fails.

Lastly, the issue of construction timing was specifically raised by Marcia Hanscom, one of the parties requesting revocation, during her presentation at the October 13, 2010 Commission hearing and in a letter submitted at the hearing by Wetlands Defense Fund and CLEAN. (**Exhibit 7**) The letter references a chart, outlining species breeding times at Malibu Lagoon, and states that the chart "demonstrates that there is really no time at all when this project should be allowed to proceed, yet the most important breeding time from the Tidewater Goby, a fish on the United States Endangered Species List, was selected…" (**Exhibit 7**). At the October 13, 2010 hearing Ms. Hanscom also raised issues with the US Fish and Wildlife Biological Opinion amendment, approving the project timeframe, which is one of the same issues raised in the subject revocation request. These issues were then presented by the same parties more than a year and a half later as a ground for the subject revocation request. Pursuant to Section 13108(d), if the Commission finds that the request for revocation was not filed with due diligence, it shall deny the revocation request. Thus, it is clear that the parties requesting revocation knew of the timing issue at the time of the hearing, informed the Commission of their concerns regarding timing at the October 13, 2010 hearing, and waited 20 months to file a revocation request. Further, the same timing issues were also recently litigated by the very same parties requesting revocation. Thus, the revocation request was not submitted with due diligence.

Revocation Request Ground 2: Tidewater Goby Critical Habitat

Assertions Regarding Incomplete Information about Presence of Tidewater Goby and the Critical Habitat Designation:

The revocation request states that project applicants did not reveal to the Commission that Malibu Lagoon was designated as critical habitat for the tidewater goby on January 31, 2008.

The revocation request also asserts that the applicants concealed the extent of the project, and the associated extent of the impacts on the tidewater goby (and other sensitive species), as described in a declaration prepared for the California Court of Appeal by Robert van de Hoek. The parties requesting revocation assert that this information about the tidewater goby would have contributed to a different decision by the Coastal Commission regarding project timing to not allow work during the summer tidewater goby breeding season. The request speculates that this additional information might have led the Commission to a denial or a postponement.

The first test in the review of the revocation grounds is whether the applicant included inaccurate, erroneous or incomplete information in connection with the subject coastal development permit application. Here, contrary to the assertion in the revocation request (at page 4) that the “project proponents conveniently left out” information about the critical habitat designation, the information provided by the applicant in connection with the coastal development permit application regarding tidewater goby included extensive information indicating the presence of critical habitat for tidewater goby in the project area. (9/29/10 staff report, Substantive File Documents, **Exhibit 6**). Because this information was provided to the Commission, test 1 is not met and, therefore, tests 2 and 3 do not apply under Section 13105(a).

As noted above, the revocation request also asserts that the applicants concealed the extent of the project and associated impacts on the tidewater goby, as described in a declaration prepared for the California Court of Appeal by Robert van de Hoek. This declaration is not relevant to the revocation request because it was not created until May 2012 and could not have informed the Commission’s decision at the October 13, 2010 hearing.

Nevertheless, the Commission was clearly aware of these facts, as explained in Section E. of the 9/29/10 staff report, Environmentally Sensitive Habitat and Marine Resources, which contained a section heading, “Tidewater Goby and Tidewater Goby Critical Habitat,” that described the presence of federally endangered tidewater goby in Malibu Lagoon (9/29/10 staff report, p.62-64). Moreover, the staff report clearly explained that areas on the west side of the lagoon both upstream and downstream of the Pacific Coast Highway bridge consistently host gobies year round, with size classes and densities varying seasonally year round. (9/29/10 Staff Report, p. 62). The project description and special conditions incorporated exhaustive protective measures to exclude tidewater gobies and other sensitive aquatic species from the project construction area, as explained in detail on pages 62-64 of the 9/29/10 staff report. Further, at the October 13, 2010 Commission hearing, Dr. Engel, Commission staff ecologist, explained that tidewater goby do not use the dead end areas of the channels due to poor water quality and fine grains of sediments and explained that the project would improve goby habitat overall. (**Exhibit 7**, 10/13/10 Hearing Transcript, p. 128) Thus, no erroneous information was provided by the applicant to the Commission regarding tidewater goby habitat at the lagoon.

Assertions Regarding the Availability of Project Plans and 2005 Dagit & Swift Fish Sampling Report:

The revocation request asserts that project proponents did not reveal the proposed temporary “dam” location to Commissioners, even though “it is reasonable to believe that the project managers knew exactly where they were going to construct the temporary dam” (at page 4) and that “construction documents” were not available to Commissioners when they made their decision. Further, the revocation request also asserts that information from the 2005 Dagit &

Swift fish sampling report, containing information about the presence of breeding tidewater goby in the proposed berm/dam location, was not made available to Commissioners. The revocation request (at page 4) asserts:

> *The placement of the dam was not revealed during the October 2010 hearing to be one the primary breeding areas where the breeding activity of Tidewater Goby had been documented in 2005. While those construction documents were not available to Commissioners when they made their decision, it is reasonable to believe that the project managers knew exactly where they were going to construct the temporary dam that would facilitate dewatering of the western lagoon. Had the information from the 2005 fish sampling report combined with the dam location match-up been made available to the Commissioners, it is likely a different decision about the project would have been made- either a decision for different conditions about dam placement, timing of the project or even an outright project denial or postponement that would be used to work out the problems of these plans.*

Thus, the revocation request asserts that the Commission would have likely come to a different decision about conditions related to “dam” placement, project timing, or would have denied or postponed their decision had information in the 2005 Dagit and Swift fish sampling report and the project plans been available to Commissioners.

As stated above, the first test in the review of the revocation grounds is whether the applicant included inaccurate, erroneous or incomplete information in connection with the subject coastal development permit application. Here, the parties requesting revocation assert that the 2005 Dagit and Swift report was not made available to the Commission, which is an untrue assertion. In fact, the permit applicant was aware of this report and provided the Dagit and Swift Fish Sampling Report as part of its permit application, and Commission staff specifically included it as a substantive file document. Further, the staff report specifically explained that the biological studies and surveys submitted by the applicant demonstrated the evidence of tidewater goby presence in the lagoon at all times of the year (9/29/10 Staff Report, p. 62). Finally, as noted above, because of the litigation by the same parties who request revocation, an administrative record was prepared, filed with the court, and used by the parties requesting revocation in their filings with the court.

Further, the parties requesting revocation assert that the project plans, showing the proposed “dam” or earthen berm, were not provided to Commissioners. That statement is untrue because the applicant provided clear project plans as part of the permit application showing the proposed earthen berm and provided a clear project description. These project plans were included in the 9/29/10 staff report, which contained a thorough project description describing the earthen berm/dike proposed to separate the main lagoon from the western lagoon construction area. (9/29/10 staff report, pages 31-35). Based on information provided by the applicant, the staff report refers to exhibits 4-6, attached to the 9/29/10 staff report provided in hard copy to Commissioners, which depicted the location of the proposed earthen berm that would separate the western lagoon work area from the main lagoon. Thus, the applicant provided all of the information that the revocation request asserts was omitted regarding the proposed project berm and the presence of tidewater gobies.

Furthermore, the 2005 Dagit and Swift study, the findings of the staff report, the project description included in the staff report, as well as the project plans showing the berm location were provided by the applicant and presented and evaluated by the Commission in its approval of CDP 4-07-098 in October 2010, and at no time did the applicant provide inaccurate, erroneous, or incomplete information related to this study or the berm location. Thus, in regard to this issue, the parties requesting revocation fail to provide any evidence that the applicant provided information in connection with the coastal development permit application that was inaccurate, erroneous or incomplete and test 1 is not met, therefore tests 2 and three do not apply under Section 13105(a) of the California Code of Regulations.

<u>Assertions Related to the Mariposa Land Company's Pending Permit Application to Retain Rock Slope Protection along Malibu Creek</u>:

The revocation request asserts that the Commission failed to consider the cumulative impacts of the project and other projects, referring specifically to a "nearby enforcement action" that "was not considered by the Commission in any cumulative effects analysis." The revocation request alleges that the project agent, Mark Abramson, "was aware of and was one of the chief proponents of removal of the rip-rap by the Adamson family's business, which is the entity which was required and permitted by the Commission to remove the rip rap."

Although not expressly stated in the revocation request, the implication of this statement is that the applicant failed to notify the Commission of this "nearby enforcement action" and thereby provided incomplete information. It appears that the revocation request is referring to an area of rock rip-rap placed on the western edge of the creek channel, north of the Pacific Coast Highway Bridge, originally permitted and constructed pursuant to an emergency permit, CDP 4-98-024-G (Mariposa Land Company) in 1998 ("Mariposa project"). The revocation request inaccurately characterizes the Mariposa project as a rip-rap removal and replacement project. The Commission approved CDP 4-09-013 for rock rip-rap bank protection in August 2009. However, that 2009 Commission action was subject to subsequent litigation. The Commission is scheduled to act on a remand of CDP 4-09-013 at the August 2012 Commission hearing. Staff is now recommending approval of the existing, "as-built", approximately 500 linear feet of rock rip-rap revetment that was installed along the west bank of lower Malibu Creek to protect an existing commercial development from flood waters pursuant to Emergency CDP No. 4-98-024-G.

The first test in the review of the revocation grounds is whether the applicant included inaccurate, erroneous or incomplete information in connection with the subject coastal development permit application. It is true that the applicant did not specifically notify the Commission of the nearby Mariposa project. However, in this case, information about that project was not available at the time the applicant submitted their application in 2007. In fact, it was not until 2009 that an application was submitted for a follow-up emergency permit for that project, so the applicant had no way of knowing what the project would be. Further, it is not reasonable for an applicant to be expected to inform the Commission about nearby projects or proposed coastal development permit applications that the Commission itself must eventually act upon, and that may impact the applicant's pending application, after the applicant's application has already been submitted. Therefore, information regarding the nearby Mariposa project is not relevant and no information in connection with the subject permit application was inaccurate or incomplete. Furthermore, even assuming that the Mariposa matter were relevant to the State Parks application, such that it would have been informative to consider the Mariposa matter in the context of the State Parks application," criticism of the Commission's analysis is not a legitimate ground for revocation pursuant to Section 13105(a) of the Commission's Regulations.

Thus, because the first test pursuant to Section 13105(a) of the Commission's regulations has not been met and the applicant did not provide inaccurate, erroneous, or incomplete information in connection with the permit application regarding tidewater goby critical habitat designation, potential construction impacts to tidewater goby, or the Mariposa matter, test 2 and 3 will not apply. Thus, no grounds exist for the revocation and, further, the underlying factual assertions related to what information the applicant provided regarding the critical habitat designation of tidewater goby and potential impacts to tidewater goby are, themselves, inaccurate, because the record clearly shows no inaccurate, erroneous, or incomplete information was submitted by the applicant.

Lastly, information regarding tidewater goby critical habitat and potential impacts to tidewater goby as explained in the staff report, was presented at the October 13, 2010 Commission hearing by Commission staff based on the substantive file documents submitted by the applicant as part of the coastal development permit application process. Wetlands Defense Fund and CLEAN, the parties requesting revocation, submitted a letter at the Commission October 13, 2010 Commission hearing raising the issue of impacts to tidewater goby, the same issue raised in the subject revocation request by Wetlands Defense Fund and CLEAN (Exhibit 6). The letter states: "[i]t is disturbing that the Coastal Commission might consider approving a project that would be so destructive of critical habitat for the Tidewater Goby and functioning habitat without reviewing in its entirety the record as it now stands." The parties requesting revocation knew of the tidewater goby critical habitat designation at the time of the hearing, and waited more 20 months to file a revocation request. Pursuant to Section 13108(d), if the Commission finds that the request for revocation was not filed with due diligence, it shall deny the revocation request. Here, because the same parties requesting revocation raised the same issues at the time of Commission's action, the revocation request was not filed with due diligence.

Public Access

The revocation request asserts that the applicant did not accurately characterize public access to Surfrider Beach during construction. The revocation request states: "[d]uring the public hearing for the Coastal Commission permit for this project, it was repeatedly stated that public access would not be impeded during construction and that access to the beach would be open." The revocation request asserts that: "[a]t no time during the permit approval process did the public understood (sic) or been informed (sic), nor was the Coastal Commission itself informed that public access to Surfrider Beach's 3rd point would be atop a sandbag constructed dike that has not been engineered as of yet." The request asserts that concerns regarding ADA compliance, wheelchair accessibility, stroller accessibility, and other safety concerns have not been vetted nor addressed. Further, the request claims that access is only available sporadically, and that the dewatering pipe will directly block emergency access to lifeguards and as secondary emergency access from Colony residential homes.

As stated above, the first test in the review of the revocation grounds is whether the applicant included inaccurate, erroneous or incomplete information in connection with the subject coastal development permit application. At the October 13, 2010 Commission hearing, the applicant's representative stated "we will maintain beach access throughout construction." (**Exhibit 10**, Hearing Transcript, p.50). This was the only statement by the applicant or the applicant's representatives at the hearing about public access during construction. This statement was not inaccurate, erroneous, or incomplete. The applicant was aware of Special Condition 10 of the permit, which specifically required the applicant to submit, for the review and approval of the Executive Director, a Final Public Access Program that describes the methods (including signs, fencing, posting of security guards, etc.) by which safe public access to or around the construction areas and/or staging areas shall be maintained <u>during all project operations</u> (emphasis added). Special Condition 10 of the permit also required the public access plan to include signs directing the public to alternative parking areas for the duration of construction and staging. Further, where public paths will be closed during active operations, the access plan required a person to be on-site to detour traffic and adequate fencing and signage is required. The applicant did not state anything about the exact details of the public access plan at the hearing. The applicant was not required to provide those details until the condition compliance phase of the permit.

Thus, in regard to this issue of public access during construction, the parties requesting revocation fail to provide any evidence that the applicant provided information in connection with the coastal development permit application that was inaccurate, erroneous or incomplete. Because the first test pursuant to Section 13105(a) of the Commission's regulations has not been met (i.e., there is no evidence that the applicant provided inaccurate, erroneous, or incomplete information in connection with the permit application regarding public access during construction), test 2 (whether they did so intentionally) does not apply. Similarly, test 3 (whether complete and accurate information would have caused the Commission to take a different action) also does not apply.

Moreover, the Commission was aware of the limits of construction, as described in the staff report and accurately depicted on the project plans attached as exhibits to the 9/29/10 staff report, including improvements along the western beach access pathway. Thus, it was anticipated that the access plan would include any measures necessary to maintain access to the beach at all times, even through portions of the construction site, if necessary, during construction operations along the western path. The Public Access Program, submitted in compliance with Special Condition 10, approved by the Executive Director on June 6, 2012, shows that, when the western perimeter road/path is required to be closed, public beach access will be along the top of the earthen berm. The berm will not be atop a "sand-bag constructed dike", as the parties requesting revocation assert, but will be atop the earthen berm, as described in the staff report. While temporary access via the perimeter road and/or the dike/berm will not be ADA compliant, the permanent trail after project completion will be. In the meantime, the slope of the road and dike/berm is less than 5% and the Department of Parks and Recreation rangers and employees are available to assist people with special needs during construction during the short periods when the perimeter access may be closed to complete portions of the project.

Lastly, although permit violations are not a valid ground for revocation pursuant to the Commission's regulations, because the revocation requester also asserted that violations exist, Commission enforcement staff has confirmed from the applicant and in-person during multiple site visits by Commission staff that public access has been and will be maintained during all project operations. Additionally, the dewatering pipe is buried under the perimeter path and does not impede access, including lifeguard access, at any point.

Dewatering Concerns

The revocation request raises three separate concerns related to lagoon dewatering operations. The revocation request claims that the applicant withheld the fact that chlorinated water will be discharged into tide pools from dewatering operations and will harm the tide pools and kill the biota within them. The revocation letter states that the Petitioners "believe that the project proponents had access to and knew of the studies related to MRSA and other toxic contaminants that lay dormant in the sand at Surfrider Beach," which Petitioners assert will be resuspended by the dewatering, causing a public health hazard, but that they did not reveal these facts. Additionally, the revocation letter raises concerns over "rip-rap" being placed in the tidal area and that "such a plan was not considered or approved by the Commission." The parties requesting revocation assert that "the project managers knew the details of these issues and did not inform the Commission about them" and that if these issues related to dewatering were known, the Commission would not have granted the permit.

The first test in the review of the revocation grounds is whether the applicant included inaccurate, erroneous or incomplete information in connection with the subject coastal development permit application. Here, the applicants did not withhold any information from the Commission about the proposed use of chlorine as part of the dewatering treatment system. In fact, the applicant presented the Commission with information, as part of the substantive file documents, that chlorine was proposed to be used in the treatment system for dewatering operations. The applicant provided a complete description of the potential water contaminants that would be treated prior to discharge into the lagoon. The Commission's staff report is based on information provided by the applicant about the proposed treatment process. Section D. of the 9/29/10 staff report contained 11 pages of findings regarding water quality (9/29/10 staff report, pgs.43-54). Further, based on information submitted by the applicant, the Commission's staff report described potential water quality contaminants and explained how the filtration system would treat the contaminants, which includes standards for chlorinated discharge to the Pacific Ocean listed in the Water Board approved NPDES permit for the project. Further, the Commission required Special Condition 13 of the permit, incorporating all of the waste discharge requirements, limitations and other requirements and provisions contained in California Regional Water Quality Control Board, Los Angeles Region National Pollutant Discharge Elimination System (NPDES) Permit No. CAG994004 and Monitoring and Reporting Program No. Cl-9573. Special Condition 4 required the applicant to submit a final dewatering plan. The applicant did not present information about potential harm to marine life in tidepools from chlorine, because no tidepools are present at the discharge location. The applicant provided information that the discharge would be into the surfzone on the sandy beach. Thus, the first test pursuant to Section 13105(a) of the Commission's regulations has not been met because no information regarding the treatment process or impacts to marine life was withheld or mischaracterized, test 2 (whether they did so intentionally) does not apply. Similarly, test 3 (whether complete and accurate information would have caused the Commission to take a different action) also does not apply.

Next, the parties requesting revocation assert that information was withheld regarding studies related to Methicillin-resistant Staphylococcus Aureus (MRSA) bacteria and other toxic contaminants that lay dormant in the sand at Surfrider beach. However, the revocation request does not explain what exactly these studies were or who they were prepared by. The revocation letters states that the dewatering operation "is feared to dislodge the currently dormant toxic materials in the sand and transport them into the surf zone, which would cause a public health hazard." It is true that the Commission was not presented with information regarding MRSA during the permit application process (despite that it is unclear what information on the subject actually exists). However, such information was not relevant to the Malibu Lagoon restoration project because no beach sand grading operations on the beach were proposed that could potentially expose dormant bacteria in sand. Even if such information was relevant to the permit and was not provided in relation to the permit application, test 2 (whether they did so intentionally) is not met here. It has not been demonstrated that information about potentially contaminated sand was intentionally withheld because such information would not be relevant to the permit application since no grading of sand was proposed by the applicant. Thus, test 3 (whether complete and accurate information would have caused the Commission to take a different action) also does not apply. Nevertheless, the water resulting from dewatering operations will be treated in a manner consistent with all state and federal water quality requirements and will be discharged within the active surfzone area and will not mobilize any sand that is not already subject to wave action.

Lastly, the parties requesting revocation assert that information was withheld by the applicant regarding proposed rip rap. The parties requesting revocation assert that the project manager has plans "to surround the pipe from the dewatering tanks with rip-rap to hold the pipe in place" and that such a plan "was never considered nor approved by the Coastal Commission and would require approval according to the Coastal Act and past practices of the Commission." The revocation request is referring to the dewatering discharge pipe proposed as part of the dewatering filtration process.

The applicant has never provided information that the discharge pipe would be held in pace by rip-rap. The description asserted in the revocation request is not accurate, and the pipe will not be surrounded with rock rip rap. No rip rap to hold the pipe in place was approved or is proposed as part of the project. Pursuant to the dewatering plan, at the outlet end of the pipeline, there will be a temporary approximately 10' by 10' area covered with a geofabric blanket covered in cobble for flow dissipation. This component of the project is an important best management practice for energy dissipation from water flowing out of the pipe in to the ocean in order to minimize erosion and does not function to provide any form of foundational support for the pipe or as a shoreline protection structure. Thus, the first test pursuant to Section 13105(a) of the Commission's regulations has not been met, test 2 (whether they did so intentionally) does not apply. Similarly, test 3 (whether complete and accurate information would have caused the Commission to take a different action) also does not apply.

Unknown Contentions- Additional Materials Submitted on June 15, 2012 and July 13, 2012

Three documents were submitted by the parties requesting revocation, including: a report from Dr. Travis Longcore, submitted on June 15, 2012, an enforcement request letter by the parties requesting revocation, dated June 14, 2012, and a Sixty Day Notice of Intent to Sue letter from the parties requesting revocation to the Army Corps of Engineers under Section 7 of the Endangered Species Act, dated May 30, 2012 (**Exhibits 2-4**). These three documents were submitted at the Commission hearing, on June 14, 2012, by Marcia Hanscom and later requested by Ms. Hanscom, in an email to Commission staff on June 15, 2012, that these documents be "included along with the official revocation request." None of these additional three documents raise any grounds for revocation nor did the parties requesting revocation submit an accompanying explanation of how any of these documents relate to the grounds asserted in the original revocation request dated June 14, 2012, or assert any of the grounds of a revocation request required pursuant to Section 13105(a) of Title 14 of the California Code of Regulations.

Specifically, the enforcement request letter, dated June 14, 2012, on its face, does not constitute grounds for revocation. Because of the impacts on an applicant, the grounds for revocation are necessarily narrow. Although Commission staff confirmed that no Coastal Act violations had occurred on site (see Enforcement Response Letter, **Exhibit 5**), it should be noted that a violation of the Coastal Act or the terms and conditions of a permit or an allegation that a violation has occurred are not grounds for revocation under the California Code of Regulations. The grounds for revocation are, of necessity, confined to information in existence at the time of the Commission's action. Further, the document provided by Dr. Travis Longcore, prepared after the Commission’s October 13, 2010 approval, is a biological assessment of the project that disagrees with the approved project without asserting any grounds for revocation (**Exhibit 2**). Similarly, the letter from the parties requesting revocation addressed to the Army Corps of Engineers (ACOE) informing the ACOE that they intend to sue them, clearly fail to identify or raise any grounds for revocation of a CDP pursuant to Section 13105(a) of the California Code of Regulations (**Exhibit 3**).

Lastly, on July 13, 2012, an additional email was submitted to the Commission from Marcia Hanscom regarding a new critical habitat designation at Malibu Lagoon State Park for snowy plover (**Exhibit 9**). The email does not state how this information raises any grounds for revocation of a CDP pursuant to Section 13105(a) of the California Code of Regulations and does not allege that the applicant intentionally included inaccurate, erroneous, or incomplete information. Further, information relating to this new critical habitat designation is unrelated to the permit action and was not in existence at the time of the Commission’s action on October 13, 2010 (the new critical habitat designation was not issued until June 19, 2012).

2. Section 13105(b) of the California Code of Regulations

Section 13105(b) of the Commission’s regulations provides an alternative ground for the revocation of a permit, based upon an applicant’s failure to comply with the Commission’s noticing requirements. However, the party requesting revocation did not allege any such failure as a basis for revocation, and the Commission is aware of no evidence that such a failure occurred. Therefore, there is no basis for revocation of the permit pursuant to the grounds listed in Section 13105(b).

3. Conclusion

For the reasons discussed in detail in the preceding sections of this report, the revocation request does not demonstrate that the applicant knowingly and intentionally provided inaccurate, erroneous, or incomplete information relevant to the Coastal Act analysis as to whether the Malibu Lagoon restoration and enhancement project approved by the Commission pursuant to CDP 4-07-098 is consistent with the Chapter 3 policies of the Coastal Act. Thus, the grounds necessary for revocation under Section 13105(a) of the Commission’s regulations have not been satisfied. In addition, there is no claim or evidence of grounds for revocation under Section 13105(b). The Commission finds that the revocation request must be denied because the contentions raised in the revocation request do not establish the grounds identified in Sections 13105 (a) or (b) of Title 14 of the California Code of Regulations.

F. SECTION 13108(D) OF THE CALIFORNIA CODE OF REGULATIONS

Pursuant to Section 13108 (d) of the California Code of Regulations, if the Commission finds that the request for revocation was not filed with due diligence, it shall deny the revocation request. Revocation grounds are limited to those based on information in existence at the time of the Commission's action on the coastal development permit application.

As explained throughout this report, the parties requesting revocation waited more than 1.5 years after the approval of CDP 4-07-098, on October 13, 2010, to file the revocation request. The parties requesting revocation, Wetlands Defense Fund and CLEAN, fully participated in the Commission hearing of October 13, 2010, through written and oral testimony, and in that context, they raised many of the same issues that they now raise in their revocation request, including issues related to project construction timing, steelhead trout, potential impacts to tidewater goby. They also challenged the Commission's action in court, and it was not until the trial court had denied the writ petition by Wetlands Defense Fund, Access for All, and CLEAN, where several of the issues raised herein were already fully litigated, and the court of appeal denied their request for a stay of the project pending their appeal, that they filed their revocation request.

Thus, the Commission finds that the revocation request must also be denied because it was not filed with due diligence.

Wetlands Defense Fund
Protecting wetlands
the cradle of life

CLEAN
COASTAL LAW ENFORCEMENT ACTION NETWORK

Wetlands Defense Fund
protecting wetlands, the cradle of life
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Playa del Rey, CA 90293
(310) 821-9045

Coastal Law Enforcement Action Network
enforcing laws protecting the California coast
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HAND DELIVERED AT 6.14.12 MEETING OF CALIFORNIA COASTAL COMMISSION

Received at Commission Meeting

JUN 14 2012

From: ____________

June 14, 2012

Dr. Charles Lester
Executive Director
California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

Re: Request for Hearing to Consider Revocation of Coastal Development Permit (CDP) # 4-07-098 "Malibu Lagoon Restoration & Enhancement Plan"

Dear Dr. Lester:

We write to request a hearing to revoke the permit #4-07-098 that provides permission under the California Coastal Act for the Santa Monica Bay Restoration Foundation, California State Parks and the Resource Conservation District of the Santa Monica Mountains to proceed with what is referred to in the record as the "Malibu Lagoon Restoration & Enhancement Plan."

We invoke the following law to request this hearing, as we believe the facts support grounds for revocation of permit accordingly:

> Section 13105(a) of the California Code of Regulations, which states the following grounds for revocation of a CDP:
>
> intentional inclusion of inaccurate, erroneous or incomplete information

EXHIBIT 1
R-4-07-098 (Malibu Lagoon Revocation Request)

> in connection with a coastal development permit application, where the commission finds that accurate and complete information would have caused the commission to require additional or different conditions on a permit or deny an application (14 CCR §13105).

Several issues rise to this standard.

In addition, there are numerous permit compliance problems which we believe should cause the Commission to want to place the project on hold and convene a public hearing to determine the appropriate remedies for these permit compliance problems. We outline these issues in a separate enforcement request letter dated today.

As well, the permit holder is proceeding with work in spite of an incomplete and unapproved dewatering plan and an incomplete and unapproved public access plan.

PROJECT TIMING

On May 26, 2010, CCC staffer Amber Tysor asked a question of the project agenct and manager, Mark Abramson, about the seeming discrepancies about when the project would take place. This question made sense at the time, as it does now, as many people think, "what are they thinking doing a project like this in the midst of the nesting and breeding season?" Ms. Tysor's question was:

> "I just want to make sure that I have the correct timeline for the proposed work period- June 1 st to October 15th- noted several places in the file.
>
> However, this proposed timeframe (June 1st to October 15th) seems to conflict with the following timerines stated in the USFWS Biological Opinion 2009 (CON 1-8-08-F-4).
>
> The timeframes that the USFWS does not want work to occur in order to protect the gobies and least terns are during the proposed work timeframe. Page 5 of the Biological Opinion states:
>
> (1) "Construction of the restoration project will be timed to minimize disturbance of the western shoreline of the main lagoon when larval tidewater gobies [sic] are using the near-shore habitat. To avoid peak tidewater goby breeding periods, construction in the main lagoon will occur outside of the May 1 through November 1 window."
>
> (4) "To avoid disturbance of foraging California least terns, construction activities and ground disturbance would be scheduled outside of the breeding season and post-breeding season (July through August). On-site monitoring by a Service-approved biologist would be conducted during any disturbance within suitable habitat or occupied habitat for this species."
> Can you explain this inconsistency?"

Mark Abramson then responded:

> "The timeline we are working on June 1 to October 31. The discrepancy in usfw Bo was a typo and they have stated to the army corps that they are good with this timeframe. I think they provided suplemental [sic] info in the 404 permit but you can also call chris delith at usfw Ventura."

There was also a response to Commissioner questions on this topic at the October 2012 hearing, an officer of the State Coastal Conservancy, who has been one of the most intimate with the project planning details over the past decade, Kara Kemmler, stated for the record that there were concerns about the Steelhead being present during the winter months.

One of the primary reasons during the permitting process by the Coastal Commission that project applicants' representatives provided for needing to change the timing of the project construction (from that which was approved in the mitigations for the EIR, which were all included as part of the CCC permit approval) was that they needed to consider the needs of the endangered Southern Steelhead *(O. mykiss.)*

In fact, the Biological Assessment prepared by Jones & Stokes revealed that there no Southern Steelhead were found in Malibu Lagoon during surveys for the environmental review.

Later, after the California Coastal Commission permit was approved, in several public settings, representatives of the California State Parks Department have admitted that the reason they sought a change in project construction timing was because it would be too expensive and unwieldy to maneuver bulldozers, dredgers and other heavy equipment in the muddy soils of the lagoon during winter storm season. There is nothing in the Endangered Species Act or the California Coastal Act that allows for balancing of the needs of bulldozers, dredgers and heavy equipment operators to those of imperiled species like the Tidewater Goby, California Least Tern and Western Snowy Plover. The statements by public officials, including Suzanne Goode and Mark Abramson, in several public settings, demonstrate intentional misrepresentation by the project planning team.

The certified EIR's mitigations required the project be constructed outside of May to November, and recommendations from the Dagit Swift fish report also required this timing.

In the final conclusion to this report, Dagit & Swift (2005: p.29) states:

> "The abundance of Tidewater Gobies this year poses a significant constraint to the proposed restoration. .... The construction of the proposed restoration of Malibu Lagoon should be timed to avoid disturbance of the western shoreline during the months of May – November, when larval Tidewater Gobies are using the near-shore habitat."

If this information had been considered by the Commission in October, 2010, it is likely that the Commission would have at least determined the conditions to be required to not allow work during the summer breeding season of the Tidewater Goby and other sensitive and migratory species, as was required by the EIR mitigations which were incorporated into the project approval. At the very least, the Commission would have changed the project timing. It is possible this additional information might have also led the Commission to a denial or at least a postponement of the project in order to harmonize these extremely disparate and inaccurate assertions and conclusions put forth by the project applicant, agent and proponents.

TIDEWATER GOBY, CRITICAL HABITAT

The United States government in January 31, 2008 designated Malibu Lagoon as critical habitat for the endangered Tidewater Goby. (Federal Register Vol. 31, No. 21) Yet, the project proponents conveniently left out this information which we believe would have contributed to a different decision by the Coastal Commission (not revealing information is the same as providing inaccurate information; both are misleading to the decision-making body.)

The Tidewater Goby was reestablished within Malibu Lagoon in 1991, more than 20 years ago, in two locations within the proposed dredging action area. The Tidewater Goby multiplied in the first year after its reintroduction from 52 fish to more than 500 individuals, a 1000+% increase. Since then, the numbers increased to approximately 2000 individual gobies by the late 1990s. The most recent attempt at a population estimate (approximately 5,000 individuals) was in 2005 at the time of the project's Environmental Impact Report (EIR) analysis.

While the Tidewater Goby breeds primarily in areas of the main lagoon, one of those areas where Tidewater Goby larvae was found in large numbers in the most recent official survey is directly where a dam is scheduled to be constructed as part of the impending action, on the western edge of the creek channel, and another of the specific areas where breeding activity occurs is scheduled and mandated to be subject to an enforcement order whereby the California Coastal Commission has required that a private landowner remove a large rock rip rap wall and then return the rocks in a different fashion.

The placement of the dam was not revealed during the October 2010 hearing to be one of the primary areas where the breeding activity of Tidewater Goby had been documented in 2005. While those construction documents were not available to the Commissioners when they made their decision, it is reasonable to believe that the project managers knew exactly where they were going to construct the temporary dam that would facilitate dewatering of the western lagoon. Had the information from the 2005 fish sampling report combined with the dam location match-up been available to the Commissioners, it is likely a different decision about the project would have been made – either a decision for different conditions about dam placement, timing of the project or even an outright project denial or postponement that would be used to work out the problems of these plans.

While it is true that Tidewater Goby can breed at other times of year, at Malibu Lagoon the ideal time for breeding is during the spring, summer and fall when the still, shallow lagoon waters are not subject to wave action due to the closed sand bar condition, and also because of the abundance of Wigeon grass (*Ruppia* spp.) which provides cover, protection from predators and food sources for this endangered fish.

In fact, Dr. Camm Swift, the senior investigator, in Dagit & Swift, "Malibu Lagoon Fish Survey 20 June 2005" (2005: p.5), has concluded that, indeed, the most important time for protecting the Tidewater Goby is from May through November.

> "The abundance of Tidewater Gobies poses a significant constraint to the proposed restoration. The construction of the proposed restoration of Malibu Lagoon should be timed to avoid disturbance of the western shoreline during the months of May- November, when larval Tidewater Gobies are using the near-shore habitat."

In addition, in the June, 2005 when the field work was being done for the Dagit & Swift report, one of the sampling stations was so "dominated by tidewater gobies" that:

> "In order to avoid accidental take or injury, we ceased seining at this location." Dagit & Swift (2005: p. 21)

This location (station #1) is, according to construction documents, exactly at or immediately adjacent to where a dam is scheduled to be constructed as part of the "restoration" project – in June 2012, corresponding to the same time of year when the larval Tidewater Goby were found in such numbers that the acknowledged Tidewater Goby expert, Dr. Camm Swift, was not even comfortable sampling in this area through much less invasive work of seining than what is planned with the dam construction, lagoon draining, bulldozing and dredging.

This adverse effect to the Tidewater Goby breeding habitat – both by the dam construction area and the nearby enforcement action - was not considered by the Coastal Commission in any cumulative effects analysis of the Malibu Lagoon restoration & enhancement project. In other words, the cumulative effects of both of these Coastal Commission permitted projects were not considered, yet the project agent, Mark Abramson, was aware of and was one of the chief proponents of removal of that rip-rap by the Adamson family's business, which is the entity which was required and permitted by the Commission to remove that rip-rap. The California Coastal Commission did not even consider the impact of the rip-rap removal and replacement on the endangered Tidewater Goby.

Besides the lack of consideration of these cumulative impacts, the risk of direct and indirect, adverse effects to the Tidewater Goby population at Malibu Lagoon was not adequately analyzed in the initial consultation, as it has only been since the Coastal Commission permit was issued and subsequent construction documents have been widely available to the public that it has become clear the extent and drastic nature of the project. The entire western lagoon will be dammed, drained, dredged and re-contoured, essentially resulting in adverse effects to significant amounts of habitat used for breeding, feeding, foraging, resting, and other essential behaviors, as well as adversely affecting the primary constituents elements for this endangered fish.

According to a declaration submitted to a California Court of Appeal, biologist Robert van de Hoek stated the following:

> "The Tidewater Goby therefore has found suitable habitat in Malibu Lagoon, especially inside the proposed project area. For the Tidewater Goby, the existing hydrology and geomorphology of the three channels within Malibu Lagoon's western sloughs is ideal habitat for this species to mature into adulthood, and this area serves as a refuge during high rainfall events of winter storms. These features explain why restoration of the Tidewater Goby was successful in 1991, which first required the 1983 restoration of the three (3) channels to be completed. The two prior restoration efforts of 1983 and 1991 in Malibu Lagoon therefore have been successful.

> The hydrology that the Tidewater Goby is most suited to is that existing today in the western area of Malibu Lagoon, which is the project site. Specifically, this area has slow-moving, shallow water with narrow channels that are heavily vegetated with submerged aquatic vegetation (SAV), particularly with a native plant species complex known as *Ruppia spp.* (commonly known as "wigeon grass"), which also benefits numerous other species of fish, birds, and invertebrate animal life.
>
> Hydrologically, Malibu Lagoon's western lagoon (the project site) functions ideally now with slow moving water in an estuarine environment with no wave shock or fetch from the ocean. This physical condition serves a desirable biological function allowing both planktonic and delicate benthic invertebrate animal life to be maintained in the western lagoon rather than being washed out to sea or buried by wave turmoil in sediment during winter rainstorms. The proposed large fetch with wind waves facilitated by the removal of the wooden bridges and connected islands, would destroy these conditions.
>
> In this respect, extensive dredging and removal of the bridges and islands is not desirable for the Tidewater Goby nor the native vegetation and invertebrate wildlife of dragonflies, mayflies, damselflies, planktonic copepods and amphipods and other aquatic insects and crustaceans, because it would alter the current stabilized conditions within the western lagoon. Eutrophication is a natural part of ecology and desirable in summer for bodies of freshwater and low salinity wetlands. This natural condition is good for native plants, native invertebrate animals, native fish, native birds and native mammals.
>
> Malibu Lagoon is naturally above sea level at a mountain front with its river mouth influenced by alluvium, and therefore it is raised or perched. This type of lagoon is largely fresh-water rather than salt-water dominated creating favorable conditions for the Tidewater Goby's survival. Dredging the lagoon to lower the sea-level elevation will disrupt the ecological equilibrium found now after approximately 30 years since the last 1983 restoration."

If this information about **CRITICAL HABITAT of the endangered Tidewater Goby** had been considered by the Commission in October, 2010, it is likely that the Commission would have at least determined the conditions to be required to not allow work during the summer breeding season of the Tidewater Goby and other sensitive and migratory species, as was required by the EIR mitigations which were incorporated into the project approval. At the very least, the Commission would have changed the project timing. It is possible this additional information might have also led the Commission to a denial or at least a postponement of the project in order to harmonize these extremely disparate and inaccurate assertions and conclusions put forth by the project applicant, agent and proponents.

PUBLIC ACCESS

During the public hearing for the Coastal Commission permit for this project, it was repeatedly stated that public access would not be impeded during construction and that access to the beach would be open. It is easy to believe that the permit would never have been granted otherwise.

At no time during the permit approval process did the public understood or been informed, nor was the Coastal Commission itself informed that public access to Surfrider Beach's 3rd point would be atop a sand-bag constructed dike that has not been engineered as of yet. Concerns re: ADA compliance, wheelchair accessibility, stroller accessibility and other safety concerns have not been vetted nor addressed.

Currently – this week – **public access is ONLY available sporadically** along the perimeter access road – as the bridges trail has been shut off completely from public access, and heavy machinery is using the perimeter access path for habitat removal purposes. Therefore, there is regularly currently no access to the beach to the west of the sand bar breach – making a portion of Surfrider Beach a private beach, only open to the exclusive gated community of the Malibu Colony.

In addition, Craig Sap of State Parks informed us that the emergency lifeguard access – since the perimeter trail will be unavailable at times – is via this gate to the Malibu Colony, yet the dewatering pipe planned to go to the sea in this area will be blocking such vehicular access.

The PIPE which is going to be moving water from the dewatering operation to the ocean will be directly blocking the only emergency access available to lifeguards and as a secondary emergency access from the Colony residential homes.

Given the continued reassurances by project proponents that the "Malibu Lagoon Restoration & Enhancement Plan" that public access WOULD NOT BE IMPEDED, it is shocking and completely unacceptable that public access provisions to an area that is one of southern California's most popular beach destinations – in the height of summer tourism season – is being treated so cavalierly by the state agencies that are carrying out this plan. Those who participated in the October, 2010, hearing on this issue are convinced that this permit would never have been granted had such egregious blocking of public access from this important coastal region during heavy summer use were known and understood at the time.

DEWATERING CONCERNS

HUMAN HEALTH CONCERNS: Additional dewatering concerns were raised by the City of Malibu during the public approval process of the CDP for this project. While they were not adequately addressed and still have not been to the satisfaction of the City or the public that uses Surfrider Beach, we believe that the project proponents had access to and knew of the studies related to MRSA and other toxic contaminants that lay dormant in the sand at Surfrider Beach.

The pipe from the dewatering operation is planned to transport water from the lagoon across the sand and into the surf zone. This dewatering operation is feared to dislodge the currently dormant toxic materials in the sand and transport them into the surf zone, which would cause a public health hazard.

CHLORINATED WATER FROM DEWATERING TO HARM TIDEPOOLS: Additionally, this chlorinated water will be pumped into the area where there are currently tidepools filled with life. "Clean" chlorinated water will kill the life in these tidepools, especially in the quantities that will be continual and dramatic over weeks and possibly months.

RIP-RAP INTO TIDAL AREA: Finally, we have learned recently of the project managers' plans to surround the pipe from the dewatering tanks with rip-rap in order to hold the pipe in place. Such a plan was never considered nor approved by the Coastal Commission and would require approval according to the Coastal Act and past practices of the Commission.

Given the record on this matter, those who participated in the October, 2010, hearing on this issue are convinced that this permit would never have been granted had such issues related to the dewatering portion of this project were known and understood at the time. We believe the project managers knew the details of these issues and did not inform the Commission about them.

Due to all of the facts presented herein, and according to the provisions of the law, we ask that a revocation hearing be scheduled one these matters at the soonest possible date and a stopping of the project be directed in the meantime, in order to minimize damage to coastal resources and to public access.

Sincerely,

Marcia Hanscom /s/

Marcia Hanscom
Executive Director
WETLANDS DEFENSE FUND
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Robert van de Hoek /s/

Robert van de Hoek
President & Wildlife Biologist
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cc: The Law Offices of James Birkelund

Hudson, Steve@Coastal

From: Marcia Hanscom [wetlandact@earthlink.net]
Sent: Friday, June 15, 2012 3:59 PM
To: Ainsworth, John@Coastal; Hudson, Steve@Coastal; Lester, Charles@Coastal
Subject: Revocation - please include

Dear Dr. Lester, Mr. Ainsworth and Mr. Hudson ~

Please include, along with the official revocation request, the following:

the report from Dr. Travis Longcore, the enforcement letter request and the 60-day notice re: Endangered Species Act.

Thank you.

~ Marcia Hanscom

~ Marcia Hanscom
Executive Director

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SAVE MALIBU LAGOON ~ a campaign project of Wetlands Defense Fund
SaveMalibuLagoon.com

Impending Malibu Lagoon "Restoration" Destructive and Misguided

Travis Longcore, Ph.D.
(310) 247-9719
longcore@usc.edu

The following assessment of the impending Malibu Lagoon project is provided in hopes that any officials with the power to do so will halt this destructive and futile project and instead develop plans that incorporate current understanding of the processes that govern coastal estuaries in a manner that will protect rather than harm native species that depend on these unique seasonally tidal wetland ecosystems.

Popular media accounts of the impending start of the Malibu Lagoon Restoration and Enhancement Project characterize it as "emotional activists vs. scientists" — implying that all of those opposed to the project are simply ill-informed and that all scientists agree that the project is both necessary and prudent. As a scientist, I disagree. The rationale upon which the project is based does not withstand scrutiny and reveals a fundamental misunderstanding of the historical and current forces that created and maintain the Malibu Lagoon. I have worked on the general topic of the historical characteristics of southern California rivers and estuaries for the past seven years and been part of research teams investigating the historical nature of these systems and the natural processes that form them.

The fundamental complaint about Malibu Lagoon from project proponents is that it lacks water circulation and as a consequence has low dissolved oxygen and sedimentation with nutrient rich waters and soils from the Malibu Creek watershed. Their solution is to scrape out the sediments in the west lagoon and reconfigure the Lagoon to increase tidal flow. But to expect this to change the nature of the lagoon is a mistake: Malibu Lagoon was historically and will in the future tend to be brackish and prone to sedimentation and low dissolved oxygen. In fact, it is likely that in its pre-European settlement state it would not have met current water quality standards. To understand this, consider the historical extent and nature of the area where Malibu Creek meets the ocean.

Early maps of Malibu Lagoon, such as the Coast Survey Sheet T-1432 from 1877, do not show a tidal marsh with a singe main channel and branching arms. The reproductions I have seen of this map are not high resolution, but it appears that Malibu Creek swings out to the west and then forms a lagoon behind a barrier beach. There seems to be a marsh, not an extensive one, but rather one with maybe two channels branching off at 90 degree angles from a main channel. The same configuration is evident in the 1903 topographic map, except the stream has moved to the east. Subsequent maps show these features in various degrees of being filled in by development. Nowhere have I ever seen evidence of the characteristic dendritic network of a fully tidal salt marsh. Which brings us to a second point. Malibu is, and has been for at least hundreds of years, a closing estuary.

The flow from Malibu creek is insufficient to keep the longshore wave action from forming a berm during the summer. Malibu Creek is closed completely from the ocean about half of the

EXHIBIT 2
R-4-07-098 (Malibu Lagoon Revocation Request)

year. This might change from year to year, but the pattern of annual closure is a natural part of this system. The tendency for a system such as this will be that back channels will slowly sediment in until they are cleared out by a big flood or a shift in the creek's route. That is, the lagoon of recent history (last 200 years) was not a set of channels created and maintained by tidal flow, but rather was the remnants of former creek routes scoured out during extreme flooding events and subsequent movement of the creek mouth. The creek would change routes across the whole floodplain of the Civic Center area, with a tendency for the mouth to migrate to the east with the longshore flow of wave action over time, until constrained by the bluffs at the eastern edge.

So long as it is not jettied open to the ocean, we should not expect the Malibu Lagoon to behave like a fully tidal salt marsh, even if it is graded to look like one. Yet, this is the apparent goal of the project proponents. They want to change the water quality by introducing more tidal flushing. They expect this to reduce sedimentation and increase dissolved oxygen. Although not an explicit goal of the project, many proponents have argued the dredging will reduce bacteria in the lagoon. Some have also suggested that this will help deal with invasive plant species by making the water saltier. But all of this reflects an attempt to make the lagoon into something it historically was not and that is not supported by the physical processes currently in place. The back channels of the lagoon will have low dissolved oxygen. As long as there are nutrient rich sediments coming down Malibu Creek the lagoon will tend to silt up and accumulate these sediments. During the summer the lagoon will close and there will be a heavy freshwater influence. And because conditions very similar to these occurred in California estuaries for hundreds and thousands of years, native species are adapted to them. Tidewater gobies — the endangered fish that breeds very successfully in the lagoon — has an enormously wide range of tolerance for dissolved oxygen and loves the submerged aquatic vegetation that some see as an indicator of poor water quality. It is doing very well in the lagoon as is.

The field of coastal wetland restoration in California is dominated by people who believe that the only good wetland is one that is fully tidal year round. So we see various "restorations" that consist of constructing jetties to artificially open to the ocean naturally closing estuaries— Bolsa Chica Wetlands, Batiquitos Lagoon, San Dieguito Lagoon, Talbert Marsh, and the current plans for the Ballona Wetlands. Each time this is done, some of the native biodiversity and natural variation in California estuaries is lost (see our detailed report on this topic). And because these "restorations" are attempts to create a condition not supported by the physical processes of the place, they also involve incredible expense and energy to dredge these artificial openings to keep them from silting in.

Which brings us to a final point about the Malibu Lagoon project. The planning documents for the project indicate that if the tidal flows in the newly constructed channels falls below those at some reference marshes, then heavy equipment could be used (again) to make sure that the Lagoon behaves like the designers intended by dredging the channels. The reference marshes listed to trigger such actions are all systems that are artificially jettied open (Talbert Marsh, Batiquitos Lagoon, and Carpinteria Marsh) and are dredged to stop the natural process of mouth closure. Using these as references for Malibu Lagoon reflects that managers both misunderstand the natural dynamics of Malibu Lagoon — the flow in channels of a naturally closing estuary should not be expected to match that of one that is jettied open — and ensure that they will be fighting those natural processes for years to come to get it to behave more like what they want it to be, instead of what it is. Furthermore, tidewater gobies are no longer found at these "reference" marshes, and could never be reintroduced because of management for a permanently open channel mouth.

If the restoration proceeds, and I sincerely hope it does not, I predict that it will fare little better than the previous attempt ending in 1983 on the metrics that motivate project proponents. In the short run it may increase dissolved oxygen and increase salinity (which would actually be a degradation of habitat for the original native flora and fauna adapted to a brackish marsh). In the long run, sedimentation will continue, nutrient levels will be high, water will stagnate in the channels, and it will be full of bacteria. We should only be upset about these things if they are caused by humans (e.g., polluted runoff and increased erosion from the watershed). These problems have to be dealt with before the water gets to the lagoon. Even if they are cleaned up entirely the lagoon might not meet arbitrary water quality standards, but then again it probably would not have met those standards 200 years ago either!

Certainly things could be done to promote native biodiversity at Malibu Lagoon. They should not, however, be premised around a misunderstanding of what the natural processes will support. And they should recognize that the native biodiversity of Malibu Lagoon is that associated with either the main channel or brackish marshes and stagnant water, not a fully tidal saltmarsh. The area where the parking lot was removed could be graded down and added to the wetland area, but there is no need or long-term benefit to reconfiguring the channels into some idealized saltmarsh form as if it were San Francisco Bay. Even as rare as saltmarsh habitat is in California, the brackish and freshwater wetlands of the naturally closing systems (which historically were the majority) are even more rare and we should resist the temptation to homogenize them.

To claim that Malibu Lagoon is "dying" is to fail to grasp what kind of wetland it is. It is not dying. It is simply approaching equilibrium with the physical processes of the watershed and some people have decided that they would prefer a different type of wetland. The lagoon supports significant biodiversity, just not the same species as one would find in a permanently tidal salt marsh. We should no more expect a seasonal creek to be river or a meadow to be forest than to expect a lagoon that is closed to the ocean for half of the year to have the same water characteristics as those that are flushed year round by the ocean. The current "restoration" will be destructive to the natural community that has developed since the first dredging project (including the extremely successful reintroduction of endangered tidewater gobies), have obvious impacts to the waterfowl that use the lagoon for nesting and foraging, and provide little benefit that could not instead be achieved in a far less destructive manner.

About the Author*

Dr. Travis Longcore is Science Director of The Urban Wildlands Group and President of the Board of Directors of the Los Angeles Audubon Society. He is also Associate Research Professor at the University of Southern California Spatial Sciences Institute and Associate Adjunct Professor at the UCLA Institute of the Environment and Sustainability where he has taught, among other courses, Bioresource Management, Environmental Impact Analysis, and the Environmental Science Practicum. He was graduated *summa cum laude* from the University of Delaware with an Honors B.A. in Geography, holds an M.A. and a Ph.D. in Geography from UCLA, and is professionally certified as a Senior Ecologist by the Ecological Society of America. He has worked with research teams to describe the historical ecology of rivers and estuaries along the southern California coast, including the San Gabriel River, Ballona Creek, Santa Clara River, Ventura River, and Ventura County coastal wetlands. These reports can be downloaded at: http://www.urbanwildlands.org/longcore.html in the "Historical Ecology" section.

*Affiliations are provided for identification purposes only and do not indicate endorsement by any organization, institution, or individual.

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California Coastal Commission
South Central Coast District

CLEAN
COASTAL LAW ENFORCEMENT ACTION NETWORK

Wetlands Defense Fund
Protecting wetlands
the cradle of life

Wetlands Defense Fund
protecting wetlands, the cradle of life
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(310) 821-9045

Coastal Law Enforcement Action Network
enforcing laws protecting the California coast
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Playa del Rey, CA 90293
(310) 877-2435

BY CERTIFIED MAIL TO ALL
RETURN RECEIPT REQUESTED
ADDITIONAL FAX & HAND DELIVERIES TO SOME ADDRESSEES DUE TO TIME URGENCY

May 30, 2012

The Honorable Ken Salazar
Secretary of the Interior
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Washington, DC 20240

The Honorable Lt. Gen. Thomas P. Bostick
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United States Army Corps of Engineers
Department of the Army
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Mr. Mike Fris
Assistant Regional Director
Region 8 – Pacific Southwest
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The Honorable Daniel M. Ashe, Director
U.S. Fish & Wildlife Service
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The Honorable Jerry Brown
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Sacramento, CA 95814

The Honorable Lisa Jackson
Administrator, United States
Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

EXHIBIT 3
R-4-07-098 (Malibu Lagoon Revocation Request)

Brigadier General Michael C. Wehr,
Commander and Division Engineer
US Army Corps of Engineers
South Pacific Division
333 Market Street
San Francisco, CA 94105-2195

The Honorable Jared Blumenfeld
Regional Administrator, Region IX
U.S. Environmental Protection Agency
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San Francisco, CA 94105

Ms. Diane Noda, Field Supervisor
Ventura Fish & Wildlife Office
US Fish & Wildlife Service
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Ventura, CA 93003

The Honorable Ruth Coleman
Director, California State Parks
1416 9th Street
Sacramento, CA 95814

Dr. Charles Lester
Executive Director
California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

Colonel Mark Toy
District Commander
United States Army Corps of Engineers
Los Angeles District Corps of Engineers
915 Wilshire Blvd., Suite 980
Los Angeles, CA 90017-3401

The Honorable Sam Schuchat
Executive Officer
CA State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, CA 94612-2530

Re: Sixty Day Notice of Intent to Sue re: Failure to Complete Section 7 Consultation on the Malibu Lagoon "Restoration & Enhancement Plan", Imminent Harm of Endangered Species and Destruction of Habitat, Canyon Stream (Creek) and Coastal Wetlands in Violation of the Clean Water Act and the Endangered Species Act

Dear Secretary Salazar, Governor Brown, Lt. General Bostick, Brigadier General Wehr and Colonel Toy, Messrs. Ashe, Fris & Blumenfeld, Ms. Jackson, Dr. Lester, Ms. Noda, Ms. Coleman, Mr. Schuchat and any person acting in concert with any of the foregoing:

The proposed restoration and enhancement plan for Malibu Lagoon in Los Angeles County, California, is a deeply flawed project that will result in significant damage to one of the few remaining coastal wetlands in southern California and result in unauthorized take of the endangered Tidewater Goby (*Eucyclogobius newberryi*), endangered California Least Tern (*Sterna antillarum browni*), and the threatened Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*), as well as adverse modification of designated critical habitat for the Tidewater Goby. **We urge the U.S. Army Corps of Engineers (Army Corps) to withdraw its permit issued under the authority of the Clean Water Act for this project.**

If the Army Corps refuses to withdraw its authorization for this misguided project, on behalf of Wetlands Defense Fund and the Coastal Law Enforcement Action Network (CLEAN), we write to notify you of our intent to sue for violations of the federal Endangered Species Act ("ESA") 16 U.S.C §§ 1563 et. seq.

and the Federal Water Pollution Control Act (Federal Water Pollution Control Act, 33 USC1251 et seq.) ("Clean Water Act").

Section 505(b) of the Federal Clean Water Act, (the "Act"), 33 U.S.C. Section 1365(b) requires that sixty (60) days prior to the filing of a citizens' suit in Federal District Court under Section 505(a) of the Act, 33 U.S.C.A. 1365(a), the alleged violator, the United States Environmental Protection Agency (the "EPA"), The United States Army Corps of Engineers, (The Corps), and the State in which the violations occur must be given notice of the alleged violations, and of intent to bring a citizens' suit action.

WETLANDS DEFENSE FUND and CLEAN hereby place you on notice, pursuant to 33 U.S.C. 1365(b) that the actions taken by The State of California, particularly California State Parks and several other state agencies, its affiliates and agents of altering and filling with material into a natural watercourse or stream, as well as adding other debris into the former bed of the watercourse is contrary to Sections 301 and 404 of the Federal Clean Water Act, 33 U.S.C. §1344.

Under Federal law, each day that you violate the Federal Clean Water Act is a separate violation. Under 33 U.S.C. § 1319(d) of the Federal Clean Water Act, the U.S. District Court may impose a civil penalty of up to Twenty-Five Thousand Dollars ($25,000.00) per day, per stream for each violation under both Section 404 and Section 402.

The United States Army Corps of Engineers and the Secretary of the Interior, as well as others included in this notice are hereby notified that Wetlands Defense Fund and CLEAN intend to file suit, pursuant to the citizen suit provision of the Endangered Species Act ("ESA"), 16 U.S.C. § 1540(g), to challenge the Army Corps of Engineers' failure to reinitiate and complete consultation in a timely manner concerning the impacts of the Malibu Lagoon restoration and enhancement plan on threatened and endangered species.

The filling and development of biologically significant habitat and the impacts associated with a bulldozing, dredging and habitat removal within immediate vicinity of a canyon stream, a coastal wetland and in the midst of what qualifies as environmentally sensitive habitat area (ESHA), will result in the "take" of at least three federally-listed endangered or threatened species.

In addition, suit will be brought pursuant to the federal Administrative Procedure Act ("APA"), 5 U.S.C. §§ 701 et seq., challenging actions by the United States Army Corps of Engineers ("Army Corps"), the Secretary of the Interior ("Secretary"), the U.S. Fish & Wildlife Service ("USFWS"), the California Coastal Commission ("CCC"), California State Parks, California State Coastal Conservancy, its agents, affiliates and its contractors.

URGENCY – NEED FOR IMMEDIATE ACTION TO PROTECT ENDANGERED SPECIES

Because of the urgency of this matter, we ask that all parties addressed on this letter take action to place the project at Malibu Lagoon on hold before June 1, 2012 – this coming Friday – or as soon as possible after that date and urge or cause the Army Corps to withdraw their Clean Water Act permit and/or to reinitiate consultation with the USFWS related to the species named in this letter.

Given the clearly stated intent of the applicant to implement this project within two (2) days of the date of this letter, we believe the 60-day notice requirement of the Endangered Species Act (16 USC 1540(g)(2)(A)-(C) does not apply to this imminent action highly likely to result in unauthorized take of three federally listed species.

SUMMARY OF THE LAW, THE PROJECT & ITS IMPACTS

On June 1st of this year, 2012, at Malibu Lagoon State Beach (a unit of the State Park system) the State of California (including several agencies, headed by the State Parks Department and permitted by the California Coastal Commission and funded and instigated by its sister agency, the State Coastal Conservancy) and its various partners, subsidiaries, agents and contractors, and their predecessors have plans to begin a project that will dam, drain and dredge, fill and re-contour 88,700 cubic yards of soils in what the agencies have called a restoration, but which would actually disturb and destroy acres of native plant habitat and wetlands and stream/creek ecosystem, including disturbance and destruction of habitat supporting endangered species.

The massive overhaul proposed for this site will adversely modify designated critical habitat Unit LA-3 for the endangered Tidewater Goby (*Eucyclogobius newberryi*), a species which uses Malibu Lagoon for breeding and for post-breeding dispersal and for food and shelter, and will result in "take" of the endangered California Least Tern (*Sterna antillarum browni*), which uses the lagoon for post-breeding foraging (parents and juveniles.) The project will also result in "take" of the threatened Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*) which forages and rests on the sand berm and sandy shore between the ocean and the lagoon, where dewatering and other construction activities are planned.

As defined in the Endangered Species Act, "take" is defined as "...to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." "Harass" means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to breeding, feeding, or sheltering. "Harm" has been further defined to include habitat destruction when it injures or kills a listed species by interfering with essential behavioral patterns, such as breeding, foraging, or resting.

The Act prohibits activities that "...remove and reduce to possession any listed plant from areas under Federal jurisdiction; maliciously damage or destroy any such species on any such area; or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law." The term "person" is defined as "...an individual, corporation, partnership, trust, association, or any other private entity; or any officer, employee, agent, department, or instrumentality of the Federal government, of any State, municipality, or political subdivision of a State, or any other entity subject to the jurisdiction of the United States."

The massive overhaul proposed for this site will adversely modify designated critical habitat Unit LA-3 for the endangered Tidewater Goby, a species which uses Malibu Lagoon for the significant behaviors of breeding, post-breeding dispersal, and for food and shelter; result in take of the endangered California Least Tern which uses the lagoon for post-breeding foraging (parents and juveniles); and take of the Pacific coast population of the western snowy plover though (harassment of adults and possibly nestlings.)

BIOLOGICAL OPINION, TECHNICAL ASSISTANCE LETTER – FAULTY, INCOMPLETE ESA ANALYSIS, ILLEGAL CLEAN WATER ACT PERMIT

The applicant through the Corps has not received authorization for incidental take of the California Least Tern, and the discussions of incidental take in the Fish and Wildlife Service's August 26, 2009, biological opinion (2008-F-0149), and the technical assistance letter dated January 8, 2010 (81440-2010-TA-0095) are vague and indecipherable at best. In fact, these two documents provide scant basis upon which to determine if the incidental take of the endangered Tidewater Goby resulting from this project have been exceeded from that authorized, let alone if this take could result in jeopardy to this listed species.

The August 26, 2009, biological opinion concurred with a "may affect, not likely adversely affect" determination by the Corps, because "....western Snowy Plovers are not known to breed within the study area," (page 1 of the biological opinion.) There is new scientific information available about the threatened Western Snowy Plover *Charadrius alexandrinus nivosus* and its presence in the action area. (they forage in the action area and agencies have reason to believe they will breed there soon, as the agencies in collaboration with local Audubon chapters have invested in installation of a boundary fence for nesting purposes.)

In addition, neither the Corps nor the Service analyzed the effects of this project on the threatened California Red-legged Frog (*Rana draytonii*), endangered Ventura Marsh Milk-vetch (*Astragalus pycnostachyus* var. *lanosissimus*), and the endangered Salt Marsh Bird's-beak (*Chloropyron maritimum* subsp. *maritimum*). For the California Red-legged Frog there are reports by the Resource Conservation District of the Santa Monica Mountains (SMMRCD) of this species being in or near the action site. As well, this species is listed as confirmed at Malibu Beach on the CNDDB as of May, 2011 *(Malibu Beach and Point Dume combined CNDDB confirmed 9-Quad Analysis database accessed 3 May 2011.)* North of Malibu Lagoon and south of Malibu Lagoon there are historical records of these listed species that lead us to believe that they also were found in Malibu Lagoon and the associated watershed; botanical records from the 1890s to the 1930s – the time period for which this region of the country has been able to assemble knowledge on imperiled plant species - for Malibu Lagoon are scarce from that time due to the lands and access roads through Malibu being private.

It appears that adequate rare plant surveys following California Department of Fish and Game or USFWS protocols were not completed within the action area for the Ventura Marsh Milk-vetch or the Salt Marsh Birds-beak. Unless such surveys were completed and documented, there appears to be no basis upon which to conclude a "no effect" finding or a "may affect" determination pursuant to the USFWS's section 7 regulations.

Therefore, the section 7 consultation conducted for this project by the Army Corps and the USFWS has incorrectly been finalized, and the project should be held in abeyance until consultation is completed in order to avoid irretrievable and irreversible commitment of resources that would prevent the formulation or implementation of any reasonable and prudent alternatives by the Corps and the applicant pursuant to section 7(d) of the Endangered Species Act (16 USC 1536(d)).

To our knowledge, no final permit pursuant to section 404 of the federal Clean Water Act, 33 U.S.C. 1344 ("section 404 permit") has been issued on this site, and the destruction of both the wetlands and stream/creek, as well as habitat supporting endangered species was done and continues to be done without proper or adequate consultation with the U.S. Fish & Wildlife Service, or the authorization for the incidental take of listed species, both consultation and authorization as required by the Endangered Species Act. To date, only a PROVISIONAL permit issued by the Army Corps of Engineers (Army Corps) Los Angeles District is in the files of the California Coastal Commission, and despite a Freedom of Information Act (FOIA) request to the Army Corps, dated April 19, 2012, we have not been able to determine that any final permit exists. Yet, the project is set to begin on June 1, 2012.

The re-initiation of formal consultation is required and must be requested by the US Army Corps and undertaken by the USFWS if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; *(2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the action is modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion;* or (4) a new species is listed or critical habitat designated that may be affected by the identified action. 50 C.F.R. §-402.16. [*emphasis added.*]

TIDEWATER GOBY, CRITICAL HABITAT

The United States government in January 31, 2008 designated Malibu Lagoon as critical habitat for the endangered Tidewater Goby. (Federal Register Vol. 31, No. 21)

The Tidewater Goby was reestablished within Malibu Lagoon in 1991, more than 20 years ago, in two locations within the proposed dredging action area. The Tidewater Goby multiplied in the first year after its reintroduction from 52 fish to more than 500 individuals, a 1000+% increase. Since then, the numbers increased to approximately 2000 individual gobies by the late 1990s. The most recent attempt at a population estimate (approximately 5,000 individuals) was in 2005 at the time of the project's Environmental Impact Report (EIR) analysis.

While the Tidewater Goby breeds primarily in areas of the main lagoon, one of those areas where Tidewater Goby larvae was found in large numbers in the most recent official survey is directly where a dam is scheduled to be constructed as part of the impending action, on the western edge of the creek channel, and another of the specific areas where breeding activity occurs is scheduled and mandated to be subject to an enforcement order whereby the California Coastal Commission has required that a private landowner remove a large rock rip rap wall and then return the rocks in a different fashion.

This adverse effect to the Tidewater Goby breeding habitat – both by the dam construction area and the nearby enforcement action - was not considered by the USFWS in any cumulative effects analysis of the

Malibu Lagoon restoration & enhancement project. In other words, re-initiation of consultation is necessary so that the cumulative effects of both of these Coastal Commission permitted projects are considered in the section 7 consultation. The California Coastal Commission did not even consider the impact of the rip-rap removal and replacement on the endangered Tidewater Goby.

Besides the lack of consideration of these cumulative impacts, the risk of direct and indirect, adverse effects to the Tidewater Goby population at Malibu Lagoon was not adequately analyzed in the initial consultation, as it has only been since the Coastal Commission permit was issued and subsequent construction documents have been widely available to the public that it has become clear the extent and drastic nature of the project. The entire western lagoon will be dammed, drained, dredged and re-contoured, essentially resulting in adverse effects to significant amounts of habitat used for breeding, feeding, foraging, resting, and other essential behaviors, as well as adversely affecting the primary constituents elements for this endangered fish.

According to a declaration submitted to a California Court of Appeal, biologist Robert van de Hoek stated the following:

> "The Tidewater Goby therefore has found suitable habitat in Malibu Lagoon, especially inside the proposed project area. For the Tidewater Goby, the existing hydrology and geomorphology of the three channels within Malibu Lagoon's western sloughs is ideal habitat for this species to mature into adulthood, and this area serves as a refuge during high rainfall events of winter storms. These features explain why restoration of the Tidewater Goby was successful in 1991, which first required the 1983 restoration of the three (3) channels to be completed. The two prior restoration efforts of 1983 and 1991 in Malibu Lagoon therefore have been successful.
>
> The hydrology that the Tidewater Goby is most suited to is that existing today in the western area of Malibu Lagoon, which is the project site. Specifically, this area has slow-moving, shallow water with narrow channels that are heavily vegetated with submerged aquatic vegetation (SAV), particularly with a native plant species complex known as *Ruppia spp.* (commonly known as "wigeon grass"), which also benefits numerous other species of fish, birds, and invertebrate animal life.
>
> Hydrologically, Malibu Lagoon's western lagoon (the project site) functions ideally now with slow moving water in an estuarine environment with no wave shock or fetch from the ocean. This physical condition serves a desirable biological function allowing both planktonic and delicate benthic invertebrate animal life to be maintained in the western lagoon rather than being washed out to sea or buried by wave turmoil in sediment during winter rainstorms. The proposed large fetch with wind waves facilitated by the removal of the wooden bridges and connected islands, would destroy these conditions.
>
> In this respect, extensive dredging and removal of the bridges and islands is not desirable for the Tidewater Goby nor the native vegetation and invertebrate wildlife of dragonflies, mayflies, damselflies, planktonic copepods and amphipods and other aquatic insects and crustaceans, because it would alter the current stabilized conditions within the western lagoon. Eutrophication is a natural part of ecology and desirable in summer for bodies of freshwater and low salinity wetlands. This natural condition is good for native plants, native invertebrate animals, native fish, native birds and native mammals.

> Malibu Lagoon is naturally above sea level at a mountain front with its river mouth influenced by alluvium, and therefore it is raised or perched. This type of lagoon is largely fresh-water rather than salt-water dominated creating favorable conditions for the Tidewater Goby's survival. Dredging the lagoon to lower the sea-level elevation will disrupt the ecological equilibrium found now after approximately 30 years since the last 1983 restoration."

The USFWS' August 26, 2009 biological opinion failed to adequately analyze the effects of this project on the critical habitat of the Tidewater Goby. The proposed project will result in significant damage or more likely the loss of or adverse impacts to Primary Constituent Elements b and c as described on page 65003 of the October 19, 2011, proposed re-designation of critical habitat. *To wit* "submerged and emergent aquatic vegetation, such as *Potamogeton pectinatus, Ruppia maritima, Typha latifolia* and *Scirpus* spp., that provides protection from predators and high flow event" and "presence of a sand bar(s) across the mouth of a lagoon or estuary during the late spring, summer and fall that closes or partially closes the lagoon or estuary, thereby providing relatively stable water levels and salinity."

The project goal is to reduce nutrient availability and increase circulation of water within the western lagoon during both open and closed estuary conditions. If the project is successful at achieving its stated goals, the cover of submerged and emergent aquatic vegetation (especially *Ruppia* spp.) will be decreased because it is not tolerant of high saline conditions. The design goal of increased tidal circulation during open lagoon conditions will adversely impact those species of submerged aquatic vegetation that characterize the brackish marsh habitat for Tidewater Goby.

Speaking in support of the project, Dr. Martha Sutula of the Southern California Coastal Water Research Project, stated at the Coastal Commission hearing for the project, "I think it is important to consider that the brackish water is an important part of the habitat, by developing this configuration that is not likely to eliminate it, but just *going to decrease the density*, and I think it is, overall, in my opinion, a reasonable design to balance the water quality aspects…" [*emphasis added.*] In other words, project proponent Dr. Sutula acknowledges that the project design would adversely affect Primary Constituent element B of Tidewater Goby critical habitat at Malibu Lagoon through the mechanism of increasing tidal flows within the lagoon. [So although the project could possibly increase the total area that would support submerged aquatic vegetation, it would not necessarily be as suitable for the Tidewater Goby.]

The project EIR (Environmental Impact Report) acknowledges that the changes in configuration of the western lagoon could change the frequency and duration of closure of the sandbar across the mouth of Malibu Creek (Primary Constituent element c of Tidewater Goby critical habitat.) The EIR (pp. 2-9) states, "The project could affect natural tidal lagoon opening and closure patterns." While the EIR goes on to state that such changes are "not anticipated" the FWS Biological Opinion does not even discuss the potential adverse impacts to this primary constituent element of Tidewater Goby critical habitat. The project is designed to point the opening of the west lagoon at the mouth of Malibu Creek and to increase tidal flow in and out of the lagoon. No evidence, other than a conclusory statement that changes are "not anticipated" is given that these natural closure patterns, which are essential to Tidewater Goby survival, will not be altered.

Another reason for withdrawal of the authorization for this project, or at minimum a re-initiation of consultation is the important genetic composition of the Malibu Creek/Lagoon population of Tidewater Goby, as explained in a declaration to the California Superior Court in San Francisco in May, 2011, biologist Robert van de Hoek states that:

> "…an aggressive competitor, namely the Shimofuri Goby, is threatening to outcompete this sister-population in the Ventura River area (Moyle, 2002; pers. comm.. 1 October 2010), making protection of the Malibu Lagoon populations of Tidewater gobies of regional significance….The Malibu Lagoon population of Tidewater gobies is of a unique genetic makeup, transplanted originally from the Ventura River Lagoon."

Withdrawal of authorization and re-initiation of consultation under the ESA are also required based on new information from the report* by Dr. David Jacobs, Dr. Travis Longcore & Dr. Eric Stein, in which their analysis of closure of coastal estuaries in the west leads them to draw conclusions about previous coastal wetland restoration being based on faulty assumptions. These assumptions relate directly to the Tidewater Goby and this species' needs related to low salinity, shallow, still water – which is provided in Malibu Lagoon currently, but which would be altered based on the dredging plans in the subject project. In particular, USFWS should consider this report's framework to describe the range of closure states that characterize California estuaries.

*http://www.urbanwildlands.org/Resources/619.a_EstuarineClassificationRestorationDesign.pdf

Even when Malibu Creek is open to the ocean, the depth of the opening does not encompass the full range of tide heights. The breached lagoon conditions will usually only open down to the middle of the range between high and low tide, although opening lower in the tidal range will occur during high rainfall years such as during the 1997-1998 study reported in the 2000 UCLA report ("Lower Malibu Creek and Lagoon Resource Enhancement and Management" by Ambrose and Orme.)

The project as a whole is based on the rationale that reconfiguration of the western channels will result in the level of circulation and tidal flushing as would be seen in fully tidal estuaries. The natural degree of opening (as measured by the depth of the channel opened to the ocean) at Malibu Creek does not support this conclusion. The EIR erroneously uses other estuaries with different degrees of opening as benchmarks to trigger remedial action for water circulation (p. 65 of Final Malibu Lagoon Restoration and Enhancement Plan, incorporated into EIR): Carpinteria Marsh, Talbert Marsh, and Batiquitos Lagoon. For example, Carpinteria Marsh opens much lower in the tidal range than does Malibu Creek. (See Table 2 of Jacobs et al.)

Additionally, the USFWS Biological Opinion (BO) does not discuss the ongoing management measures that are part and parcel of the proposed project. The BO does not make reference to these measures, which would be based on the following triggers:

> "the west arm main channel closes off from the main lagoon by sedimentation, and/or
>
> Peak tidal flow velocity drops to less than 0.25 feet per second, and/or tide range drops to 1 foot during spring tides. This value is an estimate based on adequate tidal flushing measured at other

> sites (Carpinteria Marsh, Talbert Marsh, and Batiquitos Lagoon), and observations made at Malibu Lagoon in the summer of 2004 (M&N, 2005)."

In the events of such actions, the project description includes, but USFWS does not analyze, the following actions:

> "Do nothing and allow the entire lagoon to close and fill during summer, and monitor the natural breach the following fall season to identify if the sediment deposit is scoured; or
>
> Manually open the closure between the west lagoon and main lagoon with either hand-held equipment or larger earthmoving equipment such as a backhoe; and/or
>
> Create a connection to the main creek via an alternate path to route water through the West Arms to eventually breach the barrier to the main lagoon."

These actions are based on a faulty choice of reference systems and would harm the primary constituent elements of critical habitat for Tidewater Goby. The reference systems are faulty because:

1. Carpinteria Marsh is a very different type of estuary. It is formed by trapped space from a barrier spit while Malibu Creek is formed hydraulically. Carpinteria is in a coastal setting that is prograding, while Malibu Creek is not and the watersheds are of different sizes and steepness (see Jacobs et al. 2011; Table 2).

2. Batiquitos Lagoon and Talbert Marsh are inappropriate reference systems because they are both artificially jettied open and their tidal flow dynamics are consequently altered dramatically from natural conditions (both were closing estuaries before "restoration").

3. Attempting to duplicate the tidal flow rates from these systems could adversely affect Tidewater Gobies.

Furthermore, the BO does not even discuss subsequent use of heavy equipment in Malibu Lagoon for the purpose of maintaining arbitrary tidal flow rates equivalent to those at inappropriately chosen reference sites.

Additional new information about the Tidewater Goby required by the Endangered Species Act to be considered in a re-initiation of consultation includes new DNA analysis that Dr. Jacobs has undertaken in his UCLA lab. This knowledge is readily available and we believe has been discussed with the recovery team for Tidewater Goby, of which the USFWS is a member, so the USFWS needs to consider this information in full.

Besides this failure to comply with ESA mandates, there is another reason that re-initiation is required in order for strict compliance with the ESA. The premise on which the Technical Assistance letter's conclusion was based is faulty, from a scientific perspective.

While it is true that Tidewater Goby can breed at other times of year, at Malibu Lagoon the ideal time for breeding is during the spring, summer and fall when the still, shallow lagoon waters are not subject to wave action due to the closed sand bar condition, and also because of the abundance of Wigeon grass (*Ruppia* spp.) which provides cover, protection from predators and food sources for this endangered fish.

In fact, Dr. Camm Swift, the senior investigator, in Dagit & Swift, "Malibu Lagoon Fish Survey 20 June 2005" (2005: p.5), has concluded that, indeed, the most important time for protecting the Tidewater Goby is from May through November.

> "The abundance of Tidewater Gobies poses a significant constraint to the proposed restoration. The construction of the proposed restoration of Malibu Lagoon should be timed to avoid disturbance of the western shoreline during the months of May- November, when larval Tidewater Gobies are using the near-shore habitat."

In addition, in the June, 2005 when the field work was being done for the Dagit & Swift report, one of the sampling stations was so "dominated by tidewater gobies" that:

> "In order to avoid accidental take or injury, we ceased seining at this location." Dagit & Swift (2005: p. 21)

This location (station #1) is, according to construction documents, exactly at or immediately adjacent to where a dam is scheduled to be constructed as part of the "restoration" project – in June 2012, corresponding to the same time of year when the larval Tidewater Goby were found in such numbers that the acknowledged Tidewater Goby expert, Dr. Camm Swift, was not even comfortable sampling in this area through much less invasive work of seining than what is planned with the dam construction, lagoon draining, bulldozing and dredging.

In the final conclusion to this report, Dagit & Swift (2005: p.29) states:

> "The abundance of Tidewater Gobies this year poses a significant constraint to the proposed restoration. .... The construction of the proposed restoration of Malibu Lagoon should be timed to avoid disturbance of the western shoreline during the months of May – November, when larval Tidewater Gobies are using the near-shore habitat."

Altering the date of construction to be at the very same time that this conclusion states should be timed to avoid is in absolute opposition to the Endangered Species Act's mandate to take all possible measures to insure protection of listed species.

CALIFORNIA LEAST TERN

In addition to the Tidewater Goby, the California Least Tern inhabits the action area. While the original 30-page August 26, 2009 letter to the Army Corps from the USFWS claims the Least Tern is "likely to be disturbed by the presence of project workers, noise from equipment, and project activities," the extent of disturbance was not deemed to be such that this species might be harmed.

However, this analysis was based on the fact that at the time the letter was written, the USFWS presumed that "State Parks has proposed to limit work to outside of the months of July and August" – which indeed is what State Parks stated and agreed to for mitigation for breeding and post-breeding birds (including the California Least Tern) in the Final Environmental Impact Report (FEIR) that it certified.

When the much shorter 1.5 page letter changing the timing of the project work to take place from June 1 through October 31, which was forbidden in the FEIR mitigations, there was no rationale or analysis provided by the USFWS as to why the California Least Tern would suffer no additional harm, despite the time period being changed to include construction activities and even elimination of foraging habitat for the California Least Tern.

While a landscape architect who is serving as the manager for the project has informed a former Coastal Commissioner in an ex parte communication, when asked, that this species does not feed in the western part of the lagoon that is the project site, long-time birders and biologists who have observed this area for many years have observed California Least Tern feeding in this very area during the summer months. Thus, an analysis, as required under the Endangered Species Act is required, factoring in this new information – not just a one line non-sequitur conclusion that says:

> "Therefore, because the tidewater gobies [sic] are known to breed year round and the fact that the U.S. Army Corps of Engineers and California Department of Parks and Recreation have proposed to use the protective measures described in the biological opinion, we believe the change in construction activity timing from outside of May 1 through November 1 to this range of months will not result in additional affects to the California least tern or Tidewater Goby and its critical habitat beyond those already considered in the biological opinion (1-8-08-F-4)."

The breeding times of Tidewater Goby, combined with a significant change in construction timing that allows the project to proceed at the time that was expressly forbidden in both the FEIR and in the August 29, 2009 Biological Opinion letter, can not logically lead to a conclusion that the California Least Tern, a completely different species with different needs from the Tidewater Goby, will not suffer from additional affects. The January 8, 2010, letter is thus, an insufficient analysis and not in compliance with the mandates of the ESA that USFWS is required to follow, especially related to the California Least Tern.

At the very least, the USFWS must re-initiate consultation and provide an adequate analysis of whether or not "take" of this endangered bird species is likely when the adult birds bring their young to Malibu Lagoon (as is their habit) to feed in wetland lagoon channels which have been drained and no longer provide fish for food.

WESTERN SNOWY PLOVER

As stated earlier in this letter, while the initial Biological Opinion issued by the USFWS stated that, "western Snowy Plovers are not known to breed within the study area," there is new information available about the Western Snowy Plover and its presence at and near the project site. There is also new information about the construction activities that are likely to impact this species and, perhaps, cause it not to nest in an area where scientists, government agencies and bird protection advocates have been working to achieve that very goal.

Western Snowy Plover has been observed in numbers in excess of 50 for the past several years on the sandy beach berm in locations where chlorinated water will be pumped out to the sea after an extensive dewatering operation that is part of this project. The dewatering system for this project and its extensive nature was not known to the USFWS at the time of the initial consultation, and this system and its potential impacts on Western Snowy Plover is essential to comply with the Endangered Species Act.

In fact, last night at the Malibu City Council meeting, the City Manager, Jim Thorsen announced that his discussion with Art Unger, Director of the Los Angeles Regional Water Quality Control Board, it was revealed that the project proponents' dewatering plan is not sufficient and the State Parks Dept. would need to submit a new plan. This circumstance underscores the need for USFWS and the Army Corps to, likewise, review the dewatering plan and determine how it will impact listed species, including the Tidewater Goby, California Least Tern and Western Snowy Plover.

Currently, and for the past two months, a fenced-in area has been marked specifically to encourage breeding of this species on the sandy area less then 100 ft. from the project site, and possibly in the project boundaries where dewatering activities will have an impact.

A re-initiation of consultation for this species is required to comply with the mandates of the Endangered Species Act.

ADDITIONAL NEW INFORMATION

Because of new information now available from the US Geological Survey there is a reason to believe that the Environmental Baseline has changed, which also would prompt a re-initiation of consultation according to provisions of the ESA.

http://www.malibucity.org/download/index.cfm/fuseaction/download/cid/17213/

PROJECT TIMING

In addition, one of the primary reasons during the permitting process that project applicants' representatives have provided for needing to change the timing of the project construction was that they needed to balance the needs of the endangered Southern Steelhead *(O. mykiss.)* In fact, the Biological Assessment prepared by Jones & Stokes revealed that there no Southern Steelhead were found in Malibu Lagoon during surveys for the environmental review.

Later, after the California Coastal Commission permit was approved, in several public settings, representatives of the California State Parks Department have admitted that the reason they sought a change in project construction timing was because it would be too expensive and unwieldy to maneuver bulldozers, dredgers and other heavy equipment in the muddy soils of the lagoon during winter storm season. There is nothing in the Endangered Species Act that allows for balancing of the needs of bulldozers, dredgers and heavy equipment operators to those of imperiled species like the Tidewater Goby, California Least Tern and Western Snowy Plover.

The certified EIR's mitigations required the project be constructed outside of May to November, and recommendations from the Dagit Swift fish report also required this timing. Breeding of numerous bird species, as protected under the Migratory Bird Treaty Act, is occurring at Malibu Lagoon presently and is expected to continue for the next few months.

REQUIRED ACTION

By neglecting the duties of the Army Corps to analyze and consider the propriety of issuance of a section 404 permit for dredge and fill activities, as well as other habitat destruction on the subject site, the Army Corps, the Secretary, USFWS and California State Parks, the California State Coastal Conservancy and the California Coastal Commission have violated section 7, and likely will violate section 9 of the Endangered Species Act (ESA.)

Pursuant to the citizen suit provision of the ESA, 16 U.S.A. § 1540 (g)(1)(A), and subject to the emergency exception contained in section 16 U.S.C. §1540(g)(2)(C), and the citizen suit provision of the Clean Water Act (Federal Water Pollution Control Act, 33 USC 1251 et seq.), we hereby place you on notice of our intention to commence a civil action under the ESA, Clean Water Act and APA to challenge the foregoing violations of law and any violations that may occur after the date of this notice letter.

For all of the above stated reasons, the US Army Corps of Engineers and other possible entities named in this letter have violated and remain in ongoing violation of section 7 and likely will be in violation of section 9 of the ESA. **If these violations of law are not rectified immediately and without delay,** Wetlands Defense Fund and CLEAN intend to file suit for declaratory and injunctive relief, as well as attorney and expert witness fees and costs. 16 U.S.C. § 1540(g). This notice letter was prepared based on good faith information and belief after reasonably diligent investigation.

The undersigned and the organization represented thereby is willing to pursue negotiations to resolve the issues raised in this notice letter if possible. If you have any questions about the issues raised in this letter or if you believe that any of the allegations are incorrect, please contact us by telephone or mail.

WETLANDS DEFENSE FUND is organized under the laws of the State of California. Its address is 322 Culver Boulevard, Ste. 317, Playa del Rey, California, 90293, telephone number (310) 821-9045 CLEAN is organized under the laws of the State of California. Its address is 181 Culver Blvd., Ste. C, Playa del Rey, CA 90293, telephone number (310) 877-2435.

If you wish to contact us before we file a complaint, we request that you do so as quickly as possible. We intend to file suit 60 days after the date of this letter.

Sincerely,

Marcia Hanscom

Marcia Hanscom
Executive Director
WETLANDS DEFENSE FUND
Protecting wetlands ~ the cradle of life
322 Culver Blvd., Ste. 317
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Robert van de Hoek

Robert van de Hoek
President & Wildlife Biologist
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cc: The Law Offices of James Birkelund

Wetlands Defense Fund
Protecting wetlands
the cradle of life

CLEAN
COASTAL LAW ENFORCEMENT ACTION NETWORK

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HAND DELIVERED AT 6.14.12 MEETING OF CALIFORNIA COASTAL COMMISSION

June 14, 2012

The Honorable Mary Shallenberger, Chair, & Honorable Commissioners
California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

IMMEDIATE EMERGENCY Enforcement Request Permit (CDP) #4-07-098 "Malibu Lagoon Restoration & Enhancement Plan"

Dear Commissioners:

We write to request IMMEDIATE ENFORCEMENT inspection at Malibu Lagoon re: the permit #4-07-098 that provides permission under the California Coastal Act for the Santa Monica Bay Restoration Foundation, California State Parks and the Resource Conservation District of the Santa Monica Mountains to proceed with what is referred to in the record as the "Malibu Lagoon Restoration & Enhancement Plan."

There are numerous permit compliance problems which we believe should cause the Commission to want to place this project on hold and convene a public hearing to determine the appropriate remedies for these permit compliance problems.

As well, the permit holder is proceeding with work in spite of an incomplete and unapproved dewatering plan and an incomplete and unapproved public access plan.

EXHIBIT 4
R-4-07-098 (Malibu Lagoon Revocation Request)

CONDITION COMPLIANCE PROBLEMS:

The California Coastal Commission, as we have witnessed its work over the past 20 years, takes great pains in compiling, approving and requiring compliance with conditions that staff and commissioners deem to be protective of coastal resources.

I. Public Access Program

On page 26 of the staff report that the Commission approved in October, 2010, the following condition was outlined entitled "Final Public Access Program":

\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`

A. *Prior to commencement of development, [emphasis in original document]* the applicant shall submit, for the review and approval of the Executive Director, a Final Public Access Program that describes the methods (including signs, fencing, posting of security guards, etc.) by which safe public access to or around construction areas and/or staging areas shall be maintained **during all project operations. [emphasis added]** The plan shall also include signs directing the public to alternative parking areas for the duration of construction and staging. Where public paths will be closed during active operations, a person(s) shall be on-site to detour traffic or adequate fencing and signage shall be used. The applicant shall maintain public access pursuant to the approved version of the report. Any proposed changes to the approved program shall be reported to the Executive Director. No change to the program shall occur without a Commission-approved amendment to the permit unless the Executive Director determines that no such amendment is required.

B. Where use of public parking spaces is unavoidable, the minimum number of public parking spaces (on and off-street) that are required at each receiver site for the staging of equipmemnt, machinery and employee parking shall be used. At each site, the number of public parking spaces utilized shall be the minimum necessary to implement the project.

C. The applicant shall post each construction site with a notice indicating the expected dates of construction and/or trail or public access closures (if temporarily necessary.)

\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`

Of the excerpt detailed above, the following are violations of compliance terms:

"Development" officially began on June 4, two days before an "initial" plan entitled "Site Access & Staging Plan Before Construction of Dike" was submitted (stamped as received by the South Central Coast District in Ventura on June 6, 2012.) This plan includes a description of it: "Site access Before Contruction of Dike, After the Construction of Dike Public Access to the Beach will be From Top of the Dike Per Separate Plan." **Where IS that separate plan?** It is not in the Coastal Commission file as of this week. If there is a separate plan not yet completed, then a **"Final Public Access Program"** has not yet been completed, and "development" – which has been EXTENSIVE this week, including wholesale destruction of ACRES of native ESHA habitat – was done illegally and without a valid permit.

In addition, the following condition terms were not and have not been met:

• there are no signs directing the public to alternative public parking, as is required in the above excerpted conditions that were approved by the Commission.

• The applicant shall post each construction site with a notice indicating **the expected dates of construction and/or trail or public access closures** (if temporarily necessary.)

As is stated above:

The applicant shall maintain public access pursuant to the approved version of the report. Any proposed changes to the approved program shall be reported to the Executive Director. No change to the program shall occur without a Commission-approved amendment to the permit unless the Executive Director determines that no such amendment is required.

In addition, there are several other public access issues that need to be addressed in whatever final public access program is approved (which it does not appear has been finalized, due to the "separate plan" involving the dike access not being available to the public or in coastal commission files.)

A. At no time previous to the recent week has the public understood or been informed, nor was the Coastal Commission itself informed that public access to Surfrider Beach's 3rd point would be atop a sand-bag constructed dike that has not been engineered as of yet. Concerns re: ADA compliance, wheelchair accessibility, stroller accessibility and other safety concerns have not been vetted nor addressed.

B. Currently – this week – **public access is ONLY available sporadically** along the perimeter access road – as the bridges trail has been shut off completely from public access, and heavy machinery is using the perimeter access path for habitat removal purposes.

C. The PIPE which is going to be moving water from the dewatering operation to the ocean will be directly blocking the only emergency access available to lifeguards and as a secondary emergency access from the Colony residential homes. Craig Sap of State Parks informed us that the emergency lifeguard access – since the perimeter trail will be unavailable at times – is via this gate, yet the dewatering pipe will be blocking such vehicular access.

Given the continued reassurances by project proponents that the "Malibu Lagoon Restoration & Enhancement Plan" that public access WOULD NOT BE IMPEDED, it is shocking and completely unacceptable that public access provisions to an area that is one of southern California's most popular beach destinations – in the height of summer tourism season – is being treated so cavalierly by the state agencies that are carrying out this plan. Those who participated in the October, 2010, hearing on this issue are convinced that this permit would never have been granted had such egregious blocking of public access from this important coastal region during heavy summer use were known and understood at the time.

II. Final Dewatering Plan

On page 15 of the staff report that the Commission approved in October, 2010, the following condition was outlined entitled "Final Dewatering Plan":

\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`

***Prior to issuance of the coastal development permit**, [emphasis in original document]* the applicant shall submit, for the review and approval of the Executive Director, a Final Revised Dewatering Plan.

A. The Final Dewatering Plan **shall delete all references to a one-time mechanical breach of the lagoon** *[emphasis added – in other words, it was unacceptable to the Coastal Commission and its staff that a breach of the lagoon during Tidewater Goby breeding season would occur, in spite of the desires of the project managers to have such a scenario, which would make the job easier if not possible],* and

B. The Final Dewatering Plan shall incorporate a tidewater goby, southern steelhead, and other sensitive aquatic species dewatering protection plan including the following requirements:

The applicant shall…

i.) The qualified biologist or environmental resource specialist…

ii.) The qualified biologist or environmental resource specialist and a crew working under his/her direction shall clear all fish, including tidewater gobies and southern steelhead, from the area to be dewatered prior to construction. The capture, handling, exclusion, and relocation activities identified by the qualified biologist **<u>will be completed no earlier than 48 hours before construction begins</u>** to minimize the probability that listed species will recolonize the affected areas. **<u>[emphasis added.]</u>**

The applicant has already begun fish trapping and "moving" – on Tuesday June 12, 2012, and maybe before that date, but we have photo documentation and eye witness observations of that activity on June 12, 2012, yet the dewatering plan that would allow the "construction" in the lagoon channels is not yet approved and not anticipated to occur until at least next week, and possibly beyond that time.

Therefore, the provision that states that the fish trapping team should not capture, handle, exclude or relocate the Tidewater Goby and other fish earlier than 48 hours before construction begins has been violated. The exclusion of fish from certain areas began immediately on June 11 and June 12 when plastic curtains were installed (to prevent tidal waters from entering the western arms of the channel). This activity only was made possible by the illegal – and mysterious? - breaching of the sand bar had happened in the early morning of Sunday, June 10, 2012.

As you might be aware, the permit approval was VERY clear that no mechanical breaching of the sand bar to the lagoon was approved. Sometime between 12 midnight of June 9 and 5:30 am on June 10, the sand bar was manually breached – illegally – by unknown individuals.

In addition, the following condition terms may not have been met:

III. Herbicide Use

Following is the language from the permit on this topic:

9. Herbicide Use

No herbicides shall be used during the proposed restoration project or during subsequent maintenance of revegetation plantings for the life of the project.

Observers of the Malibu Lagoon area have witnessed and reported to us the use of herbicides on mustard plants in the project area. Please investigate this claim of a serious violation of the terms of the permit conditions.

While our own investigations are ongoing, and it is possible there are other violations of the permit conditions for the Malibu Lagoon project, we are most concerned that these very important issues related to public access and dewatering, which is directly related to the endangered Tidewater Goby and its breeding season, have not been complied with according to the terms of the permit that the Coastal Commission granted.

ENDANGERED SPECIES RISKS HIGHLIGHTED:

In addition to these issues described above, on May 30, 2012, a 60-day notice letter was sent to the United States Secretary of the Interior, the Pentagon's chief of the Army Corps of Engineers, the Director of the US Fish & Wildlife Service, the Coastal Commission's Charles Lester and other relevant authorities, as required under the federal Endangered Species Act. This letter outlines violations of the Clean Water Act and the Endangered Species Act, which as agents of the State of California, the Coastal Commission is also required to uphold. (see attached letter.)

We continue to believe that these violations are ongoing and have likely been exacerbated since the letter was sent, especially since the sand bar at the lagoon was artificially breached, conveniently to the project managers and contractors who were just a few days earlier heard by members of the concerned public to be lamenting and wondering aloud how they were going to do the work they wanted to do with the lagoon so full of water (as is its natural condition during closed sand bar conditions at this time of year and is necessary for the successful and optimum breeding conditions for the endangered Tidewater Goby.)

Please direct your enforcement staff to immediately go to Malibu Lagoon today or tomorrow at the latest to inspect the site and to ask questions of those who are carrying out the work there, including, but not limited to inquiries to Ms. Rosi Dagit, who has been charged with endangered species removal and care for the project. Please ask for solid documentation and demand answers to questions about the number of Tidewater Goby fish and California Killifish and other species of Gobies that were harmed in any way (including having breeding cycle disruption) during the lagoon breaching and the subsequent fish catching that she and her staff have been carrying out. (Fin damage, lateral line damage, snout damage and tail damage all need to be documented.)

The US Fish & Wildlife Service will be grateful to know of the results of your enforcement staff's inspection, as the Endangered Species Act and the Biological Opinion that USF&WS issued include "take" provisions that not only include death to individuals of the Tidewater Goby species, but also any harm or injury that may have occurred. The USF&WS may require re-initiation of consultation based on this information.

In addition, we remind the Commission of its own duty to uphold protections for endangered species.

Sincerely,

Marcia Hanscom /s/

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Executive Director
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Robert van de Hoek /s/

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cc: The Law Offices of James Birkelund

STATE OF CALIFORNIA – THE NATURAL RESOURCES AGENCY

EDMUND G. BROWN, JR, *Governor*

CALIFORNIA COASTAL COMMISSION

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22 June 2012

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Roy van de Hoek
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Re: Malibu Lagoon Restoration and Enhancement Plan – Report of alleged violations of CDP No. 4-07-098

Dear Ms. Hanscom and Mr. van de Hoek:

I am in receipt of your letter dated June 14, 2012, a hard copy of which was hand-delivered to Lisa Haage (Chief of Enforcement, CCC) at the Commission's hearing in Huntington Beach on June 14, 2012 and received by me on June 18, 2012. The letter is regarding alleged violations of the terms and conditions of Coastal Development Permit ("CDP") No. 4-07- 098 – issued to the California Department of Parks and Recreation ("DPR") authorizing the Malibu Lagoon Restoration and Enhancement Plan.

On June 20, 2012, I called Mark Abramson (Project Manager) and arranged to meet with him and Suzanne Goode (Senior Ecologist, DPR) at the project site on that same day. At the project site, I discussed the various allegations in your letter with Mr. Abramson and Ms. Goode and I observed conditions onsite. In addition, I spoke with other people involved in restoration work and monitoring at the project site. Also on June 20, 2012, Jack Ainsworth (Senior Deputy Director, CCC) visited the project site and his observations were similar to mine.

CCC staff also visited the project site on June 11, 2011 to investigate allegations that the sand bar at the mouth of the lagoon had been artificially breached (which you also assert in your letter).

With that background in mind, I will try to address the issues raised in your letter under the same headings:

Public Access Program

The public access program required by CDP No. 4-07-098 was submitted to the Executive Director and approved prior to commencement of construction on June 6, 2012 (not June 4 as your letter alleges). While DPR had people onsite on June 4, actual work (fencing and placement of power poles) did not commence until June 6 at 7:00 am, after receiving clearance from the CCC. DPR has been in close communication with CCC staff before and since

EXHIBIT 5
R-4-07-098 (Malibu Lagoon Revocation Request)

commencement of the project. I am informed by DPR that handmade plywood signage went up immediately and other required signage and notices went up as soon as the fence (upon which they are posted) was up.

When I visited the project site on June 11 public access was open to the beach via the perimeter road. On June 20, public access via the perimeter road was again open and a highly visible white sign with blue letters that says “"path to beach" and a directional arrow was in place. In addition, various maps and notices regarding construction closures and parking locations were posted in multiple locations.

When the perimeter road is required to be closed, public beach access will be via the top of the dike or berm. This is identified in the approved public access program. While temporary access via the perimeter road and/or the dike/berm will not be ADA compliant, the permanent trail after project completion will be. In the meantime, the slope of the road and dike/berm is less than 5% and DPR rangers are available to assist people with special needs during construction. There may be temporary short-term closures of the road and/or berm for safety reasons while equipment is operating. A flag person will be on duty at those times to halt the public until it is safe to proceed.

In your letter you allege that the pipe for dewatering operations will block emergency lifeguard access. Emergency lifeguard access is via the perimeter road and will not be affected by the pipe. The pipe will be about 6 inches in diameter and partially buried. Thus, the pipe should not present a significant obstacle to access in any event.

<u>Final Dewatering Plan</u>

Special Condition 4 of CDP No. 4-07-098 requires the applicant to submit a final revised dewatering plan to the Executive Director for review and approval. The final dewatering plan was approved on May 21, 2012 before the CDP was issued. Portions of Special Condition 4 quoted in your letter were actually included in the approved dewatering plan. Further, pursuant to the dewatering plan approved on May 21, 2012, DPR will submit additional details regarding the filtration treatment system to Commission staff. As of the date of this letter we have not yet received this additional information and dewatering has not occurred. DPR has agreed to not commence dewatering until Commission staff has reviewed this additional information and gives the go-ahead to dewater. When the additional information is received, it will be made available for public review prior to commencement of dewatering.

On June 10, or thereabouts, Malibu Lagoon breached. On June 11, DPR began installing silt and turbidity fencing (fish exclusion) and they began fish capture. The breaching of the lagoon precipitated the need to immediately commence these activities. While construction in upland areas commenced on June 6 (fence and power pole installation) earth moving activities commenced on June 14. As explained above, DPR has an approved dewatering plan, but "dewatering" by DPR has not taken place. However, the breaching of the lagoon resulted in dewatering and thus precipitated commencement of fish capture and exclusion to prevent fish from re-colonizing affected areas during construction. – as is the intent of Special Condition 4.

In your letter you allege that the sand bar at the mouth of the lagoon was "manually breached – illegally – by unknown individuals." Please be advised that this is a serious allegation involving criminal activity. On June 11, 2012, CCC enforcement staff conducted an investigation of the lagoon breaching and found no evidence that the lagoon was artificially breached. Both DPR and USFWS conducted investigations and also found no evidence that the lagoon was artificially breached.

On June 11, I observed (and photographed) evidence that the water level in the lagoon prior to breaching had been very close to the top of the bar. It is quite possible, even likely, that high water level coupled with tide/wind/wave action was responsible for the breaching. I have reviewed Mr. van de Hoek's emails dated June 18, 2012 and June 2012 regarding his theory that the Malibu Lagoon was "mechanically breached". While the tide information and Mr. van de Hoek's observations of high tides washing over the bar are interesting, I see no compelling evidence in these emails that the breach was human-caused. Factors other than the tides could have been at play: perhaps wind and wave action or stream flow. Perhaps the higher tides of a few days before the breaching served to weaken the bar or overfill the lagoon. A variety of factors could have been at play here. If you have other evidence that the breaching was human-caused, please submit same to my attention and I will be happy to review it.

Herbicide Use

In your letter you allege the use of herbicides to control mustard as part of this project. I spoke with the project applicants and they assure me that no herbicides have been used. They pointed out that their project involves the physical removal of vegetation and therefore it would make no sense to use herbicides to control vegetation.

Endangered Species Risks Highlighted

Under this heading in your letter, you ask that CCC staff go to Malibu Lagoon and investigate your various allegations and ask questions of DPR and RCD staff as regards endangered species. I have done so. I understand that no steelhead were moved or handled and that eight gobies (species unknown) were relocated. In addition, other fish (mosquito fish, killifish, etc) were observed and/or handled, but they are not endangered species. I also understand that details regarding fish capture are in DPR's monitoring reports.

Please be advised that CCC staff and DPR staff have been in daily communication since CDP No. 4-07-098 was issued. It appears that every effort is being made by the applicant to comply with the terms and conditions of that permit.

If you have any questions about this letter, please feel free to contact me. If you have questions about the project, please contact Mark Abramson or Suzanne Goode. If you have questions about the permit, please contact Steve Hudson or Jack Ainsworth in our Ventura office.

Sincerely,

N. Patrick Veesart
Enforcement Supervisor

cc: Charles Lester, Executive Director, CCC
John Ainsworth, Senior Deputy Director, CCC

Lisa Haage, Chief of Enforcement, CCC
Steve Hudson, South Central Coast District Manager, CCC
Barbara Carey, Supervisor, Planning and Regulation, CCC
Alex Helperin, Senior Staff Counsel, CCC
Amber Geraghty, Coastal Program Analyst II, CCC
Kristen Hislop, South Central Coast District Enforcement Officer, CCC
Suzanne Goode, Senior Ecologist, DPR
Ann Malcolm, Chief Counsel, DPR
Mark Abramson, Santa Monica Bay Restoration Foundation

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Filed:	2/1/10
180th Day:	07/31/10
270th Day:	10/29/10
Staff:	A. Tysor
Staff Report:	9/29/10
Hearing Date:	10/13/10

Item W6a

STAFF REPORT: REGULAR CALENDAR

APPLICATION NO.: 4-07-098

APPLICANT: California Department of Parks and Recreation

AGENTS: Mark Abramson, Santa Monica Bay Restoration Foundation

PROJECT LOCATION: Malibu Lagoon State Beach, City of Malibu, Los Angeles County

PROJECT DESCRIPTION: Implementation of a Wetland Habitat Restoration and Enhancement Plan for Malibu Lagoon to improve the function of the lagoon ecosystem by recontouring/reconfiguring the lagoon slopes and channels to increase hydrologic flow involving 88,700 cu. yds. of grading (51,200 cu yds. excavation and 37,500 cu. yds. fill); revegetation with native wetland and upland plant species and removal of non-native plant species; construction of a public access trail around lagoon with new interpretive public informational/educational improvements; and implementation of a long-term lagoon monitoring plan.

MOTION & RESOLUTION: Page 10

SUMMARY OF STAFF RECOMMENDATION

Staff recommends **APPROVAL** of the proposed project **with seventeen (17) special conditions** regarding: (1) Construction, Timing, and Sensitive Species Surveys, (2) Erosion Control Plans, (3) Timing, Operations, and Maintenance Responsibilities, (4) Final Dewatering Plan, (5) Final Hydrological Monitoring Plan (6) Habitat (Plant Communities) Vegetation, Restoration Monitoring and Reporting Plan, (7) Final Aquatic Vegetation, Benthos, Fish and Avian Monitoring Plan, (8) Plans Conforming to Engineer's Recommendations, (9) Herbicide Use, (10) Final Public Access Program, (11) Required Approvals, (12) Assumption of Risk, (13) Discharge Requirements, (14) Mitigation Measures, (15) Archaeological Resource Monitoring, (16) Removal of Excavated Material, and (17) New Zealand Mud Snail Measures.

The proposed project is for the implementation of a comprehensive restoration and enhancement plan for Malibu Lagoon. The project includes dewatering the western 12 acre portion of the lagoon and recontouring slopes and channels within the western portion of the lagoon, including 51,200 cu. yds. fill, and 13,700 cu. yds. export of phased grading to improve circulation, increase tidal flow, and enhance habitat diversity. No excavation or recontouring will occur within the main channel of the lagoon. The project includes implementation of a restoration and planting plan to remove non-native plant species and revegetate all disturbed areas with an appropriate mix of native plant species, including low marsh, mid-high marsh, high marsh transitional, and coastal scrub plantings. A north-south oriented temporary berm is proposed in order to temporarily separate the western lagoon area where restoration will occur from the main portion of Malibu Lagoon in order to allow dewatering of the restoration area. A small area adjacent to the Adamson House is proposed to be deepened and replanted. All excavated material will be temporarily stockpiled in designated areas on site, including the parking lot and appropriate erosion control measures are proposed to ensure that uncontrolled runoff does not occur and that there is no potential increase in sedimentation of the lagoon. The project includes detailed plans for management of erosion during construction, a habitat planting plan, a public access, education, and interpretation plan, and a detailed long-term monitoring program for habitat (flora and fauna), water quality during both open and closed lagoon mouth conditions, sediment quality, and lagoon topography/bathymetry.

The project raises several issues relating to the disruption of the current lagoon habitat. Although the restoration project may have short term construction-related impacts, the restoration activities are intended to enhance the long-term value and function of the Malibu Lagoon ecosystem. As explained in Section IV.B. of this report, Site History and Past Commission Action, Malibu Lagoon was reconfigured as part of a restoration effort approved by the Commission in 1979. The proposed restoration project is expected to correct problems created by the previous lagoon restoration effort, including problems with inadequate circulation, habitat function, and water quality. Several special conditions are recommended to ensure that the proposed restoration effort is successful and will comply with Coastal Act policies. **Special Condition (1)** requires an environmental resources specialist to be present during all construction, grading, excavation, vegetation eradication and removal, hauling, and maintenance activities and requires sensitive species surveys and protective measures to assure that construction impacts will not harm (avian and terrestrial) sensitive species. **Special Condition Four (4)** requires a final dewatering plan to assure the proper protection and relocation techniques for tidewater goby, steelhead, and other important aquatic species during dewatering operations. To protect water quality during construction, **Special Conditions (2), (3), and (16)** require that proper construction measures and adequate erosion control measures are implemented. **Special Condition (8)** assures that the applicant will comply with the recommendations contained in all engineering and hydrological reports submitted for the project and **Special Conditions (11)**, **(13)**, and **(14)** require the applicant to obtain and comply with other permits, including any conditions and mitigation measures, issued by other state and federal agencies. To assure appropriate long-term monitoring of the restoration project, **Special Condition (5), Special Condition (6)** and **Special Condition (7)** require the applicant to conduct bi-annual monitoring and submit annual monitoring reports (for at least 5 years) regarding: hydrology, plant community revegetation, aquatic vegetation, benthos, fish, and avian species. If the monitoring reports do not indicate improvement of water circulation, water quality, or indicate impacts to sensitive species, the applicant is required to submit a revised or supplemental plan, certified by a registered engineer and a qualified Resource Specialist, that specifies additional or supplemental measures to modify the portions of the original plan that have failed or are not in conformance with the approved plan. **Special Condition (9)** requires restricts the type of herbicides used and requires procedures for application Archeological resources exist on the site and **Special Condition (15)** requires the applicant to have a qualified archaeologist(s) and appropriate Native American consultant(s) present on-site during all restoration activities which occur within or adjacent to the archaeological sites and to document work and to halt work if necessary. Further, **Special Condition (10)** requires the applicant to develop and implement a public access program to ensure that the public has maximum access to the State Park during construction.

Comment Letters

The Commission received approximately thirty letters from interested parties in response to its July 29, 2010 staff report for this project, which was originally scheduled for the August Commission hearing agenda, but postponed to be heard at the October 2010 Commission hearing. Letters of support for the staff recommendation were received from the United States Environmental Protection Agency, Santa Monica Baykeeper, Santa Monica Bay Restoration Commission, Santa Monica Mountains Conservancy, California Regional Water Quality Control Board, Resource Conservation District of the Santa Monica Mountains, California Trout, Assembly Member Julie Brownley and State Senator Fran Pavley, the National Park Service, Heal the Bay, and Malibu Surfing Association. (**Exhibit 24**)

Letters were also received from several residents of the Malibu Colony community asserting that the proposed project raises the following issues: (1) potential drainage problems on private property due to the design of the new boundary wall (also herein referred to as the “Adamson House” wall) proposed to be located on State Parks property along the shared property line at the southern edge of the western portion of the lagoon between the Malibu Colony residential community and the public accessway, (2) loss of private access gates to public park land from the adjacent residential properties due to construction of new wall along shared property line boundary, (3) loss of emergency fire ingress/egress to public park land for adjacent private property owners due to construction of the new wall along shared property line boundary, and (4) potential increase in fire hazard to adjacent private property owners due the proposed revegetation within Malibu Lagoon. (**Exhibit 24)** A letter was also received from a homeowner in Malibu Colony concerning a private drainage pipe draining into the lagoon. This letter is addressed in the Water Quality Section, below. (**Exhibit 24**)

In response to Malibu Colony residents’ concerns of potential surface flow drainage problems on private property that may result due to the design of the Adamson House wall, the applicant has modified the originally proposed project to address residents’ concerns. The applicant originally proposed a solid masonry wall in this area, but has modified the design of the proposed wall to add openings along the bottom of the wall that will allow stormwater runoff and surface drainage to pass through. These openings will allow for a 50% open condition at grade between masonry piers, adequate to handle loads from a 50 year storm event. Drainage from the property line through the wall will be diverted to a series of vegetated drainage swales (approx. 800 ft. long, with width varying between 6 to 10 ft.) running parallel to the wall face on the north side.

Additionally, the applicant has responded to Malibu Colony residents' concerns that revegetation of the lagoon may increase fire danger by re-designing the project to only include native "low-flammability" plant species, ensuring that no plant species will be used for revegetation on site that are listed by the County of Los Angeles Fire Department Fuel Modification Unit as "undesirable" for fuel modification purposes, The existing site contains tall, dense stands of ornamental trees and shrubs, non-native salt bush, and mixed scrub. The proposed planting plan includes removing these highly flammable species and planting less flammable native species. Further, the applicant has modified the project, in response to the adjacent private property owner's concerns, to now include drainage swales along the perimeter of the Adamson House wall, planted with low ground cover type wetland and upland plants to collect surface drainage and stormwater flows. Thus, in response to comments received by the adjacent private property owners, the project has been revised to reduce the fire risk (compared to current site conditions with the existing vegetation) and to meet all Los Angeles County Fire Department fuel modification standards. Further, as noted above, Malibu Colony residents raised concerns that the proposed boundary wall will eliminate emergency fire ingress/egress to public park land that currently exists. However, although some residences do have a private access gate, many do not have a private access gate to State Parks property for an emergency escape route. In addition, no evidence has been provided to Commission staff that the Fire Department requires private access gates for emergency fire access to or through Malibu Lagoon, either for escape routes or for ingress/egress to respond to a fire or emergency situation. Further, the private residential gates do not provide public access to or from the State Park for members of the public.

The City of Malibu submitted a letter raising several concerns with the July 29, 2010 staff report and recommendation. The City's letter asserts that the proposed wetland restoration project may result in potential increases in bacteria and nutrients in the water which could result in impacts to water quality at Surfrider Beach. The City also asserts that the applicant should be required to monitor bacteria levels within the lagoon including Total Coliform, Fecal Coliform and Enterococcus. The City requests that the water quality monitoring plan include all constituents subject to the Total Maximum Daily Load ("TMDL") requirements. Further, the City relayed concerns related to the lagoon restoration design, revegetation plan design, invasive species, impacts to Malibu Colony drainage due to the design of the Adamson House wall, and dewatering impacts. (**Exhibit 24**) Approximately ten studies related to lagoon water quality were attached to the City's letter. (**Exhibit 24**)

As indicated above, the applicant has addressed the issue of the Malibu Colony drainage concerns by modifying the originally proposed project to redesign the Adamson House wall. Regarding invasive species, the applicant has clarified the project description by including specific measures that will be taken to reduce the spread of the New Zealand mud snail. Additionally, as noted in the City's letter, the City had not yet reviewed any approvals or other evidence that the Regional Water Quality Control Board had reviewed the proposed restoration project. However, the Regional Water Quality Control Board has since submitted a letter to the Commission, dated August 6, 2010, in support of the proposed project, and it is the Regional Water Quality Control Board that is responsible for implementing TMDL requirements, regulated under the Federal Clean Water Act.

The City has raised concerns over degradation of water quality due to lagoon design, revegetation, and construction impacts. The City has expressed concerns that revegetation of Malibu Lagoon may increase bacteria produced from the natural decaying process due to an increased amount of vegetation and more bank surface area. The City's letter also states that "[i]t is noted that improved circulation and increased tidal flow, a goal of the project, will decrease contact time with lagoon capable of removing some bacteria." The Commission notes that one of the main goals of this project is to improve water quality in the lagoon by increasing circulation and tidal flushing through the reconfiguration of the lagoon channel. Moreover, the proposed reconfiguration is expected to reduce fine sediment accumulation, which in turn will allow water flow to increase, resulting in less stagnant water. Revegetation of the lagoon is expected to enhance overall habitat quality and is not expected to adversely impact water quality. Although there may be inadvertent short term impacts to water quality during construction due to increased turbidity and disturbance of fine sediments, overall water quality is expected to improve as a result of the project over the long term, as discussed throughout this report. All dewatering will include filtration, decontamination, and testing before discharge to the Pacific Ocean, pursuant to the Regional Water Quality Control Board approvals. Specifically, California Regional Water Quality Control Board, NPDES Permit No. CAG994004, Order No. R4-2008-0032, and Monitoring and Reporting Program No. CI-9573, dated March 9, 2010, list specific discharge limits for several constituents, including Fecal Coliform (*see* P.50-51 of this report). Also, staff notes that **Special Condition Five (5)** requires the applicant to submit a final hydrological monitoring plan, including success criteria and supplemental measures to take if water quality in the lagoon has not improved, as shown by measuring a variety of parameters, some of which include measuring nutrients in sediment samples and nutrients in surface water and bottom water. The applicant has agreed to compile monitoring data for bacteria levels and provide the results as part of the applicant's annual monitoring reports, required by **Special Condition Five 5.** Bacteria levels are currently monitored by the City of Los Angeles Bureau of Sanitation, Environmental Monitoring Division, at three sites within the lagoon and by Las Virgenes Municipal Water District at one site near the Pacific Coast Highway bridge. The applicant is required to incorporate this bacteria data into the monitoring reports required by **Special Condition Five (5).**

Additionally, the Wetlands Defense Fund (**Exhibit 24**), along with approximately 15 other form letters from residents of the Malibu Colony community (**Exhibit 24**) were submitted to the commission to request additional time to comment and review the July

29, 2010 staff report and recommendation. In part in response to those requests, the Commission postponed the hearing on this matter from its August meeting to this October meeting, providing the public approximately 75 days to review the staff recommendation.

PROCEDURAL NOTE: PROJECT JURISDICTION AND CONSOLIDATED REVIEW

The proposed project includes components that are located within the City of Malibu's Local Coastal Program (LCP) jurisdiction as well as components within the retained jurisdiction of the Coastal Commission. The City of Malibu would typically have jurisdiction over the onshore portions of the project within its LCP jurisdiction. However, Section 30601.3 of the Coastal Act authorizes the Commission to process a consolidated coastal development permit application, when its criteria are satisfied, for both aspects of a proposed project that would otherwise require a coastal development permit from both a local government with a certified local coastal program and the Commission.

The standard of review for a consolidated coastal development permit application submitted pursuant to Section 30601.3(a) shall follow Chapter 3 of the Coastal Act (commencing with Section 30200), with the appropriate local coastal program used as guidance.

The proposed development is the restoration of Malibu Lagoon and its upland public park facilities and public amenities. Although the portions of the project involving wetland restoration are located within the Commission retained coastal development permit jurisdiction, the construction and replacement of the upland components of the project cross the boundary of the Commission's retained jurisdiction into areas where the City of Malibu's LCP is effective. Typically, development located within a certified area requires a coastal development permit from the certified local government. However, in this case, the project work that would occur within the Commission's original jurisdiction, including reconfiguration of the 12-acre western portion of the lagoon, is physically integrated with the activities that would occur outside the area of retained jurisdiction (i.e. in the City's permit jurisdiction).

Pursuant to Section 30601.3(a)(2), the applicant, appropriate local government, and the Commission may agree to consolidate a permit action for a project that spans local and state jurisdictions. In this case, the City of Malibu, in a letter to Commission staff dated October 25, 2007, requested that the Commission assume jurisdiction over all activities associated with the proposed project. The applicant both consented to, and facilitated this consolidated jurisdictional process. Further, public participation is not substantially impaired by the consolidated review in this case because the other portions of the project were reviewed by the City of Malibu in a public hearing process and the subject portion of the project was made known at the time. Additionally, an Environmental Impact Report was prepared for this project. Further, the subject application will be noticed and heard consistent with the Coastal Commission's public hearing process, which facilitates both written and oral comment.

Table of Contents

I. STAFF RECOMMENDATION 10

II. STANDARD CONDITIONS 10

III. SPECIAL CONDITIONS..11

1. Construction Timing and Sensitive Species Surveys 11
2. Erosion Control Plans.. 12
3. Timing, Operations, and Maintenance Responsibilities 14
4. Final Dewatering Plan.. 15
5. Final Hydrological Monitoring Plan 16
6. Plant Communities Restoration, Monitoring, and Reporting Plan............................. 21
7. Final Benthic Invertebrate, Fish, Avian and Algal Monitoring and Reporting Plan . 24
8. Plans Conforming to Engineer's Recommendations... 25
9. Herbicide Use... 25
10. Final Public Access Program.. 26
11. Required Approvals... 26
12. Assumption of Risk 26
13. Discharge Requirements 27
14. Mitigation Measures.. 27
15. Archaeological Resources and Monitoring.. 27
16. Removal of Excavated Material 27
17. New Zealand Mud Snail 28

IV. FINDINGS AND DECLARATIONS 29

A. PROJECT DESCRIPTION.. 29
B. PROJECT LOCATION AND BACKGROUND 38
C. DIKING, FILLING, AND DREDGING OF COASTAL WATERS 41
D. WATER QUALITY 43
E. ENVIRONMENTALLY SENSITIVE HABITAT AND MARINE RESOURCES 54
1. Sensitive Bird Species.. 56
2. Sensitive Aquatic Species 62
3. Lagoon Vegetation 64
F. HAZARDS AND SHORELINE PROCESSES 67
G. PUBLIC ACCESS AND VISUAL RESOURCES 69
H. ARCHAEOLOGICAL RESOURCES 73
I. CEQA... 74

EXHIBITS:

Exhibit 1. Vicinity Map
Exhibit 2. Project Location Map
Exhibit 3. Existing Site
Exhibit 4. Site Plan
Exhibit 5. Trail Demolition Plan
Exhibit 6. Erosion Control Plan

Exhibit 7. Grading Plan Sheet 1
Exhibit 8. Grading Plan Sheet 2
Exhibit 9. Grading Plan Sheet 3
Exhibit 10. Grading Plan Sheet 4
Exhibit 11. Planting Plan Sheet 1
Exhibit 12. Planting Plan Sheet 2
Exhibit 13. Planting Plan Sheet 3
Exhibit 14. Planting Plan Sheet 4
Exhibit 15. Plant Palette Sheet 1
Exhibit 16. Plant Palette Sheet 2
Exhibit 17. Plant Palette Sheet 2
Exhibit 18. Public Access and Interpretive Map
Exhibit 19. Sampling Location Map
Exhibit.20. Dr. Engel Memorandum
Exhibit 21. City of Malibu Permit Consolidation Agreement
Exhibit 22. Applicant Consolidation Agreement
Exhibit 23. Ex-Parte Communication Disclosures
Exhibit 24. Comment Letters
City of Malibu Comment Letter
City of Malibu Comment Letter Continued

LOCAL APPROVALS RECEIVED: City of Malibu Coastal Development Permit No. 07-021 for relocation of existing parking lot (Phase I of Malibu Lagoon restoration project), approved June 19, 2007, Final Action July 24, 2007; Letters of agreement from City of Malibu and project applicant for a consolidated CDP review, dated October 25, 2007.

AGENCY REVIEWS AND APPROVALS: California Regional Water Quality Control Board, Los Angeles Region, General NPDES Permit No. CAG994004, Order No. R4-2008-0032 and Monitoring and Reporting Program No. CI-9573, Discharges of Groundwater from Construction and Project Dewatering to Surface Waters in Coastal Watersheds of Los Angeles and Ventura Counties, March 9, 2010; California Regional Water Quality Control Board, Los Angeles Region, Water Quality Certification for Proposed Malibu Lagoon Restoration Project, Malibu Lagoon, City of Malibu, Los Angeles (File No. 07-133);United States Fish and Wildlife Service Biological Opinion for the Malibu Lagoon Restoration and Enhancement Project (CON-1-8-08-F-4), dated August 26, 2009; United States Fish and Wildlife Service letter to Daniel P. Swenson, Chief, U.S. Army Corps of Engineers, Biological Opinion Amendment, dated January 8, 2010; National Marine Fisheries Service, Endangered Species Act Section 7 Informal Consultation Letter, dated August 18, 2008 to US Army Corps of Engineers; California Department Fish & Game, Streambed Alteration Agreement (Default Approval), No. 1600-2007-0316-R5, dated November 20, 2007; United States Army Corps of Engineers Provisional Permit No. SPL-2007-01016-MAS, dated December 14, 2009.

SUBSTANTIVE FILE DOCUMENTS: Malibu Lagoon Restoration Feasibility Study – Final Alternatives Analysis, prepared by Moffatt & Nichol, in association with Heal the Bay, dated March 2005; Malibu Lagoon Restoration and Enhancement Plan, Project Assessment and Evaluation Plan, prepared by California State Coastal Conservancy, dated July 29, 2005; Malibu Lagoon Restoration and Enhancement Plan, Project Monitoring Plan, prepared by California State Coastal Conservancy, dated July 29, 2005; Malibu Lagoon Restoration and

Impact Report (SCH #2005101123), prepared by Jones & Stokes, dated March 2006;Jurisdictional Delineation for Malibu Lagoon Restoration and Enhancement Project, prepared by Jones & Stokes, dated July 2007; Enhanced Environmental Monitoring Program at Malibu Lagoon and Malibu Creek, Prepared by R. Ambrose, I. Suffet, and S. Que Hee, dated March 23, 1995; Malibu Lagoon: A Baseline Ecological Survey, Prepared by Sean Manion and Jean Dillingham, dated 1989; Floristic Survey of Malibu Lagoon State Beach, prepared by Carl Wishner of Envicom Corp., dated July, 2005; Breeding Bird Survey Results, prepared by Daniel Cooper, Cooper Ecological Monitoring Inc., dated August 24, 2005; Birds of Malibu Lagoon, Final Report 2006, prepared by Daniel Cooper, Cooper Ecological Monitoring Inc., dated August 8, 2006; Malibu Lagoon Fish Survey Results, Prepared by Rosi Dagit (SMMRCD) and Dr. Camm Swift (Entrix Inc.), dated July 20, 2005; Amphibian, Reptile, and Terrestrial Invertebrate Survey Results, prepared by Frank Hovore & Associates, dated August 28, 2005; Small Mammal Trapping Survey, prepared by Natural Resources Assessment, Inc., dated October 6, 2005;The Tidewater Goby: Reintroduction of an isolated fish species into Malibu Lagoon-A Watershed Perspective, prepared by Sean Manion, dated June 1993; Study of Potential Water Quality Impacts on Malibu Creek and Lagoon from On-site Septic Systems, prepared by URS Greiner Woodward Clyde, prepared for City of Malibu, dated June 1999; Sediments as a Non-Point Source of Nutrients to Malibu Lagoon, prepared by M. Sutula, K. Kramer and J. Cable, dated November 1, 2004; Drainage Calculations prepared by Steve Seville, P.E., ICF International, dated September 3, 2010.;“Enumeration and speciation of enterococci found in marine and intertidal sediments and coastal water in southern California,” by D.M. Fergosun, Moore, et. al, January 2005; “Multi-Tiered Approach Using Quantitative Polymerase Chain Reaction for Tracking Sources of Fecal Pollution to Santa Monica Bay, California,” by Noble, Griffith, Blackwood, et. al., February 28, 2005; “Modeling the Dry-Weather Tidal Cycling of Fecal Indicator Bacteria in Surface Waters of an Intertidal Wetland,” by Sanders, Arega, and Sutula, June 2005; “Final Report: Identification and Control of Non-Point Sources of Microbial Pollution in a Coastal Watershed,” by Sanders, Grant, Horne, et. al., February 2006; “Fecal Indicator Bacteria Levels During Dry Weather from Southern California Reference Streams,” by Tiefenthaler, Stein, and Lyon, January 2008; “Coastal groundwater dynamics off Santa Barbara, California: Combining geochemical tracers, electronic seepmeters, and electrical resistivity,” by Swarzenski and Izbicki, United States Geological Survey, September 2009; “Sources of Fecal Indicator Bacteria in Urban Streams and Ocean Beaches, Santa Barbara, California,” by Izbickie, Swarzenski, et. al., September 2009; Letter from Peter Martin, Program Chief, U.S. Geological Survey, California Water Science Center, to Mr. James Thorson, City Manager, City of Malibu, dated October 29, 2009; “Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu, California, by John Izbicki; PowerPoint Presentation: “Summary of 2009 UCLA Study in Malibu Lagoon,” Ambrose, Jay, Thulsiraj, Estes; “Malibu Lagoon Bacteria Study- Synopsis with Preliminary Results,” by Ambrose, Jay, Meyers, and Estes, University of California, Los Angeles, April 25, 2009; “2009 Investigation of Spatial and Temporal Distribution of Human-specific *Bacteroidales* marker in Malibu Creek, Lagoon, and Surfrider Beach,” by Ambrose, Jay, Thulsiraj, Estes, University of California, Los Angeles; The September 22, 2010 Memorandum Regarding the Malibu Lagoon Restoration and Enhancement Plan, Phase 2 Project, prepared by Jonna Engel, Ph. D.

I. STAFF RECOMMENDATION

MOTION: ***I move that the Commission approve Coastal Development Permit No. 4-07-098 pursuant to the staff recommendation.***

STAFF RECOMMENDATION OF APPROVAL:

Staff recommends a **YES** vote. Passage of this motion will result in approval of the permit as conditioned and adoption of the following resolution and findings. The motion passes only by affirmative vote of a majority of the Commissioners present.

RESOLUTION TO APPROVE THE PERMIT:

The Commission hereby approves a coastal development permit for the proposed development and adopts the findings set forth below on grounds that the development as conditioned will be in conformity with the policies of Chapter 3 of the Coastal Act and the policies of the certified Local Coastal Program for the City of Malibu. Approval of the permit complies with the California Environmental Quality Act because either 1) feasible mitigation measures and/or alternatives have been incorporated to substantially lessen any significant adverse effects of the development on the environment, or 2) there are no further feasible mitigation measures or alternatives that would substantially lessen any significant adverse impacts of the development on the environment.

II. STANDARD CONDITIONS

1. Notice of Receipt and Acknowledgment. The permit is not valid and development shall not commence until a copy of the permit, signed by the permittee or authorized agent, acknowledging receipt of the permit and acceptance of the terms and conditions, is returned to the Commission office.

2. Expiration. If development has not commenced, the permit will expire two years from the date on which the Commission voted on the application. Development shall be pursued in a diligent manner and completed in a reasonable period of time. Application for extension of the permit must be made prior to the expiration date.

3. Interpretation. Any questions of intent or interpretation of any term or condition will be resolved by the Executive Director or the Commission.

4. Assignment. The permit may be assigned to any qualified person, provided assignee files with the Commission an affidavit accepting all terms and conditions of the permit.

5. Terms and Conditions Run with the Land. These terms and conditions shall be perpetual, and it is the intention of the Commission and the permittee to bind all future owners and possessors of the subject property to the terms and conditions.

III. SPECIAL CONDITIONS

1. Construction Timing and Sensitive Species Surveys

For any construction activities, the applicant shall retain the services of a qualified biologist or environmental resource specialist (hereinafter, “environmental resources specialist”) to conduct sensitive species surveys (including birds and other terrestrial species) and monitor project operations associated with all construction activities:

At least 30 calendar days prior to commencement of any construction activities, the applicant shall submit the name and qualifications of the environmental resources specialist, for the review and approval of the Executive Director. The applicant shall have the environmental resources specialist ensure that all project construction and operations are carried out consistent with the following:

A. The environmental resources specialist shall conduct surveys 30 calendar days prior to the listed activities to detect any active sensitive species, reproductive behavior, and active nests within 500 feet of the project site. Follow-up surveys must be conducted 3 calendar days prior to the initiation of construction and nest surveys must continue on a monthly basis throughout the nesting season or until the project is completed, whichever comes first.

B. In the event that any sensitive species are present in the project area but do not exhibit reproductive behavior and are not within the estimated breeding/reproductive cycle of the subject species, the qualified biologist shall either: (1) initiate a salvage and relocation program prior to any excavation/maintenance activities to move sensitive species by hand to safe locations elsewhere along the project reach or (2) as appropriate, implement a resource avoidance program with sufficient buffer areas to ensure adverse impacts to such resources are avoided. The applicant shall also immediately notify the Executive Director of the presence of such species and which of the above actions are being taken. If the presence of any such sensitive species requires review by the United States Fish and Wildlife Service and/or the California Department of Fish and Game, then no development activities shall be allowed or continue until any such review and authorizations to proceed are received, subject to the approval of the Executive Director.

C. If an active nest of a federally or state-listed threatened or endangered species, bird species of special concern, or any species of raptor or heron is found, the applicant shall notify the appropriate State and Federal agencies within 24 hours, and shall develop an appropriate action specific to each incident. The applicant shall notify the California Coastal Commission in writing by facsimile or e-mail within 24 hours and consult with the Commission regarding determinations of State and Federal agencies.

D. If an active nest of any federally or state listed threatened or endangered species, species of special concern, or any species of raptor or heron is found within 300 feet of construction activities (500 feet for raptors), the applicant shall retain the services of an environmental resources specialist with experience conducting bird and noise surveys, to monitor bird behavior and construction noise levels. The environmental resources specialist shall be present at all relevant construction meetings and during all significant construction activities (those with potential noise impacts) to ensure that nesting birds are not disturbed by construction related noise. The environmental resources specialist shall monitor birds and noise every day at the beginning of the project and during all periods of significant construction activities. Construction activities may occur only if construction noise levels are at or below a peak of 65 dB at the nest(s) site. If construction noise exceeds a peak level of 65 dB at the nest(s) site, sound mitigation measures such as sound shields, blankets around smaller equipment, mixing concrete batches off-site, use of mufflers, and minimizing the use of back-up alarms shall be employed. If these sound mitigation measures do not reduce noise levels, construction within 300 ft. (500 ft. for raptors) of the nesting trees/areas shall cease and shall not recommence until either new sound mitigation can be employed or nesting is complete.

E. The environmental resources specialist shall be present during all construction, grading, excavation, vegetation eradication and removal, hauling, and maintenance activities within the lagoon. The environmental resource specialist shall require the applicant to cease work should any breach in permit compliance occur, or if any unforeseen sensitive habitat issues arise. If significant impacts or damage occur to sensitive habitats or to wildlife species, the applicants shall be required to submit a revised, or supplemental program to adequately mitigate such impacts. The revised, or supplemental, program shall be processed as an amendment to this coastal development permit or a new coastal development permit

2. <u>Erosion Control Plans</u>

Prior to issuance of a coastal development permit, the applicants shall submit, for the review and approval of the Executive Director, two (2) sets of erosion control plans to reduce erosion for all disturbed portions of the project area. The subject plan shall be prepared by a qualified engineer. The erosion control plan shall be reviewed and approved by the consulting engineer to ensure that the plans are in conformance with the consultants' recommendations. The erosion control plan shall incorporate the following criteria:

1. The plan shall delineate the areas to be disturbed by grading or construction activities, including staging and stockpile areas. Areas to remain undisturbed shall be clearly delineated on the project site with fencing or survey flags.

2. The plan shall specify that should grading take place during the rainy season (November 1 – March 31), with Executive Director approval in accordance with **Special Condition Two (2)**, the applicants shall install or construct temporary sediment basins (including debris basins, desilting basins or silt traps), temporary drains and swales, sand bag barriers, silt fencing, stabilize any stockpiled fill with geofabric covers or other appropriate cover, install geotextiles or mats on all cut or fill slopes and close and stabilize open trenches as soon as possible.

3. Erosion control measures shall be required on the project site prior to or concurrent with the initial grading operations and maintained throughout the development process to minimize erosion and sediment from runoff waters during construction. All sediment should be retained on-site unless removed to an appropriate approved dumping location either outside the coastal zone or to a site within the coastal zone permitted to receive fill.

4. The plan shall also include temporary erosion control measures should grading or site preparation cease for a period of more than 30 days, including but not limited to: stabilization of all stockpiled fill, access roads, disturbed soils and cut and fill slopes with geotextiles and/or mats, sand bag barriers, silt fencing; temporary drains and swales and sediment basins. The plans shall also specify that all disturbed areas shall be seeded with native grass species and include the technical specifications for seeding the disturbed areas. These temporary erosion control measures shall be monitored and maintained until grading or construction operations resume.

5. All excavated material shall be contained within the designated access and stockpile sites. Stockpile sites shall be located as far as possible from the lagoon. During dewatering, the stockpile site(s) shall be lined with silt fencing to prevent any silt from entering the creeks/channels/wetlands.

6. The plan shall include measures to minimize the area of bare soil exposed at one time (phased grading).

The applicants shall undertake development in accordance with the final erosion control plans approved by the Executive Director. No proposed changes to the approved final plans shall occur without a Commission amendment to this coastal development permit unless the Executive Director determines that no amendment is required. The applicants shall be fully responsible for advising construction personnel of the requirements of the Erosion Control Plan. Throughout the construction period, the applicants shall conduct regular inspections of the condition and operational status of all structural BMPs required by the approved Erosion Control Plan. The applicants shall repair or replace failed or inadequate BMPs expeditiously.

3. Timing, Operations, and Maintenance Responsibilities

A. It shall be the applicant's responsibility to assure that the following occurs concurrent with, and after completion of, all project operations:

a. All project activities involving the wetlands, including dewatering, dredging, and planting restoration activities, shall occur only during the period from June 1st through October 15. Construction for the public access and interpretive elements outside of wetland areas shall occur between June 1^{st} and December 31^{st}. The Executive Director may grant additional time for good cause.

b. All project activities, with the exception of monitoring, shall occur Monday through Friday, excluding state holidays. No work shall occur on Saturday or Sunday. The Executive Director may authorize work outside of this time frame for good cause.

c. Staging areas shall be used only during active construction operations and will not be used to store materials or equipment between operations, should construction operations cease for a period of 14 days or more.

d. The applicant shall not store any construction materials or waste where it will be or could potentially be subject to wave erosion and dispersion. In addition, no machinery shall be placed, stored or otherwise located in the intertidal zone at any time, except for the minimum necessary to implement the project.

e. Construction equipment shall not be cleaned on the temporary lagoon berm or in the public parking lots/public trails (outside of the staging areas).

f. Construction debris and sediment shall be properly contained and secured on site with BMPs to prevent the unintended transport of sediment and other debris into coastal waters by wind, rain or tracking.

g. Construction debris and sediment shall be removed from construction areas as necessary to prevent the accumulation of sediment and other debris which may be discharged into coastal waters. Any and all debris resulting from construction activities shall be removed from the project site within 24 hours. Debris shall be disposed at a debris disposal site outside of the coastal zone or at a location within the coastal zone authorized to receive such material.

h. The applicant shall be responsible for removing all unsuitable material or debris within the area of placement should the material be found to be unsuitable for any reason, at any time, when unsuitable material/debris can reasonably be associated with the placement material. Debris shall be disposed at a debris disposal site outside of the coastal zone or at a location within the coastal zone authorized to receive such material.

i. All upland areas disturbed as a result of this project shall be planted and maintained for habitat restoration purposes as soon as possible after disturbance has occurred.

4. Final Dewatering Plan

Prior to issuance of the coastal development permit**,** the applicant shall submit, for the review and approval of the Executive Director, a Final Revised Dewatering Plan.

A. The Final Dewatering Plan shall delete all references to a one-time mechanical breach of the lagoon, and

B. The Final Dewatering Plan shall incorporate a tidewater goby, southern steelhead, and other sensitive aquatic species dewatering protection plan including the following requirements:

The applicant shall retain the services of a qualified biologist or environmental resource specialist with experience handling tidewater gobies, southern steelhead, or other sensitive aquatic species and with experience in the application of standard survey, capture, and handling methods for tidewater gobies, steelhead, and other sensitive aquatic species. At least 30 days prior to commencement of any onset of work, the applicant shall submit the name and qualifications of the qualified biologist or environmental resources specialist, for the review and approval of the Executive Director. The applicant will exclude tidewater gobies, southern steelhead, and other sensitive aquatic species from the restoration construction area by following the actions required by US Fish and Wildlife Service (FWS) approval dated Aug 26, 2009 and the National Marine Fisheries Service (NMFS) approval dated Aug 18, 2008, including the following:

i.) The qualified biologist or environmental resource specialist retained by the applicant shall conduct a training session for all construction personnel prior to the onset of work. The training shall include a description of the tidewater goby, southern steelhead, and other sensitive aquatic species, their habitats; the specific measures that are being implemented to protect sensitive aquatic species during construction; and the project limits.

ii.) The qualified biologist or environmental resource specialist and a crew working under his/her direction shall clear all fish, including tidewater gobies and southern steelhead, from the area to be dewatered prior to construction. The capture, handling, exclusion, and relocation activities identified by the qualified biologist will be completed no earlier than 48 hours before construction begins to minimize the probability that listed species will recolonize the affected areas.

iii.) The qualified biologist or environmental resource specialist and a crew working under his/her direction shall inspect the dewatered areas and construction site regularly to detect whether any tidewater gobies, southern steelhead or other fish are passing through the berm and/or cofferdam and investigate whether sensitive aquatic species protection measures are being implemented.

iv.) The qualified biologist or environmental resource specialist and a crew working under his/her direction shall be present when the berms and/or cofferdams are removed and the construction area refilled with water to relocate any fish present in the construction area before completion of removal operations and to ensure successful reintroduction of aquatic habitat in the construction area.

v.) Following construction, the qualified biologist or environmental resource specialist shall complete post-construction surveys for tidewater gobies, southern steelhead, and other sensitive aquatic species.

vi.) The qualified biologist or environmental resource specialist shall prepare a post-project monitoring report documenting the efforts to protect the tidewater goby, southern steelhead, and other sensitive aquatic species and the results. In the event that monitoring shows a significant decrease in tidewater goby, southern steelhead, or other sensitive aquatic species that cannot be readily explained by natural factors or is clearly linked to the restoration, the qualified biologist, in consultation with the USFWS and other experts, shall recommend a course of action to address the problem.

C. The applicant shall undertake development in accordance with the final approved plans. Any proposed changes to the approved final plans shall be reported to the Executive Director. No changes to the approved final plans shall occur without a Coastal Commission - approved amendment to the coastal development permit, unless the Executive Director determines that no amendment is legally required.

5. Final Hydrological Monitoring Plan

A. ***Prior to issuance of the Coastal Development Permit***, the applicant shall submit, for the review and approval of the Executive Director, a Final Hydrological Monitoring Plan, prepared by a qualified hydrologic engineer. The final plan shall incorporate all provisions of the *Malibu Lagoon Restoration & Enhancement Plan* prepared by Moffat & Nichol, dated June 17, 2005, the *Project Monitoring Plan* and the *Project Assessment and Evaluation Plan* prepared by the California State Coastal Conservancy, dated July 29, 2005, and the *Quality Assurance Project Plan* prepared by 2nd Nature, dated February 6, 2006, except that it shall be consistent with the following provisions:

1. Sampling Locations Map

Prior to issuance of the coastal development permit, the applicant shall provide revised full-size plans, prepared by a licensed surveyor or engineer, clearly delineating the eight (8) proposed Sampling locations, as generally shown on

Exhibit 19. The plans shall be of adequate scale to clearly delineate the precise location of each of the sites and shall have a key identifying clearly what parameters will be measured at each location.

2. Monitoring and Reporting Requirements

The Final Monitoring Plan shall be revised to require that all monitoring be conducted bi-annually for a period of 5 years after initial construction. Post-project monitoring should take place in a functionally equivalent location and as close as possible to the pre-project monitoring sites. In addition, the Plan shall also provide that the applicant shall conduct monitoring to provide an annual assessment of changes in bathymetry/physical conditions, sediment sampling, water quality sampling and surface and bottom water nutrient sampling, consistent with the following provisions:

a. *Cross-Sections/Physical Conditions Monitoring*

i.) The 4 identified transect lines/cross-sections shall be surveyed on a bi-annual basis each spring (during open lagoon conditions, approximately April) and fall season (prior to the wet season, approximately September) at approximately the same time each year for a period of 5 years after initial construction. The points of each transect shall be at a permanently marked location that can be identified by Baseline Survey Markers and GPS coordinates. Cross-sections shall be obtained by attaching survey tape to the monuments and recording channel depth and water elevation at equal increments across each cross section to collect at least 20 data points. The date, time and tidal conditions for all measurements shall be recorded. Estimates of sediment volume scour or deposition shall be provided.

b. *Sediment Analysis*

i.) A total of at least 22 surface sediment samples (20 samples plus 1 triplicate at the top 0-2 cm) shall be collected bi-annually (end of April and end of September) at the 4 cross-section locations identified in the Sampling Locations Map (**Exhibit 19**).

ii.) A minimum of 5 sediment samples shall be collected at each transect following the protocol outlined in the Quality Assurance Project Plan, dated February 6, 2006. Sediment samples will be collected from 5 locations equally spaced along the transect including each side of the wetted perimeter edge. The wetted perimeter and the second and fourth samples will be composited. The third sample will be collected from the deepest part of the channel thalweg and analyzed separately.

iii.) All samples shall be analyzed for grain size distribution in order to obtain the following grain size distribution:

a. Greater than sand: >2.0mm
b. Sand: .05 to 2.0 mm in diameter

c. Silt: .002 to 0.5 mm in diameter
d. Clay: less than .02 mm in diameter
e. Average size (d50) um

iv.) All sediment samples shall be analyzed for nutrients, including total organic carbon, total nitrogen, and total phosphorous concentrations. Sediment samples will be collected from 5 locations equally spaced along the transect including each side of the wetted perimeter edge. The wetted perimeter and the second and fourth samples will be composited. The third sample will be collected from the deepest part of the channel thalweg and analyzed separately.

c. *Water Sampling:*

i.) At least 3 multi-parameter water quality data loggers (YSI 600 XLM) shall be used to collect data from April through the first storm of the rainy season (October or November) at the sites noted in the Sampling Location Map (Exhibit 19) to monitor water depth, dissolved oxygen (% and mg/L), temperature, salinity, conductivity, pH, and oxygen reduction potential (ORP) on 30-minute interval.

ii.) Vertical profiles of water quality parameters (including dissolved oxygen, water temperature, conductivity, salinity, and pH) shall be performed using a YSI 85 (or equivalent) hand-held water quality instrument. Vertical profiles shall be conducted bi-annually at 0.5 ft. intervals at 6 sites shown on the Sampling Location Map and shall be conducted at the same time of day for each monitoring event. The testing protocol shall follow the procedures outlined in the Quality Assurance Project Plan, dated February 6, 2006.

d. *Surface and Bottom Water Nutrient Sampling*:

i.) Bi-annual surface water (1 ft. below surface) and bottom water samples shall be located at the 6 sites shown on the Sampling Location Map (**Exhibit 19**).

ii.) Surface water samples shall be analyzed for dissolved nitrate as nitrogen, nitrite (NO3-N and NO2), ammonia as nitrogen (NH3-N), total Keldjahl nitrogen (TKN), soluble reactive phosphorous (SRP), and total phosphorous (TP), and % cover of macroalgae, and cover and biomass of submerged aquatic vegetation. The surface water sampling shall also provide a dataset to evaluate the concentrations of total and biological available fractions of nutrients required for primary production;

iii.) Bottom water samples shall be evaluated for nitrate-nitrogen, total nitrogen, SRP, TKN, and TP.

e. Reporting Requirements:

i.) The applicant shall submit an annual monitoring report, for the review and approval of the Executive Director, for a period of 5 years after initial construction is complete. The monitoring report shall be submitted on annual basis and shall include all survey data and a written report prepared by a qualified expert indicating the results of each of the parameters listed above, including cross-sectional data, sediment sampling, water quality sampling and surface and bottom water nutrient sampling.

ii.) The monitoring report shall include conclusions regarding the level of success of the project, a detailed analysis of any change in cross-sections/physical conditions, sediment quality, and water quality. More specifically, the report shall include, but not be limited to, the following:

- Water quality change and sediment comparisons at each sampling location for each survey period, using the initial pre-project conditions as the baseline.
- If feasible, utilization of aerial photographs to provide information to address lagoon circulation and sediment aggradation/degradation dynamics.
- Conclusions regarding the level of success and any adverse effects, including any observed impacts to water quality and sediment quality and size.
- The data collected in the restored areas shall be compared to the pre-restoration conditions at functionally similar sites.
- The annual precipitation totals, timing, and magnitude of peak stream flows and estimates of annual peak reoccurrence intervals.
- The report shall include a brief history of all previous years' monitoring results to track changes in cross-sectional data, sediment, and water quality conditions.
- The report shall include sampling results for fecal indicator bacteria within the lagoon and shall explain how the sampling results compare to water quality bacteria standards and whether any exceedences in bacteria have occurred.

B. Success Criteria and Supplemental Measures

1. The Final Monitoring Plan shall incorporate specific indicators/success criteria that will be used to determine whether the restored lagoon shows improvements in water circulation and tidal flushing, including but not limited to the following:

a. Grain size distribution (percent sand in the sample and/or of the median grain size, D_{50}) at each sampling location should increase from the baseline monitoring conditions. Adaptive management shall be implemented if:

i.) any one site fails the grain size criteria, above, for 6 consecutive samplings for a period of 3 consecutive years, ii.) the average of any transect shows decreased grain size and increased nutrient sequestering over 3 consecutive years as compared to the baseline monitoring in similar locations.

b. Water quality monitoring indicates persistent stratification of lagoon waters (salinity differences) and depressed bottom water dissolved oxygen (DO) and oxygen-reduction potential (ORP) values during closed lagoon conditions, measured by any of the following:

i.) at locations within the western channel persistent DO levels below 1.5 mg/l for a sustained period of more than 12 hours a day over two closed lagoon periods of more than 60 days or consistently low dissolved oxygen levels below 1.0 mg/l that occur for more than 6 hours a day over the course of 30 days during closed conditions.

c. The average of any transect shows decreased grain size and increased nutrient sequestering of Nitrogen (N) and Phosphorous (P) over 3 consecutive years.

d. Continual occurrence of sandbar formation/sedimentation (sandbar in area that isolates the western arms from the main channel) (3 times over a 6 year period) during open lagoon conditions

2. If the monitoring reports indicate that circulation within the lagoon has not improved or has failed to meet the requirements specified above in B.1. , the applicant, or successors in interest, shall submit to the Executive Director, within 180 days of the date of the relevant monitoring report, a revised or supplemental plan, certified by a registered engineer and a qualified Resource Specialist, that specifies additional or supplemental measures to modify those portions of the original plan that have failed or are not in conformance with the original approved lagoon restoration plan. The Executive Director may grant additional time for good cause. The revised or supplemental project plan shall describe all supplemental actions in detail, including: timing of work, staging areas, equipment to be used and exact restoration/grading areas (with full-size plans) and shall include all relevant monitoring reports required pursuant to all special conditions to ensure that the operations are in substantial conformance with the resource protection and public access conditions of this permit. All supplemental actions and work shall be in accordance with all conditions of this coastal development permit, including other agency approvals. The Executive shall determine whether implementation of the revised or supplemental plan is consistent with the terms and provisions of the Commission's approval of CDP 4-07-098 or whether the plan will require an amendment to this permit. This revised or supplemental plan shall be implemented by the applicant within 180 days after the plan is approved by the Executive Director, unless the Executive Director either: (1) grants additional time for good cause or (2) determines that an amendment is required. If the Executive Director determines that the revised or supplemental plan requires an amendment to this permit, then the applicant shall

submit a complete application for an amendment to this permit within 180 days after such determination.

C. The applicant shall undertake development and monitoring in accordance with the final approved plans. Any proposed changes to the approved final plans shall be reported to the Executive Director. No changes to the approved final plans shall occur without a Coastal Commission - approved amendment to the coastal development permit, unless the Executive Director determines that no amendment is legally required.

6. <u>Plant Communities Restoration, Monitoring, and Reporting Plan</u>

The applicant shall retain the services of a qualified environmental resource specialist(s) with no less than 2 years of wetland/upland restoration experience to prepare a final wetland/upland habitat restoration/enhancement plan, monitoring program, and reporting plan. The applicant shall submit the name and qualifications of the environmental resources specialist(s) for the review and approval of the Executive Director. The environmental resource specialist(s) shall base the habitat restoration/enhancement plan, monitoring program, and reporting plan on the habitat plan and monitoring program laid out in the *Malibu Lagoon Restoration & Enhancement Plan*, prepared by Moffatt & Nichol dated June 17, 2005, the *Project Monitoring Plan*, *Project Assessment and Evaluation Plan* prepared by the California State Coastal Conservancy, dated July 29, 2005, and the *Quality Assurance Project Plan*, dated February 6, and the *Malibu Lagoon State Beach Restoration and Enhancement – Phase 2: 95% Submittal Restoration Plans* prepared by ICF International dated January 29, 2010, except as modified by the Special Conditions herein. The final wetland/upland habitat restoration/enhancement plan, monitoring program, and reporting plan shall provide for the following:

A. Final Wetland/Upland Habitat Restoration/Enhancement Plant that includes the following:

1. A baseline assessment of vegetation and habitats on site including detailed descriptions of existing conditions on site prior to any restoration/enhancement activities authorized by this coastal permit and photographs taken from pre-designated sites annotated to a copy of the site plans. The habitat restoration/enhancement plan shall delineate existing coastal wetland/upland/disturbed habitat types and show the distribution and abundance of any sensitive species.

2. Provision for collection and maintenance of all native wetland and upland plant species that would be disturbed by the habitat restoration/enhancement project activities for future planting. Native wetland/upland seeds shall also be collected in anticipation of future plantings. The habitat restoration/enhancement plan shall provide a description of the methodology of how any existing wetland/upland plants/cuttings/seeds will be collected, stored, and used for re-vegetation of the site.

3. Sufficient technical detail on the habitat restoration/enhancement design including, at a minimum, a map of the proposed habitats, a planting program including a description of planned site preparation, method and location of exotic species removal, timing of planting, and elevations on the baseline map, and maintenance timing and techniques.

4. Plant palette for all habitats to be restored/enhanced (including numbers of individual species), location of individual plants in respective habitats, and plant installation plan (use of seed mix, cuttings, containers and planting methodology). The plant palette shall consist exclusively of native plants appropriate to the respective habitats. All plant material shall be native to the region: grown from seeds or vegetative materials obtained from the site or from appropriate nearby coastal wetland/upland locations so as to protect the genetic makeup of natural populations. Horticultural varieties shall not be used. Plantings shall be maintained in good growing condition throughout the life of the project and, whenever necessary, shall be replaced with new plant materials to ensure continued compliance with the re-vegetation requirements.

5. Provisions for on-going wetland/upland habitat maintenance for a five year monitoring period after replanting is completed. At a minimum, semi-annual maintenance and/or management activities shall include, as necessary, debris removal, periodic weeding of invasive and non-native vegetation and re-vegetation consistent with the approved restoration plan.

B. A monitoring program shall be implemented to monitor the habitat restoration/enhancement project for compliance with the specified guidelines and performance standards and shall provide the following:

1. Goals of the habitat restoration/enhancement project.

2. List of the habitats, and attributes thereof, to be monitored.

3. Methods for monitoring each attribute including monitoring frequency and the location of monitoring stations.

4. Success criteria/performance standards as laid out in the for the *Malibu Lagoon Restoration & Enhancement Plan*, prepared by Moffatt & Nichol dated June 17, 2005 and the *Malibu Lagoon State Beach Restoration and Enhancement – Phase 2: 95% Submittal Restoration Plans* prepared by ICF International dated January 29, 2010 where restored/enhanced wetland habitats (low marsh, mid marsh, high marsh) and upland habitats (coastal scrub) should attain 50% total percent cover of native species within three years and 90% total cover within five years. The monitoring plan shall provide corroboration for the 90% total cover value (final habitat cover value) based on the published literature for the respective habitats. Should the published literature deviate from this percent cover objective, the final habitat value

must be adjusted accordingly. There shall be 5% non-natives in the restored/enhanced wetland habitats at the end of five years and no more than 10% non-natives in the upland habitat at the end of five years.

5. Description of how the resulting data will be analyzed and how the level of performance will be determined.

6. Identification of how the need for remediation or alteration of the habitat restoration/enhancement project will be assessed.

7. Explicit timetable for the monitoring program including data collection, data analysis, and data reporting.

C. A reporting plan for providing information on the status of the habitat restoration/enhancement project and monitoring program that includes the following:

1. Initial Monitoring Report: The applicant shall submit, upon completion of the initial habitat restoration/enhancement, a written report prepared by the environmental resources specialist, for the review and approval of the Executive Director, documenting the completion of the initial restoration/enhancement work. This report shall also include photographs taken from pre-designated sites (annotated to a copy of the site plans) documenting the completion of the initial restoration/enhancement work.

2. Interim Monitoring Reports: After initial restoration/enhancement activities are completed, the applicant shall submit, for the review and approval of the Executive Director, on an annual basis for a period of five (5) years, a written monitoring report prepared by the environmental resources specialist (s) indicating the progress and relative success or failure of the restoration/enhancement. This report shall also include further recommendations and requirements for additional restoration/enhancement activities in order for the project to meet the success criteria and performance standards. This report shall also include photographs taken from pre-designated sites (annotated to a copy of the site plans) indicating the progress of recovery at each of the sites. Each report shall be cumulative and shall summarize all previous results. (duplication of requirements in the previous paragraph above) Each report shall also include a "Performance Evaluation" section where information and results from the monitoring program are used to evaluate the status of the habitat restoration/enhancement in relation to the interim performance standards and final success criteria.

3. Final Report: A final detailed report on the habitat restoration/enhancement shall be submitted by the applicant for the review and approval of the Executive Director. If this report indicates that the habitat restoration/enhancement has, in part, or in whole, been unsuccessful, based on the success criteria and performance standards specified in the monitoring program, the applicant shall submit within 90 days a revised or supplemental habitat restoration/enhancement

plan to compensate for those portions of the original plan which did not meet the approved success criteria and performance standards. The Executive shall determine whether implementation of the revised or supplemental plan is consistent with the terms and provisions of the Commission's approval of CDP 4-07-098 or whether the plan will require an amendment to this permit. This revised or supplemental plan shall be implemented by the applicant within 90 days after the plan is approved by the Executive Director, unless the Executive Director either: (1) grants additional time for good cause or (2) determines that an amendment is required. If the Executive Director determines that the revised or supplemental plan requires an amendment to this permit, then the applicant, shall submit a complete application for an amendment to this permit within 90 days after such determination.

D. California Rapid Assessment Plan: If feasible, the applicant shall perform a CRAM (California Rapid Assessment Method) wetland survey prior to initiation of the proposed Phase 2 restoration project and every other year following completion of the proposed restoration project through year 5 of the project. CRAM should be conducted simultaneously with quantitative interim monitoring surveys. CRAM survey results shall be uploaded to "project tracker", the open-source, web-based database designed to provide wetland status and trend data to state and federal information systems.

7. <u>Final Benthic Invertebrate, Fish, Avian and Algal Monitoring and Reporting Plan</u>

The applicant shall retain the services of a qualified biologist or environmental resource specialist(s) with no less than 2 years of aquatic and terrestrial species monitoring experience to prepare a final benthic invertebrate, fish, avian, and algal monitoring program and reporting plan. The applicant shall submit the name and qualifications of the environmental resources specialist(s) for the review and approval of the Executive Director. The environmental resource specialist(s) shall base the final plan on the monitoring program for submerged aquatic vegetation and macroalgae, infaunal and epifaunal benthic invertebrates, fish, and birds laid out in the *Malibu Lagoon Restoration and Enhancement Plan* prepared by Moffat and Nichols, dated June 17, 2005, the *Project Monitoring Plan*, and the *Project Assessment and Evaluation Plan*, prepared by the California State Coastal Conservancy, dated July 29, 2005, the *Quality Assurance Project Plan*, prepared by 2nd Nature, dated February 6, 2006. The applicant shall also comply with the monitoring program and reporting plan requirements outlined above in Special Condition 6, sections B and C, substituting "Final Aquatic Vegetation, Benthos, Fish, and Birds" for "Final Habitat Restoration/Enhancement", except as modified here regarding success criteria:

The abundance and diversity of infaunal and epifaunal benthic invertebrates, fish, and birds shall not decrease following restoration. Although a short-term decrease may be expected due to construction related impacts, infaunal and epifaunal benthic invertebrates, fish, and birds should be at commensurate pre-restoration levels within three years of restoration activities and should be at or above pre-restoration levels after five years.

The occurrence of algal blooms that form floating algal mats shall not increase following restoration. The formation of floating algal mats should be at or below pre-restoration levels within three years of restoration activities and should be below pre-restoration levels after five years. If these criteria are not attained, targeted studies should be performed to determine why criteria are not being met and devise adaptive management solutions to achieve goals.

8. <u>Plans Conforming to Engineer's Recommendations</u>

By acceptance of this permit, the applicant agrees to comply with the recommendations contained in all engineering and hydrological reports prepared by Moffat and Nichol, referenced as Substantive File Documents. These recommendations shall be incorporated into all final design and construction plans, which must be reviewed and approved by the consultant prior to commencement of development.

The final plans approved by the consultant shall be in substantial conformance with the plans approved by the Commission. Any substantial changes in the proposed development approved by the Commission that may be required by the consultant shall require amendment(s) to the permit(s) or new Coastal Development Permit(s).

9. <u>Herbicide Use</u>

Herbicides shall not be used in any open water areas on the project site. Herbicide use in upland areas shall be restricted to the use of Glyphosate Aquamaster^{TM} (previously Rodeo^{TM}) herbicide for the elimination of non-native and invasive vegetation for purposes of habitat restoration only. The environmental resource specialist shall conduct a survey of the project site each day prior to commencement of vegetation removal and eradication activity involving the use of herbicide to determine whether any native vegetation is present. Native vegetation to be retained shall be clearly delineated on the project site with fencing or survey flags and protected. In the event that non-native or invasive vegetation to be removed or eradicated is located in close proximity to native riparian vegetation or surface water, the applicant shall either: (a) remove non-native or invasive vegetation by hand (Arundo donax shall be cut to a height of 6 inches or less, and the stumps painted with Glyphosate Roundup^{TM} herbicide), or (b) utilize a plastic sheet/barrier to shield native vegetation or surface water from any potential overspray that may occur during use of herbicide. In no instance shall herbicide application occur if wind speeds on site are greater than 5 mph or 48 hours prior to predicted rain. In the event that rain does occur, herbicide application shall not resume again until 72 hours after rain.

10. Final Public Access Program

A. ***Prior to commencement of development***, the applicant shall submit, for the review and approval of the Executive Director, a Final Public Access Program that describes the methods (including signs, fencing, posting of security guards, etc.) by which safe public access to or around construction areas and/or staging areas shall be maintained during all project operations. The plan shall also include signs directing the public to alternative parking areas for the duration of construction and staging. Where public paths will be closed during active operations, a person(s) shall be on-site to detour traffic or adequate fencing and signage shall be used. The applicant shall maintain public access pursuant to the approved version of the report. Any proposed changes to the approved program shall be reported to the Executive Director. No change to the program shall occur without a Commission-approved amendment to the permit unless the Executive Director determines that no such amendment is required.

B. Where use of public parking spaces is unavoidable, the minimum number of public parking spaces (on and off-street) that are required at each receiver site for the staging of equipment, machinery and employee parking shall be used. At each site, the number of public parking spaces utilized shall be the minimum necessary to implement the project.

C. The applicant shall post each construction site with a notice indicating the expected dates of construction and/or trail or public access closures (if temporarily necessary).

11. Required Approvals

By acceptance of this permit, the applicant agrees to obtain all other necessary State or Federal permits that may be necessary for all aspects of the proposed project (including the National Marine Fisheries Service, California Department of Fish and Game, California State Lands Commission, Regional Water Quality Control Board, and the U.S. Army Corps of Engineers).

12. Assumption of Risk

A. By acceptance of this permit, the applicant acknowledges and agrees (i) that the site may be subject to hazards from storm waves, surges, erosion, and flooding; (ii) to assume the risks to the applicant and the property that is the subject of this permit of injury and damage from such hazards in connection with this permitted development; (iii) to unconditionally waive any claim of damage or liability against the Commission, its officers, agents, and employees for injury or damage from such hazards; and (iv) to indemnify and hold harmless the Commission, its officers, agents, and employees with respect to the Commission's approval of the project against any and all liability, claims, demands, damages, costs (including costs and fees incurred in defense of such claims), expenses, and amounts paid in settlement.

B**. *Prior to issuance of the Coastal Development Permit***, the applicant shall submit a written agreement, in a form and content acceptable to the Executive Director, incorporating all of the above terms of this condition.

13. Discharge Requirements

A. This Coastal Development Permit incorporates all of the waste discharge requirements, limitations and other requirements and provisions contained in California Regional Water Quality Control Board, Los Angeles Region National Pollutant Discharge Elimination System (NPDES) Permit No. CAG994004 and Monitoring and Reporting Program No. CI-9573.

B. If project monitoring indicates that either discharge prohibitions or effluent limitations have failed to meet any of the standards specified in the NPDES Permit, the applicant shall immediately notify the Executive Director. Any proposed changes to the approved final plan shall be reported to the Executive Director. No changes to the approved final plan shall occur without a Coastal Commission-approved amendment to the coastal development permit, unless the Executive Director determines that no amendment is required.

14. Mitigation Measures

All mitigation measures required in the Malibu Lagoon Restoration and Enhancement Plan Final Environmental Impact Report SCH #2005101123 applicable to the proposed project are hereby incorporated by reference as special conditions of the subject permit unless specifically modified by any additional special conditions set forth herein.

15. Archaeological Resources and Monitoring

By acceptance of this permit, the applicant agrees to have a qualified archaeologist(s) and appropriate Native American consultant(s) present on-site during all grading and vegetation clearance activities that occur within or adjacent to recorded archaeological sites in the project area. Specifically, all ground-disturbing activities adjacent to recorded sites shall be controlled and monitored by the archaeologist(s) with the purpose of locating, recording and collecting any archaeological materials. In the event that any significant archaeological resources are discovered during operations, all work in this area shall be halted and an appropriate data recovery strategy be developed, subject to review and approval of the Executive Director, by the applicant's archaeologist and the native American consultant consistent with CEQA guidelines.

16. Removal of Excavated Material

Prior to commencement of development, the applicant shall provide evidence to the Executive Director of the location of the disposal site for all excess excavated material from the site. If the disposal site is located in the Coastal Zone, the disposal site must have a valid coastal development permit for the disposal of fill material. If the disposal site does not have a coastal permit, such a permit will be required prior to the disposal of material.

17. New Zealand Mud Snail

The applicant shall implement the following measures to prevent the introduction and spread of the exotic New Zealand mud snail:

A. All vehicles (including wheels and undercarriages), equipment, protective gear (e.g., waders, boots) and tools shall be pressure washed and steam cleaned prior to entering the work area. The applicant shall keep documentation that all vehicles, equipment, protective gear and tools have been cleaned prior to commencing project work.

B. During project construction, pressure washing and steam cleaning shall take place at a wash station located within the staging area. The applicant shall keep records of descriptions of wash station inspection and maintenance requirements, anticipated frequency of inspections, measures to control off-site soil or runoff outside of the wash station, and documentation logs of inspection and maintenance activities. All rinse water shall be collected and disposed of where it will not be reintroduced into the lagoon or watershed.

C. The applicant/contractor shall keep a written daily log of all vehicle/equipment/tool washing that states the date, time, location, type of equipment washed, methods used, and staff present, and includes the signature of a responsible staff member. The logs shall be available for inspection at any time.

D. All vehicles, equipment, and tools used during project construction shall be pressure washed and steam cleaned, and allowed to thoroughly dry (without soil contact) in the sun for a minimum of 72 hours before being moved off site.

E. The applicant shall assure that a chest freezer, equipped with a padlock, onsite to sterilize boots, waders, and other equipment is provided. All boots and waders used during construction shall remain onsite during the duration of the construction period. Upon completion of construction, boots and waders shall be frozen for a minimum of 48 hours. The boots and waders shall be placed in plastic bags labeled with the date and time that they were placed in the freezer. A log documenting sterilization of boots and waders shall be kept and shall be available for inspection at any time.

F. All sandbags, silt fencing, and other materials that come into contact with water and/or soil shall be allowed to thoroughly dry (without soil contact) in the sun for a minimum of 72 hours before being moved off site.

G. All trucks transporting construction debris and/or excavated soil to disposal sites shall be covered.

IV. FINDINGS AND DECLARATIONS

The Commission hereby finds and declares:

A. PROJECT DESCRIPTION

The applicant is proposing to implement the Malibu Lagoon Restoration and Enhancement Plan to improve the function of the lagoon ecosystem by recontouring/reconfiguring the lagoon slopes and channels to increase hydrologic flow involving 88,700 cu. yds. of grading (51,200 cu yds. excavation and 37,500 cu. yds. fill); revegetation with native wetland and upland plant species and removal of non-native plant species; construction of a public access trail around lagoon with new interpretive public informational/educational improvements; and implementation of a long-term lagoon monitoring plan. The applicant is proposing a work window of June 1st to October 15th in order to avoid potential impacts to sensitive bird and fish species during nesting and spawning seasons. (**Exhibits 1-10**)

<u>Project Purpose</u>:

The goal of the proposed restoration project is to increase circulation of water in the lagoon during both open mouth and closed mouth conditions in order to improve water quality and decrease eutrophication, and to restore the lagoon habitat by re-establishing suitable soil conditions and native plant species and removing non-native species. The applicant also proposes to evaluate, record, and analyze existing and changing ecological conditions of the lagoon using physical, chemical, and biological parameters to measure restoration success. The water quality of the lagoon is poor due to inflow of nutrient and pollutant rich water resulting from urban runoff and storm drainage, urban encroachment, leaking septic systems, limited water circulation, and other factors. In addition, the quality of the wetland and upland habitat area on site has also been degraded by many historic developments on site, impacts from adjacent development, and invasion by non-native plant species. Although the project will involve some short-term impacts to wetland and upland habitat on site, this project is expected to result in a substantial increase in the long-term habitat value and of these same sensitive habitat areas.

<u>Commission Jurisdiction and Permit Consolidation</u>:

The proposed project includes components that are located within the City of Malibu's Local Coastal Program (LCP) jurisdiction as well as components within the retained jurisdiction of the Coastal Commission. The City of Malibu would typically have jurisdiction over the onshore portions of the project within its LCP jurisdiction. However, Section 30601.3 of the Coastal Act authorizes the Commission to process a consolidated coastal development permit application, when its criteria are satisfied, for both aspects of a proposed project that would otherwise require a coastal development permit from both a local government with a certified local coastal program and the Commission. In this case, the City of Malibu, in a letter to Commission staff dated October 25, 2007, requested that the Commission assume jurisdiction over all activities associated with the proposed project. (**Exhibits 21** and **22**)

Therefore, the standard of review for the project is the Chapter 3 policies of the Coastal Act with the policies of the City of Malibu's Local Coastal Program serving as guidance, as noted above. As conditioned, the proposed project will be consistent with the applicable policies of the Coastal Act and the City's LCP.

Detailed Description of Project Components:

The proposed project includes several different components, which are described in detail as follows:

1. Lagoon Reconfiguration

Main Lagoon Channel
The main channel will remain substantially as it exists now. The western edge of the main lagoon at the interface with the western portion of the lagoon will be reconfigured in the form of a naturalized slope to provide a degree of separation between the main lagoon and western portion of the lagoon. The main lagoon channel will be temporarily separated from the western portion of the lagoon by a temporary berm, as described below. However, no work is proposed within the main channel itself.

Western Lagoon Complex
The 12 acre western tidal channel network and channel slopes (as shown on **Exhibit 3**) will be re-contoured to improve circulation and water quality. The existing channels will be reconfigured into a dendritic network with a single main channel to promote tidal circulation and reduce deposition of fine sediments by concentrating hydraulic energy throughout the entire channel length. The existing channels are relatively narrow and will be substantially widened as a result of the project, to approximately 20 to 60 feet in width (at mean tide level) and contoured to create broad shallow slopes to support a greater diversity of vegetation, and increase circulation within the water column and exposure of intertidal areas during open conditions (**Exhibits 4-18**). Additionally, the reconfigured channel beds will be excavated to a depth at or below mean sea level (msl) to promote full tidal exchange, and the beds of the second order channels will be sloped to provide a positive hydraulic gradient toward the main channel to increase flushing, and reduce deposition of fine sediments. The channel configuration also allows for potential future expansion of the project on the western side of the site (the golf

course property). The removal of approximately 13,700 cubic yards of sediment from the lagoon to be exported to an appropriate off-site disposal location is proposed in order to increase tidal prism, improve circulation, reduce algal growth and improve overall conditions for aquatic species. All grading and excavation of the western lagoon area will be separated from surface connections to the existing lagoon by earthen berms, as described below and as shown on Exhibits 4-6. Groundwater that may accumulate in the excavated areas will be pumped through a filtration system, described below, and will be tested before discharge to Santa Monica Bay in order to meet RWQCB standards. The reduction in fine sediments and the resulting coarser substrate is proposed in order to improve habitat for aquatic species such as tidewater goby and reduce nutrient sequestration associated with fine sediments. Salvaged native living trees will be removed from other areas of the site are proposed to be replanted on the channel slopes and along the lagoon edge to create localized scour in specific areas (i.e., the backchannel on the eastern side of the lagoon), focus stream flows towards the main channel, reinforce channel slopes for erosion control, and provide roosting habitat for avian species and cover for tidewater goby and steelhead trout.

After the reconfiguration, under open lagoon mouth conditions, the new channel network will be fully inundated during a normal tidal cycle. Native vegetation planted along the re-contoured channel slopes will be inundated at varying frequencies and durations based on elevation. Under closed conditions, the majority of the site will be inundated, and in the highest observed condition all but the top few feet (above 9' NAVD 88) of the proposed islands will be under water. The reduced size and altered orientation of the lagoon islands in the western portion of the lagoon are proposed to increase fetch and to promote wind-driven circulation under closed lagoon mouth conditions. Because of the increased fetch, it is expected that the currents driven by summer winds will more effectively reduce stagnation and increase oxygen availability in the lower depths of the lagoon through improved horizontal mixing.

Eastern Channel

The existing boathouse channel adjacent to the Adamson House on the eastern side of the lagoon is proposed to be deepened and re-contoured due to sedimentation that has naturally occurred. This will re-create mudflat habitat and promote additional water circulation. The work on the eastern side of the lagoon will utilize hand crews and low tide windows. Dewatering will not be necessary for work on the eastern side of the main lagoon channel. Additionally, salvaged native trees are proposed to be placed on the channel slope and along the lagoon edge on the eastern side of the main channel to create localized scour in specific areas (i.e., the backchannel on the eastern side of the lagoon), to focus stream flows towards the main channel, to reinforce channel slopes, and to provide roosting habitat for avian species and cover for tidewater goby and steelhead trout.

2. Dewatering Plan

The 12 acres on the western side of the lagoon ("western lagoon complex") will be included in the grading operation and will require dewatering. A small portion of the eastern side of the lagoon will be hand excavated during low tide and will not require dewatering. All grading operations in the western lagoon complex will occur after the project site is dewatered to allow for construction inspection, species relocation, and to avoid turbidity. All construction is proposed to occur in dry areas only.

The applicant evaluated the alternative of working from the shore, but excavation equipment working from the shore would not have the adequate mechanical reach to complete the required grading in the center of the western lagoon area. Dry jetties were also considered to allow equipment access, but this method was rejected because this method would require the import of additional temporary jetty material and extend the overall construction window. Therefore, the applicant has proposed grading directly in the western lagoon complex after dewatering.

To dewater the western lagoon complex and provide a physical barrier to the main lagoon, a temporary earthen berm/ dike is proposed to be constructed. The temporary berm will connect one shore to the other to isolate the main lagoon from the project area. The berm will be installed either when the lagoon mouth is closed and water will be pumped out while the dike is constructed (expected during the dry summer months) or when the lagoon mouth is naturally in an open lagoon condition during the low tide where the lagoon has been naturally breached and there is little or no water in the lagoon. It is likely that the lagoon mouth will be in a closed condition when work for the project occurs during the proposed timeframe, between June 1st and October 15th, because this the dry season when flow inputs from Malibu Creek are at their lowest. However, it is possible that the lagoon mouth could be in a naturally open condition.

Dewatering and Placement of Temporary Interior Berm

The temporary interior dike/berm will need to be constructed in a wet environment. The western lagoon complex is proposed to be pumped to lower and hold the water surface to an elevation of 3 feet to expose the temporary berm foundation material. Prior to dewatering, fish biologists will conduct sweeps to clear the construction area and relocate aquatic species prior to placement of geotextile or fill material, as further described below. Material will be placed in 6 inch lifts and compacted to minimize seepage for the duration of construction. Material will be added repeatedly as the dike settles and is compressed. The soil will be confined to a geotextile so sediment will not escape. A turbidity curtain is proposed to be installed and maintained during construction and operation of the dike. The construction window for the temporary berm is approximately 12 to 16 hours. Dewatering will maintain the barrier beach and is not proposed to contribute to a potential breach of the lagoon mouth.

The applicant expects that temporary pumps will need to run 24 hours a day for approximately 1 week at a flow rate of up to 25 cfs (11,250 gpm) to achieve elevation 3 ft. in the lagoon. The temporary pumping rate will vary based on the Malibu Creek flows and the rate at which seepage will enter the lagoon during pumping operations. Pumping rates will exceed the creek surface flow rates and groundwater inflows. The applicant expects these flows to be approximately 6 cubic feet per second (cfs) (3.5 cfs average creek flow in addition to 2.5 cfs groundwater inflow). Although the actual pumping may only take 3 days, the applicant proposes a one week timeframe estimate to allow for management of intake fish screens and potential shutdowns for debris removal and maintenance.

Filtration is proposed to capture 100% of the target contaminants, including but not limited to: nutrients, bacteria, sediment, and metals. Pumped water will be filtered and tested before discharge to Santa Monica Bay in order to meet RWQCB standards, described below. Pre-filtration would be accomplished using flow-through over and under design weir tanks (e.g. “Baker tanks”). Secondary filtration would be conducted using a two-step process with bag filtration followed by particulate filtration to remove solids from the flow stream. The final treatment will be accomplished using carbon and resin vessels for collecting remaining contaminants and removing bacteria and nutrients. All used filter media and sediment will be disposed of at an approved landfill outside of the coastal zone.

All pumping operations will be tested and monitored to ensure that water quality standards for the Santa Monica Bay are met during construction operations. The California Regional Water Quality Control Board (“Regional Water Board”) has approved dewatering discharges into the Pacific Ocean under the General National Pollutant Discharge Elimination System (“NPDES permit”) and Waste Discharge Requirements. (NPDES No. CAG994004, CI-9573, March 9, 2010). The NPDES permit authorizes California Department of Parks and Recreation to discharge up to 1.3 million gallons per day (MGD) of treated water into the Santa Monica Bay and the permit provides discharge limitations for specific constituents, including: total suspended solids, turbidity, biological oxygen demand (BOD), oil and grease, settleable solids, sulfides, phenols, residual chlorine, copper, and fecal coliform. The Regional Water Board’s approval also requires the applicant to comply with a monitoring and reporting program (CI-9573). Several sampling “tap” locations are proposed so that the treatment efficiency may be monitored. Treatments “taps” are proposed to be located prior to any pre-filtration, in between each treatment phase, and prior to discharge at the permitted outfall location. The treatment filtration system is designed to maintain flow and discharge back to the construction area if test results indicate treatment is not adequate. Any exceedence of water quality levels as described in the permit will require immediate reduction of flow rate and re-routing of flows back to the construction area, and potentially shut down of dewatering operations until the treatment process can meet the permitted discharge thresholds.

Western Lagoon Complex Dewatering

Once the lagoon is lowered and the temporary interior berm/dike is constructed, pumping operations will be moved to the construction side of the lagoon (12 acres) and pumping rates will be greatly reduced and only required to manage the groundwater inflow to maintain a dry working area. The applicant has provided detailed data (*See* Substantive File Documents. Jan. 2009 Dewatering Plan) regarding flow rates into the lagoon. As each channel element is constructed, it is expected that excavation would intercept the groundwater table and daylight seepage into the work area. Typical channel elements are 400 feet in length (800 feet, both sides) and the exposed seepage height on the bank would be 4 feet on average. A total of 3200 square feet would contribute at a rate of 0.000769 ft/sec generating an expected dewatering flow rate of approximately 2.5 cfs (1125 gpm). Pumping operations will be moved back to the main lagoon and rates increased to 25 cfs again to help equalize water levels during the temporary interior dike removal.

Dewatering Species Protections

Several aquatic species occupy the lagoon and need to be protected during the construction operations. Aquatic species relocation is required by the US Fish and Wildlife Service and by the National Marine Fisheries Service, as well as by Special Condition Four (4) of this permit, including pre-construction and post-construction monitoring, and pre-construction capturing, exclusion, and relocation. During the pumping periods, tidewater goby and steelhead juveniles will be of specific concern. Pumps will require isolation to avoid contact with these species. Individual pump intake screens or screen intake galleries are proposed to meet the maximum screen opening and approach velocity criteria.

Re-watering the Western Lagoon Complex

To re-water the western lagoon, the main lagoon elevation will be pumped to the filtration tanks in order to lower the lagoon to an elevation of 3 feet. The temporary interior berm can then be removed, reducing the top elevation of the berm from 10 feet to 5 feet to provide a low stable working surface for heavy equipment (e.g. hydraulic excavator). At the location of the connecting channel excavation, the dike would be lowered an additional 1 foot over a width of 100 feet, centered on the proposed channel alignment. This would create a small spillway toward the dry construction area. The pumping area would then be reduced to regulate the flow into the western lagoon until an elevation of 3 ft. is achieved. The spillway would be observed to ensure that erosion does not occur during this operation. It may become necessary to pump water into the western lagoon area to avoid spillway erosion hazards. When an elevation of 3 feet is achieved in the western lagoon, pumping rates in the main lagoon would be restored to maintain its elevation of 3 ft.

When the western lagoon re-contouring and grading is complete, grading for the main channel that will connect the western lagoon to the main lagoon will be conducted. The temporary dike located at the mouth of the main channel will be removed to finished grade over approximately a length of 150 ft.. After the western lagoon is open to the tidal cycle, water surface elevations are expected to naturally equalize. A fish biologist would perform fish rescues within the area of the turbidity curtain prior to excavation of the last channel segment and final removal of the temporary dike. The removal of the dike would occur in wet conditions until final grade is achieved. Turbidity curtains would remain in place for at least 24 hours following excavation operations to allow some clarity to return. Working from both banks, the remaining footprint of the temporary interior dike would be excavated to achieve the final construction grades. The turbidity curtains would then be removed and water allowed to flow freely between the main lagoon and the western portion of the lagoon. Pumping operations will cease and the lagoon will be allowed to flood to a pre-project “closed” condition.

3. Habitat Restoration and Revegetation Plan

The proposed revegetation plan includes the initial planting and reestablishment of native vegetation within the lagoon and its surrounding upland areas, as well as ongoing maintenance and management activities to ensure that the restoration objectives are achieved. Vegetation restoration activities include appropriately designed slopes/elevations and sediment types, topsoil and sediment salvage and management, restoration planting and natural establishment, maintaining unvegetated habitat areas, minimizing habitat loss from seasonal inundation, and long-term habitat maintenance. The applicant has submitted a planting program, including salt panne, low marsh, mid-high marsh, high marsh transitional, and coastal scrub habitats. (**Exhibits 11-17**)

4. Public Access Trail and Public Interpretive Amenities

The applicant proposes to improve the existing path around the perimeter of the lagoon and proposes to develop educational and interpretive improvements and other public amenities along the perimeter of the lagoon restoration area (**Exhibits 4** and **18**). These educational/interpretive elements will include pathways, various forms of educational and viewing platforms, a bird watching blind, a shade canopy, interpretive displays of the topography and function of the lagoon and watershed and outdoor seating elements. (**Exhibit 18**)

<u>Shade Canopy</u>
A steel shade canopy is proposed to be located adjacent to the parking area at the location of the existing interpretive node to partially shade the semicircular concrete seating. The canopy design is an abstract design of a kelp forest. The shade structure will consist of a horizontal surface of approximately 900 sq. ft. of .5 inch steel plate in the abstract design of a kelp forest and supported by 12 ft. tall, 6 in. diameter steel pipe columns. The width, height, and placement of the columns will preserve the integrity of the view of the lagoon from the parking area. The surface below the shade canopy is decomposed granite.

<u>Watershed Fountain</u>
A 6 ft. by 8 ft. topographic model of the Malibu Creek watershed will be located at the south end of the current parking access roundabout. The metal casting will be supported by a solid, stone surfaced base to a height about two feet above grade. A tubular metal pipe will be located a few inches from the edge of the model at railing height and surround most of the watershed model. The pipe will be perforated in order to emit a spray of water when a valve is opened (visitor operated), so that the water mist will fall on the topography, collect in the basin, and drain to the lowest point of the model

(the lagoon), and then spill into a trench drain corresponding to the shoreline and then track to a drainage swale, mimicking the function of the watershed. The paths leading to and from the watershed fountain will be decomposed granite throughout, except for the immediate area surrounding the fountain, which will consist of concrete pavers and sloped to drain. The concrete paver area will be approximately 250 sq. ft.

<u>Summer Clock and Winter Platform</u>
To the south of the watershed display, three paths diverge and extend to the south. A 10 ft.-wide road with 5 ft. in width of decomposed granite will be constructed at the westernmost path to allow access for lifeguard use, State Parks, and rescue operations. This access road will be blocked by a steel access gate and used as the express route for emergency access.

The middle and easternmost pathways are part of an interpretive route. The middle path is separated from the access road by an earthen berm. A small seating area will be built into the east face of the berm with decomposed granite and lengths of benches cut from tree logs reclaimed from the previous interpretive area onsite. The middle path is at an elevation of 10 ft. and above the level of the lagoon, which peaks at 9 ft. before the berm is breached. The middle path also provides a view during the summer season when the lagoon is closed from tidal influence of the east path, also known as the “Summer Clock.” The Summer Clock is a very gradually sloping, 180 ft.-long path designed to provide access to the edge of the tidal marsh during open lagoon conditions and to show the daily rising of the lagoon during the summer season, as the dry season flows slowly fill the lagoon. The increase in lagoon elevation will be evident because the water will advance a foot along the path for every three-tenths of an inch of surface elevation change.

During the winter season, when the lagoon is open to tidal influence, the path will provide access to the winter platform, at an approximately 7 ft. elevation, equal to or above the highest seasonal tides. A circular set of terraces will be located adjacent to the platform with edging designed to separate and show the species of vegetation common to the low, middle, and high elevation marsh communities. The platform and marsh terraces will be cut into a steeply sloping bank. A second sloping path (1:20) will provide a means of ingress and egress to and from the south.

These paths will be surfaced with removable precast concrete pavers and suspended on short piers to allow for subsiding tides and draining lagoon flows and silts to drain through and beneath the paths and platform. The total area of the concrete pavers and 4 ft. wide paths is 1,600 sq. ft. The short section of the summer clock ramp (from 9 ft. to 10 ft. in elevation) that slopes at 1:12 will have level landings and steel handrails for compliance with ADA requirements.

<u>Bird Watching Blind</u>
A public bird watching blind will be constructed south of the Summer Clock where a path leading from the main access road and walking path to a slightly elevated area located opposite one of the proposed lagoon islands. The blind will consist of vertical

arcing steel supports at 4 ft. on center along the perimeter of the viewing area. Light stainless steel cables will span in a 16 inch diagonal grid between the vertical elements, creating a frame against which native mulefat stalks will be planted and trained against the form in order to create the appearance of a natural vegetative barrier. The mulefat stalks will be tied against the cable form in various ways to provide opening in the vegetation for viewing the lagoon. The supporting structure will vary from about 4 ft. to a maximum of 12 ft. in height, roughly corresponding to the height of mature mulefat plantings, and will be approximately 88 ft. in length.

Picnic Area

Four concrete picnic tables will be located in a decomposed granite surfaced area, with berms covered with planted live oaks and associated understory plant species, and drainage swales containing sycamore trees, as shown the planting plan. (**Exhibits 12-17**)

Perimeter "Adamson House" Wall

A six ft.-high concrete masonry wall will be constructed the length of the southern boundary of the western lagoon complex, adjacent to the various fencing and wall types of different heights that currently exist. The wall will serve as a buffer between the public park and the residential neighborhood located immediately to the south. The wall is proposed to be approximately 880 ft. long and is designed to match the perimeter of the historic Adamson House with embedded tile and rock elements. A decomposed granite path will be constructed along the wall and will meander through the area. In response to the applicant's discussions with several concerned residents of Malibu Colony regarding drainage concerns, the applicant has modified the design of the proposed wall to add several openings along the bottom of the wall to facilitate stormwater drainage flows by allowing for a 50% open condition at grade between masonry piers. This will be accomplished by creating 8" by 8" openings at 16" on center along the length of the wall, with the bottom of the masonry opening just below grade so that a minimum 4" vertical clearance from grade to the wall above, and 8" of clear width is maintained. Drainage from the property line through the wall will be diverted to a series of vegetated drainage swales (approx. 800 ft. long, with width varying between 6 to 10 ft.) running parallel to the wall face on the north side. The swales will also collect surface water runoff, as well as runoff from two stormwater discharges from the Malibu Colony. The drainage swales will link east to west, ultimately reaching two larger swales at the southeast corner of the property where they will enter a filter and drain system. The project engineers estimated peak flows from Malibu Colony to quantify the potential for surface sheet drainage and determined the new wall design and swale to be adequate for a 50 year storm event. (ICF International Memorandum, dated September 3, 2010, *see* Substantive File Documents)

Watershed Overlook

A 600 sq. ft. decomposed granite overlook platform will be constructed to provide a view up the canyon to the north. The platform will be mostly located at grade except for 20 ft. of one side of the platform. The northeast corner of the platform will be constructed to extend over the grade below to a maximum height of approximately 3 ft. and supported by a concrete slab that is molded to form a concrete bench at the east end of the platform. The two exposed and elevated lengths of the platform will have a perimeter railing system consisting of steel stanchions and horizontal stainless steel cables, the top surface of which will be concrete cast within a steel angle with impressions of natural elements cast into the top to match the theme established by the existing concrete seating near the parking area.

Observation Platform (East of Parking Area)
The observation deck will consist of a semi-circular decomposed granite surface edged by an elevated radial patterned composite deck varying in width from 4 feet to 7 feet with a total deck area of 380 sq. ft. The decomposed granite will be constructed flush with the decking surface. The deck will be approximately 2 ft. to 3 ft. above grade. The railing system for the deck will consist of steel stanchions and horizontal stainless steel cable, the top surface of which will be concrete cast within a steel angle with impressions of natural elements cast to match the other concrete elements of the project.

5. Project Monitoring

The applicant has proposed a long-term program to monitor the physical conditions (i.e. bathymetry, sediment samples, grain size), water quality, and biological conditions (marsh vegetation, fish, benthos, aquatic vegetation, and birds) of the restored lagoon over a five year period. The project proposal includes semi-annual physical condition monitoring and water quality monitoring, and frequent biological assessments. The monitoring is proposed for five years after the project is complete. From 2006 to 2008, the applicant conducted baseline monitoring, including sediment testing, grain size analysis, and water quality analyses. Water quality has been monitored continuously at three locations within the lagoon complex since 2006. Additionally, at least two years of data has been collected as a baseline for aquatic species, and for bathymetry (transects).

B. PROJECT LOCATION AND BACKGROUND

Malibu Lagoon covers a 31 acre area located at the terminus of the Malibu Creek Watershed, which is the second largest watershed that drains into Santa Monica Bay. The tidally influenced area covers approximately 24 acres. The lagoon drains into the Santa Monica Bay at Surfrider Beach in the City of Malibu. Malibu Lagoon State Beach is managed and operated by the California Department of Parks and Recreation (“State Parks”). It is bordered to the north by the Pacific Coast Highway (PCH), to the west by a gated residential community (“The Colony”), “and to the south by a finger of the Malibu Colony (south of the western portion) and the Pacific Ocean (south of the main lagoon). The lagoon is ecologically significant because it is one of the last remaining wetlands within Santa Monica Bay and hosts a variety of avian and aquatic species of statewide and regional significance. The lagoon waters seasonally fluctuate between a freshwater, brackish water, and saltwater environment depending on the flow regime in Malibu Creek, the height of the beach barrier, and the diurnal tides of the ocean. The current lagoon configuration does not provide an adequate and fully functional lagoon habitat regime that historically naturally existed at this site mainly because of poor circulation. The proposed project will re-contour the 12 acre western portion of the lagoon to restore tidal complexity, improve the hydraulic circulation and enhance aquatic habitat structure and diversity.

The lagoon mouth is either open or closed depending on the height of the barrier beach. When the lagoon mouth is open, the hydraulics are dominated by freshwater creek flows during flood events and during low tides, and by the inflow of saltwater during high tides. When the lagoon mouth is open, the lagoon can drain to an elevation of 0 ft. and match the lowest daily tide. During a majority of the season when the mouth is open (winter season), the barrier beach is naturally maintained at an elevation of 3 ft. Tides enter the lagoon twice a day and flood the project area to an average elevation of 6 ft., with the extreme high tides reaching approximately 8 ft. When the lagoon mouth is closed, the lagoon stores water flowing from Malibu Creek, runoff from PCH, runoff from the adjacent neighborhood, groundwater seepage, and maintains an elevation of approximately 9 ft. above mean high tide. Water quality in the lagoon during the closed condition is generally poor and exceeds water quality standards set by the Regional Water Quality Control Board for the Santa Monica Bay.

Site History and Past Commission Action

Malibu Lagoon has been significantly altered from its original condition. The existing 31 acre lagoon contains only a small portion of its historic reach. In 1929, the California Department of Transportation used the site as a dumping ground during construction of the Pacific Coast Highway. Since that time, urban development has surrounded the lagoon, including an adjacent housing development (Malibu Colony) and construction of the Pacific Coast Highway bridge to the north through the lagoon. Further, a large portion of the lagoon was filled in during the 1940’s and 1950’s and baseball fields were constructed.

Coastal Development Permit No. P-79-5515 was approved by the Commission on August 13, 1979 for a “General Development Plan for Malibu Lagoon Beach” granted to the California Department of Parks and Recreation. The CDP authorized 60,000 cu. yds. of excavation of sediment material for the purpose of marsh restoration of which 50,000 cu. yds. of the excavated material disposed of offsite at Malibu Creek State Park, approximately 6 miles away. The project included creation/restoration of approximately 7 acres of area (the “western lagoon complex”) that was historically part of the lagoon but filled in by the California Department of Transportation in 1969 and preceding years as a result of highway construction. The restoration included 3.5 acres of permanent lagoon, 6 acres of tidal marsh, and 3.5 acres of upper marsh. Additionally, a 50-car parking lot adjacent to the marsh area, chemical restroom facilities, a perimeter road, and an elevated walkway over the marsh were also approved. This CDP approval was challenged by the Malibu Little League who received a Superior Court order temporarily suspending the permit and requiring the Commission to review the Executive Director’s determination of compliance with a condition that State Parks provide assistance to the Little League organization (who had used the property since 1970) to find an alternative site for ball fields. A permit extension was subsequently approved by the Commission on August 25, 1982, whereupon the CDP was reissued as CDP No. 5-81-135E and the lagoon restoration took place in 1983.

In 1986, the Commission approved additional development at the site, including a 1,000 ft. walkway, viewing deck, two stairways, ramp, and underground utilities. (CDP No. 5-86-143) Various other projects have been approved at Malibu Lagoon State Beach by the Commission, including restoring 0.60 acres of wetland and creating salt marsh and dune habitat (CDP No. 5-87-689), breaching the sand berm at the mouth of the lagoon as a one-time emergency measure to remediate flooding (CDP No. 4-95-242-G), installing temporary symbolic fencing for the threatened snowy plover (CDP No. 4-08-015-W and 4-08-085-W), and redirecting the mouth of the Malibu Creek using a tractor to close the channel in order to direct the flow upcoast as a one-time emergency measure to remediate flooding (CDP 4-06-051-G). Another partial restoration project within the lagoon occurred in 1996, pursuant to the Commission approval of Coastal Development Permit 5-90-1066. This restoration project was implemented by the California Department of Transportation (CalTrans) and coordinated by State Parks and the Resource Conservation District of the Santa Monica Mountains. The restoration was implemented as mitigation for impacts to Malibu Lagoon from construction during the PCH Bridge Replacement Project. That restoration program included a tidewater goby habitat enhancement project and a revegetation program.

In the late 1990's, the California Coastal Conservancy funded a study by the University of California, Los Angeles to identify restoration goals for the Malibu Lagoon task force. This led to the preparation of the Malibu Lagoon Restoration Feasibility Study and Final Alternatives Analysis (*see* Substantive File Documents). In 2005, the California Department of Parks and Recreation completed the Malibu Lagoon Restoration Feasibility Study and Final Alternatives Analysis to assess further restoration of Malibu Lagoon. This effort involved coordination meetings between the California Department of Parks and Recreation (State Parks), the California State Coastal Conservancy, Heal the Bay, the Lagoon Restoration Working Group, and the Malibu Lagoon Technical Advisory Committee to determine the most ecologically beneficial restoration design with the least amount of harmful impacts to the lagoon ecosystem, focusing on long-term habitat and water quality benefits. A Final Environmental Impact Report was completed for this project dated March 2006. Subsequently, the applicant has obtained preliminary permit approvals for the project from the Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), and the Army Corps of Engineers (Corps) and permit approvals from the Regional Water Quality Control Board (RWQCB).

The State Coastal Conservancy secured funding from the State Water Resources Control Board to complete "Phase I" of the Malibu Lagoon Restoration and Enhancement Plan, the parking lot relocation, which was completed in 2008. The City of Malibu approved a Coastal Development Permit Application by the California Department of Parks and Recreation (CDP NO. 07-012) for "Phase I" of the Malibu Lagoon Restoration and Enhancement Plan in 2007 to relocate the parking lot for

Malibu Lagoon State Beach. The City of Malibu simultaneously approved Variance No. 07-024 allowing the parking facilities to be located within the front yard setback and within a public open space. The City's CDP authorized the relocation and redesign of the previously existing parking to allow for additional habitat to be restored in "Phase 2" of the Malibu Lagoon Restoration and Enhancement Plan, the currently proposed project. The new parking lot includes permeable pavement, landscaping, and a stormwater treatment system to treat runoff before it flows to the lagoon. The CDP also authorized a public use area adjacent to the parking lot with various forms of seating, the relocation of the vehicular entryway and pedestrian pathway (the primary pedestrian and vehicle entryway from Pacific Coast Highway), and a new pedestrian footpath and bridge allowing entry to Surfrider Beach approximately 300 ft. to the southeast.

C. DIKING, FILLING, AND DREDGING OF COASTAL WATERS

The proposed project is located within Malibu Lagoon, a wetland area. Wetlands are defined in Section 30121 of the Coastal Act as follows:

'Wetland' means lands within the Coastal Zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens.

Section 30233 of the Coastal Act allows filling of coastal waters (or wetlands) only where feasible mitigation measures have been provided to minimize adverse environmental effects, and for only the following seven uses listed in Section 30233(a) of the Coastal Act:

> ***(1) New or expanded port, energy, and coastal-dependent industrial facilities, including commercial fishing facilities.***
> ***(2) Maintaining existing, or restoring previously dredged, depths in existing navigational channels, turning basins, vessel berthing and mooring areas, and boat launching ramps.***
> ***(3) In open coastal waters, other than wetlands, including streams, estuaries, and lakes, new or expanded boating facilities and the placement of structural pilings for public recreational piers that provide public access and recreational opportunities.***
> ***(4) Incidental public service purposes, including but not limited to, burying cables and pipes or inspection of piers and maintenance of existing intake and outfall lines.***
> ***(5) Mineral extraction, including sand for restoring beaches, except in environmentally sensitive areas.***
> ***(6) Restoration purposes.***
> ***(7) Nature study, aquaculture, or similar resource dependent activities.***

As previously described above, the proposed development includes the restoration and enhancement of Malibu Lagoon to improve the long-term function of the lagoon ecosystem by recontouring/reconfiguring the lagoon, slopes and channels to increase hydrologic flow. The project involves approximately 51,200 cu yds. of excavation and 37,500 cu. yds. fill for the purpose of wetland and habitat restoration. Approximately 13,700 cu. yds. of excavated sediment material will be exported from the project site to an appropriate disposal location. The project also includes implementation of a habitat restoration plan to replant native wetland and upland plant species and remove non-native plant species, construct an public access trail around lagoon with interpretive public educational/interpretive exhibits and improvements, and implement a long-term monitoring plan to monitor physical processes, biological changes, and vegetation restoration of the lagoon over a 5-year period to ensure the success of the restoration efforts.

Section 30233(a) limits dredging and fill activities in wetlands to seven allowable uses, including restoration. In this case, all proposed dredging/grading within wetland areas is for the purpose of restoration of the lagoon ecosystem. Moreover, the proposed grading is necessary to improve the circulation of the lagoon in order to increase water movement, water quality, and the long-term biological productivity of coastal waters. The project includes an extensive revegetation plan to remove non-native plant species and plant appropriate native wetland and upland plant species. Thus, the proposed grading (including all excavation and fill) is clearly an allowable use within a wetland pursuant to Section 30233(a)(6).

Section 30233 allows grading in a wetland only where there is no feasible less environmentally damaging alternative to the proposed project. Alternatives to the project as proposed must be considered prior to finding that a project satisfies this provision of Section 30233. As noted above, the purpose of the proposed project is restoration and enhancement of the Malibu Lagoon. The Final Environmental Impact Report (FEIR) SCH No. 2005101123 found that although the proposed project will, in the long-term, significantly improve the wetland and upland habitat on site and increase the biological productivity of coastal waters, the proposed project may result in potential short-term impacts to sensitive species during initial construction/restoration operations. Specifically, recontouring of the lagoon banks and slopes would occur in areas where sensitive fish species are located. In order to avoid such impacts or minimize them to the maximum extent feasible, the applicant proposes to temporarily relocate the tidewater gobies, steelhead, and all other aquatic species from the construction areas to the main lagoon channel. The applicant proposes to accomplish this by seining the work area to collect the gobies and other species, releasing them behind a blocking net, constructing a berm to create a complete barrier across the estuary, and then dewatering the construction area with screened pumps. Moreover, all work involving the gobies and other sensitive species would be conducted by qualified biologists authorized by the U.S. Fish and Wildlife Service (USFWS) approval. Additionally, in order to ensure that the applicant's proposed best management practices are adequately implemented, **Special Condition (4)** requires the applicant to submit a Final Dewatering Plan, for the review and approval of the Executive Director. The plan must incorporate all USFWS requirements into the plan for species removal and relocation, and the special condition also requires pre-construction surveys, construction personnel training, biological supervision of species removal and relocation, post-construction surveys, and post-project monitoring reports. In addition, these plans must be approved by the project engineers, consistent with their recommendations in the engineering and hydrological reports prepared for this project, as described in **Special Condition Eight (8)**.

As noted above, grading and recontouring the lagoon is integral to the proposed project's main objective to expand lagoon capacity, enhance circulation, and restore habitat. Any project alternative including excavation of the estuary banks would require dewatering of the estuary and grading and its attendant impacts on tidewater gobies and other aquatic and terrestrial species. The "no project" alternative would avoid short-term impacts to sensitive aquatic and terrestrial species from grading, dewatering, and construction noise. However, the "no project" alternative would not meet any of the goals of the proposed project, including the long-term improvement of both water quality and enhancement of wetland and upland habitat areas on site. Failure to implement the proposed project would result in the continuation of the degraded condition of the lagoon and its surrounding upland habitat areas and would not resolve the current problems on site, including poor circulation, eutrophication, sedimentation, poor water quality, lack of species diversity, and diminished quality of aquatic and riparian habitat. Overall, the proposed project is expected to have long-term beneficial impacts on the tidewater goby population and populations of other sensitive species with minimal short-term impacts from recontouring and revegetating the lagoon. The project includes removal of non-native species and implementation of a detailed restoration program using locally sourced native plantings. Discussion of the long-term benefits of this project are discussed in the September 22, 2010 memorandum prepared by the Commission's Ecologist, Dr. Jonna Engel (hereinafter "Dr. Engel Memorandum"), which is incorporated as if set forth in full herein. Thus, the Commission finds that there is no less environmentally damaging alternative.

Section 30233 requires that adequate mitigation measures to minimize adverse impacts of the proposed project on habitat values shall be provided. The applicant has incorporated numerous mitigation measures in the proposal, including erosion control measures, revegetation of the lagoon banks with emergent wetland and riparian vegetation (**Exhibit 6**), and the proposed dewatering and aquatic species protection plan described above. **Special Condition Fourteen (14)** incorporates, by reference, all of the mitigation measures listed in Final Environmental Impact Report SCH No. 2005101123, as special conditions of the subject permit. Additionally, **Special Conditions Six (6) and Seven (7)** require additional monitoring and reporting relating to the success of lagoon physical hydrology, revegetation, aquatic, and terrestrial species and also require corrective action if results indicate that the lagoon is not functioning as expected and success criteria is not met. Therefore, the Commission finds that, as conditioned, the project will provide adequate mitigation measures to minimize adverse impacts on habitat values and no net loss of wetland area or function will occur as a result, as required by the third test of Section 30233.

Due to the reasons discussed above, the Commission finds that the proposed project, as conditioned, is consistent with §30233 of the Coastal Act and with all relevant policies of the adopted City of Malibu Local Coastal Program.

D. WATER QUALITY

The Malibu LCP incorporates Section 30231 of the Coastal Act, which states:

The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, minimizing alteration of natural streams.

Further, the following LUP water quality policies are applicable:

3.100 ***New development shall be sited and designed to minimize impacts to water quality from increased runoff volumes and nonpoint source pollution. All new development shall meet the requirements of the Los Angeles Regional Water Quality Control Board (RWQCB) in its the Standard Urban Storm Water Mitigation Plan For Los Angeles County And Cities In Los Angeles County (March 2000) (LA SUSMP) or subsequent versions of this plan.***

3.102 ***Post-construction structural BMPs (or suites of BMPs) should be designed to treat, infiltrate, or filter the amount of stormwater runoff produced by all storms up to and including the 85th percentile, 24-hour storm event for volume-based BMPs and/or the 85th percentile, 1-hour storm event (with an appropriate safety factor, i.e. 2 or greater) for flow-based BMPs. This standard shall be consistent with the most recent Los Angeles Regional Water Quality Control Board municipal stormwater permit for the Malibu region or the most recent California Coastal Commission Plan for Controlling Polluted Runoff, whichever is more stringent.***

3.110 ***New development shall include construction phase erosion control and polluted runoff control plans. These plans shall specify BMPs that will be implemented to minimize erosion and sedimentation, provide adequate sanitary and waste disposal facilities and prevent contamination of runoff by construction chemicals and materials.***

3.111 ***New development shall include post-development phase drainage and polluted runoff control plans. These plans shall specify site design, source control and treatment control BMPs that will be implemented to minimize post-construction polluted runoff, and shall include the monitoring and maintenance plans for these BMPs.***

3.125 ***Development involving onsite wastewater discharges shall be consistent with the rules and regulations of the L.A. Regional Water Quality Control Board, including Waste Discharge Requirements, revised waivers and other regulations that apply.***

3.126 ***Wastewater discharges shall minimize adverse impacts to the biological productivity and quality of coastal streams, wetlands, estuaries, and the ocean. On-site treatment systems (OSTSs) shall be sited, designed, installed, operated, and maintained to avoid contributing nutrients and pathogens to groundwater and/or surface waters.***

3.127 ***OSTSs shall be sited away from areas that have poorly or excessively drained soils, shallow water tables or high seasonal water tables that are within floodplains or where effluent cannot be adequately treated before it reaches streams or the ocean.***

3.131 ***The construction of private sewage treatment systems shall be permitted only in full compliance with the building and plumbing codes and the requirements of the LA RWQCB. A coastal development permit shall not be approved unless the private sewage treatment system for the project is sized and designed to serve the proposed development and will not result in adverse individual or cumulative impacts to water quality for the life of the project.***

3.141 ***Applications for a coastal development permit for OSTS installation and expansion, where groundwater, nearby surface drainages and slope stability are likely to be adversely impacted as a result of the projected effluent input to the subsurface, shall include a study prepared by a California Certified Engineering Geologist or Registered Geotechnical Engineer that analyzes the cumulative impact of the proposed OSTS on groundwater level, quality of nearby surface drainages, and slope stability. Where it is shown that the OSTS will negatively impact groundwater, nearby surface waters, or slope stability, the OSTS shall not be allowed.***

The Commission recognizes that new development has the potential to adversely impact coastal water quality and aquatic resources because changes such as the removal of native vegetation, the increase in impervious surfaces, and the introduction of new uses cause increases in runoff, erosion, and sedimentation, reductions in groundwater recharge and the introduction of pollutants such as petroleum, cleaning products, pesticides, and other pollutants, as well as effluent from septic systems.

In this case, the proposed development is the restoration and enhancement of Malibu Lagoon, a degraded lagoon ecosystem that is currently characterized by poor water quality conditions due in part to inflow of nutrient and pollutant rich water from Malibu Creek including urban runoff, storm drainage, and groundwater inputs. Currently, the water quality in the lagoon fails to meet Regional Water Quality Control Board standards for concentrations of various constituents and pollutants. The proposed reconfiguration of the lagoon and hydrological system is expected to improve circulation and result in improved water quality. However, the temporary dewatering of the 12 acre western lagoon complex may result in potential short-term adverse impacts to water quality in other portions of the lagoon and to Santa Monica Bay due to increased disturbance during construction. As explained below, the discharges from dewatering the western portion of the lagoon are regulated by the California Regional Water Quality Control Board and will be treated according to the standards outlined in the approved National Pollutant Discharge Elimination System Permit (“NPDES Permit”). Moreover, although the proposed restoration activities may result in some short-term construction impacts to water quality, the proposed project is expected, in the long-term, to significantly improve the circulation of the lagoon in order to increase water movement, water quality, and the long-term biological productivity of coastal waters. Dr. Engel’s September 22, 2010 memorandum evaluates various technical studies of Malibu Lagoon and explains how the impaired water quality has negatively impacted the marine ecosystem. According to the studies evaluated in the memorandum, sediment samples obtained in the western channels of the lagoon contained very fine particles that were high in organic matter, reflecting poor circulation. Releases of the stored nutrients within the fine sediments trigger growth of primary producers, creating hypoxic water conditions, which in turn may contribute to the low infaunal and epifaunal invertebrate diversity found in the lagoon. Lagoon water quality is discussed in detail below.

1. Hydrologic Connectivity of Malibu Lagoon

Malibu Lagoon is influenced by streamflow inputs, tides, and wave action. In the rainy winter season, streamflows in Malibu Creek are higher. As noted above, Malibu Creek inputs in the lagoon include flows from surface water runoff, discharges from Tapia Wastewater Treatment Plan, and seepage from groundwater. Malibu Creek has the potential to discharge large storm flows that generally occur in the late fall and winter months and these flows can contribute to the lagoon mouth opening. The Las Virgenes Municipal Water District Tapia Water Reclamation Plant (LVMWD) is permitted to discharge only during the rainy season, from November 15th through April 15th. LVMWD is permitted to discharge in the summer months only during a rain event or when flows are measured below 2.5 cubic feet per second (cfs). When flows are measured below 2.5 cfs, LVMWD is required to discharge approximately 1cfs until those flows daylight at Serra Retreat Bridge which triggers a stoppage of this regulated discharge. These flows are required by the RWQCB to augment naturally occurring flow in order to protect steelhead trout. By the time these flows reach the lagoon, as little as 1.2 cfs will typically pass through the lagoon as surface flow. The mean daily flows from the creek were calculated from data collected between 1931 to 2009 from June to October and measured to be approximately 3.5 cfs.

During the spring months and drier summer months, the force of the streamflow decreases, the lagoon mouth may close. When the mouth is closed, poor circulation and warmer temperatures leads to eutrophication, which in turn degrades water quality and aquatic habitat. Increases in dry season runoff in Malibu Creek watershed could impact lagoon water levels which could cause a breach in the summer of the closed lagoon. Additionally, summer breaching has occurred in the past informally by local beachgoers or others.

2. Lagoon Water Quality

A key objective of the proposed project is to improve water quality in the lagoon by increasing circulation of water in the lagoon. Water quality in the lagoon when the lagoon is closed is generally poor since creek flows, local runoff, and seepage from poorly functioning residential and commercial septic systems is collected and held by the lagoon. The water quality objectives for nutrients, including nitrate and phosphate, are regularly exceeded.

a. TMDL Water Quality Targets

Malibu Lagoon and Malibu Creek are listed as impaired water bodies under Section 303(d) of the Clean Water Act. Malibu Lagoon is listed as impaired by enteric viruses, eutrophication, high coliform counts, and pH. Malibu Creek is listed as impaired by high coliform counts, nutrients (algae), and scum/unnatural foam. TMDL's to address nutrients and bacteria impairment within the Malibu Creek Watershed, including the lagoon, were adopted by the Los Angeles Region of the California Regional Water Quality Control Board in 2003.

(i) TMDL for Nutrients in the Malibu Creek Watershed

The numeric targets for nitrogen and phosphorus in the Malibu Creek watershed established are provided in Table 1, below. These targets were established to reduce nutrient loading in the watershed to achieve the beneficial uses for the waterbodies, and consider seasonal variations in nutrient concentrations. The RWQCB has eliminated winter limits as data has shown that algal and nutrient impairments exist in both winter and summer.

Table 1. TMDL Targets for Nutrients

Summer (April 15 to November 15)		Winter (November 16 to April 14)
Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
1.0	0.1	8.0

Existing Water Quality Conditions- Nutrients

Previous studies have shown that excessive inputs of nutrients (nitrogen and phosphorus) into the lagoon from the surrounding watershed can result in nuisance algal blooms, objectionable odors, low dissolved oxygen concentrations, and fish kills. The primary sources of nitrogen to the lagoon include septic systems, surface runoff, and sediment release. The primary sources of phosphorus to the lagoon include septic systems, upland systems, surface runoff, and sediment release.

Average lagoon values recorded by Ambrose and Orme (2000) during the summer months were 1.39 mg/l for nitrogen and 0.49 mg/l for phosphorus. The average winter concentrations measured by Ambrose and Orme were 4.0 mg/l for nitrogen and 0.63 mg/l for phosphorus. Water quality sampling conducted by the LVMWD in the lagoon (station HtB-20) between April and September 2003, reported a combined nitrate-N plus nitrite-N concentration of from 0.10 to 2.5 mg/l and ammonia-N from 0.005 to 0.1 mg/l. Additional surface water quality sampling was conducted by the Malibu Creek Preservation Company LLC in the Lagoon west of the Malibu Creek Plaza from February 2003 to December 2003. Samples collected from this location in February, October, November, and December of 2003 reported total N concentrations ranging from 1 mg/l to 4 mg/l.

Sampling in groundwater monitoring wells conducted by Stone (2004) reported mean total nitrogen concentrations for the 3 monitoring wells located along the southern (C-1 and C-2) and northwestern shoreline (P-7) of the lagoon ranging from 0.80 mg/l to 6.47 mg/l. Maximum and minimum total nitrogen concentrations reported at these locations are provided in Table 2, below.

Table 2. Total Nitrogen Concentrations

Well ID	# of Samples	Minimum Total N (mg/l)	Mean Total N (mg/l)	Maximum Total N (mg/l)
C-1	12	3.2	6.47	10.62
C-2	12	0.55	1.01	1.93
P-7	12	0.18	0.80	1.65

(ii.) TMDL for Bacteria/Coliform in the Malibu Creek Watershed

The numeric targets for bacteria in the Malibu Creek watershed established by the U.S. Environmental Protection Agency (EPA) are provided in Table 2, below. These targets were established to protect water contact recreational use in the watershed.

Table 3. TMDL Targets for Coliform

Parameter	Geometric Mean	Single Sample
Total	1,000	10,000 or 1,000 *if* FC/TC >1.0
Fecal	200	400
Enterococcus	35	104

Existing Water Quality Conditions- Bacteria

The bacteria TMDL for the Malibu Creek watershed estimate that 158,000 billion counts of fecal coliform are present in the lagoon, annually. Bacteria are transported into the lagoon from the surrounding watershed through wastewater treatment discharges into Malibu Creek, and leaching from septic systems located in the immediate vicinity of the lagoon.

Surface water quality sampling conducted by the Malibu Creek Preservation Company, LLC in the Lagoon west of the Malibu Creek Plaza from February 2003 to December 2003 reported Enterococcus counts ranging from 52 MPN/100 ml to greater than 2,419.2 MPN/100 ml. The highest counts occurred in June, July, and August.

Sampling in groundwater monitoring wells conducted by Stone (2004) reported mean total coliform concentrations for the 3 monitoring wells located along the southern (C-1 and C-2) and northwestern shoreline (P-7) of the lagoon ranging from 8 MPN/100 ml to

57 MPN/100 ml. Maximum and minimum total coliform concentrations reported at these locations are provided in the Table 4, below.

Table 4. Total Coliform Concentrations

	# of Samples	Minimum Total Coliform (MPN/100 ml)	Mean Total Coliform (MPN/100 ml)	Maximum Total Coliform (MPN/100 ml)
C-1	12	ND	8	22
C-2	12	ND	14	50
P-7	12	ND	57	1600

Mean fecal coliform levels ranged from 3 MPN/100 ml to 9 MPN/100 ml, and mean Enterococcus concentrations ranged from 31 MPN/100 ml to 38 MPN/100 ml at these locations. Maximum and minimum fecal coliform and Enterococcus concentrations reported at these locations are provided in Table 5 and Table 6, below.

Table 5. Fecal Coliform Concentrations

Well ID	# of Samples	Minimum Fecal Coliform (MPN/100 ml)	Mean Fecal Coliform (MPN/100 ml)	Maximum Fecal Coliform (MPN/100 ml)
C-1	12	ND	3	6
C-2	12	ND	7	8
P-7	12	ND	9	50

Table 6. Enterococcus Concentrations

Well ID	# of Samples	Minimum Enterococcus (MPN/100 ml)	Mean Enterococcus (MPN/100 ml)	Maximum Enterococcus (MPN/100 ml)
C-1	12	ND	31	649
C-2	12	ND	32	2419
P-7	12	ND	38	722

3. Circulation Improvements

Currently, the channels of the western lagoon are configured to receive storm flows, but are mostly sheltered from scouring by tides or streamflows due to the lack of hydraulic connectivity with the main lagoon area. The proposed project includes creating a new deepened channel along the southern edge of the western lagoon complex. This channel would serve as the single main exit and entrance for water conveyed in and out of the west lagoon complex. Under open conditions, the tidal circulation would be expected to improve due to increases in flows around the western arms. Under closed conditions, the new channel in the western portion of the lagoon would allow for increased wind-generated wave and water movement. Upstream sources of pollutants, including nitrogen and phosphorous, would still impact water quality in the lagoon. However, the proposed project is expected to reduce eutrophic conditions due to better circulation and result in overall improved water quality. Additionally, the new configuration is expected to direct storm delivered sediments more directly to the ocean and reduce the amount of fine sediments retained within the lagoon.

4. Lagoon Dewatering for Construction

The 12 acres on the western side of the lagoon will be subject to the proposed grading operation and will require dewatering in order to allow restoration/construction activities to occur. All grading operations in the western lagoon complex will occur after the project site is dewatered to allow for construction inspection, species relocation, and to avoid turbidity. All construction and heavy equipment operation is proposed to occur in dry (dewatered) areas only.

Hydrologic connectivity is a key factor in determining the quantity of water expected to be encountered during dewatering operations. The potential flow rates are variable and range between 10 ft/day and 123 ft/day. The mean flow rate between these two numbers is 2.5 cfs (66.5 ft/day) and is presented by the applicant as the basis for the dewatering calculations. Dewatering is proposed to be minimized by using a phased grading approach and the entire west area will not be open to dewatering activities all at one time. As each channel element is constructed, each side of the excavation is expected to intercept the groundwater table and daylight seepage into the work area. Typical channel elements are 400 ft. in length (800 ft. both sides) and the exposed seepage height on the back would be 4 ft. on average. This estimated flow rate will be verified by excavating test pits along the perimeter of the lagoon prior to construction.

Containment Filtration for Dewatering

Pre-filtration of the water to be transferred out of the site is proposed to be accomplished using flow through over and under design weir tanks ("Baker tanks"). Secondary filtration is proposed using a two step process with bag filtration followed by particulate filtration to remove all solids from the stream flow. The final treatment system prior to discharge of the lagoon water/effluent is proposed to be achieved using carbon and resin vessels for collection of the remaining contaminants, and for disinfection, further explained below. **Special Condition Sixteen (16)** requires that all used filter media, sediment, and other debris collected will be disposed of outside of the Coastal Zone.

The California Regional Water Quality Control Board ("Regional Water Board") has approved dewatering discharges into the Pacific Ocean under the General National Pollutant Discharge Elimination System ("NPDES permit") and Waste Discharge Requirements for Malibu Lagoon State Park. (NPDES No. CAG994004, CI-9573, March 9, 2010). This NPDES permit authorizes California Department of Parks and Recreation to discharge up to 1.3 million gallons per day (MGD) of treated water into the Santa Monica Bay. Water extracted from the site will be treated by passing through activated carbon vessels to remove organic contaminants, chlorinated to destroy pathogen bacteria, and treated by passing through ion exchange resin vessels to remove heavy metals prior to discharge. The NPDES permit provides discharge limitations for specific constituents, including: total suspended solids, turbidity, biological oxygen demand (BOD), oil and grease, settleable solids, sulfides, phenols, residual chlorine, copper, and fecal coliform.

Effluent Discharge Limitations

Constituent	**Units**	**Daily Maximum**	**Monthly Average**
Total suspended solids	mg/L	150	50
Turbidity	NTU	150	50
BOD_5 20°C	mg/L	30	20
Oil and Grease	mg/L	15	10
Settleable solids	mg/L	0.3	0.1
Sulfides	mg/L	1.0	N/A
Phenols	mg/L	1.0	N/A
Residual Chlorine	mg/L	0.1	N/A
Copper	µg/l	5.8	2.9
		Long mean (based on a minimum of at least 4 samples for any 30-day period)	10 percent of total samples during any 30-day period
Fecal Coliform	#/100 ml	200	400

The Regional Water Board's approval also requires the applicant to comply with a monitoring and reporting program (CI-9573). The monitoring and reporting program ("MRP") includes general monitoring provisions (e.g. analytical methods for each pollutant, sample collection requirements), monitoring locations, toxicity testing and reporting, monitoring periods and reporting schedules. **Special Condition Thirteen (13)** incorporates all of the waste discharge requirements into this coastal development permit. **Special Condition Thirteen (13)** also requires the applicant to immediately notify the Executive Director if monitoring indicates any violations of the NPDES permit.

Any proposed changes to the plan will require a Coastal Commission approved CDP amendment unless the Executive Director determines that no amendment is required.

The beach and marine environment could also be temporarily impacted as a result of the implementation of project activities by unintentionally introducing sediment, debris, or chemicals with hazardous properties during construction activities. To ensure that construction material, debris, or other waste associated with project activities does not enter the water, the Commission finds **Special Condition Three (3)** is necessary to define the applicant's responsibility to ensure proper disposal of solid debris and material unsuitable for placement into the marine environment. As provided under **Special Condition Three (3)**, it is the applicant's responsibility to ensure that the no construction materials, debris or other waste is placed or stored where it could be subject to wave erosion and dispersion. Furthermore, **Special Condition Three (3)** assigns responsibility to the applicant that any and all construction debris and trash shall be properly contained and removed from construction areas within 24 hours. Further, construction equipment shall not be cleaned on the beach or in the beach parking lot outside of the staging areas. Additionally, **Special Condition Two (2)** requires the applicant to submit erosion control plans to reduce erosion for all disturbed portions of the project area, including grading activities. **Special Condition Two (2)** specifies that erosion control measures shall be implemented prior to and concurrent with grading operations and that all sediment shall be retained onsite. Additionally, should grading or other work cease for a period of 30 days, the site shall be stabilized with geotextiles or mats, sand bag barriers, silt fencing, temporary sediment basins or swales. **Special Condition Two (2)** requires measures to minimize the area of bare soil exposed at any one time, including phased grading.

Several letters were received in response to the July 29, 2010 staff report for this item relating to water quality. The Regional Water Quality Control Board submitted a letter to the Commission, dated August 6, 2010, (**Exhibit 24**) in support of this restoration project urging the Coastal Commission to approve this project. Also, a letter was submitted to Commission staff by Ralph W. Kiewit, Jr., received on August 4, 2010 (**Exhibit 24**), stating that he believes he has a prescriptive easement under adverse possession common law for a pipeline draining into the lagoon. Mr. Kiewit's letter states that he installed a corrugated iron pipeline to drain stormwater from his property and his neighbor's property into the Malibu Lagoon approximately 20 years ago. The Commission is not authorized to assess a claim of adverse possession in this case, which would properly be assessed by a court of law. Further, Commission records indicate no Coastal Development Permit or application was ever submitted or issued for the installation of the pipe by Mr. Kiewit. This drainage pipe is partially located on State Parks property and after-the-fact approval of the pipe was not included by State Parks as part of the subject application. Commission enforcement staff will evaluate further action to address this unpermitted private residential pipeline draining into Malibu Lagoon. Drainage into the lagoon via any point source, including a pipeline draining into the lagoon from the adjacent residential area, could have adverse impacts to water quality in the lagoon.

Lastly, City of Malibu submitted a letter to the Chair and Coastal Commissioners, received on August 9, 2010 (**Exhibit 24**), raising concerns of the projects potential detrimental impacts to water quality, among other issues. The City's letter asserts that the proposed wetland restoration project may result in potential increases in bacteria and nutrients in the water that may impact water quality at Surfrider Beach. The City also asserts that the applicant should be required to monitor bacteria levels within the lagoon including Total Coliform, Fecal Coliform and Enterococcus. The City requests that the water quality monitoring plan include all constituents subject to the Total Maximum Daily Load ("TMDL") requirements. Further, the City relayed concerns related to the lagoon restoration design, revegetation plan design, invasive species, impacts to Malibu Colony drainage due to the design of the Adamson House perimeter wall, and dewatering impacts. Approximately ten studies related to lagoon water quality were attached to the City's letter. (**Exhibit 24**)

As noted in the City's letter, the City had not yet reviewed any approvals or other evidence that the Regional Water Quality Control Board had reviewed the proposed restoration project. However, the Regional Water Quality Control Board has since submitted a letter to the Commission, dated August 6, 2010, in support of the proposed project, and it is the Regional Water Quality Control Board that is responsible for implementing TMDL requirements, regulated under the Federal Clean Water Act.

The City has raised concerns over degradation of water quality due to lagoon design, revegetation, and construction impacts. More specifically, the City has expressed concerns that revegetation of Malibu Lagoon may increase bacteria produced from the natural decaying process due to an increased amount of vegetation and more bank surface area. The City's letter also states that "[i]t is noted that improved circulation and increased tidal flow, a goal of the project, will decrease contact time with lagoon capable of removing some bacteria." The Commission notes that one of the main goals of this project is to improve water quality in the lagoon by increasing circulation and tidal flushing through the reconfiguration of the lagoon channel. Moreover, the proposed reconfiguration is expected to reduce fine sediment accumulation, which in turn will allow water flow to increase, resulting in less stagnant water. Revegetation of the lagoon is expected to enhance overall habitat quality and is not expected to adversely impact water quality. Although there may be inadvertent short term impacts to water quality during construction due to increased turbidity and disturbance of areas of the lagoon with fine sediments and high contaminant levels, overall water quality is expected to improve as a result of the project over the long term, as discussed throughout this report. All dewatering will include filtration, decontamination, and testing before discharge to the Pacific Ocean, pursuant to the Regional Water Quality Control Board approvals. Specifically, California Regional Water Quality Control Board, NPDES Permit No. CAG994004, Order No. R4-2008-0032, and Monitoring and Reporting Program No. CI-9573, dated March 9, 2010, list specific discharge limits for several constituents, including Fecal Coliform (*see* P.50-51 of this report). Also, staff notes that **Special Condition Five (5)** requires the applicant to submit a final hydrological monitoring plan, including success criteria and supplemental measures to take if water quality in the lagoon has not improved, as shown by measuring a variety of parameters, some of which include measuring nutrients in sediment samples and nutrients in surface water and bottom water. The applicant has agreed to compile monitoring data for bacteria levels and provide the results as part of the applicant's annual monitoring reports, required by **Special Condition Five (5).** Bacteria levels are currently monitored by the City of Los Angeles Bureau of Sanitation, Environmental Monitoring Division, at three sites within the lagoon and by Las Virgenes Municipal Water District at one site near the Pacific Coast Highway Bridge. The applicant is required to incorporate this bacteria data into the monitoring reports required by **Special Condition Five (5).**

Therefore, the Commission finds that the proposed project, as conditioned, is consistent with Section 30231 of the Coastal Act and with all relevant policies of the adopted City of Malibu Local Coastal Program.

E. ENVIRONMENTALLY SENSITIVE HABITAT AND MARINE RESOURCES

Section **30230** of the Coastal Act states:

> ***Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.***

Section **30231** of the Coastal Act states that:

> ***The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges- and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.***

Section **30236** of the Coastal Act states:

> ***Channelizations, dams, or other substantial alterations of rivers and streams shall incorporate the best mitigation measures feasible, and be limited to (l) necessary water supply projects, (2) flood control projects where no other method for protecting existing structures in the floodplain is feasible and where such protection is necessary for public safety or to protect existing development, or (3) developments where the primary function is the improvement of fish and wildlife habitat.***

Section **30240** of the Coastal Acts states:

> ***(a)** Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas.*
>
> ***(b)** Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.*

In addition, the City of Malibu certified LUP contains policies that protect the environmentally sensitive habitat areas of the City. LUP Policy 3.8 states that Environmentally Sensitive Habitat Areas (ESHAs) shall be protected against significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas. The LUP policies also establish the protection of areas adjacent to ESHA through the provision of buffers. Natural vegetation buffer areas must be provided around ESHA that are of sufficient size to prevent impacts that would significantly degrade these areas. Development, including fuel modification, shall not be permitted within required buffer areas.

LUP Policy 3.23 states the following:

> ***Development adjacent to ESHAs shall minimize impacts to habitat values or sensitive species to the maximum extent feasible. Native vegetation buffer areas shall be provided around ESHAs to serve as transitional habitat and provide distance and physical barriers to human intrusion. Buffers shall be of a sufficient size to ensure the biological integrity and preservation of the ESHA they are designed to protect. All buffers shall be a minimum of 100 feet in width, except for the case addressed in Policy 3.27.***

Section 30231 of the Coastal Act requires that the biological productivity and quality of coastal waters be maintained. Section 30230 requires that uses of the marine environment be carried out in a manner that will sustain the biological productivity of coastal waters for long-term commercial, recreational, scientific, and educational purposes. Section 30236 allows for alterations to streambeds when required for flood control projects where no other less damaging alternative is feasible and when necessary to protect public safety or existing development. In addition, Section 30240 of the Coastal Act states that environmentally sensitive habitat areas shall be protected and that development within or adjacent to such areas must be designed to prevent impacts which could degrade those resources.

The Malibu Lagoon is a 31-acre shallow water embayment occurring at the terminus of Malibu Creek Watershed, the second largest watershed draining into the Santa Monica Bay. This lagoon contains important biological resources and provides habitats for several important plant and animal species. Although in a degraded condition due to poor water quality and invasive non-native plants, Malibu Lagoon is an environmentally sensitive habitat area (ESHA) and provides habitat for several sensitive aquatic and avian species, described in detail below. These species may potentially be located, at times, within or near the project area and could be adversely impacted from temporary construction impacts. Additionally, salt marsh vegetation is found at the site and constitutes important habitat for several coastal floral and faunal species. According to the March 2006 Final Environmental Impact Report, lagoon habitats do not support many mammal or reptile species because most of the available scrub habitat is very dense at ground level and the coastal salt marsh is almost entirely covered with jaumea with little ground exposed. However, some common mammals that are known to occur include the mule deer, Audubon's rabbit, coyote, black rat, deer mouse, and the meadow mouse. According to the March 2006 Final Environmental Impact Report, construction impacts to biological resources, include:

(1) the removal or disturbance of southern willow scrub vegetation, atriplex scrub vegetation, baccharis scrub, mulefat scrub, Venturan coastal sage scrub, mixed scrub, southern coastal salt marsh, brackish marsh, coastal and valley freshwater marsh;
(2) potential impacts to mudflat, sand beach/sandbar, open water, common wildlife species found to occur in the project area, California black walnut, wandering skipper, and southern steelhead trout
(3) potentially significant impacts to tidewater goby, California brown pelican, western snowy plover, Heermann's Gull, elegant tern, and California least tern.

1. Sensitive Bird Species

The 2006 FEIR reports that past studies of Malibu Lagoon have identified 200 species of birds at the lagoon. Several species of aquatic birds have been observed in the lagoon including gadwall, mallard, common yellowthroat, song sparrow, black phoebe, pied-billed grebe, black-necked stilt, black-crowned night heron, great egret, great blue heron, snowy egret, and green heron. (FEIR, p.6-11) Upland bird species including the California towhee, Anna's hummingbird, bushtit, northern mockingbird, morning dove, American crow, western scrub-jay, and house finch have been observed in upland habitats surrounding the lagoon, which consists primarily of Venturan coastal sage scrub and mixed scrub habitats. Five sensitive bird species were recorded during 2005 breeding surveys, including savannah sparrow, California brown pelican, western snowy plover, Heermann's gull, elegant tern, and California least tern. These birds are considered "sensitive" because they are protected by state and/or federal endangered species acts, because they are recognized as threatened by the International Union for Conservation of Nature and Natural Resources (IUCN), or because they are being considered for listing as California Bird Species of Special Concern. (FEIR, p. 6-16, citing Cooper Ecological Monitoring, Inc. 2005).

Endangered California Least Tern

The California least tern (*Sterna antillarum browni*) ("least tern" or "tern"), listed as one of three subspecies of least tern in the United States, was listed as federally endangered in 1970 and listed on the California endangered species list in 1971. Although critical habitat has not been designated for the California least tern, it is a fully protected species under California law. The California least tern was historically concentrated in three southern California Counties, Los Angeles, Orange, and San Diego. At the time of listing, only 600 breeding pairs were identified, but the population was documented at approximately 7,100 pairs in 2005 (USFWS Biological Opinion 2009). Large nesting colonies have been discontinuous and are spread out along beaches at the mouths of larger estuaries. The Santa Margarita River mouth in San Diego County generally hosts the largest number of California least terns among all locations. The breeding season typically begins in April. Terns typically nest in colonies on relatively open beaches kept free of vegetation by natural scouring from tidal action. Nesting areas are relatively flat sandy beaches in close proximity to foraging habitat and are relatively secluded from disturbance and predation. Near-shore ocean waters and shallow estuaries serve as foraging habitat.

Repeated disturbance of breeding sites can have significant effects on California least tern reproductive success and can cause nest failure, re-nesting, and site abandonment. For example, the least tern colony at Ormond Beach, Ventura County was repeatedly disturbed by paragliders and ultralight aircraft. During a four year period, all nesting attempts at Ormond Beach failed and the site was abandoned. (USFWS 2009 Biological Opinion, p.10, citing C. Dellith pers. obs. 2006)

The California least tern is a common summer resident of Malibu lagoon. Spring migrants arrive and move through the area in late April. California least terns that forage at the lagoon arrive in early to mid-May, and all summer foraging, roosting, and migrating California least terns leave the area by late August to mid-September. California least terns forage over Malibu lagoon and the ocean immediately offshore during their season migrations and during breeding. (USFWS 2009 Biological Opinion). A large concentration of least terns (up to 42) were documented at Malibu Lagoon on July 13 and 14, 2005, roosting along the southern shore and foraging in the main body of the lagoon and feeding in the west basin of the lagoon. It was documented by the 2005 Cooper Study that, on both days, a total of 14 hatch-year California least terns were present with adults, many of which were banded. These banded terns and the adults were presumed to be from a colony near Terminal Island in Los Angeles Harbor, where several hundred California least terns were monitored and banded during the spring of 2005. (Cooper 2005)

The Fish and Wildlife Service has determined that the proposed project would adversely affect a small number of California least terns in the project area. (USFWS 2009 Biological Opinion CON 1-8-08-F-4) Foraging and roosting least terns would be disturbed by the presence of project workers, noise from equipment and other project activities. The breeding season for the California least tern typically begins in April, with eggs laid in the first part of May and hatching in early June. State Parks has proposed a work timeframe of June 1st through October 15th, during which the California least tern foraging may be disturbed in the lagoon. No direct impacts to breeding sites on the beach are proposed. However, the Fish and Wildlife Service has determined that the foraging may be impacted due to the temporary dewatering of the lagoon and by diverting lagoon flow, thereby decreasing the foraging area or killing some of its prey. However, the USFWS expects that the individuals displaced by the actions will find ample foraging opportunities nearby.

Roosting sites of the least terns could be disturbed during the restoration activities. Chronic Disturbance to non-breeding birds can affect body condition, metabolic rate, habitat use, and subsequent reproductive success due to reduced lipid reserves. However, the USFWS has determined that the adverse effects of being flushed from roost sites will be minimal and that no California least terns are likely to be killed or injured during this work. Additionally, according to the Final Environmental Impact Report (FEIR) for the project, no work will be done in the main lagoon channel that the California least tern uses for roosting habitat, including the snags and high sand bar (FEIR, p. 6-35) and that the protected islands will enhance habitat. The FEIR also states that post-project acreages of suitable habitat for the least tern would be similar, if not identical, to pre-project acreages and did not require mitigation.

California Brown Pelican

California brown pelicans (*Pelecanus occidentalis)* are present at Malibu Lagoon year round. This species does not nest on the California mainland, but uses Malibu Lagoon for post-breeding dispersal and day and night roosting. Foraging areas are offshore of Malibu Beach. Up to 210 California brown pelicans have been observed at Malibu Lagoon, generally roosting along the sand spit separating the lagoon from the ocean or on the island in the middle of the lagoon exposed by low tide. (USFWS 2009 Biological Opinion, *citing* Cooper 2005).

The proposed project will result in the temporary loss of roosting habitat from some of the project area, which could adversely affect the species. Roosting sites are essential for the survival of California brown pelicans. California brown pelicans typically have a strong traditional use of night roosts, although changes in roost site availability in southern California have resulted in use of some sites on a temporary basis.

According to the USFWS Biological Opinion, working in the vicinity of any roosting sites in Malibu Lagoon could result in California brown pelicans expending excess energy to search for new roost sites, increasing susceptibility to predation and disease (citing Strong and Jaques 2003). The proposed project could result in the incidental flushing of brown pelicans from roosting sites prior to restoration activities. However, the USFWS has evaluated protective measures proposed by the applicant and have determined that no brown pelicans are likely to be killed or injured during the work and that opportunities for California brown pelicans to roost will remain in and around portions of the Malibu Lagoon. Additionally, according to the Final Environmental Impact Report (FEIR) for the project, no work will be done in the main lagoon channel that the Brown Pelican uses for roosting habitat, including the snags and high sand bar (FEIR, p. 6-33).

Western Snowy Plover

The Western Snowy Plover (*Charadtrius alexandrinus nivosus*) is a CDFG Species of Special Concern and a federally threatened species. Two western snowy plovers were present briefly along the southern edge of Malibu lagoon on June 14, 2005. However they were flushed by pedestrians and did not return. This bird species uses Malibu Lagoon as a major wintering site, but does not nest on the nearby beach. (FEIR p. 6-16) Additionally, according to the USFWS, snowy plovers are not known to breed within the study area and no restoration or enhancement activities will occur along the coastal portion of the project area and no habitat will be affected by the proposed project. (USFWS Biological Opinion 2009).

Heermann's Gull

The Heermann's Gull (*Larus heermanni*) is listed as near-threatened on the UUCN Red List. Up to 70 individuals were counted during the 2005 survey of the Lagoon. These birds do not nest within the project reach, but can be found roosting on the sand spit or beach. Their nesting extends from early winter into spring. (FEIR, p.6-17)

Elegant Tern

The Elegant Tern (*Sterna elegans*) is a CDFG species of special concern. Their nesting season extends from early winter into spring. They are numerous at Malibu Lagoon, but during the 2005 survey only a handful were observed. This species does not nest within the project area. (FEIR, p.6-17)

Effects of Noise on Bird Species

The Commission notes that the proposed project may result in potential adverse effects to sensitive avian species due to unintentional disturbance from construction equipment and activity, including grading and noise. In particular, the effects of construction noise upon birds are not well known; however, significant noise levels may impact birds in a number of ways. Continuous noise above the ambient environment or single or multiple loud impulse noises may produce changes in bird foraging and reproductive behavior; mask signals birds use to communicate; mask biological signals impairing detection of sounds of predators and/or prey; decrease hearing sensitivity temporarily or permanently; and/or increase stress and alter reproductive and other hormone levels.[1] Dooling and Popper prepared a review report in 2007 for Caltrans titled, "The Effects of Highway Noise on Birds".[2] This report reviews the literature for studies that evaluate the impacts of traffic and construction noise on birds. They list three classes of potential effects of noise on birds: (1) physiological and behavioral effects; (2) damage to hearing from acoustic over-exposure; and (3) masking of important bioacoustic and communication signals all of which may also lead to dynamic behavioral and population effects.

Much of the information regarding impacts of noise on birds has been extrapolated from studies involving the influence of noise on humans and other mammals. A relatively small number of studies have focused directly on impacts of noise on birds and those studies have been performed on a limited number of bird species; to date no studies of noise impacts have been performed on wading bird species. Dooling and Popper (2007) state that, "Generally, humans have better auditory sensitivity (lower auditory thresholds) both in quiet and in noise than does the typical bird." Mammals in general

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[1] Longcore, T. & C. Rich. 2001. A Review of the Ecological Effects of Road Reconfiguration and Expansion on Coastal Wetland Ecosystems. The Urban Wildlands Group

[2] Dooling, R.J. & A.N. Popper. 2007. The Effects of Highway Noise on Birds. Prepared for: The California Department of Transportation, Division of Analysis. Prepared by: Environmental BioAcoustics LLC, Rockville, MD

have much greater auditory sensitivity than birds. Birds are more resistant to both temporary and permanent hearing loss or to hearing damage from acoustic overexposure than are humans and other mammals that have been tested.[3]

Sixty decibels (60 dB) is a widely used threshold for projects involving heavy equipment in areas supporting sensitive bird species. This threshold criterion is used by many agencies and consultants as the noise threshold, above which, birds may be adversely impacted. While this decibel range appears to be widely accepted and employed for projects involving potential noise impacts upon birds, its use is without well founded scientific justification.[4] Noise levels in quiet outdoor rural areas range from 40 to 45 dB(A)[5] and from 50-55 dB(A) in quiet suburban areas.[6] The 60 dB criterion stems from taking average ambient environment noise measurements and determining at what noise level, beyond that measured in the natural environment, would one expect to see adverse effects on avian vocal communication.[7] While this criterion is valuable as a starting point for it is conservative and protective, ambient environment noise levels must also be analyzed and figured into the decibel thresholds applied to projects on a case by case basis. Rural areas will have much lower exposure to significant ambient noise compared to urban areas. And while all projects have specific and unique circumstances, those with the potential to adversely impact sensitive bird species due to increased noise levels must minimize those noise impacts to the maximum extent possible.

Dooling and Popper, in their 2007 report, present a table with guidelines for potential noise effects on birds at relative distances from the source based on a synthesis of the available literature. Hearing damage can potentially result from single impulses at or above 140 dB(A) or multiple impulses at or above 125 dB(A) when birds are close to the source. At greater distances from the noise source, where noise levels fall below 110 dB(A), birds may experience a temporary loss of hearing (known as a temporary threshold shift) from continuous noise above 93 dB(A). Masking may occur at decibels above and below 93 dB(A) depending on ambient noise levels. At even greater distances from the noise source, where the noise is still above ambient levels, masking may occur. Dooling and Popper suggest that noise levels below 50 to 60 dB(A) are unlikely to cause masking.

Although 60 dB is the noise threshold widely used for projects involving heavy equipment in areas supporting sensitive bird species, this criterion is not always warranted or attainable. Threshold noise values must be considered on a case by case basis. The setting of the proposed work is a popular public park that experiences heavy

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[3] Op. Cit. Dooling & Popper 2007

[4] James, R.A. 2006. California innovation with highway noise and bird issues. In: Proceedings of the 2005 International Conference on Ecology and Transportation, Eds. Irwin CL, Garrett P, McDermott KP. Center for Transportation and the Environment, North Carolina State University, Raleigh, NC: p. 569.

[5] dB(A) – a weighted decibel average

[6] Ouis, D. 2001. Annoyance from road traffic noise: a review. Journal of Environmental Psychology. Vol. 21, pgs. 101-120.

[7] Op. Cit. Dooling & Popper 2007

use patterns by beachgoers, noise from vehicle traffic and parking, and associated noise from the adjacent highway (Highway 1). In previous coastal development permit actions involving development in similar areas, including CDP 5-08-242 (County of Los Angeles Department of Public Works) and CDP 4-07-116 (Caltrans), the Commission has typically found that 65 dB is an appropriate threshold noise levels at construction sites in order to minimize impacts to adjacent to environmentally sensitive habitat areas. Further, given Dooling and Popper's 2007 review findings that, while masking may occur below 93 dB, it is noise above this level that presents real problems for birds. In addition, given the fact that birds, like humans, are known to compensate in a number of behavioral and physical ways to ambient noise[8]; Commission staff have determined that 65 db is an appropriate noise threshold to apply to this project given the sensitive lagoon habitat. Therefore, to ensure that the applicant's proposed monitoring program is adequately implemented in a manner that will ensure that impacts to wildlife are avoided or minimized to the maximum extent feasible, **Special Condition One (1)** requires the applicant to retain the services of a qualified biologist or environmental resource specialist to conduct sensitive bird species surveys and monitor project operations associated with construction activities that will take place between February 15th and September 1st (the proposed project timeframe is June 1st to October 15th).

Special Condition One (1) also requires bird surveys to be conducted 30 calendar days prior to the listed activities to detect any active bird nests in all trees within 500 feet of the project site and requires a follow-up survey to be conducted 3 calendar days prior to the initiation of construction. Further, nest surveys must continue on a monthly basis throughout the nesting season or until the project is completed, whichever comes first. If an active nest of any federally or state listed threatened or endangered species, species of special concern, or any species of raptor or heron is found within 300 ft. of construction activities (500 ft. for raptors), the applicant is required to retain the services of an environmental resources specialist with experience conducting bird and noise surveys, to monitor bird behavior and construction noise levels. The environmental resources specialist is required to monitor birds and noise every day at the beginning of the project and during all periods of significant construction activities. Construction activities may occur only if construction noise levels are at or below a peak of 65 dB at the nest(s) site. If construction noise exceeds a peak level of 65 dB at the nest(s) site**,** sound mitigation measures such as sound shields, blankets around smaller equipment, mixing concrete batches off-site, use of mufflers, and minimizing the use of back-up alarms shall be employed. If these sound mitigation measures do not reduce noise levels below the above referenced threshold, construction within 300 ft. of the nesting trees/areas (500 ft. for raptors) shall cease and may not recommence until either new sound mitigation can be employed or nesting is complete. Additionally**, Special Condition One (1)** requires the applicant to notify the appropriate State and Federal Agencies within 24 hours, including the Coastal Commission, and take action to mitigate any further disturbance specific to each agencies' requirements.

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[8] Op. Cit. Dooling & Popper 2007

2. Sensitive Aquatic Species

Steelhead

Malibu Lagoon is within the endangered Southern California Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*) and is designated critical habitat for the species. Southern steelhead are anadromous (migrating from freshwater to the ocean as juveniles and returning to freshwater as an adult to spawn). Spawning occurs from December through June when higher winter stream flows occur.

The 2006 Final Environmental Impact Report states that patterns of steelhead presence and reproduction in Malibu Creek have been studied since the 1980's and are known to occur upstream within Malibu Creek. However, no steelhead adults or smolts were documented by the 2005 fish surveys in the lagoon. It should be noted that from July 2006 to October 2006, all fish in the upper watershed of Malibu Creek, including steelhead, died from unknown causes. In March 2007, only two fish were found in Malibu Creek and subsequently in 2008 several steelhead were observed, indicating a repopulation by this species (June 30, 2008 US Army Corps approval letter, *citing* Dagit and Abramson 2007).

The Army Corps of Engineers and the National Marine Fisheries Service determined that the project is not likely to affect steelhead or critical habitat for this species because: the project takes place outside of the steelhead migration window, siltation fences and an earthen berm will prevent steelhead from entering the construction zone and will prevent sedimentation and turbidity, the project is not expected to alter the natural breaching regime of the lagoon or interfere with adult and juvenile steelhead migration, aquatic habitat will be augmented, and any vegetation removed will be replaced, and best management practices are proposed (sediment control measures). (*See* USFWS letter, dated August 18, 2008, Agency Approvals).

Tidewater Goby and Tidewater Goby Critical Habitat

The tidewater goby (*Eucyclogobius newberryi*) is a federally endangered species and CDFG Species of Special Concern that was historically known to occur within the lagoon. However, according to the March 2006 FEIR, studies conducted between the late 1960's and the early 1990's indicated that this species had been absent from the project area since 1970. The species was re-introduced to this area in 1991 and the areas on the west side of the lagoon both upstream and downstream of the Pacific Coast Highway bridge consistently host gobies year round, with size classes and densities varying seasonally year round. (FEIR, p.6-15).

According to the USFWS Biological Opinion Amendment, dated January 8, 2010, tidewater gobies exhibit some general, but highly variable trends in seasonable population abundance and can be quite high during fall periods. The USFWS "believes that encountering high densities of tidewater gobies could occur at almost any time of the year and that with the appropriate protective measures in place, adverse affects to tidewater gobies should be minimized regardless of project timing." (USFWS Biological Opinion Amendment, dated January 8, 2010).

The applicant is proposing to exclude tidewater gobies and other sensitive aquatic species from the project construction area (the western lagoon complex) through incorporating several protective measures required by the Fish and Wildlife Service and the Los Angeles District Army Corps of Engineers including: (1) pre-construction surveys of the project area conducted by a qualified biologist to determine if listed or proposed species are present, (2) when listed species are present and it is determined that they could be injured or killed by construction activities, a qualified biologist will identify methods for capture, handling, exclusion, and relocation of individuals that could be affected, (3) the project biologist will conduct, monitor, and supervise all capture, handling, exclusion, and relocation activities, (4) ensure sufficient personnel for safe and efficient collection of listed species, (5) Electrofishing may be implemented when all other standard fish capture methods would be ineffective; the project biologist must have appropriate training and experience in electrofishing techniques, (6) individual organisms will be relocated to the shortest distance possible to habitat unaffected by construction activities, (7) within occupied habitat, capture, handling, exclusion and relocation activities will be completed no earlier than 48 hours before construction begins to minimize the probability that listed species will recolonize the affected areas, (8) within temporarily drained stream channel areas, salvage activities will be initiated before or at the same time as stream area draining and completed within a time frame necessary to avoid injury and mortality of listed species, (9) a biologist will continuously monitor in-water activities (e.g. placement of cofferdams, dewatering of isolated areas) for the purpose of removing and relocating any listed species that were not detected or could not be removed and relocated prior to construction, (10) the project biologist will be present at the work site until all listed species have been removed and relocated, and (11) the project biologist will maintain detailed records of the species, numbers, life stages, and size classes of listed species observed, collected, relocated, injured, and killed, and the date and time of each activity or observation.

Additionally, **Special Condition Four (4)**, Final Dewatering Plan, requires the applicant to incorporate all tidewater goby, southern steelhead, and other sensitive aquatic species dewatering requirements outlined in the agency approvals into a Final Dewatering Plan. Special Condition Four also lists additional special requirements for protection of aquatic species during dewatering including: requiring the applicant to hire a qualified biologist, training sessions for all construction personnel prior to the onset of work, requiring qualified biologist to inspect the dewatered areas and construction site regularly to detect whether any tidewater gobies, southern steelhead or other fish are passing through the berm and/or cofferdam and investigate whether sensitive aquatic species protection measures are being implemented; requiring the qualified biologist to be present when the berms and/or cofferdams are removed and the construction area refilled with water to relocate any fish present in the construction area before completion of removal operations and to ensure successful reintroduction of aquatic habitat in the construction area; post-construction surveys for tidewater gobies, southern steelhead, and other sensitive aquatic species; and a post-project monitoring report documenting the efforts to protect the tidewater goby, southern steelhead, and other sensitive aquatic species and the results.

3. Lagoon Vegetation

The habitat conditions within Malibu Lagoon are primarily a result of elevation and hydrology. Seventeen vegetation communities and habitats were mapped at the lagoon in a 2004 study. The diversity of vegetation is a result of several past restoration efforts. The vegetation communities include: southern willow scrub, atriplex scrub, baccharis scrub, mule fat scrub, Ventura coastal sage scrub, mixed scrub, southern coastal salt marsh, coastal and valley freshwater marsh, brackish marsh, southern sycamore alder riparian woodland, disturbed coastal dunes, non-native grassland, mudflat, sand beach/sandbar, open water and undeveloped land. (FEIR, p. 6-3) The project includes a proposal to salvage and transplant as much of the native vegetation as possible; however, much of the existing vegetation is proposed to be removed and the lagoon will be replanted with local native species. Although native vegetation will be removed, it will be replaced with more appropriate native vegetation communities appropriate to the site that will establish highly valuable functioning ecosystem in the long-term. In total, the project will serve to increase marsh habitat within the limit of work by approximately 4 acres (from approximately 5.2 to 9.2 acres) and increasing available subtidal and intertidal habitat by about an acre or 11%.

The proposed revegetation plan includes the initial planting and establishment of habitats within the lagoon, as well as ongoing maintenance and management activities to ensure that the restoration habitat objectives are achieved. Dr. Engel's September 22, 2010 memorandum explains that results from plant surveys within the lagoon reveal significantly impaired plant communities with a paucity of native estuarine species and large numbers of non-native species and indicates that restoration is necessary to restore the lagoon habitat. Vegetation restoration activities include appropriately designed slopes/elevations and sediment types, topsoil and sediment salvage and management, restoration planting and natural establishment, maintaining unvegetated habitat areas, minimizing habitat loss from seasonal inundation, and long-term habitat maintenance elevations. The applicant has submitted a planting program, including salt panne, low marsh, mid-high marsh, high marsh transitional, and coastal scrub habitats. In order to ensure that the applicant's proposal to revegetate all areas of the site that will be disturbed as a result of the restoration/construction activities is adequately implemented, **Special Condition Six (6)** requires that, prior to issuance of the coastal development permit, the applicant shall submit a final Plant Community Restoration, Monitoring, and Reporting Plan with specifications regarding vegetation plantings, a specific monitoring protocol with performance criteria, and reporting plan to provide detailed information about the status of the habitat restoration plan to be submitted to the Executive Director. **Special Condition Six (6)** requires the applicant to implement a monitoring program for a period of five years after the completion of initial planting in order to ensure the success of the restoration efforts. The applicant shall submit, upon completion of the initial habitat restoration/enhancement, a written report prepared by the environmental resources specialist, for the review and approval of the Executive

Director, documenting the completion of the initial restoration/enhancement work. After initial restoration/enhancement activities are completed, the applicant shall submit, for the review and approval of the Executive Director, on an annual basis for a period of five (5) years, a written monitoring report prepared by the environmental resources specialist(s) indicating the progress and relative success or failure of the restoration/enhancement. This report shall also include further recommendations and requirements for additional restoration/enhancement activities, if necessary, in order for the project to meet the success criteria and performance standards.

Moreover, **Special Condition Six (6)** requires a final detailed report on the habitat restoration/enhancement be submitted by the applicant for the review and approval of the Executive Director. If this report indicates that the habitat restoration/enhancement has, in part, or in whole, been unsuccessful, based on the success criteria and performance standards specified in the monitoring program, the applicant shall submit within 90 days a revised or supplemental habitat restoration/enhancement plan to compensate for those portions of the original plan which did not meet the approved success criteria and performance standards. The Executive shall determine whether implementation of the revised or supplemental plan is consistent with the terms and provisions of the Commission’s approval of CDP 4-07-098 or whether the plan will require an amendment to this permit. This revised or supplemental plan shall be implemented by the applicant within 90 days after the plan is approved by the Executive Director, unless the Executive Director either: (1) grants additional time for good cause or (2) determines that an amendment is required. If the Executive Director determines that the revised or supplemental plan requires an amendment to this permit, then the applicant, shall submit a complete application for an amendment to this permit within 90 days after such determination.

Additionally, the adjacent riparian, wetland, and marine environment could be adversely impacted as a result of the implementation of project activities by unintentionally introducing sediment, debris, or chemicals with hazardous properties. To ensure that construction material, debris, or other waste associated with project activities does not enter the water or sensitive lagoon habitat, **Special Condition Two (2)** requires the applicant to submit final erosion control plans. Additionally**, Special Condition Three (3)** is necessary to define the applicant’s responsibility ensure proper erosion control and implement construction best management practices, including disposal of solid debris and construction material unsuitable for placement into the marine environment. As provided under **Special Condition Three (3),** it is the applicant’s responsibility to ensure that no construction materials, debris or other waste is placed or stored where it could be subject to erosion and dispersion. Special Condition Three (3) assigns responsibility to the applicant that any and all construction debris, sediment, or trash shall be properly contained and removed from construction areas within 24 hours. Furthermore, **Special Condition Nine (9)** requires that any herbicides, if necessary for revegetation, shall not be used in any open water areas on the project site. Herbicide use in upland areas shall be restricted to the use of Glyphosate Aquamaster^{TM} (previously Rodeo^{TM}) herbicide for the elimination of non-native and invasive vegetation for purposes of habitat restoration only.

Moreover, to ensure that excess excavated material is moved off site so as not to contribute to unnecessary landform alternation and wetland fill, inconsistent with Section 30240 of the Coastal Act, the Commission finds it necessary to require the applicant to dispose of all excess excavated material at an appropriate disposal site or to a site that has been approved to accept fill material, as specified in **Special Condition Sixteen (16)**. In addition, **Special Condition Eleven (11)** requires the applicant obtain all other necessary State or Federal permits, including the USFWS, NMFS, Fish and Game, and Regional Water Quality Control Board, that may be necessary for all aspects of the proposed project because the proposed project includes work within streams, wetland areas, and tidally influenced areas. The project has already obtained the approvals listed in Agency Approvals and Reviews, on page 8 of this staff report.

Finally, **Special Condition Seventeen (17)** requires the applicant to implement measures to assure that the invasive aquatic species, the New Zealand mud snail, is not spread as a result of this project. Surveys conducted in Spring 2006 found the invasive New Zealand mud snail (*Potamopyrgus atipodarum)* in the Malibu Creek watershed. The tiny snails reproduce rapidly and can achieve densities of up to 500,000 organisms per square meter. Because of their massive density and quantity, the New Zealand mud snail can out-compete and reduce the number of native aquatic invertebrates that the watershed's fish and amphibians rely on for food. This reduction in aquatic invertebrate food supply can disrupt the entire food web with dramatic consequences. **Special Condition Seventeen (17)** requires the applicant to: pressure wash and steam clean all vehicles (including wheels and undercarriages), equipment, protective gear (e.g., waders, boots) and tools prior to and after use. Pressure washing and steam cleaning will take place at a wash site that will be inspected and maintained and will incorporate measures to control off-site soil or runoff outside of the wash station. Documentation logs of inspection and maintenance activities will be kept. Further, all rinse water will be collected and disposed of in a sanitary sewer or in another manner approved by the State's Representative. A chest freezer, equipped with a padlock, will be kept onsite to sterilize boots, waders, and other equipment. All boots and waders used during construction will remain onsite during the duration of the construction period. Upon completion of construction, boots and waders will be frozen for a minimum of 48 hour and will be placed in plastic bags, labeled with the date and time that they were placed in the freezer, and noted in a log book. All sandbags, silt fencing, and other materials that come into contact with water and/or soil will be allowed to thoroughly dry (without soil contact) in the sun for a minimum of 72 hours before being moved off site. Lastly, all trucks transporting construction debris and/or excavated soil to disposal sites will be covered.

Therefore, the Commission finds that the proposed project, as conditioned, is consistent with Sections 30230, 30231, 30236, and 30240 of the Coastal Act.

F. HAZARDS AND SHORELINE PROCESSES

Section **30253** of the Coastal Act, which is incorporated as part of the Malibu LCP, states in part that new development shall:

> ***(1) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.***
>
> ***(2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs***

In addition, the following LCP policies are applicable in this case:

> ***4.2 All new development shall be sized, designed and sited to minimize risks to life and property from geologic, flood, and fire hazard.***
>
> ***4.5 Applications for new development, where applicable, shall include a geologic/soils/geotechnical study that identifies any geologic hazards affecting the proposed project site, any necessary mitigation measures, and contains a statement that the project site is suitable for the proposed development and that the development will be safe from geologic hazard. Such reports shall be signed by a licensed Certified Engineering Geologist (CEG) or Geotechnical Engineer (GE) and subject to review and approval by the City Geologist.***
>
> ***4.10 New development shall provide adequate drainage and erosion control facilities that convey site drainage in a non-erosive manner in order to minimize hazards resulting from increased runoff, erosion and other hydrologic impacts to streams***.
>
> ***6.29 Cut and fill slopes and other areas disturbed by construction activities shall be landscaped or revegetated at the completion of grading. Landscape plans shall provide that:***
>
> - ***Plantings shall be of native, drought-tolerant plant species, and blend with the existing natural vegetation and natural habitats on the site, except as noted below.***
> - ***Invasive plant species that tend to supplant native species and natural habitats shall be prohibited.***
> - ***Non-invasive ornamental plants and lawn may be permitted in combination with native, drought-tolerant species within the irrigated zone(s) required for fuel modification nearest approved residential structures.***
> - ***Lawn shall not be located on any geologically sensitive area such as coastal blufftop.***
> - ***Landscaping or revegetation shall provide 90 percent coverage within five years. Landscaping or revegetation that is located within any required fuel modification thinning zone (Zone C, if required by the Los Angeles County Fire Department) shall provide 60 percent coverage within five years.***

Section 30253 of the Coastal Act mandates that new development shall minimize risks to life and property in areas of high geologic, flood, and fire hazard. The purpose of the proposed project is to restore and enhance Malibu Lagoon. The proposed project includes extensive dredging and earthwork in order to recontour the lagoon and create appropriate channels and elevations for the purpose of wetland restoration. Ultimately, the project is expected to increase lagoon capacity. The project includes 51,200 cu. yds. of excavation and 37,500 cu. yds. fill with 13,700 cu. yds. export. This includes earthwork necessary to create the temporary berm that will be constructed to separate the western lagoon complex from the main lagoon channel. Some of this material will be temporarily stockpiled adjacent to the lagoon in the existing parking lot area. The Commission notes that excavated materials that are placed in stockpiles are subject to increased erosion and potential adverse effects to adjacent streams and wetland areas from sedimentation and increased turbidity. The Commission also notes that additional landform alteration would result if the excavated material were to be retained on site. Therefore, in order to ensure that dredged material will not be permanently stockpiled on site and that erosion and resedimentation of the streams on site are minimized during any temporary stockpiling activities, **Special Condition Three (3**) also requires that any stockpiled materials shall be located as far from the stream or wetland areas on site as feasible. Temporary erosion control measures (such as sand bag barriers, silt fencing; swales, etc.) shall be implemented in the event that temporary stockpiling of material is required. These temporary erosion control measures shall be monitored and maintained until all stockpiled fill has been removed from the project site. Permanent stockpiling of material on site shall not be allowed. Additionally, **Special Condition Two (2)** requires the applicant to submit final erosion control plans.

In addition, the Commission notes that the proposed development is located in a tidally influenced lagoon habitat subject to potential hazards from flooding. As such, the Commission notes that evidence exists that the project site is subject to potential risks due to erosion, and flooding. The Coastal Act recognizes that certain types of development, such as the proposed project, may involve the taking of some risk. Coastal Act policies require the Commission to establish the appropriate degree of risk acceptable for the proposed development and to determine who should assume the risk. When development in areas of identified hazards is proposed, the Commission considers the hazard associated with the project site and the potential cost to the public, as well as the individual's right to use his property. As such, the Commission finds that due to the unforeseen possibility of erosion and flooding, the applicant shall assume these risks as a condition of approval. Therefore, **Special Condition Twelve (12)** requires the applicant to waive any claim of liability against the Commission for damage to life or property which may occur as a result of the permitted development. The applicant's assumption of risk, will show that the applicant is aware of and appreciates the nature of the hazards which exist on the site, and which may adversely affect the stability or safety of the proposed development.

Several letters were received from residents of the adjacent Malibu Colony community related to fire hazards. The residents have raised concerns about a potential increase in fire hazard due the proposed revegetation within Malibu Lagoon. (**Exhibit 24)** The applicant has responded to Malibu Colony residents' concerns that revegetation of the lagoon may increase fire danger by re-designing the project to only include native "low-flammability" plant species, ensuring that no plant species will be used for revegetation on site that are listed by the County of Los Angeles Fire Department Fuel Modification Unit as “undesirable” for fuel modification purposes, The existing site contains tall, dense stands of ornamental trees and shrubs, non-native salt bush, and mixed scrub. The proposed planting plan includes removing these highly flammable species and planting less flammable native species. Further, the applicant has modified the project, in response to the adjacent private property owner’s concerns, to now include drainage swales along the perimeter of the Adamson House wall, planted with low ground cover type wetland and upland plants to collect surface drainage and stormwater flows. Thus, in response to comments received by the adjacent private property owners, the project has been revised to reduce the fire risk (compared to current site conditions with the existing vegetation) and to meet all Los Angeles County Fire Department fuel modification standards.

Further, as noted above, Malibu Colony residents raised concerns that the proposed boundary wall will eliminate emergency fire ingress/egress to public park land that currently exists. However, although some residences do have a private access gate, many do not have a private access gate to State Parks property for an emergency escape route. In addition, no evidence has been provided to Commission staff that the Fire Department requires private access gates for emergency fire access to or through Malibu Lagoon, either for escape routes or for ingress/egress to respond to a fire or emergency situation. Further, the private residential gates do not provide public access to or from the State Park for members of the public.

Therefore, the Commission finds that the proposed project, as conditioned, is consistent with Coastal Act Section 30253 and with all relevant policies of the adopted City of Malibu Local Coastal Program.

G. PUBLIC ACCESS AND VISUAL RESOURCES

Coastal Act Section **30210** states that:

> ***In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.***

Coastal Act Section **30214** states:

> ***(a) The public access policies of this article shall be implemented in a manner that takes into account the need to regulate the time, place, and manner of public access depending on the facts and circumstances in each case including, but not limited to, the following:***
>
> ***(1) Topographic and geologic site characteristics.***
>
> ***(2) The capacity of the site to sustain use and at what level of intensity.***

(3) The appropriateness of limiting public access to the right to pass and repass depending on such factors as the fragility of the natural resources in the area and the proximity of the access area to adjacent residential uses

(4) The need to provide for the management of access areas so as to protect the privacy of adjacent property owners and to protect the aesthetic values of the area by providing for the collection of litter.

(b) It is the intent of the Legislature that the public access policies of this article be carried out in a reasonable manner that considers the equities and that balances the rights of the individual property owner with the public's constitutional right of access pursuant to Section 4 of Article X of the California Constitution. Nothing in this section or any amendment thereto shall be construed as a limitation on the rights guaranteed to the public under Section 4 of Article X of the California Constitution.

(c) In carrying out the public access policies of this article, the commission and any other responsible public agency shall consider and encourage the utilization of innovative access management techniques, including, but not limited to, agreements with private organizations which would minimize management costs and encourage the use of volunteer programs.

In addition, the City of Malibu certified LUP contains policies that protect public access:

Policy 2.23 states the following:

No new structures or reconstruction shall be permitted on a bluff face, except for stairways or accessways to provide public access to the shoreline or beach or routine repair and maintenance or to replace a structure destroyed by natural disaster.

Section 30251 of the Coastal Act, which is incorporated as part of the Malibu LCP, requires that visual qualities of coastal areas shall be considered and protected, landform alteration shall be minimized, and where feasible, degraded areas shall be enhanced and restored. Section 30251 of the Coastal Act states that:

The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinated to the character of its setting.

In addition, the following LCP visual resource policies are applicable in this case:

6.1 The Santa Monica Mountains, including the City, contain scenic areas of regional and national importance. The scenic and visual qualities of these areas shall be protected and, where feasible, enhanced.

6.2 Places on and along public roads, trails, parklands, and beaches that offer scenic vistas are considered public viewing areas. Existing public roads where there are

views of the ocean and other scenic areas are considered Scenic Roads. Public parklands and riding and hiking trails which contain public viewing areas are shown on the LUP Park Map. The LUP Public Access Map shows public beach parks and other beach areas accessible to the public that serve as public viewing areas.

6.4 Places on, along, within, or visible from scenic roads, trails, beaches, parklands and state waters that offer scenic vistas of the beach and ocean, coastline, mountains, canyons and other unique natural features are considered Scenic Areas. Scenic Areas do not include inland areas that are largely developed or built out such as residential subdivisions along the coastal terrace, residential development inland of Birdview Avenue and Cliffside Drive on Point Dume, or existing commercial development within the Civic Center and along Pacific Coast Highway east of Malibu Canyon Road.

6.5 New development shall be sited and designed to minimize adverse impacts on scenic areas visible from scenic roads or public viewing areas to the maximum feasible extent. If there is no feasible building site location on the proposed project site where development would not be visible, then the development shall be sited and designed to minimize impacts on scenic areas visible from scenic highways or public viewing areas, through measures including, but not limited to, siting development in the least visible portion of the site, breaking up the mass of new structures, designing structures to blend into the natural hillside setting, restricting the building maximum size, reducing maximum height standards, clustering development, minimizing grading, incorporating landscape elements, and where appropriate, berming.

6.6 Avoidance of impacts to visual resources through site selection and design alternatives is the preferred method over landscape screening. Landscape screening, as mitigation of visual impacts shall not substitute for project alternatives including resiting, or reducing the height or bulk of structures.

6.13 New development in areas visible from scenic roads or public viewing areas shall incorporate colors and exterior materials that are compatible with the surrounding landscape. The use of highly reflective materials shall be prohibited.

6.15 Fences, walls, and landscaping shall not block views of scenic areas from scenic roads, parks, beaches, and other public viewing areas.

6.23 Exterior lighting (except traffic lights, navigational lights, and other similar safety lighting) shall be minimized, restricted to low intensity fixtures, shielded, and concealed to the maximum feasible extent so that no light source is directly visible from public viewing areas. Night lighting for sports courts or other private recreational facilities in scenic areas designated for residential use shall be prohibited.

Coastal Act section 30210 mandates that maximum public access and recreational opportunities be provided and that development not interfere with the public's right to access the coast. Coastal Act 30214 requires that specific site characteristics, including the fragility of natural resources, be taken into account when evaluating the time, place, and manner of public access. In addition, Coastal Act Section 30251 requires that visual qualities of coastal areas shall be considered and protected, landform alteration shall be minimized, and where feasible, degraded areas shall be enhanced and restored.

The proposed project will be located adjacent to and within public recreational areas including Malibu Lagoon State Beach and adjacent to Surfrider Beach. This area is a popular area for recreational uses, including nature walks, surfing, sunbathing, birdwatching, picnicking and other coastal activities. A major part of the proposed project includes several public access, educational/interpretative improvements. The existing primary accessway built to connect the previously existing parking lot and landward area to the beach is a boardwalk with a series of bridges bisecting the lagoon. This path will be removed in order to allow lagoon habitat and tidal circulation to be restored. There is currently a lesser used pathway that arcs from the new parking lot around the perimeter of the western lagoon to the beach. This path will be improved and will serve as the primary beach access way. This pathway will be located outside of the restored lagoon area and will not require any construction within the lagoon or placement of any hard structures in the lagoon. A perimeter wall is proposed along the southern boundary adjacent to the existing location of several fences, including private gates, separating the lagoon from the Malibu Colony residential area. The 6 ft. tall, and approximately 880 ft. long masonry wall will extend the length of the southern boundary of the State Park property. It is designed to match the perimeter wall of the historic Adamson House located just to the east of Malibu Lagoon State Beach.

Additionally, the proposed restoration activities will result in some potential temporary disruption to the public's ability to use the area, including the temporary closure of the public beach access trail during demolition and relocation and potentially portions of the public parking lot during construction. In addition, the Commission notes that the restoration activities are proposed during the summer and fall months when visitor-use of Malibu Lagoon State Beach is high. However, the timing of operations, from June 1st to October 15th, is necessary in order to allow work to occur with the least biological and hydrological impacts while the lagoon mouth is closed, including avoiding steelhead migrating season as noted above. In order to minimize these temporary impacts to public access, the applicant proposes to maintain beach access on site during construction via an alternate route around the lagoon. The parking lot is expected to be partially open during construction; however, signage will direct the public to alternative parking locations along the street nearby. Therefore, to ensure that maximum access is maintained for the public in the project area consistent with Coastal Act Section 30210, **Special Condition One (1)** requires that all dewatering, grading, and restoration, including any restrictions on public access, be prohibited on any part of the lagoon in the project area on Saturdays and Sundays, thereby removing the potential for construction-related disturbances to conflict with weekend visitor activities. In this way, scheduling operations outside of peak recreational times will serve to minimize potential impacts on public access.

Furthermore, to ensure the safety of recreational users of the project site and to ensure that the interruption to public access of the project site is minimized, the Commission requires the applicant to submit a public access plan, pursuant to **Special Condition Ten (10),** to the Executive Director for review and approval. **Special Condition Ten (10)** requires a description of the methods (including signs, fencing, posting or security guards, etc.) by which safe public access to and around the receiver site shall be maintained during and after restoration activities. Where use of public parking spaces is unavoidable, the minimum number of public parking spaces that are occupied for the staging of equipment, machinery and employee parking shall be used. Additionally, excavated material will be temporarily stockpiled in designated areas. Stockpiled materials may be temporarily visible from several public viewing areas including Pacific Coast Highway, but will not result in any significant adverse impacts to public views.

Therefore, the Commission finds that the proposed project, as conditioned, is consistent with Sections 30210, 30211, and 30251 of the Coastal Act and with all relevant policies of the adopted City of Malibu Local Coastal Program.

H. ARCHAEOLOGICAL RESOURCES

Coastal Act Section 30244 of the Coastal Act states that:

> ***Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.***

In addition, the following Malibu LCP archeological resource policies are applicable:

> ***5.60 New development shall protect and preserve archaeological, historical and paleontological resources from destruction, and shall avoid and minimize impacts to such resources.***
>
> ***5.61 Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.***
>
> ***5.62 The City should coordinate with appropriate agencies, such as the UCLA Archaeological Center, to identify archaeologically sensitive areas. Such information should be kept confidential to protect archaeological resources.***
>
> ***5.63 Coastal Development Permits for new development within archaeologically sensitive areas shall be conditioned upon the implementation of the appropriate mitigation measures.***
>
> ***5.64 New development on sites identified as archaeologically sensitive shall include on-site monitoring of all grading, excavation and site preparation that involve earth moving operations by a qualified archaeologist(s) and appropriate Native American consultant(s).***

Additionally, Chapter 11 of the City of Malibu's Implementation Plan requires that a Cultural Resource Review be conducted for all projects prior to the issuance of a planning approval or development permit to assure that archaeological/cultural resources are protected.

Archaeological resources are significant to an understanding of cultural, environmental, biological, and geological history. The Coastal Act requires the protection of such resources to reduce the potential adverse impacts through the use of reasonable mitigation measures. Degradation of archaeological resources can occur if a project is not properly monitored and managed during earth moving activities and construction.

Site preparation can disturb and/or obliterate archaeological materials to such an extent that the information that could have been derived would be permanently lost. In the past, numerous archaeological sites have been destroyed or damaged as a result of development. As a result, the remaining sites, even though often less rich in materials, have become increasingly valuable as a resource. Further, because archaeological sites, if studied collectively, may provide information on subsistence and settlement patterns, the loss of individual sites can reduce the scientific value of the sites which remain intact.

Malibu Lagoon is located within the historic territory of Chumash Native Americans. A historic Chumash village, *Humaliwo*, was located beyond the northeastern side of the lagoon on a small rise overlooking the lagoon at the present site of the Adamson House (a historic residence on the National Register of Historic Places and listed as California Historical Landmark No.966). (FEIR, p.7-3) Various cultural remains have been documented at this site including an extensive shell midden, glass and shell beads, fish and whale effigies, as well as more than 200 human burial grounds. The village is documented as archeological site CA-LAN-264, which dates back at least 3,000 years. (FEIR, p. 7-4) The project area was mapped in relation to the known boundaries of CA-LAN-264 and the archeological site lies immediately east of the main lagoon channel, adjacent to the Adamson House boat house. In order to minimize the potential for adverse effects to cultural resources that could be buried in lagoon sediment adjacent to the site, the proposed restoration activities will be conducted only using hand tools in this area. However, the Commission notes that potential adverse effects to those resources may still occur due to inadvertent disturbance during dredging activity. To ensure that impacts to archaeological resources are minimized, **Special Condition Fifteen (15)** requires that if project activities are undertaken within an area known to have archaeological resources, the applicant agrees to have a qualified archaeologist(s) and appropriate Native American consultant(s) present on-site during all restoration activities which occur within or adjacent to the archaeological sites in the project area. The restoration operations on the project site shall be controlled and monitored by the archaeologist(s) with the purpose of locating, recording and collecting any archaeological materials. In the event that any significant archaeological resources are discovered during operations, work in the area will be stopped and appropriate data recovery strategy be developed, subject to review and approval of the Executive Director, by the applicant's archaeologist and the native American consultant consistent with CEQA guidelines.

Therefore, the Commission finds that the proposed project, as conditioned, is consistent with Section 30244 of the Coastal Act.

I. CEQA

Sections 13096(a) and 13057(c) of the Commission's administrative regulations require Commission approval of a Coastal Development Permit application to include findings supporting the conclusion that the approval of the application, as conditioned by any conditions of approval, is consistent with any applicable requirements of the California

Environmental Quality Act (CEQA), Cal. Pub. Res. Code ("PRC") §§ 21000 *et seq.*, including specific findings evaluating the conformity of the development with the requirements of PRC section 21080.5(d)(2)(A). Section 21080.5(d)(2)(A) prohibits a proposed development from being approved if there are feasible alternatives or feasible mitigation measures available which would substantially lessen any significant adverse effect which the activity may have on the environment.

The Commission incorporates its findings regarding the project's consistency with the Coastal Act and the City of Malibu LCP at this point as if set forth here in full. Those findings identify the following potentially substantial adverse impacts that the proposed project could have on the environment: impacts to sensitive aquatic and terrestrial species, including avian species, lagoon vegetation, water quality, flooding hazards, erosion, public access, and archeological resources. As discussed in detail above, for each such impact, project alternatives and mitigation measures have been considered and incorporated into the project to substantially lessen any significant adverse effect.

Five types of mitigation measures include those that are intended to avoid, minimize, rectify, reduce, or compensate for significant impacts of development. Mitigation measures and/or alternatives required as part of this coastal development permit include the avoidance of impacts to ESHA and sensitive biological resources through timing and operational constraints, grading and construction monitoring, and biological monitoring (see Sections IV.C and IV.E, on pages 41 to 66, above), and include the avoidance of impacts to water quality through hydrological monitoring and following Regional Water Quality Control Board requirements (see Section IV.D on pages 44 to 55, above.) Mitigation measures and/or alternatives required as part of this coastal development permit to avoid erosional hazards include requirements for erosion control plans and project management requirements and are discussed in Section IV.F (on pages 67 to 70). Mitigation measures and/or alternatives required to minimize adverse impacts to public access include restrictions on the timing of the project and a requirement for a public access plan including signage and fencing, as discussed in Section IV.G (on pages 70 to 73). Finally, mitigation measures and/or alternatives are required to minimize impacts to archeological resources, including monitoring by an archeologist and a Native American consultant during all ground-disturbing activities adjacent to recorded archeological sites, as discussed in Section IV.H (pages 73 to 74).

As noted above, the project was also evaluated in the Malibu Lagoon Restoration and Enhancement Plan Final Environmental Impact Report (EIR), SCH# 2005101123, adopted by the California Department of Parks and Recreation, dated March 2006. All of the mitigation measures required in the EIR have been considered and incorporated as conditions of this project approval.

As conditioned, there are no feasible alternatives or feasible mitigation measures available, beyond those required, which would substantially lessen any significant adverse impact that the activity may have on the environment. Therefore, the Commission finds that the proposed project, as conditioned to mitigate the identified impacts, is consistent with the requirements of the Coastal Act to conform to CEQA.

Finally, these findings also address and respond to all public comments regarding potential significant adverse environmental effects of the project that were received prior to preparation of the staff report. Those comments and the Commission's responses are summarized on pages 3-6, in the "Comment Letters" section of the Summary of Staff Report, which section is adopted as part of the Commission's findings and incorporated at this point as if set forth here in full, and are also included within Section IV.C through F of this report. One procedural issue was raised as well. The Wetlands Defense Fund, along with approximately 15 other form letters from residents of the Malibu Colony community (**Exhibit 24**) were submitted to the commission to request additional time to comment and review the July 29, 2010 staff report and recommendation. In part in response to those requests, the Commission postponed the hearing on this matter from its August meeting to this October meeting, providing the public approximately 75 days to review the staff recommendation.

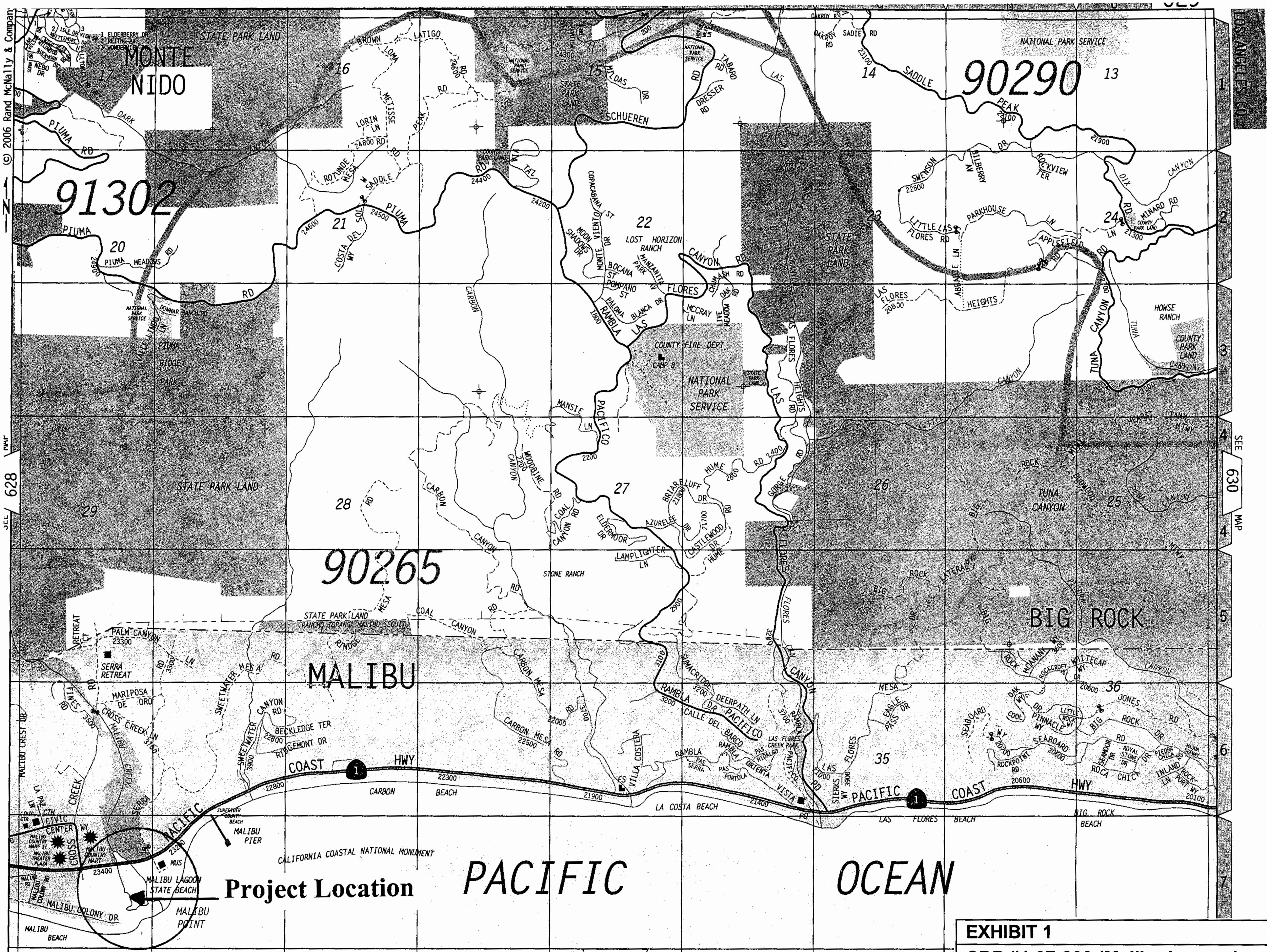


EXHIBIT 1

CDP #4-07-098 (Malibu Lagoon)

Vicinity Map

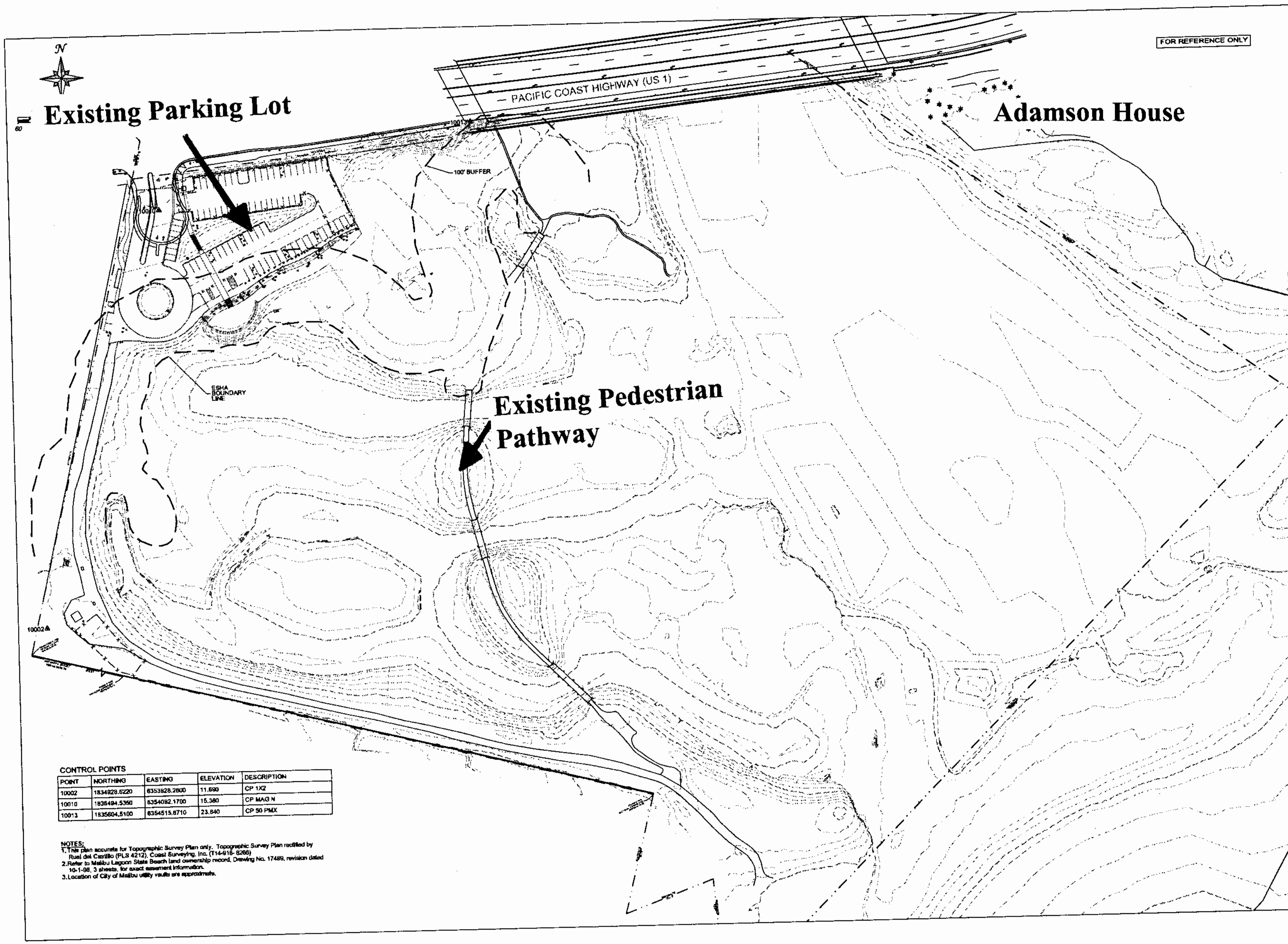
SOURCE: USGS 7.5' Quad., California: Malibu (1982)

Figure 1
Project Location

Jones & Stokes

Malibu Lagoon Restoratio

EXHIBIT 2
CDP #4-07-098 (Malibu Lagoon)
Project Location Map



CONTROL POINTS

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
10002	1834928.6220	6353828.2600	11.690	CP 1X2
10010	1836494.5350	6354092.1700	15.380	CP MAG N
10013	1835604.5100	6354515.8710	23.840	CP 50 PMX

NOTES:
1. This plan accurate for Topographic Survey Plan only. Topographic Survey Plan rectified by Ruel del Castillo (PLS 4212), Coast Surveying, Inc. (T14-916-8266)
2. Refer to Malibu Lagoon State Beach land ownership record, Drawing No. 17489, revision dated 10-1-98, 3 sheets, for exact easement information.
3. Location of City of Malibu utility vaults are approximate.

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ACQUISITION & DEVELOPMENT DIVISION
Southern Service Center
8885 Rio San Diego Dr. # 270
San Diego, CA. 92108

CALIFORNIA STATE FIRE MARSHAL - APPROVED
Approval of this plan does not authorize or approve any omission of deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.
Reviewed by Date

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION
CERTIFICATION #
Reviewed by Date

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION, NORTHERN SERVICE CENTER

DESIGNED: SS
DRAWN: JS/KT
CHECKED: SS
DATE: 10/05/07

REVISIONS | DATE

Jones & Stokes
2600 V Street, Sacramento, CA 95818

PROJECT:
65% SUBMITTAL - NOT FOR CONSTRUCTION
MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

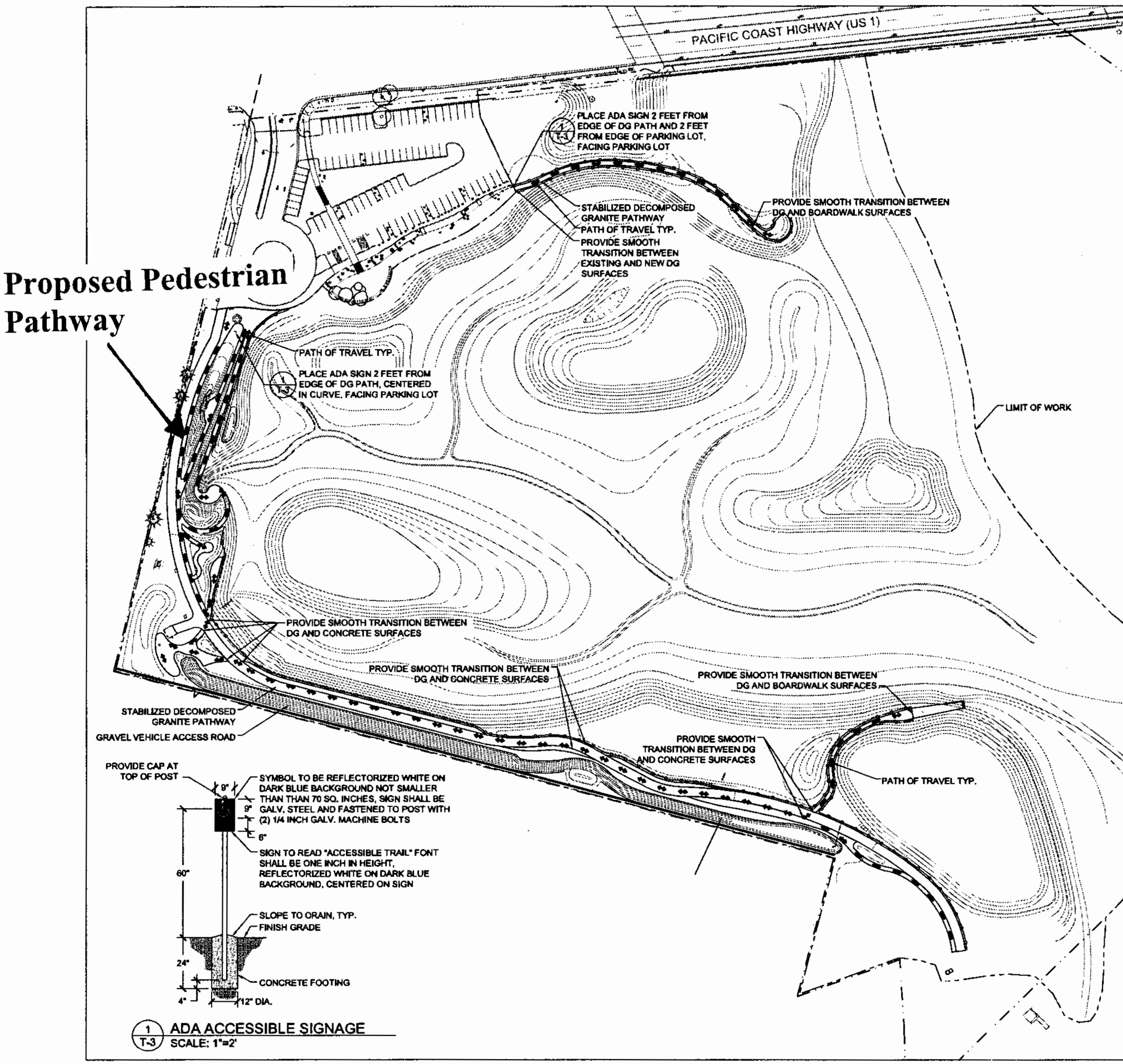
SHEET TITLE:
TOPOGRAPHIC SURVEY
(FOR REFERENCE ONLY)

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

DRAWING NO.
T-4

SHEET NO.
4
OF
24

EXHIBIT 3
CDP #4-07-098 (Malibu Lagoon)
Existing Site



WALKS:

1. All walks must comply with the California Department of Parks and Recreation 2009 Accessibility Guidelines (CDPR) and the California Building Code, Title 24, Chapter 11B: Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Publicly Funded Housing (CBC)
2. Surfaces shall be firm, stable and slip resistant (CBC Section 1124B.1 and CDPR Section 33)
3. Continuous surface: Pathways shall have a continuous common surface, not interrupted by steps or by abrupt changes in level exceeding 1/2 inch and shall be a minimum of 60 inches in width. (CBC Section 1133B.7.1 and CDPR Section 33)
4. Slopes in the direction of travel: The slope in the direction of shall be a maximum of 5%. Where conditions dictate a slope greater then 5%, a ramp shall be provided (CBC Section 1133B.7.3 and CDPR Section 33)
5. Surface cross slopes: The slope perpendicular to the direction of travel, cross slope, shall be a maximum of 2% (CBC 1133B.7.1.3 and CDPR Section 33)
6. Changes in level: Surfaces changes in elevation shall be 1/4 inch maximum without edge treatment. Surface elevation changes between 1/4 inch and 1/2 inch shall be beveled at 50%. Surface elevation changes greater than 1/2 inch must be ramped (CBC Section 1124B.2 and CDPR Section 33).
7. Warning curbs: Abrupt changes in level, except between a walk or sidewalk and an adjacent street or driveway, exceeding 4 inches in a vertical dimension, such as at planters or foundations located in or adjacent to walks, sidewalks or other pedestrian ways, shall be identified by curbs projecting at least 6 inches in height above the walk or sidewalk surface to warn the blind of a potential drop off. When a guardrail or handrail is provided, no curb is required when a guide rail is provided centered 3 inches plus or minus 1 inch above the surface of the walk or sidewalk, the walk is 5 percent or less gradient or no adjacent hazard exists (CBC Section 1133B.8.1 and CDPR Section 33).
8. Protruding objects: Objects that protrude into the accessible route with their leading edge between 27 inches and 80 inches from the ground shall not protrude more than 4 inches. Objects mounted below 27 inches may protrude any amount but shall not reduce the clear width of the accessible route (CBC Section 1133B.8.6 and CDPR Section 33).
9. Vertical clearance: Vertical clearance on the accessible route shall be 80 inches. If the vertical clearance of an area djoining the accessible route is less than 80 inches, a cane detectable barrier to warn the visually impaired shall be provided (CBC Section 1133B.8.6.2 and CDPR Section 33).
10. Dectable warning strips: Detectable ground surface or pavement warings shall be provided where the access route crosses or adjoins a vehicular travel way that is not separated by a curb, guardrails or handrails. Detectable warnings shall be durable, slip-resistant, truncated domes with an inline grid that extends 24 inches minimum in the direction of travel. Domes shall have a diameter of 0.9 inches at the bottom, a diameter of 0.4 inches at the top, a height of 0.2 inches and a center-to-center spacing of 2.35 inches, measured along one side of a square grid. The detectable warnings shall contrast visually from the adjacent surface both in color and in resiliency or sound upon contact with a cane (CBC 1133B.8.3-5 and CDPR Section 33)
11. Suface openings: Openings in the surface, such as on a boardwalk, cannot be greater than 1/2 inch wide. Elongated openings shall be placed so that the long dimension is perpendicular or diagonal to the dominant direction of travel. Exception: openings are permitted to run parallel to the direction of travel so long as the opening is no wider than 1/4 inch (CDPR Section 33).

ACCESSIBLE SIGNAGE:

12. International symbol of accessibility: The following elements and spaces of accessible facilities shall be identified by the international symbol of accessibility:
    A. Entrance to all accessible trail systems.
13. Design: The international symbol of accessibility shall be the standard used to identify facilities that are accessible to and usable by phsically disabled persons.
14. Color of symbol: The symbol specified above shall consist of a white figure on a blue background. The blue shall be equal to color No. 15090 in federal standard 595b.
    Exception: The authorized state review agency may approve special signs and identification necessary to complement decor or unique design when it is determined that such signs and identification provide adequate direction to persons with disabilities.
15. Braille symbols: Contracted grade 2 braille shall be used whereever braille symbols are specifically required in other portions of these standards. Dots shall be 1/10 inch on centers in each cell with 2/10 inch space between cells. Dots shall be raised a minimum of 1/40 inch above the background.
16. Proportions Letters and numbers on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10.
17. Character height: Characters and numbers on signs shall be sized according to teh viewing distance from which they are to be read. The minimum height is measured using an upper-case "X". Lowercase charecers are permitted. For signs suspended or porjected 80 inches minimum above the floor, the minimum character height shall be 3 inches.
18. Contrast and finish: Character and symbols shall contrast with their background, light characters on a dark background. The (finish of) characters and background of signs shall be eggshell, matte, or other non-glare finish.
19. Raised characters and pictorial symbol signs: When raised characters or symbols are used, they shall conform to the following requirements.
    B. Letter type: Letters and numbers on signs shall be raised 1/32 inch minimum and shall be Sans-Serif uppercase characters accompanied by grade 2 braille.
    C. Symbol size: Raised characters or symbols shall be a minimum of 5/8 inch high to a maximum height of 2 inches.
    D. Pictorial symbol signs (pictograms nongeometric): Pictorial symbols signs (pictograms) shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be a minimum of 6 inches in height.
20. Mounting location and height: Where permanent identification is porvided or where signage is required for rooms and spaces, raised letters shall be provided and shall be accompanied by braille in conformance with a note. Door mounted sign shall be centered on the door 60 inches from floor. Unless door mounted symbol shall be 12 inches diameter circle 1/4 inch thick with 1/4 inch triangle superimposed within circle.

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Southern Service Center
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San Diego, CA 92108

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Reviewed by ______ Date

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION
CERTIFICATION #
Reviewed by ______ Date

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION, NORTHERN SERVICE CENTER

DESIGNED:	SS
DRAWN:	AA/KT/PW
CHECKED:	SS/KM
DATE: 09/14/10	

REVISIONS	
△	DATE

ICF INTERNATIONAL
9775 BUSINESSPARK AVENUE
SUITE 200
SAN DIEGO, CA 92131
858.578.8964

PROJECT: 95% SUBMITTAL - NOT FOR CONSTRUCTION
MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT - PHASE 2

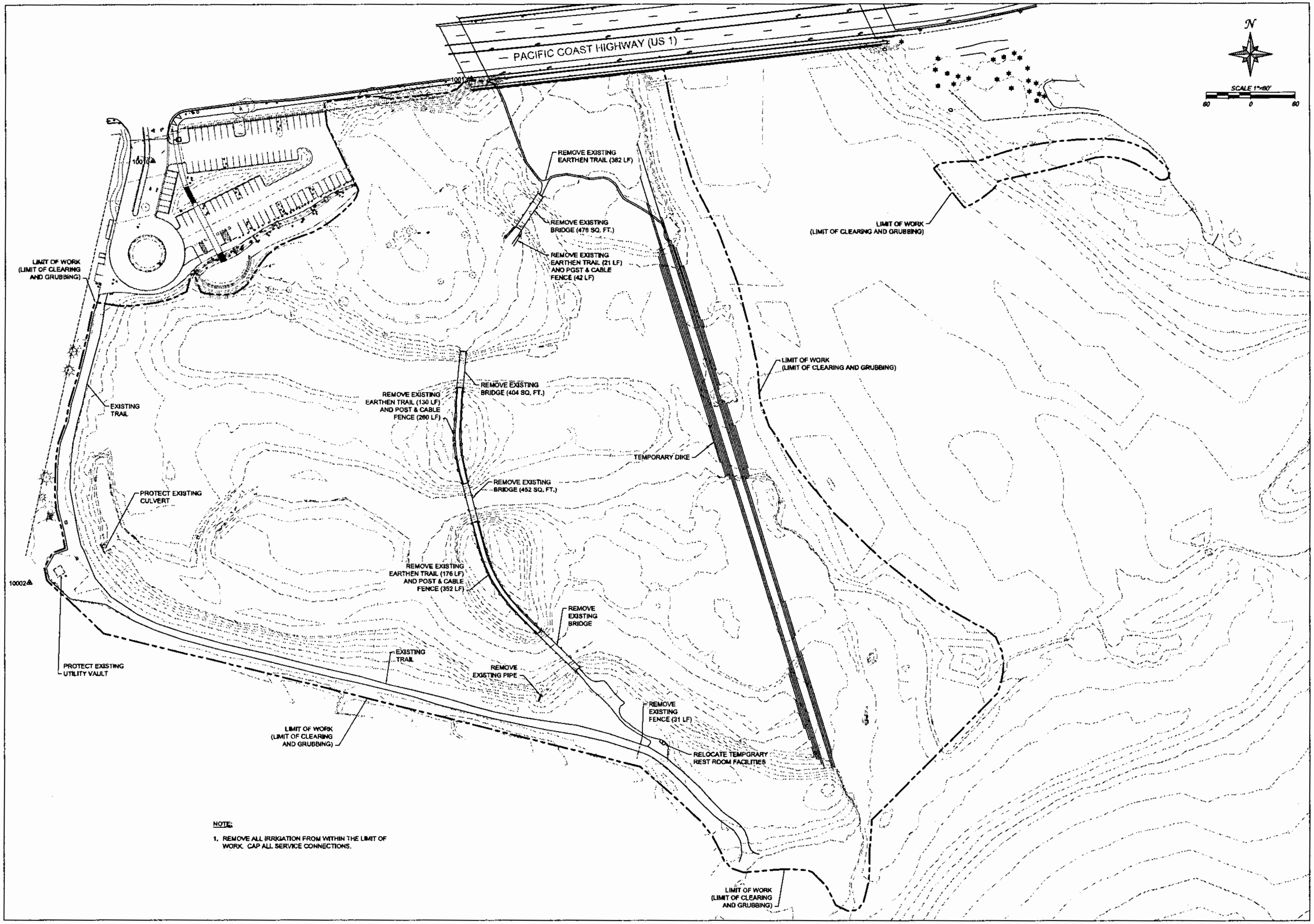
SHEET TITLE: ACCESSIBILITY COMPLIANCE

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

DRAWING NO.
T-3

SHEET NO.
3
OF
48

EXHIBIT 4
CDP #4-07-098 (Malibu Lagoon)
Site Plan



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ACQUISITION & DEVELOPMENT DIVISION
Southern Service Center
8885 Rio San Diego Dr. # 270
San Diego, CA. 92108

CALIFORNIA STATE FIRE MARSHAL- APPROVED
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Reviewed by Date

DPR ACCESS COMPLIANCE REVIEW
ACCESSIBILITY SECTION
CERTIFICATION #

Reviewed by Date

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DESIGNED:	SS
DRAWN:	JS/KT
CHECKED:	SS
DATE: 10/05/07	

REVISIONS	
	DATE

Jones & Stokes
2600 V Street, Sacramento, CA 95818

PROJECT:
65% SUBMITTAL - NOT FOR CONSTRUCTION
MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

SHEET TITLE:
SITE PREPARATION - DEMOLITION PLAN

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

DRAWING NO.
SP-2

SHEET NO.
6
OF
24

EXHIBIT 5

CDP #4-07-098 (Malibu Lagoon)

Trail Demolition Plan

LEGEND

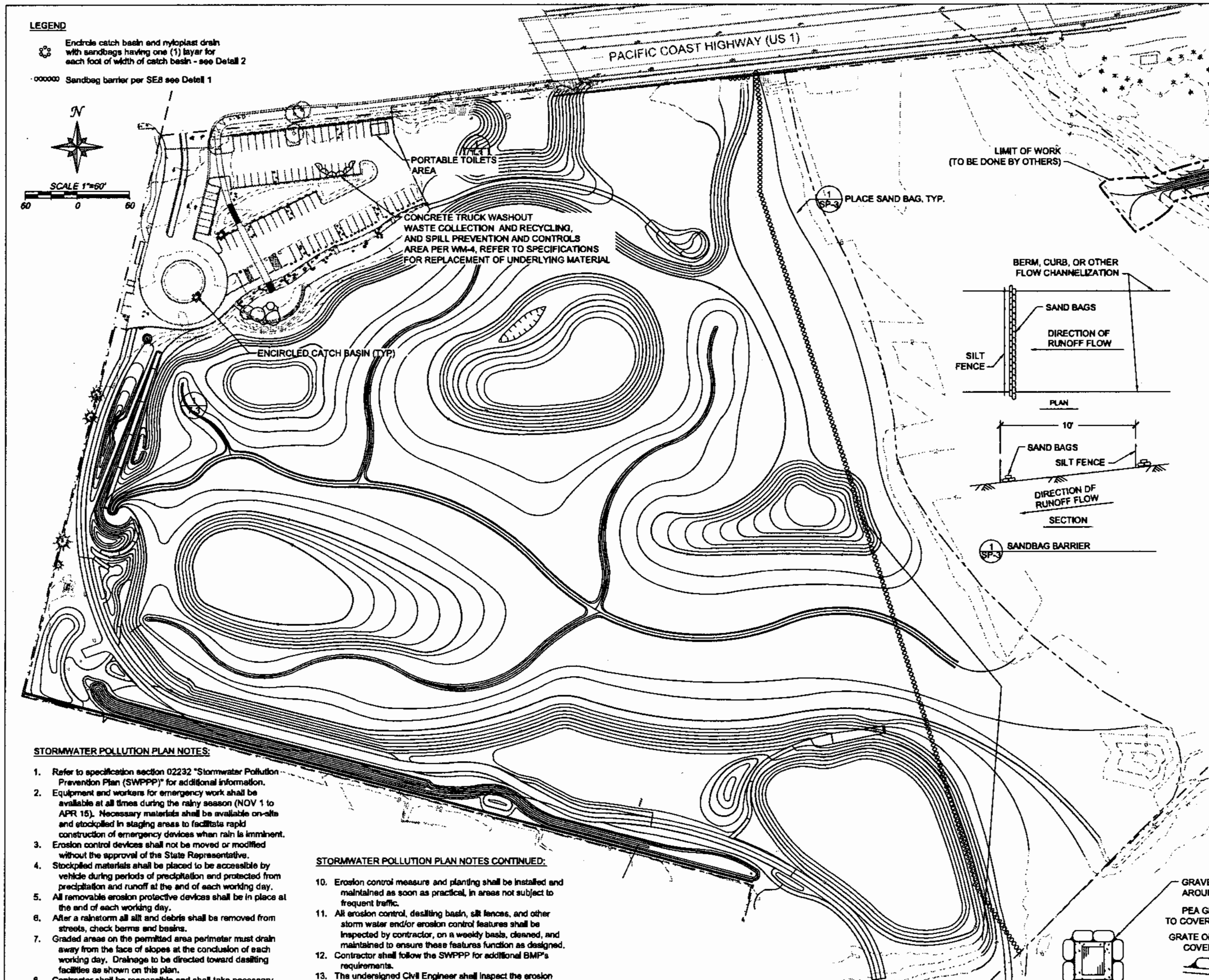
Encircle catch basin and nyloplast drain with sandbags having one (1) layer for each foot of width of catch basin - see Detail 2

Sandbag barrier per SE8 see Detail 1

N

SCALE 1"=60'

60 0 60



BERM, CURB, OR OTHER FLOW CHANNELIZATION

SAND BAGS

DIRECTION OF RUNOFF FLOW

SILT FENCE

PLAN

10'

SAND BAGS

SILT FENCE

DIRECTION OF RUNOFF FLOW

SECTION

1/SP-3 SANDBAG BARRIER

GRAVEL BAGS AROUND CATCH BASIN

PEA GRAVEL TO COVER GAPS

GRATE OR COVER

CATCH BASIN

PEA GRAVEL TO COVER GAPS

PLAN

SECTION

2/SP-3 FILTER INLET DETAIL

STORMWATER POLLUTION PLAN NOTES:

1. Refer to specification section 02232 "Stormwater Pollution Prevention Plan (SWPPP)" for additional information.
2. Equipment and workers for emergency work shall be available at all times during the rainy season (NOV 1 to APR 15). Necessary materials shall be available on-site and stockpiled in staging areas to facilitate rapid construction of emergency devices when rain is imminent.
3. Erosion control devices shall not be moved or modified without the approval of the State Representative.
4. Stockpiled materials shall be placed to be accessible by vehicle during periods of precipitation and protected from precipitation and runoff at the end of each working day.
5. All removable erosion protective devices shall be in place at the end of each working day.
6. After a rainstorm all silt and debris shall be removed from streets, check berms and basins.
7. Graded areas on the permitted area perimeter must drain away from the face of slopes at the conclusion of each working day. Drainage to be directed toward desilting facilities as shown on this plan.
8. Contractor shall be responsible and shall take necessary precautions to prevent public trespass onto areas where impounded water creates a hazardous condition.
9. Issuance of a grading permit does not eliminate the need for permits from other agencies with regulatory responsibilities for construction activities associated with the work authorized on this plan. The State's representative shall provide all permits to contractor.

STORMWATER POLLUTION PLAN NOTES CONTINUED:

10. Erosion control measure and planting shall be installed and maintained as soon as practical, in areas not subject to frequent traffic.
11. All erosion control, desilting basin, silt fences, and other storm water and/or erosion control features shall be inspected by contractor, on a weekly basis, cleaned, and maintained to ensure these features function as designed.
12. Contractor shall follow the SWPPP for additional BMP's requirements.
13. The undersigned Civil Engineer shall inspect the erosion control work and ensure that the work is in accordance with the approved plans.

Signature: ____________________ Date: __________

NOTES:

1. This plan accurate for erosion control plan only.
2. Contractor to maintain pre-development runoff flow patterns.
3. Eroded sediments and other pollutants must be retained on site and may not be transported from the site via sheetflow, swales, area drains, natural drainage courses or wind.
4. Stockpiles of earth and other construction related materials must be protected from being transported from the site by the forces of water or wind.
5. Fuels, oils, solvents, and other toxic materials must be stored in accordance with their listing and are not to contaminate the soil and surface waters. All approved storage containers are to be protected from the weather. Spills must be cleaned up immediately and disposed of in a proper manner. Spills may not be washed into the drainage system.
6. Excess or waste concrete may not be washed into the public way or any other drainage system. Provisions shall be made to retain concrete wastes on site until they can be disposed of as solid waste.
7. Trash and construction related solid wastes must be deposited into a covered receptacle to prevent contamination of rainwater and dispersal by wind.
8. Sediments and other materials may not be tracked from the site by vehicle traffic. The construction entrance roadways must be stabilized so as to inhibit sediments from being deposited into the public way. Accidental depositions must be swept up immediately and may not be washed down by rain or other means.
9. Any slopes with disturbed soild or denuded of vegetation must be stabilized so as to inhibit erosion by wind and water.

- The following BMPs as outlined in, but not limited to, the California Stormwater Best Management Practices Handbook, January 2003, or the latest revised edition, may apply during the construction of this project

EROSION CONTROL
- EC1 - SCHEDULING
- EC2 - PRESERVATION OF EXISTING VEGETATION
- EC3 - HYDRAULIC MULCH
- EC4 - HYDROSEEDING
- EC5 - SOIL BINDERS
- EC6 - STRAW MULCH
- EC7 - GEOTEXTILES & MATS
- EC8 - WOOD MULCHING
- EC9 - EARTH DIKES AND DRAINAGES SWALES
- EC10 - VELOCITY DISSIPATION DEVICES
- EC11 - SLOPE DRAINS
- EC12 - STREAMBANK STABILIZATION
- EC13 - POLYACRYLAMIDE

EQUIPMENT TRACKING CONTROL
- TC1 - STABILIZED CONSTRUCTION ENTRANCE EXIT
- TC2 - STABILIZED CONSTRUCTION ROADWAY
- TC3 - ENTRANCE/OUTLET TIRE WASH

TEMPORARY SEDIMENT CONTROL
- SE1 - SILT FENCE
- SE2 - SEDIMENT BASIN
- SE3 - SEDIMENT TRAP
- SE4 - CHECK DAM
- SE5 - FIBER ROLLS
- SE6 - GRAVEL BAG BERM
- SE7 - STREET SWEEPING AND VACUUMING
- SE8 - SANDBAG BARRIER
- SE9 - STRAW BALE BARRIER
- SE10 - STORM DRAIN INLET PROTECTION

WASTE MANAGEMENT & MATERIAL POLLUTION CONTROL
- WM - 1 MATERIAL DELIVERY AND STORAGE
- WM - 2 MATERIAL USE
- WM - 3 STOCKPILE MANAGEMENT
- WM - 4 SPILL PREVENTION AND CONTROL
- WM - 5 SOLID WASTE MANAGEMENT
- WM - 6 HAZARDOUS WASTE MANAGEMENT
- WM - 7 CONTAMINATION SOIL MANAGEMENT
- WM - 8 CONCRETE WASTE MANAGEMENT
- WM - 9 SANITARY/SEPTIC WASTE MANAGEMENT
- WM - 10 LIQUID WASTE MANAGEMENT

NON- STORMWATER MANAGEMENT
- NS - 1 WATER CONSERVATION PRACTICES
- NS - 2 DEWATERING OPERATIONS
- NS - 3 PAVING AND GRINDING OPERATIONS
- NS - 4 TEMPORARY STREAM CROSSING
- NS - 5 CLEAR WATER DIVERSION
- NS - 6 ILLICIT CONNECTION/DISCHARGE
- NS - 7 POTABLE WATER/IRRIGATION
- NS - 8 VEHICLE EQUIPMENT CLEANING
- NS - 9 VEHICLE EQUIPMENT FUELING
- NS - 10 VEHICLE AND EQUIPMENT MAINTENANCE
- NS - 11 PILE DRIVING OPERATIONS
- NS - 12 CONCRETE CURING
- NS - 13 CONCRETE FINISHING
- NS - 14 MATERIAL AND EQUIPMENT USE
- NS - 15 DEMOLITION ADJACENT TO WATER
- NS - 16 TEMPORARY BATCH PLANTS

WIND EROSION CONTROL
- WE1 - WIND EROSION CONTROL

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ACQUISITION & DEVELOPMENT DIVISION
Southern Service Center
8885 Rio San Diego Dr. # 270
San Diego, CA. 92108

CALIFORNIA STATE FIRE MARSHAL- APPROVED

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Reviewed by ______ Date ______

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION

CERTIFICATION # ______

Reviewed by ______ Date ______

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION, NORTHERN SERVICE CENTER

DESIGNED:	SS
DRAWN:	AA/KT/PW
CHECKED:	SS/KM
DATE: 09/14/10	

REVISIONS	
△	DATE

ICF INTERNATIONAL
9775 BUSINESSPARK AVENUE
SUITE 200
SAN DIEGO, CA 92131
858.578.8964

PROJECT: 95% SUBMITTAL - NOT FOR CONSTRUCTION
MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

SHEET TITLE: SITE PREPARATION - EROSION CONTROL PLAN

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

DRAWING NO. SP-3

SHEET NO. 7 OF 48

EXHIBIT 6

CDP #4-07-098 (Malibu Lagoon)

Erosion Control Plan

'A' Line Curve Data				
Curve #	Radius	Δ	T	L
C4	300.00	48°42'05"	135.77	255.00
C5	160.00	34°01'10"	48.95	95.00
C6	55.00	83°20'22"	48.95	80.00
C7	45.00	48°22'59"	20.22	38.00
C8	155.00	21°26'23"	29.34	58.00
C9	19.00	57°17'45"	10.38	19.00

'C' Line Curve Data				
Curve #	Radius	Δ	T	L
C15	75.00	45°50'12"	31.71	60.00
C16	115.00	84°41'53"	104.82	170.00
C17	70.00	85°56'37"	65.21	105.00
C18	70.00	40°55'32"	26.12	50.00

'D' Line Curve Data				
Curve #	Radius	Δ	T	L
C19	120.00	40°35'04"	44.37	85.00
C20	90.00	85°56'37"	83.84	135.00
C21	85.00	60°39'58"	49.74	90.00
C22	45.00	69°07'36"	44.32	70.00
C23	55.00	41°40'11"	20.93	40.00

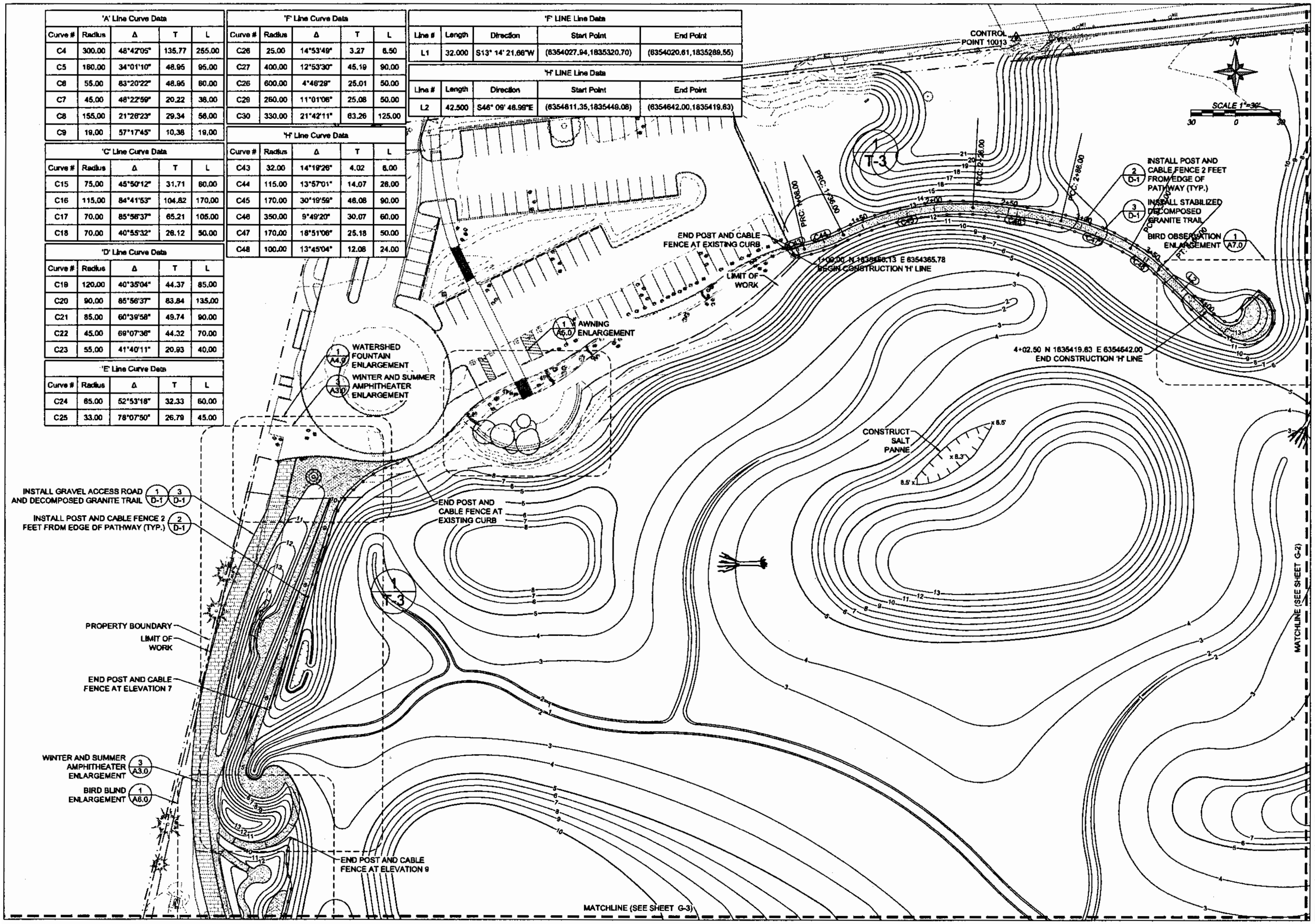
'E' Line Curve Data				
Curve #	Radius	Δ	T	L
C24	65.00	52°53'18"	32.33	60.00
C25	33.00	78°07'50"	26.79	45.00

'F' Line Curve Data				
Curve #	Radius	Δ	T	L
C26	25.00	14°53'49"	3.27	6.50
C27	400.00	12°53'30"	45.19	90.00
C26	600.00	4°46'29"	25.01	50.00
C29	260.00	11°01'06"	25.08	50.00
C30	330.00	21°42'11"	63.26	125.00

'H' Line Curve Data				
Curve #	Radius	Δ	T	L
C43	32.00	14°19'26"	4.02	8.00
C44	115.00	13°57'01"	14.07	28.00
C45	170.00	30°19'59"	46.08	90.00
C46	350.00	9°49'20"	30.07	60.00
C47	170.00	18°51'06"	25.18	50.00
C48	100.00	13°45'04"	12.08	24.00

'F' LINE Line Data				
Line #	Length	Direction	Start Point	End Point
L1	32.000	S13° 14' 21.66"W	(6354027.94,1835320.70)	(6354020.61,1835289.55)

'H' LINE Line Data				
Line #	Length	Direction	Start Point	End Point
L2	42.500	S46° 09' 46.99"E	(6354611.35,1835448.08)	(6354642.00,1835419.63)



CALIFORNIA STATE PARKS SINCE 1864

ACQUISITION & DEVELOPMENT DIVISION
Southern Service Center
8885 Rio San Diego Dr. # 270
San Diego, CA 92108

CALIFORNIA STATE FIRE MARSHAL - APPROVED

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Reviewed by Date

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION

CERTIFICATION #

Reviewed by Date

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION, NORTHERN SERVICE CENTER

DESIGNED: SS
DRAWN: AA/KT/PW
CHECKED: SS/KM
DATE: 09/14/10

REVISIONS	
△	DATE

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9775 BUSINESSPARK AVENUE
SUITE 200
SAN DIEGO, CA 92131
858.578.8964

PROJECT: 95% SUBMITTAL - NOT FOR CONSTRUCTION
MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

SHEET TITLE: GRADING PLAN

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

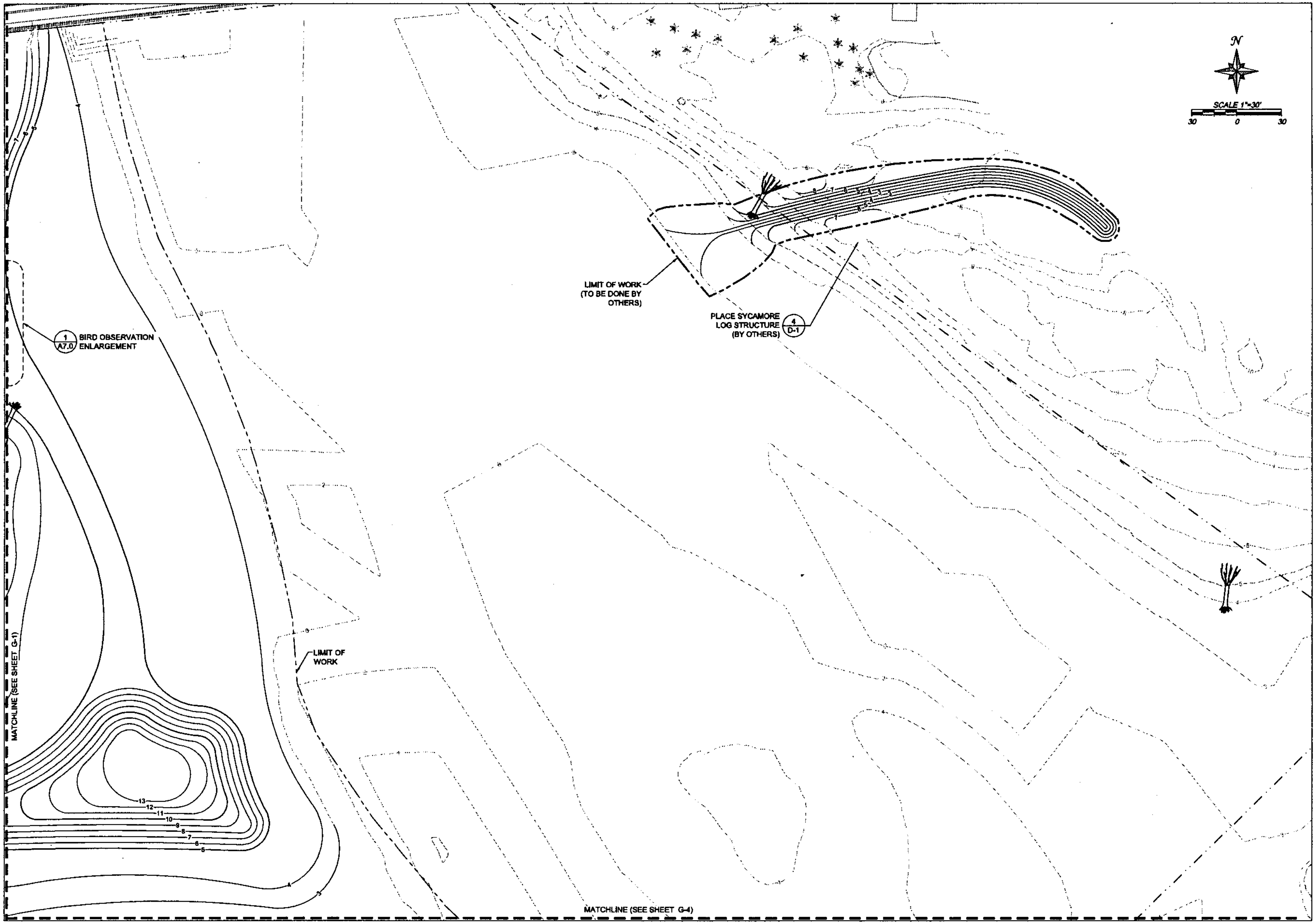
DRAWING NO. G-1

SHEET NO. 8 OF 48

EXHIBIT 7

CDP #4-07-098 (Malibu Lagoon)

Grading Plan Sheet 1



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Southern Service Center
8885 Rio San Diego Dr. # 270
San Diego, CA. 92108

CALIFORNIA STATE FIRE MARSHAL - APPROVED

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ACCESSIBILITY SECTION
CERTIFICATION #

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858.578.8964

PROJECT:
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MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

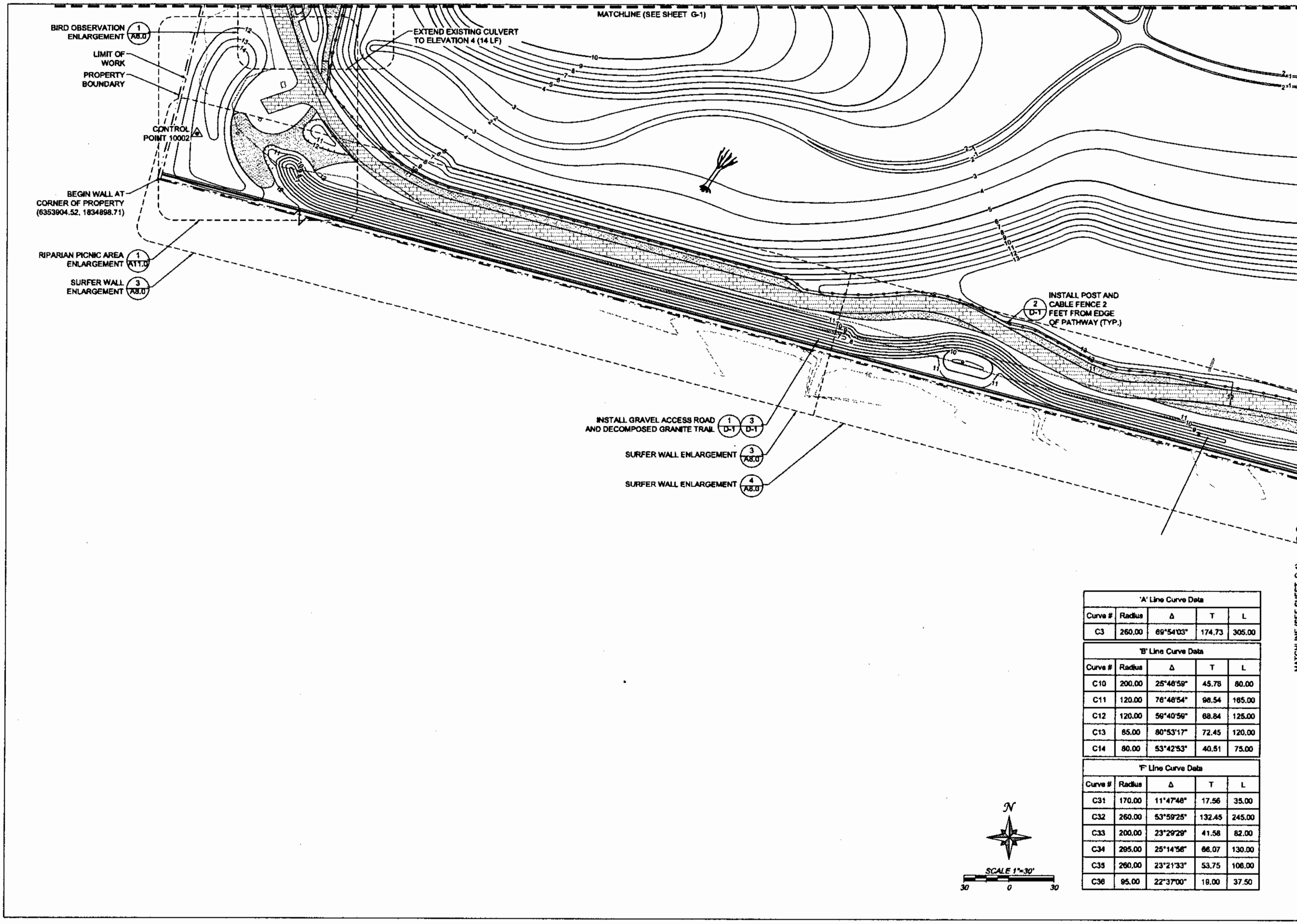
SHEET TITLE:
GRADING PLAN

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

DRAWING NO.
G-2

SHEET NO.
9
OF
48

EXHIBIT 8
CDP #4-07-098 (Malibu Lagoon)
Grading Plan Sheet 2



'A' Line Curve Data

Curve #	Radius	Δ	T	L
C3	260.00	69°54'03"	174.73	305.00

'B' Line Curve Data

Curve #	Radius	Δ	T	L
C10	200.00	25°46'59"	45.78	80.00
C11	120.00	78°46'54"	98.54	165.00
C12	120.00	59°40'59"	68.84	125.00
C13	85.00	80°53'17"	72.45	120.00
C14	80.00	53°42'53"	40.51	75.00

'F' Line Curve Data

Curve #	Radius	Δ	T	L
C31	170.00	11°47'46"	17.56	35.00
C32	260.00	53°59'25"	132.45	245.00
C33	200.00	23°29'29"	41.58	82.00
C34	295.00	25°14'56"	66.07	130.00
C35	260.00	23°21'33"	53.75	106.00
C36	95.00	22°37'00"	19.00	37.50

MATCHLINE (SEE SHEET G-4)

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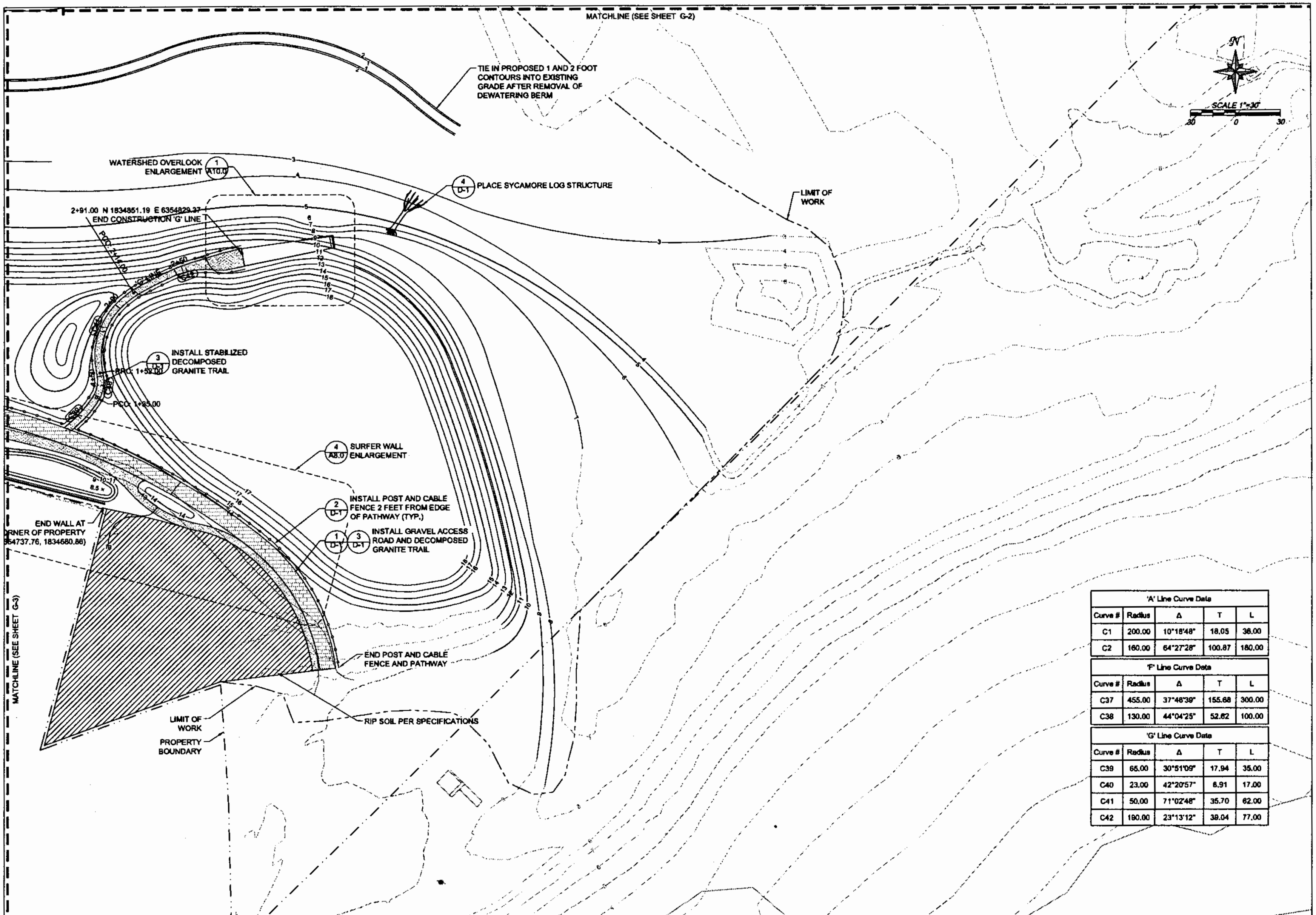
DRAWING NO.
G-3

SHEET NO.
10
OF
48

EXHIBIT 9
CDP #4-07-098 (Malibu Lagoon)
Grading Plan Sheet 3



'A' Line Curve Data				
Curve #	Radius	Δ	T	L
C1	200.00	10°18'48"	18.05	36.00
C2	160.00	64°27'28"	100.87	180.00

'F' Line Curve Data				
Curve #	Radius	Δ	T	L
C37	455.00	37°46'39"	155.68	300.00
C38	130.00	44°04'25"	52.62	100.00

'G' Line Curve Data				
Curve #	Radius	Δ	T	L
C39	65.00	30°51'09"	17.94	35.00
C40	23.00	42°20'57"	8.91	17.00
C41	50.00	71°02'48"	35.70	62.00
C42	190.00	23°13'12"	39.04	77.00

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PROJECT: 95% SUBMITTAL - NOT FOR CONSTRUCTION
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RESTORATION & ENHANCEMENT - PHASE 2
SHEET TITLE: GRADING PLAN
ADDRESS: MALIBU LAGOON STATE BEACH
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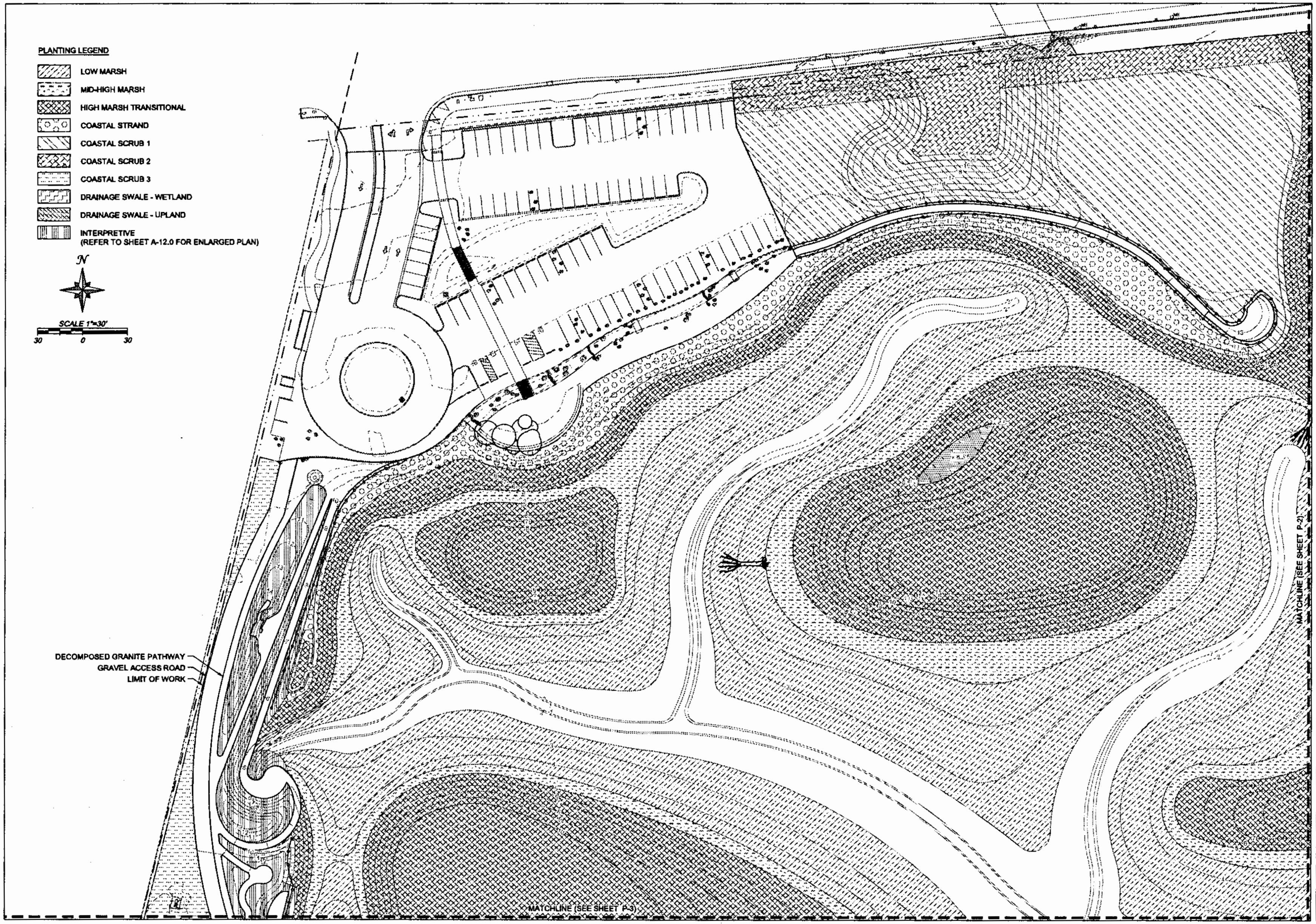
MALIBU, CA 90265

DRAWING NO. G-4
SHEET NO. 11 OF 48

EXHIBIT 10
CDP # 4-07-098 (Malibu Lagoon)
Grading Plan Sheet 4



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MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT - PHASE 2

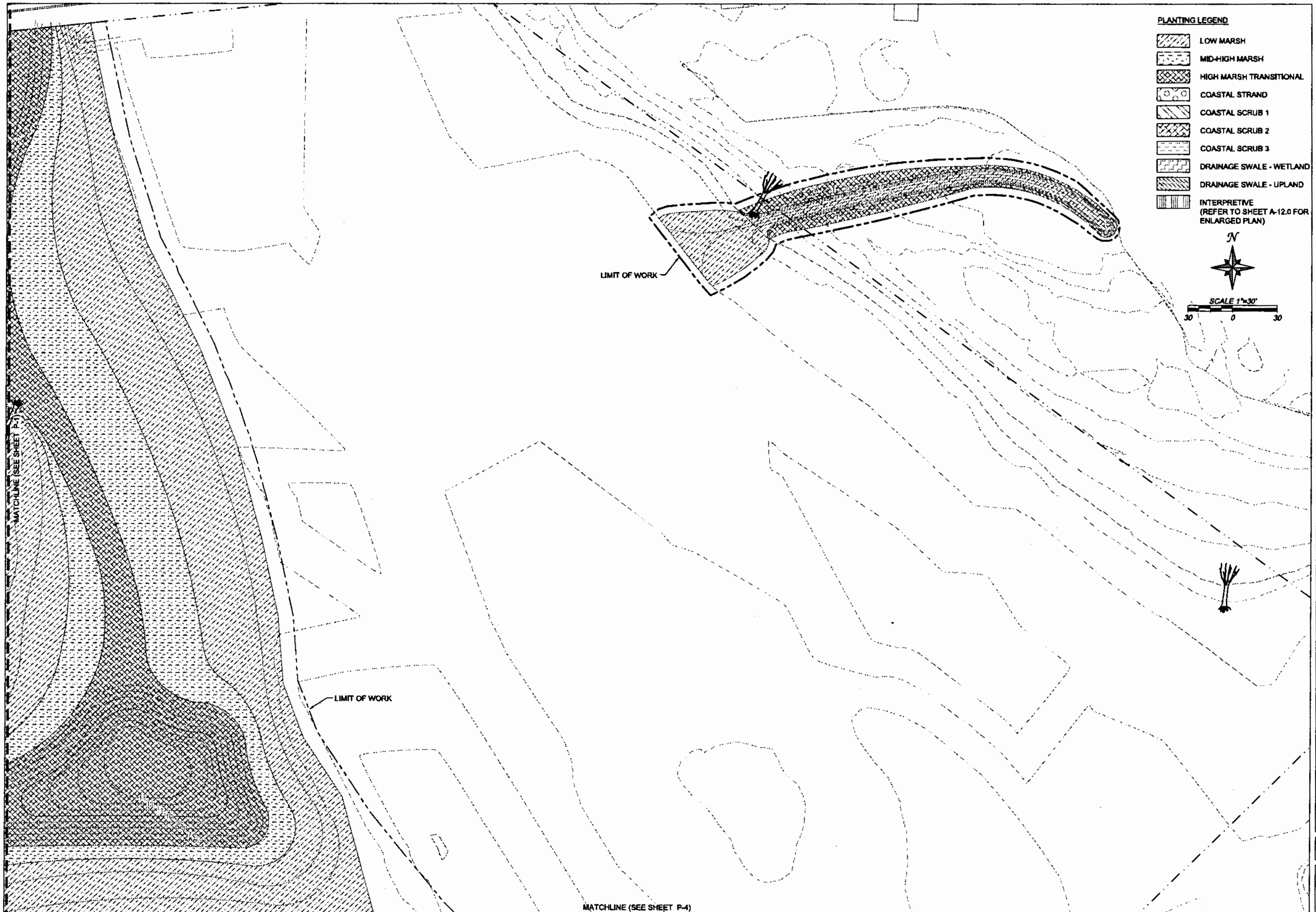
SHEET TITLE:
PLANTING PLAN

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

DRAWING NO.
P-1

SHEET NO.
12
OF
48

EXHIBIT 11
CDP # 4-07-098 (Malibu Lagoon)
Planting Plan Sheet 1



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MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

SHEET TITLE: PIANTING PALN

ADDRESS: MALIBU LAGOON STATE BEACH
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MALIBU, CA 90265

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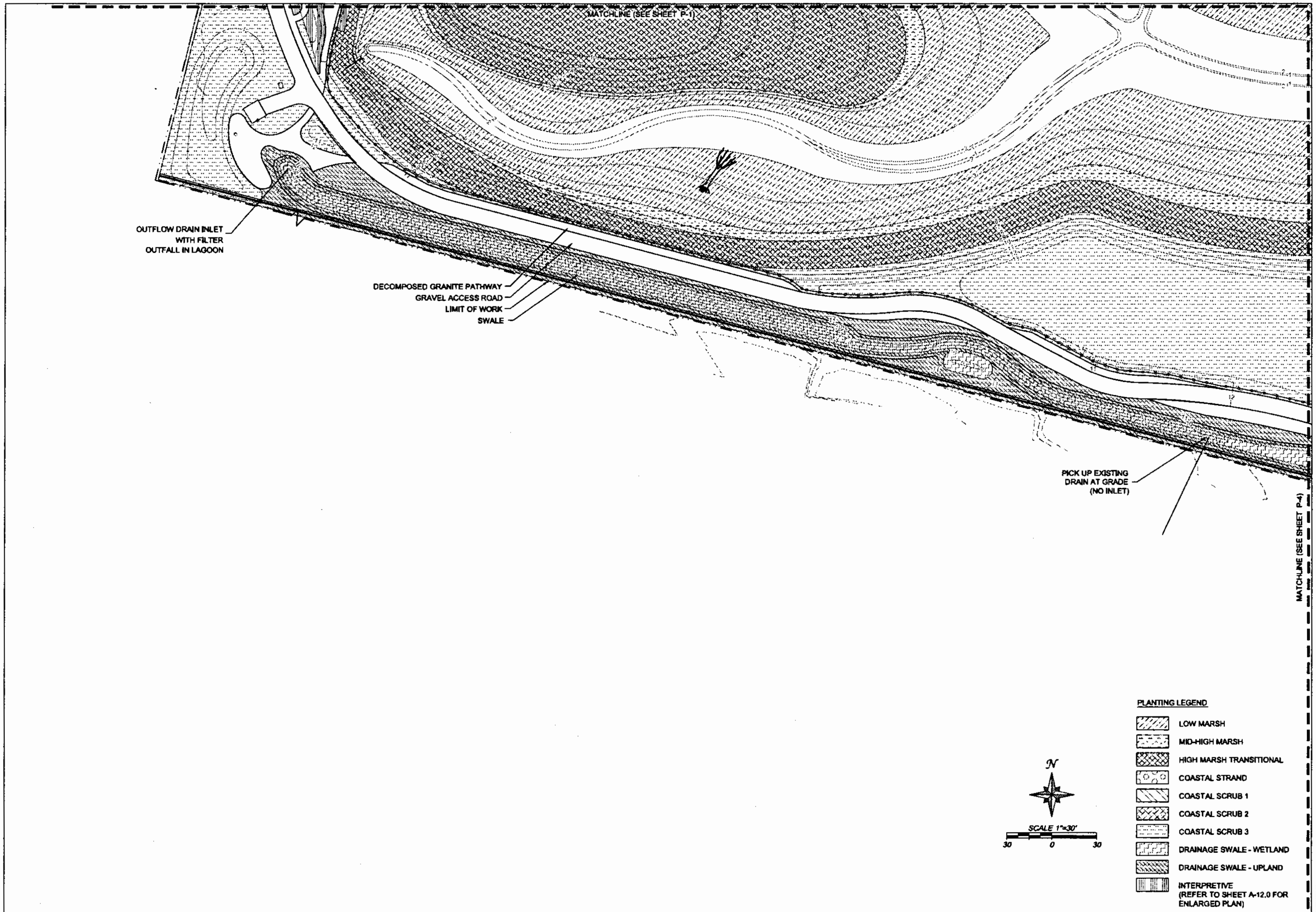
SHEET NO. 13 OF 48

EXHIBIT 12
CDP #4-07-098 (Malibu Lagoon)
Planting Plan Sheet 2



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SHEET TITLE:
PLANTING PLAN

ADDRESS: MALIBU LAGOON STATE BEACH
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P-3

SHEET NO.
14
OF
48

EXHIBIT 13
CDP #4-07-098 (Malibu Lagoon)
Planting Plan Sheet 3

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RESTORATION & ENHANCEMENT- PHASE 2

SHEET TITLE:
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15
OF
48

EXHIBIT 14
CDP # 4-07-098 (Malibu Lagoon)
Planting Plan Sheet 4

RESTORATION PLANTING PROGRAM

SYMBOL	PLANTING ZONE AND TIDAL RANGE	DETAIL	SPECIES NAME: BOTANICAL NAME	SPECIES NAME: COMMON NAME	AVERAGE PLANT SPACING (FEET ON CENTER)	PERCENTAGE OF PLANT PALETTE	CONTAINER PLANT: SIZE	CONTAINER PLANT: QUANTITY
	LOW MARSH MTL-MHW (2.5'-4.5' NAVD)	2/P-6	*JUNCUS ACUTUS*	SPIKE RUSH	3' O.C.	10	TREEBAND	2231
			JUNCUS BALTICUS	BALTIC RUSH	3' O.C.	10	TREEBAND	2231
			JUNCUS MEXICANUS	MEXICAN RUSH	3' O.C.	25	TREEBAND	5577
			SCHOENOPLECTUS (SCIRPUS) ACUTUS	HARDSTEM BULRUSH	3' O.C.	10	TREEBAND	2231
			SCHOENOPLECTUS (SCIRPUS) CALIFORNICUS	TULE	3' O.C.	30	TREEBAND	6692
			SCHOENOPLECTUS (SCIRPUS) MARITIMUS	ALKALAI BULRUSH	3' O.C.	10	TREEBAND	2231
			TYPHA DOMINGENSIS	SOUTHERN CATTAIL	3' O.C.	5	TREEBAND	1115
	MID-HIGH MARSH MHW-MHHW (4.5'-5' NAVD)	2/P-6	*BATIS MARITIMA*	SALTWORT	3' O.C.	10	TREEBAND	714
			CUSCUTA SALINA	MARSH DODDER	3' O.C.	5	TREEBAND	357
			DISTICHLIS SPICATA	SALTGRASS	3' O.C.	15	TREEBAND	1071
			FRANKENIA SALINA	ALKALAI HEATH	3' O.C.	15	TREEBAND	1071
			JAUMEA CARNOSA	MARSH JAUMEA	3' O.C.	10	TREEBAND	714
			SARCOCORNIA PACIFICA (SALICORNIA VIRGINICA)	PERENNIAL PICKLEWEED	3' O.C.	20	TREEBAND	1428
			SALICORNIA BIGELOVII	DWARF GLASSWORT	3' O.C.	10	TREEBAND	714
			SUAEDA ESTEROA	ESTUARY SEA BLITE	3' O.C.	10	TREEBAND	714
			TRIGLOCHIN CONCINNUM	ARROW-GRASS	3' O.C.	5	TREEBAND	357
	HIGH MARSH TRANSITIONAL MHHW (5' -9' NAVD)	2/P-6	*ARTHORCNEMUM (SALICORNIA) SUBTERMINALIS*	PARISH'S GLASSWORT	3' O.C.	5	TREEBAND	866
			CRESSA TRUXILLENSIS	ALKALAI WEED	3' O.C.	5	TREEBAND	866
			DISTICHLIS SPICATA	SALTGRASS	3' O.C.	20	TREEBAND	3465
			EUTHAMIA OCCIDENTALIS	WESTERN GOLDENROD	3' O.C.	5	TREEBAND	866
			FRANKENIA SALINA	ALKALAI HEATH	3' O.C.	10	TREEBAND	1733
			GRINDELIA ROBUSTA	GUM PLANT	3' O.C.	10	TREEBAND	1733
			JAUMEA CARNOSA	MARSH JAUMEA	3' O.C.	10	TREEBAND	1733
			LIMONIUM CALIFORNICUM	WESTERN MARSH ROSEMARY	3' O.C.	5	TREEBAND	866
			MONANTHOSCHLOE LITTORALIS	SHOREGRASS	3' O.C.	10	TREEBAND	1733
			SPERGULARIA MACROTHECA	LARGE FLOWERED SAND SPURRY	3' O.C.	5	TREEBAND	866
			SUAEDA ESTEROA	ESTUARY SEA BLITE	3' O.C.	10	TREEBAND	1733
			SYMPHYOTRICHUM SUBULATUM	MARSH ASTER	3' O.C.	5	TREEBAND	866
	COASTAL STRAND ABOVE CLOSED CONDITION (> 9' NAVD)	1/P-6	*ABRONIA UMBELLATA*	PURPLE SAND VERBENA	3' O.C., PLACE IN CLUSTERS OF 3	10	TREEBAND	153
			CALYSTEGIA MACROSTEGIA	MORNING GLORY	3' O.C., PLACE IN CLUSTERS OF 3	10	TREEBAND	153
			CALYSTEGIA SOLDANELLA	BEACH MORNING GLORY	3' O.C., PLACE IN CLUSTERS OF 3	10	TREEBAND	153
			ERICAMERIA ERICOIDES	MOCK HEATHER	3' O.C.	10	DEEPOT 40	154
			ERIOGONUM FASCICULATUM	CALIFORNIA BUCKWHEAT	3' O.C.	15	DEEPOT 40	232
			ERIOGONUM PARVIFOLIUM	CLIFF BUCKWHEAT	3' O.C.	10	DEEPOT 40	154
			ISOCOMA MENZIESII	COAST GOLDEN BUSH	3' O.C.	10	DEEPOT 40	154
			LUPINUS CHAMISSONIS	DUNE LUPINE	3' O.C.	15	DEEPOT 40	232
			SUAEDA TAXIFOLIA	WOLLY SEA-BLITE	3' O.C.	10	DEEPOT 40	154
	COASTAL SCRUB 1 ABOVE CLOSED CONDITION (> 9' NAVD)	1/P-6	*ABRONIA UMBELLATA*	PURPLE SAND VERBENA	3' O.C., PLACE IN CLUSTERS OF 3	5	TREEBAND	531
			ARTEMISIA CALIFORNICA	CALIFORNIA SAGEBRUSH	8' O.C.	10	DEEPOT 40	149
			ATRIPLEX LENTIFORMIS	QUAIL BUSH	8' O.C.	5	DEEPOT 40	75
			ATRIPLEX TRIANGULARIS	SPEARSCALE	8' O.C.	5	DEEPOT 40	75
			CALYSTEGIA MACROSTEGIA	MORNING GLORY	3' O.C., PLACE IN CLUSTERS OF 3	5	TREEBAND	531
			CALYSTEGIA SOLDANELLA	BEACH MORNING GLORY	3' O.C., PLACE IN CLUSTERS OF 3	5	TREEBAND	531
			COREPOSIS GIGANTEA	GIANT COREOPSIS	8' O.C.	5	DEEPOT 40	75
			ERICAMERIA ERICOIDES	MOCK HEATHER	3' O.C.	5	DEEPOT 40	530
			ERIOGONUM FASCICULATUM	CALIFORNIA BUCKWHEAT	3' O.C.	5	DEEPOT 40	530
			ERIOGONUM PARVIFOLIUM	CLIFF BUCKWHEAT	3' O.C.	5	DEEPOT 40	530
			ISOCOMA MENZIESII	COAST GOLDEN BUSH	3' O.C.	5	DEEPOT 40	530
			ISOMERIS ARBOREA	BLADDERPOD	8' O.C.	10	DEEPOT 40	149
			LUPINUS CHAMISSONIS	DUNE LUPINE	3' O.C.	5	DEEPOT 40	530
			LYCIUM CALIFORNICUM	CALIFORNIA BOX THORN	8' O.C.	5	DEEPOT 40	75
			MALOSMA LAURINA	LAUREL-LEAF SUMAC	8' O.C.	5	DEEPOT 40	75
			RHUS INTEGRIFOLIA	LEMONADEBERRY	8' O.C.	10	DEEPOT 40	149
			SALVIA APIANA	WHITE SAGE	8' O.C.	5	DEEPOT 40	75

RESTORATION PLANTING PROGRAM CONTINUED

SYMBOL	PLANTING ZONE AND TIDAL RANGE	DETAIL	SPECIES NAME: BOTANICAL NAME	SPECIES NAME: COMMON NAME	AVERAGE PLANT SPACING (FEET ON CENTER)	PERCENTAGE OF PLANT PALETTE	CONTAINER PLANT: SIZE	CONTAINER PLANT: QUANTITY
	COASTAL SCRUB 2 ABOVE CLOSED CONDITION (> 9' NAVD)	1/P-6	*ARTEMISIA CALIFORNICA*	CALIFORNIA SAGEBRUSH	8' O.C.	15	DEEPOT 40	24
			ENCELIA CALIFORNICA	CALIFORNIA ENCELIA	8' O.C.	10	DEEPOT 40	16
			ISOMERIS ARBOREA	BLADDERPOD	8' O.C.	10	DEEPOT 40	16
			LYCIUM CALIFORNICUM	CALIFORNIA BOX THORN	8' O.C.	10	DEEPOT 40	16
			MALOSMA LAURINA	LAUREL-LEAF SUMAC	8' O.C.	10	DEEPOT 40	16
			RHUS INTEGRIFOLIA	LEMONADEBERRY	8' O.C.	15	DEEPOT 40	24
			SALVIA APIANA	WHITE SAGE	8' O.C.	10	DEEPOT 40	16
			SALVIA LEUCOPHYLLA	PURPLE SAGE	8' O.C.	10	DEEPOT 40	16
			SALVIA MELLIFERA	BLACK SAGE	8' O.C.	10	DEEPOT 40	16
	COASTAL SCRUB 3 ABOVE CLOSED CONDITION (> 9' NAVD)	1/P-6	*ATRIPLEX LENTIFORMIS*	QUAIL BUSH	8' O.C.	5	DEEPOT 40	64
			ATRIPLEX TRIANGULARIS	SPEARSCALE	8' O.C.	5	DEEPOT 40	64
			CALYSTEGIA MACROSTEGIA	MORNING GLORY	3' O.C., PLACE IN CLUSTERS OF 3	2.5	TREEPOT	228
			CALYSTEGIA SOLDANELLA	BEACH MORNING GLORY	3' O.C., PLACE IN CLUSTERS OF 3	2.5	TREEPOT	228
			CAMMISSONIA BISTORTA	CALIFORNIA SUN CUP	3' O.C., PLACE IN CLUSTERS OF 3	2.5	TREEPOT	228
			CAMMISSONIA CHEIRANTHIFOLIA	DUNE PRIMROSE	3' O.C., PLACE IN CLUSTERS OF 3	2.5	TREEPOT	228
			DISTICHLIS SPICATA	SALTGRASS	3' O.C., PLACE IN CLUSTERS OF 3	5	TREEPOT	459
			ERICAMERIA ERICOIDES	MOCK HEATHER	3' O.C.	5	DEEPOT 40	458
			ERIOGONUM PARVIFOLIUM	CLIFF BUCKWHEAT	3' O.C.	5	DEEPOT 40	458
			FRANKENIA SALINA	ALKALAI HEATH	3' O.C., PLACE IN CLUSTERS OF 3	5	TREEPOT	459
			ISOCOMA MENZIESII	COAST GOLDEN BUSH	3' O.C.	5	DEEPOT 40	458
			ISOMERIS ARBOREA	BLADDERPOD	8' O.C.	10	DEEPOT 40	129
			LIMONIUM CALIFORNICUM	WESTERN MARSH ROSEMARY	3' O.C.	5	TREEBAND	458
			LOTUS SCOPARIUS	DEERWEED	3' O.C., PLACE IN CLUSTERS OF 3	2.5	TREEBAND	228
			LUPINUS CHAMISSONIS	DUNE LUPINE	3' O.C.	2.5	DEEPOT 40	229
			LYCIUM CALIFORNICUM	CALIFORNIA BOX THORN	8' O.C.	5	DEEPOT 40	64
			MALACOTHRIX SAXATILIS	CLIFF ASTER	3' O.C., PLACE IN CLUSTERS OF 3	5	TREEBAND	459
			OENOTHERIA ELATA VAR. HOOKERI	HOOKER'S EVENING PRIMROSE	3' O.C., PLACE IN CLUSTERS OF 3	2.5	TREEBAND	228
			RHUS INTEGRIFOLIA	LEMONADEBERRY	8' O.C.	5	DEEPOT 40	64
			RHUS OVATA	SUGAR BUSH	8' O.C.	5	DEEPOT 40	64
			SAMBUCUS MEXICANUS	ELDERBERRY	10' O.C.	2.5	DEEPOT 40	21
			SILENE LACINIATA	CARDINAL CATCH FLY	3' O.C., PLACE IN CLUSTERS OF 3	2.5	TREEBAND	228
			SPERGULARIA MACROTHECA	LARGE-FLOWERED SAND SPURRY	3' O.C., PLACE IN CLUSTERS OF 3	2.5	TREEBAND	228

NOTES:

1. DO NOT COMPACT AREAS TO BE PLANTED BEYOND 85% RELATIVE DENSITY.
2. TREEBAND CONTAINER VOLUME SHALL BE 20 CUBIC INCHES.
3. DEEPOT 40 CONTAINER VOLUME SHALL BE 40 CUBIC INCHES.

RESTORATION SEED MIX

PLANTING ZONE	SPECIES NAME: BOTANICAL NAME	SPECIES NAME: COMMON NAME	APPLICATION RATE (PLS/ACRE)
ALL COASTAL STRAND AND SCRUB ZONES	*ABRONIA UMBELLATA*	PURPLE SAND VERBENA	1
	CALYSTEGIA SOLDANELLA	BEACH MORNING GLORY	4
	ERIOGONUM FASCICULATUM	CALIFORNIA BUCKWHEAT	4
	HELIANTHUS ANNUUS	CALIFORNIA SUNFLOWER	2
	LEYMUS CONDENSATUS	GIANT WILDRYE	8
	LUPINUS LONGIFOLIUS	BUSH LUPINE	2

NOTE:

1. DO NOT COMPACT AREAS TO BE PLANTED BEYOND 85% RELATIVE DENSITY.

CALIFORNIA STATE PARKS SINCE 1864

ACQUISITION & DEVELOPMENT DIVISION
Southern Service Center
8885 Rio San Diego Dr. # 270
San Diego, CA. 92108

CALIFORNIA STATE FIRE MARSHAL- APPROVED

Approval of this plan does not authorize or approve any omission of deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

Reviewed by Date

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION
CERTIFICATION #

Reviewed by Date

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION, NORTHERN SERVICE CENTER

DESIGNED:	SS
DRAWN:	AA/KT/PW
CHECKED:	SS/KM
DATE: 09/14/10	

REVISIONS

△	DATE

ICF INTERNATIONAL
9775 BUSINESSPARK AVENUE
SUITE 200
SAN DIEGO, CA 92131
858.578.8964

PROJECT: 95% SUBMITTAL - NOT FOR CONSTRUCTION
MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

SHEET TITLE: RESTORATION PLANTING PROGRAM AND SEED MIX

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

DRAWING NO.
P-5

SHEET NO.
16
OF
48

EXHIBIT 15
CDP # 4-07-098 (Malibu Lagoon)
Plant Palette 1

RESTORATION PLANTING PROGRAM CONTINUED

	DRAINAGE SWALE - WETLAND ABOVE CLOSED CONDITION (>9' NAVD)	2/P-7	ANEMOPSIS CALIFORNICA	YERBA MANSA	3' O.C.	3	TREEBAND	24
			CAREX PRAEGRACILIS	FIELD SEDGE	2' O.C.	10	TREEBAND	183
			CRESSA TRUXILLENSIS	ALKALAI WEED	3' O.C.	5	TREEBAND	41
			CYPERUS ERAGROSTIS	TALL FLATSEDGE	3' O.C.	6	TREEBAND	48
			ELEOCHARIS MACROSTACHYA	CREEPING SPIKE RUSH	2' O.C.	7	TREEBAND	128
			HORDEUM DEPRESSUM	ALKALAI BARLEY	3' O.C.	5	TREEBAND	41
			JUNCUS ACUTUS	SPINY RUSH	3' O.C.	5	TREEBAND	41
			JUNCUS BALTICUS	WIRE RUSH	3' O.C.	6	TREEBAND	49
			JUNCUS BUFONIUS VAR. OCCIDENTALIS	TOAD RUSH	3' O.C.	7	TREEBAND	57
			JUNCUS MEXICANUS	MEXICAN RUSH	3' O.C.	20	TREEBAND	163
			JUNCUS PATENS	COMMON RUSH	3' O.C.	20	TREEBAND	163
			JUNCUS TEXTILIS	BASKET RUSH	3' O.C.	6	TREEBAND	48
	DRAINAGE SWALE- UPLAND ABOVE CLOSED CONDITION (>9' NAVD)	1/P-7	ARTEMISIA DOUGLASIANA	MUGWORT	3' O.C.	8	TREEBAND	140
			BACCHARIS DOUGLASII	SALT MARSH BACCHARIS	3' O.C.	7	TREEBAND	122
			BACCHARIS SALICIFOLIA	MULEFAT	3' O.C.	5	DEEPOT 40	87
			DISTICHLIS SPICATA	SALT GRASS	3' O.C., PLACE IN CLUSTERS OF 3	9	TREEBAND	157
			FRANKENIA SALINA	ALKALAI HEATH	3' O.C., PLACE IN CLUSTERS OF 3	8	TREEBAND	140
			ISOCOMA MENZIESII	COAST GOLDEN BRUSH	3' O.C.	7	DEEPOT 40	122
			ISOMERIS ARBOREA	BLADDERPOD	8' O.C.	6	DEEPOT 40	14
			LEYMUS CONDENSATUS	GIANT WILD RYE	3' O.C.	5	TREEBAND	87
			LOTUS SCOPARIUS	DEERWEED	3' O.C., PLACE IN CLUSTERS OF 3	8	TREEBAND	140
			NASELLA LEPIDA	FOOTHILL NEEDLEGRASS	2' O.C., PLACE IN CLUSTERS OF 3	12	TREEBAND	210
			NASELLA PULCHRA	PURPLE NEEDLEGRASS	2' O.C., PLACE IN CLUSTERS OF 3	12	TREEBAND	210
			RHUS INTEGRIFOLIA	LEMONADEBERRY	8' O.C.	6	DEEPOT 40	14
			SAMBUCUS MEXICANA	BLUE ELDERBERRY	12' O.C.	7	DEEPOT 40	8

NOTES:

1. DO NOT COMPACT AREAS TO BE PLANTED BEYOND 85% RELATIVE DENSITY.
2. TREEBAND CONTAINER VOLUME SHALL BE 20 CUBIC INCHES.
3. DEEPOT 40 CONTAINER VOLUME SHALL BE 40 CUBIC INCHES.

ACQUISITION & DEVELOPMENT DIVISION
Southern Service Center
8885 Rio San Diego Dr. # 270
San Diego, CA. 92108

CALIFORNIA STATE FIRE MARSHAL - APPROVED
Approval of this plan does not authorize or approve any omission of deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.
Reviewed by Date

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION
CERTIFICATION #
Reviewed by Date

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION, NORTHERN SERVICE CENTER

DESIGNED: SS
DRAWN: AA/KT/PW
CHECKED: SS/KM
DATE: 09/14/10

REVISIONS
DATE

ICF INTERNATIONAL
9775 BUSINESSPARK AVENUE
SUITE 200
SAN DIEGO, CA 92131
858.578.5964

PROJECT: 95% SUBMITTAL - NOT FOR CONSTRUCTION
MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

SHEET TITLE: RESTORATION PLANTING PROGRAM AND SEED MIX

ADDRESS: MALIBU LAGOON STATE BEACH
23400 PACIFIC COAST HIGHWAY
MALIBU, CA 90265

DRAWING NO. P-6

SHEET NO. 17 OF 48

EXHIBIT 16
CDP # 4-07-098 (Malibu Lagoon)
Plant Palette 2

INTERPRETIVE PLANTING PROGRAM

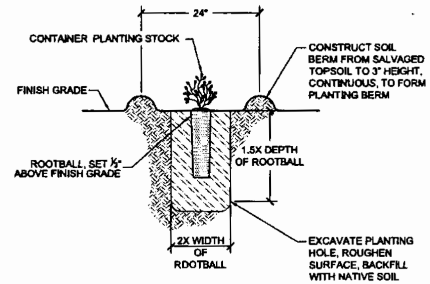
SYMBOL	PLANTING ZONE	DETAIL	SPECIES NAME		AVERAGE PLANT SPACING (FEET ON CENTER)	CONTAINER PLANT	
			BOTANICAL NAME	COMMON NAME		SIZE	QUANTITY
	SUMMER AMPHITHEATER TALL VEG	1/P-7	*ISOMERIS ARBOREA*	BLADDERPOD	4' O.C.	DEEPOT 40	8
			RHUS INTEGRIFOLIA	LEMONADEBERRY	6' O.C.	DEEPOT 40	8
	SUMMER AMPHITHEATER BERM		*ERIOGONUM PARVIFOLIUM*	CLIFF BUCKWHEAT	1.5' O.C.	DEEPOT 40	13
	HIGH MARSH TRANSITIONAL WEST BAND 1	2/P-7	*DISTICHLIS SPICATA*	SALTGRASS	1' O.C.	TREEBAND	130
	HIGH MARSH TRANSITIONAL WEST BAND 2		*JAUMEA CARNOSA*	MARSH JAUMEA	1' O.C.	TREEBAND	205
	HIGH MARSH TRANSITIONAL WEST BAND 3		*FRANKENIA SALINA*	ALKALI HEATH	1' O.C.	TREEBAND	280
	HIGH MARSH TRANSITIONAL EAST BAND 1		*SARCOCORNIA PACIFICA (SALICORNIA VIRGINICA)*	PERENNIAL PICKLEWEED	1' O.C.	TREEBAND	35
	HIGH MARSH TRANSITIONAL EAST BAND 2		*SUAEDA ESTEROA*	ESTUARY SEA BLITE	1' O.C.	TREEBAND	80
	HIGH MARSH TRANSITIONAL EAST BAND 3		*MONANTHOCHLOE LITTORALIS*	SHOREGRASS	1' O.C.	TREEBAND	130
	LOW MARSH TRANSITIONAL MONOCULTURE WEST		*SCHOENOPLECTUS (SCIRPUS) MARITIMUS*	ALKALAI BULRUSH	1.5' O.C.	TREEBAND	18
	LOW MARSH TRANSITIONAL MONOCULTURE EAST		*JUNCUS ACUTUS*	SPIKE RUSH	1.5' O.C.	TREEBAND	20
	MID MARSH TRANSITIONAL MONOCULTURE WEST		*SARCOCORNIA PACIFICA (SALICORNIA VIRGINICA)*	PERENNIAL PICKLEWEED	1' O.C.	TREEBAND	50
	MID MARSH TRANSITIONAL MONOCULTURE EAST		*BATIS MARITIMA*	SALTWORT	1' O.C.	TREEBAND	45
	HIGH MARSH TRANSITIONAL MONOCULTURE		*LIMONIUM CALIFORNICUM*	WESTERN MARSH ROSEMARY	1' O.C.	TREEBAND	12
	UPPER WINTER PLATFORM AMPHITHEATER BERM, BARRIER SHRUBS, AND LOW VEGETATION AREA	1/P-7	*ERIOGONUM PARVIFOLIUM*	CLIFF BUCKWHEAT	1.5' O.C.	DEEPOT 40	910
	WILLOW TOPIARY		*SALIX EXIGUA*	SANDBAR WILLOW	5' O.C.	DEEPOT 40	185
	BIRDER SCREEN	2/P-7	*JUNCUS BALTICUS*	BALTIC RUSH	3' O.C.	TREEBAND	25
	RIPARIAN PICNIC AREA	3/P-7	PLATANUS RACEMOSA	CALIFORNIA SYCAMORE	LAYOUT PER PLAN	15 GAL	3
						24" BOX	3
			QUERCUS AGRIFOLIA	COAST LIVE OAK		15 GAL	5
						24" BOX	1

NOTES:

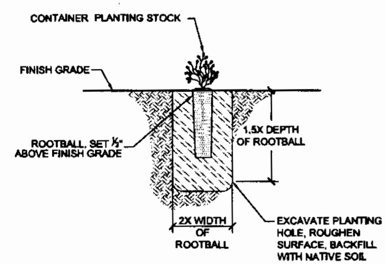
1. REFER TO SHEET A-12.0 FOR PLANTING PLAN
2. DO NOT COMPACT AREAS TO BE PLANTED BEYOND 85% RELATIVE DENSITY.
3. TREEBAND CONTAINER VOLUME SHALL BE 20 CUBIC INCHES.
4. DEEPOT 40 CONTAINER VOLUME SHALL BE 40 CUBIC INCHES.

GENERAL PLANTING NOTES

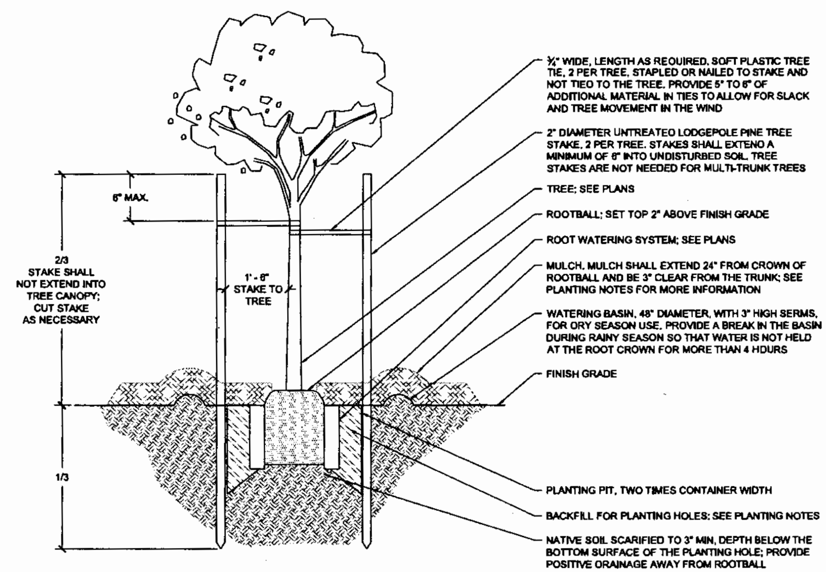
1. SEE TECHNICAL SPECIFICATIONS AND GENERAL NOTES FOR ADDITIONAL INFORMATION TO CONSIDER IN PLANTING INSTALLATION INCLUDING INFRASTRUCTURE AND UTILITIES PROTECTION AND REPAIR INFORMATION.
2. THE CONTRACTOR SHALL INSTALL ALL PLANTS SHOWN DIAGRAMMATICALLY ON THE DRAWINGS.
3. WHERE IRRIGATION SYSTEMS ARE INSTALLED, THEY SHALL BE IN PLACE, FULLY OPERATIONAL, AND APPROVED BY STATE'S REPRESENTATIVE PRIOR TO PLANTING AND SEEDING.
4. PROTECT ALL EXISTING PLANT MATERIAL TO REMAIN, INCLUDING ANY INDICATED TREES. THE CONTRACTOR SHALL REPLACE, AT NO COST TO OWNER, PLANT MATERIAL INDICATED AS EXISTING ON PLANS THAT IS DAMAGED OR ALLOWED TO DIE AS A RESULT OF THE NEGLIGENCE OF THE CONTRACTOR.
5. PLACE PLANTS NO CLOSER THAN 12" TO SPRINKLER HEAD.
6. TREES SHALL NOT BE PLANTED WITHIN 5 FEET OF A WATER MAIN AS MEASURED FROM THE EDGE OF THE TRUNK.
7. THE CONTRACTOR SHALL ENSURE PLANTING PITS HAVE POSITIVE DRAINAGE PRIOR TO PLANTING. PLANTING HOLES SHALL BE FILLED WITH WATER AND ALLOWED TO DRAIN COMPLETELY A MAXIMUM OF 24 HOURS BEFORE PLANTING CONTAINER PLANTS.
8. PLANTING AND SEEDING SHALL ONLY OCCUR WHEN ENVIRONMENTAL CONDITIONS ARE FAVORABLE FOR SUCH ACTIVITIES, BASED ON STANDARD HORTICULTURAL PRACTICES. PLANTING OR SEEDING SHALL NOT TAKE PLACE IF TEMPERATURES ARE UNSEASONABLY HIGH OR IF THE SITE IS EXCESSIVELY WET OR MUDDY.
9. CONTAINER PLANTS SHALL BE PLANTED PER DETAIL(S), AND SHALL BE WATERED IN THOROUGHLY IMMEDIATELY AFTER BEING PLANTED.
10. SEEDING SHALL OCCUR ONLY AFTER THE STATE'S REPRESENTATIVE HAS OBSERVED AND APPROVED THAT THE SITE HAS BEEN PROPERLY PREPARED.



1 / P-7 CONTAINER PLANTING - WITH WATERING BASIN
SCALE: 1"=1'



2 / P-7 CONTAINER PLANTING - NO WATERING BASIN
SCALE: 1"=1'



NOTES:

1. LEAVE THE SMALL BRANCHES ON THE TREE, REMOVE THEM IF THE BRANCH LOCATION IS NOT SUITABLE FOR PERMANENT BRANCHES, 1" OR GREATER IN DIAMETER. DO NOT TOP THE TREE.
2. REMOVE ALL NURSERY STAKES

3 / P-7 15 GALLON AND 24' BOX TREE PLANTING
SCALE: 1"=1'

CALIFORNIA STATE PARKS SINCE 1864

ACQUISITION & DEVELOPMENT DIVISION
Southern Service Center
8885 Rio San Diego Dr. # 270
San Diego, CA. 92108

CALIFORNIA STATE FIRE MARSHAL - APPROVED
Approval of this plan does not authorize or approve any omission of deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.
Reviewed by / Date

DPR ACCESS COMPLIANCE REVIEW ACCESSIBILITY SECTION
CERTIFICATION #
Reviewed by / Date

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHAL SIGNED ORIGINALS ARE ON FILE AT THE DEPARTMENT OF PARKS AND RECREATION NORTHERN SERVICE CENTER

DESIGNED: SS
DRAWN: AAK/KT/PW
CHECKED: SS/KM
DATE: 09/14/10

REVISIONS
DATE

ICF INTERNATIONAL
9775 BUSINESSPARK AVENUE SUITE 200
SAN DIEGO, CA 92131
858.578.8964

PROJECT: 95% SUBMITTAL - NOT FOR CONSTRUCTION
MALIBU LAGOON STATE BEACH
RESTORATION & ENHANCEMENT- PHASE 2

SHEET TITLE: INTERPRETIVE PLANTING PROGRAM, GENERAL PLANTING NOTES & DETAILS

ADDRESS: MALIBU LAGOON STATE BEACH 23400 PACIFIC COAST HIGHWAY MALIBU, CA 90265

DRAWING NO. P-7

SHEET NO. 18 OF 48

EXHIBIT 17

CDP # 4-07-098 (Malibu Lagoon)

Plant Palette 3

MALIBU LAGOON INTERPRETIVE MAP

THE STORY BEGINS HERE

(1) **Shade Canopy**
- A steel shade canopy designed to provide shade cover in the existing semicircular seating and teaching area.

(2) **Watershed Fountain**
- A topographic model of the Malibu Creek Watershed with a visitor-operated water mister mimics the function of the watershed.

PRIMARY INTERPRETIVE AREA

(3) **Summer Clock & Winter Platform**
- A path gradually sloping down to a platform at the water's edge. During the summer months when the lagoon is closed, water rises up along the path as the lagoon slowly fills (summer clock). During the winter months when the lagoon is open, visitors can access the viewing platform (winter platform). Adjacent to the winter platform is a set of circular demonstration terraces that exhibit vegetation species native to low, middle and high marsh communities.

(4) **Bird Blind**
- A sheltered bird blind provides a space for birders and students to view birds in the lagoon without disturbing the birds.

(5) **Picnic Area**
- A riparian forested picnic area provides a natural space for visitors to eat and rest.

(6) **Adamson House Wall**
- A wall reflecting the aesthetic design of the Adamson House wall acts as an interpretive surface to illuminate the rich cultural history of the site.

(8) **Observation Platform**
- A viewing platform offering a view of the lagoon and bird watching opportunities.

3 PATHS:

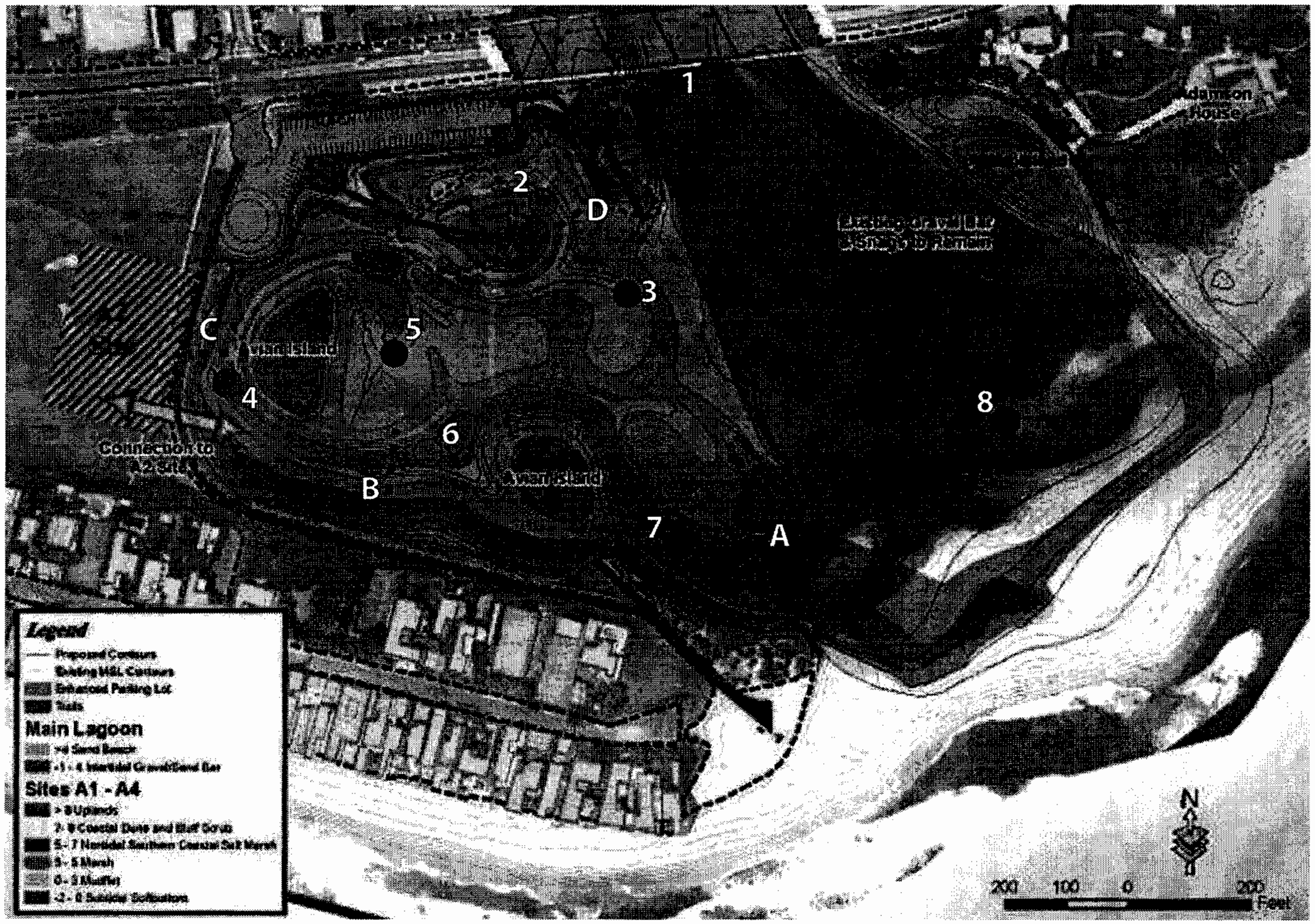
Birder Stalk
Teacher's Path
Surfer PassThru

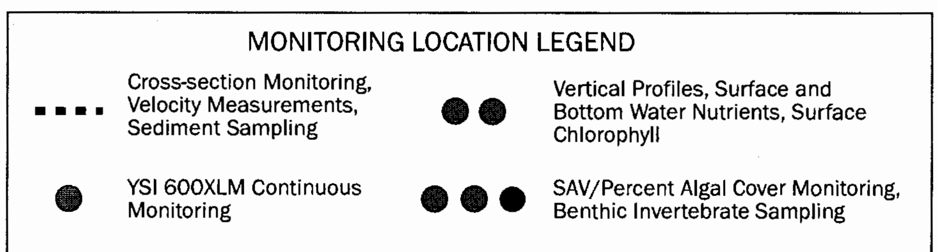
Teacher's Path:

(1) Plankton Station w/ microscope
Fish anatomy w/ the fish wagon
(2) Intro to Watershed
(3) Water Level
(4) Birding w/ binocuars & walk
(7) Watershed View

(7) **Watershed Overlook**
- A viewing platform offering a vista toward the Santa Monica Mountains and the Malibu Creek Watershed.

EXHIBIT 18
CDP #4-07-098 (Malibu Lagoon)
Public Access and Interpretive Plan





Malibu Lagoon Restoration Monitoring Project
RESTORED CONDITONS MONITORING LOCATIONS (adapted from Malibu Lagoon Restoration and Enhance

EXHIBIT 19
CDP # 4-07-098 (Malibu Lagoon)
Sampling Location Map (Approx. Location of Monitoring Sites)

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, *Governor*

CALIFORNIA COASTAL COMMISSION

SOUTH CENTRAL COAST AREA
89 SOUTH CALIFORNIA ST., SUITE 200
VENTURA, CA 93001
(805) 585-1800

MEMORANDUM

FROM: Jonna D. Engel, Ph.D.
Ecologist

TO: Amber Tysor
Coastal Program Analyst

SUBJECT: Malibu Lagoon Restoration and Enhancement Plan, Phase 2

DATE: September 22, 2010

Documents Reviewed:

Moffatt & Nichol in Association with Heal the Bay. March 2005. Malibu Lagoon Restoration Feasibility Study Final Alternatives Analysis. Prepared for Coastal Conservancy and California Department of State Parks and Recreation.

Moffatt & Nichol in Association with Heal the Bay. June 2005. Malibu Lagoon Restoration and Enhancement Plan. Prepared for Coastal Conservancy and California Department of State Parks and Recreation.

Jones & Stokes. March 2006. Malibu Lagoon Restoration and Enhancement Plan Final EIR. Prepared for Coastal Conservancy and California Department of State Parks and Recreation.

Jones & Stokes. July 2007. Jurisdictional Delineation for Malibu Lagoon Restoration and Enhancement Project in the City of Malibu, Los Angeles County, California. Prepared for: Resource Conservation District of the Santa Monica Mountains.

ICF International. January 2010. 95% Submittal – Not for construction. Malibu Lagoon State Beach. Restoration and Enhancement – Phase 2.

California State Parks and the California State Coastal Conservancy have undertaken an ambitious two phase restoration and enhancement project for Malibu Lagoon which is part of Malibu Creek State Beach. Phase 1 of the project was completed in May 2008 and involved moving the lagoon and beach visitor parking lot to the western side of the park and replacing it with a permeable parking area imbedded with a number of features to insure that parking lot runoff and water from outside sources is filtered before entering the lagoon. This design also employed an approach that incorporates the filtration capabilities of native riparian vegetation in a pragmatic and aesthetically

EXHIBIT 20
CDP #4-07-098 (Malibu Lagoon)
Dr. Engel Memorandum (9 pages)

pleasing way. The new parking lot was designed with features to enhance visitor experience and is a splendid success and provides a great model for the design of similar future projects.

California State Parks and the California State Coastal Conservancy have completed research and planning for phase 2 of the Malibu Lagoon restoration and enhancement project and have submitted a coastal development permit application for this phase of the project. As part of the phase 2 project review, Barbara Carey, CCC South Central Coast Manager and I visited Malibu Lagoon on April 22, 2010 for a tour of the existing lagoon and a presentation of the planned restoration by Mark Abramson, Santa Monica Bay Restoration Commission; Kara Kemmler, California State Coastal Conservancy; Suzanne Goode, California State Parks; and several project consultants. In addition to the site visit I have reviewed the documents associated with this project including the "Malibu Lagoon Restoration and Enhancement Plan Final EIR" and the "Malibu Lagoon Restoration and Enhancement Plan"[1].

California has lost a greater percentage of its wetlands (91%) than any other state[2]. In the southern region, which comprises Santa Barbara, Ventura, Los Angeles, Orange and San Diego Counties, tidal wetland loss is estimated at 75 percent[3]. Southern California has a long history of human occupation and the coast is the most heavily populated. The California coastline has been subjected to incredible development pressure and coastal wetlands, especially tidal wetlands, have been lost or greatly altered under this pressure. Wetlands serve as vital components of regional hydrologic systems; they filter and transform pollutants from watershed runoff, help control floods, moderate sediment delivery, promote groundwater recharge, protect shorelines from erosion, provide habitat for resident plant and animal assemblages, provide food chain support for both aquatic and terrestrial ecosystems, and are stopover grounds for migrating waterfowl and shorebirds. Losses of coastal wetlands in southern California, as well as the degraded state of those remaining, have greatly reduced these natural functions in the landscape.

The Malibu Creek Watershed is the second largest watershed terminating in Santa Monica Bay. Malibu Creek flows into the seasonably open shallow 31-acre Malibu Lagoon, which also receives tidal waters through an inlet at Surfrider Beach. The lagoon lies within the footprint of the Pacific Flyway and is an important stop-over location for migrating birds. Once part of a much larger coastal lagoon ecosystem, Malibu Lagoon has been significantly diminished and altered by urban development. The first significant impacts were construction of the Rindge Railroad in 1908 and the

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[1] See citations under "Documents Reviewed".

[2] Dahl, T.E. 1990. Wetlands losses in the United States 1780's to 1980"s. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 21.

[3] Hymanson, Z.P. & H. Kingma–Rymek. 1995. Procedural Guidance for Evaluating Wetland Mitigation Projects in California's Coastal Zone. California Coastal Commission. (http://www.coastal.ca.gov/weteval/wetitle.html)

Roosevelt Highway (now Pacific Coast Highway) in 1929. Construction of the Pacific Coast Highway Bridge in the late-1940's bisected the lagoon and reduced its surface area. Beginning in the 1940's and 1950's, the low-lying areas near the mouth of Malibu Creek were filled for commercial and residential development and by the 1970's they were completely filled and covered by two baseball fields. Urbanization in the Malibu Creek Watershed has increased the volume of water transported into the lagoon, particularly in the dry season, and urban pollution has impaired the water quality through inputs of nutrients, sediments, and chemical pollutants. The City of Malibu is continuing to undertake projects within the watershed to address and improve water quality in Malibu Creek and Lagoon.

Over the last 30 years several restoration efforts have been undertaken on the site. In 1983, California State Parks excavated three distinct channels (identified as A, B, and C) in the western portion of the lagoon, re-vegetated the channels and adjacent areas, and built boardwalks for public access. In 1996, the California Department of Transportation funded a restoration plan to mitigate for impacts incurred during the Malibu Lagoon Pacific Coast Highway Bridge Replacement Project. This restoration project was conducted by California State Parks and the Resource Conservation District of the Santa Monica Mountains and included tidewater goby habitat enhancement, riparian habitat restoration, and extensive removal of non-native species.

While these restoration efforts have improved ecological and recreation values somewhat, the natural system is still significantly physically and biologically degraded due to past human activities. Physical degradation includes a dysfunctional channel configuration (three dead-end channels perpendicular to the larger lagoon water body) which has resulted in poor circulation, anoxic sediments, and impaired water quality. Biological degradation includes fragmented plant communities highly invaded by non-natives and low biodiversity.

Currently the bed elevations of the western channels are perched above mean sea level and hence can only be inundated about 50% of the time. Their perpendicular orientation to tidal currents in the main lagoon, shallow depths, narrow channel widths, and pinch points associated with bridges and boardwalks, all restrict tidal circulation and promote deposition of fine sediments in the channel bottoms. Sediment samples obtained in the western channels consist primarily of very fine particles and high organic content reflecting poor circulation and limited to no tidal flushing[4,5]. Releases of stored nutrients from fine sediments trigger growth of primary producers during dry weather periods creating hypoxic surface water conditions[6]. Water that is high in nutrients and

[4] Sutula, M., K. Kamer & J. Cable. 2004. Sediments as a non-point source of nutrients to Malibu Lagoon California (USA). Southern California Coastal Water Research Project Technical Report 441.

[5] Manion, B.S. & J.H. Dillingham. 1989. Malibu Lagoon. A Baseline Ecology Survey. Performed for Los Angeles County Department of Beaches and Harbors and California Department of Parks and Recreation. Grant # 4-400-7171.

[6] Sutula et al. (2004) op. cit.

low in salinity stagnates at the ends of the three dead-end channels where sediments are deposited and anoxic "dead zones" develop and persist. Several researchers have suggested that these conditions contribute to the low infaunal and epifaunal invertebrate diversity found in Malibu Lagoon[7,8]. Partly because their orientation is perpendicular to the tidal currents in the main lagoon, the western channels are not fully inundated during a normal tidal cycle.

A baseline ecological study performed by Manion & Dillingham (1989) for Los Angeles County Department of Beaches and Harbors and California State Parks surveyed a number of biological parameters including plant species richness and plant community structure, invertebrate infauna and eipifauna species richness, and fishes and bird species richness[9]. Results from plant surveys reveal significantly impaired plant communities with a paucity of native estuarine species and large numbers of non-native species. In addition, there are many native species, including Channel Island endemics, that are out of place in the Malibu Lagoon ecosystem but were inappropriately prescribed in the 1983 California State Parks restoration plans. The botanical inventory found 133 species of vascular plants in Malibu Lagoon. Of these 5.3% were native to estuarine habitats, 29.7% were native non-estuarine species planted as part of a landscaping effort, and an astounding 65% were non-native and invasive introduced species.

Manion & Dillingham (1989) state that "the majority of species found are naturalized exotics and other native plants normally not found in estuaries. Malibu Lagoon has a very small number of estuarine species in comparison with those found in other Southern California salt marshes." Regarding the abundance of naturalized exotics and non-estuarine natives, Manion & Dillingham (1989) state "this opportunistic growth has produced an ecosystem with little resemblance to less disturbed, zonated Southern California coastal wetlands." Figure 3.7 from the study compares native estuarine species richness across eight southern California coastal wetlands[10]. Malibu Lagoon had the lowest species richness with only 7 native species present. Ballona Lagoon was close with only 8 native species. Point Mugu Lagoon and Tijuana Estuary had the highest richness with all 18 characteristic species present. Manion & Dillingham (1989) also state that "Distribution of vegetation follows some unusual patterns as a result of high levels of disturbance. Starting at the higher elevations, species common to more upland habitats (roadsides, coastal scrub, cultivated areas, disturbed coastal habitats) dominate. Shrubs such as *Atriplex* (sp.) and *Baccharis glutinosa* are common. These

[7] Manion & Dillingham (1989) op. cit.
[8] Ambrose, R.F., I.H. Suffet & S.S. Que Hee. 1995. Enhanced environmental monitoring program at Malibu Lagoon and Malibu Creek. Report to: Las Virgenes Municipal Water District, Calabasas, CA. 113 pp.
[9] Manion & Dillingham (1989) op. cit.
[10] From a total of 18 marsh species that are characteristic of healthy, functioning Southern California marsh habitats.

plants are associated with exotic grasses and dry soils. The dominant vegetation for these areas consists of the grasses."

Manion & Dillingham (1989) also found low benthic infaunal and epifaunal invertebrate richness and diversity in Malibu Lagoon[11]: "Repeated sampling at 5 locations in Malibu Lagoon revealed an infauna limited to two species of invertebrates; a spionid polychaete, *Polydora nuchalis* and a tellinid clam, *Tagelus califonianus*." The study noted that *Polydora nuchalis* was common while the jack-knife clam was less common and more patchy. Both species prefer muddy organic sediments and disappear from more sandy areas. The infaunal surveys occurred five years after the 1983 restoration and Manion & Dillingham (1989) state that "the more usual development of a more diverse benthic infauna has yet to occur." Epifaunal invertebrate species richness was also very low and Manion & Dillingham (1989) state "It is important to continue studies of the mud crab, for it appears to be thriving in the Lagoon, where only a few other species of invertebrates have colonized five years after restoration."

In 1995, Ambrose, Suffet, and Que Hee, conducted an extensive survey at Malibu Lagoon which found that *Polydora nuchalis* represented 72% of the total numbers of individuals of the 17 species of benthic invertebrates collected and was also the most frequently collected infaunal organism at every sampling location[12]. They found that two large motile species, the mud-flat crab, *Hemigrapsus oregonenesis* and the introduced oriental shrimp, *Palaemon macrodactulus*, were common. While Ambrose et al. (1995) identified 17 benthic species, they noted that a number of taxa were severely underrepresented including bivalves (one species) and polychaete worms (two families). They concluded that "The observations of macrobenthic organisms in this study suggest that Malibu Lagoon ranks poorly at this trophic level when compared to less disturbed southern California estuaries." Ambrose and Orme (2000) identified *Polydora nuchalis* as a negative indicator species for Malibu Lagoon because it is an opportunistic species known to rapidly colonize and dominate benthic communities during or following disturbances such as nutrient additions and subsequent eutrophication, oil spills, and discharge of sewage or industrial waters.

Like Manion & Dillingham (1989), Ambrose et al. (1995) identified thirteen species of fish in Malibu Lagoon, including the federally endangered tidewater goby, *Eucyclogobius newberryi*. Consistent with Manion & Dillingham's work they also found that three species (California killifish, *Fundulus parvipinnis*; topsmelt, *Atherinops affinis;* mosquitofish, *Gambusia affinis*) made up two-thirds of the total catch. Ambrose et al. (1995) caught and released a total of 118 tidewater gobies during their surveys and while this represented only 1.4% of the total fish catch, the tidewater goby was the fourth most frequently collected fish species. Ambrose et al. (1995) state that "With 13 species of fish, Malibu Lagoon falls on the low end of fish species richness in southern

[11] Manion & Dillingham (1989) op. cit.
[12] Ambrose et al. (1995) op. cit.

California coastal wetlands. Malibu Lagoon's species richness is low relative to some other southern California wetland systems, particularly large estuaries with uninterrupted tidal flushing, but is comparable to other southern California estuaries with similar hydrology"[13]. During a one day fish survey in 2005 a total of eight species of fish were captured in Malibu Lagoon[14]. Tidewater goby and smelt (*Atherinops sp.*) were the most numerous with a total of 473 and 244 caught respectively. A review of fish studies at Malibu Lagoon show that at total of 33 fish species have been identified at Malibu Lagoon at one time or another over a span approximately 20 years[15].

A number of studies have examined the status of bird species at Malibu Lagoon. Manion & Dillingham (1989) observed the most bird species in the lagoon between October and March and the fewest bird species between May and August. They attributed this pattern to migration times along the Pacific Flyway. Ambrose et al. (1995) surveyed birds over a 10 month period from July 1993 to April 1994. They reported that "During this time period, 107 bird species were observed (68 species of waterbirds and 39 species of landbirds). A grand total of 27,700 individuals were recorded during the censusing period." Ambrose et al. (1995) found that aquatic species were typically more abundant than terrestrial species but that for both groups the species composition changed throughout the year; abundance and species composition was highly variable. Ambrose et al. (1995) partly attribute the high numbers and diversity of birds to the diversity of habitat types at Malibu Lagoon. They also attribute bird abundance and diversity to the fact that "Malibu Lagoon represents one of only a few remaining coastal wetlands in southern California and one of only two remaining estuaries in all of Los Angeles County." Ambrose et al. (1995) conclude that although Malibu Lagoon has been disturbed by humans it still attracts a disproportionate number of bird species for its size and that it is likely of great importance to migrating shorebirds and waterfowl because of its location along the Pacific Flyway.

Cooper conducted breeding and quarterly bird surveys in Malibu Lagoon during 2005 and 2006[16,17]. In 2005 he recorded a total of 54 species, 16 of which he believed had bred or attempted to do so. Combining all surveys over two years, Cooper reports that he detected 127 species "with roughly 75 species seen on the January, April, and October surveys, and 48 on the July surveys." Cooper found that only a small number of species (26) were recorded on every survey period and that his observations

---

[13] Same conclusion made in: Ambrose, R.F. & D.J. Meffert. 1999. Fish-assemblage dynamics in Malibu Lagoon, a small, hydrologically altered estuary in southern California. Wetlands. 19 (2): 327-340.

[14] Dagit, R. (RCDSMM) & C. Swift (Entrix, Inc.). July 2005. Malibu Lagoon Fish Survey. Prepared for California State Coastal Conservancy.

[15] Ibid.

[16] Cooper, D (Cooper Ecological Monitoring). 2005. 2005 Breeding Bird Survey, Malibu Lagoon State Park, Malibu California. Prepared for Resource Conservation District of the Santa Monica Mountains.

[17] Cooper, D (Cooper Ecological Monitoring). 2006. Birds of Malibu Lagoon: Final Report. Malibu Lagoon State Park, Malibu California. Prepared for Resource Conservation District of the Santa Monica Mountains.

illustrate the dynamic nature of migration in the area. Cooper reports that the lagoon acts as a concentration area for certain bird species that occur in high numbers and that for other species that may not occur in high numbers, the lagoon is the only habitat in the area. Cooper observed a wide diversity of birds including terrestrial, shore, and waterfowl species. Malibu Lagoon clearly represents extremely important habitat for a wide array of bird species. Ambrose et al. (1995) state that "With respect to plants, invertebrates and fish, Malibu probably ranks in the middle or lower end of the range of wetland quality in southern California. It ranks much higher for birds, being an important stopover on the Pacific Flyway as well as supporting a diversity of species year-round."

There are numerous environmental problems associated with the current lagoon configuration and past development and restoration activities including:

- Loss of ecosystem function due to poor circulation, sedimentation, and eutrophication,
- Loss of upland, salt-marsh, and lagoon habitat due to historic fill, urbanization of the surrounding areas, and inappropriate landscaping,
- Proliferation of non-native and invasive plants and animals; elevated freshwater and nutrients have facilitated invasion of exotics
- Impoverished native benthic invertebrate communities likely due to altered hydrology, and,
- Reduced native fish populations.

Opportunities for tidal wetland restoration are extremely limited in southern California and the overall goal of the phase 2 Malibu Lagoon restoration is to enhance and expand the lagoon's tidal wetlands and associated habitats; to restore Malibu Lagoon to a healthy and functional seasonally closed tidal lagoon ecosystem. Specific restoration goals include:

- Increase tidal circulation and flushing to improve water quality under open and closed lagoon conditions.
- Restore a diverse mosaic of coastal salt-marsh and transitional upland habitats.
- Increase and enhance aquatic habitat for benthic invertebrates and native fish including the federally endangered tidewater goby (increase sediment grain size) and the federally threatened steelhead (higher water quality within the lagoon).
- Increase native foraging, nesting, and roosting habitat for resident and migratory shore birds and waterfowl.
- Provide education/interpretive opportunities while minimizing disturbance to habitat and wildlife.

Phase 2 will change the lagoon configuration, improve slopes and drainages, restore and enhance native coastal salt-marsh plant communities, remove non-native vegetation, and enhance the visitor and recreational experience. This phase of the project will involve temporary dike installation, temporary dewatering, and reconfiguration and re-contouring activities using earthmoving equipment. In order to accomplish the desired ecosystem restoration it is necessary to dredge and remove a significant amount of fill and sediment. The majority of the grading activities will occur in the western portion of the lagoon complex. The main channel of Malibu Creek will remain the same except that the lagoon-channel interface will be reconfigured to form a more natural slope.

Considerable time and effort has been directed at determining the best design for restoring lagoon circulation, water quality, and habitats in order to realize the restoration goals. Based on the results of the "Malibu Lagoon Restoration Feasibility Study Final Alternatives Analysis"[18], the Lagoon Technical Advisory Committee[19], State Parks, and the State Coastal Conservancy have recommended implementation of Alternative 1.5, the Modified Restore and Enhance Alternative, as identified in the Malibu Lagoon Restoration and Enhancement Plan Environmental Impact Report. After reviewing the documents listed above, including the "Malibu Lagoon Restoration Feasibility Study Final Alternatives Analysis", I concur with the recommendation to implement the proposed project.

The proposed design for the western portion of the lagoon consists of a single main channel with a system of dendritic (sinuous) side channels. The single channel is designed with the opening close to the beach and angled to enhance water circulation and to promote maximum tidal circulation during open conditions and maximize wind driven circulation during closed conditions. The lagoon tidal prism will be increased with the proposed project design and elevation at the channel entrance is the deepest area and the back channels are the shallowest so that water will be encouraged to run out as the tide drops and fill in as the tide rises. An existing boathouse channel located on the grounds of the Adamson House will be deepened and re-contoured with hand tools to restore functional hydrology and native wetland vegetation.

The project includes plans for restoring the lagoon plant communities to a healthier, high-functioning native coastal salt-marsh ecosystem with low-marsh, mid-marsh, high-marsh, and transitional coastal scrub habitats with appropriate native plant species in the respective habitats[20]. The areal extent of tidal wetland and tidal wetland (salt-marsh) plant communities will be increased and the areal extent of coastal scrub habitat will be reduced. Although the disturbed coastal scrub habitat around Malibu

[18] Moffatt & Nichol in Association with Heal the Bay. March 2005. Malibu Lagoon Restoration Feasibility Study Final Alternatives Analysis. Prepared for Coastal Conservancy and California Department of State Parks and Recreation.

[19] The Lagoon Technical Advisory Committee consists of the following individuals: Richard F. Ambrose, UCLA; Andy Brooks, UCSB; John Callaway, University of San Francisco; Kimball Garrett, Los Angeles County Natural History Museum; Robert Gearheart, Humboldt State University; Martha Sutula, Southern California Coastal Water Research Project

[20] ICF International. January 2010. 95% Submittal – Not for construction. Malibu Lagoon State Beach. Restoration and Enhancement – Phase 2.

Lagoon provides important resource values, it is even more important to restore and increase tidal wetland resources because of their rarity in southern California. Special care must be taken when planting the transitional coastal scrub habitat; the plant palette should emphasize small stature herbaceous species interspersed with a small number of larger shrubs such as lemonade berry and laurel sumac. To eliminate any fire concerns these larger shrubs must not be planted along the south side of the lagoon bordering the Malibu Colony neighborhood. The final planting plan and plant palette must be reviewed and approved by the California Coastal Commission Executive Director.

Tidal wetlands have been so diminished is southern California that we need to take every opportunity to maximize their extent and function. Malibu Lagoon is the second largest wetland in the Santa Monica Bay Watershed and the Southern California Wetlands Recovery Project (SCWRP) has identified Malibu Lagoon as an impaired coastal lagoon ecosystem that requires restoration. The SCWRP Board of Governors vetted and approved phase 2 of the Malibu Lagoon restoration and enhancement project and listed it on the SCWRP work plan[21]. The California State Park and California State Coastal Conservancy Phase 2 Malibu Lagoon Restoration and Enhancement Plan has been thoroughly researched and designed, and while implementation of the plan will result in significant short term impacts, I believe that restoration and enhancement of Malibu Lagoon will ultimately result in substantially greater long term improvements to the natural functioning and biodiversity of this seasonally closed tidal lagoon ecosystem.

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[21] Southern California Wetlands Recovery Project Work Plan Project Descriptions. SCWRP website: http://www.scwrp.org/pdfs/2010-Work-Plan-Project-Descriptions-Final-Web-Version-June-2010.pdf.

City of Malibu

23815 Stuart Ranch Road · Malibu, California · 90265-4861
Phone (310) 456-2489 · Fax (310) 456-3356 · www.ci.malibu.ca.us

October 25, 2007

Ms. Barbara J. Carey
California Coastal Commission
89 South California Street, Suite 200
Ventura CA 93001

Re: California Coastal Commission CDP No. 4-07-098 – Application by California Department of Parks and Recreation for Phase 2 of Malibu Lagoon Restoration, filed August 10, 2007

Dear Ms. Carey:

It appears that the above-referenced project includes development which would require coastal development permits from both the City of Malibu and the Coastal Commission. The City is in agreement that the project is appropriate for a consolidated coastal development permit review to be conducted by the Coastal Commission, pursuant to Section 30601.3(a) of the Coastal Act, and hereby consents to the consolidated permit action.

Please let me know if there are questions or additional information is needed.

Sincerely,

Stacey Rice, PhD, AICP
Acting Planning Manager

RECEIVED
OCT 29 2007
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

P:\Projects\Pacific Coast Highway\23400 PCH\Consolidated Ph 2 CDP Letter.doc

RESOURCE CONSERVATION DISTRICT
OF THE
SANTA MONICA MOUNTAINS

P.O BOX 638 AGOURA HILLS, CALIFORNIA 91376-0638
(818) 597-8627 FAX (818) 597-8630

DANIEL C. PREECE
District Manager

Deanna Christensen
California Coastal Commission
South Central Coast Area
89 S. California Street, Ste. 200
Ventura, CA 93001-2801

RE: Consolidation of Coastal Development Permit Review File No. 4-07-098 Malibu Lagoon Restoration

The Malibu Lagoon restoration project File No. 4-07-098 includes a small area of the project site that is under the jurisdiction of the City of Malibu while the majority of the project site falls within the jurisdiction of the California Coastal Commission. The proposed Malibu Lagoon Restoration Project includes restoration activities that would require a Coastal Development Permit (CDP) from the City of Malibu and the California Coastal Commission. The project team believes that a thorough review of the entire project site will best protect the sensitive resources and make for the best possible restoration project. The Project Team agrees that consolidating the review into a single CDP to be processed by the California Coastal Commission would be the best course of action.

Sincerely,

Mark Abramson
Malibu Lagoon Project Manager

EXHIBIT 22
CDP # 4-07-098 (Malibu Lagoon)
Applicant Consolidation Agreement

FORM FOR DISCLOSURE OF
EX-PARTE COMMUNICATIONS

Name or description of the project::	Malibu Lagoon Restoration
Time/Date of communication:	6/30/2010, 1 pm
Location of communication:	22350 Carbon Mesa Rd, Malibu
Person(s) initiating communication:	Shelly Luce, Mark Abramson
Person(s) receiving communication:	Sara Wan
Type of communication:	meeting

Expect this to be on in August.
Phase I- parking lot is in
Phase II- water quality is main issue. - history back to the '83 initial restoration when they moved the ball fields- resulted in some problems- one of the goals is to increase tidal flushing
EIR was certified in '96- Colony homeowners concerns about the design- they don't want people behind their homes
There will be a path, 2 bird decks, observation decks, picnic tables and a bird blind
will have a masonry wall at read end- 6 ft. Now the homeowners have access through their gates out onto State Park Property- they use this area as their own- throw their trash there, let their dogs out and have planted this as their own gardens- now claim need gates in wall for fire- but should not allow- they have adequate access for escape- main road goes in front of their homes and easy distance to the beach. Fire is always possible but not likely to jump PCH.
There are also 2 pipes form the Colony to the lagoon- there are no permits for them- one of which was recently installed. They claim that State Parks gave them permission but the only permission was in 1997 from a flap gate and nothing from the Coastal Commission.

Date: 7/3/2010

Sara J Wan

Commissioner's Signature

EXHIBIT 23
CDP # 4-07-098 (Malibu Lagoon)
Ex-Parte Comminication Disclosures
(10 pages)

FORM FOR DISCLOSURE OF EX PARTE COMMUNICATIONS

Name or description of project, LPC, etc.: Malibu Lagoon Restoration

Date and time of receipt of communication: July 22, 2010 3:00pm

Location of communication: ~~[illegible]~~ Clements, Calif

Type of communication (letter, facsimile, etc.): Conference call with GoToMeeting

Person(s) initiating communication: Mark Abramson & Shelley Luce

Detailed substantive description of content of communication:
(Attach a copy of the complete text of any written material received.)

see attached

RECEIVED
AUG 03 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

July 28, 2010
Date

Mary K. Shallenberger
Signature of Commissioner

If the communication was provided at the same time to staff as it was provided to a Commissioner, the communication is not ex parte and this form does not need to be filled out.

If communication occurred seven or more days in advance of the Commission hearing on the item that was the subject of the communication, complete this form and transmit it to the Executive Director within seven days of the communication. If it is reasonable to believe that the completed form will not arrive by U.S. mail at the Commission's main office prior to the commencement of the meeting, other means of delivery should be used, such as facsimile, overnight mail, or personal delivery by the Commissioner to the Executive Director at the meeting prior to the time that the hearing on the matter commences.

If communication occurred within seven days of the hearing, complete this form, provide the information orally on the record of the proceeding and provide the Executive Director with a copy of any written material that was part of the communication.

This conference call was set up through "Go To Meeting" which enabled the three of us to be looking at the images on Mark's computer. (It was very cool). The images were aerial pictures of the site, graphics of the proposed restoration plan and of the gates from the adjacent land owners on to the project site. Mark said all of these pictures would be in their presentation at the commission hearing and that he would forward all of them to Amber, Coastal Commission staff.

Mark and Shelley gave me a brief summary of the history of the Lagoon and explained why the previous restoration (1983) with three separate channels and "pinch points" at each of the boardwalk bridges had resulted in the lagoon not having enough flushing, scouring and mixing to result in real restoration. They explained a great deal has been learned about lagoon restoration since 1983. They showed graphics of the proposed restoration plan and explained why it will result in a biologically healthier lagoon.

They then focused on three issues of controversy with the neighboring home owners.

1) They showed me pictures of several rather shabby gates that connect the public land with the home owners' back yards. The project proposal is to have a solid wall along the property line, similar to the wall that runs between the home owners' back yards and the Perenchio golf course (which will eventually be part of the lagoon). They told me the home owners want to retain these gates as a route of escape in the case of fire.
2) Currently, there are drainage pipes taking run off from the private properties into the Lagoon. They said they are working out a way to connect these pipes to a single pipe that will run along the road and filter the water before it is dumped into the Lagoon. They thought this issue would be resolved to the home owners' satisfaction before the hearing.
3) The home owners are objecting to a solid wall between the private property and the lagoon because they are worried about fire danger from the vegetation along the lagoon property. Mark asserted that the fire danger would be greatly reduced from today because there would be less vegetation than there is today and it would be native and less prone to fire. The aerial pictures showed extensive large trees and vegetation on the home owner's side of the property line.

In response to my question about what other objections to the project did they anticipate we would hear at the public hearing, they said they thought the Wetlands Action would testify that they were opposed to anything being done to alter the lagoon configuration.

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AUG 03 2010
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COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

From: Sara Wan [mailto:lwan22350@aol.com]
Sent: Thursday, August 05, 2010 1:06 PM
To: Vanessa Miller
Subject: FW: Agenda

Ex-parte

From: Sara Wan [mailto:lwan22350@aol.com]
Sent: Thursday, August 05, 2010 1:05 PM
To: 'Mark Abramson'
Subject: RE: Agenda

Thanks for the answers to my questions.

1- Can we insert Herons in 1C and elsewhere?
2- Does the noise level exceed 65db at the locations of concern from PCH? What is the ambient noise level?

Sara

From: Mark Abramson [mailto:mabramson@santamonicabay.org]
Sent: Thursday, August 05, 2010 12:06 PM
To: Shelley Luce
Cc: lwan22350@aol.com
Subject: RE: Agenda

From: Sara Wan [mailto:lwan22350@aol.com]
Sent: Thursday, August 05, 2010 11:51 AM
To: 'John Ainsworth'
Cc: Shelley Luce
Subject: Agenda

Item Th 19a, Malibu Lagoon
I have some specific concerns
Conditions:
1C- Only applies to listed species or species of special concern or raptors. This does not include herons and it should since they are most likely to be found here. Should add "or any species of raptor *or heron* is found"
1D- 85db is too high. In most instances, except one, we have limited it to 65db. The only reason we wound up with 85db in MDR is that I wasn't at the hearing and Mary asked for a limit but didn't know what was an acceptable level. The fact that there is not "well founded scientific justification" is because there haven't been a lot of studies. We should be taking the precautionary approach and not go above the 60 db level, certainly not above 65db. FYI the Dooling and Popper study is dealing with hearing damage and masking. Our concern here should be for flushing and behavioral effects and that is at lower levels then masking. Hey Sara we had requested that they change the language for 65 db to 65 db or 5db above existing ambient background (5 db being a detectable change in amplification) I would

suggest that the 85 never be exceeded as an upper threshold. Are only concern was near PCH or along the Colony ambient noise could exceed that threshold.

Additionally, the work is being limited to June-October, I presume to do it at lowest water levels, but this results in impacts to Least Terns. The statement that they will find other foraging areas ignores the fact that there aren't many others in the area. That's why Terns from elsewhere come here to forage even though they don't nest here. I have concerns about the timing and would hope that work could be done in none Tern season using berms to deal with the water. No work is occurring on the main lagoon or the barrier beach berm which are the area that the terns use. We are using these dates because they are the most protective of all the species we could not totally eliminate potential impacts to tern without impacting other species essentially something would be affected year round and we can't construct in the winter. This time frame was the most protective we could come up with.

Sara

FORM FOR DISCLOSURE OF EX PARTE COMMUNICATIONS

Name or description of project, LPC, etc.: Malibu Lagoon

Date and time of receipt of communication: 9/17/10 @ 7:58am

Location of communication: LaJolla, Ca.

Type of communication (letter, facsimile, etc.): email

Person(s) initiating communication: Robert Pousman

Detailed substantive description of content of communication:
(Attach a copy of the complete text of any written material received.)

"See attached email!"

9/20/10
Date

Signature of Commissioner

If the communication was provided at the same time to staff as it was provided to a Commissioner, the communication is not ex parte and this form does not need to be filled out.

If communication occurred seven or more days in advance of the Commission hearing on the item that was the subject of the communication, complete this form and transmit it to the Executive Director within seven days of the communication. If it is reasonable to believe that the completed form will not arrive by U.S. mail at the Commission's main office prior to the commencement of the meeting, other means of delivery should be used, such as facsimile, overnight mail, or personal delivery by the Commissioner to the Executive Director at the meeting prior to the time that the hearing on the matter commences.

If communication occurred within seven days of the hearing, complete this form, provide the information orally on the record of the proceeding and provide the Executive Director with a copy of any written material that was part of the communication.

Pat Kruer

From:	Robert Pousman [frostitude@yahoo.com]
Sent:	Friday, September 17, 2010 7:58 AM
To:	richard@bloomlaw.net; esanchezccc@aol.com; Pat Kruer; mark.stone@co.santa-cruz.ca.us
Subject:	Save Malibu Lagoon

This writing is to state my opposition to the planned re-engineering of the Malibu Lagoon.

Personally after reading the phases planned for this project I don't see how it can be anything but destructive.

I would hope you would reconsider allowing this to be funded and move forward. To use bull dozers in such an environmentally sensitive area is so short sighted as well.
I also understand that state funds would pay for this. That is a misappropriation of resources and community efforts as well as other volunteer work should be used if any work is to go forward.

Without taking more of you time I would hope that you would reject this plan and use efforts on more important environmental issues at hand.

Sincerely,
Robert Pousman
20612 PCH
Malibu, 90265
310.774.6472

FORM FOR DISCLOSURE OF EX-PARTE COMMUNICATIONS

Name or description of the project::	Malibu Lagoon Restoration
Time/Date of communication:	9/23/10, 11am
Location of communication:	22350 Carbon Mesa Rd, Malibu
Person(s) initiating communication:	Keely Brosnan
Person(s) receiving communication:	Sara Wan
Type of communication:	phone call

Keely called and said she had heard from many people that they were very upset with an opposed to the Malibu Lagoon restoration plan. She wanted to know what I thought about it. I said it was a very good plan. That the current habitat was very degraded and this will correct that. She said people were concerned that all of the wildlife would be killed by either the bull dozers or the poisons. I said they were taking steps to avoid that and that I didn't know how much or if they were using poisons but I would find out and let her know

Date: 9/23/2010

Sara J Wan

Commissioner's Signature

From: Sara Wan
Sent: Thursday, September 23, 2010 12:34 PM
To: 'Keely Brosnan'
Subject: RE: MALIBU LAGOON

Keely,
Thanks. I opened up the flyer on this. Number one- says that this is a "healthy marshlands" which will be turned into a rock-defined channel. To begin with this is not a healthy marshland and it will not be turned into a "rock-defined" channel. The lagoon is highly degraded. I have pasted below the summary of the project from the August staff report on this. I also pasted in what it says about herbicide use. If people feel this is still too much herbicide use then they should argue against its use altogether and see what can be done to require hand removal of the invasive plants. However, certain plants, such as Arundo simply can't be removed without the use of a herbicide. If you cut it down and then pull out the roots, no matter how fully you do that, it will come back.

Sara

The proposed project is for the implementation of a comprehensive restoration and enhancement program for Malibu Lagoon. The project includes dewatering the western 12 acre portion of the lagoon and recontouring slopes and drainages within the western portion of the lagoon, including 51,200 cu ydfill, and 13,700 cu. yds. export of phased

4-07-098 (State Parks)
Page 2

grading to improve circulation and increase tidal flow. No excavation or recontouring will occur within the main channel of the lagoon. The project includes implementation of a restoration and planting plan to remove non-native plant species and revegetation of all disturbed areas with an appropriate mix of native plant species, including low marsh, mid-high marsh, high marsh transitional, and coastal scrub plantings. A north-south oriented temporary berm is proposed in order to temporarily separate the western lagoon area where restoration will occur from the main portion of Malibu Lagoon in order to allow dewatering of the restoration area. A small area adjacent to the Adamson House is proposed to be deepened and replanted. All excavated material will be temporarily stockpiled in designated areas on site, including the parking lot and appropriate erosion control measures are proposed to ensure that uncontrolled runoff does not occur and that there is no potential increase in sedimentation of the lagoon. The project includes detailed plans for management of erosion during construction, a habitat planting plan, a public access, education, and interpretation plan, and a detailed long-term monitoring program for habitat (flora and fauna), water quality during both open and closed lagoon mouth conditions, sediment quality, and lagoon topography/bathymetry.
The project raises several issues relating to the disruption of the current lagoon habitat. Although the restoration project may have short term construction-related impacts, the restoration activities are intended to enhance the long-term value and function of the Malibu Lagoon ecosystem. Several special conditions are recommended to ensure that

the proposed restoration effort is successful. **Special Condition (1)** requires an environmental resources specialist to be present during all construction, grading, excavation, vegetation eradication and removal, hauling, and maintenance activities and requires sensitive species surveys and protective measures to assure that construction impacts will not harm (avian and terrestrial). **Special Condition Four (4)** requires a final dewatering plan to assure the proper protection and relocation techniques for tidewater goby, steelhead, and other important aquatic species during dewatering operations. To protect water quality during construction, **Special Conditions (2), (3), (8) and (16)** require that proper construction measures and adequate erosion control measures are implemented. To assure appropriate long-term monitoring of the restoration project, **Special Condition (6)** and **Special Condition (7)** require the applicant to conduct bi-annual monitoring and submit annual monitoring reports (for at least 5 years) regarding: hydrology, plant community revegetation, aquatic vegetation, benthos, fish, and avian species. If the monitoring reports do not indicate improvement of water circulation, water quality, or indicate impacts to sensitive species, the applicant is required to submit a revised or supplemental plan, certified by a registered engineer and a qualified Resource Specialist, that specifies additional or supplemental measures to modify the portions of the original plan that have failed or are not in conformance with the approved plan. Archeological resources exist on the site and **Special Condition (16)** requires the applicant to have a qualified archaeologist(s) and appropriate Native American consultant(s) present on-site during all restoration activities which occur within or adjacent to the archaeological sites and to document work and to halt work if necessary. Further, **Special Condition (10)** requires the applicant to develop and implement a public access program to ensure that the public has maximum access to the State Park during construction.

Here is what is said about herbicide use

Herbicide Use
Herbicides shall not be used in any open water areas on the project site. Herbicide use in upland areas shall be restricted to the use of Glyphosate AquamasterTM (previously RodeoTM) herbicide for the elimination of non-native and invasive vegetation for purposes of habitat restoration only. The environmental resource specialist shall conduct a survey of the project site each day prior to commencement of vegetation removal and eradication activity involving the use of herbicide to determine whether any native vegetation is present. Native vegetation shall be clearly delineated on the project site with fencing or survey flags and protected. In the event that non-native or invasive vegetation to be removed or eradicated is located in close proximity to native riparian vegetation or surface water, the applicant shall either: (a) remove non-native or invasive vegetation by hand (Arundo donax shall be cut to a height of 6 inches or less, and the stumps painted with Glyphosate RoundupTM herbicide), or (b) utilize a plastic sheet/barrier to shield native vegetation or surface water from any potential overspray that may occur during use of herbicide. In no instance shall herbicide application occur if wind speeds on site are greater than 5 mph or 48 hours prior to predicted rain. In the event that rain does occur, herbicide application shall not resume again until 72 hours after rain.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Amber Tysor
California Coastal Commission
South Central Coast Area
89 South California Street, Suite 200
Ventura, CA 93001

RE: Application NO. 4-07-098 Malibu Lagoon Restoration Project

Dear Coastal Commissioners:

We encourage the Coastal Commission to approve the California State Park application for a Coastal Development Permit to support the restoration of Malibu Lagoon.

Malibu Lagoon is on the state's Clean Water Act 303(d) list of impaired waterbodies for benthic invertebrates, shellfish harvesting advisory, nutrients, eutrophication, pH, swimming restrictions, and viruses. Compared with other Southern California coastal estuaries, Malibu Lagoon suffers from chronically low species richness and low diversity of benthic invertebrates, bivalves, crustaceans, and fish. The Lagoon consistently has eutrophication and excessive algae problems. We are developing three analyses of the Malibu watershed, known as Total Maximum Daily Loads (TMDLs), including one focused on benthic community effects in the Lagoon. As part of a Consent Decree between EPA and local environmental groups, EPA will complete TMDLs for Malibu Lagoon and Creek by 2012. We believe the restoration project is an important effort and will directly address the impairments in the Malibu watershed.

We have reviewed the restoration project goals and believe the current and proposed actions should lead to a successful restoration effort. The restoration project in Malibu Lagoon is critical to addressing the impaired benthic macroinvertebrate community, its habitat, and water quality problems associated with excess nutrients, sediments and algae. We understand the restoration efforts will lead to increased flushing and circulation within the Lagoon, reduction of invasive species, improvement and expansion of the native habitat, and the capture and infiltration of runoff from surrounding developed areas before it reaches the lagoon. All of these actions will lead to protection of the critical beneficial uses in Malibu Lagoon. We are aware the first phase of restoration has been completed, which resulted in the replacement of the existing asphalt parking lot with a permeable, low impact development (LID) parking lot that infiltrates the first 3.2" rainstorm; initial results show this modification significantly reduced polluted runoff to the wetlands. We strongly support Green Infrastructure and LID efforts to address water quality problems.

Sincerely yours,

Alexis Strauss
Alexis Strauss
Director, Water Division

23 Sept. 2010

EXHIBIT 24
CDP # 4-07-098 (Malibu Lagoon)
Comment Letters

Heal the Bay.

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RECEIVED
AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

California Coastal Commission
South Central Coast Area Office
89 South California St., Suite 200
Ventura, CA 93001
Submitted via FAX: (805) 641-1732

Re: Agenda item Th19a; Application No. 4-07-098 Malibu Lagoon Habitat Restoration and Enhancement Program (California State Department of Parks and Recreation and Santa Monica Bay Restoration Commission)

On behalf of Heal the Bay, a non-profit environmental organization with over 13,000 members dedicated to making the Santa Monica Bay and southern California coastal waters and watersheds safe and healthy for people and local ecosystems, we have reviewed the staff report for the Malibu Lagoon habitat restoration and enhancement program and strongly support the project. We urge the Commission to approve the application so that restoration efforts may soon begin in Malibu Lagoon.

Heal the Bay is dedicated to enhancing the natural resources throughout the Malibu Creek Watershed. With 25 years of coastal protection and water quality experience and success, we obviously care deeply about the Malibu Creek Watershed and Santa Monica Bay. Our Stream Team program has conducted water chemistry monitoring and restoration activities throughout the watershed for over a decade. Our restoration efforts have involved stream barrier removals on Malibu Creek to improve riparian and in-stream habitat, including the removal of an Arizona Crossing in Sierra Retreat and a Texas Crossing in Malibu Creek State Park. We have also conducted regular volunteer-based restoration events for over six years, removing invasive plant species and replacing them with native plants.

Malibu Lagoon has historically suffered from poor water quality and degraded habitat

Malibu Lagoon is a shallow water embayment occurring at the terminus of the Malibu Creek Watershed. It is one of the few remaining tidal lagoons in southern California and is critical habitat for the federally-endangered tidewater goby[1] and southern steelhead trout.[2] Malibu Lagoon is also home to a diversity of shorebirds and is a major stop over on the Pacific Flyway for migratory birds.[3] Malibu Lagoon empties

---

[1] Federal Register, Volume 73, Number 21 50 CFR, Part 17; Department of the Interior, Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Tidewater Goby (Eucyclogobius newberryi); Final Rule." January 31, 2008.

[2] Federal Register, Vol. 70, Number 170, 50 CFR Part 226; Department of Commerce, National Oceanic and Atmospheric Administration. "Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California; Final Rule." September 2, 2005.

[3] Moffatt & Nichol, "Final Malibu Lagoon Restoration and Enhancement Plan," prepared for the California State Coastal Conservancy and California State Department of Parks and Recreation. June 17, 2005.

Heal the Bay

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into the Pacific Ocean at Surfrider Beach, a world-renowned surfing and recreational destination that attracts millions of visitors annually.

The 110-square mile Malibu Creek watershed is the second largest watershed in Santa Monica Bay. Many of the waterbodies throughout the Santa Monica Mountains suffer high levels of bacteria and nutrients, as well as excessive algal growth. In December 2004, the Los Angeles Regional Water Quality Control Board passed a bacteria Total Maximum Daily Load ("TMDL") for the Malibu Creek Watershed, and the US Environmental Protection Agency approved a nutrient TMDL for the Malibu Creek Watershed in March 2003. The Santa Monica Bay Beaches bacteria TMDL's summer dry weather compliance deadline was in July 2006; however Surfrider Beach has experienced numerous violations since the deadline.[4]

As the receiving water for the creeks and streams throughout the Malibu Creek watershed, Malibu Lagoon is highly degraded due to the inflow of nutrient and bacteria polluted water, sedimentation, encroachment of development, and other stressors throughout the watershed. These problems are exacerbated by poor circulation within the Lagoon's boundaries.

Malibu Lagoon suffers from high levels of algal growth in the form of floating and mat algae (see photos in Attachment A). Excessive algal biomass can alter habitat and cause extremely low levels of dissolved oxygen. The excessive algal growth in Malibu Lagoon is likely linked to nutrient loading, and the low levels of dissolved oxygen may have significant impacts on the aquatic life. A 2005 study found extremely low levels of pre-dawn dissolved oxygen in the Malibu Lagoon (average DO of 1.15 ± 0.12 mg/l SE), significantly below Basin Plan thresholds.[5] Similar levels (DO < 1mg/l) have been found in subsequent, ongoing, monitoring efforts. Low dissolved oxygen levels may have contributed to reported fish die offs in the area in recent years.

Malibu Lagoon also suffers very low species richness and low diversity of benthic invertebrates, bivalves, crustaceans, and fish, compared to other southern California coastal estuaries.[6] In addition to its aforementioned water quality impairments, Malibu Lagoon was listed on the California 303(d) list of impaired waterbodies for benthic community effects in 2006. The Lagoon also suffers from exotic and invasive vegetation that crowd out valuable wetland species.

---

[4] Heal the Bay Beach Report Card data for Surfrider Beach, available at: www.healthebay.org/brc.

[5] Briscoe *et. al.*, Southern California Coastal Water Research Project, Pre-dawn Dissolved Oxygen Levels in the Malibu Creek Watershed, 2005

[6] Moffatt & Nichol, "Final Malibu Lagoon Restoration and Enhancement Plan," prepared for the California State Coastal Conservancy and California State Department of Parks and Recreation. June 17, 2005.

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Heal the Bay.

It is Imperative that a Comprehensive Restoration Effort to Water Quality and Habitat Improvement be Implemented

The Coastal Commission is charged under Coastal Act section 30231 to maintain, and where feasible restore, the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health. The proposed Malibu Lagoon restoration plan is expected to increase the species richness and diversity of benthic invertebrates, crustaceans, fish and vegetation [illegible] comparable to other similarly-sized southern California estuaries. The plan is designed to [illegible] improve tidal influence and circulation by adapting three existing poorly functioning tidal channels into a single meandering tidal channel, typical of southern California coastal estuaries. The increased tidal flow and circulation will improve dissolved oxygen levels in the Lagoon. Increased flow will also decrease sedimentation and nutrient deposition, thereby improving habitat for fish, shellfish and other invertebrates that live in the Lagoon.

Malibu Lagoon has suffered a history of habitat disturbance. It was previously used as a dump site for fill material by Cal Trans and others in the 1950s and 60s. By the late 1970s the site was completely filled and housed two baseball fields.[7]

Recent restoration efforts have occurred in the Lagoon, although none have been comprehensive. In 1983 the State Department of Parks and Recreation removed baseball fields that existed on filled areas of historic wetland, created three dead-end tidal channels, and planted salt marsh and other vegetation. Since then, wetland restoration science has advanced, and numerous studies have identified problems at the semi-restored Lagoon.[8]

The proposed Malibu Lagoon restoration plan is based on over a decade of comprehensive planning. The primary objectives of the plan are to improve water quality through increased circulation and enhance lagoon habitat for birds, fish and invertebrates. The goals and design of the restoration plan grew out of a long-term multi-stakeholder process that included a diverse group of local residents, agencies and environmental groups, including California State Parks and Recreation, the California State Coastal Conservancy, wetland restoration scientists, esteemed wetlands experts, and Heal the Bay. The stakeholders determined that restoring wetland habitats at Malibu Lagoon was their highest priority short-term project. The restoration design was led by a panel of renowned wetland experts. Heal the Bay participated in the development of the final Malibu Lagoon Restoration Plan, which was peer reviewed and completed in June 2005.[9] In April 2008, the first phase of the restoration plan was completed, which converted an old paved parking lot to a smaller permeable parking lot (that captures, treats and infiltrates runoff through bioswales) and restored the surrounding grounds with native

[7] *Id.*
[8] *Id.*
[9] *Id.*

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vegetation. Now it is essential that the next phase, as detailed in the proposed project, move forward without further delay.

Sediment reconfiguration is necessary to achieve the goals of the restoration project

As previously mentioned, one of the goals of the Malibu Lagoon restoration project is to enhance water circulation through the elimination of narrow dead-end channels and the creation of a single, bigger channel. Therefore, it is necessary to reconfigure the sediments to stimulate tidal flow and circulation. The current configuration is not based on historic lagoon boundaries, so preservation of a historic wetland is not of concern. Instead, it is critical that the proposed restoration plan be implemented to improve tidal flow and circulation throughout the lagoon.

Special condition 7 needs to be revised to reflect the intent of the restoration project

One of the primary goals of the proposed project is to decrease nutrients and algal growth in the Malibu Lagoon. High concentrations of nutrients and algae are a major problem in the Lagoon, as reflected by the Malibu Creek Watershed nutrient TMDL and listing of Malibu Lagoon to on the 2006 California 303(d) list of impaired waterbodies list for eutrophic conditions.

The staff report current states under special condition 7 that,

> "The abundance and diversity of submerged aquatic vegetation and ***macroalgae***, infaunal and epifaunal benthic invertebrates, fish, and birds shall not decrease following restoration. Although a short-term decrease may be expected due to construction related impacts, submerged aquatic vegetation and ***macroalgae***, infaunal and epifaunal benthic invertebrates, fish, and birds should be at commensurate pre-restoration levels within three years of restoration activities and should be at or above pre-restoration levels after five years." [emphasis added]

The staff report also calls for targeted studies examining why these goals are not being met if the abundance and diversity of these parameters decreases post restoration.[10] Although we agree that the restoration activities should not cause a net decrease in native vegetation or fauna, the intent of the restoration effort is to improve water quality and reduce algal growth through the improvement of tidal flow and circulation. This restoration effort may also be paired with future efforts to remove invasive species, such as New Zealand Mudsnails and Crayfish. As currently written, special condition 7 could be interpreted to prohibit such activities. We recommend special condition be revised to remove reference to macroalgae, and specify that it only applies to native flora and fauna.

[10] Coastal Commission Staff Report filed February 1, 2010 on Application No. 4-07-098, pg 21; available at: http://documents.coastal.ca.gov/reports/2010/8/Th19a-8-2010.pdf.

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Conclusion

Southern California has lost approximately 95% of its historic coastal wetlands.[11] The Malibu Lagoon restoration project is a historic opportunity to restore critical wetland habitat in the Santa Monica Bay. It will also help to greatly improve water quality at chronically polluted Surfrider Beach. The Malibu Lagoon restoration plan was completed five years ago. Subsequently, the plan went through the California Environmental Quality Act ("CEQA") process and complies with all CEQA requirements. California's budget crisis has been the only cause for delayed implementation of the Malibu Lagoon restoration effort. Thankfully, funding is now in place to move forward with the project. Restoring Malibu Lagoon is one of the highest priorities under the Santa Monica Bay Restoration Plan. Heal the Bay strongly urges the Coastal Commission to approve the Malibu Lagoon restoration program, so the state can move forward with this critical and long-overdue project.

Sincerely,

Sarah Abramson Sikich, MESM
Coastal Resources Director

Mark Gold, D.Env
President

[11] Moffatt & Nichol, "Final Malibu Lagoon Restoration and Enhancement Plan," prepared for the California State Coastal Conservancy and California State Department of Parks and Recreation. June 17, 2005.

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Attachment A

Exhibit 1: Lower Malibu Creek and Lagoon, taken from inland the Pacific Coast Highway Bridge, June 2009

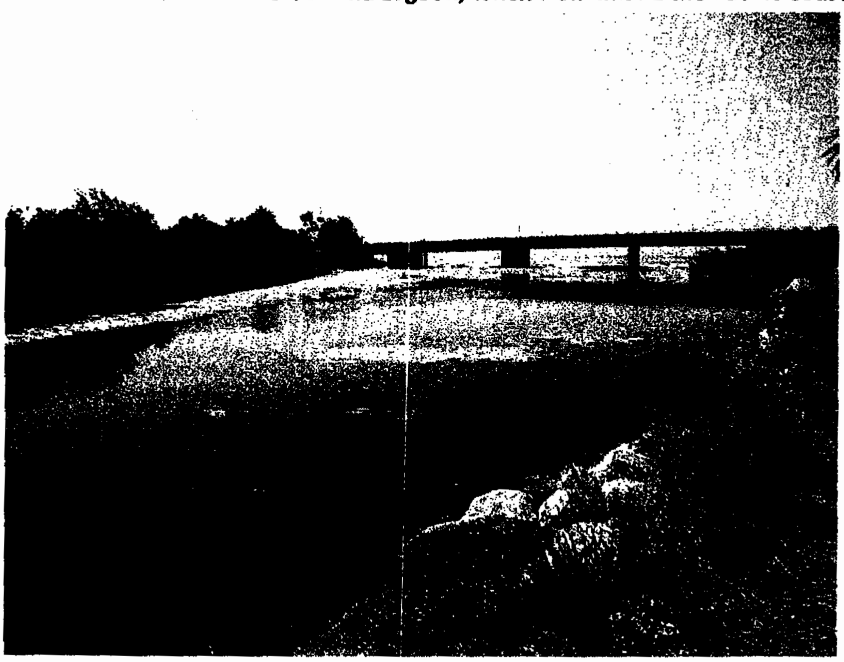
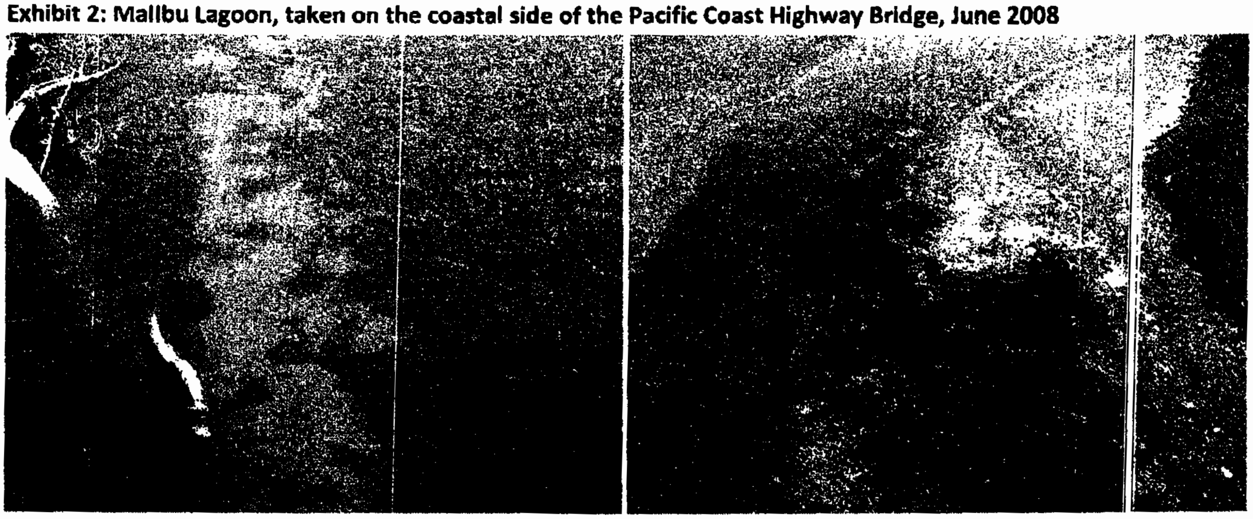


Exhibit 2: Malibu Lagoon, taken on the coastal side of the Pacific Coast Highway Bridge, June 2008



SANTA MONICA
BAYKEEPER

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AUG 04 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

August 4, 2010

Amber Tysor
California Coastal Commission
South Central Coast Area
89 South California St., Suite 200
Ventura, CA 93001
Re: **Application No. 4-07-098** *Malibu Lagoon Restoration Project*

Dear Coastal Commissioners:

Santa Monica Baykeeper urges the Coastal Commission to issue a Coastal Development Permit and strongly supports the Malibu Lagoon Restoration Project. Malibu Lagoon is one of the most important coastal wetland resources of Santa Monica Bay and the Santa Monica Mountains. Malibu Lagoon is a sensitive habitat area that is characterized by poor water quality and impaired habitat conditions due to prior modifications, urban encroachment, and watershed influences. Anthropogenic activities have significantly altered the physical configuration of Malibu Lagoon. The existing lagoon is only a very small portion of its historic area. Urban encroachment has occurred on all sides, thus reducing both wetland habitat and water quality. The design and goals of the lagoon restoration plan were created by the Malibu Lagoon Task Force consisting of 85 members that included local home owners associations, state and local political representatives, and environmental organizations. It was recommended that restoring the lagoon was the highest short term restoration priority for the watershed in 2001.

Santa Monica Baykeeper managed and provided oversight of the Malibu Lagoon Restoration during the construction of the Low Impact Development (LID) parking lot that was completed in April 2008. The rain garden parking lot captures, treats, and infiltrates on site a 3.2 inch storm over a 24 hour period. Almost two acres of wetland habitat were regained by relocating and reducing the total size of the parking lot, while accommodating more parking.

The existing lagoon configuration prohibits the lagoon from functioning properly. During the original 1983 restoration conducted by the State Department of Parks and Recreation, three tidal channels were created in the western lagoon and inappropriate vegetation was planted, which reduces the ecological integrity of the lagoon system. Since this restoration, science has advanced and additional problems associated with the lagoon configuration have been identified. These tidal channels are perpendicular to the main channel resulting in deposition of fine sediments and organic matter due to the low tidal influence and circulation. The boardwalk that bisects the lagoon allowing pedestrians beach access includes three bridges that span the three western tidal channels. These tidal channels are reduced in width creating "pinch points" under the boardwalk that further reduces tidal influence and circulation.

The proposed restoration plan will benefit Malibu Lagoon by increasing salt marsh habitat by recapturing approximately two acres of area where the previous asphalt parking lot was demolished. Restoring native vegetation at the site, removing the inappropriate plant species and expanding the salt marsh habitat will also significantly reduce fire danger to adjacent properties. Furthermore, the removal of the foot bridge "pinch points" that currently restrict the tidal flow into the three western channels and the reconfiguration of the lagoon

120 Broadway, Suite 105 • Santa Monica • CA | 310•305•9645 | Fax 310•305•7985 | www.smbaykeeper.org

to a single meandering channel will greatly improve circulation in the lagoon and better scour fine sediments and organic matter out to the ocean. The existing access path along the perimeter of the project site will be most protective of the sensitive flora and fauna that use the Lagoon while safely accommodating beach access to both pedestrians and emergency vehicles. This path will also include several interpretive features and teaching areas designed to educate visitors about the flora and fauna of coastal estuaries, the Malibu Creek watershed and pollution issues, the unique cultural resources of Malibu Lagoon, and will provide wonderful opportunities for bird watching.

Santa Monica Baykeeper urges the Commission to approve the permit application and to strongly support the Malibu Lagoon Restoration Plan.

Sincerely,

Liz Crosson
Executive Director/Baykeeper
Santa Monica Baykeeper
liz@smbaykeeper.org

bay restoration commission

STEWARDS OF SANTA MONICA BAY

santa monica bay restoration commission 320 west 4th street, ste 200; los angeles, california 90013
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July 30, 2010

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SOUTH CENTRAL COAST DISTRICT

AMBER TYSOR
CALIFORNIA COASTAL COMMISSION
SOUTH CENTRAL COAST AREA
89 SOUTH CALIFORNIA ST., SUITE 200
VENTURA, CA 93001
RE. **APPLICATION NO.:** 4-07-098 *Malibu Lagoon Restoration Project*

Dear Coastal Commissioners:

The Santa Monica Bay Restoration Commission (SMBRC) urges the Coastal Commission to issue a Coastal Development Permit and strongly support the Malibu Lagoon Restoration Project. The lagoon restoration plan is based on a comprehensive planning effort that began in 1989. The goals and design of the lagoon restoration plan grew out of a stakeholder process that included a diverse group of local residents, agencies and environmental groups. The stakeholders determined that restoring wetland habitats at Malibu Lagoon was their highest priority short-term project. The State Coastal Conservancy and the SMBRC then worked to secure funding for this stakeholder-driven project.

The lagoon restoration design was led by a panel of renowned wetland experts. The implementation of the lagoon restoration plan will improve habitat and water quality for a variety of species, including the federally-endangered tidewater goby and steelhead trout. The 110-square mile Malibu Creek watershed is the second largest watershed in Santa Monica Bay and drains into Malibu Lagoon. Malibu Lagoon outlets into the Pacific Ocean at the world-famous Surfrider Beach, visited by more than 1.5 million people annually. Malibu Lagoon is one of the few remaining coastal wetlands in southern California and is critical habitat for the federally-endangered tidewater goby and southern steelhead trout. Malibu Lagoon is also a major stop over on the Pacific Flyway for migratory birds.

The SMBRC has been an active financial supporter of restoration actions and water quality improvement projects in the Malibu Creek watershed since our inception in 1988. Additionally, SMBRC has participated in or funded myriad scientific research projects in the Malibu Creek watershed, with the goal of enhancing habitat and water quality. As a result of our expertise and working experience in the Malibu Creek system, the SMBRC's Bay Restoration Plan (2008) calls for restoration of Malibu Lagoon (Objective number 7.2), and includes several objectives related to improving water quality and habitat in the Malibu Creek watershed and lagoon.

An early restoration project in the western portion of Malibu Lagoon was conducted by the State Department of Parks and Recreation (DPR) in 1983. This project removed baseball fields that existed on filled areas of historic wetland, created three dead-end tidal channels, and planted salt marsh and other vegetation. Since then, wetland restoration science has advanced, and numerous studies have identified problems at the semi-restored Lagoon. Specifically, the Lagoon suffers very low species richness and low diversity of benthic invertebrates, bivalves (clams and mussels), crustaceans (crabs), and fish, compared to other southern California coastal estuaries. Malibu Lagoon also suffers from high algae levels and eutrophication, which results in critically low levels of dissolved oxygen in the Lagoon. Malibu Lagoon is on the state's 303d list of impaired waterbodies for benthic

bay restoration commission

STEWARDS OF SANTA MONICA BAY

santa monica bay restoration commission ⁄ *320 west 4th street, ste 200; los angeles, california 90013*
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invertebrates, nutrients and eutrophication. Low dissolved oxygen levels have led to a number of reported fish die offs. The Lagoon also suffers from exotic and invasive vegetation that crowd out valuable wetland species.

The proposed Malibu Lagoon Restoration Plan will dramatically improve tidal influence and circulation by adapting three existing poorly functioning tidal channels into a single meandering tidal channel, of the type that is typical of southern California coastal estuaries. The increased tidal inundation, flushing, and circulation will improve dissolved oxygen levels. Improved tidal flushing will also allow more effective flushing of fine sediments, and thereby improve habitat for shellfish and other invertebrates that live on the bottom of the lagoon. The lagoon restoration is expected to increase the species richness and diversity of benthic invertebrates, crustaceans, fish, and vegetation to levels comparable to other similarly-sized southern California estuaries.

The restoration will also lower the existing topography, and enhance access for visitors to the lagoon. The enhanced public access will incorporate a series of unique interpretive elements that will enrich the visitor experience. Interpretive elements allow visitors to interact with and learn about tidal lagoons, local flora and fauna, and cultural resources. Specific elements have been created to enhance the numerous educational programs that already utilize the Lagoon, such as natural bird blinds, designed by birdwatchers. Surfing is an important recreational use of Malibu Surfrider Beach and has also been incorporated into the interpretive plan.

The Santa Monica Bay Restoration Commission supports implementation of the restoration and enhancement plan to improve circulation and increase the lagoon's ability to flush fine sediments. The combination of these improvements will increase and dramatically enhance Malibu Lagoon's habitat for fish and other species.

I urge you to approve the permit application and to strongly support the Malibu Lagoon Restoration Plan.

Sincerely,

Shelley Luce, D.Env.
Executive Director

Amber Tysor

From: michael blum [michael.blum@gmail.com]
Sent: Wednesday, August 04, 2010 3:13 PM
To: Amber Tysor
Cc: mabramson@santamonicabay.org
Subject: Malibu Lagoon Restoration Project :: APPROVE

RECEIVED
AUG 04 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

Amber Tysor
California Coastal Commission
South Central Coast Area
89 South California Street, Ste. 200
Ventura, California 93001

SENT VIA EMAIL

RE: MALIBU LAGOON RESTORATION PROJECT : APPROVE

Dear Ms. Tysor.

The Malibu Surfing Association (MSA) was formed in 1961 by members of the Malibu community as one of California's first surfing clubs. Today, the MSA is an all-volunteer, nonprofit organization dedicated to the fellowship of surfing and to the stewardship of Malibu Surfrider Beach.
We are a primary user group of the Surfrfider Beach and Malibu Lagoon areas. We speak on behalf of our members whose views represent the surfing community and the 1.5M annual visitors to Malibu Surfrider Beach.

The MSA urges the Coastal Commission to both issue a Coastal Development Permit and support the Malibu Lagoon Restoration Project.
The Lagoon Restoration Plan is based on a comprehensive planning effort that began more than 20 years ago; growing out of a stakeholder-driven process that included a diverse group of local residents, agencies and environmental groups. Through that process, stakeholders determined that restoring wetland habitat at Malibu Lagoon was their highest priority, short-term project.

Third Point is one of the premier high-performance surfing breaks in Malibu, located proximate to the Malibu Lagoon's western end.
Recreational surfers represent the largest user group of the Third Point beach and it has been home to three generations of professional surfers coming from the Malibu area. Because of its natural beauty, relative isolation, and high-quality wave, it has also been used as a site for elite-level surfing competitions. Earlier this year, Third Point hosted one of the six, Surfing America Prime events -- a competition series used to determine the 18 and Under USA international surfing team. That Surfing America would produce their only LA-area event at Third Point underscores its importance to the surfing community.

During the Malibu Lagoon Restoration Project planning, MSA has been consulted on the plans to modify pedestrian access to Third Point through enhancements to the Lagoon's perimeter access road. Throughout these discussions, easy access to Third Point by beach visitors and recreational surfers, in addition to the protection of ocean water quality during construction, has always been considered. MSA believes the Restoration Project balances the requirements of beachgoer's and surfer's access to Third Point, protection of flora and fauna, privacy for nearby homeowners, and access for emergency and maintenance vehicles.

We urge you to approve the permit application and to support the Malibu Lagoon Restoration Project. Please contact me at 818.564.4217 with any questions.

Sincerely,

Michael Blum
President, Malibu Surfing Association

STATE OF CALIFORNIA–THE NATURAL RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, *Governor*

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PHONE (310) 589-3200
FAX (310) 589-3207
WWW.SMMC.CA.GOV

Via Email

RECEIVED
AUG 05 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

August 5, 2010

California Coastal Commission
c/o Ms. Amber Tysor
South Central Coast Area
89 South California Street, Suite 200
Ventura, California 93001

Application No. 4-07-098, Malibu Lagoon Restoration Project

Dear Commissioners:

The Santa Monica Mountains Conservancy staff supports the Malibu Lagoon Restoration Project, subject of Application No. 4-07-098 which will be before you at your upcoming meeting. Malibu Lagoon receives all the runoff from the 110-square mile Malibu Creek Watershed, the second-largest watershed of Santa Monica Bay. The Lagoon has been the subject of decades of environmental concern and study. The proposed project is the culmination of multi-agency efforts to restore natural functions and greatly improve habitat and water quality, while enhancing the public's right to enjoy and appreciate this rare coastal resource.

The Conservancy and other federal, state, and local park agencies own and manage thousands of acres of natural open space parkland in the Malibu Creek Watershed, including Palo Comado Canyon, Cheeseboro Canyon, Upper Las Virgenes Canyon Open Space Preserve (former Ahmanson Ranch), Zev Yaroslavsky Las Virgenes Highlands Park, Las Virgenes View Park, King Gillette Ranch, and Malibu Creek State Park. Malibu Lagoon is a unit of the California State Park system. Watershed protection, resource protection, water quality objectives, public access, and habitat enhancement are key values that are managed by the park agencies. Restoration of Malibu Lagoon will contribute to overall parkland and habitat values throughout the Malibu Creek Watershed.

The restoration project will improve tidal influence and circulation and greatly increase flushing of fine sediments, essential for optimizing the lagoon's ecological function.

A greater diversity and abundance of fish, bird, invertebrate, and plant species is an expected result of the restoration project, including increased protection and viability for the federally-endangered southern steelhead trout and tidewater goby.

The restoration project elements designed to enhance access for visitors to the state-owned lagoon are also essential benefits of the plan. Because the existing boardwalk system has the effect of impeding tidal action, it will be removed. The existing perimeter access road will instead be improved as the superior park pathway, with environmental interpretive features and opportunities for educational programming, while still maintaining emergency vehicle access.

We join the Santa Monica Bay Restoration Commission in urging your approval of the Malibu Lagoon Restoration permit application.

Sincerely,

Rorie Skei

RORIE SKEI
Chief Deputy Director

California Regional Water Quality Control Board
Los Angeles Region

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 FAX (213) 576-6640 - Internet Address: http://www.waterboards.ca.gov/losangeles

Linda S. Adams
Cal/EPA Secretary

Arnold Schwarzenegger
Governor

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CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

August 6, 2010

Amber Tysor
California Coastal Commission
South Central Coast Area
89 South California Street, Suite 200
Ventura, CA 93001

RE: APPLICATION NO. 4-07-098 ***Malibu Lagoon Restoration Project***

Dear Coastal Commissioners:

The Los Angeles Regional Water Quality Control Board (LARWQCB) staff urges the Coastal Commission to approve the California State Park's application for a Coastal Development Permit for the restoration of Malibu Lagoon.

Along with the State Water Quality Control Board and the Santa Monica Bay Restoration Commission, the LARWQCB has been an active supporter of Malibu Lagoon restoration. To date, we have committed almost $4 million in state bond funding to the California Coastal Conservancy and California State Parks towards the implementation of the Malibu Lagoon Restoration and Enhancement Plan. Additionally, we have participated in or funded multiple scientific research projects in the Malibu Creek watershed with the goal of enhancing water quality and restoring critical habitat.

Compared to other southern California coastal estuaries, Malibu Lagoon has very low species richness and diversity. The lagoon also has high levels of algae, and eutrophication has resulted in a number of fish kills. Additionally, exotic and invasive vegetation have displaced important native wetland species. The lagoon is on the State's 303d list of impaired water bodies for benthic community effects, pH, eutrophic conditions, a shellfish harvesting advisory, swimming restrictions, and viruses.

The lagoon restoration will improve habitat and water quality for a variety of species, including the federally-endangered tidewater goby and steelhead trout.

LARWQCB staff urges the Coastal Commission to approve California State Park's Coastal Development Permit application referenced above, and to support the restoration of Malibu Lagoon.

Sincerely,

Chief Deputy Executive Officer
for

Samuel Unger, P.E.
Interim Executive Officer

RESOURCE
CONSERVATION DISTRICT
OF THE
SANTA MONICA MOUNTAINS

818.597.8627 phone
818.597.8630 fax
info@rcdsmm.org

30000 Mulholland Highway, Agoura Hills, CA 91301
Mail: PO Box 638, Agoura Hills, CA 91376-0638

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AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

3 August 2010

Amber Taylor
California Coastal Commission
South Central Coast Area
89 S. California Street, Suite 200
Ventura, CA 93001

RE: APPLICATION No: 4-07-098 Malibu Lagoon Restoration Project

Dear Commissioners

The Resource Conservation District of the Santa Monica Mountains (RCDSMM) appreciates the opportunity to urge the Coastal Commission to issue a development permit and support the Malibu Lagoon Restoration Project. The RCDSMM has provided leadership in the Malibu Creek Watershed planning process and extensive grant funding and management since the early 1990's. Our effort to facilitate the comprehensive planning efforts in the watershed has resulted in several phases of restoration of Malibu Lagoon. Restoring a hydrologically functional lagoon has faced numerous challenges over the years, but the plan under consideration attempts to utilize the best coastal restoration sciences available to achieve the goal.

Malibu Lagoon is unique in many ways. Due to its size and location, restoring Malibu lagoon and watershed is on the forefront of redefining and repairing the relationship between coastal development and coastal resources. Despite numerous problems related to development, such as water quality impairments, constriction of natural creek patterns and introduction of invasive aquatic species, Malibu Creek still manages to support a recovering population of endangered Tidewater gobies and remnant population of southern steelhead trout.

The proposed Malibu Lagoon Restoration project addresses critical issues that have limited the ecological function of the lagoon since restoration began in 1984. By re-directing trails around the perimeter of the lagoon, it is possible to develop a more functional tidal influence, which has numerous benefits for many species. The present configuration with the trails meandering through marginally functional channels has resulted in a depauperate benthic invertebrate community, limited foraging for shorebirds that rely on mudflats and compounded water quality problems.

The proposed trail alignment provides public access that will create opportunities for visitors to interact with and learn more about the functional patterns of a typical southern California estuary system. Interpretive elements that immerse the visitor in the ecological, cultural and social elements of the lagoon and watershed will provide the opportunity for greater understanding of how these systems integrate human and natural processes.

The restoration planning process has evolved with extensive input from a wide variety of stakeholders over the years. The inclusive efforts of watershed planning are designed to develop a consensus approach to solving problems. The Malibu Lagoon Restoration Project reflects a long effort to identify, respond to and integrate both community and ecological concerns in a respectful and functional way.

The RCDSMM is grateful for the opportunity to have had a leadership role in the overall watershed planning process and looks forward to continued efforts to coordinate the long-term sustainability of Malibu Creek and Lagoon.

Respectfully submitted,

Clark Stevens, AIA
Executive Officer

CALIFORNIA TROUT

KEEPER OF THE STREAMS

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CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

5 August 2010

Amber Tysor
California Coastal Commission
South Central Coast Area
89 South California Street, Ste. 200
Ventura, California 93001

SENT VIA EMAIL

RE: APPLICATION NO: 4-07-098 Malibu Lagoon Restoration Project.
Applicant: California State Parks

Dear Members of the Coastal Commission,

The purpose of this letter is offer California Trout's (CalTrout) support for the the Malibu Lagoon Restoration Project (Project) and to urge the Coastal Commission to approve the Coastal Development Permit for this Project. Since 1971, CalTrout has been the only statewide organization solely committed to the recovery of California's wild trout, steelhead, and salmon waters. Under increasing threat from dramatic population growth and the effects of global climate change, the rivers, streams, estuaries & lagoons cold, that sustain our fish and enable our state's economy to thrive, require coordinated and strategic conservation efforts to endure.

The Malibu Lagoon Restoration Plan is based on a comprehensive planning effort that began more than 20 years ago; growing out of a stakeholder-driven process that included a diverse group of local residents, agencies and environmental groups, including Cal Trout. Through that process, stakeholders determined that restoring wetland habitat at Malibu Lagoon was their highest priority, short-term project.

The Malibu Lagoon and Malibu Creek watershed is designated as critical habitat for the federally listed endangered Southern California steelhead trout. The proposed restoration project will enhance circulation and increase chronically depressed dissolved oxygen levels in the Lagoon. These persistently low levels of dissolved oxygen negatively impact all fish species that use the Lagoon, including the SoCal steelhead trout. Steelhead trout are especially susceptible to depressed levels of dissolved oxygen and increased water temperatures. Additionally, during the Lagoon restoration large woody debris will be installed at several locations to provide cover for steelhead trout and other fish species. The improved flushing and circulation that will result from this project will also help to lower water temperatures. Water temperatures under existing conditions often reach or exceed the upper limits of what is considered safe for steelhead.

4592 Santa Monica Avenue, San Diego, CA 92107
Phone: (619)269-9207 **E-mail:** nknite@caltrout.org **Web:** www.caltrout.org

The new interpretive elements along the enhanced Lagoon's perimeter access road will educate visitors about how Coastal estuaries function, local flora and fauna, and cultural and archeological resources. Part of the interpretive elements will include educational information about southern steelhead trout. The project proponents have worked closely with NOAA fisheries and other resource management agencies to protect water quality and fish species during construction. We believe the restoration promotes public access, protects native flora and fauna, enhances water quality, and improves habitat for multiple species, including the endangered Southern California steelhead.

We urge you to approve the permit application and to support the Malibu Lagoon Restoration Project. Please contact me at 619-269-9207 with any questions.

Sincerely,

Nica Katherine Knite

Nica Katherine Knite
Southern California Regional Manager

California Trout
Southern California Office
4592 Santa Monica Avenue
San Diego, CA 92107
nknite@caltrout.org

COMMITTEES
BUDGET
BUDGET, SUBCOMMITTEE No. 2 ON EDUCATION FINANCE
EDUCATION
JUDICIARY
NATURAL RESOURCES
COMMISSION ON THE STATUS OF WOMEN
SANTA MONICA BAY RESTORATION COMMISSION
SANTA MONICA MOUNTAINS CONSERVANCY

Assembly
California Legislature

JULIA BROWNLEY
ASSEMBLYMEMBER, FORTY-FIRST DISTRICT
CHAIR, ASSEMBLY COMMITTEE ON EDUCATION

STATE CAPITOL
P.O. BOX 942849
SACRAMENTO, CA 94249-0041
(916) 319-2041
FAX (916) 319-2141

DISTRICT OFFICE
6355 TOPANGA CANYON BLVD.
SUITE 205
WOODLAND HILLS, CA 91367-2108
(818) 596-4141
(310) 395-3414
(805) 644-4141
FAX (818) 596-4150

August 6, 2010

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AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

Amber Tyson
California Coastal Commission
89 South California Street, Suite 200
Ventura, CA 93001

Re: Item 19a – Malibu Lagoon Restoration, SUPPORT

Dear Coastal Commissioners:

As the Assemblywoman and State Senator, respectively, representing the City of Malibu, we strongly support the Malibu Lagoon Restoration Project and respectfully urge you to issue the required Coastal Development Permit for this important project.

We are very proud to have the Santa Monica Mountains National Recreation Area in our districts. The Malibu Creek watershed which drains to the Pacific Ocean has enormous environmental importance and challenges, including the need for improved habitat and water quality for a wide variety of species that inhabit the Lagoon, including the Federally-endangered tidewater goby and steelhead trout. The Malibu Lagoon is one of the few remaining coastal wetlands in southern California, and also a magnificent place of recreation for countless visitors every year, including at world-famous Surfrider Beach. Unfortunately, the Lagoon remains on the state's 303d list of impaired waterbodies, with severe impacts on benthic invertebrates, low levels of dissolved oxygen, and other water quality problems which the proposed Restoration Plan will dramatically improve.

Thank you for what we hope will be adoption of the staff's recommendation to approve the project. Please don't hesitate to call on either of us to discuss this very important project.

Sincerely,

Julia Brownley

JULIA BROWNLEY
Assemblywoman, 41st District

Fran Pavley

FRAN PAVLEY
State Senator, 23rd District

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COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

United States Department of the Interior

NATIONAL PARK SERVICE
Santa Monica Mountains National Recreation Area
401 West Hillcrest Drive
Thousand Oaks, California 91360-4207

In reply refer to:
L76 / 134-90

August 11, 2010

Amber Tysor, California Coastal Commission
South Central Coast Area
89 South California Street, Suite 200
Ventura, CA 93001

Re: Application No. 4-07-098, Malibu Lagoon Restoration Project

Dear Ms. Tysor:

The National Park Service has reviewed the staff report for implementation of a Wetland Habitat Restoration and Enhancement Program for Malibu Lagoon. The project would reconfigure the existing lagoon to improve hydrologic performance, remove non-native species and restore native wetland and upland plant species, and construct a public interpretative trail. The National Park Service appreciates the opportunity to participate in the public review process for the proposed project. We fully support the proposed project, which we find to be consistent with our management objectives for Santa Monica Mountains National Recreation Area.

Overall, the project represents a comprehensive and improved design over the previous restoration effort. The relocation of public access to the perimeter of the lagoon site will improve the hydrology of the lagoon and provide more suitable habitat. Currently, flows are restricted by the narrowness of the channel underneath the trail bridge crossings. Also, removal of the bridges will allow wind to naturally circulate the lagoon water. Relocation and removal improves habitat conditions on the islets within the lagoon by providing seclusion and protection for wildlife, especially birds.

Thank you for the opportunity to comment. If you have questions, please call Melanie Beck, Outdoor Recreation Planner, at (805) 370-2346.

Sincerely,

Meghan Kish

for Woody Smeck
Superintendent

cc: Joe Edmiston, Executive Director, Santa Monica Mountains Conservancy
Ron Schafer, Superintendent, Angeles District, State Department of Parks and Recreation
Clark Stevens, Executive Officer, Resource Conservation District of the Santa Monica Mountains

Coastal Law Enforcement Network
A biodiversity project of the International Humanities Center enforcing laws protecting the California coast

322 Culver Boulevard Suite 317
Playa del Rey, CA 90293
p: (310) 821-9045
f: (310) 448-1219

CLEAN

TH19A

Wetlands
Defense
Fund

The Honorable Bonnie Neely, Chair **August 3, 2010**
& Honorable Commissioners, California Coastal Commission
& Jack Ainsworth, Deputy Director, California Coastal Commission
89 South California Street, Ste. 200
Ventura, CA 93001

delivered via facsimile & mailed August 3, 2010

Re: Application# 4-07-098
Malibu Lagoon Wetland Habitat Restoration & Enhancement Project –

Dear Commission Chair Neely, Coastal Commissioners & Mr. Ainsworth:

On behalf of Coastal Law Enforcement Action Network (CLEAN) and Wetlands Defense Fund, we ask that you delay this item from being heard at the San Luis Obispo hearing due to the Los Angeles Superior Court's recurring opinions that the Coastal Commission is not complying with CEQA (the California Environmental Quality Act) when it has not posted staff reports that allow the public a 30-day time period for review.

According to several recent legal cases brought against the California Coastal Commission in Los Angeles Superior Court, the Court has ruled that the Coastal

Commission must provide 30 days notice to the public for review of permit approvals such as there. The staff report for this item was not circulated to the public with the required 30 days notice, having been posted on the Coastal Commission's website on July 30, 2010 for a hearing scheduled for August 13, 2010.

Here is a citation from one of the relevant cases: November 30, 2009 decision. *Littlejohn v. California Coastal Commission*

> "Public Resources Code section 21091(1) states that the 'public review period for a draft environmental impact report may not be less than 30 days.' The Coastal Commission is not exempt from section 21091, which is part of chapter 2.6 and regulatory programs certified under section 21080.5 in pertinent part are exempt only from Chapters 3 and 4. This regulatory program exemption also must be narrowly construed. See Ultramar, Inc. v. South Coast Air Quality Management District (1993) 17 Cal.App.4th 689, 699; City of Coronado, 69 Cal.App.3d 570, 581."
>
> "In sum, the Coastal Commission is governed by section 21091's requirement for a 30-day review period for its staff report, the functional equivalent of an EIR."

In alignment with this ruling and others that the Los Angeles Superior Court has issued related to Coastal Commission legal challenges, we also believe this circulation of the staff report must include review by all relevant agencies, as CEQA requires, including the United States Fish & Wildlife Service, the California Department of Fish & Game, National Marine Fisheries Service and others.

In addition, the volume of information presented in the staff report, combined with seeming contradictions on the Environmental Impact Report, which we only received a copy of recently, make it impossible to provide meaningful comments and recommendations related to the restoration of this important coastal resource, which is designated as Environmentally Sensitive Habitat Area (ESHA) in the Malibu Local Coastal Program (LCP.)

Finally, while we are seeking the minimum of 30 days time required by law for proper circulation of this staff report, we are mindful that the next possible hearing date is scheduled for September in Eureka, many hundreds of miles away from Malibu and its surrounding county area of Los Angeles.

Therefore, we ask that you convene the public hearing on this important topic at the next hearing which is scheduled for Los Angeles or Orange County, so that the many members of the public, who are extremely interested in this lagoon and its resources and public access to the lagoon and Malibu's adjacent Surfrider Beach, will not be caused a hardship in having to travel to such a distant locale as Eureka. We understand that the next possible Los Angeles/Orange County hearing date is November, so the item can still be considered before the end of this calendar year.

Thank you for your time and consideration of the important issues discussed above.

With best regards,

/s/ *Marcia Hanscom*

Marcia Hanscom
Managing Director, **Coastal Law Enforcement Action Network ~ CLEAN**
Director, **Wetlands Defense Fund**

RECEIVED
AUG 04 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

RALPH W. KIEWIT, JR.

23334 MALIBU COLONY DRIVE
MALIBU, CA 90265

Item Th 19a
@ SLO 8/12/10

AUGUST 2, 2010

CALIFORNIA COASTAL COMMISSION STAFF
ATTN: MR. JACK AINSWORTH
C/O AMBER TYSOR, COASTAL PROGRAM ANALYST

WITH RESPECT FOR THE COASTAL COMMISSION MEMBERS, I ASK CONSIDERATION OF THESE STATEMENTS AND THAT THE STAFF MAKE THESE AVAILABLE.

1. PROBABLY 20 YEARS AGO I INSTALLED A CORRUGATED IRON PIPELINE TO DRAIN STORM WATER FROM MINE AND NEIGHBOR'S PROPERTIES INTO THE LAGOON. I BELIEVE THIS WAS BEFORE STATE PARKS EVEN OWNED THE PROPERTY, AND THAT I HAVE A PRESCRIPTIVE EASEMENT UNDER ADVERSE POSSESSION COMMON LAW.

2. STATE PARKS PARTIALLY HONORED THIS BY A WRITTEN PERMIT TO ENTER IN NOVEMBER 1997 WHICH AUTHORIZED INSTALLING AN INSIDE "LINER" AND INSTALLATION OF A TOP "GATE VALVE". ANY REMOVAL WOULD SERIOUSLY DAMAGE OUR PROPERTIES.

3. COMMISSIONER SARA WAN STATED TO THE STAFF THAT I HAD NO PERMIT TO ENTER (SEE ATTACHED COPY OF PERMIT). SHE FURTHER STATED THAT WILD FIRE DAMAGE TO OUR PROPERTIES WOULD PROBABLY STOP AT THE PACIFIC COAST HIGHWAY, YET EVERY WILD FIRE (AND I HAVE BEEN THROUGH FOUR) CROSSED THE PACIFIC COAST HIGHWAY AND BURNED RIGHT TO OUR PROPERTY LINE AND WERE ONLY STOPPED THERE BY FIRE ENGINE TRUCKS AND CREWS, USING THE EXISTING ROAD.

Ralph W Kiewit, Jr
RALPH W. KIEWIT, JR.

RECEIVED
AUG 04 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

Date: November 5, 1997

STATE OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
PERMIT TO ENTER

Permission is hereby granted to: Ralph W. Kiewit, Jr., 114 Malibu Colony, Malibu, California 90265, (310) 456-8965, hereinafter referred to as PERMITTEE, to enter Malibu Lagoon State Beach; for the purpose of installing and maintaining a gate value on an existing drainage pipe, and installing an inside "liner" in existing drainage pipe.

The rights and privileges hereby granted to PERMITTEE at the option of PERMITTEE, may be exercised by any authorized agent or contractor of PERMITTEE.

By acceptance of this Permit to Enter, it is expressly understood and agreed by and between the parties that PERMITTEE agrees to indemnify and hold the undersigned and STATE harmless against any and all loss, damage and/or liability which may be suffered or incurred by STATE and against any and all claims, demands and causes of action that may be brought against STATE caused by, or arising out of, or in any way connected with the use and/or occupancy of said further agrees to assume full responsibility for any and all damages caused by PERMITTEE'S operation under this Permit and PERMITTEE shall, at its option, either repair or pay for such damages.

PERMITTEE shall adhere to the following conditions:

1. No grading, digging or any other type of soil manipulation is allowed., except for existing digging to allow replacement of corrugated existing pipe to receive gate valve. (Approximate 8 Ft. section at entry end.)

Sincerely,

[signature]

Date 11-6-97

Daniel C. Preece, District Superintendent
Angeles District
State of California
Department of Parks and Recreation

ACCEPTED:

[signature]

Date November 5, 1997

Ralph W. Kiewit, Jr.

TOTAL P.02

FAX TRANSMISSION

CALIFORNIA DEPARTMENT OF PARKS AND RECREATION
ANGELES DISTRICT

November 5, 1997

TO: Ralph W. Kiewit, Jr. 818-[redacted] 501-3127

FROM: RICHARD ROZZELLE, ASSOCIATE LAND AGENT
CALIFORNIA DEPARTMENT OF PARKS AND RECREATION
(818) 880-0362
(818) 880-6165 FAX

NUMBER OF PAGES (Including Cover Sheet): 2

MESSAGE: Superintendent Guiney asked me to process the attached permit for your "gate valve". Please review and sign the document. If you can then fax it to my office, I will have it completed and returned to you as soon as possible. Thank you for your cooperation.

10/5 Millie: Please conform to attached - I sign + you fax return.

STEVE LITTLEJOHN
PO BOX 176
MALIBU, CA 90265
310-457-5431

RECEIVED
AUG 05 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

8/3/10

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
South Central Coast District Office
89 South California Street, Suite 200
Ventura, CA 93001-2801

Via facsimile: (805) 641-1732 and Regular US Mail

Re: Rescheduling of item TH 19a scheduled to be heard in San Luis Obispo on August 12, 2010.

Dear Ms. Neely and Ms. Ainsworth:

I wanted to thank Jack Ainsworth for the time it took to meet with a group of us a couple of weeks ago about the Malibu Lagoon Restoration Project. As we mentioned, this is one of the major wetland areas in all of the Southern California area and as such you need as much input from all the diverse groups that will be affected by this project. My understanding of the Coastal Act and CEQA requirements is the staff report needed to be posted a full 30 calendar days prior to the hearing date. As it was posted only 15 days prior to the hearing, we are requesting that you remove this item from the current hearing date to one that would be most appropriate here in Southern California – which would be in November here in Southern California or in San Clemente in the month of October. At minimum, it should be held in Eureka in September. However, considering the vast importance of this item, the proper venue is Southern California at the November hearing.

In reviewing the 87 page staff report and the 455 page EIR (that was prepared in 2005), it is evident that the staff is writing about construction aspects not covered by the EIR. Not to mention this item is a huge undertaking that cannot be digested in a mere 15 calendar days from the posting of the staff report. It has also been noted back in 2005 the nearby homeowners did not receive a written notice required for all landowners within a 500' radius that an EIR was being prepared for this project. Thus this EIR is lacking the very important input from the homeowners that have drainage, access, and emergency fire escape issues.

The EIR itself seems to lack the proper analysis of the most feasible and least environmentally damaging project for all involved. As I understand it, this in itself is a violation of CEQA. The project seems to ignore the fact that this is a spectacular and established ecosystem which will be obliterated by bulldozers and seems more driven by the use of bond funds than common sense. For example, there is barely a mention that the wooden bridges that cross the lagoon which affords a magnificent viewing location for the public and the shortest path for the beachgoers and surfers that are lugging heavy items to the beach will be eliminated! Did anyone stand there and ask the public what they wanted? Did anyone ask the Audubon Society if they don't care if this vantage point of the lagoon will be lost forever? Do you realize that with hardly a mention in these 2 major reports, these bridges, which are one of only two access ways and the shortest way to the beach as well, are being eliminated? I also understand that the consulting firms used didn't have biologists or the right biologists involved and proper and complete wildlife surveys are lacking. How can that be?

On the 2nd to the last page of the staff report is an ex-parte communication from Sara Wan which I will use as an example of why the public and nearby residents needs a full 30 days to respond to this staff report. Simply, the staff themselves will need to be educated. Mrs. Wan wrote the Malibu Colony residents have access gates to the park land which are used to "throw their trash, let dogs out, etc." Yet there is not one shred of evidence of such activities being caused by the Colony residents. She goes on to say that a wildfire would likely never jump the PCH. I was there for the wildfire in 1970 that burned down 50 homes in the Cross Creek area just to the north of the Malibu Colony and I must tell you it is terrifying to watch what happens. It is so hot, windy, and dry, the cinders fly for miles in the 85 mph plus winds in temperatures well over 100 degrees and end up starting fires on anything combustible where they land and stick – it could be a fence post, dead ice plant, you name it, it starts to go up in flames creating more flying cinders. I personally put out fires on my neighbor's fences. Why the Colony didn't burn down that day was a miracle. The amount of deadwood that exists in the park land right now is enough to start a fire large enough to burn the whole Colony down in these conditions. She goes on to state there is adequate fire escape right now. I ask Sara, what if you are there and the house on the left and right of you are up in flames being fanned by 85 mph winds and the houses across the street are also engulfed in flames, where is this adequate fire escape now? Have you ever been in a fire storm? Next she shows a lack of understanding of the drainage problems that exist in the area. She only mentions that the Parks did grant Ralph Kiewit (a resident since 1957) a permit to have a drain pipe installed so his property and that of his neighbor, Carl Deutsch, don't flood out, but the Coastal Commission didn't grant a permit, therefore the drain must be removed. Why is there no integration of the Colony's drainage problems with this project? Surely something can be done to solve this drainage problem and tie it into the drain system that services the Malibu Colony Plaza and the Malibu Road other than to callously remove the only drain that the residents have. What happens when the El Nino storms hit and the Colony floods out (I have personally seen 18" of sea water on Malibu Colony Drive during these storms)? My point being, there are so many important things which need to be developed and integrated here, such a huge item cannot be rammed though within a 15 day posting time. I don't think the public is able to respond to the staff report in this short of a response period. I know the residents of the Colony cannot either.

Another item which should be looked into: On Sunday 8/1/10 I went for a walk around the lagoon and I noticed where the posting of this item ended up. It was on the chain link fence on the exit side of the driveway from the parking lot. It was facing PCH. I don't think anyone could possibly notice this posting. From what I understand, it is required that you post in a "conspicuous location". How about moving it to where the parking attendant's booth is (post on the entrance side) so everyone driving in will see it? As not all the people entering the park do so by car, so I would think on an item of this importance, you would also post on both the trails to the beach and add a line about the bridge being removed forever. I assume you want the public to know about the renovation plans?

I am cutting and pasting the ruling to this letter that was written on November 30, 2009 by Superior Court Judge James C. Chalfaut in regards to the need for a full 30 days for the public to digest and respond to a staff report. I believe his ruling strongly applies to item TH 19a as well. Please read his decision below. In addition, I am attaching the permission granted by the parks to Ralph Kiewit for the drain pipe.

Sincerely,

Steve Littlejohn

1. <u>30 Day Public Review Period</u>

The Coastal Commission's regulations provide for the orderly evaluation of proposed developments, and requires distribution of the notice of hearing on an application at least 10 calendar days prior to the hearing. 14 CCR §13059. The regulations also require distribution of the staff report within a "reasonable time to assure adequate notification prior to the scheduled public hearing." 14 CCR §13063(a). Notice includes a description of the development, its location and a "statement that the staff report will be distributed as set forth in section 13059." 14 CCR §13063(a)(2) and (6). The regulations further provide that staff reports shall be distributed "within a reasonable time to assure adequate notification prior to the scheduled public hearing." 14 CCR §13059.

The Coastal Commission released the staff report on June 25, 2008, 15 days prior to the July 10,2008 public hearing on the project. AR 1636. This exceeded the 10-day notice requirement in the Coastal Commission's regulations and complied with the Coastal Commission's consistent practice of 36 years under the Coastal Act.

Public Resources Code section 21091(a) states that the "public review period for a draft environmental impact report may not be less than 30 days." The Coastal Commission is not exempt from section 21091, which is part of chapter 2.6 and regulatory programs certified under section 21080.5 in pertinent part are exempt only from Chapters 3 and 4. This regulatory program exemption also must be narrowly construed. *See* Ultramar, Inc. v. South Coast Air Quality Management District, (1993) 17 Cal.App.4th 689, 699; City of Coronado, 69 Cal.App.3d 570, 581.

The Coastal Commission makes the following argument that section 21091 is inapplicable to its certified regulatory program.

Section 21080.5(c) allows state agencies with environmental responsibilities to use their own procedures for reviewing proposed projects in lieu of' an EIR. Certification of a regulatory program requires a state agency to comply with criteria contained in section 21080.5(d). Strother v.California Coastal Commission, (2009) 173 Cal.App.4th 873, 878. In turn, section 21080.5(d)(2)(B) requires, in part, that the agency's rules and regulations include guidelines for the orderly evaluation of proposed activities and the preparation of the plan or other written documentation. Section 21080.5 also provides its own time limitation for review and comment on the agency's "plan or other written documentation:" it must be "available for a reasonable time for review and comment by other public agencies and the general public." Pub. Res. Code §21080.5(d)(3); Sierra Club v. State Board of Forestry, (1994) 7 Cal.4th1215, 1230. The Coastal Commission's notice for public review of its staff report was in compliance with its regulations, and in the context of a certified regulatory program "compliance with applicable statutes and regulations constitutes CEQA compliance." Californians for Alternatives to Toxics v. California Dept. of Pesticide Regulation, (2006) 136 Cal.App.4th 1049, 1067.

The Coastal Commission further argues that section 21091's 30 day public notice period does not apply because section 21091 is expressly limited to public review periods for a "draft environmental impact report" or a "negative declaration." Pub. Res. Code §21091(a)and(b). Thus, section 21091 is inapplicable to the Coastal Commission's regulatory program, which does not involve preparation of a "draft environmental impact report" or "negative declaration." Additionally, section 21080.5 has its own provision requiring a "reasonable" time for public review and comment, not a 30-day period. Pub. Res. Code §21080.5(d)(3). Had the Legislature intended section 21091 to apply to a certified regulatory program or trump the specific notice and review period provided in section 21080.5, it would have said so. Moreover, to the extent that the provisions conflict, section 21080.5 is more specific than the general review period in section 21091.

Finally, the Coastal Commission argues that "CEQA specifically recognizes that there may be inconsistencies or conflicts between its provisions and the Coastal Act and provides that in such a situation the Coastal Act controls." La Costa Beach Homeowners Assoc. v. California Coastal Commission, *supra*, 101 Cal.App.4th at 820; Pub. Res. Code §21174. No other entity with a certified regulatory program is so favored by the Legislature. Under Section 21174, the time limits set in the Coastal Commission's regulations control in the event of any conflict.

The problem with all of the Coastal Commission's arguments is that they are foreclosed by Ultramar, Inc. v. South Coast Air Quality Management District, ("Ultramar") (1993) 17 Cal.App.4th 689, 699. In Ultramar, the court held that the South Coast Air Quality Management District ("SCAQMD"), a section 21080.5 certified regulatory agency, was bound by section 21091's 30 day review period for its environmental assessment, the functional equivalent to an EIR. The court stated that "[t]he fact that [section 21091] section refers to EIR's, rather than [environmental assessments of a certified regulatory agency], is of no consequence." Id. at 699.

In Joy Road Area Forest and Watershed Assn. v. California Dept of Forestry (2006) 142 Cal.App.4th 656, the Department of Forestry, a certified regulatory agency, made similar arguments to those made by the Coastal Commission. Forestry had made numerous and significant changes to its initial timber harvest plan ("THP") without new notice and recirculation. The department argued that its regulatory program was excused under section 21080.5 from any CEQA provision concerning the "EIR process," that a THP is not an EIR, and that the timing for EIRs does not apply to a THP. The court swiftly rejected this argument by construing CEQA's references to EIR to mean THPs. The department also argued that its governing statute had different methodology of providing notice than CEQA. The court found that this difference had no bearing on the need for notice when significant new information is added to a THP. Id. at 669. Finally, the department argued that since its governing statute specifically addressed public inspection and review of a THP, it took precedence over CEQA. The court failed to see how there was a conflict. Indeed, it found that the two statutes supplement each other and should be harmonized. Id. at 669-70. Therefore, the department was not excused from complying with CEQA's substantive notice and recirculation requirements. Ibid.

Ultramar is on point and controls this case, and Joy Road further supports that conclusion. As the Coastal Commission argues, Ultramar is a case where the agency's own regulations required a 30 day review of staff reports. Moreover, Joy Road did not involve the application of section 21091 or a certified regulatory program that includes specific time limits for distribution of staff reports. But these factual distinctions have no bearing on Ultramar's express holding, which is that a certified regulatory program must comply with section 21091. The court did so on based on the fundamental analysis that a certified regulatory program is exempt only from Chapters 3 and 4 and section 21167 of CEQA. Since section 21091 is part of chapter 2.5, the SCAQMD was not exempt. The court noted that an interpretation of section 21080.5 which permits shortening of the 30 day public comment period would thwart CEQA's legislative intent. 17 Cal.App.4th at 700. The Ultramar court did not rely on SCAQMD's own regulations for this conclusion about section 21091. 17 Cal.App.4th at 702-03. *See* Joy Road, 142 Cal.App.4th at 671-72 (discussing Ultramar's holding).

Ultramar mandates that section 21091's 30 day public comment period apply to the Coastal Commission's staff report. This leaves only the Coastal Commission's argument that another CEQA provision (section 21174) provides that conflicts between the Coastal Act and CEQA must be reconciled in favor of the Coastal Act. Thus, the Coastal Act "trumps" CEQA where there is a conflict, and this provides a basis for distinguishing Ultramar and Joy Road because no similar provision favored the agencies in those cases.

The Coastal Commission points to no inconsistency between the notice provisions in section 21174 and the Coastal Act. Instead, it merely argues that there is an inconsistency between its *regulations* and CEQA. But CEQA trumps, and need not defer to, the Coastal Commission's regulations. Additionally, there is no inconsistency between the Coastal Commission's 10 day notice and section 21091 30 day notice. Just as with CEQA and the governing forestry statute in Joy Road, the Coastal Act and CEQA are supplemental statutes which must be harmonized, if possible. The is no inconsistency in layering CEQA's 30 day notice requirement over the Coastal Commission's 10 day *minimum* notice requirement.

In sum, the Coastal Commission is governed by section 21091's requirement for a 30 day review period for its staff report, the functional equivalent of an EIR. It did not provide 30 days for public comment. Pub. Res. Code section 21168.5 provides that an agency decision may be set aside only if there was a prejudicial abuse of discretion. Abuse of discretion is established if the agency did not proceed in a manner required by law. Ibid. Although lack of adequate notice usually requires prejudice in other contexts, and there is no evidence that Littlejohn or any other member of the public was prejudiced by the 10 day period for comment on the staff report, full compliance with the letter of CEQA is essential to its public purpose and a failure to provide the full 30 day period by itself warrants setting aside the Coastal Commission's decision. *See* Ultramar, *supra*, 17 Cal.App.4th at 701-02, 703-04. *See also* Gilroy Citizens for Responsible Planning v. City of Gilroy, (2006) 140 Cal.App.4th 911, 922.[5]

Date: November 5, 1997

STATE OF CALIFORNIA
DEPARTMENT OF PARKS AND RECREATION
PERMIT TO ENTER

Permission is hereby granted to: Ralph W. Kiewit, Jr., 114 Malibu Colony, Malibu, California 90265, (310) 456-8565, hereinafter referred to as PERMITTEE, to enter Malibu Lagoon State Beach; for the purpose of installing and maintaining a gate value on an existing drainage pipe, and installing an inside "liner" in existing drainage pipe.

The rights and privileges hereby granted to PERMITTEE at the option of PERMITTEE, may be exercised by any authorized agent or contractor of PERMITTEE.

By acceptance of this Permit to Enter, it is expressly understood and agreed by and between the parties that PERMITTEE agrees to indemnify and hold the undersigned and STATE harmless against any and all loss, damage and/or liability which may be suffered or incurred by STATE and against any and all claims, demands and causes of action that may be brought against STATE caused by, or arising out of, or in any way connected with the use and/or occupancy of said further agrees to assume full responsibility for any and all damages caused by PERMITTEE'S operation under this Permit and PERMITTEE shall, at its option, either repair or pay for such damages.

PERMITTEE shall adhere to the following conditions:

1. No grading, digging or any other type of soil manipulation is allowed., except for existing digging to allow replacement of corrugated existing pipe to receive gate valve. (Approximate 8 Ft. section at entry end.)

Sincerely,

Daniel C. Preece Date 11-6-97

Daniel C. Preece, District Superintendent
Angeles District
State of California
Department of Parks and Recreation

ACCEPTED:

Ralph W. Kiewit, Jr. Date November 5, 1997

Ralph W. Kiewit, Jr.

R A L P H W. K I E W I T, J R.

SUITE 710
15233 VENTURA BOULEVARD
SHERMAN OAKS, CALIFORNIA 91403-2201
TELEPHONE 818 990-4500
FACSIMILE 818 501-3127

November 3, 1997

Via Facsimile - 310 589-1522

Mr. Russell G. Guiney
Malibu Sector Superintendent
State of California
Department of Parks and Recreation
Angeles District/Malibu Sector
39996 Pacific Coast Highway
Malibu, CA 90265

Re: 12 Inch Corrugated Metal Drain Pipe into Malibu Lagoon

Dear Russ:

You will recall your prompt assistance to us when my flap valve (installed as a result of meetings between you, I and Rick Morgan, Malibu City Engineer) was jammed open by debris and the Lagoon waters backed into the east section of the Malibu Colony. There was a lot of environmental opposition to the breaching of the beach and drainage of the Lagoon although it was certainly necessary.

To prevent future occurrences I and my neighbor decided to install a gate valve at the entry end. Although both the entry and discharge portions of that pipe are on State land, I'm certain that it enjoys a Prescriptive Easement as it was there long before the Lagoon was developed in its present state.

True, we were going to install the gate valve without paper work permission as we were sure you would approve this double safety device to prevent future Lagoon water back ups into the Colony. As luck would have it, last week just as we were starting to prepare for installation of the gate valve the construction work was stopped by a group of "volunteer State Environmentalists" (as I understand it) who wanted the work stopped, said the State ought to pay for the work if it were necessary and prevented us from completing the work while the Lagoon was naturally breached. We thought the entry end hidden in the trees outside my property fence would not be observed and the job easily completed.

I am the R.M.O. as President for Unitco Realty and Construction Company, Inc. which holds an active State of California "B" Contractors License. I enclose copy of my Family Trust Asset Statement total as of September 30, 1997. As Trustee of my Family Revocable Trust I will indemnify the State of California and its Department of Parks and Recreation against claims for damages resulting from the construction work in the installation of the gate valve on my Prescriptive Easement 12 inch corrugated metal drain line.

I would like your approval to complete this gate valve installation under the above conditions, it being in the best interests of the State, the Environmentalists and the Malibu Colony east end property owners.

I will be at home early Tuesday morning, November 4, 1997 working with glass men on my house at 114 Malibu Colony. If you should want to visit the site please call at 310 456-8565 and try to get there before 10:00 A.M.

With best regards.

Sincerely yours,

RALPH W. KIEWIT, JR., Trustee of
Ralph W. Kiewit, Jr. Family
Revocable Trust of 1991

RWK:mc

Attachments

CC By FAX: Mr. Carl Deutsch - 310 453-6467
Steve Littlejohn Construction - 310 456-2978

R A L P H W. K I E W I T, J R.

SUITE 710
15233 VENTURA BOULEVARD
SHERMAN OAKS, CALIFORNIA 91403-2201
TELEPHONE 818 990-4500
FACSIMILE 818 501-3127

June 18, 1997

Via Facsimile 310 589-1522

Mr. Russell G. Guiney
Malibu Sector Superintendent
State of California
Department of Parks and Recreation
Angeles District/Malibu Sector
39996 Pacific Coast Highway
Malibu, CA 90265

Re: Malibu Lagoon

Dear Mr. Guiney:

Confirming today's telephone conversation, the Malibu Lagoon high level is backing into the Colony east end drainage pipes (flap valve inoperative due to debris in the Lagoon) and inundating my home property carport, driveway, rear yard and septic system (23331 Malibu Colony Drive, Malibu, CA).

My immediate neighbor Carl Deutsch is suffering water damage in that the lagoon water is inundating his tennis court and surrounding yard.

We request immediate help from any source to make sure the Lagoon is drained to the Ocean at the earliest possible moment. **We are suffering property damage and this emergency situation grows by the hour.**

Sincerely yours,

RALPH W. KIEWIT, JR.

RWK:mc

cc by FAX: Carl Deutsch 310 453-6467

453-0055

CARL DEUTSCH
2444 WILSHIRE BOULEVARD · ROOM 600
SANTA MONICA, CALIFORNIA 90403

18 June 1997

Mr. Russell G. Guiney
Malibu Sector Superintendent
STATE OF CALIFORNIA
Deparmtent of Parks and Recreation
Angeles District/Malibu Sector
39996 Pacific Coast Highway
Malibu, CA 90265

FAX: (310) 589-1522

RE: EMERGENCY SITUATION / MALIBU LAGOON

Dear Mr. Guiney:

My tennis court property and surrounding yard area located at 23337 Malibu Colony Road, along with neighboring property belonging to Mr. Ralph Kiewit, is being inundated by water that is backing up from the Lagoon.

It appears that debris in the Lagoon is clogging the drainage pipes.

We appeal to you for assistance on an immediate basis.

Thank you, in advance, for any help you can provide.

Very truly yours,

Carl Deutsch

Carl Deutsch

cc: R. Kiewit FAX: (818) 501-3127

RECEIVED
JUN 1 8 1997
UNITCO MGMT. CO.

Toni Littlejohn
23425 Malibu Colony Drive
Malibu, CA 90265

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

Dear Ms. Neely and Mr. Ainsworth:

I am very concerned about the proposed changes to the Malibu Lagoon, a major coastal resource in Los Angels County and the extremely short notice concerning this project. Since the law (CEQA - California Environmental Quality Act) requires that the public have 30 days to review the staff report, and the posting for the August hearing does not meet that requirement, I strongly urge you to postpone the currently scheduled August hearing on Malibu Lagoon.

We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Toni Littlejohn

Toni Littlejohn
Daughter of Malibu Colony resident William Littlejohn

GEOFFREY M. NATHANSON

RECEIVED
AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

August 6, 2010

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
South Central Coast District Office
89 South California Street, Suite 200
Ventura, CA 93001- 2801

Re: Rescheduling of Item TH 19a to be heard in San Luis Obispo on August 12, 2010

Dear Ms Neely:

I am a 49 year resident of Malibu, and I live within 200 yards of the Malibu Lagoon. I am very concerned about the future of this beautiful nature preserve and some of the major changes proposed in the Malibu Lagoon Restoration Project as they appear today. Of concern also is the impact that the proposed project will have on the security, safety and privacy enjoyed by my family and my neighbors in the adjacent Malibu Colony.

I received notice of this proposed hearing before the Commission on August 12 only a few days ago. It was dated July 30, 2010. It is my understanding that by tradition and perhaps by statute notice of a hearing before the Commission should have been originated 30 days prior to a scheduled hearing which obviously was not the case in this matter. I am requesting therefore that the hearing be rescheduled for a later date and preferably at a location here in Southern California. This will give the public additional time to study the proposal, meet with its proponents, and discuss the concerns I have mentioned above.

Thank you for your consideration

Geoffrey Nathanson

84 Malibu Colony Malibu CA 90265 (310) 456-0338 fax (310) 456-0671 hnagin@verizon.net

MICHAEL E. TENNENBAUM

RECEIVED
AUG 10 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

August 10, 2010

Via Facsimile 805-641-1732

The Honorable Bonnie Neely
Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801

Dear Ms. Neely and Mr. Ainsworth,

I have resided at this location for 33 years and am very distressed at the fire hazard that exists by reason of the illegal plants growing near my house on Malibu Lagoon property. We are not permitted such plants in the fire zone and these should be removed immediately. I am advised that your Lagoon project will add additional illegal plants and contribute to the fire hazard. The responsible persons should certify that is not the case and should become personally responsible if they violate that certificate.

I understand that the storm drainage from Malibu Colony to the Lagoon will be eliminated as part of the Lagoon project. I believe that we are grandfathered in that right and a flood hazard to our homes that have been here for almost 100 years is untenable. Kindly advise how you propose to deal with the Malibu storm drainage as part of this project.

Sincerely,

Michael E. Tennenbaum

MET:sjk

118 Malibu Colony Road, Malibu, California 90265
310-566-1001 Phone 310-899-4950 Fax
Michael@TennenbaumCapital.com

William Littlejohn
23425 Malibu Colony Drive
Malibu, CA 90265

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

Dear Ms. Neely and Mr. Ainsworth:

I am very concerned about the proposed changes to the Malibu Lagoon, a major coastal resource in Los Angels County and the extremely short notice concerning this project. Since the law (CEQA - California Environmental Quality Act) requires that the public have 30 days to review the staff report, and the posting for the August hearing does not meet that requirement, I strongly urge you to postpone the currently scheduled August hearing on Malibu Lagoon.

The Commission should reschedule this item for the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Sincerely,

William Littlejohn

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

RECEIVED
AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

Dear Ms. Neely and Mr. Ainsworth:

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We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Judith Israel
JUDITH ISRAEL
23349 MALIBU Colony Rd
MALIBU 90265

AUG-09-2010 09:42 FROM: TO:8056411732 P.1/1

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

RECEIVED
AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

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We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Carl & Roberta Deutsch

#112 MALIBU COLONY

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

RECEIVED
AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

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We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Robert W Kiwitt OWNER 23334 MALIBU COLONY Dr. CA 90265
23331 MALIBU COLONY Dr. CA 90265

RECEIVED
AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

August 9 -2010

To:
California Coastal Commission
The Honorable Bonnie Neely, Chair
John Ainsworth, Deputy Director
Fax:805-641-1732

From: V. Donnovan Field
108A Malibu Colony Drive
Malibu, Ca 90265 –Fax 310-456-9971

Re: Extremely short notice regarding Malibu Lagoon proposed major project. The law requires that we have 30 days to review the report and the posting for the August hearing does not meet that requirement. We did not have this.

This project will have a major ecological effect – actually removing all wildlife and plants and diverting water patterns which have been established for years.

The law requires we have proper notice. The August hearing does not meet that requirement.
Please as the California Coastal Commission, schedule this project discussion at the next Los Angeles County/Orange County hearing slated for November.

Any attention you can give this matter will be appreciated. It is important to everyone to do things properly. Thank you.

V. Donnovan Field

RECEIVED
AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

Dear Ms. Neely and Mr. Ainsworth:

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We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Andrea Jose
107 Malibu Colony
Malibu Ca 90265

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

RECEIVED
AUG 11 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

Dear Ms. Neely and Mr. Ainsworth:

I am very concerned about the proposed changes to the Malibu Lagoon, a major coastal resource in Los Angels County and the extremely short notice concerning this project. Since the law (CEQA - California Environmental Quality Act) requires that the public have 30 days to review the staff report, and the posting for the August hearing does not meet that requirement, I strongly urge you to postpone the currently scheduled August hearing on Malibu Lagoon.

We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Elizabeth B. Gabler

Phillip Roman and Company
Corporate Mergers & Acquisitions
Established 1946

RECEIVED
AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

8-9-10

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

Dear Ms. Neely and Mr. Ainsworth:

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We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Phillip Roman

5670 Wilshire Boulevard, Suite 2420 Los Angeles, California 90036
Telephone: 323-935-3500 Facsimile: 323-935-3520

RECEIVED
AUG 11 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

Malibu Colony Association
23554 W. Malibu Road
P.O. Box 928
Malibu, CA 90265
P: 310.456.2021
F: 310.456.2951
Email: malibucolony@earthlink.net

August 9, 2010

Via Facsimile and Mail

The Honorable Bonnie Neely, Chair
& Honorable Commissioners, California Coastal Commission
& Jack Ainsworth, Deputy Director, California Coastal Commission
89 South California Street, Ste. 200
Ventura, CA 93001

Re: Application# 4-07-098
Malibu Lagoon Wetland Habitat Restoration & Enhancement Project

Dear Commission Chair Neely, Coastal Commissioners & Mr. Ainsworth:

As you are aware, the Staff Report issued by the California Coastal Commission regarding the Malibu Lagoon has just become public on July 30. With a hearing date of August 12, 2010 at the Coastal Commission to decide the fate of this report, there is not sufficient time for neighbors, such as homeowners in the Malibu Colony, to analyze and provide meaningful input. The Malibu Lagoon is so important to our residents and community, we respectfully request that the hearing be postponed for at least 30 days to provide ample time for review and comment. We also request that the Commission should consider a hearing date in the Los Angeles area (rather than Eureka) so that more of our residents are able to attend and provide their input.

Please let us know as soon as possible of your decision in this important matter.

Very truly yours,

R. Reiner

Richard F. Reiner
President
Malibu Colony Association

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

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We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Margo and Irwin Nuke

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
c/o Jack Ainsworth, Deputy Director
89 South California Street, Suite 200
Ventura, CA 93001-2801
(805) 585-1800
FAX (805) 641-1732

Dear Ms. Neely and Mr. Ainsworth:

I am very concerned about the proposed changes to the Malibu Lagoon, a major coastal resource in Los Angels County and the extremely short notice concerning this project. Since the law (CEQA - California Environmental Quality Act) requires that the public have 30 days to review the staff report, and the posting for the August hearing does not meet that requirement, I strongly urge you to postpone the currently scheduled August hearing on Malibu Lagoon.

We feel the Commission should schedule this item at the next Los Angeles County/Orange County hearing - which is slated for November.

Thank you very much for your attention to this matter.

Respectfully,

Carolyn Dirks
Greg Dougherty

#Malibu Colony
83

The Honorable Bonnie Neely, Chair, California Coastal Commission
& Honorable Coastal Commission
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COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

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Thank you very much for your attention to this matter.

Respectfully,

Susan Dolgen
23438 Malibu Colony Road
Malibu Ca 90265

City of Malibu

23815 Stuart Ranch Road • Malibu, California • 90265-4861
Phone (310) 456-2489 • Fax (310) 456-3356 • www.ci.malibu.ca.us

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AUG 09 2010
CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

August 6, 2010

Chair Bonnie Neely and the Members of the
California Coastal Commission
Attn: A. Tysor
89 South California Street, Suite 200
Ventura, CA 93001

Re: 8/12/10 Agenda Item Malibu Lagoon State Park, City of Malibu, Los Angeles County
CCC CDP Application No.: 4-07-098

Dear Chair Neely and Members of the Commission:

I write in support of the long-awaited Malibu Lagoon Restoration Project ("project"); and, although the project provides an opportunity for improvements to an impaired water system, I also write to convey significant potential environmental consequences that must be addressed in the permit. The City of Malibu is committed to improving and protecting water quality and, to that end, the City appreciates your consideration of the following concerns.

The City requests that before the permit is approved, the Coastal Commission do the following:

1. Satisfy its obligations under CEQA by studying and identifying the potential environmental consequences of the project. The hydrology in the Lagoon is complex and recent studies (attached and discussed in detail below) have shed new light on the existence of bacteria and nutrients in the water. These finding suggest that the proposed work has the potential to increase bacteria and nutrients in the water. The Commission must fully understand the potential impacts expected from disrupting this complex hydrologic system before approving the permit.

2. Impose adequate mitigation measures for the project to mitigate and prevent degradation of water quality in the area.

3. Require monitoring before, during and after the project. The proposed bi-annual monitoring plan is not adequate to understand the baseline water condition before the project begins. Without a baseline from which to measure, the scientists cannot determine the impact that this project will have on water quality. The City also requests the Commission require more frequent monitoring to identify promptly activities that are degrading the water quality. The project will likely increase Total Coliform, Fecal Coliform and Enterococcus at Surfrider Beach during the height of recreational activities. The City and other watershed agencies can potentially be held responsible for

bacteria exceedances at Surfrider Beach and it is imperative that the monitoring be frequent enough to enable the permittee to identify and promptly cease activities that degrade the water quality in the area. The permit only contemplates potential impacts on Malibu Creek fresh water and needs to properly account for potential impacts at Surfrider Beach as well.

Additionally, the City has the following comments with respect to the water quality in the Lagoon.

1) The Santa Monica Bay Beaches Bacterial Total Maximum Daily (TMDL) Load limits are set for three constituents (Total Coliform, Fecal Coliform and Enteroccoccus)(FIB); however, the permit only references Total Coliform in one chart, and Fecal Coliform in another reference. The monitoring plan should address and require monitoring for all constituents subject to TMDLs in the area. Periodic sampling for human markers may also help participating agencies understand the source of bacteria.

2) Lagoons and estuaries, like Malibu Lagoon, are known to cause a net increase in bacteria loads especially when the physical conditions constrain naturally functioning systems. Research shows that high fecal indicator bacteria at Surfrider Beach and other coastal sites is most likely from bird feces in the sand and kelp, decaying vegetation and naturally occurring bacteria released from the lagoon sediments. (See exhibits 12, 14, 15, 21, 22, 24, 26 and 31). Further, monitoring results are particularly affected if the sample is taken at high tide and early in the day.

   Recent studies by the United States Geological Survey (USGS) demonstrate that even when the Malibu Lagoon sand berm is closed, that fecal indicator bacteria can pass through the berm and affect sampling results at Surfrider Beach, if certain conditions are present. Additionally, multiple studies show that even when no human markers were present, fecal indicator bacteria limits were exceeded at Surfrider Beach. (See 13, 28, 32).

   The project proposes to increase tidal exchange. This exchange is not clearly defined but presumably, the number of events and length of time the berm is open may increase during construction and as a result of the project. The historical monitoring records show that fecal indicator bacteria loads increase, and often exceed regulatory limits more often, when the berm is open.

3) The City supports the following restoration elements; however, as adequate environmental analysis demonstrates, the project has the potential to increase FIB and nutrient levels in Malibu Lagoon and Surfrider Beach. To mitigate such adverse impacts consider the following:

   a. Re-contouring the slopes for the 12-acre western arms of the lagoon to create broad shallow slopes will increase the surface area and lagoon sediment area. This may increase the release of naturally occurring bacteria that will increase the potential for FIB exceedances at the three sample sites at Surfrider Beach, SMB – MC 1, 2 and 3 – commonly known as Malibu Lagoon, Malibu Pier and Malibu

Colony. Malibu Colony sample station is actually seaward of the lagoon at the most western extent. These exceedances can occur when the berm is open or closed. Re-contouring could also affect nutrients released from the lagoon sediment. The project is expected to more effectively reduce stagnation and increase oxygen availability in the lower depths of the lagoon through improved horizontal mixing. The recent Lagoon studies indicate that the lower depths host the naturally occurring bacteria, which will now be more readily released to the surface waters where samples are collected.

b. Revegetation may increase bacteria produced from the natural decaying process – more bank surface area and more vegetation will result in higher levels of bacteria. There may be some time periods when slow transit time can help remove bacteria by the vegetation; but in most scenarios, there will a net increase of bacteria. It is noted that improved circulation and increased tidal flow, a goal of the project, will decrease contact time with lagoon plants capable of removing some bacteria. The project anticipates that there will be an increase in the discharge volumes and events at Surfrider Beach and affect water quality at sampling sites.

c. The project proposes to increase the mudflats on the Eastern bank near the Adamson Boat House. This activity will increase foraging and bird habitat, surface area sediment contact, and bird feces, which is likely to increase the bacteria in Lagoon waters and can impact water quality at Surfrider Beach. Exhibit 20, water sampling location map, shows no sampling proposal for this element of the project. FIB exceedances were experienced in this specific area of Malibu Lagoon, as discussed in the recent UCLA and USGS studies. The City requests the permit be revised to include a 9th sampling location between the newly created mudflats and boathouse channel and the Lagoon sand berm.

d. The staff report, environmental analysis and permit fail to consider the potential of spreading the invasive New Zealand mudsnails (known to inhabit Malibu Lagoon). The permit should include conditions to ensure that equipment and tools used at the project site are subject to the current protocol to prevent the spread of the snails to other reaches or other creeks where the equipment may do future work. Soil disposal activities must be similarly conditioned. Vegetation removal and dispersal could also transfer this highly invasive species. Many of the background studies referenced in the staff report were conducted prior to the invasion of the New Zealand mudsnail; hence, the staff report and permit does not adequately address this concern.

e. Include a provision to indemnify the City for any water quality violations that arise from exceedances caused by or primarily contributed to as a result of the Lagoon Restoration Project.

f. The background studies referenced in the staff report have been superseded with more recent studies that can provide relevant information about the complex hydrology in the Lagoon and surrounding areas. The staff report only refers to a 1999 URS Greiner Woodward Clyde study and the 2004 Stone Environmental study related to impacts from onsite wastewater treatment systems. These references have been enhanced by extensive relevant studies conducted by UCLA (28, 32) and USGS (21, 22, 24, 26, and 31), and SCCWRP (13, 14, 20).

g. Historical drainage from the Malibu Colony residential neighborhood may be significantly impacted by the project. The City has agreed to allow two, 4 inch drain diversions into its Civic Center stormwater treatment facility (SWTF) if there is a bypass to account for overflow. This will allow for diversion of dry-weather urban runoff and limited stormwater flows so that it can be treated and disinfected; however, the surface flows have not been accounted for in the permit. Malibu Colony residents have reported concerns that the project's proposed solid block wall could obstruct historically occurring surface flows from the rear yards with potential flood impacts, if a mitigation measure is not required. The City requests a revision to the project plan to account for these surface flows and prevent significant flooding during rain events.

Again, the City supports a more efficient, better functioning lagoon system, but requests that the project be properly conditioned to prevent any unintended water quality degradation. Adequate environmental analysis is essential to determine the appropriate mitigation measures.

The following questions and comments from the staff report should also be addressed before the permit is issued:

Page 11 3.A.e. If construction equipment cannot be cleaned on the temporary berm, parking lot or trails, where does the permit specify that cleaning will take place?

Page 12 4. The dewatering Plan focuses on protection of aquatic species; however, human heath could be affected depending on when and where the water is discharged and the results of increasing flow rates within the Lagoon.

Page 15 iv., c. and d. Sediment samples should also include FIB analysis and appropriate human markers analysis. Vertical profiles should be conducted quarterly, note all physical conditions, and be performed throughout the day to account for heat, sunlight, and tidal influences.

Page 16 & 17 Success Measures and Supplemental Measures

The report fails to discuss the increase in bacteria and resulting potential impact on human health for swimmers and surfers at Surfrider Beach. Since research shows that lagoons and estuaries contribute bacteria to the near shore sampling locations, what measures will be required if there is an increase in bacteria?

Page 24 16. Any excavated material should be monitored for the presence of New Zealand mudsnail.

Page 28 Dewatering

It is not clear from the project description where water will be discharged. If it is discharged into the main channel of the Lagoon, the discharge will cause an unnatural breach of the Lagoon berm and increase FIB loads at Surfrider Beach. The proposed filtration methods using carbon and resin vessels will not disinfect, and using only chlorine for disinfection at these flow rates is not recommended. The proposed list of constituents for testing only includes fecal coliform. All three FIB must be monitored during the dewatering process.

The City is also concerned about the dewatering process and the disinfection required prior to dispersal near Surfrider Beach. The staff report does not provide enough information about the Los Angeles Regional Water Quality Control Board's dewatering permit, the discharge location(s) and the actual constituents to be monitored. The City requests more information on the permit and has requested also requested a copy from the RWQCB.

Page 33 Riparian Forest Picnic Area

It is not clear whether or not this area will include a public toilet facility. The project should include a pubic facility, as the nearest facility is quite far from this area. City staff has observed toilet paper remains in the area, indicating that visitors may not go find the nearest public facility.

Page 33 "Adamson House Wall" is actually the Malibu Colony Wall

As noted earlier, an unintended consequence of the solid concrete masonry wall may increase flooding in the neighborhood directly to the south of the project if historical surface flows are subsequently impeded. There was no analysis of potential impacts or mitigation measures in any engineering study provided in the CCC staff report or environmental review documents for the project.

Page 42 and 43 Water Quality Conditions

The reference studies were conducted prior to 2005. The baseline for nutrients and bacteria should be determined from more contemporary studies and from studies that utilize state-of-the-art analytical methodologies. There has been extensive research conducted in the groundwater and surface waters that migrate to Malibu Creek and Lagoon and significant capital improvement projects have been completed since 2005. Aging onsite wastewater treatment systems along Malibu Creek have been replaced with the most advanced treatment systems. Since 2007, almost all surface flows from the Malibu Lagoon sub-watershed have been intercepted, filtered and disinfected resulting in the elimination of bacteria and significant removal of nutrients from the developed areas in the Malibu Civic Center.

In 2009, USGS conducted extensive nutrient and bacteria monitoring throughout the Civic Center area, near shore, Lower Malibu Creek, Malibu Lagoon and upcoast in the Malibu Colony and just off shore in both dry- and wet-weather conditions when the berm was closed and open. The primary source of bacteria is from natural sources such as avian feces deposited into the Creek and Lagoon, decaying vegetation, avian feces in the kelp and sand. Using the most up to date analysis, no human bacteria was found at Surfrider Beach by the University of California at Los Angeles (28, 32) nor in Malibu Creek and Lagoon or Surfrider Beach by researchers from SCCWRP in 2005 (13, 14 and 20) and in the extensive investigations by USGS in 2009 (21, 22, 24, 26, 31).

The Commission's staff report comments on Page 43 that the source of fecal indicator bacteria is from wastewater treatment facilities upstream and leaching from septic systems in the immediate vicinity of the Lagoon. This statement is not accurate; recent scientific data indicate that bacteria comes from avian sources and kelp, among other things. These attached studies should be considered, as they provide the best data on Lagoon Hydrology.

The City also requests the opportunity to review and comment on the final water monitoring plan before the Executive Director approves the plan. All water quality sampling during and post-construction must reflect the regulatory requirements for Santa Monica Bay Beaches Bacteria TMDL, since the project description anticipates a high likelihood that the berm will breach and/or there will be direct discharge to Santa Monica Bay. This would include Total coliform, Fecal coliform and Enteroccoccus. The staff report states that the permit allows for the discharge of 1.3 million gallons per day into Santa Monica Bay. Chlorination alone, without ozone or ultraviolet disinfection, is an uncertain process, especially for the high volume and flow rate anticipated.

Lastly, the City would request that the Project Manager provide contact information where he or she can be reach 24 hours a day, seven days a week. The public will generally contact the City of Malibu with emergency concerns and having this information will reduce response time.

Thank you for your consideration of these comments

Sincerely,

Jim Thorsen
City Manager

Enclosures: City of Malibu Comment Letter Reference Documents

Cc: Mayor Wagner and Honorable Members of the Malibu City Council
Christi Hogin, City Attorney
Los Angeles Regional Water Quality Control Board

City of Malibu Comment Letter Reference Documents

	Title	Author	Date	Notes
12	Enumeration and Spaciation of Enterococci Found in Marine and Intertidal Sediments and Coastal Water in Southern California	Ferguson, Moore, et al.	January 2005	Journal of Applied Microbiology
13	Multi-Tiered Approach Using Quantitative Polymerase Chain Reaction For Tracking Sources of Fecal Pollution to Santa Monica Bay	Noble, Griffith, Blackwood, et al.	February 2005	Southern California Coastal Water Research Project Also published in American Society for Microbiology
14	Modeling the Dry-Weather Tidal Cycling of Fecal Indicator Bacteria in Surface Waters of an Intertidal Wetland	Sanders, Arega, and Sutula	July 2005	Department of Civil and Environmental Engineering, UC Irvine and Southern California Coastal Water Research Project
15	Final Report: Identification and Control of Non-Point Sources of Microbial Pollution in a Coastal Watershed	Sanders, Grant, Horne, et al.	February 2006	United States Environmental Protection Agency-National Center for Environmental Research
20	Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams	Tiefenthaler, Stein and Lyon	January 2008	Southern California Coastal Water Research Project
21	Coastal groundwater dynamics off Santa Barbara, California: Combining geochemical tracers, electronic seepmeters, and electrical resistivity	USGS Swarzenski, Izbicki	April 2009	Estuarine, Coastal and Shelf Science published by Elsevier
22	Sources of Fecal Indicator Bacteria in Urban Streams and Ocean Beaches, Santa Barbara	Izbicki, Swarzenski, et al	September 2009	United States Geologic Survey, Annals of Environmental Science
24	Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu	Izbicki, Swarzenski, et al	Interim Reports: 10/29/09, 1/11/10, 2/18/10	City of Malibu - United States Geologic Survey – Dry Weather
26	Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu	Izbicki, Swarzenski, et al	May 2010	City of Malibu - United States Geologic Survey – Wet Weather Power Point Presentation to RWQCB staff
28	Malibu Lagoon Bacterial Study PowerPoint Presentation	Ambrose, Jay et al	05/25/10	UCLA Bacterial study comparing FIB with Human-Specific bacteriodes in Lower Malibu Creek, Malibu Lagoon and Surfrider Beach
31	Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu	Izbicki, Swarzenski, et al	Report 6/25/10	City of Malibu - United States Geologic Survey – Wet Weather
32	Malibu Lagoon Bacterial Study	Ambrose, Jay et al	Report July 2010	UCLA Bacterial study comparing FIB with Human-Specific bacteriodes in Lower Malibu Creek, Malibu Lagoon and Surfrider Beach

 doi:10.1111/j.1365-2672.2005.02660.x

Enumeration and speciation of enterococci found in marine and intertidal sediments and coastal water in southern California

D.M. Ferguson, D.F. Moore, M.A. Getrich and M.H. Zhowandai
Orange County Public Health Laboratory, Newport Beach, CA, USA

2004/1187: received 14 October 2004, revised 24 January 2005 and accepted 25 January 2005

ABSTRACT

D.M. FERGUSON, D F. MOORE, M.A. GETRICH AND M.H. ZHOWANDAI. 2005.

Aims: To determine the levels and species distribution of enterococci in intertidal and marine sediments and coastal waters at two beaches frequently in violation of bacterial water standards.

Methods and Results: Faecal indicator bacteria were extracted from sediment and enumerated using membrane filtration. High levels of enterococci were detected in intertidal sediments in a seasonal river and near a storm drain outlet. Low levels were found in marine sediments at 10 m depths and in surf zone sand. Bacterial isolates presumptively identified as *Enterococcus* on mEI media were speciated. The predominant species found in both water and sediment included *Enterococcus faecalis*, *Enterococcus faecium*, *Enterococcus hirae*, *Enterococcus casseliflavus* and *Enterococcus mundtii*. A number of isolates (11–26%) from regulatory water samples presumptively identified as enterococci on mEI media were subsequently identified as species other than *Enterococcus*. At both study sites, the distribution of species present in water was comparable with those in sediments and the distribution of species was similar in water samples passing and exceeding bacterial indicator standards.

Conclusions: High levels of *Enterococcus* in intertidal sediments indicate retention and possible regrowth in this environment.

Significance and Impact of the Study: Resuspension of enterococci that are persistent in sediments may cause beach water quality failures and calls into question the specificity of this indicator for determining recent faecal contamination.

Keywords: beach pollution, enterococci, faecal indicator bacteria, marine sediments, water quality.

INTRODUCTION

In 1999, California adopted new, more extensive ocean recreational water quality standards (AB411 1999). The United States Environmental Protection Agency (USEPA) numerical standards for enterococci, total coliform and faecal coliform bacteria (USEPA 1986), which are used to indicate faecal contamination in marine waters, were implemented along with regulations for increased testing of recreational water. In southern California, the implementation of all three faecal indicator bacteria standards along with intensified testing led to an increased number of beach sites that exceeded standards (Noble *et al.* 2003). Beaches that fail any of these standards must be posted with warning signs or closed for swimming. The *Enterococcus* standard has proven to be the most sensitive of the three indicator bacteria. In the summer dry weather season, 60% of water quality failures are the result of exceedances of the *Enterococcus* standard alone (Noble *et al.* 2003). Summer beach postings and closings have resulted in public pressure on governmental agencies to take action to improve recreational water quality.

The two beaches studied here are representative of southern California open ocean and harbour pocket beaches

Correspondence to: Donna M. Ferguson, Orange County Public Health Laboratory, 700 Shellmaker Road, Newport Beach, CA 92660, USA (e-mail: dferguson@ochca.com).

with ongoing bacterial indicator failures during summer dry weather. Numerous studies conducted at both sites ruled out obvious large point sources of faecal contamination such as leaking sewer lines and outfalls. Nonpoint sources, including urban runoff were suggested, but no definitive source(s) were identified (Grant *et al.* 2001; Boehm *et al.* 2002; Kim *et al.* 2004; Noble and Xu 2004). Subsequently, water quality improvement projects, including storm drain diversions were implemented. Yet, indicator failures at these beaches continue. In this study, we investigate a less obvious nonpoint source of indicator bacteria: intertidal or marine sediments. Laboratory and field studies have demonstrated long-term survival of indicator bacteria such as *Escherichia coli* and other faecal coliforms in sediments (Gerba and McLeod 1976; LaLiberte and Grimes 1982). High densities of faecal coliforms (Valiela *et al.* 1991), faecal streptococci (Sayler *et al.* 1975; Obiri-Danso and Jones 2000) and enterococci (Anderson *et al.* 1997) found in marine sediments are suggestive of natural or environmental sources of contamination to overlying water. Regrowth of *E. coli* and enterococci was shown to occur in river sediments (Desmarais *et al.* 2002) and in soil, water and plants (Byappanahalli *et al.* 2003). Recently, indicator bacteria in sediments was directly linked to beach water quality failures. In England, resuspension of sewage impacted intertidal sediments was suggested as the cause of exceedances of regulatory standards (Obiri-Danso and Jones 2000). In New Zealand, resuspension of enterococci in sediments impacted by stream and storm water contributed to elevated levels in beach water (Le Fevre and Lewis 2003).

The objective of this study was to determine if intertidal or marine sediments harbour faecal indicator bacteria that could contribute to recreational water pollution at Huntington State Beach and Dana Point Harbor Baby Beach. The levels of indicator bacteria in marine and intertidal sediments from areas most likely to impact these beaches were determined. Enterococci isolated from sediments and recreational water were further characterized by identification to species level. The distribution of *Enterococcus* and enterococci-related species were compared in sediments *vs* beach water and in water samples passing or failing regulatory bacterial standards to determine possible relationships.

MATERIALS AND METHODS

Study sites

Dana Point Baby Beach is a small pocket beach *c.* 118 m wide and located inside an artificial harbour. A breakwater allows minimal current flow and protects the beach from ocean swell and currents (Fig. 1). Two storm drains discharge runoff from local residences, businesses, streets and parking lots to the west or east end of the beach. Beach usage includes swimming and kayak launching. Boat docks and a pier are located adjacent to the beach. Remediation actions that have been implemented include plugging and diverting storm drains during the summer to prevent urban runoff flow into the beach, installing bird netting below the pier and restricting bird feeding to reduce direct faecal contamination. The beach water is sampled once a week at four sampling sites and tested for total and faecal coliforms and enterococci. During the study period, there were failures because of at least one bacterial indicator group on 32 of 90 (35·6%) sampling days; 66% of all indicator failures were caused by *Enterococcus*.

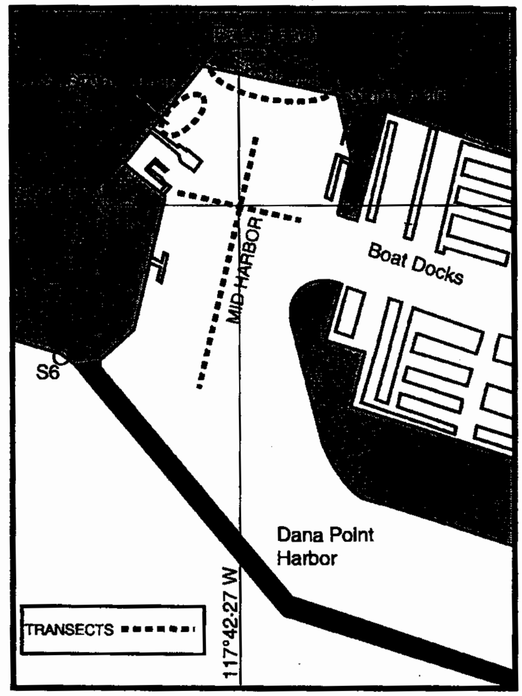

Fig. 1 Sampling locations at Dana Point Baby Beach

Huntington State Beach spans *c.* 7·2 km and is bordered by the Santa Ana River (SAR) and Talbert Marsh (TM) outlet on the south-east and Huntington City Beach on the north-west (Fig. 2). The SAR is a seasonal river/flood control channel where tidal flows in the channel can reach as far as 7·7 km inland during spring tides (Grant *et al.* 2001). Approximately 535 200 m^3 of sediment comprised of gravel, sand and mud lies in the channel from the mouth to *c.* 5·8 km upriver. The channel is lined with cement walls or rock boulders. All major contributing storm drains are diverted during the summer, so the water in the SAR is almost exclusively tidally induced flow with minimal urban runoff. The Talbert Marsh outlet channel is located 290 m north-west of the SAR. Storm drains leading into the marsh

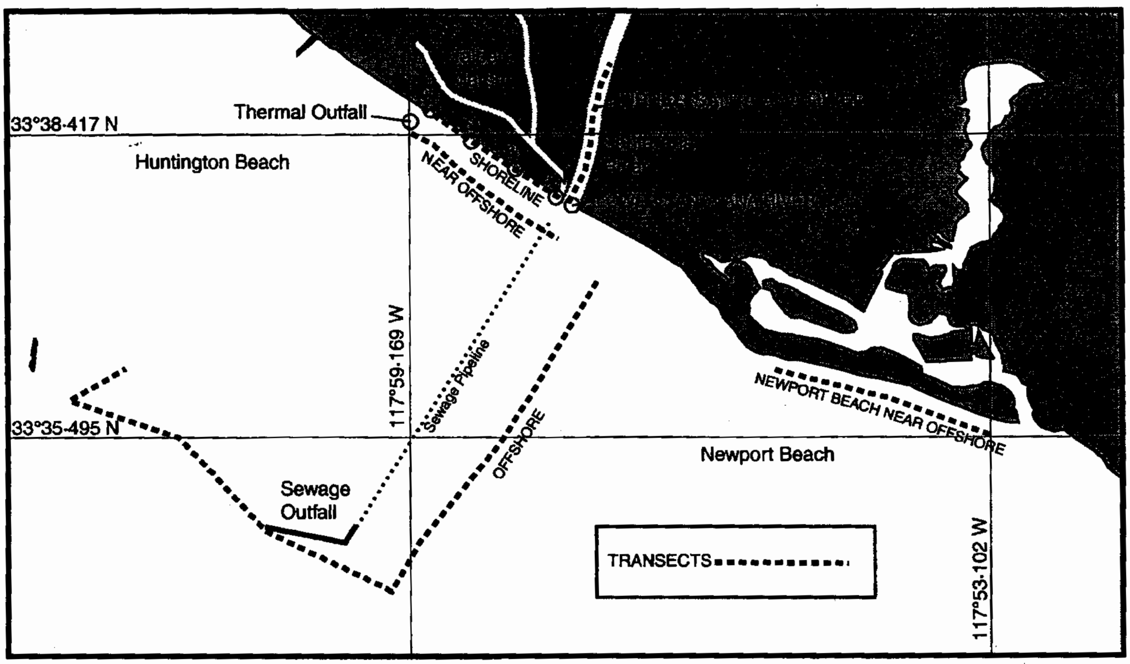

Fig. 2 Sampling locations at Huntington State Beach

are also diverted during summer. A sewage outfall lies 7·6 km offshore from the SAR mouth and releases *c.* 10^6 m^3 per day of chlorine treated sewage in 60 m of water. A thermal outfall of a power plant, located *c.* 700 m offshore discharges a maximum of $1{\cdot}9 \times 10^6$ m^3 per day of water at 10 m depth. Previous studies did not find direct evidence implicating the sewage (Noble and Xu 2004) or thermal outfalls (Kim *et al.* 2004) as sources of pollution to the beach. Surf zone water from regulatory sampling sites: 0N, 3N, 6N and 9N corresponding to 0, 914, 1829 and 2743 m north-west of the SAR are monitored five times weekly for indicator levels (Fig. 2). During the study period, beach failures for at least one bacterial indicator occurred on 8 of 31 (25·8%) sampling days; 57% of all indicator failures were because of *Enterococcus*.

Sampling strategy

To determine sediment indicator bacteria densities, samples were taken along transects at onshore beach and river sites (intertidal) and offshore (marine) areas suspected of impacting the beach water and from two control sites adjacent to beaches with generally low to nondetectable levels of indicators. The transect locations are shown in Figs 1 and 2 and described in Table 1. At Baby Beach, water and sediment samples were collected between 7 August 2002 and 20 November 2003. At Huntington State Beach, the water samples were collected between 5 August and 15 September 2003 for regulatory monitoring purposes. Sediments from the SAR were collected between 23 December 2003 and 24 January 2004 along an upper and lower transect that was delineated by the Pacific Coast Highway Bridge. Near offshore sediment samples were collected about 330 m offshore Huntington State Beach at 10 m depths. The north-west end of this transect was in the thermal outfall area. Offshore sediment samples were collected around the sewage outfall. The Newport Beach near offshore control transect starts at *c.* 4·0 km south-east of the mouth of the SAR (Fig. 2).

Sample collection methods

Offshore. Sediment samples from the ocean bottom were collected by boat using a Van Veen grab sampler (Kahl Scientific Instrument, El Cajon, CA, USA) that was rinsed between sampling stations by submerging it in seawater. A portion (100 ml) of the water overlaying the sediment was collected to compare the levels of indicator bacteria in water to sediment. The water was then decanted and *c.* 75 g of the top 2 cm of sediment was aseptically scraped into a 100 ml sterile bottle.

Intertidal. Sediment samples were collected from the intertidal river or shoreline sites at negative tide levels to avoid collecting overlying water. Approximately 75 g of the

Table 1 Description of sediment transects

	Sediment type	Number transects	Number samples	Transect length (m)	Transect spacing (m)	Water depth (m)
Dana Point Baby Beach						
Shoreline	Intertidal	21	168	120	10	NA
West Storm Drain	Intertidal	27	269	60	3	NA
Mid-Harbor	Marine	2	14	380	20	0·5–6
S-6 (Control)	Intertidal	NA*	13	NA	NA	NA
Huntington State Beach						
Upper Santa Ana River	Intertidal	2	35	2520	90	NA
Lower Santa Ana River	Intertidal	1	15	400	30	NA
Shoreline	Intertidal	1	10	3600	300	NA
Near offshore	Marine	2	31	3200	160	10
Offshore (sewage outfall)	Marine	1	10	15 240	670–2597	10–51
Newport Beach near offshore (control)	Marine	1	15	4950	330	10

*NA, not applicable.

top 2 cm of sediment was collected into a sterile bottle, taking care to avoid bird droppings. Water samples from the beach shoreline sites were collected at ankle depth using a sterile bottle (100 ml) that was clamped to a sampling pole. The pole was extended to obtain samples at ankle depth at a short distance away from the sample collector.

Sample processing

Water and sediments were held at 5–10°C and analysed for faecal indicator levels within 6 h of collection. To extract bacteria from sediments, 10 g of sediment was suspended in 100 ml of 1% (w/v) sodium metaphosphate (Valiela *et al.* 1991) and sonicated at the rate of 30% output using a Branson Sonifier® Cell Disruptor 450 (13 mm tip; Branson Ultrasonics, Danbury, CT, USA) for 30 s. Sonication time and intensity were previously optimized in our laboratory (D. M. Ferguson, D. F. Moore and M. A. Getrich, unpublished data). Suspended sediment and water samples were analysed using the membrane filtration method as per Standard Methods (APHA 1998). Total coliforms were enumerated using mENDO agar incubated for 24 h at 35°C. Faecal coliforms were enumerated using mFC agar incubated for 24 h at 44·5°C. Enterococci were enumerated using mEI agar incubated for 22–24 h at 41°C (USEPA 2000). Faecal indicator levels were reported as colony forming units (CFU) per 100 ml of water or CFU per 10 g of wet weight sediment.

As marine sediments are mixed with water trapped within sediment macropores, the concentration of indicators present in the overlying water was determined to account for bacteria present in the water fraction of sediment. The water content of each sediment sample was determined as the difference in weight before and after drying sediments overnight in an oven at 105°C.

Enterococci speciation

Colonies on mEI media that had blue halos were considered presumptive for *Enterococcus* species as per USEPA Method 1600 (USEPA 2000). Up to five colonies per sample were subcultured onto Trypticase™ soy agar with 5% sheep blood (BBL, Bethesda, MD, USA) and incubated at 35°C for 24 h. In some cases, there were fewer than five colonies present per sample. Isolates were identified to species level using the API™ 20 Strep identification system (API; bioMérieux, St Louis, MO, USA) and additional biochemical testing. The biochemical test results were interpreted using published standard biochemical identification charts (Facklam and Collins 1989; Facklam and Elliot 1995; Facklam 2002; American Society for Microbiology 2003). Biochemical tests included: carbohydrate fermentation with 1% mannitol, sorbitol, arabinose, raffinose, sucrose, lactose and inulin; Motility Test Medium w/TTC, pyrrolidonyl arylamidase (PYR) and leucine arylamidase (LAP) using disc tests (Remel, Inc., Lenexa, KS, USA); bile esculin, growth in 6·5% NaCl and at 45°C in brain–heart infusion broth, deamination of arginine in Moeller's decarboxylase broth (BBL, Franklin Lakes, NJ, USA); and catalase. Isolates that were not identified to species level that had positive reactions to PYR and LAP using API, esculin hydrolysis, growth at 45°C and tolerance to 6·5% NaCl were identified as *Enterococcus* species (American Society for Microbiology 2003).

Data analysis

The Pearson chi-square test in SPSS, version 12.0 for Windows, 2003 (Chicago, IL, USA) was used to test the statistical differences between enterococci species distribution in regulatory water samples passing and exceeding single sample standards.

RESULTS

Faecal indicator bacteria levels in sediments

The levels and percentage of samples positive for total coliforms, faecal coliforms and enterococci found in sediments from the two study sites are summarized in Table 2. Sediments from the Upper SAR transect adjacent to Huntington State Beach and West Storm Drain area at Dana Point Baby Beach had the highest percentage of positive samples as well as the highest geometric mean and maximum concentrations for all three indicator bacteria. At the Upper SAR, total coliforms and enterococci were found in 91·4% and 100% of 35 samples, respectively, with corresponding geometric mean concentrations of 1876 and 5922 CFU 10 g^{-1}. At the West Storm Drain area, total coliforms and enterococci were found in 61·8% and 66·5% of 269 samples, respectively, with corresponding geometric mean concentrations of 85 and 79 CFU 10 g^{-1}. Maximum concentrations were at the 10^5 CFU 10 g^{-1} level, or about 4 log higher than the geometric mean levels. Faecal coliforms were detected less frequently and at geometric mean concentrations that were about 1 log lower than total coliforms and enterococci.

At both study sites, indicator bacteria were also detected in shoreline and near offshore sediments but less frequently and at lower concentrations. Of the three indicators, *Enterococcus* was most abundant, followed by total coliforms and faecal coliforms with maximum geometric mean concentrations of 17, 9 and 3 CFU 10 g^{-1} respectively. Most samples collected from a section of the Huntington Beach transect in a thermal outfall area of a power plant were below detection limits for indicators. As for the sewage outfall area, enterococci and faecal coliforms were not detected, however three sediment samples collected closest to the outfall pipe had low levels of total coliforms. Only a few sediment samples from near offshore Newport Beach (control area) were positive for indicators as compared with Huntington Beach near offshore, with similar bacterial concentrations found at both sites. At Dana Point Baby Beach, sediments collected from sites distant to the West Storm Drain, including the Mid-Harbor and a shoreline control site located outside the harbour, were generally below detection limit for all indicator bacteria.

Overall, *Enterococcus* was present more often and at higher concentrations in sediment samples when compared with total and faecal coliforms. Of a total of 580 samples from both study sites, 57·5% were positive for *Enterococcus*, 42·7% for total coliforms and 22·9% for faecal coliforms. Of all three indicators, the geometric mean levels of *Enterococcus* was highest in all transects except for the Baby Beach West Storm Drain and Huntington Beach offshore transects.

Water overlying marine sediment samples may contain bacteria that could affect the measurement of the bacterial

Table 2 Faecal indicator bacteria levels in sediment samples

	Number	Total coliforms			Faecal coliforms			Enterococci		
		% Positive	Concentration*		% Positive	Concentration		% Positive	Concentration	
	samples	samples	Geomean	Maximum	samples	Geomean	Maximum	samples	Geomean	Maximum
Dana Point Baby Beach										
Shoreline	168	35·3	9	51 000	17·3	3	15 500	48·8	17	200 000
West Storm Drain	269	61·8	85	191 000	30·1	6	20 200	66·5	79	268 000
Mid Harbor	14	7·1	1	200	0·0	NA	NA	7·1	1	200
S-6 (control)	13	0·0	NA	NA	0·0	NA	NA	15·4	1	10
Huntington State Beach										
Upper Santa Ana River	35	91·4	1876	200 000	77·1	137	3500	100·0	5922	77 400
Lower Santa Ana River	15	13·3	2	100	0·0	NA	NA	73·3	21	940
Shoreline	10	20·0	3	140	10·0	2	200	40·0	6	500
Near offshore	31	9·7	1	20	3·2	1	20	48·4	6	200
Offshore (sewage outfall)	10	30·0	5	500	0·0	NA	NA	0·0	NA	NA
Newport Beach near offshore (control)	15	6·7	1	20	0·0	NA	NA	33·3	3	50

*Colony forming units 10 g^{-1} (wet weight).

% Positive samples, samples with values greater than detection limit; NA, not applicable.

concentration in sediment. In this study, the bacterial concentrations in overlying water were at least 2 logs lower than concentrations in corresponding sediment samples. Thus, the calculated bacterial concentrations in sediment were not because of overlying water.

Spatial and temporal variation of faecal indicator concentrations in sediment

The spatial and temporal variability of the concentration of all three indicator bacteria in sediments was determined for a single transect at Dana Point Baby Beach. Sampling sites included two intertidal and two marine sites along a 6·1 m transect running eastward from the mouth of the West Storm Drain. The intertidal sites were located within 3·0 m of the drain mouth. Sediments at the marine sites, located further away, were below the waterline. Sediments were collected at six different times (at 1 to 2-week intervals) over a 14-week period during the summer dry season (Fig. 3). On most of these sampling days, bacterial levels and frequency in species observed were highly variable between sites.

Indicators were more consistently detected and present in higher concentrations in samples from the intertidal sites when compared with the marine sites. The geometric mean concentrations of all three indicators were approximately 2 logs higher here than at the marine sites. There was also higher variability in bacterial concentrations in sediments from the marine sites.

Distribution of *Enterococcus* and enterococci-related species in sediment samples and shoreline water

The species distribution of isolates presumptively identified as *Enterococcus* using mEI agar was determined for sediment and adjacent shoreline water samples. Shoreline water samples were obtained from regulatory agencies responsible for monitoring indicator bacteria on a routine basis; samples from all other sites were collected for the purposes of this study. A total of 1361 isolates from sediment and shoreline water samples from both beaches were speciated (Table 3). In general, *Enterococcus faecalis* and *Enterococcus faecium* were the most common species found in both sediment and water samples. *Enterococcus hirae*, *Enterococcus casseliflavus* and *Enterococcus mundtii* were also frequently seen when compared with *Enterococcus gallinarum*, *Enterococcus durans* and *Enterococcus avium*. Surprisingly, a high percentage of isolates from sediment (8·2–15·0%) and shoreline water (11·4–25·5%) were non-*Enterococcus* species (Table 3). These isolates, which appeared identical to enterococci on mEI media, included *Streptococcaceae* and related organisms (Bascomb and Manafi 1998) such as *Streptococcus bovis*, other *Streptococcus* spp., *Aerococcus* spp., as well as species that could not be identified with the methods used.

Enterococcus faecalis was the predominant species isolated from shoreline water at both Huntington Beach (39·8%) and Baby Beach (33·2%), West Storm Drain water (35·6%) and Huntington State Beach near offshore sediments (68·8%). *Enterococcus faecium* was the predominant species isolated from sediments at the West Storm Drain (35·2%) and the SAR (51·4%) (Table 3).

Enterococcus species distribution during single sample failure periods

The overall species distribution of samples from shoreline water at both study sites was similar, with the exception of a higher incidence of *Streptococcus* spp., particularly *S. bovis*, at Huntington State Beach (Table 3). The source(s) of these organisms to the beach are uncertain. To better understand

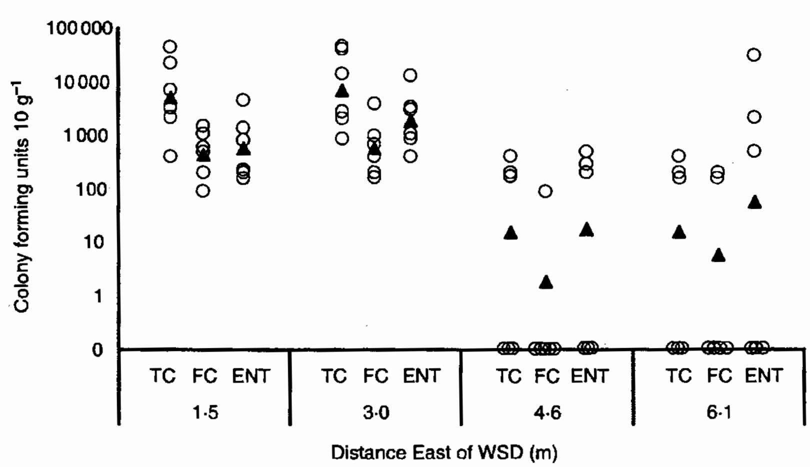

Fig. 3 Temporal and spacial variability of faecal indicator concentrations in sediments from four West Storm Drain sites sampled six times over 14 weeks, O, concentration; ▲, geometric mean; TC; total coliforms; FC, faecal coliforms; ENT, *Enterococcus*

Table 3 Enterococcus species distribution in water and sediment samples

	No. samples	No. isolates	Number (%) of isolates: *E. faecalis*	*E. faecium*	*E. hirae*	*E. casseliflavus*	*E. mundtii*	*E. gallinarum*	*E. durans*	*E. avium*	Other ENT*	*S. bovis*	STR	AER	Other, not ENT†
Dana Point Baby Beach															
Shoreline water	169	349	116 (33·2)	74 (21·2)	40 (11·5)	42 (12·0)	29 (8·3)	4 (1·1)	1 (0·3)	1 (0·3)	3 (0·8)	11 (3·2)	0 (0·0)	0 (0·0)	28 (8·0)
West Storm Drain water	26	45	16 (35·6)	6 (13·3)	0 (0·0)	15 (33·3)	1 (2·2)	1 (2·2)	0 (0·0)	0 (0·0)	0 (0·0)	0 (0·0)	0 (0·0)	0 (0·0)	6 (13·3)
West Storm Drain sediments	73	105	11 (10·5)	37 (35·2)	15 (14·3)	14 (13·3)	9 (8·6)	2 (1·9)	1 (1·0)	3 (2·8)	1 (1·0)	3 (2·8)	0 (0·0)	0 (0·0)	9 (8·6)
Huntington State Beach															
Shoreline water	144	576	229 (39·8)	75 (13·0)	73 (12·7)	36 (6·2)	9 (1·6)	5 (0·9)	1 (0·2)	0 (0·0)	1 (0·2)	102 (17·7)	27 (4·7)	5 (0·9)	13 (2·2)
Upper and lower SAR sediments	47	206	41 (19·9)	106 (51·4)	19 (9·2)	14 (6·8)	7 (3·4)	0 (0·0)	2 (1·0)	0 (0·0)	0 (0·0)	3 (1·4)	1 (0·5)	8 (3·9)	5 (2·4)
Near offshore sediments	20	80	55 (68·8)	9 (11·2)	2 (2·5)	0 (0·0)	0 (0·0)	0 (0·0)	0 (0·0)	1 (1·2)	1 (1·2)	11 (13·8)	0 (0·0)	0 (0·0)	1 (1·2)
Total	479	1361	468 (34·4)	307 (22·6)	149 (10·9)	121 (8·9)	55 (4·0)	12 (0·9)	5 (0·4)	5 (0·4)	6 (0·4)	130 (9·6)	28 (2·0)	13 (1·0)	62 (4·6)

*Four isolates unidentified *Enterococcus* spp., one *Enterococcus raffinosus* isolate and one *Enterococcus malodratus* isolate.
†Sixty unidentified non-*Enterococcus* spp., one *Lactococcus* spp. and one *Helcococcus* spp.
ENT, *Enterococcus* spp.; STR, *Streptococcus* spp.; AER, *Aerococcus* spp.

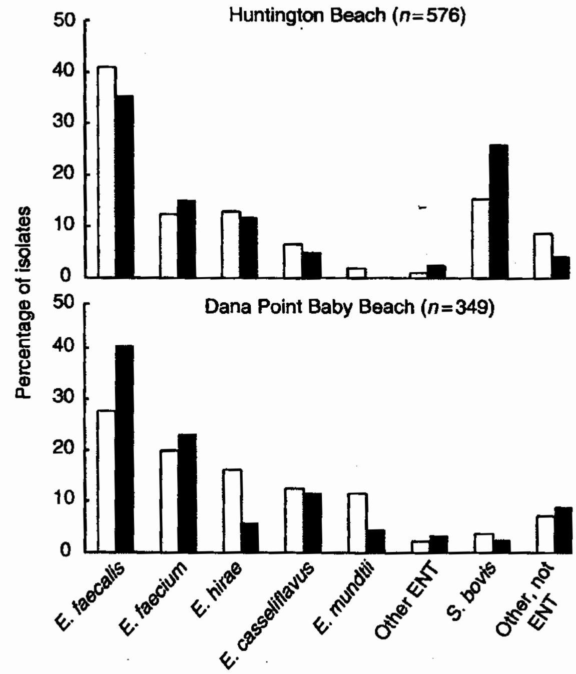

Fig. 4 Distribution of *Enterococcus* and related species in recreational marine water samples collected during ambient (□) and exceedance (■) conditions

possible relationships between contamination events and changes in species distribution, enterococci species composition in water samples with levels in water above and below the single sample standard (≥104 CFU 100 ml^{-1}) was compared (Fig. 4). There was no significant difference in the species distribution in samples at both Baby Beach and Huntington State Beach in samples collected during beach failures when compared with ambient conditions ($P = 0{\cdot}13$ and $P = 0{\cdot}10$, respectively; Pearson chi-square test).

DISCUSSION

In southern California, it is well recognized that a major cause of bacterial pollution of coastal waters is urban runoff in rivers/channels and storm drains that discharge into the ocean (Dwight *et al.* 2002; Reeves *et al.* 2004). The data presented here points to another source associated with urban runoff. Intertidal sediments harbouring high levels of indicator bacteria can be resuspended in water and transported to beaches by waves and wind, leading to water quality failures. We found a concentration gradient of faecal indicator bacteria in sediments: extremely high densities in the Santa Ana River near Huntington Beach and West Storm Drain area at Dana Point Baby Beach; significantly lower concentrations in shoreline and near offshore sediments at both beaches and even lower or nondetectable levels in offshore and control site sediments. These results indicate that shoreline waters at Huntington State Beach and Baby Beach may be recipients of faecal indicator bacteria originating from intertidal sediments in the SAR that contain high levels of bacteria. Field studies conducted at the Huntington Beach area suggest that indicator bacteria from the SAR and TM sediments are resuspended and flushed to the ocean during ebb tides and transported to the beach by surf zone and tidal currents (Grant *et al.* 2001; Kim *et al.* 2004). This resuspension and transport process is more pronounced during spring tide conditions, which occurs during full and new moon periods. At these times the greatest volume of tidal water flows inland into coastal outlets such as the TM and SAR and back out to the ocean, which is also when most of the beach failures at Huntington State Beach occur during the dry weather season (Boehm *et al.* 2004; Noble and Xu 2004). Other possible reasons for the indicator concentration gradient observed may be related to differences in sediment type, organic content and amount of UV exposure at the intertidal, onshore and offshore locations, parameters which were not measured at all sites in this study.

The high densities of total coliforms, faecal coliforms and enterococci found in intertidal sediments in the SAR and Baby Beach are similar to sediment indicator levels found at several different geographical locations: a tidally influenced river in Florida (Solo-Gabriele *et al.* 2000), an embayment in New Zealand (Le Fevre and Lewis 2003), an estuary in Massachusetts (Valiela *et al.* 1991) and freshwater creeks and lakes in Michigan (Byappanahalli *et al.* 2003) and in Wisconsin (LaLiberte and Grimes 1982).

The low levels of indicator bacteria found in sediments around the sewage outfall area offshore Huntington State Beach indicate that the discharge pipe may not be a constant source of contamination to these sediments. This finding is in contrast to a similar study conducted at Moracambe Bay, a bathing beach in England. Here, high levels were found in bay sediments receiving sewage effluent from an outfall pipe (ranging from untreated through to secondary treatment) and agricultural runoff from streams and rivers (Obiri-Danso and Jones 2000). The low levels found at Huntington State Beach may be the result of chlorination of the wastewater by the sewage treatment plant and the dilution or dispersion of bacteria by ocean currents. Wastewater entering the plant contains approximately 10^7 to 10^8 total coliforms per 100 ml and is reduced to 10^5 per 100 ml for total coliforms and 10^4 for faecal coliforms and enterococci after disinfection. The effluent is discharged from the outfall pipe that is engineered to achieve a 180 : 1 dilution in ocean water. In this study, finding higher levels of indicator levels at storm drain impacted sediments as opposed to the outfall area was surprising. In fact, the geometric mean levels in storm drain impacted intertidal sediments were about one order of magnitude higher concentration when compared with the sewage impacted sediments at Moracambe Bay.

At Dana Point Baby Beach, contamination of beach water during summer dry weather appears to be related to the proximity of the storm drain to the beach, retention and/or regrowth of indicator bacteria in sediments and resuspension of indicator bacteria because of wave action in the harbour. In a previous study at this location, we determined that exceptional surf heights of 2–3 m that topped the break-water and greater wave action correlated with a considerable increase in indicator levels at the beach (BBBSSR 2003). A similar study conducted at a protected beach in New Zealand also showed that storm and stream water contributed high numbers of enterococci to sediments around these discharge points and that resuspension of sediments because of wave action led to elevated levels in water (Le Fevre and Lewis 2003). Increased bacterial levels because of resuspended sediments can occur as a result of increased turbulence due to runoff, animal traffic, sustained winds, storms, boats and dredging activities (Gerba and McLeod 1976; Sherer *et al.* 1992; Obiri-Danso and Jones 2000).

Repeated sampling of Baby Beach intertidal sediments around the West Storm Drain indicated high temporal and spatial variability in indicator concentrations. Although total coliforms and enterococci were consistently detected within 3·0 m of the storm drain, higher concentrations of enterococci were also found in two samples collected furthest from the drain where the levels were generally low. Determining the causes of temporal and spatial variability of indicator concentrations in sediment was not included in this study. Further studies on sediment characteristics that can affect bacterial growth and decay rates, such as temperature, moisture content, nutrient content, particle size, surface area and biofilm formation are needed to understand the potential flux of indicator bacteria from sediments to water.

Indicator levels ranging from 10^3 to 10^5 CFU 10 g^{-1} of sediment suggest the occurrence of long-term survival and regrowth of indicator bacteria in this environment. It has generally been accepted that faecal indicator bacteria do not survive for very long in seawater. In seawater, 90% of total coliforms, *E. coli* and enterococci die off in about 2·2, 19·2 and 60 h respectively (Bartram and Rees 2000). However, prolonged survival may be possible in marine and freshwater sediments. Indicator bacteria have been shown to persist in storm drain impacted sediments for up to 6 days following storm events without further supplementation of bacteria from runoff (Marino and Gannon 1991). Davies *et al.* (1995) showed that *E. coli* remains culturable in marine sediment for up to 68 days. In addition, laboratory studies have shown that faecal indicators survive longer in water supplemented with sediment (Gerba and McLeod 1976; Sherer *et al.*

1992). Survival in sediment may be enhanced because of protection from UV inactivation and predation, moisture, buffered temperatures and availability of nutrients originating from algae, debris and plankton (Whitman and Nevers 2003). Phytoplankton are most active in late spring to early summer and late summer to early fall, which are also the periods when bacterial levels in coastal waters increase (Dowd *et al.* 2000). Seaweed (Anderson *et al.* 1997), seawrack (Valiela *et al.* 1991) and zooplankton (Maugeri *et al.* 2004) provide both nutrients and surfaces for indicator bacteria to survive in the marine environment. Recently, groundwater discharge at Huntington Beach was found to be a source of nitrogen and orthophosphate to the surf zone that may enrich intertidal sediments and allow bacteria to persist (Boehm *et al.* 2004).

At both study sites, enterococci were found more frequently and in higher concentrations in intertidal sediment samples than total and faecal coliforms. *Enterococcus* spp. may be more abundant in intertidal sediments because these organisms are more resilient in seawater and are not as easily inactivated by sunlight when compared with *E. coli* (Bartram and Rees 2000). Enterococci are also capable of growing at a wider range of temperature (between 10 and 45°C) and pH (4·8–9·6) as well as in the presence of 28% sodium chloride (Huycke 2002).

Presumptive enterococci isolates were speciated to better understand the sources and ecology of these organisms in the marine environment. Of 1361 isolates tested, the predominant species identified in water and sediment, in order of occurrence were *E. faecalis*, *E. faecium* and *E. hirae*. These results are similar to the distribution reported for environmental strains elsewhere (Stern *et al.* 1994; Pinto *et al.* 1999; Dicuonzo *et al.* 2001; Ott *et al.* 2001; Harwood *et al.* 2004). *Enterococcus faecalis* and *E. faecium* are also the predominant *Enterococcus* spp. in the intestinal microflora of humans and animals and are considered opportunistic pathogens (Willey *et al.* 1999). *Enterococcus hirae* is a member of animal microflora, but has been found to occasionally cause infections in humans (Tannock and Cook 2002). *Enterococcus gallinarum* and the yellow pigmented species, *E. casseliflavus* and *E. mundtii*, are associated with plants and soil and are rarely associated with human infection (Pinto *et al.* 1999). In this study, these three 'environmental' associated species comprised 13·8% of all isolates tested. Thus, the species distribution of enterococci in insects, plants and sediments as well as in pristine and faecal-contaminated waters is important when assessing this group as faecal indicators (Leclerc *et al.* 1996).

During beach failures, the species distribution of enterococci and related species in shoreline waters was similar to the distribution found during ambient conditions. This distribution in water was also comparable with intertidal sediment samples with high concentrations of enterococci. These findings suggest that there may be constant loading of a stable enterococcal population from intertidal sediments and other sources to water that increases because of changes in environmental conditions, resulting in frequent failures. The enterococci species distribution found in sediments and water were similar to that of humans, animals and birds. Thus, species distribution was not useful in pinpointing major source(s) of beach contamination in this study. However, this determination could be useful to finding sources of contamination in other sites where 'environmental' species may be predominant.

Comparison of the enterococci species composition in water *vs* sediments in highly contaminated areas could provide additional information in assessing sediments as a source. Knowledge of the predominant species present in specific sites could also be useful to investigators using or developing microbial source tracking methods targeting enterococci.

The API Strep system and traditional biochemical tests and identification charts used to speciate enterococci and related organisms in this study are culture-based methods designed to identify clinical isolates. Further studies are needed using PCR or 16S rRNA sequencing to identify environment isolates, particularly the noncultivable strains.

There was a high incidence of non-*Enterococcus* species (17·1%) using mEI media. The majority of these isolates (9·6%) were identified as *Streptococcus bovis*, a member of the faecal streptococcus group. This finding was unexpected as *Streptococcus* spp. are not known to persist in marine water (Geldreich and Kenner 1969). The mEI media used to isolate enterococci in this study was formulated to differentiate enterococci from other genera of the faecal streptococcal group (Messer and Dufour 1998). Like enterococci, *S. bovis* is also β-D-glucosidase-positive, which is indicated on mEI media by the formation of a blue halo around the colony. Marine water samples from Baby Beach and Huntington Beach had false-positive rates (occurrence nonenterococci species) of 11·2% and 25·5% respectively. These rates are much higher than 6%, as reported by the EPA (USEPA 2000).

To our knowledge, this is the first publication showing high concentrations of faecal indicator bacteria in intertidal sediments impacted by storm drains. The levels of enterococci found in shoreline and near offshore sediments could be a result of continuous loading of faecal indicator from highly contaminated sediments in areas associated with urban runoff. Exceedances in enterococci standards may also occur because of resuspension of bacteria-laden sediment in water. This occurrence supports the suggestion made by others that an evaluation of faecal indicators in sediments may be a more stable index of overall or long-term water quality than the overlying water (LaLiberte and Grimes

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1982; Sherer *et al.* 1992; Obiri-Danso and Jones 2000). The long-term persistence/regrowth of indicators in sediments, particularly enterococci, calls into question the reliability of this indicator for determining recent faecal contamination of water.

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Multi-Tiered Approach Using Quantitative Polymerase Chain Reaction For Tracking Sources of Fecal Pollution to Santa Monica Bay, California

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Multi-Tiered Approach Using Quantitative Polymerase Chain Reaction For Tracking Sources of Fecal Pollution to Santa Monica Bay, California

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ABSTRACT

The ubiquity of fecal indicator bacteria such as *Escherichia coli* and enterococcus make tracking sources in urban watersheds extremely challenging. In this study, a multi-tiered approach was used to assess sources of fecal pollution in Ballona Creek, an urban watershed that drains to Santa Monica Bay (SMB), CA. A mass-based design at six mainstem sites and four major tributaries was used to quantify the flux of enterococcus and *E. coli* using traditional culture-based methods, and three additional indicators including enterococcus, *Bacteroides* sp. and enterovirus, using quantitative polymerase chain reaction (QPCR). Sources and concentrations of fecal indicator bacteria were ubiquitously high throughout Ballona Creek and no single tributary appeared to dominate the fecal inputs. The flux of enterococcus and *E. coli* averaged 10^9 to 10^{10} cells/hr and were as high at the head of watershed as they were at the mouth prior to its discharge into SMB. In contrast, the site furthest upstream had the most frequent occurrence and generally the greatest concentrations of enterovirus. Ninety-two percent of the samples that tested positive for enterovirus also tested positive for *Bacteroides* sp. A similar survey in Malibu Creek, a nearby non-urban watershed, found low levels of traditional fecal indicator bacteria and no detectable enterovirus or *Bacteroides* sp. The influent and effluent from three structural best management practices (BMPs) were evaluated for removal efficiency. Results indicated that those with ultraviolet (UV) treatment worked better than a constructed treatment wetland for reducing enterococcus concentrations using culture-based methods, but also degrading its DNA based on QPCR measurements.

TABLE OF CONTENTS

Abstract i

Introduction 1

Materials and Methods 3
- Sample Collection and Filtration 3
- Indicator Bacteria Analyses Using Chromogenic Substrate 5
- Enterovirus Analyses Using QRTPCR 5
- Bacterial Analyses Using QPCR 7
- Bacteroides sp. Using Conventional PCR 8

Results 10
- Ballona Creek 10
- Malibu Creek 11
- BMP's 12

Discussion 13

References 15

INTRODUCTION

Santa Monica Bay (SMB), California, is home to some of the most popular beaches in the world. It is located adjacent to metropolitan Los Angeles where more than 50 million beachgoers visit SMB shorelines every year, which is more than all other beaches in California combined (SMBRC 2005). However, there are serious concerns about beach water quality because of continued exceedences of water quality thresholds based on fecal indicator bacteria such as total coliforms, fecal coliform or *E. coli*, and enterococcus, particularly in areas impacted by urban runoff. Thirteen percent of the shoreline mile-days in SMB exceeded water quality thresholds between 1995-2000 with over 50% of these exceedences located near storm drains (Schiff et al 2003). In contrast, sewage spills were relatively rare accounting for less than 0.1% of the water quality exceedences and subsequent warnings to swimmers. Moreover, swimming near storm drains in SMB can lead to an increased risk of swimming-related illnesses. Haile et al (1999) demonstrated that swimmers near storm drain discharges in SMB had a higher likelihood of respiratory and/or gastrointestinal symptoms compared to swimmers more than 400 m from a storm drain.

Despite the impairments to water quality and risk to human health, identifying and eliminating the sources of bacteria responsible for the beach warnings remains elusive. The difficulty in identifying and eliminating the sources of bacteria results from two important factors. First, the traditional indicators of fecal pollution on which the water quality thresholds were derived are not specific to humans. These fecal indicator bacteria can be shed from any warm-blooded organism including wild and domesticated animals (Geldreich 1978). Therefore, source tracking turns into a challenging scenario when these diffuse and frequently intermittent or episodic fecal releases occur. The second difficulty when identifying and eliminating sources of fecal indicator bacteria is their ubiquity in the environment. Unlike many of the pathogens of interest, fecal indicator bacteria may survive and even grow in the environment. For example, fecal indicator bacteria were able to persist in beach wrack impacting beaches in Cape Cod, MA (Weiskel et al. 1996).

Viruses are one tool that could prove useful in source tracking studies because they are the pathogen of interest. Viruses are known to cause a significant portion of waterborne disease from water contact, mostly from ingestion of sewage contaminated water and seafood (Fogarty et al. 1995). Until recently, however, methods for virus detection and quantification have relied on growth-based endpoints that are much too slow to be effective source tracking tools. Recently developed molecular techniques, such as Quantitative Reverse Transcriptase Polymerase Chain Reaction (QRTPCR) can detect and quantify viral genetic material directly from water samples. Results of tests conducted previously in Southern California (Noble and Fuhrman, 2000; Tsai et al., 1993; Tsai et al., 1994), in Florida (Griffin et al., 1999; Rose et al., 1997), and Europe (Pina et al., 1998) using conventional RTPCR or PCR have detected a host of genetic material from human specific viruses including enterovirus, hepatitis A virus, rotavirus, and adenovirus in urban runoff discharges or seawater samples. The major drawback to using viruses as source tracking tools, however, is their dependence on a large human population in order to have sufficient numbers for detection (Noble et al. 2003).

A different approach would be to use alternative bacterial indicators for source tracking that might be much more abundant in fecal waste discharges. This alternative approach could prove useful if host specific bacterial indicators could be found. Of the facultative anaerobic organisms common in human fecal flora, enterococci have been found in almost all subjects with a mean level of $\log_{10}$ 8.9 per gram feces (Klessen et al, 2000). Another option would be *Bacteroides* sp., which make up approximately one-third of the human fecal microflora, considerably outnumbering the fecal coliforms. *Bacteroides* sp. belongs to a group of nonspore forming obligate anaerobes, so there is little concern over persistence or regrowth in the environment. More importantly, human specific *Bacteroides* sp. markers have been developed increasing the value of this potential indicator (Bernhard and Field 2000a, Bernhard and Field 2000b).

Both virus and alternative bacterial indicators such as *Bacteroides* sp. have been shown to be potentially useful source tracking tools. Griffith et al (2003) concluded that genetic based methods, such as PCR consistently provided the best information when attempting to conduct source tracking on mixed source samples. *Bacteroides* sp. correctly identified human sources of fecal pollution when present in mixed water samples delivered blind to the laboratory. Likewise, human enterovirus measurements had virtually no false positives, a problem that plagued many other methods in that study. However, the human marker identified in *Bacteroides* sp. may be present in additional hosts or the primers used to detect the human marker may cross react with species from nonhuman hosts (Kreader 1995). Similarly, enterovirus consistently and correctly detected human sewage when present, but had difficulty determining human sources when only one or a few likely uninfected individuals contributed fecal material. Since no method has all of the traits to be the consummate bacterial source tracking tool, a multi-tiered multi-indicator approach has been recommended by some investigators (Stewart et al 2003). By using multiple tools, investigators can utilize the strengths of each to ascertain inputs and track fates that will ultimately lead to successful management solutions.

This objective of this study was to identify the contributions and quantify the loading of fecal contamination to the SMB using a multi-tiered approach. The first tier included traditional fecal indicator bacteria measurements. The second tier included newly developed methods for enterococcus, *Bacteroides* sp., and enterovirus. All of these newly developed methods rely on QPCR or QRTPCR, which has not been applied previously for source tracking studies in urban watersheds until now. The multi-tiered approach was applied using a mass-based design to quantify inputs and flux through an urban watershed to the beach. A subsidiary objective included using the multi-tiered approach through a relatively undeveloped watershed. Finally, the multi-tiered approach was used to determine the effectiveness of a variety of structural best management practices (BMPs) that were aimed at reducing bacterial inputs from urban watersheds.

MATERIALS AND METHODS

This study was conducted in three phases. The first phase quantified inputs of flow, bacteria concentrations and virus particles, then tracked them through an urban watershed over time. This mass-based design was applied in the Ballona Creek watershed, the largest tributary to SMB. Ballona Creek is over 85% developed and currently has the largest inputs of fecal indicator bacteria to SMB (Figure 1). The second phase quantified bacteria concentrations and virus particles in the Malibu Creek watershed, the second largest tributary to SMB. Malibu Creek is only 12% developed and has a large lagoon system at its terminus prior to discharging across the beach to the world famous Surfrider Beach. Although no flow was measured in Malibu Creek to provide flux estimates, this system provided the opportunity to measure concentrations at several points through the lagoon and as it enters the ocean to assess shoreline mixing and dilution. The third phase examined the effectiveness of three BMPs to reduce bacteria and virus concentrations. The three BMPs, only two of which were located in the Santa Monica Bay watershed, included a multimedia filtration system with inline ultraviolet (UV) treatment, a filtration-aeration system with an inline UV treatment system, and a constructed wetland. For each of the BMPs, an influent-effluent approach was used to estimate treatment effectiveness.

Sample Collection and Filtration

Ballona Creek

Samples were collected at six mainstem and four of the major tributaries to the Ballona Creek system. The six mainstem sites extended from where the system daylights at Cochran Avenue to Inglewood Avenue, which is located at the head of tide just prior to discharge into SMB (Table 1). The four tributaries represented the four largest hydrodynamic inputs to the system and were located in reaches between each of the mainstem sampling sites.

Flow was calculated as the product of flow rate and wetted cross-sectional area. Doppler area-velocity sensors were used to measure flow rate. Pressure transducers that measure stage, along with verified as-built cross sections, were used to estimate wetted cross-sectional area. One minute instantaneous flow was logged electronically during the entire six hour sampling period. Both the area-velocity sensors and pressure transducers were calibrated prior to sampling.

One hour composite water samples were collected at each site between 8:00 AM and 2:00 PM on August 26, 2004. The six hour sampling period corresponds to the approximate hydrodynamic travel time from Cochran Avenue to Inglewood Avenue (Ackerman et al, 2004). Four liter composite samples at each site were created after combining ten individual 400 ml grab samples collected every 6 minutes into a single container. In total, 60 composite samples were collected at Ballona Creek as a result of sampling 6 hours at 10 different sites.

Table 1. Ballona Creek sampling sites.

Site	Description	GPS Coordinates (NAD 83 datum)
Cochran Ave.	mainstem	34 02.662N 118 21.237W
Fairfax Drain	tributary	34 02.298N 118 22.136W
Adams Ave.	mainstem	34 02.009N 118 22.494W
Adams Drain	tributary	34 02.009N 118 22.494W
Rodeo/Higuera	mainstem	34 01.305N 118 22.693W
Benedict Box Channel	tributary	34 00.925N 118 23.432W
Overland Ave.	mainstem	33 00.429N 118 23.771W
Sawtelle Ave.	mainstem	33 59.816N 118 24.164W
Sepulveda Channel	tributary	33 59.512N 118 24.693W
Inglewood Ave.	mainstem	33 59.394 N 118 24.696W

Malibu Creek

One hour composite samples were collected at five sites along the mainstem of Malibu Creek (Table 2). The sites stretched from the Cold Creek tributary to the head of the lagoon, near the mouth of the lagoon, in the discharge across the beach, and in the wave wash immediately in front of the discharge across the beach. Composite samples were collected in a similar fashion as Ballona Creek with the following exceptions. A single composite sample was collected at each site daily on three consecutive days (November 10, 11 and 12, 2004) coinciding with low tide to ensure that the flow direction was from the lagoon, across the beach, and into the wave wash. No flow information was collected since most of the sites were hydrologically unrateable.

Table 2. Malibu Creek sampling sites.

Site	Description	GPS Coordinates (NAD 83 datum)
Bridge at Cold Creek	Mainstem	34 04.865N 118 42.262W
Bridge at Cross Creek	Mainstem	34 02.578N 118 41.052W
Head of Malibu Lagoon	Lagoon	34 02.154N 118 41.036W
Mouth of Malibu Lagoon	Lagoon	34 01.920N 118 40.810W
Malibu Creek Wavewash	Mixing Zone	34 01.920N 118 40.810W

BMPs

Three BMPs were selected for sampling. The three sites included: the Santa Monica Urban Runoff (SMURRF) treatment facility located in Santa Monica; the Clear Creek, Inc. MURF™ pilot treatment facility located in Paradise Cove; and a constructed wetland (WET CAT) located in Laguna Niguel. The SMURRF consists of a grit screen to remove debris and trash, a dissolved aeration system to separate the oil and grease, and a microfiltration system to remove solids inline with a UV treatment device. The MURF system uses a combination of proprietary multi-media filtration and UV treatment. The WET CAT is a 2.1 acre constructed wetland with no other in line treatment. Grab samples were collected from the influent and effluent at each BMP.

Filtration

After collection, samples were placed on ice in a cooler and transported immediately to the University of Southern California for processing. For each composite sample, 200-600 ml of sample volume was vacuum filtered through replicate 47mm 0.45μm polycarbonate filters (Poretics, Inc.) using a filter funnel and receiver (Millipore, Inc.) for bacterial marker analysis by QPCR. In addition, replicate filtrations were conducted using 47 mm diameter 0.7 μm nominal pore size, type GF/F microporous filters (Whatman, Inc.), and replicate Type HA Millipore mixed ester cellulose acetate/nitrate, 0.45 um pore size filters (for subsequent enterovirus analysis). The polycarbonate filters were immediately placed into a 1.5 ml screw-cap tube and placed on dry ice until storage at -80°C. Type HA filters were either placed into a Whirl-pak bag for analysis by the Fuhrman laboratory (EnteroA), or into a 1.5 ml screw-cap tube for subsequent analysis by the Noble laboratory (EnteroB). Type GF/F filters were cut into quarters, each quarter placed in a 1.5 ml screw cap tube and placed on dry ice until storage at –80°C. .

Indicator Bacteria Analyses Using Chromogenic Substrate

Concentrations of *E. coli* and enterococcus were measured by chromogenic substrate methods using kits supplied by IDEXX Laboratories, Inc. (Westbrook, ME). *E. coli* was measured using the Colilert-18® reagents, while enterococci were measured using Enterolert™ reagents. Both tests used the Quanti-Tray/2000 for enumeration of cells. Samples were incubated overnight per the manufacturer's instructions and inspected for positive wells. Conversion of positive wells from these tests to a most probable number (MPN) was done following Hurley and Roscoe (1983).

Enterovirus Analyses Using QRTPCR

Samples were analyzed for enteroviruses using two separate, but similar methods conducted in two separate laboratories, EnteroA (Fuhrman laboratory) and EnteroB (Noble laboratory). For EnteroA, filters were extracted using the RNeasy mini kit (Qiagen Cat. No.74106) and QIAvac 24 vacuum manifold (Qiagen Cat. No.19403). The extraction protocol was modified from the manufacturer's instructions as follows: 1ml lysis buffer RLT (with 10μl β-mercaptoethanol) was added directly into each Whirl-Pak bag, allowed to soak the filter for ten minutes, and the resulting extracts (lysates) were carefully removed by pipet into 2 ml microcentrifuge tubes (droplets hanging in the bag and water clinging to the filter were first squeezed to the bottom corner of the bag by manually applying pressure to the outside of the bag). If there was visible filter or sample debris, the particulate matter was removed by brief centrifugation. Then one volume of 70% ethanol (usually 1 ml) was added to the extract and mixed by pipetting. Samples were transferred to the RNeasy spin columns, filtered through with the QIAvac at approximately 500 mm Hg vacuum, and were washed on the manifold once with 700 μl RW1 solution, and twice with 500 μl RPE solution to remove contaminants. The columns were cleared of remaining droplets of buffer by centrifugation into a 2 ml collection tube (14,000 rpm, Eppendorf 5415 microfuge, 2 minutes), and the buffer discarded. The RNA was eluted from the columns into a 1.5 ml collection tube with 50 µl volumes of RNase free water by centrifugation (Eppendorf 10,000 rpm, 2 min.), after allowing the water to stay in the column 1 min. This filter extraction step typically took up to two hours for 15 samples.

For each PCR reaction, 5 µl of the 50 µl RNA was analyzed by QRTPCR on a Mx3000P Thermal Cycler (Stratagene, Inc.). The PCR protocol was modified from the single-tube RT-PCR method previously developed for sludge samples by Monpoeho et al. (2001). Primers and probe, not changed from that original published method (except for the BHQ quencher), were reverse primer Ev1 [5'-GATTGTCACCATAAGCAGC-3'], forward primer Ev2 [5'-CCCCTGAATGCGGCTAATC-3'], synthesized by Qiagen and Ev-probe [5'-FAM-CGGAACCGACTACTTTGGGTGTCCGT-BHQ-Phosphor-3'], synthesized by Sigma Genosys. A GenBank BLAST search done on 3 June 2004 revealed that only human (not other animal) enteroviruses matched all three primer and probe sequences. Each PCR reaction contained 5 µl RNA extract and 20 µl master mix, each 20 µl master mix contained: 1X Taq gold buffer (ABI), 5.5mM $MgCl_2$ (ABI), 500uM dNTPs (ABI), 6% glycerol (Sigma Chemical Co.), 2% PVP 40 (polyvinylpyrrolidone, av. MW 40,000, Sigma Chemical Co.), 500nM Ev1, 400nM Ev2, 120nM Ev-probe, 1.5µg T4 gene 32 protein (Ambion), 10 units of RNAsin (ABI), 2.5 units of AmpliTaq gold (ABI) and 5 units MULV reverse transcriptase (ABI). Each RNA extract was analyzed in duplicate. Enterovirus RNA was transcribed into cDNA at 50°C for 45 minutes, the cDNA was amplified by PCR, after a 95°C 10 minute hot start, for 50 cycles at 94°C for 15 sec and 60°C for 1min. Fluorescence measurements were made during the extension step, every cycle at 60°C. Calculations for quantification were done by the Stratagene QPCR software in real time, with raw data saved for possible reanalysis. Parameters (e.g. fluorescence threshold) were set manually after PCR was done to generate a standard curve with optimal statistics (usually r^2>0.95, slope around 3.3) and unknowns were calculated based on that standard curve. Standards were prepared using the poliovirus stock described above. Standards used in the high concentration set were 10-fold dilutions ranging from high to low concentration. For EnteroB, a similar approach was used. Samples were extracted using the RNeasy mini kit (Qiagen Cat. No.74106), with additional of 2.0% polyvinylpyrrolidone (PVP)-40 (final concentration) and the filter fully homogenized in the screw cap tube. After homogenization, approximately 700µl of the RLT/filter slurry was applied to a QiaShredder column (until the Qiashredder was full) and spun at max speed, ≥ 8000 x *g*, for 2 minutes. It was often necessary to perform two spins to ensure the entire volume of RLT/filter slurry was shredded. The supernatant fluid was then carefully removed and placed into a new 1.5 ml tube. The volume of solution in each tube was estimated by pipetting and 0.4 volumes of potassium acetate were added. Tubes were mixed by inversion and incubated on ice for 15 minutes. The mixture was then spun at 4°C for 15-30 minutes and the supernatant transferred to a new 1.5 ml microfuge tube. Following this, the protocol for the Qiagen RNeasy Plant and Fungi RNA isolation was followed starting at step 5. Five µl of extracted RNA from the previous procedure was added to 5X RT Buffer, 6 mM MgC12, 500 nM dNTPs (final concentration), 700 nM EV1 Reverse primer, 700 nM EV1 Forward primer, and 300 nM EV-BHQ TaqMan probe, 10 units of RNAsin, 2.5 units of Taq polymerase, and 5 units MULV reverse transcriptase. The Cepheid Smart Cycler® was programmed to: 1 hour

RT at 37°C followed by a 15 minute hold at 95°C for *Taq* activation, then 45 cycles of 94°C 15 seconds (denature), 60°C 1 minute (anneal/extension-optics on).

QRTPCR results were available three hours after the start of analysis, making the total PCR preparation and analysis time less than 5 hours for 15 samples. Results are reported as equivalent virus particles per unit sample volume, meaning that this is where the QRTPCR calculation indicated the sample appeared relative to the standard curve prepared from poliovirus standards.

Bacterial Analyses Using QPCR

The polycarbonate filters were processed for DNA extraction using the UltraClean™ Fecal DNA Isolation Kit (MoBio Laboratories, Inc., 12811-50) as per manufacturer's alternative protocol. Eluted DNA extracts were stored at –20°C until use.

Table 3. Primer and probe sequences for PCR detection of enterococci

Sequence Name	Nucleotide Sequence 5' to 3'	Length	GC (%)	T_m (°C)	Detection System*
ECST748F[1]	5'aga aat tcc aaa cga act tg-3'	20mer	35	51.2	
ENC854R[1]	5'-cag tgc tct acc tcc atc att-3'	21mer	47.6	57.9	
GPL813TQ[1]	5'Cy3-tgg ttc tct ccg aaa tag ctt tag ggc ta-BHQ-2-3'	29mer	44.8	65.3	Taqman

[1]Ludwig and Schleifer, 2000.

Total enterococci primers and probe were constructed using the rDNA regions around the target site of a well established enterococci group specific primer (ENC854R) (Table 3). The primer ECST748F targets enterococci, lactococci, and several clostridia. The target site of the probe GPL813TQ is present in rDNA from a variety of representatives of gram-positive bacteria with a low G+C DNA content (Ludwig and Schleifer, 2000).

Table 4. Master mix using individual reagents

Reagents	Final conc. (μM)	Initial vol (μl)
Water		3.9
10X Taq buffer (Mg^{++} free)	1	2.5
250mM MgCl2	5	0.5
10mM DNTPs	0.5	1.25
10μM ENC854R	1	2.5
10μM ECT748F	1	2.5
10μM GPL813 TQ Cy3 Probe	0.08	0.2
5U/u Taq polymerase	0.05	0.5

The Master Mix of reagents (Table 4) yields a final volume of 20 µl, to which 5 µl of sample (either DNA extract from an environmental sample, or 5 µl of lysed cell suspension or genomic equivalents) was added for a final volume of 25 µl. The samples were run under the following optimized assay conditions for PCR: 1 cycle initial hold at 95°C for 2 min, and 45 cycles of denaturation (94°C) for 15 seconds, and annealing (60°C) for 30 seconds, the optics were turned on during the annealing step. The Cepheid Smart Cycler was set with the following specific parameters for this assay. The Dye Set was set for FCTC25. The Ct analysis mode was set for growth curve (linear) analyses, with a manual threshold typically set at between 5 and 15 fluorescence units. The background subtract level was set at a minimum of 12 and a maximum of 40. The BoxCar averaging feature was set at 0. For quality control, combined *E. faecalis* and *E. faecium* were used as our calibration strain for the total enterococci primer and probe set. Control bacteria preparations were prepared by boiling bacteria for 5 minutes, centrifuging 1 min at 12,000 rpm in a Beckman Microcentrifuge, and immediate storage on ice. *E. faecalis* and *E. faecium* cells were enumerated using either SYBR Green I epifluorescence microscopy (Noble and Fuhrman, 1998) and/or using Enterolert® or the EPA 1600 methods (APHA 1992). This yielded information on both the cell numbers in the sample, and the number of metabolically active cells present in the sample. Serial dilutions of the standards were made in duplicate in DEPC-treated sterile water, and four point standard curves are run in concert with the unknown samples on the Smart Cycler II instrument. Total enterococci primers were tested with all 19 validly described species of the genus enterococci, and demonstrated amplification of rDNA of all strains, with varying efficiencies.

Bacteroides **sp. Using Conventional PCR**

Amplification of the human-specific Bacteroides/Prevotella marker generally followed the procedure of Bernhard and Field (2000), with PCR primers that amplify partial 16S rRNA from the human fecal (HF) specific group. DNA was extracted a MoBio Ultra Clean fecal extraction kit. A range of extracted DNA quantities (2 – 5 µl, representing 1-70 ng per assay, with most samples in the range of 5-20 ng) was tested to avoid problems with inhibition. DNA was amplified with Bacteroides-Provotella specific primers Bac708r CAATCGGAGTTCTTCGTG and HF183f ATCATGAGTTCACATGTCCG. Each 50-µl PCR mixture contained the following reagents: 1 X Taq polymerase buffer (Promega), each primer at a concentration of 1µM, each deoxynucleoside triphosphate at a concentration of 200µM, 1.25U of Taq polymerase (Promega), 0.64 µg of bovine serum albumin (Sigma) per µl and 1.5mM $MgCl_2$. The thermal cycler was run under the following conditions, 2 min 95°C, then 25 cycles of 95°C for 30 sec, 60°C for 30 sec and 72 °C for 30 sec followed by a 5-min extension at 72°C. Then 1µ of each PCR product was re amplified using the same conditions as above for another 25 cycles. PCR products were visualized in a 2% agarose gel stained with 1X SYBR Gold (Molecular Probes) and compared to a 100bp DNA ladder (Promega). Positive results had 525 bp products. The positive control was human fecal sample extracted with a QIAamp stool kit. Negative controls use water instead of sample. All negative samples are spiked (in a second PCR run) with 0.1 ng of positive control to determine possible inhibition. Inhibited samples are re-run with less DNA.

RESULTS

Ballona Creek

Total volume discharged from Ballona Creek during the six-hour sampling period was 13,390 m^3 (Figure 2). Of this volume, 97% was attributed to monitored inputs from Cochran, Fairfax, Adams and Benedict, and Sepulveda tributaries. The largest volume was contributed at Cochran Avenue where the creek daylights from beneath downtown Los Angeles. Flow remained relatively stable over the study period at all sites with little variation or pattern in discharge. For example, the coefficient of variation for flow at the most downstream site, Inglewood Avenue, was less than 8% approaching the resolution of our flow monitoring devices.

The flux of fecal indicator bacteria remained relatively constant moving downstream in Ballona Creek (Figure 3). The average flux of *E. coli* ranged from 1.1 X 10^{10} to 5.3 X 10^{10} cells/hr at the six mainstem sites. The average flux of enterococcus ranged from 6.6 X 10^8 to 1.4 X 10^9 cells/hr at the six mainstem sites. In both cases, there was no discernable increase in bacterial flux; no two mainstem sites were significantly different from one another for either *E. coli* or enterococcus.

The flux of fecal indicator bacteria decreased over time (Figure 4). The average flux of enterococcus was highest at 9:00 AM (2.9 X 10^9 cells/hr) and monotonically decreased throughout the study period. The lowest flux was measured at 2:00 PM (3.0 X 10^9 cells/hr). Similar patterns were observed for *E. coli* (data not shown). In contrast to the culture-based methods, the QPCR method for measuring enterococcus did not decrease over time. The flux of enterococcus ranged from 2.7 X 10^{10} to 4.7 X 10^{10} cells/hr with the 9:00 AM and 2:00 PM samples being nearly equivalent.

The relative pattern of enterococcus contributions between tributaries was similar at all time periods (Figure 5). Benedict tributary always had the greatest flux of fecal indicator bacteria followed by Sepulveda, Fairfax and Adams tributaries. A similar pattern was also observed for *E. coli*. The flux of enterococcus from Benedict tributary ranged from 4.1 X 10^9 to 1.4 X 10^{10} cells/hr throughout the sampling period while the flux of enterococcus from Adams tributary ranged from 3.7 X 10^5 to 4.4 X 10^6 cells/hr. On average, Benedict tributary contributed 81% of the enterococcus loading from all four tributaries.

The hourly flux of enterococcus (using culture-based methods) from each of the four main tributaries approximated the load being passed down Ballona Creek (Figure 5). Regardless of hour, the flux from each of the tributaries was within a factor of 10^1 compared to its nearest downstream site on the mainstem of Ballona Creek. The only exception was the Adams tributary, which was as much as four orders of magnitude less than its nearest downstream site. The mainstem showed virtually no response to any of these tributary inputs, including Adams. Enterococcus flux remained virtually unchanged from upstream to downstream of each of the tributary inputs (Figure 5, Figure 3).

Measurements of *Bacteroides* sp. and enterovirus indicated the presence of human fecal contamination throughout the system (Table 5). *Bacteroides* sp. was present in 12 of 36 mainstem samples (33%). Enterovirus was present in 14 of 36 mainstem samples (44%). The concordance among these measurements was nearly complete; almost every location that detected *Bacteroides* sp. was also positive for enterovirus. Only two samples were positive for enterovirus and not *Bacteroides* sp. These two samples were furthest downstream or latest in the day.

Table 5. Number of enterovirus genomes (per 100 ml) detected.

Distance Upstream (km)	Time of Day					
	9:00	10:00	11:00	12:00	1:00	2:00
6.3	106*	71*	93*	70*	67*	
5.4		41*	19**	25*		
4.7		17*		113*	51	
2.6				79*		
1.5				13*		39
0						

* Human Bacteroides marker also detected.
** PCR reaction for human Bacteroides marker inconclusive due to inhibition.

Spatial and temporal patterns in enterovirus concentration were evident in the Ballona Creek system (Table 3). Main channel locations in the upper reaches of the study area were more likely to be positive for enteroviruses than downstream sites. The most consistently positive site was Cochran Ave., where 89% of the samples contained measurable levels of enterovirus. In addition, the highest concentrations of enterovirus were measured at Cochran Ave. during four of the six time periods. A general pattern in enterovirus detection was observed during the course of the day. Enterovirus was detected earliest in the day at upstream sites. Enterovirus was detected most frequently late in the day at the downstream sites. The 12:00 sampling interval had the most frequent detection of enterovirus with the highest concentrations observed at the middle sites in the watershed. Enterovirus was not detected in high concentrations in any of the tributaries; only Adams tributary had any detectable enterovirus.

Malibu Creek

Malibu Creek had a similar pattern of fecal indicator bacteria concentrations at each sampling event throughout the study period (Figure 6). Concentrations decreased along the mainstem as it flowed from Cold Creek to Cross Creek, then increased as it flowed through the estuary until it discharged into the ocean at Malibu Beach. The increase in fecal indicator bacteria through the lagoon averaged 10^2 MPN/100 ml for both enterococcus and *E. coli*. The dilution factor from the discharge to the shoreline as a result of wave induced mixing averaged 0.86 for *E. coli* and 0.34 for enterococcus. Despite the increase in fecal indicator bacteria concentrations, none of the Malibu samples were positive for enteroviruses or *Bacteroides* sp.

BMP's

Both of the BMPs that incorporated UV treatment systems were more effective than the constructed wetland at removing fecal indicator bacteria (Table 6). Albeit concentrations were low in the influent, the constructed wetland did not reduce concentrations of *E. coli* or enterococcus using either culture-based or QPCR methods in the effluent. Both UV treatment systems, however, reduced influent concentrations of *E. coli* and enterococcus in the effluent to near or below method reporting levels. Enterococcus concentrations by QPCR were reduced by an order of magnitude, which was not as great as the culture-based method. No enterovirus or *Bacteroides* sp. were detected in any of the BMP influent or effluent samples analyzed.

Table 6. BMP effectiveness for indicator bacteria removal measured by culture-based (chromogenic substrate, CS) or quantitative polymerase chain reaction (QPCR) methods.

Indicator	Constructed Wetland		Filtration+UV		Filter+DAF+UV	
	Influent	Effluent	Influent	Effluent	Influent	Effluent
***E. coli* (CS) (MPN/100 ml)**	<10	36	58	20	147	<10
Enterococcus (CS) (MPN/100 ml)	<10	47	184	15	42	<10
Enterococcus (QPCR) (Cells/100 ml)	163	110	5004	729	No Data	No Data
Enterovirus (genomes/100 ml)	-	-	-	-	No Data	No Data

* no *Bacteroides* sp. detected
- no enterovirus detected

DISCUSSION

The Ballona Creek watershed is a system severely impacted by fecal pollution. The flux of fecal indicator bacteria was as high at the head of the watershed as it was at the mouth of the creek where it discharges into SMB. Although we focused on flux of these fecal indicator bacteria, it is important to note that 92% of all samples collected from Ballona Creek in this study, including 100% of the samples just upstream of SMB, exceeded the water quality thresholds established by the State of California. The presence of human enterovirus and human specific markers of *Bacteroides* sp. further documents the fecal inputs and should increase an environmental manager's awareness of the possible human health risks associated with these discharges.

Our study is not the first to examine the presence of viruses in urban runoff entering shorelines in SMB and other southern California urban watersheds. For example, Gold *et al.* (1990) and Gold *et al.* (1992) found viruses in repeated samples from multiple storm drains to SMB using both cell culture and RTPCR techniques. Haile *et al.* (1999) detected human specific viruses in all three storm drains tested in their epidemiology study of SMB. Noble and Fuhrman (2001) found human enteric virus genomes in the nearshore marine waters of SMB. Jiang et al (2001) found human adenovirus in samples collected at 12 sites between Malibu and the Mexican border.

The multi-tiered approach used in this study can assist watershed managers in determining sources and efficiently abating the most significant inputs of fecal indicator bacteria. If managers relied solely on the patterns in fecal indicator bacteria from Ballona Creek, then the only option would be to treat the entire 37 m^3/s discharge furthest downstream at Inglewood Ave. because the flux of fecal indicator bacteria was similar from all sources. The use of multiple tools, however, allows managers to prioritize the most important sources. In this case, the presence of human enterovirus was greatest from the Cochran Ave. site, where the system daylights from the underground storm drain system beneath Los Angeles and the discharge volume is one-third the volume at Inglewood Ave. Since Cochran Ave. had the most frequent occurrence and highest concentrations of enterovirus, this source would appear to be the most likely candidate for future management actions. The co-occurrence of the human *Bacteroides* sp. marker at most of the locations and time periods where enterovirus was quantified, most notably in all of the Cochran Ave. samples, provides the reassurance most managers would need before planning future management steps.

The lack of correlation between bacterial indicator levels and levels of human pathogenic viruses has been observed in previous studies (Dufour, 1984; Elliott and Colwell, 1985) and demonstrates the value of a multi-tiered approach used herein for source identification. For example, analysis of wild shellfish from the Atlantic coast of France indicated no significant correlation between fecal coliforms and enteroviruses or hepatitis A virus (LeGuyader et al., 1993; Leguyader et al., 1994), and viruses have sometimes been found in oysters without coliform contamination (Goyal et al., 1984; Yamashita et al., 1992). Noble and Fuhrman (2001) detected enterovirus in 35% of the 50 shoreline samples they examined over a five year period and no significant statistical relationship to any of the standard bacterial indicators was found. Noble *et al* (2000) measured virus and fecal indicator bacteria in dry weather urban runoff in drains along 300 km of shoreline from Santa Barbara to San Diego. Despite 46% of the storm drains containing detectable enterovirus, there was no correlation with fecal indicator bacteria concentrations.

The results of this study indicated that Ballona Creek presents a greater risk to human health than Malibu Creek. There were no enterovirus or *Bacteroides* sp. detected in any sample from the Malibu Creek watershed. The bacterial concentrations were lower at Malibu Creek than at Ballona Creek; none of the Malibu Creek samples from the bottom of the watershed (at Cross Creek) exceeded water quality thresholds established by the State of California. Interestingly, fecal indicator bacteria concentrations increased as water flowed through the lagoon at the base of the Malibu watershed. No enterovirus or *Bacteroides* sp. was detected in these samples either, although other studies have detected human specific sources of viruses in this discharge (John Griffith *personal communication*).

The use of QPCR to measure fecal indicator bacteria presents unique opportunities and challenges. The advantage of QPCR for measuring fecal indicator bacteria is speed potentially providing measurements in less than four hours (Griffith et al 2004). However, culture-based methods only quantify viable bacteria, while QPCR measures the DNA from both cultivable and noncultivable microbes. This was most apparent in the temporal trends from Ballona Creek. Samples of enterococcus using culture-based methods generally decreased as the day progressed, most likely as the result of degradation from sunlight (Noble et al. 2004). Ballona Creek is a 40m wide concrete-lined channel concentrating solar energy into the shallow creek in the channel invert. The QPCR results, however, remained steady indicating that the bacterial DNA was still intact even though the enterococci were not viable.

The data from this study suggested the UV treatment systems were more effective than the constructed wetland at reducing fecal indicator bacterial concentrations. We suspected the UV treatment system would be effective since this method is a well-known mechanism for degrading bacteria (Fujioka et al. 1981, Davies and Evison, 1991, Davies-Colley et al. 1994, Noble et al 2004). Not only did the UV system reduce concentrations of enterococci using culture-based techniques , but it also degraded its DNA as shown by large reductions in enterococcus by QPCR. On the other hand, the effectiveness of the treatment wetland remains incompletely quantified. Although levels of fecal indicator bacteria were similar before and after flowing through the wetland, concentrations were very low to begin with. Monitoring by others at this treatment wetland suggest that it has been effective at reducing fecal indicator bacteria concentrations using culture-based methods (Nancy Palmer, City of Laguna Niguel *personal communication*). More study, particularly with the QPCR, will be needed before the wetland effectiveness can be fully quantified.

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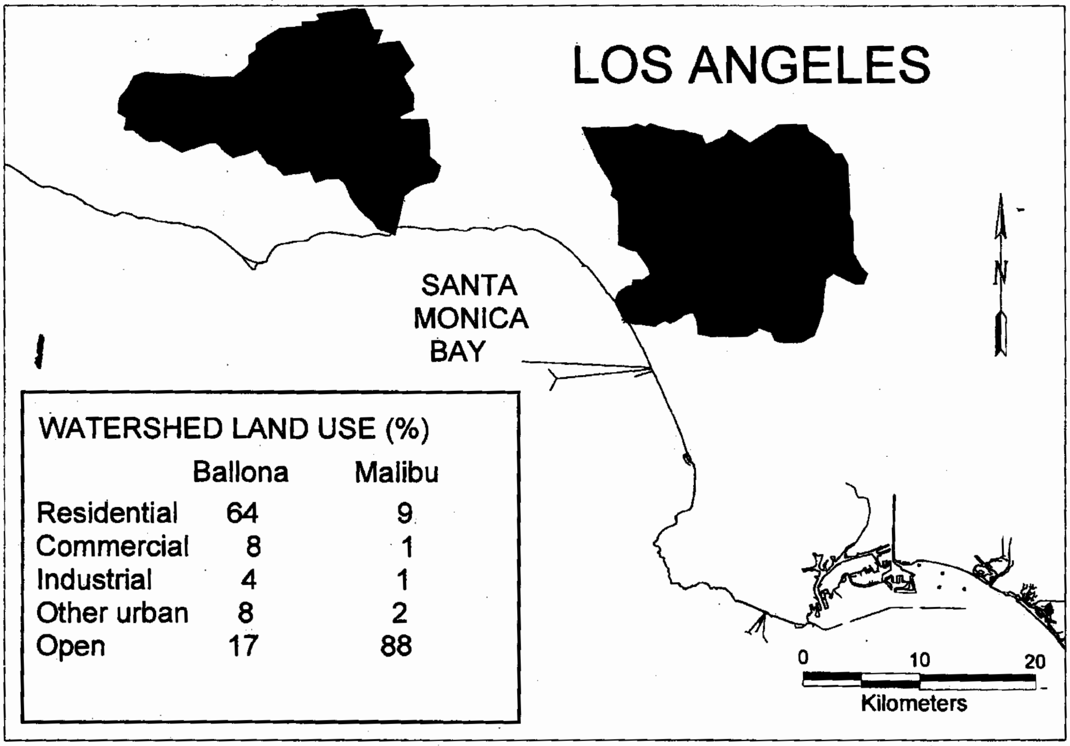


WATERSHED LAND USE (%)

	Ballona	Malibu
Residential	64	9
Commercial	8	1
Industrial	4	1
Other urban	8	2
Open	17	88

Figure 1: Map of Santa Monica Bay, CA indicating the locations and land use distribution for Ballona Creek and Malibu Creek watersheds.

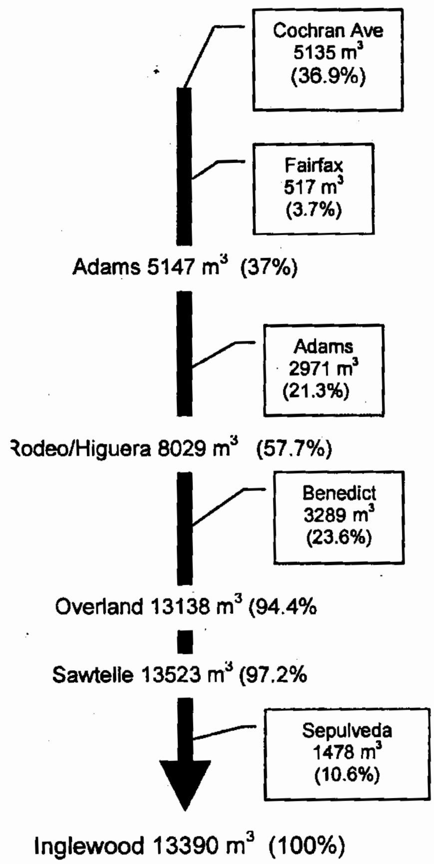


Figure 2. Schematic diagram depicting additive flow in main channel and percent contribution from each tributary.

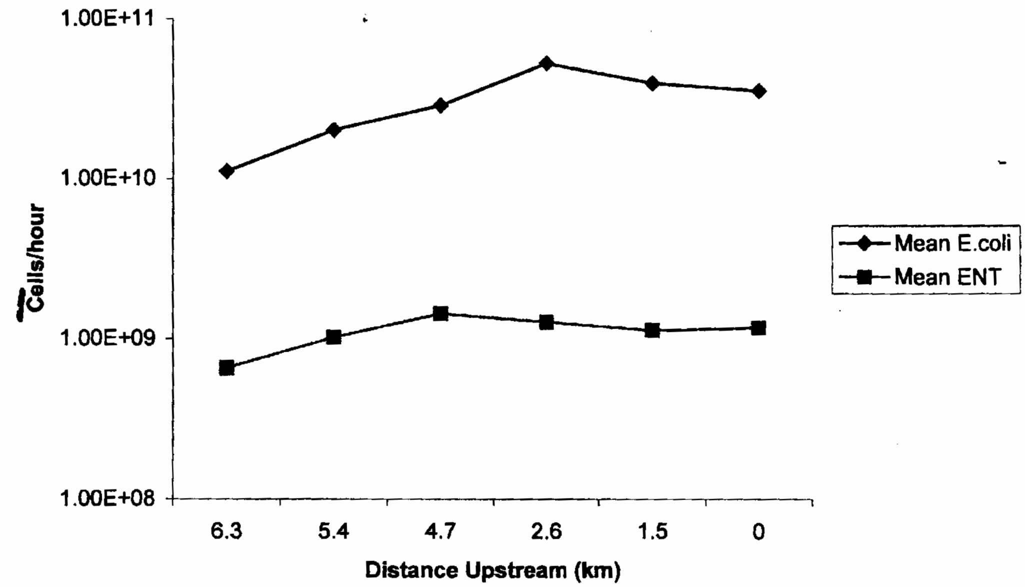


Figure 3. Mean hourly flux of *E. coli* and enterococcus at each station in main channel of Ballona Creek measured using the IDEXX™ method.

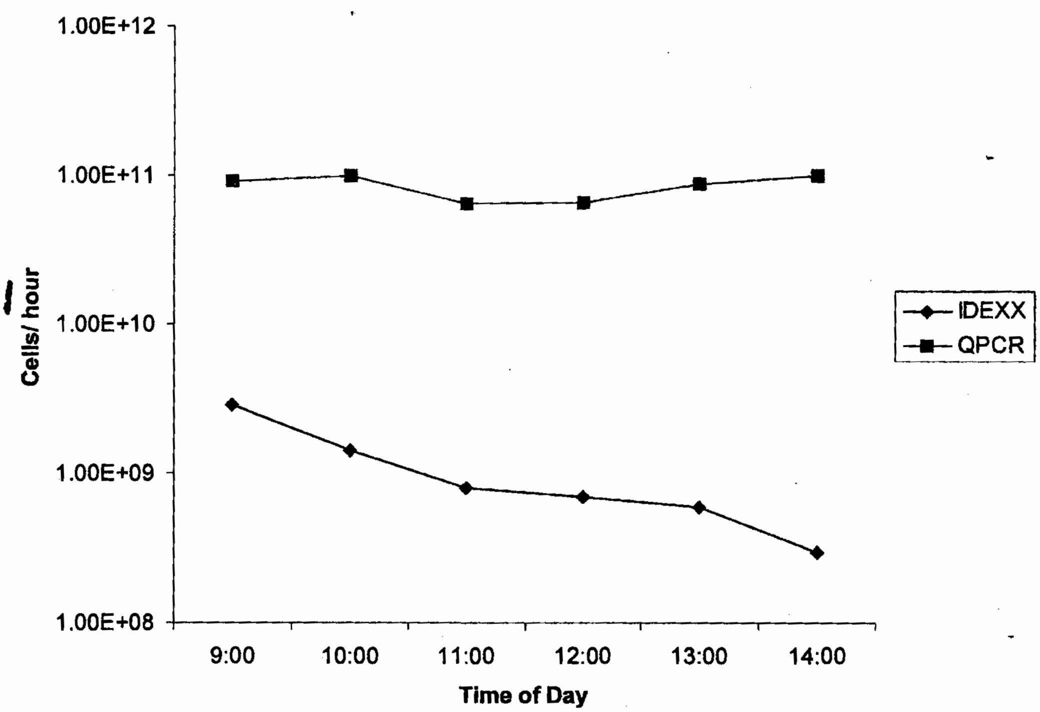


Figure 4. Mean hourly flux of enterococcus along the main channel of Ballona Creek as measured using both IDEXX the QPCR methods.

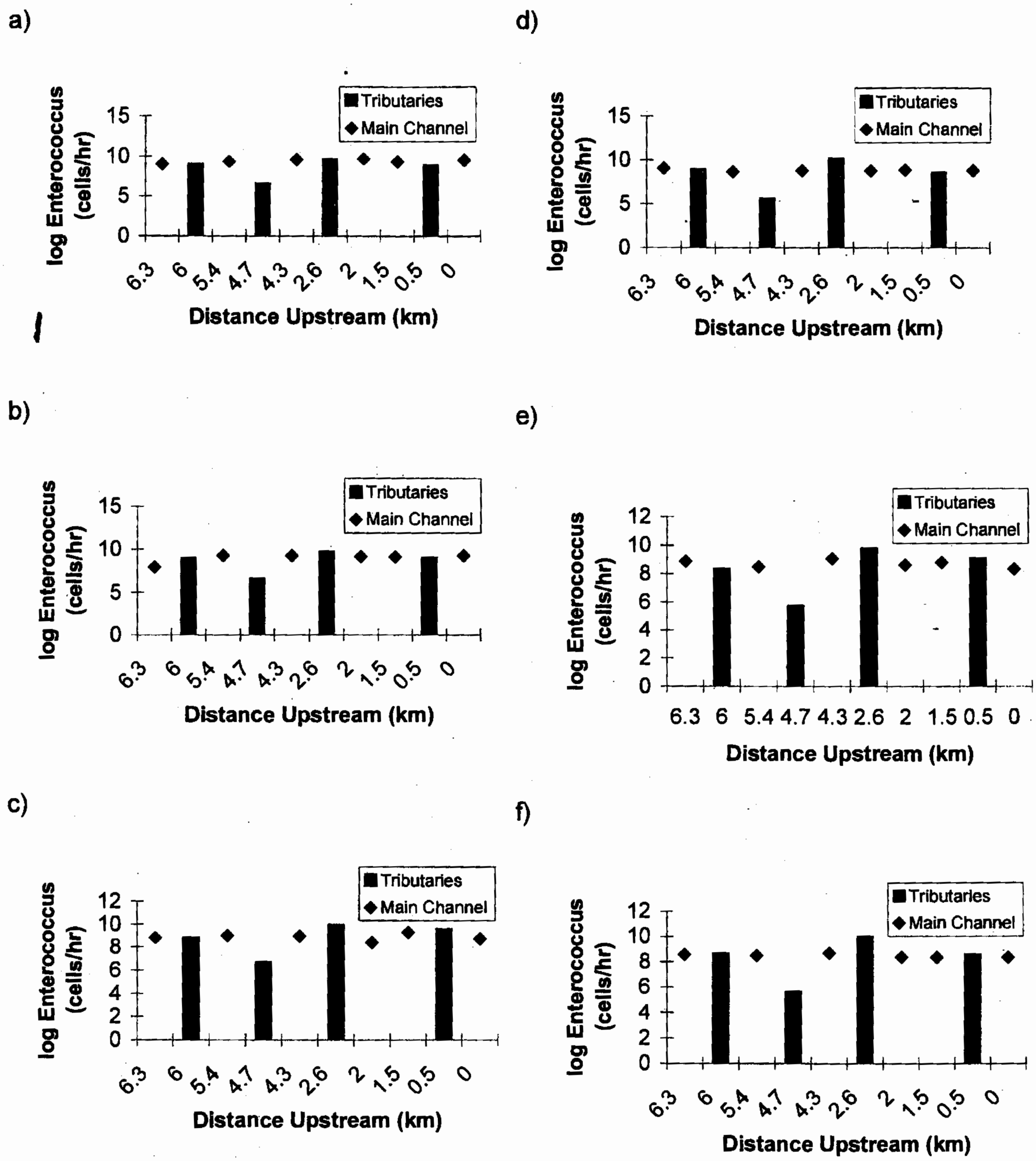
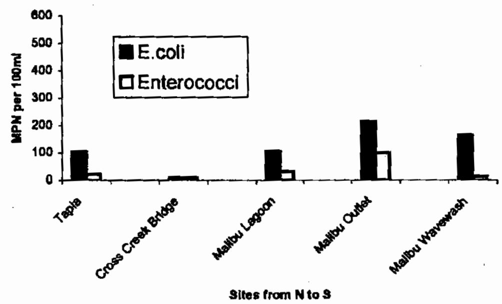
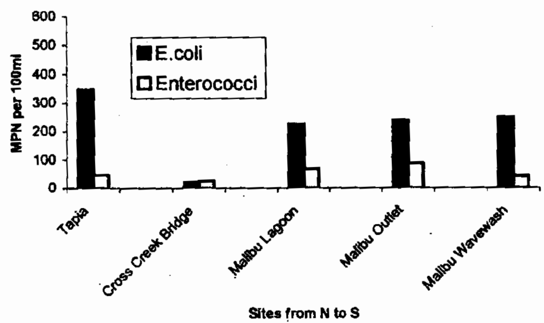


Figure 5. Enterococcus loading in main channel and tributaries of Ballona Creek at a) 9:00, b) 10:00, c)11:00, d) 12:00, e)13:00, f)14:00.

a)



b)



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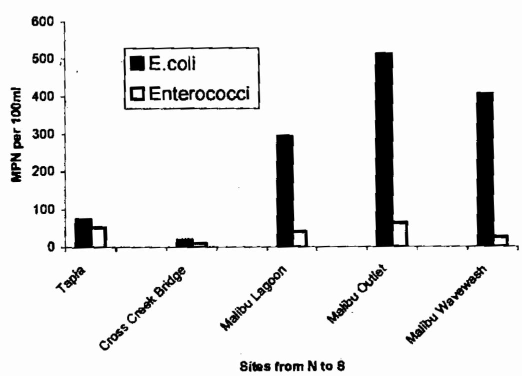

Figures 6. Fecal indicator bacteria concentrations in Malibu Creek on a) 11/10/04 b) 11/11/04 and c) 11/12/04

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Modeling the dry-weather tidal cycling of fecal indicator bacteria in surface waters of an intertidal wetland

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Abstract

Recreational water quality at beaches in California and elsewhere is often poor near the outlets of rivers, estuaries, and lagoons. This condition has prompted interest in the role of wetlands in modulating surface water concentrations of fecal indicator bacteria (FIB), the basis of water quality standards internationally. A model was developed and applied to predict the dry-weather tidal cycling of FIB in Talbert Marsh, an estuarine, intertidal wetland in Huntington Beach, California, in response to loads from urban runoff, bird feces, and resuspended sediments. The model predicts the advection, dispersion and die-off of total coliform, *Escherichia coli*, and enterococci using a depth-integrated formulation. We find that urban runoff and resuspension of contaminated wetland sediments are responsible for surface water concentrations of FIB in the wetland. Model predictions show that urban runoff controls surface water concentrations at inland sites and sediment resuspension controls surface water concentrations near the mouth. Direct wash-off of bird feces into the surface water is not a significant contributor, although bird feces can contribute to the sediment bacteria load. The key parameters needed to accurately predict FIB concentrations, using a validated hydrodynamic model, are: the load due to urban runoff, sediment erodibility parameters, and sediment concentrations and surface water die-off rates of enteric bacteria. In the present study, literature values for sediment erodibility and water column die-off rates are used and average concentrations of FIB are predicted within 1/2 log unit of measurements. Total coliform are predicted more accurately than *E. coli* or enterococci, both in terms of magnitude and tidal variability. Since wetland-dependent animals are natural sources of FIB, and FIB survive for long periods of time and may multiply in wetland sediments, these results highlight limitations of FIB as indicators of human fecal pollution in and near wetlands.

Keywords: Enteric bacteria; Intertidal wetland; Coastal; Water quality; Sediment

1. Introduction

Fecal indicator bacteria (FIB) groups such as total coliform (TC), fecal coliform (FC), *Escherichia coli* (EC), and enterococci (ENT) are utilized world wide to measure health hazards in bathing and shellfish harvesting waters (Thomann and Mueller, 1987). Water samples at popular beaches and harvesting waters are

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routinely tested for FIB, which are thought to signal the presence of pathogens but are not necessarily pathogenic (US EPA, 1986). Chronic exceedances of California criteria have placed coastal water bodies such as Tomales Bay, Moss Landing Harbor, Morro Bay, Ventura Harbor, Marina Del Rey Harbor, Newport Bay, and Mission Bay on lists of pathogen impaired water bodies (CalEPA, 2002). Exceedances are also common at open ocean beaches, particularly near the outlets of storm drains, rivers, estuaries, and lagoons. Numerous coastal water bodies are impaired worldwide according to such standards.

Pathways by which FIB enter coastal waters include urban and agricultural runoff, waste water discharges, sewage leaks and spills, and fecal deposits by wildlife, notably birds. A complex web of processes influence the distribution of FIB in surface waters including flushing by ocean water, die-off, predation, sedimentation and resuspension, and regrowth on sediments, vegetation, and debris (Savage, 1905; Goyal et al., 1977; Roper and Marshall, 1979; Jensen et al., 1979; LaBelle et al., 1980; Grimes et al., 1986; Thomann and Mueller, 1987; Davies et al., 1995; Oshiro and Fujioka, 1995; Anderson et al., 1997; Byappanahalli and Fujioka, 1998; Solo-Gabriele et al., 2000; Grant et al., 2001). Use of FIB as indicators of human pathogens is complicated by these processes, particularly in wetlands where wildlife is abundant and nutrient rich sediments support growth of bacteria. So long as FIB remain the basis of regulations governing coastal water quality, a need will exist to identify the forcing factors (river inputs, storm drains, etc.) supporting FIB populations so that appropriate and cost-effective management measures can be implemented.

Several researchers have recently reported on models to predict FIB concentrations in coastal waters. Use of such models in coordination with field monitoring programs can help to identify the relative impact of various sources (e.g., a river versus a storm drain), characterize the mechanisms governing the fate of these organisms (e.g., flushing versus die-off) and predict the efficacy of a range of potential management measures. Kashefipour et al. (2002) used a model consisting of depth-integrated continuity, momentum, and transport equations to predict FIB concentrations in the Ribble Estuary, England. Fiandrino et al. (2003) used a model consisting of three dimensional continuity, momentum, and transport equations to predict FIB concentrations in Thau lagoon, France. Steets and Holden (2003) used a one-dimensional model to predict FIB concentrations in Arroyo Burro lagoon, California.

In this study we use a model to simulate dry-weather tidal cycling of TC, EC, and ENT concentrations in surface waters of Talbert Marsh, an intertidal wetland in Huntington Beach, California. Runoff from an urbanized watershed drains to the marsh, the marsh accommodates a high concentration of shore birds, and high sediment concentrations of FIB have been measured. Grant et al. (2001) reported that Talbert Marsh was a net source of ENT to coastal waters and hypothesized that it was due to a combination of bird feces and interactions with sediments and vegetation. Sediments act as a reservoir of FIB (Goyal et al., 1977, e.g.), and suspension and deposition cycles are germane to the estuarine environment (Mehta and Dyer, 1990). In Talbert Marsh, it is not clear whether FIB concentrations are predominantly controlled by urban runoff, erosion of contaminated sediments, bird feces, or some combination of these factors. Therefore, the model is applied to examine and rank the influence of these "forcing factors." The modeling effort described in this paper is unique relative to previously published studies in that non-point loads of FIB (bird feces, erosion of contaminated sediments) are incorporated into a multi-dimensional, time-dependent formulation for the first time.

The model in this study consists of depth-integrated continuity and momentum equations to simulate circulation, and depth-integrated transport equations to simulate surface water concentrations of FIB resulting from urban runoff, bird droppings and resuspended sediments. The model is parameterized using either in situ data or previously published values of model parameters. The model is applied to predict FIB over a 15 day period beginning May 2, 2000, coincident with an extensive field monitoring effort previously reported (Grant et al., 2001, 2002). This work demonstrates the power of first-principle models to elucidate the mechanisms and pathways by which near-shore coastal waters are polluted by FIB.

2. Methods and materials

2.1. Site description

Talbert Watershed, shown in Fig. 1, is a 3300 ha catchment along the southern California coastline in the cities of Huntington Beach and Fountain Valley. On average, the watershed receives 29 cm of rainfall, over 90% of which falls between November and April. Daily high/low temperatures average 23/17 °C in September and 17/8 °C in January. The watershed slopes mildly (10^{-4}) towards the ocean and is drained by a network of channels that, due to the low elevation and mild slope of the watershed, are flooded by tides. Talbert Channel is the main stem of the network. Inland 2 km from the mouth, Huntington Beach Channel branches west and extends 5 km inland; and 8 km from the mouth, Fountain Valley Channel branches east. High tide floods Talbert Channel to the Fountain Valley Channel junction and the length of the Huntington Beach channel. Depths in the channels are comparable to the

Fig. 1. View of Talbert Marsh, channel network, and surrounding watershed as low tide. Channels and watershed extends several kilometers further inland than indicated in the figure. At high tide, the southwestern and southern portions of Talbert Marsh are flooded. PCH, BRK, and AES indicate monitoring stations.

tidal amplitude, roughly 1 m. Near the outlet, Talbert Marsh occupies roughly 10 ha of what used to be an extensive (1200 ha) tidal marsh environment that was filled for development over the past century. Talbert Marsh was created in 1990 when remnant marsh was flooded following the removal of a Talbert Channel levee. The channel bed consists of beach sand and silts near the outlet and within a flood delta that penetrates a short distance into the marsh. Further inland, the marsh and channel bed consists of organic rich silts and muds, except the upper reaches of Talbert Channel and Fountain Valley Channel where the bed is lined with concrete. In this study, the Talbert Marsh and tidal channels are collectively referred to as the wetland. From a perspective of flushing the wetland may be divided into two zones: a poorly mixed zone inland where residence times are at least a week, and a well-mixed zone near the mouth that is flushed each tide cycle with ocean water. The interface between these zones oscillates with the ebb and flow of the tides.

The watershed is heavily developed as is common to the greater Los Angeles basin, and it contains separate networks of storm and sanitary sewers. Storm sewers direct runoff into street drains that funnel to the wetland. In the lower half of the watershed where the topography is lowest, runoff collects in one of several roughly 500 m^3 forebays that are intermittently drained by pump stations. A program is now in place to divert dry-weather runoff from the storm sewer to the sanitary sewer for treatment. This program began on a limited basis in Fall 1999 and encompassed the entire watershed by Summer 2001. During the 15 day period that is the focus of this study, pump stations were operated in two different modes. During the first 8 days, pumpstations were not activated so runoff either collected in the forebay or was diverted to the sanitary sewer system.

During the remaining 7 days, pumpstations intermittently discharged untreated runoff to the channel network. Over the entire 15 day period, there was dry-weather baseflow in Talbert Channel that entered the wetland.

Monitoring stations referenced in this paper include Pacific Coast Highway (PCH), Brookhurst Street (BRK), and AES Corp. (AES). These are shown in Fig. 1.

2.2. FIB modeling

A hydrodynamic model was developed to simulate surface water concentrations of FIB in the wetland, from the outlet of Talbert Marsh to the head of the Huntington Beach Channel and, along Talbert Channel, to the Fountain Valley Channel junction. The model consists of depth-integrated continuity, momentum, and transport equations (Arega and Sanders, 2004), similar to the approach adopted by Kashefipour et al. (2002). The flow equations (continuity and momentum) were forced by the ocean tide just offshore of the marsh, and by runoff flowing into the upper reaches of the wetland. Ocean tide forcing was based on tide levels recorded at NOAA station 9410660, Los Angeles and archived on-line at `http://tidesonline.nos.noaa.gov/`. The discharge of runoff at the Talbert Channel inflow boundary, Q_R, was assumed steady over the study period. To model pumpstation operations, the discharge of runoff from each pumpstation, Q_P, was assumed uniform and steady over the final seven days of the study period, but zero over the first eight days. Seven pumpstations that discharge directly into the wetland were incorporated into the model. Runoff data (Q_R and Q_P) were obtained from other reports (Grant et al., 2001, 2002; Chu, 2001) and appear in Table 1. Topographic data necessary for flow predictions were obtained from as-built plans of the concrete-line portions of the channels and a field survey of the Talbert Marsh (Chu, 2001). A uniform Manning coefficient was used to account for bed resistance (Arega and Sanders, 2004).

Simultaneous with the flow prediction described above, surface water FIB were predicted by solving the following transport equations:

$$\begin{aligned}\frac{\partial}{\partial t}(hc_i) + \frac{\partial}{\partial x}(\bar{u}hc_i) + \frac{\partial}{\partial y}(\bar{v}hc_i) &= \frac{\partial}{\partial x}\left(hE_{xx}\frac{\partial c_i}{\partial x} + hE_{xy}\frac{\partial c_i}{\partial y}\right) \\ &\quad + \frac{\partial}{\partial y}\left(hE_{yx}\frac{\partial c_i}{\partial x} + hE_{yy}\frac{\partial c_i}{\partial y}\right) \\ &\quad - hl_i + a_i + \sum_{k=1}^{N_{PS}} \mathscr{L}_{ik}\,\delta(x - x_s^k, y - y_s^k), \end{aligned} \tag{1}$$

where $h=$ depth [m] and $\bar{u}$, $\bar{v}=$ components of the depth-averaged fluid velocity [m/s], E_{xx}, E_{xy}, E_{yx}, and $E_{yy}=$ elements of the dispersion tensor [m^2/s], c_i, $(i=1,\ldots,N_b)=$ water column concentration of FIB [MPN/m^3], $N_b=$ number of FIB groups tracked by the model, $l_i=$ water column loss rate [MPN/m^3/s], $a_i=$ flux of FIB to water column at sediment/water interface [MPN/m^2/s], and $\mathscr{L}_{ik}=$ FIB loading rate of the ith FIB group at the kth inflow point [MPN/s], N_{PS} is the

Table 1
Measured, cited, and computed parameters used to estimate loading and die-off models

Parameter	Units	Total coliform		*E. coli*		Enterococci	
		Value	Uncertainty	Value	Uncertainty	Value	Uncertainty
k[a]	m^2/Watts/h	0.0018	±10%	0.0017	±10%	0.00097	±10%
c_R[b]	MPN/100 mL	1.5×10^4	$2.2\times10^4/1.0\times10^4$	9.8×10^2	$1.4\times10^3/7.1\times10^2$	1.8×10^3	$2.4\times10^3/1.3\times10^3$
r[b]	MPN/bird/day	2.8×10^7	$8.4\times10^7/2.1\times10^6$	1.5×10^7	$1.0\times10^8/1.2\times10^7$	7.2×10^6	$2.6\times10^7/5.2\times10^6$
s[b]	MPN/g	5.2×10^3	$1.3\times10^4/2.0\times10^3$	2.1×10^2	$8.5\times10^2/5.1\times10^1$	6.8×10^2	$1.6\times10^3/2.9\times10^2$
Parameter	Units	Value	Uncertainty (%)	Parameter	Units	Value	Uncertainty (%)
Q_R	m^3/d	1000	±50	$\overline{n_b}$	—	174	±50
Q_P	m^3/d	300	±50	$\langle\bar{\tau}\rangle$	Pa	0.08	±50
$\overline{A_S}$	ha	32	±50	τ_0	Pa	0.75	±50
E_0[c]	kg/m^2/s	1×10^{-4}	±50	τ_c[c]	Pa	0.25	±50

Except where noted, a conservative estimate of 50% uncertainty was adopted. Note that the mathematical model is presented using SI units, so conversion factors need not appear in model equations. Commonly used units are presented here to facilitate comparison with previous works and other studies.

[a] Die-off rates based on Sinton et al. (1999).

[b] Measured in situ, uncertainty based on standard error.

[c] Erodibility rates based on Uncles and Stephens (1989).

number of inflow points where runoff is added to the wetland (pump stations and tributary inflow), x_s^k and y_s^k = coordinates of each inflow point [m], and δ = Dirac delta function [1/m^2]. The dispersion tensor accounts for longitudinal dispersion (Elder, 1959) and transverse mixing (Ward, 1974), and it is computed locally depending on the orientation of the currents (Arega and Sanders, 2004). Note that SI units are adopted for the purpose of presenting the mathematical model, so conversion factors need not appear in model equations. However, many model parameters are reported in Table 1 with commonly used units to facilitate comparison with previous works and other studies.

Eq. (1) was solved using $N_b = 9$ to predict the distribution of TC, EC, and ENT resulting from urban runoff, bird feces, and sediment resuspension. Groups 1–3 correspond to TC, EC, and ENT concentrations resulting from runoff sources, 4–6 from bird sources, and 7–9 from sediment sources. All model predictions account for surface water die-off using first order kinetics as follows:

$$l_i(x, y, t) = k_i I(t) c_i(x, y, t), \tag{2}$$

where k_i = die-off rate constant [m^2/Watts/s] based on Sinton et al. (1999), and $I(t)$ = solar intensity [Watts/m^2]. Die-off rates used in the model were taken from Sinton et al. (1999), and solar intensity data for the study period were obtained from Grant et al. (2001).

The model does not account for settling. Suspended sediments in the 1–10^3 μm size range are typical of intertidal wetlands adjacent to sandy ocean beaches, but FIB in southern California coastal waters are either free-living (planktonic, roughly 1 μm in size) or associated with very fine sediments, probably in the 10 μm range or less (Ahn et al., 2005). The relative influence of settling and die-off is defined by the ratio $w_s/k_i I h$, where w_s is the settling velocity. Using Stokes Law to model the settling velocity in terms of particle size (e.g. Nazaroff and Alvarez-Cohen, 2001, Chapter 4), the average solar radiation rate for the study period (288 Watts/m^2), die-off rates reported by Sinton et al. (1999), and a depth of 1 m which is typical for the wetland, this ratio is unity for ENT when particle diameter d = 10 μm and for TC and EC when d = 13 μm. When d = 5 μm, this ratio is 0.3 for ENT and 0.2 for TC and EC. The nonlinear dependence is due to the quadratic relationship between settling velocity and particle size. Without a clear understanding of the partitioning of FIB between free-living and particle-associated states, and knowledge of the median diameter of particles with attached FIB, selecting an appropriate settling velocity is difficult. Certainly, without settling terms the model will under-estimate water column FIB losses if these organisms are associated with particles in the 10–20 μm range or larger. Therefore, this assumption should be reconsidered if the model significantly overpredicts FIB concentrations.

For all predictions, the concentration of FIB in water entering the wetland from the ocean was set to zero. For the urban runoff predictions (i = 1–3), point loads of FIB were specified at runoff inflow points and the non-point loading term, a_i, was set to zero. The loading rate was set equal to the volumetric flow rate multiplied by the concentration of FIB in runoff, c_R, which was specified based on average Talbert Watershed urban runoff concentrations reported by Reeves et al. (2004).

FIB loading to surface waters by bird feces (i = 4–6) was modeled as a spatially distributed (around the water line) and temporally variable non-point source. It was assumed that all bird feces fell exclusively on the shoals of the marsh, were subject to sunlight induced die-off, and upon flooding by the tide were instantaneously and completely transferred to the water column. Hence, loading in the model occurs at water's edge during the rising tide. This approach was motivated by bird surveillance data, which showed birds congregated on shoals during low tides (Grant et al., 2001). The following mass balance equation was solved to track the build-up an die-off of FIB on the shoals of the marsh,

$$\frac{\mathrm{d}m_i(x, y, t)}{\mathrm{d}t} = d_i(t) - k_i I(t) m_i(x, y, t), \tag{3}$$

where m_i = the surficial FIB density [MPN/m^2] and d_i = FIB loading rate [MPN/m^2/s]. Note that the die-off rate constant for the marsh banks is identical to that used for surface water. The FIB loading rate was computed as,

$$d_i(t) = n_b(t) r_i / A_{\mathrm{IT}}(t), \tag{4}$$

where $A_{\mathrm{IT}}(t)$ = the exposed (or dry) inter-tidal surface area [m^2], $n_b(t)$ = bird population measured hourly in the marsh and r_i = rate of FIB loading per bird [MPN/bird/s]. The exposed inter-tidal surface area (or area of the exposed shoals) was determined from the marsh topography as the difference between the exposed surface area of the marsh and the exposed surface area under high spring tide conditions. This varied from 0 to 4.5 ha depending upon the tide stage. Table 1 presents bird loading rates used in the model, which were based upon samples collected Talbert Marsh. The sampling methodology is described in (Grant et al., 2001), but only ENT concentrations are reported. TC and EC were quantified from the same samples using defined substrate tests (IDEXX, Westbrook, Maine), but the data have not previously been reported.

FIB loading rates of birds vary widely depending upon species, habitat, diet, and feeding habits. Hussong et al. (1979) reported fecal coliform loading rates for wild swan and Canadian geese of 10^6–10^9 and 10^4–10^7 MPN/bird/day, respectively, Gould and Fletcher (1978) reported fecal coliform loading rates for several gull species in the range of 10^6–10^7 MPN/bird/day. Alderisio and DeLuca (1999) reported fecal coliform loading rates of roughly 10^8 and 10^5 MPN/bird/day for ring-billed gulls and Canadian geese, respectively. Rates reported in Table 1 for shore birds in Talbert Marsh are similar, roughly 10^7 MPN/bird/day for all three indicator groups. During the study period bird populations ranged from 0 to 1180 (Grant et al., 2001).

After being flooded by the rising tide, the wash-off of surficial bacteria from the marsh banks contributes to the sediment/water interface loading rate, a_i appearing in Eq. (1), as follows:

$$a_i(x, y, t) = m_i(x, y, t)\delta(t - t_f), \tag{5}$$

where t_f = the instant land is flooded by the rising tide [s] and δ = Dirac delta function [1/s]. Hence, the transfer of surficial FIB from the banks of the marsh to surface waters is modeled as an instantaneous exchange that is triggered by moment the bank is flooded by the rise of the tide. After transfer to surface waters, $m_i = 0$ until the banks are again dry at which point the build-up process resumes.

FIB loading to surface waters by sediments ($i = 7$–9) was modeled as a spatially distributed and temporally variable non-point. The non-point loading term a_i in Eq. (1) was formulated to account for the transfer of FIB to the water column that occurs when FIB laden particulate matter and pore water on the bed is mobilized by turbulent shear. The mobilization of estuarine sediments occurs after a threshold in turbulent shear has been exceeded, and in proportion to the excess of turbulent shear above the threshold (Partheniades, 1965; Mehta and Dyer, 1990). Whether or not the same is true for FIB is not clear, for FIB may be free living in sediment pore water, attached to sediment grains, or incorporated into microbial biofilms; and how these phases of FIB respond to shear is not known. Therefore, a novel approach was taken. The FIB loading term was developed by dimensional analysis with the following conditions in mind: (a) that the transfer rate of FIB from sediments to surface waters be proportional to the shear rate; and (b) that FIB liberated from the sediments over a tide cycle be equal to FIB present (either attached to particles or free-living in pore water) in the erodible layer of surficial sediments. Therefore, the following rate expression was used,

$$a_i(x, y, t) = s_i E \frac{\tau(x, y, t)}{\tau_0}\left(\frac{\tau_0}{\tau_c} - 1\right), \tag{6}$$

where s_i = geometric mean concentration of FIB per mass of sediment [MPN/kg], E = entrainment rate parameter [kg/m^2/s], τ = spatially and temporally varying shear stress at the bed [Pa] computed by the hydrodynamic model, τ_c = critical shear stress for erosion [Pa], and τ_0 = reference stress [Pa] representative of erosive conditions in the wetland.

The reference stress was computed based on water level and velocity data collected at BRK (Arega and Sanders, 2004). BRK serves as a good reference point due to its central location. Using a drag coefficient of 0.003 which is typical of estuaries, a fluid density of 1 g/cm^3, and a velocity of 0.5 m/s, the reference stress was estimated to be $\tau_0 = 0.75$ Pa. A velocity of 0.5 m/s was used for this calculation since the peak flood velocity varies from 0.4 to 0.6 m/s over the spring-neap cycle, while the peak ebb velocity varies from 0.1 to 0.4 m/s. Site specific entrainment rate and critical shear parameter estimates were not available, so values reported in the literature by Uncles and Stephens (1989) and Tattersall et al. (2003) were used. All model parameters are reported in Table 1.

Note that measured concentrations of FIB in Talbert Marsh sediments were utilized to estimate s_i. No attempt was made to model the cycling of FIB in submerged sediments. To estimate the concentration of FIB in sediments, cores were collected at low tide within the inter-tidal zone and immediately transported to the laboratory. Overlying water was siphoned off the top and the cores were sectioned in 1 cm intervals with an extruder. For the few cores with a high sand content, sediment was scraped from the core tube in specified intervals to avoid slumping. Each sediment section was homogenized. A 5 g sample was suspended with 45 ml of a 0.5 M mono potasium phosphate buffer solution in a sterilized glass centrifuge tube for enteric bacteria analysis (APHA, 1992, Methods 9221 and 9050C). The sample was agitated for 1 min with a vortex mixer, then centrifuged at 2000 rpm for 5 min. The supernatant was then analyzed for TC, EC, and ENT using defined substrate tests with dilutions to the supernatant made with DI water (IDEXX, Westbrook, Maine). The remaining sediment from each 1 cm section was oven dried at 50 °C, and stored for analysis of grain size. The concentration s_i was taken as the geometric mean of FIB concentrations in the top 1 cm of each sample, and is reported in Table 1.

An important assumption of this formulation is that sediment concentrations are constant over the two-week study period. Unpublished sediment data collected on a daily to weekly basis in nearby Santa Ana River wetlands show sediment concentrations of FIB increase at least one log unit immediately following storms, and subsequently decrease over a period of several days to weeks; but during dry-weather periods sediment concentrations are relatively uniform (Ambrose, 2004). This assumption would no longer be appropriate were the model used for wet-weather conditions or to predict variability on seasonal time scales.

The hydrodynamic equations, FIB transport equations, and mass balance equation for FIB build-up/

die-off on inter-tidal mudflats were integrating using a common time step of 0.2 s on an unstructured grid of 11732 quadrilateral cells encompassing all the wetted and inter-tidal portions of the channel network shown in Fig. 1. The flow and transport equations were solved by a finite volume numerical method described and validated for this study site by Arega and Sanders (2004). The build-up/die-off model for the load due to bird feces was solved using a backwards Euler discretization, for stability purposes and without concern for time-stepping errors due to the very small time step. The time of flooding, t_f appearing in Eq. (5) is determined in the model as the moment that all four nodes of a cell first become submerged by the rising tide. The solution of this model gives a spatially and temporally varying prediction of FIB concentrations in the wetland resulting from loading by urban runoff, bird feces, and sediment resuspension.

To summarize, nine different FIB concentration fields were predicted for the 15 day period beginning May 2, 2000 based on three different sources of three different FIB groups. Urban runoff loads were modeled by several point sources located at inland sites. Bird feces loads were modeled by a build-up, wash-off model: bacteria concentrations build up on inter-tidal mudflats and wash off (to surface waters) with the rising tide. Sediment loads were modeled by a non-point source that is scaled by the shear stress on the bed. For all nine predictions, the model accounts for FIB advection, dispersion, and die-off. Initial conditions for the model were obtained by a spin-up procedure. Starting with an FIB concentration of zero, predictions were made for two sequential 15 day periods, and results of the second 15 day period were saved and used for analysis purposes. Forcing data such as the ocean tide record, solar radiation data, and bird census data were simply duplicated into 30 day records. Finally, predictions were compared to FIB measurements at PCH and BRK monitoring stations (Fig. 1) reported by Grant et al. (2001, 2002). Water level, velocity, and turbidity data for PCH and BRK reported by Grant et al. (2001) were also utilized for model validation purposes.

2.3. Uncertainty in Model Predictions

Uncertainty in FIB predictions is due to several factors including: (a) approximations inherent to the mathematical representation of FIB transport processes; (b) errors incurred during the numerical solution of the mathematical model; and (c) uncertainty in model parameters and in particular, parameters that characterize point and non-point loads of FIB. Uncertainties in parameter values were estimated based on standard errors or literature reported values, where possible. Otherwise, a conservative estimate of 50% was used. Table 1 presents uncertainty estimates. In cases involving FIB concentrations, uncertainties may be 200–500%. By comparison, uncertainty associated with the mathematical model and numerical method are relatively small, roughly 20% and 1%, respectively, based on previous modeling efforts (Arega and Sanders, 2004). Therefore, the propagation of uncertainty in the model was ignored for the purpose of determining uncertainties in predicted FIB concentrations, and emphasis was placed on the uncertainty in loading terms (Holman, 1978). Hence, the relatively uncertainty in FIB predictions was assumed to be equal to the relative uncertainty in the corresponding FIB load. Based on the preceding model formulation for urban runoff, bird, and sediment loads of FIB, spatially and temporally averaged loading rates follow as:

$$L_R = (Q_R + 7Q_P)c_R, \tag{7}$$

$$L_B = \overline{n_b}r, \tag{8}$$

$$L_S = sE\,\frac{\langle \overline{\tau} \rangle}{\tau_0}\left(\frac{\tau_0}{\tau_c} - 1\right)\overline{A_S}, \tag{9}$$

where the overbar notation indicates a time-average value, the angled brackets indicate a spatial average, A_S represents the submerged surface area of the wetland, and the subscripts R, B, and S denote loads from runoff, bird droppings, and sediments, respectively. The upper limit of uncertainty was estimated by a conventional variational method (Taylor and Kuyatt, 1994), but this method predicted negative loads at the lower limit. Hence, the lower limit of the loads were estimated by computing the load based on lower limit parameter values. After upper and lower uncertainties for each of the nine FIB loads were estimated, these were normalized by the corresponding load to obtain relative uncertainties.

3. Results

Model predictions of water level and velocity during the study period compare well to measurements, as shown in Fig. 2. This indicates that the dominant circulation pattern in the wetland, which drives the mixing and flushing of FIB, is resolved. The spatial distribution of TC predictions at mid-flood tide are shown in Fig. 3 for the case of loading by bird feces (left panel), urban runoff (center panel) and sediment resuspension (right panel). For the case of loading by urban runoff, where FIB enter the wetland far inland along the channels and transport to the marsh during the ebb, the mid-flood condition highlights the transport of (assumed to be) FIB-free ocean water into the main channel of the marsh while remnant wetland water is displaced either into the fringes of the marsh or inland along the channels (note the gradient in FIB between the

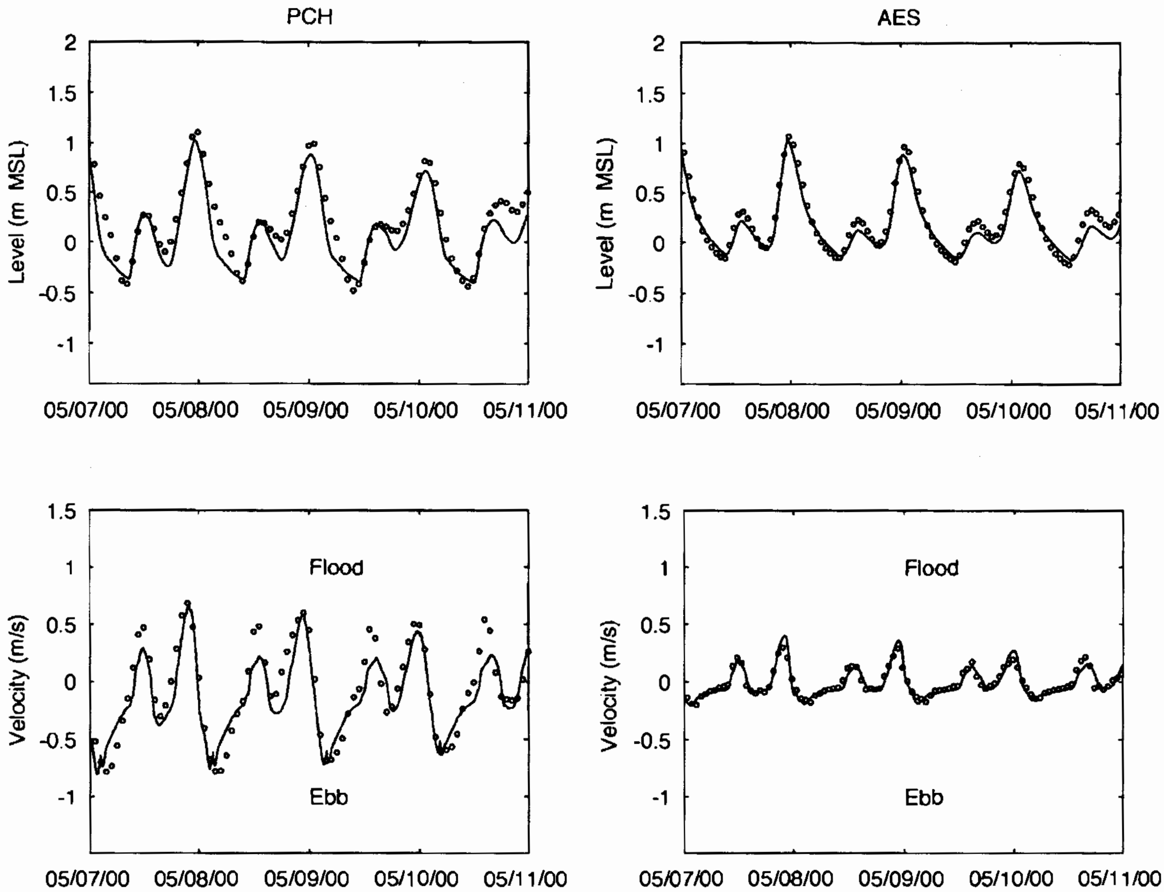

Fig. 2. Comparison of model predicted water level (top) and velocity (bottom) to data reported by Grant et al. (2001). Solid line corresponds to model prediction, symbols correspond to data.

main channel and the fringes of the marsh). For the case of loading by bird feces, model predictions illustrate the concentration of TC near the banks and over the shoals of the marsh. This is an expected response since FIB loading is modeled at the interface between wet and dry land. For the case of loading by sediment resuspension, FIB concentrations are relatively uniform across the marsh, compared to forcing by urban runoff or bird droppings. A similar distribution is predicted for EC and ENT.

Model predictions and measurements of FIB for the two-week study period are shown for BRK and PCH in Figs. 4 and 5, respectively, along with water level and turbidity. The tide record shows the spring-neap-spring transition. Note that water levels in the marsh do not drop far below -0.5 m–MSL due to hydraulic choking which occurs during the ebb at the outlet, where the minimum bed elevation is close to -0.7 m–MSL. FIB predictions vary considerably depending upon the type of loading, both in terms of magnitude and variability, particularly at 1 and 2 cycles per day. In addition, the variability of each prediction appears unique. Therefore, the phasing and magnitude of FIB predictions for each load type (i.e., urban runoff, bird feces, or sediment) can be utilized to help determine the contribution towards observed FIB concentrations. Pearson correlation coefficients were computed to quantify how well each prediction captured the variability, or phasing, of measured FIB concentrations and are shown in Table 2. Mean values of each prediction, and uncertainty based on loading rate uncertainty, are listed in Table 3. Mean values of measured FIB, along with standard errors based on $N = 360$ are also shown for comparison purposes. The "combined" FIB time series referenced in Tables 2 and 3 represent the sum of the three FIB predictions (i.e., urban runoff, bird feces, and sediment), a valid operation for linear transport equations. That is, the combined FIB time series is precisely what the model would have predicted had each of the forcing factors been incorporated into a single

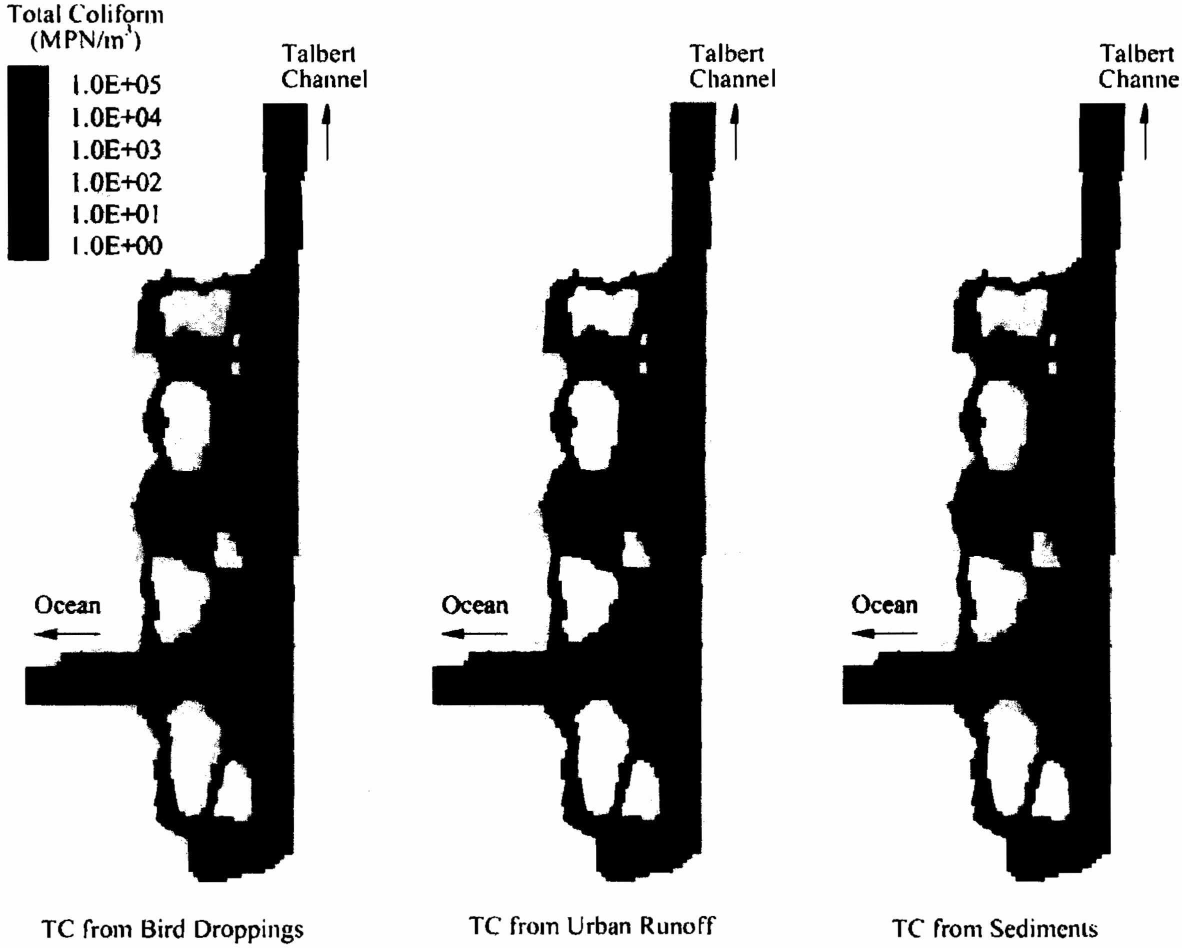

Fig. 3. Contours of total coliform in Talbert Marsh predicted by the model for mid-flood tide. Black lines indicate velocity direction and relative magnitude.

simulation. To obtain the mean value, the combined time series was first log-transformed. The combined series is not shown in Figs. 4 and 5, but at any given instant it basically tracks the largest of the three curves representing different forcing factors.

TC at PCH are predicted remarkably well based on loading by sediment resuspension, as shown in Fig. 5. The mean of log transformed measurements, log 10(TC) $= 2.17(\pm 0.04)$, or "log mean", compares well with the log mean of predictions log 10(TC) $= 2.25(+0.45/-1.02)$; and there is a moderate correlation ($R^2 = 0.58$, $p_{N=360} < 0.01$) between log transformed predictions and measurements on an hourly basis. Predictions based on loading by urban runoff compare best to measurements at the end of the ebb tide, particularly during the second week of the study when pump stations contributed runoff to the channels, but not at other phases of the tide and this is reflected by a weaker but significant correlation ($R^2 = 0.37$, $p_{N=360} < 0.01$). Predictions based on bird feces loading appear at least three orders of magnitude too small to account for observed TC.

Similar trends can be observed at BRK. Predictions based on both urban runoff and sediment loading are large enough to account for measured FIB, though in this case measurements correlate better to the prediction based on runoff ($R^2 = 0.56$, $p_{N=360} < 0.01$) than sediment resuspension ($R^2 = 0.26$, $p_{N=360} < 0.01$). The prediction based on bird feces loading is too small to account for observed TC. When predictions based on all three forcing factors are added together (valid for linear tranport equations), the prediction at BRK correlates slightly better ($R^2 = 0.58$, $p_{N=360} < 0.01$) and the magnitude of the signals compare well (Table 3).

For ENT and EC, trends in model predictions are similar to TC. However, trends in measured FIB differ. Both ENT and EC measurements compare best to predictions based on sediment resuspension loading, both in terms of geometric mean concentrations

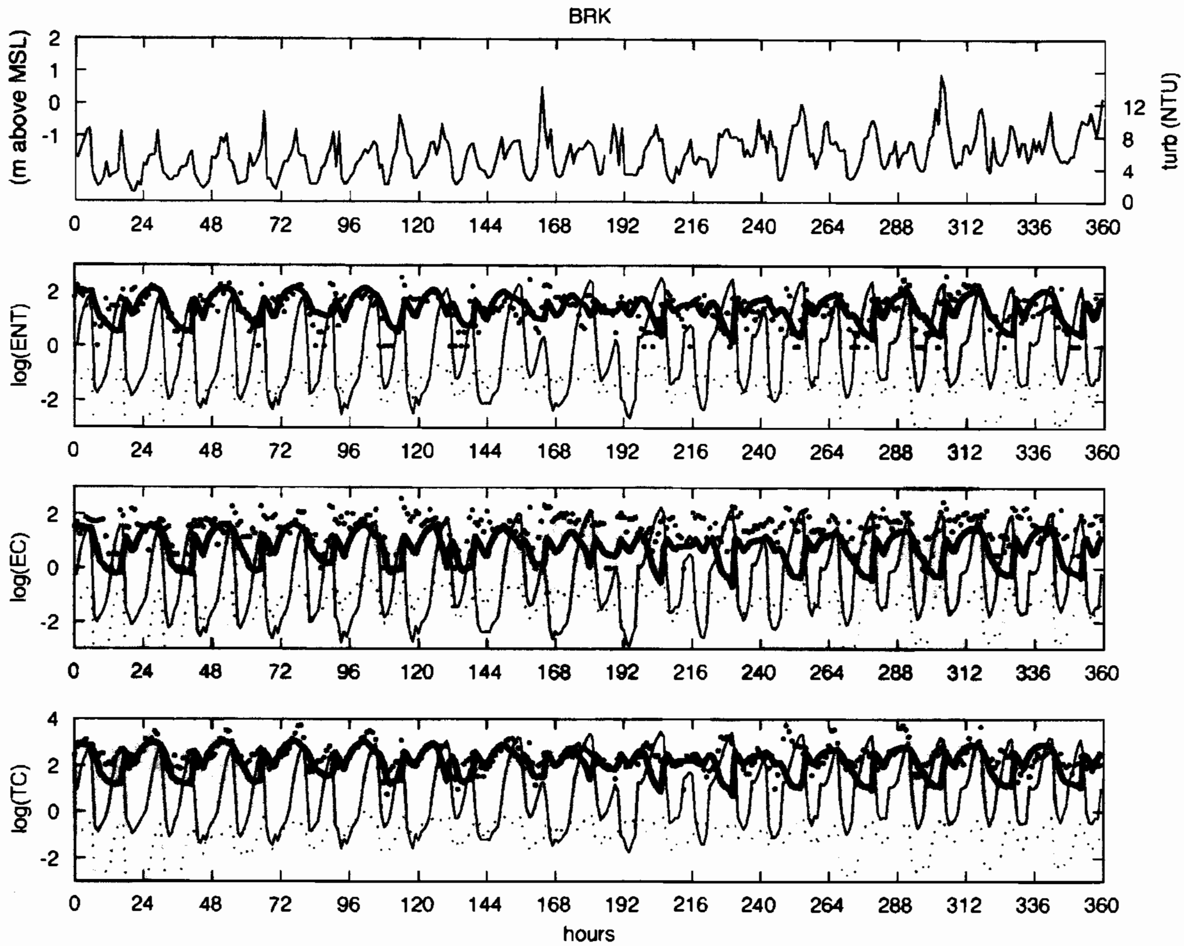

Fig. 4. BRK results. Water level and turbidy reported by Grant et al. (2001) shown in top panel. Bottom three panels show FIB concentrations: data from Grant et al. (2001, 2002) (dots), prediction based on sediment loading (heavy line), prediction based on runoff loading (light line), and prediction based on bird loading (broken line). FIB concentrations reported as log 10 (MPN/100 ml).

(Table 3) and the correlation coefficient (Table 2). Predictions based on bird feces loading are several log units too small to account for measured concentrations. Predictions based on urban runoff loading are comparable in magnitude only at the end of the ebb tide, and do not correlate to measurements.

Correlations between turbidity measurements and FIB measurements over the first six days were also computed and these appear in Table 4 (Due to drift in the turbidity data, the second week of data was excluded.) Turbidity correlates best to TC, compared to ENT and EC, and the correlation is stronger at BRK than PCH. Correlations between turbidity measurements and FIB predictions based on loading by urban runoff and sediment resuspension were also computed. Predictions based on urban runoff loads serve as an index of particulate material transported from upstream (fine mineral particles, detritus, and plankton) where flow is quiescent, while predictions based on sediment loads serve as an index of material eroded locally in the lower reaches of the wetland where the shear is greatest. At BRK the turbidity signal correlates better with FIB predictions based on runoff forcing ($R^2 = 0.70$, $p_{N=144} < 0.01$) than FIB predictions based on sediment resuspension forcing ($R^2 = 0.19$, $p_{N=144} < 0.01$). At PCH the turbidity signal correlates slightly better with the prediction based on sediment resuspension ($R^2 = 0.57$, $p_{N=144} < 0.01$) than the prediction based on runoff ($R^2 = 0.47$, $p_{N=144} < 0.01$).

4. Discussion

Hydrodynamic model predictions show that tidal cycling of TC, EC, and ENT in Talbert marsh surface waters is driven primarily by two processes: advection of

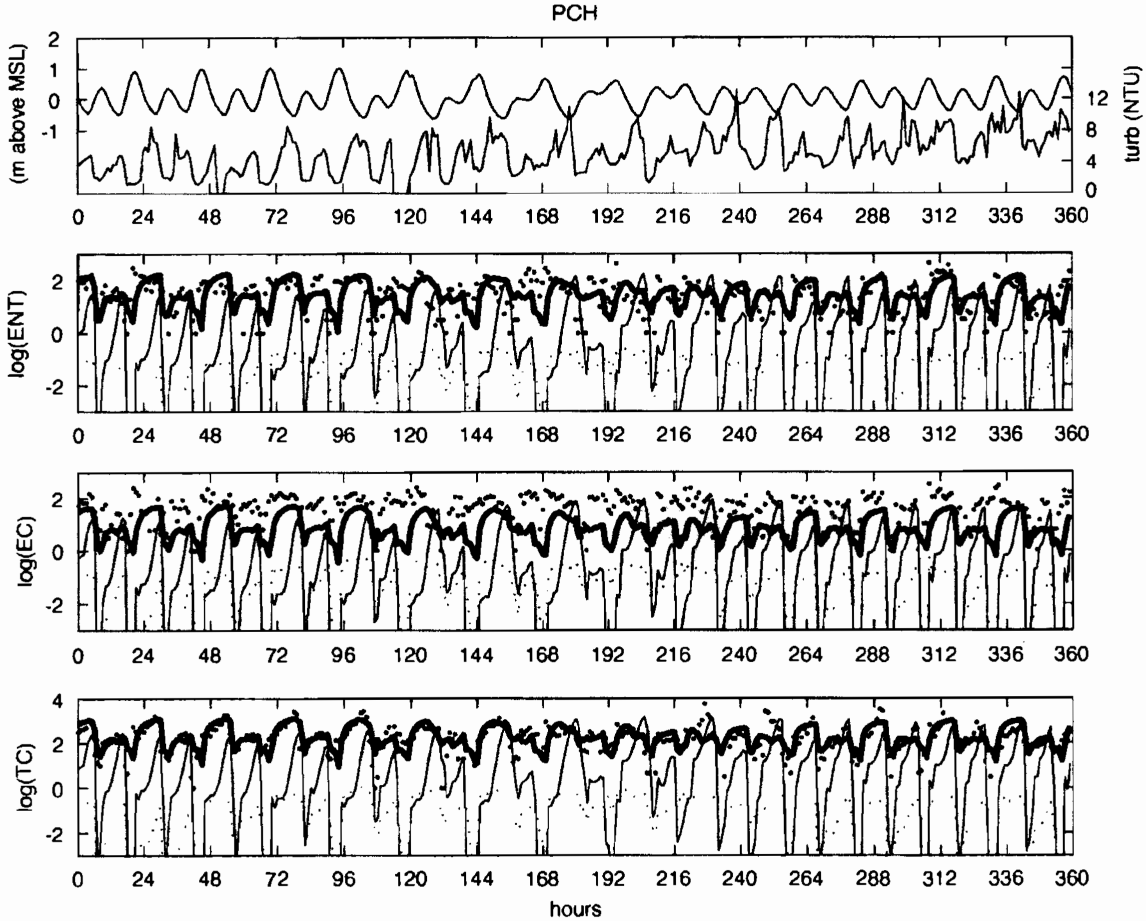

Fig. 5. PCH results. Water level and turbidy reported by Grant et al. (2001) shown in top panel. Bottom three panels show FIB concentrations: data from Grant et al. (2001, 2002) (dots), prediction based on sediment loading (heavy line), prediction based on runoff loading (light line), and prediction based on the bird loading (broken line). FIB concentrations reported as log 10 (MPN/100 ml).

FIB from inland sources (urban runoff) and entrainment of FIB from sediments. Loads of FIB from urban runoff control surface water concentrations inland within the poorly flushed zone while tidal resuspension controls surface water concentrations in the well-flushed zone near the mouth. Therefore, water quality models for FIB in hydrodynamically active wetland surface waters should at minimum account for loads from point sources (storm drains, channels, etc.), loads from resuspended sediments, transport by advection and turbulent dispersion/diffusion, and die-off. The present model captures tidal variability of TC better than EC or ENT suggesting either that processes important to EC and ENT transport are not included in the model, or perhaps the model oversimplifies one or more of the processes that are included in the model. For example, the spatial distribution of EC and ENT in sediments may differ substantially from the TC distribution due to differences in survival and/or regrowth rates. Many studies have shown that FIB can survive for long periods or regrow attached to sediments and vegetation (Savage, 1905; Roper and Marshall, 1979; LaBelle et al., 1980; Davies et al., 1995; Desmarais et al., 2002). In tropical watersheds, regrowth has been cited as the dominant factor affecting bacteria loading in streams (Hardina and Fujioka, 1991; Fujioka et al., 1999). The ability of bacteria to secrete extracellular polymers (collectively termed microbial biofilms) may be one reason why survival and regrowth of FIB is enhanced in sediments (Decho, 2000). A model capable of simulating sediment concentrations of FIB, accounting for these factors, might lead to better EC and ENT predictions. In cases where the size of particles with attached FIB is known, settling can also be included in the model if size

Table 2
Pearson correlation between log transformed enteric bacteria measurements and model predictions ($N = 360$)

	Station	Bird source	Sed. source	Runoff source	Combined
Total	BRK	0.36*	0.26*	0.56*	0.58*
coliform	PCH	0.40*	0.58*	0.37*	0.55*
E. coli	BRK	0.33*	0.35*	0.04	0.39*
	PCH	0.28*	0.33*	0.10	0.22*
Enterococci	BRK	0.27*	0.47*	−0.02	0.36*
	PCH	0.23*	0.34*	0.04	0.24*

*Significant at the 0.01 level (2-tailed).

Table 3
Comparison between predicted and measured geometric mean bacteria concentrations [log10(MPN/100 ml)]

	Station	Bird source	Sed. source	Runoff source	Combined	Measured
Total	BRK	−1.12 (+0.49/ − 0.43)	2.14 (+0.45/ − 1.02)	0.81 (+0.20/ − 0.47)	2.42 (+0.45/ − 1.02)	2.38 (±0.03)
coliform	PCH	−1.39 (+0.49/ − 0.43)	2.25 (+0.45/ − 1.02)	−0.18 (+0.20/ − 0.47)	2.33 (+0.45/ − 1.02)	2.17 (±0.04)
E. coli	BRK	−1.38 (+0.83/ − 0.40)	0.76 (+0.63/ − 1.21)	−0.36 (+0.20/ − 0.44)	1.10 (+0.63/ − 1.21)	1.49 (±0.03)
	PCH	−1.65 (+0.83/ − 0.40)	0.86 (+0.63/ − 1.21)	−1.35 (+0.20/ − 0.44)	0.98 (+0.63/ − 1.21)	1.53 (±0.03)
Enterococci	BRK	−1.56 (+0.56/ − 0.44)	1.39 (+0.43/ − 0.98)	−0.11 (+0.18/ − 0.44)	1.61 (+0.43/ − 0.98)	1.34 (±0.03)
	PCH	−1.85 (+0.56/ − 0.44)	1.42 (+0.43/ − 0.98)	−1.10 (+0.18/ − 0.44)	1.49 (+0.43/ − 0.98)	1.38 (±0.04)

Uncertainty of predictions is shown along with standard error of measurements ($N = 360$).

Table 4
Pearson correlation between turbidity measurements and bacteria predictions and measurements for first six days of study ($N = 144$)

	Station	Sed. source	Runoff source	Combined	Measured
Total	BRK	0.19	0.70*	0.51*	0.56*
coliform	PCH	0.57*	0.47*	0.59*	0.41*
E. coli	BRK	0.20	0.70*	0.56*	0.20
	PCH	0.57*	0.48*	0.60*	0.14
Enterococci	BRK	0.26*	0.70*	0.53*	0.31*
	PCH	0.58*	0.47*	0.60*	0.14

*Significant at the 0.01 level (2-tailed).

dependent settling rates are also known. This would be particularly important if FIB were associated with particles larger than 10–15 μm, in which case accurate settling data would be crucial for reliable predictions.

Both turbidity and FIB are generally associated with fine particles, but in this as well as previous studies (Goyal et al., 1977; Jensen et al., 1979) a strong association between the two has not been observed. In Talbert Marsh, peaks in turbidity and TC are observed at low tide, when brackish water from the upper reaches of the wetland is translated furthest seaward (Figs. 4 and 5). Hence, urban runoff is clearly contributing to the TC signal. On the other hand, there are not clearly defined peaks in the EC and ENT measurements and in many cases EC and ENT are elevated when turbidity values are relatively small. If sediments are the source of these FIB, a possibility strongly supported by model predictions shown here, shear stresses on the bed must be large enough to disturb and saltate surficial sediments, large enough to mix small particles, colloidal matter, and FIB through the water column, but not large enough to suspend the sandy sediments more than a short distance above the bed. Recall that sediments consist of beach sands and silts near the outlet. Hence, water quality models designed to account for the effects of sediment resuspension should be sensitive to differences between the rate of sediment entrainment, and the rate of FIB entrainment. Sediment entrainment formulations adopt the notion that mass transfer occurs when the shear stress on the bed exceeds a certain threshold (Mehta and Dyer, 1990). The entrainment of FIB in surficial pore water or incorporated into microbial biofilms may occur at a much smaller threshold.

The significance of loading due to sediment resuspension explains why tidal wetlands serve to "generate" FIB, as was reported by (Grant et al., 2001). That is, FIB associated with sediment particles, colloidal organic matter, or free living in porewater are supplied to the water column when bottom sediments are disturbed and/or scoured by tidal currents. FIB input to wetlands from wet or dry weather surface water runoff may be temporarily stored in sediments and later resuspended during storm events or during tidal scouring. The relative magnitude of resuspension effects versus die-off and settling effects is likely to control whether or not coastal wetlands are net generators or net accumulators. The results of this study are important to temper expectations that hydrodynamically-active wetlands such as estuaries or streams can provide passive treatment of urban runoff with high concentrations of FIB.

Reeves et al. (2004) reported that over 99% of the annual load of FIB from Talbert Watershed runoff is shed during storm events, while less than 1% is shed during dry-weather periods. It is therefore likely that sediments serve to couple FIB loads from storm water runoff to dry-weather water quality. Additional studies are warranted to characterize the variability of FIB in sediments over seasonal to tidal time scales and in response to storm events, to characterize the spatial variability of FIB, and to understand the mechanisms driving this variability. Do these organisms die-off, deposit, stimulate regrowth, and/or pass through the wetland? Microbiological source tracking methods (DNA fingerprinting, etc.) could also be applied to assess whether FIB in sediments are linked to human sources of fecal pollution (Simpson et al., 2002; Scott et al., 2002).

5. Conclusions

This study successfully employed a first-principle model to predict the dry-weather tidal cycling of FIB in Talbert Marsh, an estuarine, intertidal wetland in Huntington Beach, California. Model predictions show that surface water concentrations of TC, EC, and ENT in the wetland are driven by loads from urban runoff and resuspended wetland sediments. The model more accurately predicts TC than EC or ENT.

The crucial role that sediments play in the cycling of FIB is highlighted by this study. Sediments function as a reservoir of FIB that may accumulate FIB due to regrowth or settling, or shed FIB when tidal currents or storm flows scour away or even just disturb surficial particles. This finding is important to temper expectations that hydrodynamically-active wetlands serve to "treat" FIB from runoff and other sources, and it also explains why wetlands can function as net generators of surface water FIB. That is, generation occurs when the entrainment rate exceeds the rate of die-off and settling.

Additional studies should be conducted to characterized the "memory" of sediments relative to FIB. Knowing the extent to which dry-weather sediment concentrations of FIB are linked to wet-weather runoff loads, dry-weather runoff loads, regrowth or other factors such as bird droppings would help determine which factors predominatly control dry-weather water quality. Additional studies should also be conducted to evaluate the size and settling velocities of particles associated with FIB, and the partitioning of FIB between free-living and particle-associated states. Improved predictions of FIB might result from separately modeling free-living and particle-associated FIB.

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Modeling the dry-weather tidal cycling of fecal indicator bacteria in surface waters of an intertidal wetland

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Abstract

Recreational water quality at beaches in California and elsewhere is often poor near the outlets of rivers, estuaries, and lagoons. This condition has prompted interest in the role of wetlands in modulating surface water concentrations of fecal indicator bacteria (FIB), the basis of water quality standards internationally. A model was developed and applied to predict the dry-weather tidal cycling of FIB in Talbert Marsh, an estuarine, intertidal wetland in Huntington Beach, California, in response to loads from urban runoff, bird feces, and resuspended sediments. The model predicts the advection, dispersion and die-off of total coliform, *Escherichia coli*, and enterococci using a depth-integrated formulation. We find that urban runoff and resuspension of contaminated wetland sediments are responsible for surface water concentrations of FIB in the wetland. Model predictions show that urban runoff controls surface water concentrations at inland sites and sediment resuspension controls surface water concentrations near the mouth. Direct wash-off of bird feces into the surface water is not a significant contributor, although bird feces can contribute to the sediment bacteria load. The key parameters needed to accurately predict FIB concentrations, using a validated hydrodynamic model, are: the load due to urban runoff, sediment erodibility parameters, and sediment concentrations and surface water die-off rates of enteric bacteria. In the present study, literature values for sediment erodibility and water column die-off rates are used and average concentrations of FIB are predicted within 1/2 log unit of measurements. Total coliform are predicted more accurately than *E. coli* or enterococci, both in terms of magnitude and tidal variability. Since wetland-dependent animals are natural sources of FIB, and FIB survive for long periods of time and may multiply in wetland sediments, these results highlight limitations of FIB as indicators of human fecal pollution in and near wetlands.

National Center For Environmental Research

Final Report: Identification and Control of Non-Point Sources of Microbial Pollution in a Coastal Watershed

NCER Research Project Search

EPA Grant Number: R828011
Title: Identification and Control of Non-Point Sources of Microbial Pollution in a Coastal Watershed
Investigators: Sanders, Brett , Grant, Stanley B. , Horne, Alex , Keller, Robin , Sobsey, Mark D.
Institution: **University of California - Irvine** , University of California - Berkeley , University of North Carolina at Chapel Hill
EPA Project Officer: Stelz, Bill
Project Period: August 1, 2000 through July 31, 2003 (Extended to January 31, 2005)
Project Amount: $895,234
RFA: Water and Watersheds (1999)
Research Category: Water and Watersheds

Description:

Objective:

The objectives of this study were to: (1) characterize the magnitude and variability of fecal indicator bacteria (FIB) loads in the watershed along an inland to coastal gradient that includes street gutters, storm channels, tidal channels, and the surf-zone at Huntington Beach; (2) examine linkages between FIB and other indicators of human pathogens; (3) develop strategies to control FIB loads during nonstorm periods; and (4) aid decisionmaking by examining the perspectives of stakeholders, including beachgoers, environmentalists, local businesses, public health officials, and wastewater utility managers on various aspects of beach pollution problems, such as the causes, health risks, and responsibility to pay.

California beaches are a critical component of the culture and economy of California and are threatened by coastal pollution. Beach recreation in California accounts for $5.5 billion of the Gross State Product (King and Symes, 2003). Nowhere has there been greater attention on beach pollution than at Huntington Beach in southern California.

Huntington Beach, consisting of Huntington State Beach and Huntington City Beach, is located along a northwest to southeast striking section of the Pacific coastline between Los Angeles and San Diego, in Orange County, California. Several areas of Huntington State Beach have suffered chronic beach postings and closures over the past several years as a result of elevated concentrations of FIB in the surf zone (Kim and Grant, 2004). This beach is very popular (more than 5 million visitors per year), and the combination of surf zone pollution and significant beach usage implies that a large number of people (perhaps as many as 50,000) may acquire highly credible gastroenteritis from swimming and surfing in this area each year (Turbow, et al., 2003). FIB pollution at Huntington State Beach is thought to be caused by a combination of sources, including dry and wet weather runoff from the surrounding community, bird droppings deposited in the Talbert Marsh, and regrowth of bacteria on vegetation and marsh sediments (Grant, et al., 2001; Reeves, et al., 2004). Additional potential sources of FIB include the offshore discharge of partially treated sewage effluent (Boehm, et al., 2002a), the offshore discharge of power plant cooling water that contains FIB from plant wash-down and other activities (Boehm, et al., 2002b), resuspension of contaminated sediments (Sanders, et al., 2004), bather shedding, the accumulation of bird droppings along the shoreline and offshore, the exfiltration of sewage-contaminated groundwater, and contributions from watershed outlets located north and south of the study area, including the Los Angeles River, the San Gabriel River, and outlets for Huntington Harbor and Newport Bay (Kim, et al., 2004).

This project focuses on the Talbert Watershed in Huntington Beach and Fountain Valley, California, which drains to Huntington Beach and is a significant stressor of Huntington Beach water quality. The Talbert Watershed encompasses 3,400 hectares in the cities of Huntington Beach and Fountain Valley. The watershed is urbanized and consists of residential developments, commercial districts, plant nurseries, and light industry. This area of southern California has separate storm water and sanitary sewer systems, therefore, dry and wet weather runoff flows to the ocean without treatment. Runoff from the Talbert Watershed is conveyed along street gutters to inlets that connect to underground storm water pipelines. These pipelines connect to a network of three flood control channels (Fountain Valley, Talbert, and Huntington Beach) that converge near the ocean at a constructed wetland known as the Talbert Marsh. Ocean water floods both the Talbert Marsh and the lower reaches of the open channels during rising tides (flood tides), and a brackish mixture of ocean water and runoff drains from the system during falling tides (ebb tides). The Talbert Watershed is nearly flat and only a few feet above sea level. This geographical setting hinders drainage by gravity alone, so a system of transfer stations is used in the lower reaches of the Talbert Watershed to pump runoff into the open channels from storm water pipelines. Each transfer station, or pump station, consists of a forebay, where runoff can be stored, and several pumps. Pumping of runoff to the channels occurs intermittently during dry weather periods and continuously during storms. Talbert Marsh is a 10-hectare remnant of what used to be an extensive (1,200 hectare) saltwater wetland and dune system in coastal Orange County. The majority of this wetland system was drained and filled over the past century for agricultural reclamation and urban development. Most of what remained of the historical wetland, including Talbert Marsh, was cut off from tidal flushing by the construction of the Pacific Coast Highway and channelization of the surrounding area for flood control. As part of a habitat restoration effort, tidal flushing in the Talbert Marsh was restored in 1990 when a new tidal inlet was constructed. Since its restoration, Talbert Marsh has become a typical southern California tidal saltwater marsh with open water, wetland, and upland habitats (Grant, et al., 2001). Pickle weed (*Salicornia virginica*) is the dominant macrophytic vegetation, and the marsh is utilized by several special-status bird species, including the California least tern, brown pelican, and Beldings savannah sparrow.

Summary/Accomplishments (Outputs/Outcomes):

To achieve the objectives, extensive monitoring of Talbert Watershed surface waters was conducted to measure the spatio-temporal variability of FIB loads (total coliform, *Escherichia coli*, and *Enterococcus*) and analysis was performed to examine the factors that control fate and transport. Monitoring also was performed to examine the association between FIB and other indicators of fecal pollution. Both one-dimensional and two-dimensional hydrodynamic models were developed to analyze the FIB loads in tidal channels and into the surf-zone and to develop a predictive tool that can be used to examine how bacteria loads would be altered by operational changes to the infrastructure. Surveys were performed to measure stakeholder preferences in the context of multi-stakeholder, multi-objective beach pollution problems and to support decisionmaking analysis.

Closure and posting of Huntington Beach, California, during the study period was the source of widespread media attention. In response, members of the research team redirected efforts and/or engaged in a number of additional studies to better understand the factors controlling surface water quality in the Huntington Beach surf zone, as well as the response of stakeholders to the unfolding pollution problem. For example, co-principal investigator (PI) Keller focused attention on the decisionmaking of beachgoers (to swim or not to swim) in response to warning signs posted on the beach. Co-PI Keller also focused attention on the decisionmaking of public agencies, who were under great public pressure to remedy the pollution problem but had little understanding of its cause. To better understand the pollution problem, co-PI Grant analyzed short- and long-term FIB monitoring data to identify trends in Huntington Beach bathing water quality. The observed variability was examined in the context of historical management measures, such as passage of the Clean Water Act, construction of a new ocean outfall, and efforts to prevent urban runoff from draining directly to the beach. Co-PI Grant also developed a method to identify and rank the sources of pollution to the surf-zone using high-frequency monitoring data collected along the beach. PI Sanders teamed with University of California (UC) Irvine and UC San Diego researchers to examine the potential for Orange County Sanitation District effluent, discharged roughly 7 km offshore of Huntington Beach, to be transported onshore by internal tides. After the Talbert Marsh was identified as a contributor of FIB to the Huntington Beach surf zone, co-PI Sobsey focused attention on potential health risks associated with water contaminated with bird feces. In particular, marsh bird feces and surface water was examined for *Campylobacter*, *Salmonella,* and male-specific coliphages.

During dry weather, concentrations of FIB were highest in inland urban runoff, intermediate in tidal channels harboring variable mixtures of urban runoff and ocean water, and lowest in ocean water at the base of the watershed. This inland-to-coastal gradient is consistent with the hypothesis that urban runoff from the watershed contributes to coastal pollution. On a year-round basis, the vast majority (> 99%) of FIB loading occurs during storm events when runoff diversions, the management approach of choice, are not operating. During storms, the load of FIB in runoff follows a power law of the form $L \sim Q^n$, where L is the loading rate (in units of FIB per time), Q is the volumetric flow rate (in units of volume per time), and the exponent n ranges from 1 to 1.5. This power law and the observed range of exponent values are consistent with the predictions of a mathematical model that assumes FIB in storm runoff originate from the erosion of contaminated sediments in drainage channels or storm sewers. (Reeves, et al., 2004)

During dry weather periods, urban runoff controls surface water concentrations of FIB in channels where flushing is weak, and resuspension of FIB from the sediment/water interface controls surface water concentrations near the mouth where flushing by ocean water occurs once per day. The reservoir of FIB at the sediment/water interface is probably linked to settling of bacteria from both dry and wet weather urban runoff, deposition of animal feces, decaying vegetation, and bacterial regrowth. It is not clear whether the FIB are primarily attached to sediments, suspended in pore water, or incorporated into microbial biofilms. Nevertheless, surface water concentrations of FIB are rapidly amplified as turbulence in water column increases. A result is that dry weather urban runoff has little direct impact on surf zone water quality, but significant indirect impact given FIB loads from runoff accumulate at the sediment/water interface and are subsequently resuspended and exported to the surf-zone by tidal currents (Grant, et al., 2001; Arega and Sanders, 2004; Sanders, et al., 2004).

During the project period, dry-weather diversions of urban runoff to the sanitary sewer system were implemented to mitigate impacts to the surf-zone, at a cost of at least $6 million to the County of

Orange and City of Huntington Beach. The efficacy of this approach is unclear, because the vast majority of watershed loads are shed during wet weather, whereas during dry weather, the tidal channels and marsh serve to dissipate loads by promoting die-off and settling. On the other hand, diversions presumably serve to reduce loads of other contaminants, including oil, grease, heavy metals, and so forth and, therefore, may be justified on these grounds. To evaluate whether the diversions are justified on the basis of FIB control, a better understanding of the cycling of FIB in sediments is needed. The alternative is to focus management efforts on wet weather controls. For example, if erosion of sediments is driving the loading of FIB, then regular removal of contaminated sediments accumulating in the storm sewer system might be an appropriate management strategy. The creation of distributed wetland treatment systems, in which contaminants in urban runoff are removed near their source, might also prove useful for reducing downstream impacts (Reeves, et al., 2004).

Research lead by PI Sanders shows that numerical modeling can be performed to predict FIB loads in tidal wetlands, analytes that are notoriously difficult to model because of poorly characterized non-conservative processes. The key parameters needed for accurate predictions of FIB loads, using a validated hydrodynamic model, are: (1) the load as a result of urban runoff; (2) sediment erodibility parameters; and (3) sediment concentrations and surface water die-off rates of enteric bacteria. For channels in the Talbert Watershed, literature values for sediment erodibility and water column die-off rates were used and average concentrations of indicator bacteria were predicted within one-half log unit of measurements. Total coliform were predicted more accurately than *E. coli* or enterococci, both in terms of magnitude and tidal variability. This work is important because it represents the first case where first-principle models were successfully applied to predict FIB in an estuarine setting with significant nonpoint sources. The approach adopted here is highly transferable and could benefit both wetland restoration and water quality compliance efforts on a widespread basis (Sanders, et al., 2004).

Plume tracking studies conducted by UC Irvine and UC San Diego researchers, including PI Sanders, show that Orange County Sanitation Department (OCSD) effluent occasionally moves shoreward toward Huntington Beach into water less than 20 m deep. Analyses of current and temperature observations indicate cold water is regularly advected crossshelf, into and out of the nearshore, at both semi-diurnal and diurnal frequencies. Isotherms typically associated with the wastefield near the outfall are observed just outside the Huntington Beach surf zone, where the total depth is less than 6 m, highlighting the extent of the cross-shelf transport. This advection is attributed to a mode 1 internal motion, or internal tide. Based on this analysis, it is not possible to rule out the possibility that the OCSD plume contributes to poor bathing-water quality at Huntington Beach (Boehm, et al., 2002a). Concerned over potential shoreline impacts, OCSD began a disinfection program in 2002 and initiated a roughly $300 million program to build the necessary infrastructure for full secondary treatment.

Analysis of Huntington Beach monitoring data lead by co-PI Grant shows that the concentration of FIB varies over time scales that span at least seven orders of magnitude, from minutes to decades. Sources of this variability include historical changes in the treatment and disposal of wastewater and dry weather runoff, El Niño events, seasonal variations in rainfall, spring-neap tidal cycles, sunlight-induced mortality of bacteria, and nearshore mixing. On average, total coliform concentrations have decreased over the past 43 years, although point sources of shoreline contamination (storm drains, river outlets, and submarine outfalls) continue to cause transiently poor water quality. These transient point sources typically persist for 5 to 8 years and are modulated by the phase of the moon, reflecting the influence of tides on the sourcing and transport of pollutants in the coastal ocean. Indicator bacteria are very sensitive to sunlight; therefore, the time of day when samples are collected can influence the outcome of water quality testing. These results demonstrate that coastal water quality is forced by a complex combination of local and external processes and raise questions about the efficacy of existing marine bathing water monitoring and reporting programs (Boehm, et al., 2002b). Further analysis led by co-PI Grant reveals that protocols used to decide whether to post a sign are prone to error. Errors in public notification (referred to here as posting errors) originate from the variable character of pollutant concentrations in the ocean, the relatively infrequent sampling schedule adopted by most monitoring programs (daily to weekly), and the intrinsic error associated with binary advisories in which the public is either warned or not. We derived a probabilistic framework for estimating posting error rates, which at Huntington Beach range from 0 to 41 percent, and show that relatively high sample-to-sample correlations (> 0.4) are required to significantly reduce binary advisory posting errors. Public misnotification of coastal water quality can be reduced by utilizing probabilistic approaches for predicting current coastal water quality, and adopting analog, instead of binary, warning systems (Kim and Grant, 2004).

Research lead by co-PI Sobsey on the potential health risks of bathing water contaminated by bird feces has lead to only preliminary findings. Specifically, *Campylobacter* and male specific coliphages were identified in Talbert Marsh bird feces and in marsh surface waters near the marsh. *Salmonella* was found only in bird feces samples and not water samples. Analysis continues to understand the relationship between microbes in bird feces and surrounding surface waters, and potential health impacts.

Research lead by co-PI Keller indicates that stakeholders share diverse opinions about the causes of beach pollution, the risks to beachgoers, and the responsibility to pay. In the context of a multi-objective decision model, stakeholders disagree on the appropriate weights of objectives. For example, local businesses heavily weigh economics whereas beachgoers heavily weigh health risks. Stakeholders also disagree on the severity of pollution problems. For example, environmentalists believe the probability of an environmental health problem is high when beaches are posted, but beachgoers do not. Relative to beachgoers' perceptions of potential health risks, surveys showed a peer effect: decisions to enter the water at posted beaches were strongly affected by whether or not others were in the water (Biswas and Keller, 2004; Biswas, et al., 2004).

Conclusions:

The vast majority of FIB loads in runoff from the Talbert Watershed are shed during storms and are associated with particles that appear to be scoured from the water collection system, including street gutters, storm pipes, and storm channels. Loads in runoff during dry weather periods account for roughly 1 percent of the annual runoff load and dissipate within the tidal channels by a combination of die-off and settling.

Loads exported from the watershed to the surf zone during dry weather period are deflected along the shoreline by wave driven currents and can cause exceedances of water contact recreation standards. Model predictions show the origin of such loads is the scouring by tidal currents of FIB at the sediment/water interface of tidal channels and Talbert Marsh. FIB at the sediment/water interface are linked to urban runoff FIB loads during both dry and wet weather periods, bird droppings, decaying vegetation, and bacterial regrowth. Because intertidal wetlands are to some extent natural generators of FIB, these results call into question the exclusive use of FIB as the basis of water contact recreation standards at beaches near the outlet of these water bodies.

On the basis of FIB control, the efficacy of dry weather diversions in Talbert Watershed is unclear, although diversions presumably serve to mitigate other types of pollution as well. A better understanding of the cycling of FIB between the water column and sediments is needed to evaluate the linkages between wet weather and dry weather loads in relation to sediment interactions.

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Type	Citation	Project	Document Sources
Journal Article	Arega F, Sanders BF. Dispersion model for tidal wetlands. *Journal of Hydraulic Engineering* 2004;130(8):739-754.	R828011 (Final)	Not available
Journal Article	Boehm AB, Sanders BF, Winant CD. Cross-shelf transport at Huntington Beach. Implications for the fate of sewage discharged through an offshore ocean outfall. *Environmental Science & Technology* 2002;36(9):1899-1906	R828011 (2001) R828011 (Final)	• Full-text: ACS Publications Full Text EXIT Disclaimer • Other: ACS Publications PDF EXIT Disclaimer
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Journal Article	Sanders BF, Arega F, Sutula M. Modeling the dry-weather tidal cycling of fecal indicator bacteria in surface waters of an intertidal wetland. *Water Research*. 2005;39(14):3394-3408.	R828011 (Final)	Not available

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Enviro Science & Technology

Bird Droppings Are Blamed for Bacteria

By Stanley Allison June 02, 2001 in print edition B-9

A team of UC Irvine researchers has concluded that waterfowl and other animal droppings from a saltwater marsh and the Santa Ana River are a significant source of bacteria contaminating the ocean waters off Huntington Beach.

In a report that will be published in the June 15 issue of Environmental Science and Technology, the researchers point to inherent flaws in the design of the man-made saltwater Talbert Marsh.

Stanley Grant, the UCI professor who led the 18-month study of the ocean contamination problem at Huntington Beach, said water containing fecal bacteria, pesticides, nutrients and other materials filters through the marsh and then flows into the ocean in about 40 minutes– which is too fast.

For the marsh to act as a natural cleanser and remove contaminants, the water must spend at least a week filtering through the wildlife preserve, Grant said.

Even though other sources such as urban runoff from the Santa Ana River may have contributed to the contamination that resulted in four miles of beach closures for most of the summer of 1999, the levels of bacteria from the marsh were hundreds of times more than the state limits, the researchers said.

The team's conclusions contradict the accepted environmental theory that wetlands purify contaminated water flowing into the ocean.

The findings suggest that approximately 4.6 million saltwater marshes in the U.S. could be similarly affected, Grant said.

Mark Gold, a spokesman for the conservation group Heal the Bay, said that finding animal droppings in a nature preserve is nothing new, and insists that marshes still serve as a cleanser for other, more hazardous, contaminates.

"It's not surprising that wetlands are sources of fecal bacteria," Gold said. "What wetlands are great at doing is removing nutrients and metals."

The 25-acre wetlands preserve is on the inland side of Pacific Coast Highway at Brookhurst Street. Part of the Talbert watershed that encompasses 12 square miles in Huntington Beach and Fountain Valley, it attracts thousands of migratory birds and other wildlife each year.

The UCI researchers also say that the nearby AES power plant contributes to the shore's contamination. The study suggests that partly treated sewage released four miles offshore from the Orange County Sanitation District treatment plant is being pulled back to the shore by tides and the plant as it draws water to cool its towers.

Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams

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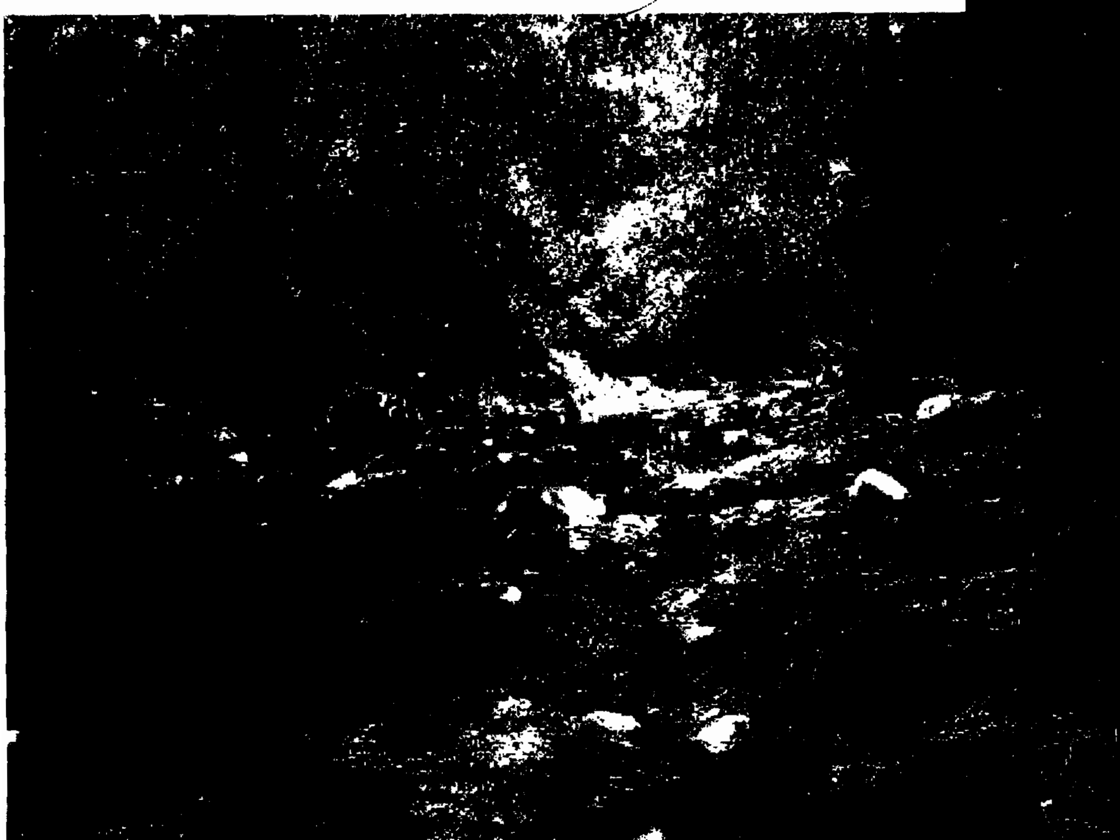

Southern California Coastal Water Research Project

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Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams

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ABSTRACT

High levels of fecal indicator bacteria (FIB) in surface waters is a common problem in urban areas that often leads to impairment of beneficial uses such as swimming or other contact recreation. Once impaired, common management and regulatory solutions include development of Total Maximum Daily Loads (TMDLs) and other water quality management plans. A critical element of these plans is establishment of a "reference" level of exceedances against which to assess management goals and TMDL compliance. Unfortunately, existing "background" or reference data on contributions of FIB from undeveloped catchments during dry weather is limited to a small number of locations measured at few time points. The goal of this study was to provide information on indicator bacteria contributions from natural streams in undeveloped catchments throughout southern California during dry weather, non-storm conditions. Specific questions addressed were: a) What are the "background" ranges of concentrations of FIB associated with dry weather flow from reference areas? b) What is the frequency with which reference FIB levels exceed relevant water quality standards? c) How does seasonality influence stream FIB levels associated with reference areas? and d) How do the ranges of FIB concentrations associated with reference areas compare with those associated with urban (developed) areas? To help establish a regional reference data set, bacteria levels (i.e. *Escherichia coli* (*E. coli*), enterococci and total coliforms)) were measured from 15 unimpaired streams in 11 southern California watersheds weekly for one full year. A total of 590 water samples were collected from spring 2006 through spring 2007. Results were compared with data from the developed Ballona Creek watershed and to established State of California bacteria standards. Concentrations measured from reference areas were typically between one to two orders of magnitude lower than levels found in developed watersheds. The absence of *B. thetaiotaomicron* indicated that the FIB in reference streams were likely of non-human origin. Nearly 82% of the time, samples did not exceed daily and monthly bacterial indicator thresholds, demonstrating good bacteriological water quality in natural streams throughout southern California. *E. coli* had the lowest daily percent exceedance (1.5%). A total of 13.7% of enterococci exceeded daily thresholds. The average measured enterococci levels of these exceedances was 292 MPN/100 ml, with a maximum of 2098 MPN/100 ml and a minimum of 160 MPN/100 ml. Indicator bacteria levels fluctuated seasonally with an average of 79% of both enterococci and total coliforms exceedances occurring during summer months (June-August). Temperature, at all sites, explained about one-half the variation in total coliforms density suggesting that stream temperatures regulated bacterial populations. Studies of human health risk associated with natural bacteria levels have not been conducted, but the levels observed in this study are below those reported to cause risk in freshwater systems with known human sources of FIB. Accounting for natural background levels will allow for management targets that are more reflective of the contributions from natural sources. Additional monitoring during wet weather is warranted to further characterize background bacterial contamination in southern California reference waterbodies.

Keywords: Dry Weather Water Quality, Indicator Bacteria, Reference Condition, Background Water Quality, TMDL

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TABLE OF CONTENTS

ABSTRACT i
ACKNOWLEDGEMENTS ii
TABLE OF CONTENTS iii
LIST OF TABLES iv
LIST OF FIGURES v
INTRODUCTION 1
METHODS 2
- Sampling Sites 2
- Sampling 2
- Laboratory Analysis 3
- Data Analysis 3

RESULTS 5
- Background Bacteria Concentrations and Fluxes 5
- Frequency of Exceedance of Bacteria Standards at Natural Sites 5
- Temporal and Spatial Patterns in FIB Levels 6
- Perennial vs. Non-perennial Streams 6
- Relationship of Bacteria Levels to Environmental Variables 6

DISCUSSION 8
- Conclusion and Future Research 10

REFERENCES 12
APPENDIX A - SUMMARY BACTERIA DATA FOR ALL NATURAL STREAM SITES 30
APPENDIX B - SUMMARY OF PHYSICAL PARAMETERS AT ALL NATURAL STREAM SITES 39
APPENDIX C - INTERLABORATORY CALIBRATION RESULTS 41

LIST OF TABLES

Table 1. List of natural stream sampling sites, characteristics and their median monthly fecal indicator bacteria densities (MPN/100 ml). 16

Table 2. State of California marine water quality standards for fecal indicator bacteria as established in Assembly Bill 411. Currently a freshwater quality standard for total coliforms does not exist. 17

Table 3. Assessment of percent exceedances between counties in southern California during the present study. A [1] represents those counties in which samples were collected only during spring and/or summer due to intermittent streams with less stable flow regimes. 18

Table 4. Percent single-sample exceedance of fecal indicator bacteria (FIB) levels in natural streams during dry weather from May 2006-May 2007. Numbers in bold are significantly different (p <0.01). 19

Table 5. Correlation table (r^2 values) between water quality variables and fecal indicator bacteria (FIB) during dry weather in natural streams in southern California between May 2006-May 2007. Significant correlations (p<0.04) are shown in bold, while significant correlations (p<0.001) are both bolded and in italics. 20

Table A1. List of natural stream sampling sites, characteristics and their daily fecal indicator bacteria densities (MPN/100 ml). 31

Table A2. Monthly *E. coli* geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 32

Table A3. Monthly enterococci geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 33

Table A4. Monthly total coliforms geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 34

Table A5. Dry season *E. coli* geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 35

Table A6. Dry season enterococci geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 36

Table A7. Dry season total coliforms geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 37

Table A8. Annual dry season fecal indicator bacteria geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 38

Table B1. Annual dry season averages of measured physical parameters in natural streams during May 2006-May 2007 in southern California, USA. 40

Table C1. List of participating laboratories and counties involved in the reference bacteria/watershed interlaboratory calibration 43

Table C2. List of the six common samples and their representative sewage dilutions in (ml) which each laboratory received for the interlaboratory calibration. 43

LIST OF FIGURES

Figure 1. Map of natural stream sampling sites and their respective catchments within southern California. 21

Figure 2. Comparison of dry weather log10 fecal indicator bacteria (FIB) densities (± standard deviations) between natural streams in undeveloped watersheds and developed Ballona creek watershed from May 2006-May 2007 in southern California, USA. 22

Figure 3. Dry season fecal indicator bacteria cumulative density frequency plots (CDFs) of natural streams relative to freshwater quality standards from May 2006 to May 2007 in southern California, USA 23

Figure 4. Mean monthly temperature (°C) and dissolved oxygen (mg/L) comparison (a) and geomean total coliform densities in natural streams in southern California (b) between May 2006 and May 2007. Summer months (June-August) were substantially higher than all other seasons ($p < 0.01$). E. coli and enterococci exhibited similar results. The dotted line indicates the 30-d geomean for total coliforms equal to 1,000 MPN/100 ml. All points above the line represent bacteria water quality exceedances. 24

Figure 5. *E. coli* a) and enterococci b) geomean densities in natural streams in southern California between May 2006 and May 2007. Summer months (June-August) were substantially higher than all other seasons. The dashed line indicates the monthly water quality standard equal to 235 MPN/100 ml and 104 MPN/100 ml for *E. coli* and enterococci respectively. All points above the line represent bacteria water quality exceedances 25

Figure 6. Perennial and non-perennial stream comparison of log10 fecal indicator bacteria densities (MPN/100 ml) in southern California during the present study. The dotted line indicates the State single-sample bacterial water quality criterion. Significant differences in indicator densities existed between streams but ranges generally overlapped ($p < 0.05$). Boxplots show mean, median, 25th and 75th percentiles. 26

Figure 7. Natural stream temperatures in southern California versus total coliform densities (MPN/100 ml) during dry weather for an entire year. Solid line indicates the exponential trend line ($r^2 = 0.48$). 27

Figure 8. Distribution of log *E. coli* a); enterococci b); and total coliforms c) concentrations in natural streams, streams with minor perturbations, and in developed Ballona Creek watershed in southern California, USA. Natural streams were significantly lower then all other streams ($p < 0.001$). Minor perturbation streams were significantly lower than developed Ballona Creek ($p < 0.001$). 28

Figure 9. Distribution of log *E. coli* a); enterococci b); and total coliforms c) concentrations in natural streams during dry weather (present study) compared to wet weather (Natural Loadings; 2003-2005 and Los Angeles River watershed; 2001-2005) studies in southern California, USA. Dry weather bacteria concentrations were significantly lower then wet weather concentrations ($p < 0.001$) 29

Figure C1. Laboratory comparison results for log transformed total coliform data at Santiago Creek, Orange County. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count. 44

Figure C2. Laboratory comparison results for *E. coli* using a 3 ml sewage dilution. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count.......... 45

Figure C3. Laboratory comparison results for Enterococcus using a 1 ml sewage dilution. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count.......... 46

INTRODUCTION

The presence of fecal indicator bacteria (FIB) in surface waters is a prevalent concern for many municipalities, health departments, and regulatory agencies. Persistent or excessive bacteria levels often result in reduced opportunities for beneficial uses such as swimming, and may lead to waterbodies being listed as impaired under Section 303(d) of the Clean Water Act. Approximately 280 waterbodies are listed as impaired in the Los Angeles, Santa Ana, and San Diego regions (http://www.swrcb.ca.gov/tmdl/303d_lists.html). Management of impaired water bodies may involve development of Total Maximum Daily Loads (TMDLs), issuance of National Pollutant Discharge Elimination System (NPDES) permits, or development of water quality plans that are intended to reduce bacteria levels to a point where water quality standards are met and beneficial uses are protected. An important step in the development of TMDLs and other water quality management plans is to identify all sources of the constituent(s) of concern in order to accurately quantify loads and set appropriate management or regulatory targets. One of the challenges in developing appropriate targets is accounting for biogenic inputs, or the natural contribution from undeveloped catchments.

Most watersheds consist of both developed and undeveloped areas, both of which can contribute bacteria to streams via surface runoff. Bacteria associated with runoff from urban surfaces are well documented (Gore & Storrie Ltd. and Proctor & Redfern Ltd. 1981, USEPA 1993). For example, (Stein *et al.* 2007) observed that recreational (horse) and agricultural land uses in Los Angeles, CA contributed substantially higher storm fluxes for *Escherichia coli* (*E. coli*). Additional investigations by Bay and Schiff (1998), Noble *et al.* (2000) and Stein and Tiefenthaler (2005) found freshwater outlets such as storm drains to be especially high contributors of dry-weather FIB contamination.

Natural areas can also be a source of bacteria originating from wildlife, including birds and mammals, pets, and livestock (Griffith *et al.* 2006). Grant *et al.* (2001) found that enterococci bacteria generated in a restored wetland had greater effect on coastal water quality than dry season urban runoff. The presumed sources of these bacteria were birds that used the tidal salt marsh as habitat. (Ahn *et al.* 2005) also recognized that natural sources could be significant contributors to total bacteria levels in urban storm water in southern California. However, most previous studies have focused on either short measurements during or immediately following storm water runoff or on bacteria in coastal waters (beaches). Few studies have attempted to quantify naturally occurring background levels of bacteria in streams during baseflow (i.e. non-storm) conditions over an extended period of time. This data gap is critical because the non-storm period is when streams and the coastal waters they drain to receive the most human use and thus the potential risk is highest.

The goal of this study is to establish a "reference" level of bacteria that can be used to set appropriate water quality management targets. More specifically, we address the following questions: a) What are the "background" ranges of concentrations of FIB associated with dry-weather runoff from natural areas? b) What is the frequency with which reference FIB levels exceed relevant water quality standards? c) How does seasonality influence stream FIB levels associated with reference areas? and d) How do the ranges of FIB concentrations associated with reference areas compare with those associated with urban (developed) areas?

METHODS

The overall approach to the study was to characterize dry weather bacteria levels at a set of sites that is representative of existing natural conditions in southern California. The specific study design consisted of an intensive sampling regime with collection of weekly dry weather bacteria data for an entire year.

Sampling Sites

Fifteen sites were selected for inclusion in the study based on criteria developed by Stein and Yoon (2007, Stein and Yoon In press). Criteria were designed to ensure that sampling would capture natural conditions without influence from any land-based anthropogenic input. The criteria included: 1) contributing drainage area should be at least 95% undeveloped. 2) sites should be in a relatively homogenous setting in terms of underlying geology and landcover, 3) sites should have either year-round or prolonged dry-weather flow to allow sampling during at least a portion of the dry season, and 4) sites should not be within watersheds that have burned during the previous three years. Although fire can be a natural occurrence, inclusion of sites in burned catchments would have added a confounding factor and, therefore, were excluded. Catchment land use was determined by plotting watershed boundaries over (year 2003) land cover maps from the (National Oceanographic Administration (NOAA) 2003) Coastal Change Analysis Program (CCAP) - http://www.csc.noaa.gov/crs/lca/ccap.html. The 15 selected sites are located across five counties (Los Angeles, Orange, Riverside, San Bernardino and San Diego) and ten different watersheds: Los Angeles River, Los Alisos Canyon, Malibu Creek, Soltice Canyon, San Juan Creek, Santa Ana River, San Jacinto, Cucamonga, Santa Margarita, and San Dieguito (Figure 1, Table 1, and Appendix A).

Sampling

Weekly dry-season sampling was conducted at all 15 sites from May 15, 2006 through May 31, 2007. A site was eligible for sampling if it had not received measurable rainfall for at least 24 h and flow was no more than 20% above baseflow. Weekly sampling continued as long as there was measurable stream flow. For intermittent streams, sampling was suspended once the stream was too low to sample. Based on these criteria, the duration of sampling ranged from 9 to 55 weeks (Table 1). Water samples were collected as composite grab samples, with equivalent volumes collected from three different points across the stream (approximately 10, 50, and 90% distance across). These samples were taken from the flowing portion of the streams at a depth sufficient to exclude surface scum without introducing bottom sediment. A replicate water sample was collected in the same way after completion of the initial water sample for approximately 25% of the samples. A field blank sample was also collected at each site once a month. All water samples were collected in presterilized 125 ml high-density polyethylene (HDPE) sample bottles. Collected water samples were immediately placed on ice and transported to the laboratories within 6 h of sample collection for subsequent analyses.

At each sampling location and during each round of sample collection, water quality readings (i.e. temperature (°C), dissolved oxygen (DO) mg/L, pH, turbidity, and conductivity (µS/cm)) were measured using hand held field probes (i.e. Orion 125, YSI 63 and Horiba U-10). Measurements were taken in triplicate at each transect. In addition, physical and biological parameters of the site and general climatic conditions were recorded and documented (using both data forms and photo documentation). Stream discharge was measured as the product of the channel cross-sectional area and flow velocity. Channel cross sectional area was measured in the field. At each sampling event, velocity was measured using a Marsh-McBirney Model 2000 flow meter (Frederick, MD). The velocity, width, and depth were measured at three points along each transect. Flow for each transect subsection was computed and summed for a total flow for the transect. Values from three transects were averaged to estimate overall flow at each site (Rantz 1982).

Laboratory Analysis

Water quality samples were analyzed for four bacteria indicators; *E. coli*, enterococci, total coliforms and *Bacteroides thetaiotaomicron*. Enterococci, total coliforms and *E. coli* were measured by the chromogenic substrate method using Enterolcrt® for enterococci and Colilert® for *E. Coli* and total coliforms (Idexx 24 h, Inc.). This commercially available product uses a Multiple Tube Fermentation (MTF) type format with defined substrate technology to detect the presence or absence of bacteria indicator density in a water sample. In this medium, the detection of coliform densities is based upon a color change caused by the reaction of a fluorogen with a bacterial enzyme. This assay is read within 24 hours and coliform densities are rcported as most probable number (MPN)/100 milliters (ml). Given the large geography covered by the study and the short holding time required for bacterial analysis, eight laboratories cooperated on sample analysis. Laboratory intercalibration studies were completed to ensure consistent methodology, data quality, and repeatability between laboratories. All laboratories had had good repeatability for all three bacterial indicators and all results fell within the median log comparability criteria. The low variability between labs indicated that interlab differences should not be a confounding factor in interpreting the results of the study. Details of the laboratory intercalibration study are provided in Appendix C.

Bacteroides thetaiotaomicron are anaerobic bacteria that comprise the majority of microorganisms that inhabit the human digestive tract. As such, they may be a more reliable measure of human fecal matter or pathogens than *E. coli* (Bernhard and Field 2000a,b). Samples were analyzed for either presence or absence of *B. thetaiotaomicron* as a negative control for human bacteria sources. This analysis was initiated at a sampling site when the State of CA single-sample water quality thresholds for both *E. coli* and enterococci were exceeded for two consecutive weeks. The presence of *B. thetaiotaomicron* would suggest that bacteria observed in the surface waters were predominantly of human origin. *B. thetaiotaomicron* was measured by DNA extraction followed by polymerase chain reaction (PCR) as described by (Brinkman *et al.* 2003).

Data Analysis

Three analyses were used to characterize FIB levels from natural streams. First the 30-d geomeans, variances, and ranges of concentrations, and fluxes were calculated to provide an estimate of expected baseline bacterial levels. Flux estimates facilitated region wide comparisons among watersheds of varying sizes. Flux was calculated as the ratio of the 30-d geomean or mean yearly bacterial concentration (MPN/100 ml) and contributing watershed area (km^2) at a specific site. Second, dry weather FIB concentrations were compared with the state of CA standards for single-sample and 30-d geomean maximum allowable densities (Table 2).

Cumulative density frequency plots (CDFs) were produced to compare observed bacterial concentrations to the CA quantitative standards and to calculate accumulated relative exceedance percentages. Third, water quality statistics from natural sites were compared with previous data collected from watercourses draining developed areas of the greater Los Angeles basin to determine if significant differences existed between natural and developed areas (Stein *et al.* 2007, Stein and Yoon 2007).

Bacteria data were analyzed for differences between perennial vs. intermittent streams, between developed and undeveloped watersheds, and to assess temporal patterns. Differences in concentration or flux were tested using a one-way analysis of variance (ANOVA), with a significance level $p < 0.05$ (Sokal and Rohlf 1995). Differences based on flow regime were assessed using a Tukey-Kramer post-hoc test for multiple comparisons; differences between developed and undeveloped sites were investigated by comparing median values using a Kruskal-Wallis one-way ANOVA on ranks.

Spatial and temporal patterns were also investigated using Pearson's r correlation coefficient to determine if there were strong associations between FIB concentrations and continuous variables (i.e. temperature and flow; Helsel and Hirsch 2002); the null hypothesis, in this case, is that the correlation coefficient is zero.

RESULTS

Background Bacteria Concentrations and Fluxes

Annual median bacteria fluxes from the natural sites were 2 ± 1.4 MPN/100 ml/km^2, 3 ± 1.7 MPN/100 ml/km^2, and 106 ± 61.4 MPN/100 ml/km^2 for *E. coli*, enterococci, and total coliforms, respectively. *E. coli* and enterococci, median density values at the natural sites (based on single-sample measurements) were 10 MPN/100 ml and 20 MPN/100 ml respectively, while median density values in Ballona Creek are typically in the 10^3 range. Densities and fluxes were significantly lower for all indicator bacteria at the natural sites relative to data from developed areas ($p < 0.001$, Figure 2).

Only two sites exceeded State water quality standards for both *E. coli* and enterococci for two or more weeks during the yearlong study. During the period of exceedance, *E. coli* levels ranged from 327 to 9804 MPN/100 ml while enterococci ranged from 388 to 7270 MPN/100 ml. Repeat exceedances were seen most commonly for enterococci. In both cases, the *B. thetaiotaomicron* samples were negative, suggesting that the bacterial populations represented by the FIB were probably derived from non-human sources.

Frequency of Exceedance of Bacteria Standards at Natural Sites

A total of 18.2% of the indicator bacteria samples (for all three indicators) from the natural sites exceeded daily (single sample) water quality standards. Approximately 14% of enterococci exceeded the daily threshold of 104 MPN/100 ml (Figure 3). The average enterococci level of these exceedances was 292 MPN/100 ml, with a maximum of 2098 MPN/100 ml (Orange County) and a minimum of 160 MPN/100 ml (San Bernardino County). For *E. coli*, 1.5% of the measurements exceeded the single sample standard of 235 MPN/100 ml with a maximum and a minimum of 5500 MPN/100 ml and 241 MPN/100 ml, respectively (Orange County). For total coliforms, 3% exceeded the single sample standard of 10,000 MPN/100 ml.

A total of 39% of enterococci samples from the natural sites exceeded the 30-d geomean water quality standard of 33 MPN/100 ml. The average enterococci level of these exceedances was 47 MPN/100 ml, with a maximum of 744 MPN/100 ml and a minimum of 3 MPN/100 ml. For *E. coli,* approximately 1% exceeded the 30-d geomean threshold of 126 MPN/100 ml with a maximum and a minimum of 146 MPN/100 ml and 1 MPN/100 ml, respectively (Orange County). For total coliforms, 45% exceeded the 30-d geomean of 1000 MPN/100 ml with a maximum and a minimum of 5040 MPN/100 ml and 23 MPN/100 ml, respectively.

Seventy-five percent of enterococci and 83% of total coliforms exceedances occurred during the summer months (June-August, Table 4). In August all indicator thresholds were exceeded with 12.5%, 62.5% and 75% of *E. coli*, enterococci and total coliforms samples exceeding monthly thresholds, respectively (Table 4).

Temporal and Spatial Patterns in FIB Levels

Bacteria levels for all three indicators were significantly higher during the summer than during all other seasons (Table 4, p <0.01). For example, 30-d geomeans for total coliforms were near the water quality standard in May 2006 with levels approximately 878 MPN/100 ml ± 3.2 SD, increased substantially during the summer, exceeding the criterion, peaking in July at 2586 MPN/100 ml ± 3.1 SD (Figure 4b). Total coliform geomeans decreased gradually throughout the winter nearing zero in February, 2007 (289 MPN/100 ml ± 4.2 SD), as stream temperatures fell below 10°C, before gradually returning to baseline geomeans throughout spring, 2007 (Figure 4a and b). Similar seasonal patterns were observed for *E. coli* and enterococci (Figure 5a and b).

Orange County had the highest daily and monthly water quality exceedances for both *E. coli* and total coliforms (12.9%; 25% and 3.2%; 100%, respectively, Table 3). For enterococci, approximately 47% of the San Diego County samples exceeded the daily threshold and 100% exceeded the monthly standard (Table 3). However, the Orange County and San Diego County streams had no flow in winter due to an unusually low 2006-2007 rainfall season, so the results are from only the spring and early summer months and do not represent annual averages that may occur in perennially flowing streams.

Perennial vs. Non-perennial Streams

Background bacteria levels differed based on the duration of stream flow (Table 1, Appendix A). *E. coli* and enterococci densities were significantly different in perennial vs. intermittent streams (p <0.05, Figure 6). Mean $\log_{10}$ concentrations for *E. coli* and enterococci at perennial streams were 1.0 ± 0.4 and 1.3 ± 0.5, respectively. Intermittent streams had higher mean $\log_{10}$ concentrations for *E. coli* and enterococci (1.6 ± 0.5 and 1.8 ± 0.6, respectively). There were no statistical differences between stream types for total coliform densities (mean 2.7 ± 0.6 vs. 3.3 ± 0.4).

Relationship of Bacteria Levels to Environmental Variables

Of the five environmental variables measured (temperature, conductivity, dissolved oxygen, pH, turbidity), only stream temperature exhibited a significant correlation with seasonal FIB levels. Water temperature varied by about 5-10°C at each of the sites, reaching a maximum of 28°C on warm sunny afternoons. Streams located in the foothills (Mill Creek, San Bernardino Co.) or where the creek was significantly shaded had the lowest average temperatures (Table 1, Appendix B). For example streams in San Bernardino County ranged from 650 m to 1200 m in elevation and averaged 12.7°C. The highest monthly average water temperatures (20.4 °C) were recorded in Orange County where streams were approximately 200 m in altitude. Stream temperature and total coliforms were significantly positively correlated (Table 5, p <0.001, r^2 = 0.48). A weaker, but still significant, positive correlation existed between stream temperature and *E. coli* or enteroccoci (p <0.04, r^2 = 0.20 and p <0.04, r^2 = 0.26, respectively). The Pearson's r for these two correlations was between 0.2 and 0.3 suggesting that similar processes may have controlled the relationship between stream temperature and FIB. A strong negative correlation existed between dissolved oxygen and both conductivity or stream temperature (Table 5, p <0.05, r^2 = -0.5; p <0.001, r^2 = -0.84, respectively). However, few statistically significant relationships existed among the other physical variables.

Total coliform densities increased exponentially at temperatures above 10°C (Figure 7, $r^2 = 0.48$). Dissolved oxygen concentrations varied inversely with stream temperatures throughout the study (Figure 4a). Monthly mean DO concentrations decreased sharply to approximately 8 mg/L at stream temperatures above 15°C, and concentrations increased to approximately 11 mg/L at stream temperatures below 10°C.

DISCUSSION

Enterococci, *E. coli* and total coliforms (FIB) are commonly used indicators of the possible presence of pathogenic (disease-causing) microorganisms in streams and the ocean. As shown in this study, these FIB can be found in natural streams, with populations increasing during warm summer months and persisting through winter. However, the densities observed in natural streams were usually below State water quality objectives, which are set below levels typically thought to impair beneficial uses (Geldreich 1978, Toranzos 2007). Furthermore, the absence of *B. thetaiotaomicron* indicated that the FIB in reference streams were likely of non-human origin (Carson *et al.* 2005). There are three possible sources of FIB observed in natural streams: External inputs from sources such as waterfowl, animals, or soil erosion; internal sources of bacterial growth and colonization within the stream associated with decomposition of organic matter; or a combination of the two (Byappanahalli *et al.* 2003, Toranzos 2007).

Higher bacteria levels observed during the summer suggest that factors existed which promote bacteria growth and regrowth in streams. The positive relationship between temperature and bacteria levels suggests that heat induced growth may be a contributing factor to seasonally high bacteria levels. In addition, warmer temperatures influence the dissolved oxygen content of the water. Decreased oxygen solubility associated with higher temperature may combine with lower dissolved oxygen levels producing algal blooms, which have been shown in previous studies to support growth of *E. coli* and enterococci in freshwater (Byappanahalli *et al.* 2003, Byappanahalli *et al.* 2007). These conditions may in turn accelerate death and decomposition of organic matter in the stream, further enhancing in situ bacterial growth. Increases in organic decomposition have been shown to increase survival and regrowth of enteric bacteria and viruses (Novotny and Olem 1994). This hypothesis is further supported by the negative correlation observed between conductivity and dissolved oxygen. Conductivity is closely correlated with total dissolved solids, which are typically comprised of inorganic and organic substances, a potential source of biological oxygen demand (BOD).

Higher FIB densities and incidence of water quality standard exceedences during the summer is consistent with the observations of others such as Noble *et al.* (2000) and Sieracki (1980). Nuzzi and Burhans (1998) compared the responses among indicator bacteria at 143 New York beach sites and found that survival was longer in the summer, but that the duration could be mediated by exposure to UV radiation from sunlight. More recently, growth or regrowth of fecal indicator bacteria in tropical and temperate soils during the summer months has also been reported (USEPA 2000, Ishii *et al.* 2006). Whitman *et al.* (1999) attributed a gradual increase of *E. coli* bacteria in water and sand at beaches during summer to higher survival and growth at warmer temperatures.

Another explanation for higher FIB levels during the summer could be higher external sources due to different patterns of use by wildlife and birds. A number of studies have shown that wildlife and other animals can be sources of bacteria in run-off (Baxter-Potter and Gilliland 1988, Bagshaw 2002, Stein *et al.* 2007). Previous studies have quantified that wildlife and bird feces contain high levels of FIB. Cox *et al.* (2005) measured fecal coliform levels of 10^3 - 10^5 CFU/g from native wildlife in Australian watersheds. Ricca and Cooney (1998) reported that droppings from feral populations of pigeons, geese and herring gulls from the environment around Boston Harbor, MA, USA contained up to 10^8 CFU/100 ml of enterococci. Bacteria from wildlife and birds can be associated with FIB levels in streams used by these animals. Noblet *et al.* (2004) found that birds were a likely source of intermittently high levels of FIB observed in the lower Santa Ana River watershed and the nearby surf zone in southern California. Similarly, Harwood *et al.* (2000) reported that animals were the dominant sources of indicator bacteria at Florida sample sites with relatively low anthropogenic impact. Bacterial source tracking studies conducted in Michigan suggested that feces from pets and raccoons were important contributors to FIB levels in streams and storm sewers (Ram *et al.* 2007). Moreover, levels increased in the late summer and fall coincident with increased raccoon den mobility following breeding.

Decreased stream flow may have also contributed to higher bacteria levels during the summer months. Although there was no statistically significant relationship between flow and bacterial densities, in all cases densities increased exponentially when stream flow decreased below approximately 0.5 m^3/s (2 cubic feet/sec). In addition, median annual bacterial densities were higher in intermittent streams than in perennial, with the differences being mainly due to high levels in the period immediately prior to streams drying up. Despite the differences between perennial and intermittent streams, the annual ranges of observed bacteria levels overlapped substantially. Therefore, the combined range of bacteria levels for perennial and intermittent streams observed in this study should reflect expected levels in natural streams throughout southern CA.

Relatively minor perturbations in the contributing watershed can cause sites to quickly deviate from background conditions. Four sites originally considered, but later rejected from the study had bacteria levels 2-3 log units greater than the natural sites retained, but significantly lower than levels observed in the developed Ballona Creek watershed (Figure 8). The watersheds of these four sites were almost entirely natural open space, but had small portions subject to agricultural or transportation related runoff. In one instance, a portion of the contributing watershed was affected by a recent fire. These small perturbations in the watershed led to dramatic changes in bacteria levels that moved sites away from reference conditions. Although these sites were not included in the analysis of background conditions, they provide valuable insight into the sensitivity of natural watersheds to small increases in anthropogenic sources.

Although this study focused on background FIB levels during dry weather (non-storm) conditions, comparison of these results to background levels in storm water is important because FIB are major constituents of concern in storm water runoff that can result in impairment of receiving waters (Noble *et al.* 2003, Schiff *et al.* 2003, Stein and Tiefenthaler 2005). Stein and Yoon (2007) reported geometric mean FIB levels from natural streams during storms of 125, 140, and 4,460 MPN/100 ml for *E. coli*, enterococci and total coliforms, respectively. These levels are generally 1.5 - 2 log units higher than geomean levels observed in this study during dry weather conditions (Figure 9). As is the case in urban areas, bacteria levels in natural systems are significantly lower during dry weather conditions than during storms, although the higher levels observed during storms are much more transient in nature. Griffith *et al.* (2006) reported that one-fifth of all samples collected within three days of rainfall from beaches at the bottom of natural catchments exceeded water quality thresholds for at least one bacterial indicator.

Analogous measurements collected three days following recorded rainfall in natural streams is warranted to further characterize "background" bacterial contamination in southern California reference waters following storms.

The results of this study indicated that streams in undeveloped watersheds contain low levels of FIB of non-human origin. An important management question is whether the levels observed pose a potential health risk. Wade *et al.* (2003) reviewed 27 studies and concluded that *E. coli* levels between 45 and 170 CFU/100 ml in freshwater pose a relative human health risk level of 1.22 (i.e. low level risk). We observed 30-day geomean *E. coli* levels ranging from 2 – 138 MPN/100 ml, with an overall 30-day geometric mean of 41 ±20 MPN/100 ml. Because the mean levels observed in this study were below the "low risk" range reported by Wade *et al.* (2003), it could be concluded that background levels in natural streams have a low likelihood of posing a human health risk. However, this conclusion should be made with caution because previous exposure and risk studies were conducted in areas known to receive wastewater or storm water discharges containing human fecal sources. In contrast, the FIB levels observed in this study were of non-human origin, so the actual risk is unknown.

Conclusion and Future Research

This study yielded the following conclusions about FIB levels in natural streams during dry weather conditions:

1. ***Fecal indicator bacteria typically occur in natural streams during dry weather conditions at levels below State water quality standards.*** Annual mean concentrations (both single sample and 30-day geometric mean) were below established water quality criteria for all three indicators. A total of 18.2% of the indicator bacteria samples (for all three indicators) from the natural sites exceeded daily (single sample) water quality standards. Approximately 1.5%, 14%, and 3% of *E. coli*, enterococci, and total coliforms, respectively, exceeded single sample water quality criteria.

2. ***Fecal indicator bacteria in natural streams are most likely of non-human origin.*** All samples tested for the presence of *B. thetaiotaomicron* were negative, indicating non-human sources in natural streams. FIB levels in natural streams likely result from a combination of natural inputs, such as wildlife, birds, and soil erosion and instream bacterial growth facilitated by high summer temperatures and presence of decaying organic matter.

3. ***Dry weather fecal indicator bacteria in natural streams are typically two orders of magnitude lower than those observed in streams draining developed watersheds.*** Data from the developed Ballona Creek watershed were typically in the 10^3 MPN/100 ml range for *E. coli* and enterococci. Even slight watershed modifications appear to result in a relatively rapid departure from background FIB levels.

4. ***Fecal indicator bacteria levels exhibit seasonal patterns.*** Mean bacteria levels and frequency of exceedance of water quality standards were higher during the warmer summer months for all three bacteria indicators. This suggests that summer is a critical period for assessing background bacteria levels. Past studies indicate that fecal indicator

bacteria levels in natural streams during storms are one to two orders of magnitude higher than those observed during dry weather conditions; however, the duration of these elevated levels is unknown. Studies of water quality at beaches at the bottom of natural watersheds indicate that high bacteria levels may persist for up to three days following storms. Analogous measurements collected three days following recorded rainfall in natural streams is warranted to further characterize the persistence of "background" bacterial contamination in southern California reference waters following storms.

5. ***Bacteria levels in natural streams were generally higher during lower flow conditions.*** For all three indicators, densities increased exponentially when stream flow decreased below approximately 0.5 m^3/s (2 cubic feet/sec). In addition, median annual bacterial densities were higher in intermittent streams than in perennial, with the differences being mainly due to high levels in the period immediately prior to streams drying up. Despite the differences between perennial and intermittent streams, the annual ranges of observed bacteria levels overlapped substantially.

6. ***Dry weather fecal indicator bacteria levels were one to two orders of magnitude lower than those observed in natural streams during storm conditions.*** Past studies of water quality at beaches at the bottom of natural watersheds indicate that high bacteria levels may persist for up to three days following storms. Analogous measurements collected three days following recorded rainfall in natural streams is warranted to further characterize the persistence of "background" bacterial contamination in southern California reference waters following storms.

7. ***Fecal indicator bacteria in natural streams occurred at levels below those reported to pose health risks due to freshwater contact recreation.*** However, past risk assessments have all occurred in waters that are known to receive bacteria inputs of human origin. No epidemiology studies have been conducted on FIB of non-human origin, so the precise risk is unknown.

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Table 1. List of natural stream sampling sites, characteristics and their median monthly fecal indicator bacteria densities (MPN/100 ml).

Site Name	Watershed	County	Catchment Size (km^2)	Number Sampling Weeks/Yr	Mean Flow (m^3/sec)	Geomean (30-d) *E. coli* (MPN/100 ml)	SD	Enterococci (MPN/100 ml)	SD	Total coliforms (MPN/100 ml)	SD
Arroyo Seco	LA River	Los Angeles	41.50	47	0.04	15.24	2.22	20.48	2.45	1291.90	2.85
Cold Creek	Malibu Creek		1.43	49	0.00	13.59	1.89	15.33	2.42	443.30	4.33
Lachusa Canyon	Los Alisos Canyon		3.86	49	0.01	16.08	2.24	20.55	2.26	1486.50	2.14
Solstice Canyon	Solstice Canyon		8.74	49	0.01	16.97	2.28	20.64	2.43	1109.21	2.68
Chesebro Creek	Malibu Creek		7.55	49	0.00	90.30	5.49	68.25	4.24	2940.41	2.88
Bell Creek	San Juan	Orange	17.97	12[a]	0.02	80.45	4.30	164.60	5.48	2008.67	3.16
San Juan Creek	San Juan		99.94	9[a]	0.03	74.66	2.46	25.25	3.29	2848.15	1.66
Santiago Creek	Santa Ana		17.02	10[a]	0.02	22.99	2.84	34.75	3.06	1869.15	1.98
Hurkey Creek	San Jacinto	Riverside	29.73	29	0.01	18.89	4.38	36.92	4.75	688.57	3.33
Mill Creek	Santa Ana	San Bernardino	15.21	55	0.08	2.06	2.68	12.74	3.32	75.00	2.98
Cucamonga Creek	Cucamonga		24.10	52	0.14	11.14	1.66	26.35	3.33	399.64	2.39
Day Creek	Santa Ana		11.70	55	0.32	11.02	1.58	25.18	2.87	545.71	2.41
Cajon Creek	Santa Ana		82.82	52	0.08	54.98	3.18	159.21	2.49	4794.47	2.04
Stone Creek	Santa Margarita	San Diego	7.00	50	0.00	138.18	3.86	52.72	3.58	1728.44	3.21
Boden Creek	San Dieguito		19.81	18[a]	0.01	45.33	6.14	98.26	2.86	1658.46	2.54
		Mean	25.89	39	0.05	40.79	3.15	52.08	3.26	1592.51	2.70
		SD	14.54	9	0.04	19.84	0.71	25.32	0.47	622.94	0.34

[a]Intermittent stream

Table 2. State of California marine water quality standards for fecal indicator bacteria as established in Assembly Bill 411. Currently a freshwater quality standard for total coliforms does not exist.

	CA Maximum Allowable Density (MPN/100 ml)	
Fecal Indictor Bacteria	**single-sample**	**30-day geometric mean**
Enterococci	104	33
E. coli	235	126
Total coliforms	10,000	1000

Additional Indicator

Bacteroides thetaiotaomicron Presence / absence of a human source

Table 3. Assessment of percent exceedances between counties in southern California during the present study. A [1] represents those counties in which samples were collected only during spring and/or summer due to intermittent streams with less stable flow regimes.

	Exceedance (%)		
	E. coli	Enterococci	Total Coliforms
Daily			
Los Angeles County	0.0	6.3	0.0
Orange County[1]	12.9	38.7	3.2
San Bernardino	0.0	13.1	0.0
San Diego[1]	5.3	47.4	0.0
Monthly			
Los Angeles County	0.0	7.7	46.2
Orange County[1]	25.0	75.0	100.0
San Bernardino	0.0	23.1	0.0
San Diego[1]	0.0	100.0	80.0

Table 4. Percent single-sample exceedance of fecal indicator bacteria (FIB) levels in natural streams during dry weather from May 2006-May 2007. Numbers in bold are significantly different (*p* <0.01).

	Exceedance (%)		
	E. coli	Enterococci	Total coliforms
Season			
Spring 06	0.0	41.7	75.0
Summer	**12.5**	**75.0**	**83.3**
Fall	0.0	0.0	28.6
Winter	0.0	0.0	11.1
Spring 07	0.0	22.2	44.4
Month			
May 2006	0.0	27.3	45.5
June 2006	0.0	66.7	75.0
July 2006	0.0	**72.7**	**90.9**
August 2006	**12.5**	**62.5**	**75.0**
September 2006	0.0	42.9	57.1
October 2006	0.0	0.0	14.3
November 2006	0.0	0.0	28.6
December 2006	0.0	0.0	14.3
January 2007	0.0	0.0	0.0
Febuary 2007	0.0	12.5	25.0
March 2007	0.0	22.2	11.1
April 2007	0.0	11.1	44.4
May 2007	0.0	25.0	62.5
Annual	1.0	26.4	41.8

Table 5. Correlation table (r^2 values) between water quality variables and fecal indicator bacteria (FIB) during dry weather in natural streams in southern California between May 2006-May 2007. Significant correlations (*p*<0.04) are shown in bold, while significant correlations (*p*<0.001) are both bolded and in italics.

			Pearson r^2-values		
	DO	**Flow**	***E. coli***	**Enterococci**	**Total Coliform**
Parameter	(mg/L)	(m^3/s)		(MPN/100 ml)	
Conductivity	**-0.50**	***0.48***	***0.22***	**0.01**	***0.19***
Dissolved Oxygen	-	0.12	***0.18***	**0.21**	***0.16***
pH	0.32	***0.09***	***0.11***	**0.02**	**0.04**
Flow	0.12	-	-0.06	-0.02	**-0.08**
Temperature (°C)	***-0.84***	**0.02**	***0.20***	***0.26***	***0.48***
Turbidity	0.19	0.00	0.02	1.44	**0.07**

Bolded values = p<0.05

Bolded italic values = p<0.001

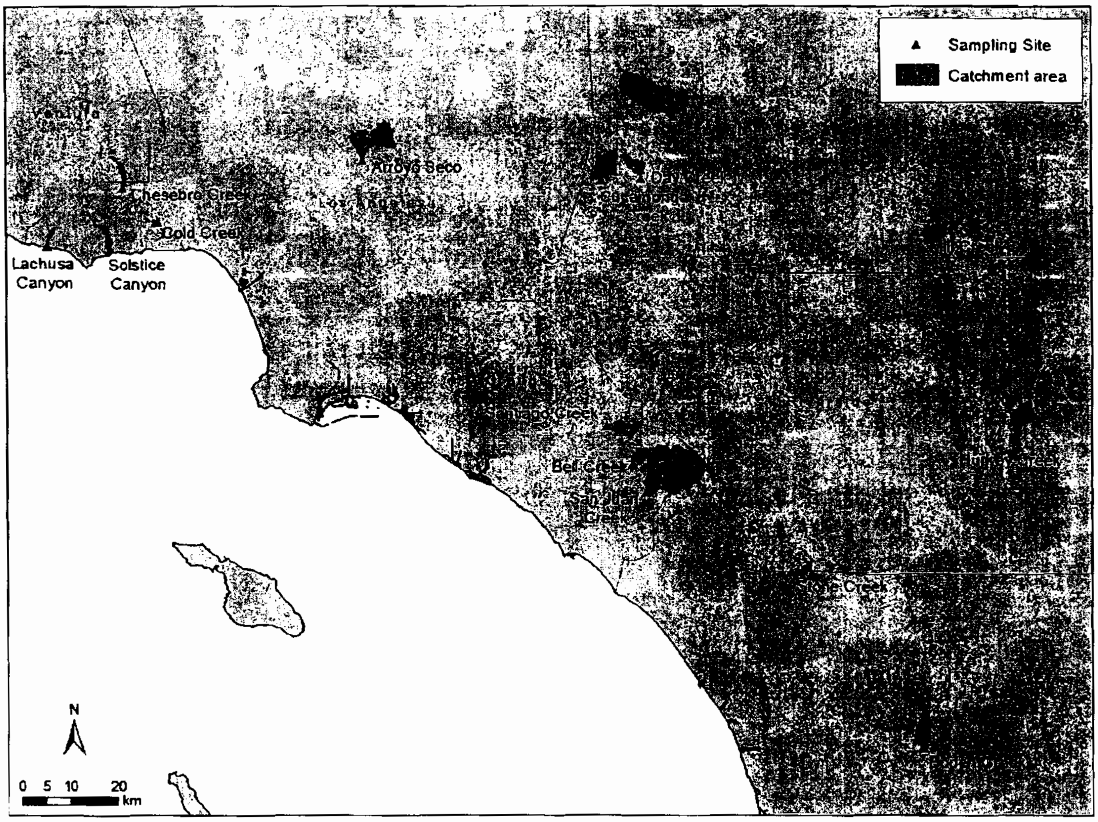

Figure 1. Map of natural stream sampling sites and their respective catchments within southern California.

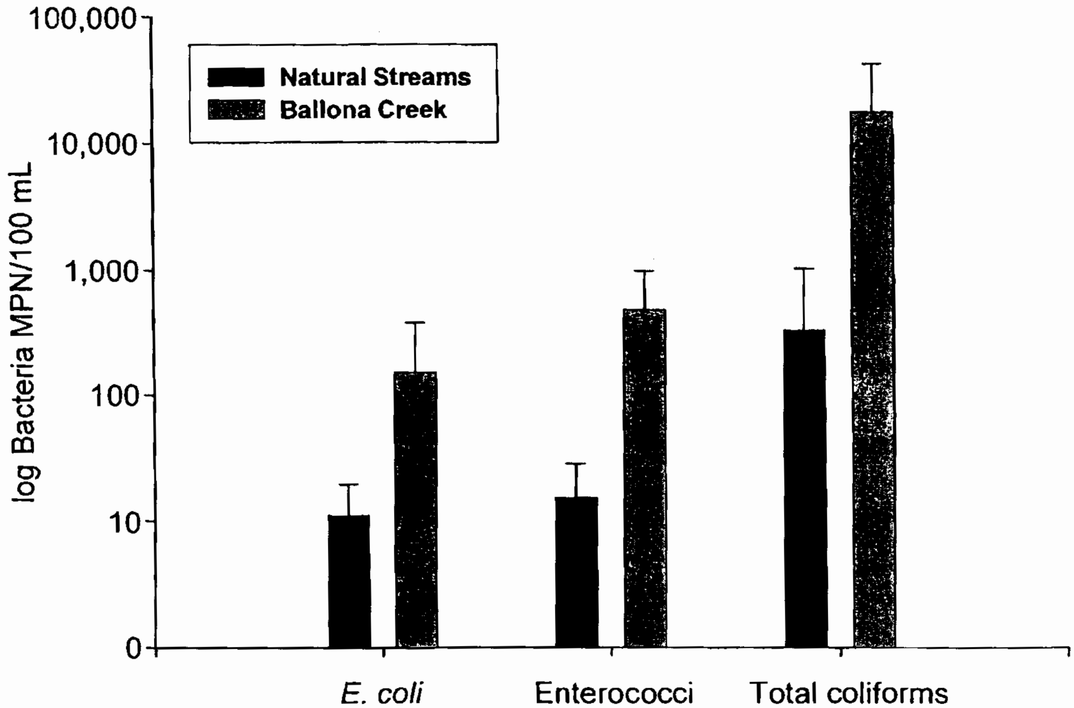

Figure 2. Comparison of dry weather log10 fecal indicator bacteria (FIB) densities (± standard deviations) between natural streams in undeveloped watersheds and developed Ballona creek watershed from May 2006-May 2007 in southern California, USA.

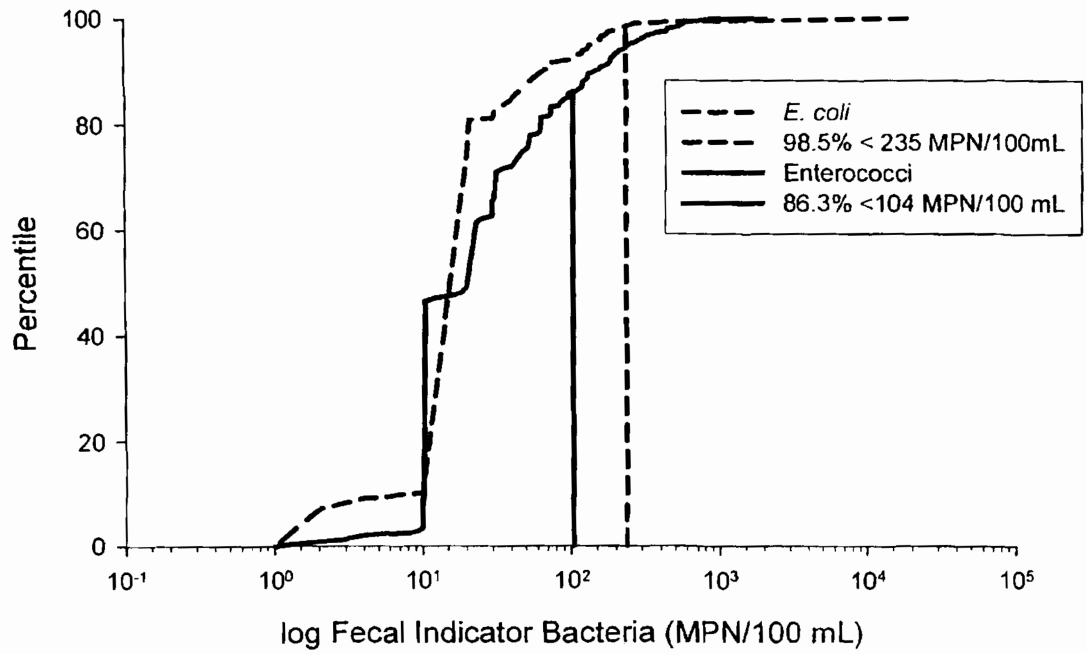

Figure 3. Dry season fecal indicator bacteria cumulative density frequency plots (CDFs) of natural streams relative to freshwater quality standards from May 2006 to May 2007 in southern California, USA.

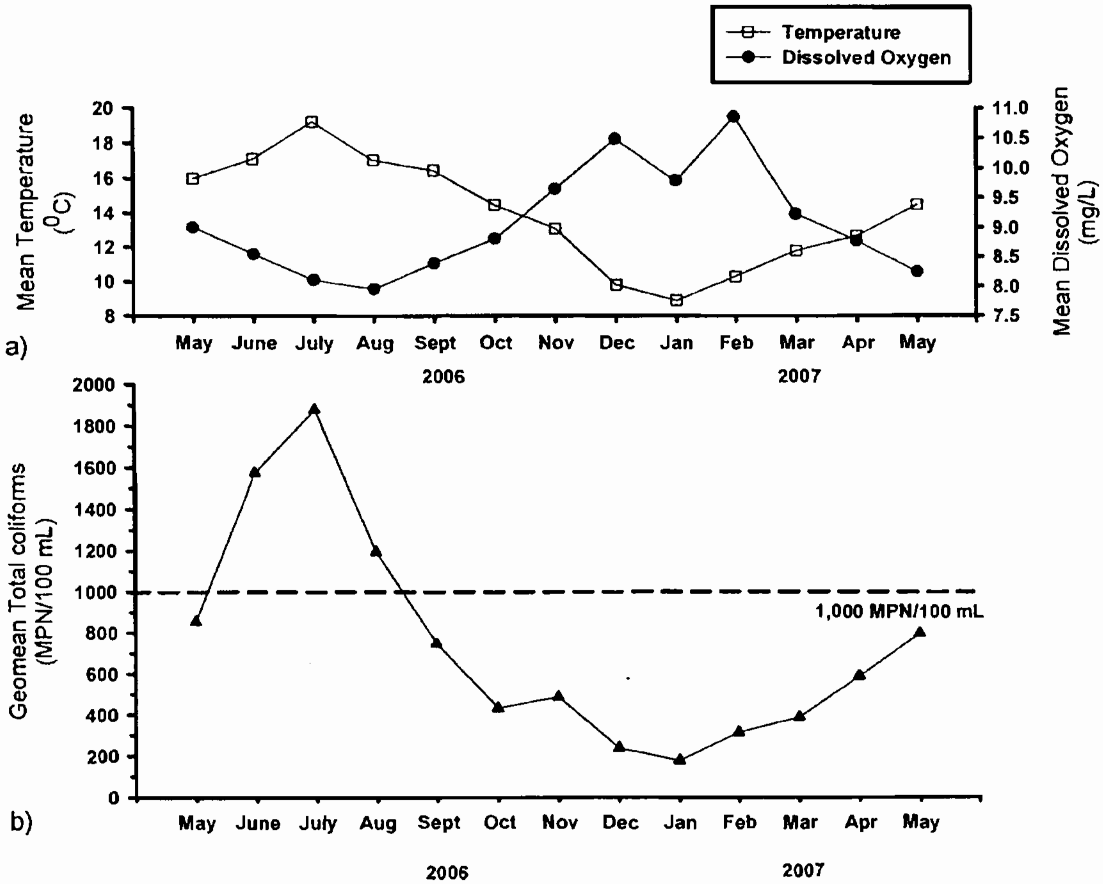

Figure 4. Mean monthly temperature (°C) and dissolved oxygen (mg/L) comparison (a) and geomean total coliform densities in natural streams in southern California (b) between May 2006 and May 2007. Summer months (June-August) were substantially higher than all other seasons ($p < 0.01$). *E. coli* and enterococci exhibited similar results. The dotted line indicates the 30-d geomean for total coliforms equal to 1,000 MPN/100 ml. All points above the line represent bacteria water quality exceedances.

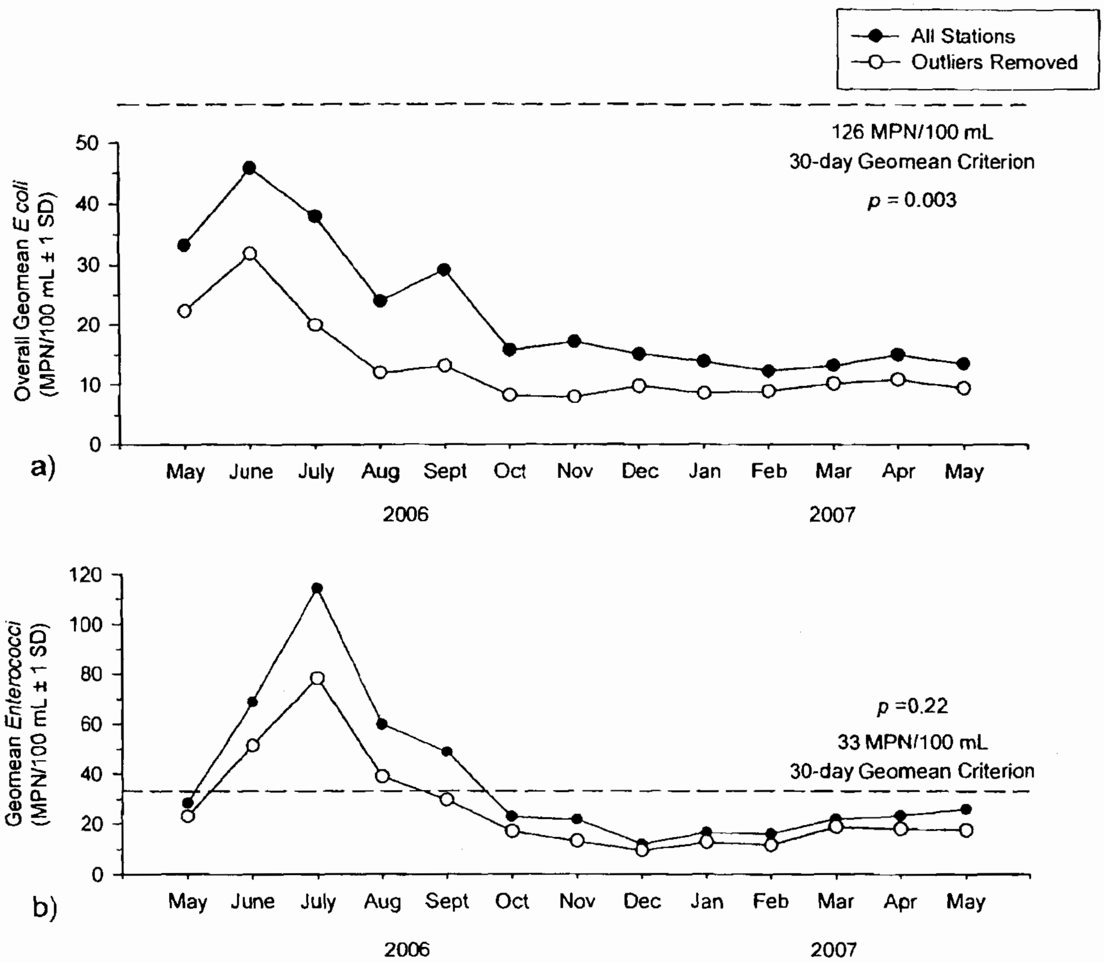

Figure 5. *E.coli* a) and enterococci b) geomean densities in natural streams in southern California between May 2006 and May 2007. Summer months (June-August) were substantially higher than all other seasons. The dashed line indicates the monthly water quality standard equal to 235 MPN/100 ml and 104 MPN/100 ml for *E. coli* and enterococci respectively. All points above the line represent bacteria water quality exceedances.

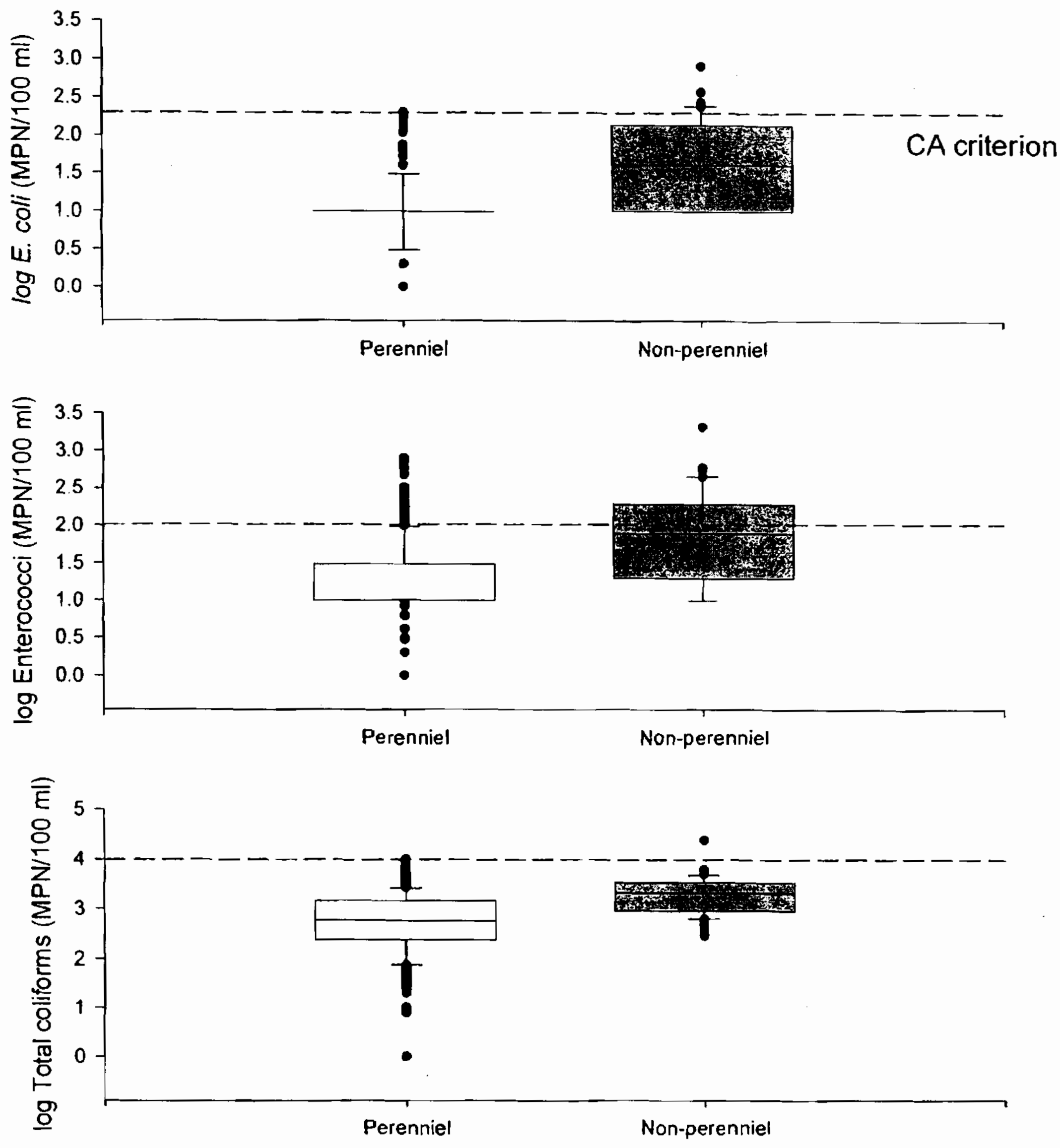

Figure 6. Perennial and non-perennial stream comparison of log10 fecal indicator bacteria densities (MPN/100 ml) in southern California during the present study. The dotted line indicates the State single-sample bacterial water quality criterion. Significant differences in indicator densities existed between streams but ranges generally overlapped ($p < 0.05$). Boxplots show mean, median, 25th and 75th percentiles.

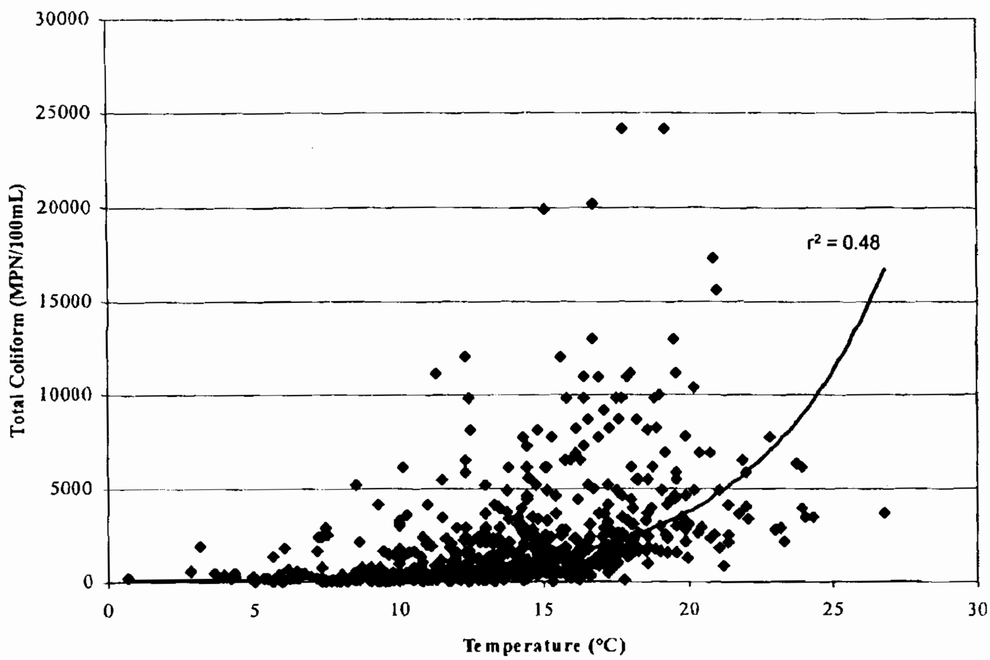

Figure 7. Natural stream temperatures in southern California versus total coliform densities (MPN/100 ml) during dry weather for an entire year. Solid line indicates the exponential trend line (r2 = 0.48).

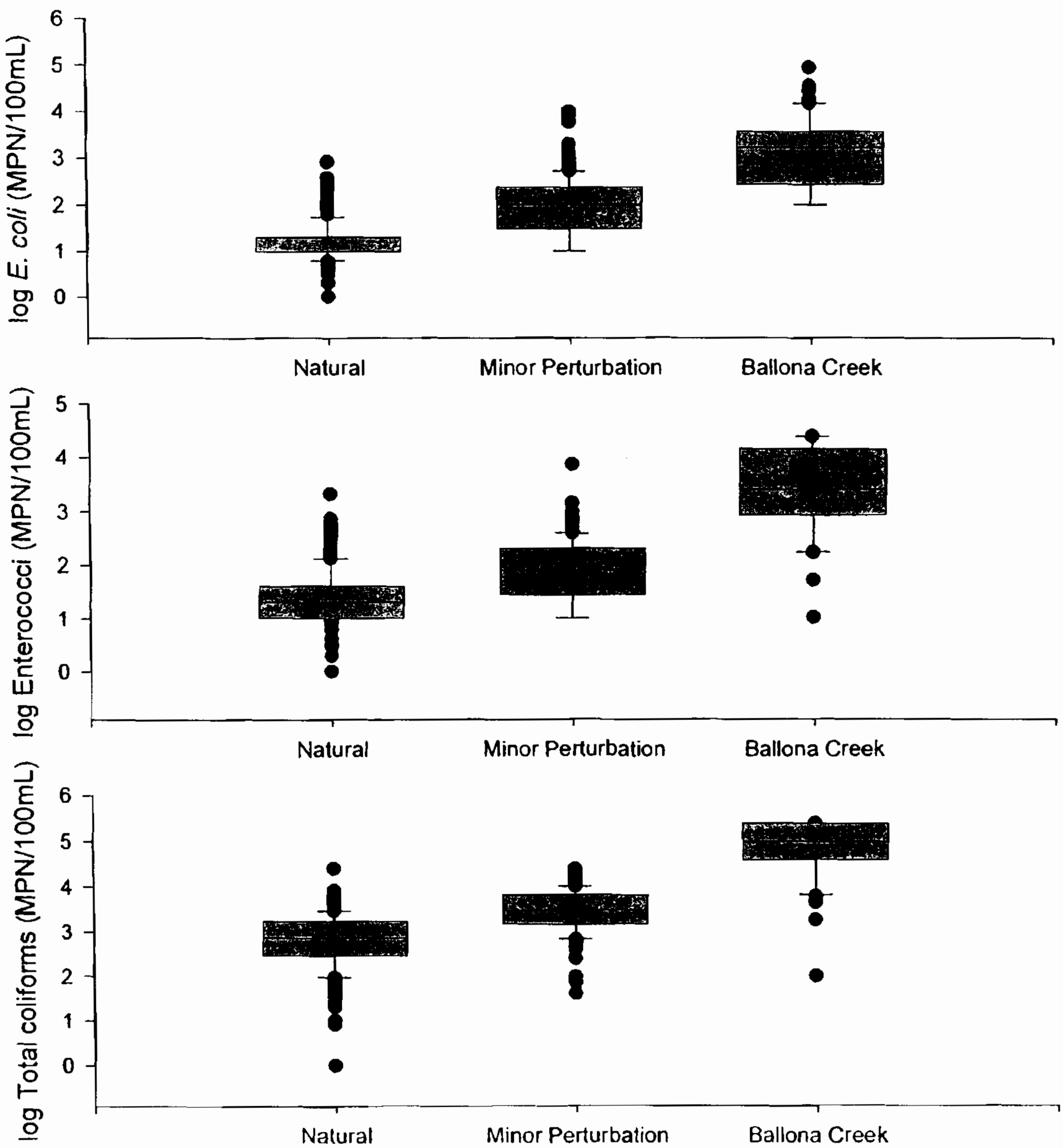

Figure 8. Distribution of log *E. coli* a); enterococci b); and total coliforms c) concentrations in natural streams, streams with minor perturbations, and in developed Ballona Creek watershed in southern California, USA. Natural streams were significantly lower then all other streams ($p < 0.001$). Minor perturbation streams were significantly lower than developed Ballona Creek ($p < 0.001$).

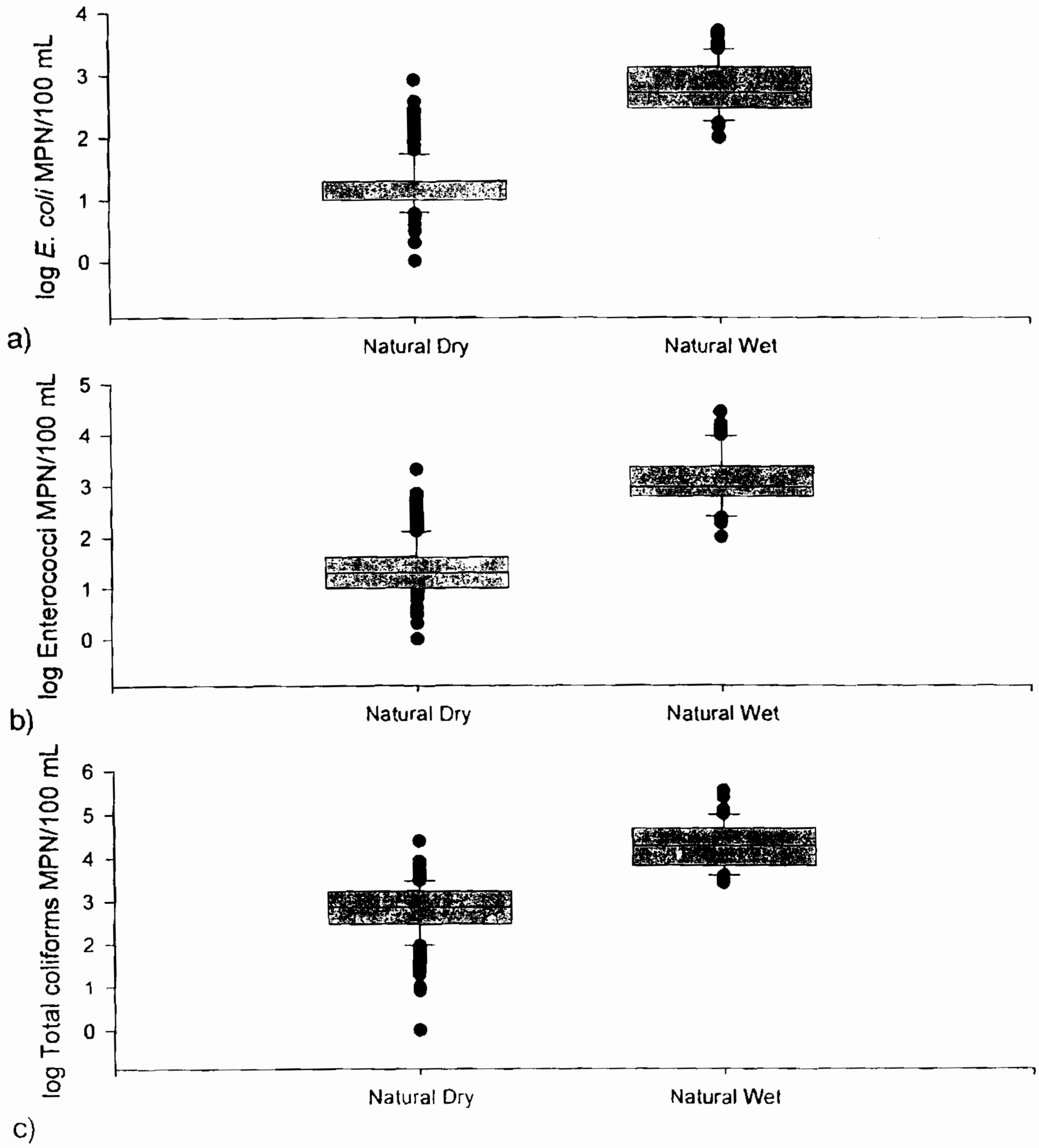

Figure 9. Distribution of log *E. coli* a); enterococci b); and total coliforms c) concentrations in natural streams during dry weather (present study) compared to wet weather (Natural Loadings; 2003-2005 and Los Angeles River watershed; 2001-2005) studies in southern California, USA. Dry weather bacteria concentrations were significantly lower then wet weather concentrations ($p < 0.001$).

APPENDIX A - SUMMARY BACTERIA DATA FOR ALL NATURAL STREAM SITES

Table A1. **List of natural stream sampling sites, characteristics and their daily fecal indicator bacteria densities (MPN/100 ml).**

		Concentration (MPN/100 ml)								
		E. coli			Enterococci			Total coliforms		
Sampling site	Watershed	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Arroyo Seco	LA River	10	15.2	148	10	20.5	250	10	1291.9	6867
Cold Creek	Malibu Creek	10	13.6	108	10	15.3	480	10	443.3	6131
Lachusa Canyon	Los Alisos Canyon	10	16.1	161	10	20.6	197	146	1486.5	8164
Solstice Canyon	Solstice Canyon	10	17.0	200	10	20.6	262	10	1109.2	5475
Chesebro Creek	Malibu Creek	10	90.3	9804	10	68.2	7270	96	2940.4	24192
Bell Creek	San Juan	10	80.5	820	10	164.6	2098	292	2008.7	24196
San Juan Creek	San Juan	20	74.7	259	10	25.2	299	1664	2848.2	6294
Santiago Creek	Santa Ana	10	23.0	134	10	34.7	228	469	1869.1	3873
Hurkey Creek	San Jacinto	10	18.9	5500	10	36.9	780	210	688.6	7700
Mill Creek	Santa Ana	1	2.1	20.9	1	12.7	190	1	75.0	435
Cucamonga Creek	Cucamonga	6	11.1	180	10	26.3	580	10	399.6	2000
Day Creek	Santa Ana	4	11.0	160	10	25.2	240	31	545.7	9800
Cajon Creek	Santa Ana	10	55.0	520	20	159.2	960	730	4794.5	13000
Stone Creek	Santa Margarita	10	138.2	5830	10	52.7	1408	40	1728.4	15530
Boden Creek	San Dieguito	10	45.3	18600	10	98.3	563	388	1658.5	20140
Mean		9.40	40.79	2829.66	10.07	52.08	1053.67	273.80	1592.51	10253.13
StDev		2.04	19.84	2662.11	1.82	25.32	911.35	222.68	622.94	3837.71

Table A2. Monthly *E. coli* geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	*E. coli* Geomeans												
	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07
Arroyo Seco	10.0	37.5	56.1	11.5	26.0	12.5	10.0	10.0	10.0	10.0	10.0	16.5	10.0
Lachusa Canyon	82.8	30.7	20.0	12.5	28.5	10.0	10.0	14.1	10.0	10.0	16.0	10.0	25.1
Cold Creek	14.4	42.1	10.0	27.6	10.0	14.2	10.0	10.0	10.0	10.0	10.0	10.0	20.0
Solstice Canyon	32.2	59.6	11.9	15.2	29.9	10.0	10.0	40.0	12.6	10.0	15.2	10.0	20.0
Chesebro Creek	150.3	276.0	444.2	233.5	1336.8	111.3	27.1	58.7	11.9	25.3	65.8	28.9	10.0
Bell Creek	25.9	125.6	104.0	146.0									
San Juan Creek	36.0	121.6	84.2										
Santiago Creek	10.0	22.8	53.6										
Hurkey Creek	5500.0	18.9	14.1						22.6	10.0	10.0	10.0	
Cucamonga Creek	10.0	10.0	10.0	12.4	10.0	10.0	10.0	20.6	10.0	13.2	10.0	10.0	10.0
Mill Creek	10.0	10.0	5.0	2.6	2.8	1.4	1.0	1.0	1.1	2.0	1.0	1.0	1.0
Day Creek	10.0	20.0	10.0	11.0	10.0	13.2	10.0	10.0	10.0	11.9	10.0	10.0	10.0
Cajon Creek	38.3	180.1	146.9	104.1	225.3	96.6	76.1	42.4	35.3	12.6	12.6	10.0	10.0
Stone Creek	65.7	129.2	269.5	134.6		156.1	441.1	57.8	240.1	82.8	20.2	99.4	112.1
Boden Creek	1082.5	26.1									21.5	63.5	30.7

Table A3. **Monthly enterococci geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.**

	Enterococci Geomeans												
Sampling site	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07
Arroyo Seco	41.0	63.0	105.7	23.9	54.6	18.1	11.9	10.0	10.0	10.0	10.0	10.0	14.1
Lachusa Canyon	20 2	13.2	15.1	17.4	21.6	20.1	11.5	14.1	14.6	34.0	82.3	24.7	17.6
Cold Creek	12.6	18.8	115.6	16.6	16.5	10.0	10.0	10.0	10.0	10.0	11.5	17.6	10.0
Solstice Canyon	25.1	23.8	39.8	61.0	47.5	16.9	13.2	10.0	12.6	10.0	12.5	10.0	35.1
Chesebro Creek	59.0	200.3	563.1	146.5	252.2	31.1	41.1	24.9	11.9	29.0	51.5	26.8	62.0
Bell Creek	12.6	402.1	467.8	158.0									
San Juan Creek	20.2	47.5	10.0										
Santiago Creek	14.6	59.0	40.8										
Hurkey Creek	380.0	121.6	744.2						18.9	10.0	10.0	19.5	
Cucamonga Creek	33.9	90.2	241.1	85.8	31.2	14.3	10.0	14.1	10.0	11.9	12.6	18.4	10.0
Mill Creek	10.0	10.0	20.2	35.8	16.5	23.2	14.8	4.0	16.1	3.2	22.6	25.8	3.9
Day Creek	21.5	43.3	125.8	92.1	42.4	18.8	24.6	11.9	11.5	21.4	10.0	11.9	14.1
Cajon Creek	87 1	307.1	486.6	367.7	253.0	157.0	217.8	56.6	66.9	100.3	74.1	95.2	200.0
Stone Creek	53.6	163.0	192.3	133.8	79.0	31.8	53.4	12.6	46.1	18.5	11.9	45.9	74.2
Boden Creek	143.4	208.4									69.4	44.9	98.4

Table A4. **Monthly total coliforms geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.**

Sampling site	*Total coliforms* Geomeans												
	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07
Arroyo Seco	708.0	1854.8	4200.8	1859.1	2506.6	1480.0	1155.9	534.0	134.9	588.4	1547.1	1843.3	2926.5
Lachusa Canyon	1611.2	1825.6	2724.7	3350.6	2074.7	998.6	1139.4	1206.9	725.0	1655.0	807.2	1009.0	2176.8
Cold Creek	997.6	1743.3	3567.4	1312.3	1347.5	488.0	250.7	109.2	70.7	78.3	123.9	218.3	277.4
Solstice Canyon	1064.2	1404.8	2278.4	2998.4	1048.4	499.8	550.8	654.2	761.3	1218.5	529.5	1783.9	2549.3
Chesebro Creek	2546.1	4655.0	9044.6	8141.9	8332.1	4770.4	2142.9	1017.2	789.6	1085.4	1515.9	1722.6	2540.4
Bell Creek	518.6	4780.6	2513.8	1483.0									
San Juan Creek	1748.1	3406.8	4139.9										
Santiago Creek	1189.6	1846.4	2985.1										
Hurkey Creek	6500.0	2102.0	5040.8						348.1	224.5	326.7	347.1	
Cucamonga Creek	419.1	688.2	1334.1	650.0	740.5	362.5	364.9	122.4	155.4	253.2	318.7	434.9	720.0
Mill Creek	170.6	224.0	126.4	139.1	35.3	91.9	151.7	27.5	30.8	24.0	48.3	52.0	115.7
Day Creek	311.1	746.5	1146.1	1320.5	668.1	267.3	417.4	374.0	232.4	569.0	450.4	498.0	2674.7
Cajon Creek	5915.7	8730.8	7512.4	3300.6	7335.3	9693.4	2667.5	3993.7	2747.3	2242.1	2946.6	5461.8	8200.0
Stone Creek	347.3	3493.6	4887.8	5727.9	7310.9	2482.6	1959.5	321.2	734.3	617.5	673.7	1610.4	1151.6
Boden Creek	7229.3	3207.2									603.5	1295.2	1302.1

Table A5. Dry season *E. coli* geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	Watershed	*E. coli* Dry Season Geomeans				
		Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07
Arroyo Seco	LA River	25.0	22.4	13.7	10.0	13.3
Lachusa Canyon	Los Alisos Canyon	45.9	15.9	13.4	12.0	13.7
Cold Creek	Malibu Creek	24.8	16.5	11.2	10.0	11.9
Solstice Canyon	Solstice Canyon	49.7	19.7	12.6	12.6	13.0
Chesebro Creek	Malibu Creek	213.3	531.7	56.0	21.5	32.8
Bell Creek	San Juan	48.3	115.8			
San Juan Creek	San Juan	74.2	75.2			
Santiago Creek	Santa Ana	16.8	31.4			
Hurkey Creek	San Jacinto	119.5	16.9		15.3	10.0
Cucamonga Creek	Cucamonga	10.0	10.8	12.7	11.1	10.0
Mill Creek	Santa Ana	10.0	4.2	1.2	1.3	1.0
Day Creek	Santa Ana	17.4	10.3	10.9	10.6	10.0
Cajon Creek	Santa Ana	84.7	126.2	102.7	20.1	11.2
Stone Creek	Santa Margarita	95.1	181.5	292.4	80.7	82.9
Boden Creek	San Dieguito	148.1	14.1		10.0	43.1

Table A6. Dry season enterococci geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	Watershed	Enterococci Dry Season Geomeans				
		Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07
Arroyo Seco	LA River	54.6	49.4	15.6	10.0	11.0
Lachusa Canyon	Los Alisos Canyon	15.9	17.1	14.2	30.6	35.0
Cold Creek	Malibu Creek	15.2	35.0	10.0	10.0	14.5
Solstice Canyon	Solstice Canyon	22.1	52.9	14.7	12.2	13.7
Chesebro Creek	Malibu Creek	118.8	365.1	33.7	21.1	46.1
Bell Creek	San Juan	60.1	338.0			
San Juan Creek	San Juan	26.8	23.4			
Santiago Creek	Santa Ana	24.2	49.9			
Hurkey Creek	San Jacinto	127.2	386.5		14.2	14.9
Cucamonga Creek	Cucamonga	47.0	138.9	14.1	11.3	16.5
Mill Creek	Santa Ana	10.0	20.6	11.4	12.4	8.0
Day Creek	Santa Ana	28.7	77.4	20.5	13.7	11.9
Cajon Creek	Santa Ana	140.7	383.2	145.4	89.6	96.7
Stone Creek	Santa Margarita	83.1	151.8	40.0	22.0	51.2
Boden Creek	San Dieguito	154.0	305.7		28.6	81.6

Table A7. **Dry season total coliforms geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern** California, USA.

Sampling site	Watershed	Total coliforms Dry Season Geomeans				
		Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07
Arroyo Seco	LA River	1066.8	2610.9	1230.6	422.2	2163.9
Lachusa Canyon	Los Alisos Canyon	1663.9	2899.9	1092.8	1034.7	1099.7
Cold Creek	Malibu Creek	1069.4	2133.9	295.8	97.2	180.3
Solstice Canyon	Solstice Canyon	1278.2	2165.1	543.3	616.5	1900.3
Chesebro Creek	Malibu Creek	3776.6	8814.0	2535.0	889.0	2281.4
Bell Creek	San Juan	1169.5	2955.9			
San Juan Creek	San Juan	2001.5	4426.6			
Santiago Creek	Santa Ana	1417.1	2465.3			
Hurkey Creek	San Jacinto	2952.6	3345.5		326.8	310.5
Cucamonga Creek	Cucamonga	508.0	958.8	254.1	216.2	500.4
Mill Creek	Santa Ana	185.3	104.5	82.8	31.6	79.5
Day Creek	Santa Ana	425.2	1001.3	374.8	348.5	795.6
Cajon Creek	Santa Ana	6926.3	5634.3	5220.2	2595.1	5267.6
Stone Creek	Santa Margarita	1343.4	5682.0	2193.0	516.7	1361.0
Boden Creek	San Dieguito	5146.1	2216.8		514.8	1163.2

Table A8. Annual dry season fecal indicator bacteria geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	Watershed	*Annual* Dry Season Geomeans		
		E. coli	Enterococci	Total Coliforms
Arroyo Seco	LA River	15.2	20.5	1291.9
Lachusa Canyon	Los Alisos Canyon	16.1	20.6	1486.5
Cold Creek	Malibu Creek	13.6	15.3	443.3
Solstice Canyon	Solstice Canyon	17.0	20.6	1109.2
Chesebro Creek	Malibu Creek	90.3	68.2	2940.4
Bell Creek	San Juan	80.5	164.6	2008.7
San Juan Creek	San Juan	74.7	25.2	2848.2
Santiago Creek	Santa Ana	23.0	34.7	1869.1
Hurkey Creek	San Jacinto	18.9	36.9	688.6
Cucamonga Creek	Cucamonga	11.1	26.3	399.6
Mill Creek	Santa Ana	2.1	12.7	75.0
Day Creek	Santa Ana	11.0	25.2	545.7
Cajon Creek	Santa Ana	55.0	159.2	4794.5
Stone Creek	Santa Margarita	138.2	52.7	1728.4
Boden Creek	San Dieguito	45.3	98.3	1658.5

APPENDIX B - SUMMARY OF PHYSICAL PARAMETERS AT ALL NATURAL STREAM SITES

Table B1. Annual dry season averages of measured physical parameters in natural streams during May 2006-May 2007 in southern California, USA.

	Physical Parameter Averages					
Sampling site	Conductivity	DO	Flow Rate	pH	Temperature	Turbidity
	□s	mg/L	m^3/s		°C	
Arroyo Seco	411.9	na	0.038	na	13.8	na
Lachusa Canyon	1431.1	na	0.006	na	16.2	na
Cold Creek	604.0	na	0.005	na	13.8	na
Solstice Canyon	1051.6	na	0.011	na	15.4	na
Chesebro Creek	3089.0	na	0.005	na	11.9	na
Bell Creek	738.8	8.7	0.018	8.0	18.7	1.1
San Juan Creek	518.8	10.4	0.028	8.2	21.1	0.7
Santiago Creek	636.9	9.6	0.017	8.1	22.2	0.5
Hurkey Creek	129.9	na	0.006	7.8	11.6	na
Cucamonga Creek	9.8	9.8	0.138	8.0	12.3	na
Mill Creek	0.7	9.4	0.080	8.0	10.6	12.3
Day Creek	13.7	9.9	0.317	8.0	12.6	1.8
Cajon Creek	37.7	8.7	0.082	7.9	15.7	8.0
Stone Creek	1171.6	7.2	0.002	7.5	16.4	16.1
Boden Creek	1012.0	7.5	0.005	7.8	15.3	6.1

APPENDIX C - INTERLABORATORY CALIBRATION RESULTS

RESULTS

SCCWRP is currently coordinating an investigation of bacteria levels in reference drainages throughout southern California. This is a cooperative study involving multiple jurisdictions that are each contributing to the project through combinations of in-kind services and direct funding. Because numerous analytical labs will be participating in analysis of fecal indicator bacteria, it was necessary to conduct a laboratory intercalibration study to ensure that comparable results could be achieved from all participating laboratories. This memo summarizes the results of this intercalibration study.

Eight laboratories from five counties participated in the calibration exercise, a performance-based approach used to evaluate analytical accuracy, reproducibility of results and to ensure that data from participating laboratories were comparable (Table C1). The calibration exercise occurred on March 22th, 2006 and consisted of each lab receiving six common samples for analysis (Table C2). Necessary dilutions or aliquot volumes were processed to insure that reportable values could be determined. Bacterial results were reported for total coliform, *Escherichia coli* (*E. coli*), and enterococcus as organism type per 100 ml of sample. Precision was examined by assessing repeatability variance (based on intralaboratory data) and reproducibility variance (based on interlaboratory data). All participating labs were required to fall within a +/- 0.5 median log count comparability goal (Noble *et al.* 2000).

All laboratories had low repeatability variability for all three constituents and all results fell within the median log comparability criteria. Based on all results there were not large variations between the laboratories (i.e. neither of the laboratories were consistently higher or lower for any parameters) in a given sample or for all samples. However, one lab (CSD) reported higher values than the rest, but this can be explained by their inadvertent double diluting of the sample. Also, both Truesdail and Weck laboratories tended to report lower values than the rest. These laboratories should be extra cautious and invest extra efforts in data interpretation in order to not bias the results of bacterial concentrations on the low side.

Figures C1-3 are an example of how the laboratories compared with the different analyses and how well the laboratories were able to reproduce results. These plots are representative of all the data and illustrated good comparability between the analytical labs. As a result of this study we conclude that there should be no bias introduced into the dataset due to sample analysis by different laboratories. All the data and plots are available from SCCWRP upon request.

Table C1. List of participating laboratories and counties involved in the reference bacteria/watershed interlaboratory calibration.

Laboratory Name	County
E. S. Babcock, & Sons, Inc.	Riverside
City of San Diego	San Diego
CRG Marine Laboratories, Inc.	Los Angeles
HCA Public Health Laboratory	Orange
Truesdale Laboratories, Inc.	Orange
Weck Laboratories	Los Angeles
Aquatic Bioassay & Consulting Laboratory (ABC)	Ventura
Weston Solutions, Inc.	San Diego

Table C2. List of the six common samples and their representative sewage dilutions in (ml) which each laboratory received for the interlaboratory calibration.

Media	Dilution (ml)
DI Water	-
Santiago Creek	-
Sewage Dilution 1	3
Sewage Dilution 2	1.5
Sewage Dilution 3	1
Sewage Dilution 4	0.5

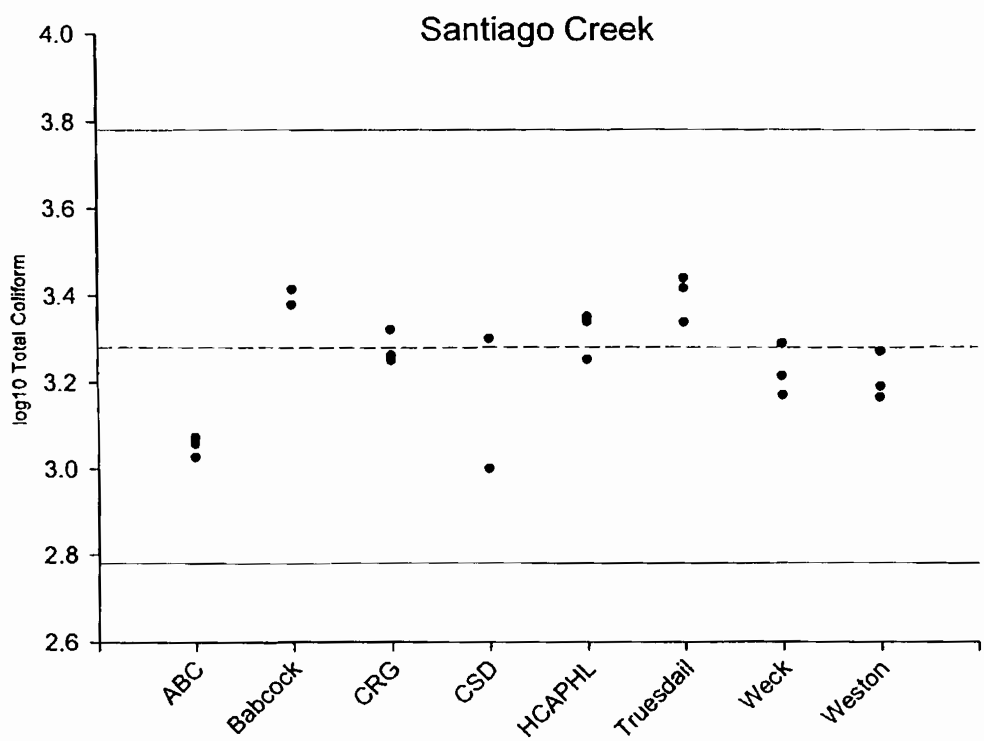

Figure C1. Laboratory comparison results for log transformed total coliform data at Santiago Creek, Orange County. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count.

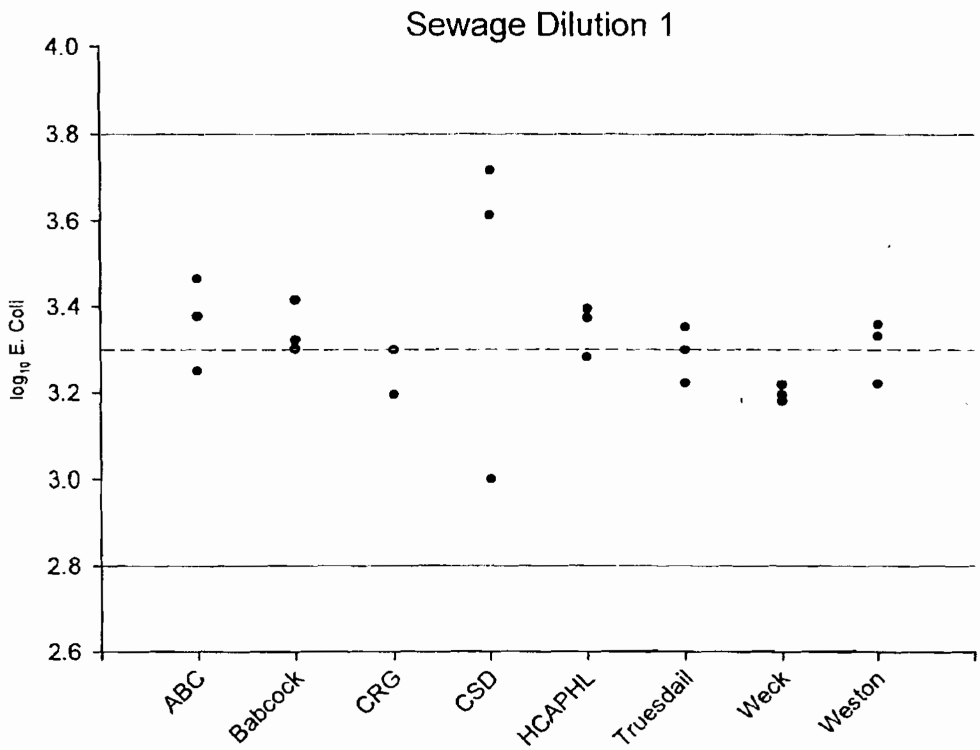

Figure C2. Laboratory comparison results for *E. coli* using a 3 ml sewage dilution. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count.

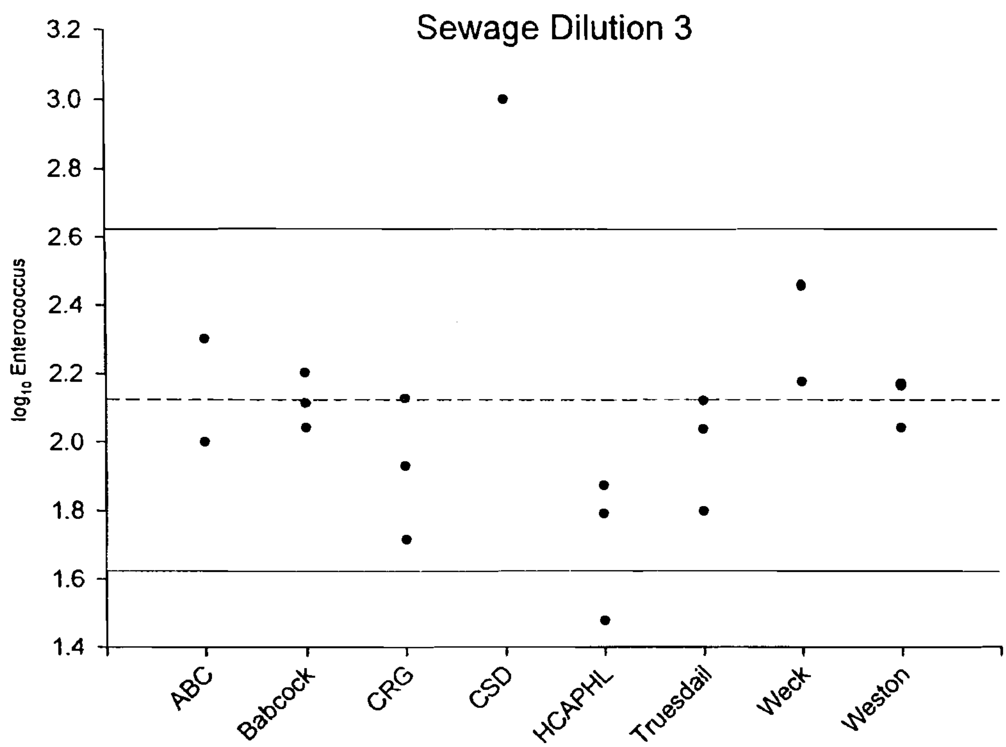

Figure C3. Laboratory comparison results for Enterococcus using a 1 ml sewage dilution. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count.

City of Malibu

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CALIFORNIA
COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT

August 6, 2010

Chair Bonnie Neely and the Members of the
California Coastal Commission
Attn: A. Tysor
89 South California Street, Suite 200
Ventura, CA 93001

Re: 8/12/10 Agenda Item Malibu Lagoon State Park, City of Malibu, Los Angeles County
CCC CDP Application No.: 4-07-098

Dear Chair Neely and Members of the Commission:

I write in support of the long-awaited Malibu Lagoon Restoration Project ("project"); and, although the project provides an opportunity for improvements to an impaired water system, I also write to convey significant potential environmental consequences that must be addressed in the permit. The City of Malibu is committed to improving and protecting water quality and, to that end, the City appreciates your consideration of the following concerns.

The City requests that before the permit is approved, the Coastal Commission do the following:

1. Satisfy its obligations under CEQA by studying and identifying the potential environmental consequences of the project. The hydrology in the Lagoon is complex and recent studies (attached and discussed in detail below) have shed new light on the existence of bacteria and nutrients in the water. These finding suggest that the proposed work has the potential to increase bacteria and nutrients in the water. The Commission must fully understand the potential impacts expected from disrupting this complex hydrologic system before approving the permit.

2. Impose adequate mitigation measures for the project to mitigate and prevent degradation of water quality in the area.

3. Require monitoring before, during and after the project. The proposed bi-annual monitoring plan is not adequate to understand the baseline water condition before the project begins. Without a baseline from which to measure, the scientists cannot determine the impact that this project will have on water quality. The City also requests the Commission require more frequent monitoring to identify promptly activities that are degrading the water quality. The project will likely increase Total Coliform, Fecal Coliform and Enterococcus at Surfrider Beach during the height of recreational activities. The City and other watershed agencies can potentially be held responsible for

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bacteria exceedances at Surfrider Beach and it is imperative that the monitoring be frequent enough to enable the permittee to identify and promptly cease activities that degrade the water quality in the area. The permit only contemplates potential impacts on Malibu Creek fresh water and needs to properly account for potential impacts at Surfrider Beach as well.

Additionally, the City has the following comments with respect to the water quality in the Lagoon.

1) The Santa Monica Bay Beaches Bacterial Total Maximum Daily (TMDL) Load limits are set for three constituents (Total Coliform, Fecal Coliform and Enteroccoccus)(FIB); however, the permit only references Total Coliform in one chart, and Fecal Coliform in another reference. The monitoring plan should address and require monitoring for all constituents subject to TMDLs in the area. Periodic sampling for human markers may also help participating agencies understand the source of bacteria.

2) Lagoons and estuaries, like Malibu Lagoon, are known to cause a net increase in bacteria loads especially when the physical conditions constrain naturally functioning systems. Research shows that high fecal indicator bacteria at Surfrider Beach and other coastal sites is most likely from bird feces in the sand and kelp, decaying vegetation and naturally occurring bacteria released from the lagoon sediments. (See exhibits 12, 14, 15, 21, 22, 24, 26 and 31). Further, monitoring results are particularly affected if the sample is taken at high tide and early in the day.

   Recent studies by the United States Geological Survey (USGS) demonstrate that even when the Malibu Lagoon sand berm is closed, that fecal indicator bacteria can pass through the berm and affect sampling results at Surfrider Beach, if certain conditions are present. Additionally, multiple studies show that even when no human markers were present, fecal indicator bacteria limits were exceeded at Surfrider Beach. (See 13, 28, 32).

   The project proposes to increase tidal exchange. This exchange is not clearly defined but presumably, the number of events and length of time the berm is open may increase during construction and as a result of the project. The historical monitoring records show that fecal indicator bacteria loads increase, and often exceed regulatory limits more often, when the berm is open.

3) The City supports the following restoration elements; however, as adequate environmental analysis demonstrates, the project has the potential to increase FIB and nutrient levels in Malibu Lagoon and Surfrider Beach. To mitigate such adverse impacts consider the following:

   a. Re-contouring the slopes for the 12-acre western arms of the lagoon to create broad shallow slopes will increase the surface area and lagoon sediment area. This may increase the release of naturally occurring bacteria that will increase the potential for FIB exceedances at the three sample sites at Surfrider Beach, SMB – MC 1, 2 and 3 – commonly known as Malibu Lagoon, Malibu Pier and Malibu

Colony. Malibu Colony sample station is actually seaward of the lagoon at the most western extent. These exceedances can occur when the berm is open or closed. Re-contouring could also affect nutrients released from the lagoon sediment. The project is expected to more effectively reduce stagnation and increase oxygen availability in the lower depths of the lagoon through improved horizontal mixing. The recent Lagoon studies indicate that the lower depths host the naturally occurring bacteria, which will now be more readily released to the surface waters where samples are collected.

b. Revegetation may increase bacteria produced from the natural decaying process – more bank surface area and more vegetation will result in higher levels of bacteria. There may be some time periods when slow transit time can help remove bacteria by the vegetation; but in most scenarios, there will a net increase of bacteria. It is noted that improved circulation and increased tidal flow, a goal of the project, will decrease contact time with lagoon plants capable of removing some bacteria. The project anticipates that there will be an increase in the discharge volumes and events at Surfrider Beach and affect water quality at sampling sites.

c. The project proposes to increase the mudflats on the Eastern bank near the Adamson Boat House. This activity will increase foraging and bird habitat, surface area sediment contact, and bird feces, which is likely to increase the bacteria in Lagoon waters and can impact water quality at Surfrider Beach. Exhibit 20, water sampling location map, shows no sampling proposal for this element of the project. FIB exceedances were experienced in this specific area of Malibu Lagoon, as discussed in the recent UCLA and USGS studies. The City requests the permit be revised to include a 9th sampling location between the newly created mudflats and boathouse channel and the Lagoon sand berm.

d. The staff report, environmental analysis and permit fail to consider the potential of spreading the invasive New Zealand mudsnails (known to inhabit Malibu Lagoon). The permit should include conditions to ensure that equipment and tools used at the project site are subject to the current protocol to prevent the spread of the snails to other reaches or other creeks where the equipment may do future work. Soil disposal activities must be similarly conditioned. Vegetation removal and dispersal could also transfer this highly invasive species. Many of the background studies referenced in the staff report were conducted prior to the invasion of the New Zealand mudsnail; hence, the staff report and permit does not adequately address this concern.

e. Include a provision to indemnify the City for any water quality violations that arise from exceedances caused by or primarily contributed to as a result of the Lagoon Restoration Project.

f. The background studies referenced in the staff report have been superseded with more recent studies that can provide relevant information about the complex hydrology in the Lagoon and surrounding areas. The staff report only refers to a 1999 URS Greiner Woodward Clyde study and the 2004 Stone Environmental study related to impacts from onsite wastewater treatment systems. These references have been enhanced by extensive relevant studies conducted by UCLA (28, 32) and USGS (21, 22, 24, 26, and 31), and SCCWRP (13, 14, 20).

g. Historical drainage from the Malibu Colony residential neighborhood may be significantly impacted by the project. The City has agreed to allow two, 4 inch drain diversions into its Civic Center stormwater treatment facility (SWTF) if there is a bypass to account for overflow. This will allow for diversion of dry-weather urban runoff and limited stormwater flows so that it can be treated and disinfected; however, the surface flows have not been accounted for in the permit. Malibu Colony residents have reported concerns that the project's proposed solid block wall could obstruct historically occurring surface flows from the rear yards with potential flood impacts, if a mitigation measure is not required. The City requests a revision to the project plan to account for these surface flows and prevent significant flooding during rain events.

Again, the City supports a more efficient, better functioning lagoon system, but requests that the project be properly conditioned to prevent any unintended water quality degradation. Adequate environmental analysis is essential to determine the appropriate mitigation measures.

The following questions and comments from the staff report should also be addressed before the permit is issued:

Page 11 3.A.e. If construction equipment cannot be cleaned on the temporary berm, parking lot or trails, where does the permit specify that cleaning will take place?

Page 12 4. The dewatering Plan focuses on protection of aquatic species; however, human heath could be affected depending on when and where the water is discharged and the results of increasing flow rates within the Lagoon.

Page 15 iv., c. and d. Sediment samples should also include FIB analysis and appropriate human markers analysis. Vertical profiles should be conducted quarterly, note all physical conditions, and be performed throughout the day to account for heat, sunlight, and tidal influences.

Page 16 & 17 Success Measures and Supplemental Measures

The report fails to discuss the increase in bacteria and resulting potential impact on human health for swimmers and surfers at Surfrider Beach. Since research shows that lagoons and estuaries contribute bacteria to the near shore sampling locations, what measures will be required if there is an increase in bacteria?

Page 24 16. Any excavated material should be monitored for the presence of New Zealand mudsnail.

Page 28 Dewatering

It is not clear from the project description where water will be discharged. If it is discharged into the main channel of the Lagoon, the discharge will cause an unnatural breach of the Lagoon berm and increase FIB loads at Surfrider Beach. The proposed filtration methods using carbon and resin vessels will not disinfect, and using only chlorine for disinfection at these flow rates is not recommended. The proposed list of constituents for testing only includes fecal coliform. All three FIB must be monitored during the dewatering process.

The City is also concerned about the dewatering process and the disinfection required prior to dispersal near Surfrider Beach. The staff report does not provide enough information about the Los Angeles Regional Water Quality Control Board's dewatering permit, the discharge location(s) and the actual constituents to be monitored. The City requests more information on the permit and has requested also requested a copy from the RWQCB.

Page 33 Riparian Forest Picnic Area

It is not clear whether or not this area will include a public toilet facility. The project should include a pubic facility, as the nearest facility is quite far from this area. City staff has observed toilet paper remains in the area, indicating that visitors may not go find the nearest public facility.

Page 33 "Adamson House Wall" is actually the Malibu Colony Wall

As noted earlier, an unintended consequence of the solid concrete masonry wall may increase flooding in the neighborhood directly to the south of the project if historical surface flows are subsequently impeded. There was no analysis of potential impacts or mitigation measures in any engineering study provided in the CCC staff report or environmental review documents for the project.

Page 42 and 43 Water Quality Conditions

The reference studies were conducted prior to 2005. The baseline for nutrients and bacteria should be determined from more contemporary studies and from studies that utilize state-of-the-art analytical methodologies. There has been extensive research conducted in the groundwater and surface waters that migrate to Malibu Creek and Lagoon and significant capital improvement projects have been completed since 2005. Aging onsite wastewater treatment systems along Malibu Creek have been replaced with the most advanced treatment systems. Since 2007, almost all surface flows from the Malibu Lagoon sub-watershed have been intercepted, filtered and disinfected resulting in the elimination of bacteria and significant removal of nutrients from the developed areas in the Malibu Civic Center.

In 2009, USGS conducted extensive nutrient and bacteria monitoring throughout the Civic Center area, near shore, Lower Malibu Creek, Malibu Lagoon and upcoast in the Malibu Colony and just off shore in both dry- and wet-weather conditions when the berm was closed and open. The primary source of bacteria is from natural sources such as avian feces deposited into the Creek and Lagoon, decaying vegetation, avian feces in the kelp and sand. Using the most up to date analysis, no human bacteria was found at Surfrider Beach by the University of California at Los Angeles (28, 32) nor in Malibu Creek and Lagoon or Surfrider Beach by researchers from SCCWRP in 2005 (13, 14 and 20) and in the extensive investigations by USGS in 2009 (21, 22, 24, 26, 31).

The Commission's staff report comments on Page 43 that the source of fecal indicator bacteria is from wastewater treatment facilities upstream and leaching from septic systems in the immediate vicinity of the Lagoon. This statement is not accurate; recent scientific data indicate that bacteria comes from avian sources and kelp, among other things. These attached studies should be considered, as they provide the best data on Lagoon Hydrology.

The City also requests the opportunity to review and comment on the final water monitoring plan before the Executive Director approves the plan. All water quality sampling during and post-construction must reflect the regulatory requirements for Santa Monica Bay Beaches Bacteria TMDL, since the project description anticipates a high likelihood that the berm will breach and/or there will be direct discharge to Santa Monica Bay. This would include Total coliform, Fecal coliform and Enteroccoccus. The staff report states that the permit allows for the discharge of 1.3 million gallons per day into Santa Monica Bay. Chlorination alone, without ozone or ultraviolet disinfection, is an uncertain process, especially for the high volume and flow rate anticipated.

Lastly, the City would request that the Project Manager provide contact information where he or she can be reach 24 hours a day, seven days a week. The public will generally contact the City of Malibu with emergency concerns and having this information will reduce response time.

Thank you for your consideration of these comments

Sincerely,

Jim Thorsen
City Manager

Enclosures: City of Malibu Comment Letter Reference Documents

Cc: Mayor Wagner and Honorable Members of the Malibu City Council
Christi Hogin, City Attorney
Los Angeles Regional Water Quality Control Board

City of Malibu Comment Letter Reference Documents

	Title	Author	Date	Notes
12	Enumeration and Spaciation of Enterococci Found in Marine and Intertidal Sediments and Coastal Water in Southern California	Ferguson, Moore, et al.	January 2005	Journal of Applied Microbiology
13	Multi-Tiered Approach Using Quantitative Polymerase Chain Reaction For Tracking Sources of Fecal Pollution to Santa Monica Bay	Noble, Griffith, Blackwood, et al.	February 2005	Southern California Coastal Water Research Project Also published in American Society for Microbiology
14	Modeling the Dry-Weather Tidal Cycling of Fecal Indicator Bacteria in Surface Waters of an Intertidal Wetland	Sanders, Arega, and Sutula	July 2005	Department of Civil and Environmental Engineering, UC Irvine and Southern California Coastal Water Research Project
15	Final Report: Identification and Control of Non-Point Sources of Microbial Pollution in a Coastal Watershed	Sanders, Grant, Horne, et al.	February 2006	United States Environmental Protection Agency-National Center for Environmental Research
20	Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams	Tiefenthaler, Stein and Lyon	January 2008	Southern California Coastal Water Research Project
21	Coastal groundwater dynamics off Santa Barbara, California: Combining geochemical tracers, electronic seepmeters, and electrical resistivity	USGS Swarzenski, Izbicki	April 2009	Estuarine, Coastal and Shelf Science published by Elsevier
22	Sources of Fecal Indicator Bacteria in Urban Streams and Ocean Beaches, Santa Barbara	Izbicki, Swarzenski, et al	September 2009	United States Geologic Survey, Annals of Environmental Science
24	Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu	Izbicki, Swarzenski, et al	Interim Reports: 10/29/09, 1/11/10, 2/18/10	City of Malibu - United States Geologic Survey – Dry Weather
26	Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu	Izbicki, Swarzenski, et al	May 2010	City of Malibu - United States Geologic Survey – Wet Weather Power Point Presentation to RWQCB staff
28	Malibu Lagoon Bacterial Study PowerPoint Presentation	Ambrose, Jay et al	05/25/10	UCLA Bacterial study comparing FIB with Human-Specific bacteriodes in Lower Malibu Creek, Malibu Lagoon and Surfrider Beach
31	Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu	Izbicki, Swarzenski, et al	Report 6/25/10	City of Malibu - United States Geologic Survey – Wet Weather
32	Malibu Lagoon Bacterial Study	Ambrose, Jay et al	Report July 2010	UCLA Bacterial study comparing FIB with Human-Specific bacteriodes in Lower Malibu Creek, Malibu Lagoon and Surfrider Beach

 doi:10.1111/j.1365-2672.2005.02660.x

Enumeration and speciation of enterococci found in marine and intertidal sediments and coastal water in southern California

D.M. Ferguson, D.F. Moore, M.A. Getrich and M.H. Zhowandai
Orange County Public Health Laboratory, Newport Beach, CA, USA

2004/1187: received 14 October 2004, revised 24 January 2005 and accepted 25 January 2005

ABSTRACT

D.M. FERGUSON, D F. MOORE, M.A. GETRICH AND M.H. ZHOWANDAI. 2005.
Aims: To determine the levels and species distribution of enterococci in intertidal and marine sediments and coastal waters at two beaches frequently in violation of bacterial water standards.
Methods and Results: Faecal indicator bacteria were extracted from sediment and enumerated using membrane filtration. High levels of enterococci were detected in intertidal sediments in a seasonal river and near a storm drain outlet. Low levels were found in marine sediments at 10 m depths and in surf zone sand. Bacterial isolates presumptively identified as *Enterococcus* on mEI media were speciated. The predominant species found in both water and sediment included *Enterococcus faecalis*, *Enterococcus faecium*, *Enterococcus hirae*, *Enterococcus casseliflavus* and *Enterococcus mundtii*. A number of isolates (11–26%) from regulatory water samples presumptively identified as enterococci on mEI media were subsequently identified as species other than *Enterococcus*. At both study sites, the distribution of species present in water was comparable with those in sediments and the distribution of species was similar in water samples passing and exceeding bacterial indicator standards.
Conclusions: High levels of *Enterococcus* in intertidal sediments indicate retention and possible regrowth in this environment.
Significance and Impact of the Study: Resuspension of enterococci that are persistent in sediments may cause beach water quality failures and calls into question the specificity of this indicator for determining recent faecal contamination.

Keywords: beach pollution, enterococci, faecal indicator bacteria, marine sediments, water quality.

INTRODUCTION

In 1999, California adopted new, more extensive ocean recreational water quality standards (AB411 1999). The United States Environmental Protection Agency (USEPA) numerical standards for enterococci, total coliform and faecal coliform bacteria (USEPA 1986), which are used to indicate faecal contamination in marine waters, were implemented along with regulations for increased testing of recreational water. In southern California, the implementation of all three faecal indicator bacteria standards along with intensified testing led to an increased number of beach sites that exceeded standards (Noble *et al.* 2003). Beaches that fail any of these standards must be posted with warning signs or closed for swimming. The *Enterococcus* standard has proven to be the most sensitive of the three indicator bacteria. In the summer dry weather season, 60% of water quality failures are the result of exceedances of the *Enterococcus* standard alone (Noble *et al.* 2003). Summer beach postings and closings have resulted in public pressure on governmental agencies to take action to improve recreational water quality.

The two beaches studied here are representative of southern California open ocean and harbour pocket beaches

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with ongoing bacterial indicator failures during summer dry weather. Numerous studies conducted at both sites ruled out obvious large point sources of faecal contamination such as leaking sewer lines and outfalls. Nonpoint sources, including urban runoff were suggested, but no definitive source(s) were identified (Grant *et al.* 2001; Boehm *et al.* 2002; Kim *et al.* 2004; Noble and Xu 2004). Subsequently, water quality improvement projects, including storm drain diversions were implemented. Yet, indicator failures at these beaches continue. In this study, we investigate a less obvious nonpoint source of indicator bacteria: intertidal or marine sediments. Laboratory and field studies have demonstrated long-term survival of indicator bacteria such as *Escherichia coli* and other faecal coliforms in sediments (Gerba and McLeod 1976; LaLiberte and Grimes 1982). High densities of faecal coliforms (Valiela *et al.* 1991), faecal streptococci (Sayler *et al.* 1975; Obiri-Danso and Jones 2000) and enterococci (Anderson *et al.* 1997) found in marine sediments are suggestive of natural or environmental sources of contamination to overlying water. Regrowth of *E. coli* and enterococci was shown to occur in river sediments (Desmarais *et al.* 2002) and in soil, water and plants (Byappanahalli *et al.* 2003). Recently, indicator bacteria in sediments was directly linked to beach water quality failures. In England, resuspension of sewage impacted intertidal sediments was suggested as the cause of exceedances of regulatory standards (Obiri-Danso and Jones 2000). In New Zealand, resuspension of enterococci in sediments impacted by stream and storm water contributed to elevated levels in beach water (Le Fevre and Lewis 2003).

The objective of this study was to determine if intertidal or marine sediments harbour faecal indicator bacteria that could contribute to recreational water pollution at Huntington State Beach and Dana Point Harbor Baby Beach. The levels of indicator bacteria in marine and intertidal sediments from areas most likely to impact these beaches were determined. Enterococci isolated from sediments and recreational water were further characterized by identification to species level. The distribution of *Enterococcus* and enterococci-related species were compared in sediments *vs* beach water and in water samples passing or failing regulatory bacterial standards to determine possible relationships.

MATERIALS AND METHODS

Study sites

Dana Point Baby Beach is a small pocket beach *c.* 118 m wide and located inside an artificial harbour. A breakwater allows minimal current flow and protects the beach from ocean swell and currents (Fig. 1). Two storm drains discharge runoff from local residences, businesses, streets and parking lots to the west or east end of the beach. Beach

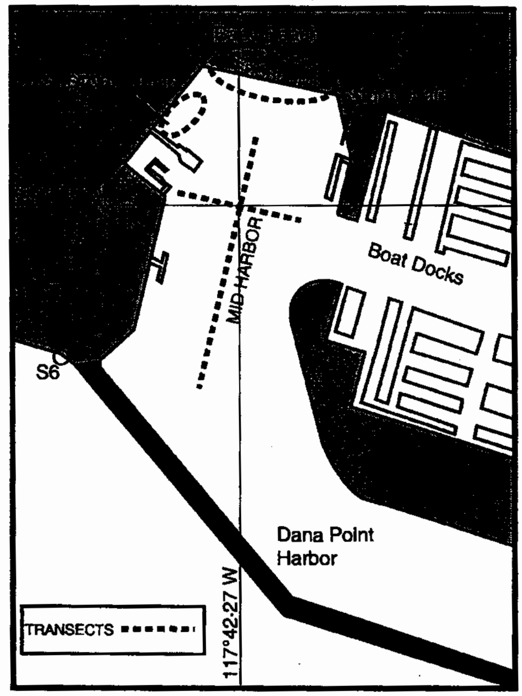

Fig. 1 Sampling locations at Dana Point Baby Beach

usage includes swimming and kayak launching. Boat docks and a pier are located adjacent to the beach. Remediation actions that have been implemented include plugging and diverting storm drains during the summer to prevent urban runoff flow into the beach, installing bird netting below the pier and restricting bird feeding to reduce direct faecal contamination. The beach water is sampled once a week at four sampling sites and tested for total and faecal coliforms and enterococci. During the study period, there were failures because of at least one bacterial indicator group on 32 of 90 (35·6%) sampling days; 66% of all indicator failures were caused by *Enterococcus*.

Huntington State Beach spans *c.* 7·2 km and is bordered by the Santa Ana River (SAR) and Talbert Marsh (TM) outlet on the south-east and Huntington City Beach on the north-west (Fig. 2). The SAR is a seasonal river/flood control channel where tidal flows in the channel can reach as far as 7·7 km inland during spring tides (Grant *et al.* 2001). Approximately 535 200 m^3 of sediment comprised of gravel, sand and mud lies in the channel from the mouth to *c.* 5·8 km upriver. The channel is lined with cement walls or rock boulders. All major contributing storm drains are diverted during the summer, so the water in the SAR is almost exclusively tidally induced flow with minimal urban runoff. The Talbert Marsh outlet channel is located 290 m north-west of the SAR. Storm drains leading into the marsh

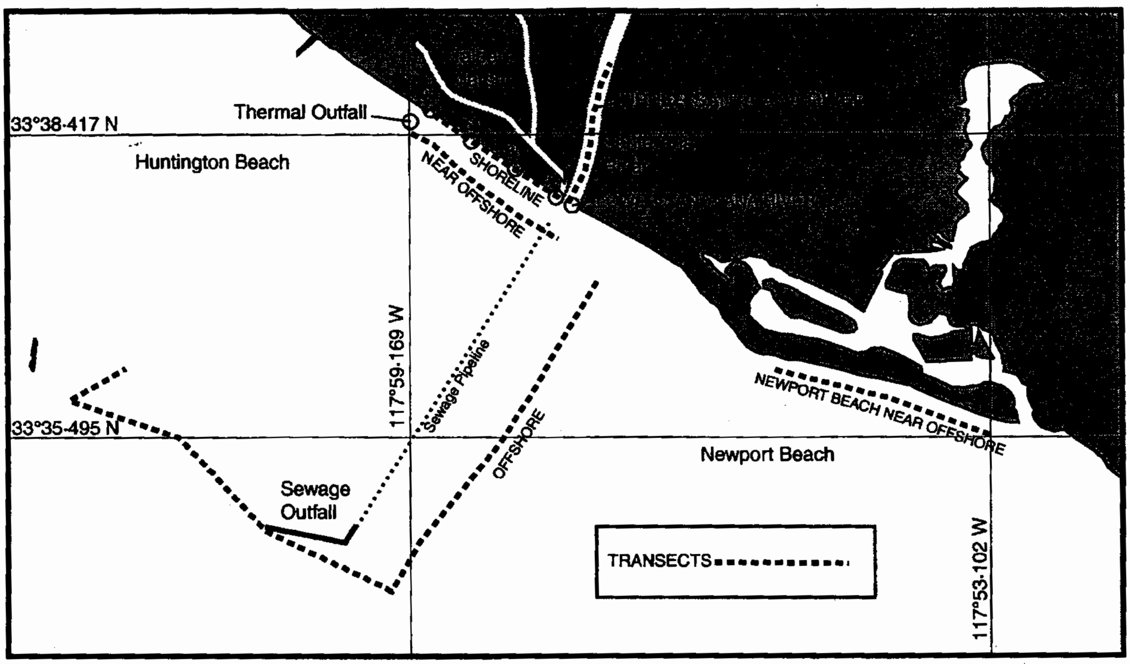

Fig. 2 Sampling locations at Huntington State Beach

are also diverted during summer. A sewage outfall lies 7·6 km offshore from the SAR mouth and releases *c.* 10^6 m^3 per day of chlorine treated sewage in 60 m of water. A thermal outfall of a power plant, located *c.* 700 m offshore discharges a maximum of $1·9 \times 10^6$ m^3 per day of water at 10 m depth. Previous studies did not find direct evidence implicating the sewage (Noble and Xu 2004) or thermal outfalls (Kim *et al.* 2004) as sources of pollution to the beach. Surf zone water from regulatory sampling sites: 0N, 3N, 6N and 9N corresponding to 0, 914, 1829 and 2743 m north-west of the SAR are monitored five times weekly for indicator levels (Fig. 2). During the study period, beach failures for at least one bacterial indicator occurred on 8 of 31 (25·8%) sampling days; 57% of all indicator failures were because of *Enterococcus*.

Sampling strategy

To determine sediment indicator bacteria densities, samples were taken along transects at onshore beach and river sites (intertidal) and offshore (marine) areas suspected of impacting the beach water and from two control sites adjacent to beaches with generally low to nondetectable levels of indicators. The transect locations are shown in Figs 1 and 2 and described in Table 1. At Baby Beach, water and sediment samples were collected between 7 August 2002 and 20 November 2003. At Huntington State Beach, the water samples were collected between 5 August and 15 September 2003 for regulatory monitoring purposes. Sediments from the SAR were collected between 23 December 2003 and 24 January 2004 along an upper and lower transect that was delineated by the Pacific Coast Highway Bridge. Near offshore sediment samples were collected about 330 m offshore Huntington State Beach at 10 m depths. The north-west end of this transect was in the thermal outfall area. Offshore sediment samples were collected around the sewage outfall. The Newport Beach near offshore control transect starts at *c.* 4·0 km south-east of the mouth of the SAR (Fig. 2).

Sample collection methods

Offshore. Sediment samples from the ocean bottom were collected by boat using a Van Veen grab sampler (Kahl Scientific Instrument, El Cajon, CA, USA) that was rinsed between sampling stations by submerging it in seawater. A portion (100 ml) of the water overlaying the sediment was collected to compare the levels of indicator bacteria in water to sediment. The water was then decanted and *c.* 75 g of the top 2 cm of sediment was aseptically scraped into a 100 ml sterile bottle.

Intertidal. Sediment samples were collected from the intertidal river or shoreline sites at negative tide levels to avoid collecting overlying water. Approximately 75 g of the

Table 1 Description of sediment transects

	Sediment type	Number transects	Number samples	Transect length (m)	Transect spacing (m)	Water depth (m)
Dana Point Baby Beach						
Shoreline	Intertidal	21	168	120	10	NA
West Storm Drain	Intertidal	27	269	60	3	NA
Mid-Harbor	Marine	2	14	380	20	0·5–6
S-6 (Control)	Intertidal	NA*	13	NA	NA	NA
Huntington State Beach						
Upper Santa Ana River	Intertidal	2	35	2520	90	NA
Lower Santa Ana River	Intertidal	1	15	400	30	NA
Shoreline	Intertidal	1	10	3600	300	NA
Near offshore	Marine	2	31	3200	160	10
Offshore (sewage outfall)	Marine	1	10	15 240	670–2597	10–51
Newport Beach near offshore (control)	Marine	1	15	4950	330	10

*NA, not applicable.

top 2 cm of sediment was collected into a sterile bottle, taking care to avoid bird droppings. Water samples from the beach shoreline sites were collected at ankle depth using a sterile bottle (100 ml) that was clamped to a sampling pole. The pole was extended to obtain samples at ankle depth at a short distance away from the sample collector.

Sample processing

Water and sediments were held at 5–10°C and analysed for faecal indicator levels within 6 h of collection. To extract bacteria from sediments, 10 g of sediment was suspended in 100 ml of 1% (w/v) sodium metaphosphate (Valiela *et al.* 1991) and sonicated at the rate of 30% output using a Branson Sonifier® Cell Disruptor 450 (13 mm tip; Branson Ultrasonics, Danbury, CT, USA) for 30 s. Sonication time and intensity were previously optimized in our laboratory (D. M. Ferguson, D. F. Moore and M. A. Getrich, unpublished data). Suspended sediment and water samples were analysed using the membrane filtration method as per Standard Methods (APHA 1998). Total coliforms were enumerated using mENDO agar incubated for 24 h at 35°C. Faecal coliforms were enumerated using mFC agar incubated for 24 h at 44·5°C. Enterococci were enumerated using mEI agar incubated for 22–24 h at 41°C (USEPA 2000). Faecal indicator levels were reported as colony forming units (CFU) per 100 ml of water or CFU per 10 g of wet weight sediment.

As marine sediments are mixed with water trapped within sediment macropores, the concentration of indicators present in the overlying water was determined to account for bacteria present in the water fraction of sediment. The water content of each sediment sample was determined as the difference in weight before and after drying sediments overnight in an oven at 105°C.

Enterococci speciation

Colonies on mEI media that had blue halos were considered presumptive for *Enterococcus* species as per USEPA Method 1600 (USEPA 2000). Up to five colonies per sample were subcultured onto Trypticase™ soy agar with 5% sheep blood (BBL, Bethesda, MD, USA) and incubated at 35°C for 24 h. In some cases, there were fewer than five colonies present per sample. Isolates were identified to species level using the API™ 20 Strep identification system (API; bioMérieux, St Louis, MO, USA) and additional biochemical testing. The biochemical test results were interpreted using published standard biochemical identification charts (Facklam and Collins 1989; Facklam and Elliot 1995; Facklam 2002; American Society for Microbiology 2003). Biochemical tests included: carbohydrate fermentation with 1% mannitol, sorbitol, arabinose, raffinose, sucrose, lactose and inulin; Motility Test Medium w/TTC, pyrrolidonyl arylamidase (PYR) and leucine arylamidase (LAP) using disc tests (Remel, Inc., Lenexa, KS, USA); bile esculin, growth in 6·5% NaCl and at 45°C in brain–heart infusion broth, deamination of arginine in Moeller's decarboxylase broth (BBL, Franklin Lakes, NJ, USA); and catalase. Isolates that were not identified to species level that had positive reactions to PYR and LAP using API, esculin hydrolysis, growth at 45°C and tolerance to 6·5% NaCl were identified as *Enterococcus* species (American Society for Microbiology 2003).

Data analysis

The Pearson chi-square test in SPSS, version 12.0 for Windows, 2003 (Chicago, IL, USA) was used to test the statistical differences between enterococci species distribution in regulatory water samples passing and exceeding single sample standards.

RESULTS

Faecal indicator bacteria levels in sediments

The levels and percentage of samples positive for total coliforms, faecal coliforms and enterococci found in sediments from the two study sites are summarized in Table 2. Sediments from the Upper SAR transect adjacent to Huntington State Beach and West Storm Drain area at Dana Point Baby Beach had the highest percentage of positive samples as well as the highest geometric mean and maximum concentrations for all three indicator bacteria. At the Upper SAR, total coliforms and enterococci were found in 91·4% and 100% of 35 samples, respectively, with corresponding geometric mean concentrations of 1876 and 5922 CFU 10 g^{-1}. At the West Storm Drain area, total coliforms and enterococci were found in 61·8% and 66·5% of 269 samples, respectively, with corresponding geometric mean concentrations of 85 and 79 CFU 10 g^{-1}. Maximum concentrations were at the 10^5 CFU 10 g^{-1} level, or about 4 log higher than the geometric mean levels. Faecal coliforms were detected less frequently and at geometric mean concentrations that were about 1 log lower than total coliforms and enterococci.

At both study sites, indicator bacteria were also detected in shoreline and near offshore sediments but less frequently and at lower concentrations. Of the three indicators, *Enterococcus* was most abundant, followed by total coliforms and faecal coliforms with maximum geometric mean concentrations of 17, 9 and 3 CFU 10 g^{-1} respectively. Most samples collected from a section of the Huntington Beach transect in a thermal outfall area of a power plant were below detection limits for indicators. As for the sewage outfall area, enterococci and faecal coliforms were not detected, however three sediment samples collected closest to the outfall pipe had low levels of total coliforms. Only a few sediment samples from near offshore Newport Beach (control area) were positive for indicators as compared with Huntington Beach near offshore, with similar bacterial concentrations found at both sites. At Dana Point Baby Beach, sediments collected from sites distant to the West Storm Drain, including the Mid-Harbor and a shoreline control site located outside the harbour, were generally below detection limit for all indicator bacteria.

Overall, *Enterococcus* was present more often and at higher concentrations in sediment samples when compared with total and faecal coliforms. Of a total of 580 samples from both study sites, 57·5% were positive for *Enterococcus*, 42·7% for total coliforms and 22·9% for faecal coliforms. Of all three indicators, the geometric mean levels of *Enterococcus* was highest in all transects except for the Baby Beach West Storm Drain and Huntington Beach offshore transects.

Water overlying marine sediment samples may contain bacteria that could affect the measurement of the bacterial

Table 2 Faecal indicator bacteria levels in sediment samples

		Total coliforms			Faecal coliforms			Enterococci		
	Number samples	% Positive samples	Concentration* Geomean	Concentration* Maximum	% Positive samples	Concentration Geomean	Concentration Maximum	% Positive samples	Concentration Geomean	Concentration Maximum
Dana Point Baby Beach										
Shoreline	168	35·3	9	51 000	17·3	3	15 500	48·8	17	200 000
West Storm Drain	269	61·8	85	191 000	30·1	6	20 200	66·5	79	268 000
Mid Harbor	14	7·1	1	200	0·0	NA	NA	7·1	1	200
S-6 (control)	13	0·0	NA	NA	0·0	NA	NA	15·4	1	10
Huntington State Beach										
Upper Santa Ana River	35	91·4	1876	200 000	77·1	137	3500	100·0	5922	77 400
Lower Santa Ana River	15	13·3	2	100	0·0	NA	NA	73·3	21	940
Shoreline	10	20·0	3	140	10·0	2	200	40·0	6	500
Near offshore	31	9·7	1	20	3·2	1	20	48·4	6	200
Offshore (sewage outfall)	10	30·0	5	500	0·0	NA	NA	0·0	NA	NA
Newport Beach near offshore (control)	15	6·7	1	20	0·0	NA	NA	33·3	3	50

*Colony forming units 10 g^{-1} (wet weight).

% Positive samples, samples with values greater than detection limit; NA, not applicable.

concentration in sediment. In this study, the bacterial concentrations in overlying water were at least 2 logs lower than concentrations in corresponding sediment samples. Thus, the calculated bacterial concentrations in sediment were not because of overlying water.

Spatial and temporal variation of faecal indicator concentrations in sediment

The spatial and temporal variability of the concentration of all three indicator bacteria in sediments was determined for a single transect at Dana Point Baby Beach. Sampling sites included two intertidal and two marine sites along a 6·1 m transect running eastward from the mouth of the West Storm Drain. The intertidal sites were located within 3·0 m of the drain mouth. Sediments at the marine sites, located further away, were below the waterline. Sediments were collected at six different times (at 1 to 2-week intervals) over a 14-week period during the summer dry season (Fig. 3). On most of these sampling days, bacterial levels and frequency in species observed were highly variable between sites.

Indicators were more consistently detected and present in higher concentrations in samples from the intertidal sites when compared with the marine sites. The geometric mean concentrations of all three indicators were approximately 2 logs higher here than at the marine sites. There was also higher variability in bacterial concentrations in sediments from the marine sites.

Distribution of *Enterococcus* and enterococci-related species in sediment samples and shoreline water

The species distribution of isolates presumptively identified as *Enterococcus* using mEI agar was determined for sediment and adjacent shoreline water samples. Shoreline water samples were obtained from regulatory agencies responsible for monitoring indicator bacteria on a routine basis; samples from all other sites were collected for the purposes of this study. A total of 1361 isolates from sediment and shoreline water samples from both beaches were speciated (Table 3). In general, *Enterococcus faecalis* and *Enterococcus faecium* were the most common species found in both sediment and water samples. *Enterococcus hirae*, *Enterococcus casseliflavus* and *Enterococcus mundtii* were also frequently seen when compared with *Enterococcus gallinarum*, *Enterococcus durans* and *Enterococcus avium*. Surprisingly, a high percentage of isolates from sediment (8·2–15·0%) and shoreline water (11·4–25·5%) were non-*Enterococcus* species (Table 3). These isolates, which appeared identical to enterococci on mEI media, included *Streptococcaceae* and related organisms (Bascomb and Manafi 1998) such as *Streptococcus bovis*, other *Streptococcus* spp., *Aerococcus* spp., as well as species that could not be identified with the methods used.

Enterococcus faecalis was the predominant species isolated from shoreline water at both Huntington Beach (39·8%) and Baby Beach (33·2%), West Storm Drain water (35·6%) and Huntington State Beach near offshore sediments (68·8%). *Enterococcus faecium* was the predominant species isolated from sediments at the West Storm Drain (35·2%) and the SAR (51·4%) (Table 3).

Enterococcus species distribution during single sample failure periods

The overall species distribution of samples from shoreline water at both study sites was similar, with the exception of a higher incidence of *Streptococcus* spp., particularly *S. bovis*, at Huntington State Beach (Table 3). The source(s) of these organisms to the beach are uncertain. To better understand

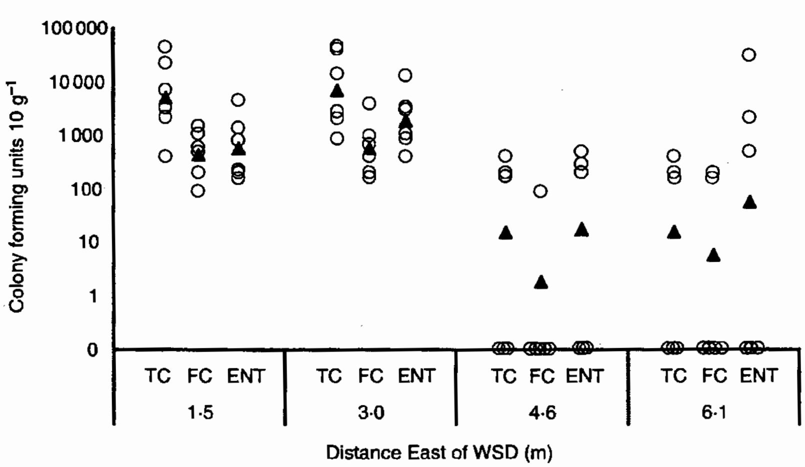

Fig. 3 Temporal and spacial variability of faecal indicator concentrations in sediments from four West Storm Drain sites sampled six times over 14 weeks, O, concentration; ▲, geometric mean; TC; total coliforms; FC, faecal coliforms; ENT, *Enterococcus*

Table 3 Enterococcus species distribution in water and sediment samples

	No. samples	No. isolates	Number (%) of isolates												
			E. faecalis	*E. faecium*	*E. hirae*	*E. casseliflavus*	*E. mundtii*	*E. gallinarum*	*E. durans*	*E. avium*	Other ENT*	*S. bovis*	STR	AER	Other, not ENT†
Dana Point Baby Beach															
Shoreline water	169	349	116 (33·2)	74 (21·2)	40 (11·5)	42 (12·0)	29 (8·3)	4 (1·1)	1 (0·3)	1 (0·3)	3 (0·8)	11 (3·2)	0 (0·0)	0 (0·0)	28 (8·0)
West Storm Drain water	26	45	16 (35·6)	6 (13·3)	0 (0·0)	15 (33·3)	1 (2·2)	1 (2·2)	0 (0·0)	0 (0·0)	0 (0·0)	0 (0·0)	0 (0·0)	0 (0·0)	6 (13·3)
West Storm Drain sediments	73	105	11 (10·5)	37 (35·2)	15 (14·3)	14 (13·3)	9 (8·6)	2 (1·9)	1 (1·0)	3 (2·8)	1 (1·0)	3 (2·8)	0 (0·0)	0 (0·0)	9 (8·6)
Huntington State Beach															
Shoreline water	144	576	229 (39·8)	75 (13·0)	73 (12·7)	36 (6·2)	9 (1·6)	5 (0·9)	1 (0·2)	0 (0·0)	1 (0·2)	102 (17·7)	27 (4·7)	5 (0·9)	13 (2·2)
Upper and lower SAR sediments	47	206	41 (19·9)	106 (51·4)	19 (9·2)	14 (6·8)	7 (3·4)	0 (0·0)	2 (1·0)	0 (0·0)	0 (0·0)	3 (1·4)	1 (0·5)	8 (3·9)	5 (2·4)
Near offshore sediments	20	80	55 (68·8)	9 (11·2)	2 (2·5)	0 (0·0)	0 (0·0)	0 (0·0)	0 (0·0)	1 (1·2)	1 (1·2)	11 (13·8)	0 (0·0)	0 (0·0)	1 (1·2)
Total	479	1361	468 (34·4)	307 (22·6)	149 (10·9)	121 (8·9)	55 (4·0)	12 (0·9)	5 (0·4)	5 (0·4)	6 (0·4)	130 (9·6)	28 (2·0)	13 (1·0)	62 (4·6)

*Four isolates unidentified *Enterococcus* spp., one *Enterococcus raffinosus* isolate and one *Enterococcus malodratus* isolate.
†Sixty unidentified non-*Enterococcus* spp., one *Lactococcus* spp. and one *Helcococcus* spp.
ENT, *Enterococcus* spp.; STR, *Streptococcus* spp.; AER, *Aerococcus* spp.

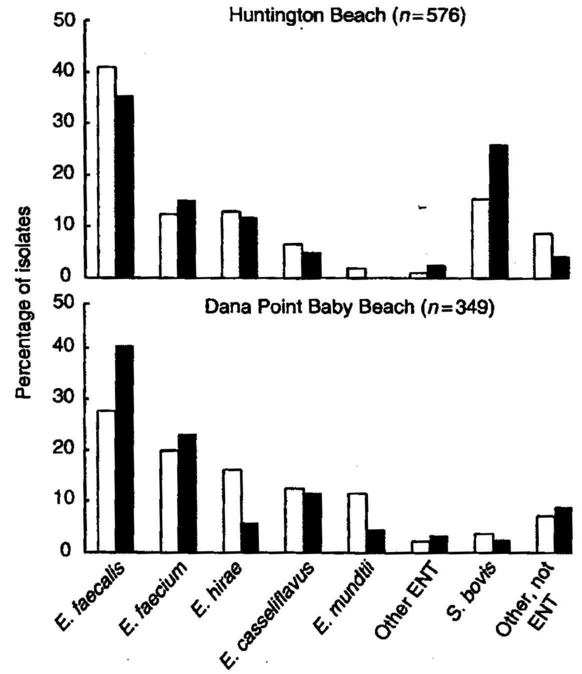

Fig. 4 Distribution of *Enterococcus* and related species in recreational marine water samples collected during ambient (□) and exceedance (■) conditions

possible relationships between contamination events and changes in species distribution, enterococci species composition in water samples with levels in water above and below the single sample standard (≥104 CFU 100 ml^{-1}) was compared (Fig. 4). There was no significant difference in the species distribution in samples at both Baby Beach and Huntington State Beach in samples collected during beach failures when compared with ambient conditions ($P = 0{\cdot}13$ and $P = 0{\cdot}10$, respectively; Pearson chi-square test).

DISCUSSION

In southern California, it is well recognized that a major cause of bacterial pollution of coastal waters is urban runoff in rivers/channels and storm drains that discharge into the ocean (Dwight *et al.* 2002; Reeves *et al.* 2004). The data presented here points to another source associated with urban runoff. Intertidal sediments harbouring high levels of indicator bacteria can be resuspended in water and transported to beaches by waves and wind, leading to water quality failures. We found a concentration gradient of faecal indicator bacteria in sediments: extremely high densities in the Santa Ana River near Huntington Beach and West Storm Drain area at Dana Point Baby Beach; significantly lower concentrations in shoreline and near offshore sediments at both beaches and even lower or nondetectable levels in offshore and control site sediments. These results indicate that shoreline waters at Huntington State Beach and Baby Beach may be recipients of faecal indicator bacteria originating from intertidal sediments in the SAR that contain high levels of bacteria. Field studies conducted at the Huntington Beach area suggest that indicator bacteria from the SAR and TM sediments are resuspended and flushed to the ocean during ebb tides and transported to the beach by surf zone and tidal currents (Grant *et al.* 2001; Kim *et al.* 2004). This resuspension and transport process is more pronounced during spring tide conditions, which occurs during full and new moon periods. At these times the greatest volume of tidal water flows inland into coastal outlets such as the TM and SAR and back out to the ocean, which is also when most of the beach failures at Huntington State Beach occur during the dry weather season (Boehm *et al.* 2004; Noble and Xu 2004). Other possible reasons for the indicator concentration gradient observed may be related to differences in sediment type, organic content and amount of UV exposure at the intertidal, onshore and offshore locations, parameters which were not measured at all sites in this study.

The high densities of total coliforms, faecal coliforms and enterococci found in intertidal sediments in the SAR and Baby Beach are similar to sediment indicator levels found at several different geographical locations: a tidally influenced river in Florida (Solo-Gabriele *et al.* 2000), an embayment in New Zealand (Le Fevre and Lewis 2003), an estuary in Massachusetts (Valiela *et al.* 1991) and freshwater creeks and lakes in Michigan (Byappanahalli *et al.* 2003) and in Wisconsin (LaLiberte and Grimes 1982).

The low levels of indicator bacteria found in sediments around the sewage outfall area offshore Huntington State Beach indicate that the discharge pipe may not be a constant source of contamination to these sediments. This finding is in contrast to a similar study conducted at Moracambe Bay, a bathing beach in England. Here, high levels were found in bay sediments receiving sewage effluent from an outfall pipe (ranging from untreated through to secondary treatment) and agricultural runoff from streams and rivers (Obiri-Danso and Jones 2000). The low levels found at Huntington State Beach may be the result of chlorination of the wastewater by the sewage treatment plant and the dilution or dispersion of bacteria by ocean currents. Wastewater entering the plant contains approximately 10^7 to 10^8 total coliforms per 100 ml and is reduced to 10^5 per 100 ml for total coliforms and 10^4 for faecal coliforms and enterococci after disinfection. The effluent is discharged from the outfall pipe that is engineered to achieve a 180 : 1 dilution in ocean water. In this study, finding higher levels of indicator levels at storm drain impacted sediments as opposed to the outfall area was surprising. In fact, the geometric mean levels in storm drain impacted intertidal sediments were about one order of magnitude higher concentration when compared with the sewage impacted sediments at Moracambe Bay.

At Dana Point Baby Beach, contamination of beach water during summer dry weather appears to be related to the proximity of the storm drain to the beach, retention and/or regrowth of indicator bacteria in sediments and resuspension of indicator bacteria because of wave action in the harbour. In a previous study at this location, we determined that exceptional surf heights of 2–3 m that topped the breakwater and greater wave action correlated with a considerable increase in indicator levels at the beach (BBBSSR 2003). A similar study conducted at a protected beach in New Zealand also showed that storm and stream water contributed high numbers of enterococci to sediments around these discharge points and that resuspension of sediments because of wave action led to elevated levels in water (Le Fevre and Lewis 2003). Increased bacterial levels because of resuspended sediments can occur as a result of increased turbulence due to runoff, animal traffic, sustained winds, storms, boats and dredging activities (Gerba and McLeod 1976; Sherer *et al.* 1992; Obiri-Danso and Jones 2000).

Repeated sampling of Baby Beach intertidal sediments around the West Storm Drain indicated high temporal and spatial variability in indicator concentrations. Although total coliforms and enterococci were consistently detected within 3·0 m of the storm drain, higher concentrations of enterococci were also found in two samples collected furthest from the drain where the levels were generally low. Determining the causes of temporal and spatial variability of indicator concentrations in sediment was not included in this study. Further studies on sediment characteristics that can affect bacterial growth and decay rates, such as temperature, moisture content, nutrient content, particle size, surface area and biofilm formation are needed to understand the potential flux of indicator bacteria from sediments to water.

Indicator levels ranging from 10^3 to 10^5 CFU 10 g^{-1} of sediment suggest the occurrence of long-term survival and regrowth of indicator bacteria in this environment. It has generally been accepted that faecal indicator bacteria do not survive for very long in seawater. In seawater, 90% of total coliforms, *E. coli* and enterococci die off in about 2·2, 19·2 and 60 h respectively (Bartram and Rees 2000). However, prolonged survival may be possible in marine and freshwater sediments. Indicator bacteria have been shown to persist in storm drain impacted sediments for up to 6 days following storm events without further supplementation of bacteria from runoff (Marino and Gannon 1991). Davies *et al.* (1995) showed that *E. coli* remains culturable in marine sediment for up to 68 days. In addition, laboratory studies have shown that faecal indicators survive longer in water supplemented with sediment (Gerba and McLeod 1976; Sherer *et al.*

1992). Survival in sediment may be enhanced because of protection from UV inactivation and predation, moisture, buffered temperatures and availability of nutrients originating from algae, debris and plankton (Whitman and Nevers 2003). Phytoplankton are most active in late spring to early summer and late summer to early fall, which are also the periods when bacterial levels in coastal waters increase (Dowd *et al.* 2000). Seaweed (Anderson *et al.* 1997), seawrack (Valiela *et al.* 1991) and zooplankton (Maugeri *et al.* 2004) provide both nutrients and surfaces for indicator bacteria to survive in the marine environment. Recently, groundwater discharge at Huntington Beach was found to be a source of nitrogen and orthophosphate to the surf zone that may enrich intertidal sediments and allow bacteria to persist (Boehm *et al.* 2004).

At both study sites, enterococci were found more frequently and in higher concentrations in intertidal sediment samples than total and faecal coliforms. *Enterococcus* spp. may be more abundant in intertidal sediments because these organisms are more resilient in seawater and are not as easily inactivated by sunlight when compared with *E. coli* (Bartram and Rees 2000). Enterococci are also capable of growing at a wider range of temperature (between 10 and 45°C) and pH (4·8–9·6) as well as in the presence of 28% sodium chloride (Huycke 2002).

Presumptive enterococci isolates were speciated to better understand the sources and ecology of these organisms in the marine environment. Of 1361 isolates tested, the predominant species identified in water and sediment, in order of occurrence were *E. faecalis*, *E. faecium* and *E. hirae*. These results are similar to the distribution reported for environmental strains elsewhere (Stern *et al.* 1994; Pinto *et al.* 1999; Dicuonzo *et al.* 2001; Ott *et al.* 2001; Harwood *et al.* 2004). *Enterococcus faecalis* and *E. faecium* are also the predominant *Enterococcus* spp. in the intestinal microflora of humans and animals and are considered opportunistic pathogens (Willey *et al.* 1999). *Enterococcus hirae* is a member of animal microflora, but has been found to occasionally cause infections in humans (Tannock and Cook 2002). *Enterococcus gallinarum* and the yellow pigmented species, *E. casseliflavus* and *E. mundtii*, are associated with plants and soil and are rarely associated with human infection (Pinto *et al.* 1999). In this study, these three 'environmental' associated species comprised 13·8% of all isolates tested. Thus, the species distribution of enterococci in insects, plants and sediments as well as in pristine and faecal-contaminated waters is important when assessing this group as faecal indicators (Leclerc *et al.* 1996).

During beach failures, the species distribution of enterococci and related species in shoreline waters was similar to the distribution found during ambient conditions. This distribution in water was also comparable with intertidal sediment samples with high concentrations of enterococci. These findings suggest that there may be constant loading of a stable enterococcal population from intertidal sediments and other sources to water that increases because of changes in environmental conditions, resulting in frequent failures. The enterococci species distribution found in sediments and water were similar to that of humans, animals and birds. Thus, species distribution was not useful in pinpointing major source(s) of beach contamination in this study. However, this determination could be useful to finding sources of contamination in other sites where 'environmental' species may be predominant.

Comparison of the enterococci species composition in water *vs* sediments in highly contaminated areas could provide additional information in assessing sediments as a source. Knowledge of the predominant species present in specific sites could also be useful to investigators using or developing microbial source tracking methods targeting enterococci.

The API Strep system and traditional biochemical tests and identification charts used to speciate enterococci and related organisms in this study are culture-based methods designed to identify clinical isolates. Further studies are needed using PCR or 16S rRNA sequencing to identify environment isolates, particularly the noncultivable strains.

There was a high incidence of non-*Enterococcus* species (17·1%) using mEI media. The majority of these isolates (9·6%) were identified as *Streptococcus bovis*, a member of the faecal streptococcus group. This finding was unexpected as *Streptococcus* spp. are not known to persist in marine water (Geldreich and Kenner 1969). The mEI media used to isolate enterococci in this study was formulated to differentiate enterococci from other genera of the faecal streptococcal group (Messer and Dufour 1998). Like enterococci, *S. bovis* is also β-D-glucosidase-positive, which is indicated on mEI media by the formation of a blue halo around the colony. Marine water samples from Baby Beach and Huntington Beach had false-positive rates (occurrence nonenterococci species) of 11·2% and 25·5% respectively. These rates are much higher than 6%, as reported by the EPA (USEPA 2000).

To our knowledge, this is the first publication showing high concentrations of faecal indicator bacteria in intertidal sediments impacted by storm drains. The levels of enterococci found in shoreline and near offshore sediments could be a result of continuous loading of faecal indicator from highly contaminated sediments in areas associated with urban runoff. Exceedances in enterococci standards may also occur because of resuspension of bacteria-laden sediment in water. This occurrence supports the suggestion made by others that an evaluation of faecal indicators in sediments may be a more stable index of overall or long-term water quality than the overlying water (LaLiberte and Grimes

1982; Sherer *et al.* 1992; Obiri-Danso and Jones 2000). The long-term persistence/regrowth of indicators in sediments, particularly enterococci, calls into question the reliability of this indicator for determining recent faecal contamination of water.

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Multi-Tiered Approach Using Quantitative Polymerase Chain Reaction For Tracking Sources of Fecal Pollution to Santa Monica Bay, California

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Multi-Tiered Approach Using Quantitative Polymerase Chain Reaction For Tracking Sources of Fecal Pollution to Santa Monica Bay, California

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Technical Report #446

ABSTRACT

The ubiquity of fecal indicator bacteria such as *Escherichia coli* and enterococcus make tracking sources in urban watersheds extremely challenging. In this study, a multi-tiered approach was used to assess sources of fecal pollution in Ballona Creek, an urban watershed that drains to Santa Monica Bay (SMB), CA. A mass-based design at six mainstem sites and four major tributaries was used to quantify the flux of enterococcus and *E. coli* using traditional culture-based methods, and three additional indicators including enterococcus, *Bacteroides* sp. and enterovirus, using quantitative polymerase chain reaction (QPCR). Sources and concentrations of fecal indicator bacteria were ubiquitously high throughout Ballona Creek and no single tributary appeared to dominate the fecal inputs. The flux of enterococcus and *E. coli* averaged 10^9 to 10^{10} cells/hr and were as high at the head of watershed as they were at the mouth prior to its discharge into SMB. In contrast, the site furthest upstream had the most frequent occurrence and generally the greatest concentrations of enterovirus. Ninety-two percent of the samples that tested positive for enterovirus also tested positive for *Bacteroides* sp. A similar survey in Malibu Creek, a nearby non-urban watershed, found low levels of traditional fecal indicator bacteria and no detectable enterovirus or *Bacteroides* sp. The influent and effluent from three structural best management practices (BMPs) were evaluated for removal efficiency. Results indicated that those with ultraviolet (UV) treatment worked better than a constructed treatment wetland for reducing enterococcus concentrations using culture-based methods, but also degrading its DNA based on QPCR measurements.

TABLE OF CONTENTS

Abstract i

Introduction 1

Materials and Methods 3
- Sample Collection and Filtration 3
- Indicator Bacteria Analyses Using Chromogenic Substrate 5
- Enterovirus Analyses Using QRTPCR 5
- Bacterial Analyses Using QPCR 7
- Bacteroides sp. Using Conventional PCR 8

Results 10
- Ballona Creek 10
- Malibu Creek 11
- BMP's 12

Discussion 13

References 15

INTRODUCTION

Santa Monica Bay (SMB), California, is home to some of the most popular beaches in the world. It is located adjacent to metropolitan Los Angeles where more than 50 million beachgoers visit SMB shorelines every year, which is more than all other beaches in California combined (SMBRC 2005). However, there are serious concerns about beach water quality because of continued exceedences of water quality thresholds based on fecal indicator bacteria such as total coliforms, fecal coliform or *E. coli*, and enterococcus, particularly in areas impacted by urban runoff. Thirteen percent of the shoreline mile-days in SMB exceeded water quality thresholds between 1995-2000 with over 50% of these exceedences located near storm drains (Schiff et al 2003). In contrast, sewage spills were relatively rare accounting for less than 0.1% of the water quality exceedences and subsequent warnings to swimmers. Moreover, swimming near storm drains in SMB can lead to an increased risk of swimming-related illnesses. Haile et al (1999) demonstrated that swimmers near storm drain discharges in SMB had a higher likelihood of respiratory and/or gastrointestinal symptoms compared to swimmers more than 400 m from a storm drain.

Despite the impairments to water quality and risk to human health, identifying and eliminating the sources of bacteria responsible for the beach warnings remains elusive. The difficulty in identifying and eliminating the sources of bacteria results from two important factors. First, the traditional indicators of fecal pollution on which the water quality thresholds were derived are not specific to humans. These fecal indicator bacteria can be shed from any warm-blooded organism including wild and domesticated animals (Geldreich 1978). Therefore, source tracking turns into a challenging scenario when these diffuse and frequently intermittent or episodic fecal releases occur. The second difficulty when identifying and eliminating sources of fecal indicator bacteria is their ubiquity in the environment. Unlike many of the pathogens of interest, fecal indicator bacteria may survive and even grow in the environment. For example, fecal indicator bacteria were able to persist in beach wrack impacting beaches in Cape Cod, MA (Weiskel et al. 1996).

Viruses are one tool that could prove useful in source tracking studies because they are the pathogen of interest. Viruses are known to cause a significant portion of waterborne disease from water contact, mostly from ingestion of sewage contaminated water and seafood (Fogarty et al. 1995). Until recently, however, methods for virus detection and quantification have relied on growth-based endpoints that are much too slow to be effective source tracking tools. Recently developed molecular techniques, such as Quantitative Reverse Transcriptase Polymerase Chain Reaction (QRTPCR) can detect and quantify viral genetic material directly from water samples. Results of tests conducted previously in Southern California (Noble and Fuhrman, 2000; Tsai et al., 1993; Tsai et al., 1994), in Florida (Griffin et al., 1999; Rose et al., 1997), and Europe (Pina et al., 1998) using conventional RTPCR or PCR have detected a host of genetic material from human specific viruses including enterovirus, hepatitis A virus, rotavirus, and adenovirus in urban runoff discharges or seawater samples. The major drawback to using viruses as source tracking tools, however, is their dependence on a large human population in order to have sufficient numbers for detection (Noble et al. 2003).

A different approach would be to use alternative bacterial indicators for source tracking that might be much more abundant in fecal waste discharges. This alternative approach could prove useful if host specific bacterial indicators could be found. Of the facultative anaerobic organisms common in human fecal flora, enterococci have been found in almost all subjects with a mean level of $\log_{10}$ 8.9 per gram feces (Klessen et al, 2000). Another option would be *Bacteroides* sp., which make up approximately one-third of the human fecal microflora, considerably outnumbering the fecal coliforms. *Bacteroides* sp. belongs to a group of nonspore forming obligate anaerobes, so there is little concern over persistence or regrowth in the environment. More importantly, human specific *Bacteroides* sp. markers have been developed increasing the value of this potential indicator (Bernhard and Field 2000a, Bernhard and Field 2000b).

Both virus and alternative bacterial indicators such as *Bacteroides* sp. have been shown to be potentially useful source tracking tools. Griffith et al (2003) concluded that genetic based methods, such as PCR consistently provided the best information when attempting to conduct source tracking on mixed source samples. *Bacteroides* sp. correctly identified human sources of fecal pollution when present in mixed water samples delivered blind to the laboratory. Likewise, human enterovirus measurements had virtually no false positives, a problem that plagued many other methods in that study. However, the human marker identified in *Bacteroides* sp. may be present in additional hosts or the primers used to detect the human marker may cross react with species from nonhuman hosts (Kreader 1995). Similarly, enterovirus consistently and correctly detected human sewage when present, but had difficulty determining human sources when only one or a few likely uninfected individuals contributed fecal material. Since no method has all of the traits to be the consummate bacterial source tracking tool, a multi-tiered multi-indicator approach has been recommended by some investigators (Stewart et al 2003). By using multiple tools, investigators can utilize the strengths of each to ascertain inputs and track fates that will ultimately lead to successful management solutions.

This objective of this study was to identify the contributions and quantify the loading of fecal contamination to the SMB using a multi-tiered approach. The first tier included traditional fecal indicator bacteria measurements. The second tier included newly developed methods for enterococcus, *Bacteroides* sp., and enterovirus. All of these newly developed methods rely on QPCR or QRTPCR, which has not been applied previously for source tracking studies in urban watersheds until now. The multi-tiered approach was applied using a mass-based design to quantify inputs and flux through an urban watershed to the beach. A subsidiary objective included using the multi-tiered approach through a relatively undeveloped watershed. Finally, the multi-tiered approach was used to determine the effectiveness of a variety of structural best management practices (BMPs) that were aimed at reducing bacterial inputs from urban watersheds.

MATERIALS AND METHODS

This study was conducted in three phases. The first phase quantified inputs of flow, bacteria concentrations and virus particles, then tracked them through an urban watershed over time. This mass-based design was applied in the Ballona Creek watershed, the largest tributary to SMB. Ballona Creek is over 85% developed and currently has the largest inputs of fecal indicator bacteria to SMB (Figure 1). The second phase quantified bacteria concentrations and virus particles in the Malibu Creek watershed, the second largest tributary to SMB. Malibu Creek is only 12% developed and has a large lagoon system at its terminus prior to discharging across the beach to the world famous Surfrider Beach. Although no flow was measured in Malibu Creek to provide flux estimates, this system provided the opportunity to measure concentrations at several points through the lagoon and as it enters the ocean to assess shoreline mixing and dilution. The third phase examined the effectiveness of three BMPs to reduce bacteria and virus concentrations. The three BMPs, only two of which were located in the Santa Monica Bay watershed, included a multimedia filtration system with inline ultraviolet (UV) treatment, a filtration-aeration system with an inline UV treatment system, and a constructed wetland. For each of the BMPs, an influent-effluent approach was used to estimate treatment effectiveness.

Sample Collection and Filtration

Ballona Creek

Samples were collected at six mainstem and four of the major tributaries to the Ballona Creek system. The six mainstem sites extended from where the system daylights at Cochran Avenue to Inglewood Avenue, which is located at the head of tide just prior to discharge into SMB (Table 1). The four tributaries represented the four largest hydrodynamic inputs to the system and were located in reaches between each of the mainstem sampling sites.

Flow was calculated as the product of flow rate and wetted cross-sectional area. Doppler area-velocity sensors were used to measure flow rate. Pressure transducers that measure stage, along with verified as-built cross sections, were used to estimate wetted cross-sectional area. One minute instantaneous flow was logged electronically during the entire six hour sampling period. Both the area-velocity sensors and pressure transducers were calibrated prior to sampling.

One hour composite water samples were collected at each site between 8:00 AM and 2:00 PM on August 26, 2004. The six hour sampling period corresponds to the approximate hydrodynamic travel time from Cochran Avenue to Inglewood Avenue (Ackerman et al, 2004). Four liter composite samples at each site were created after combining ten individual 400 ml grab samples collected every 6 minutes into a single container. In total, 60 composite samples were collected at Ballona Creek as a result of sampling 6 hours at 10 different sites.

Table 1. Ballona Creek sampling sites.

Site	Description	GPS Coordinates (NAD 83 datum)
Cochran Ave.	mainstem	34 02.662N 118 21.237W
Fairfax Drain	tributary	34 02.298N 118 22.136W
Adams Ave.	mainstem	34 02.009N 118 22.494W
Adams Drain	tributary	34 02.009N 118 22.494W
Rodeo/Higuera	mainstem	34 01.305N 118 22.693W
Benedict Box Channel	tributary	34 00.925N 118 23.432W
Overland Ave.	mainstem	33 00.429N 118 23.771W
Sawtelle Ave.	mainstem	33 59.816N 118 24.164W
Sepulveda Channel	tributary	33 59.512N 118 24.693W
Inglewood Ave.	mainstem	33 59.394 N 118 24.696W

Malibu Creek

One hour composite samples were collected at five sites along the mainstem of Malibu Creek (Table 2). The sites stretched from the Cold Creek tributary to the head of the lagoon, near the mouth of the lagoon, in the discharge across the beach, and in the wave wash immediately in front of the discharge across the beach. Composite samples were collected in a similar fashion as Ballona Creek with the following exceptions. A single composite sample was collected at each site daily on three consecutive days (November 10, 11 and 12, 2004) coinciding with low tide to ensure that the flow direction was from the lagoon, across the beach, and into the wave wash. No flow information was collected since most of the sites were hydrologically unrateable.

Table 2. Malibu Creek sampling sites.

Site	Description	GPS Coordinates (NAD 83 datum)
Bridge at Cold Creek	Mainstem	34 04.865N 118 42.262W
Bridge at Cross Creek	Mainstem	34 02.578N 118 41.052W
Head of Malibu Lagoon	Lagoon	34 02.154N 118 41.036W
Mouth of Malibu Lagoon	Lagoon	34 01.920N 118 40.810W
Malibu Creek Wavewash	Mixing Zone	34 01.920N 118 40.810W

BMPs

Three BMPs were selected for sampling. The three sites included: the Santa Monica Urban Runoff (SMURRF) treatment facility located in Santa Monica; the Clear Creek, Inc. MURF™ pilot treatment facility located in Paradise Cove; and a constructed wetland (WET CAT) located in Laguna Niguel. The SMURRF consists of a grit screen to remove debris and trash, a dissolved aeration system to separate the oil and grease, and a microfiltration system to remove solids inline with a UV treatment device. The MURF system uses a combination of proprietary multi-media filtration and UV treatment. The WET CAT is a 2.1 acre constructed wetland with no other in line treatment. Grab samples were collected from the influent and effluent at each BMP.

Filtration
After collection, samples were placed on ice in a cooler and transported immediately to the University of Southern California for processing. For each composite sample, 200-600 ml of sample volume was vacuum filtered through replicate 47mm 0.45μm polycarbonate filters (Poretics, Inc.) using a filter funnel and receiver (Millipore, Inc.) for bacterial marker analysis by QPCR. In addition, replicate filtrations were conducted using 47 mm diameter 0.7 μm nominal pore size, type GF/F microporous filters (Whatman, Inc.), and replicate Type HA Millipore mixed ester cellulose acetate/nitrate, 0.45 um pore size filters (for subsequent enterovirus analysis). The polycarbonate filters were immediately placed into a 1.5 ml screw-cap tube and placed on dry ice until storage at -80°C. Type HA filters were either placed into a Whirl-pak bag for analysis by the Fuhrman laboratory (EnteroA), or into a 1.5 ml screw-cap tube for subsequent analysis by the Noble laboratory (EnteroB). Type GF/F filters were cut into quarters, each quarter placed in a 1.5 ml screw cap tube and placed on dry ice until storage at –80°C. .

Indicator Bacteria Analyses Using Chromogenic Substrate

Concentrations of *E. coli* and enterococcus were measured by chromogenic substrate methods using kits supplied by IDEXX Laboratories, Inc. (Westbrook, ME). *E. coli* was measured using the Colilert-18® reagents, while enterococci were measured using Enterolert™ reagents. Both tests used the Quanti-Tray/2000 for enumeration of cells. Samples were incubated overnight per the manufacturer's instructions and inspected for positive wells. Conversion of positive wells from these tests to a most probable number (MPN) was done following Hurley and Roscoe (1983).

Enterovirus Analyses Using QRTPCR

Samples were analyzed for enteroviruses using two separate, but similar methods conducted in two separate laboratories, EnteroA (Fuhrman laboratory) and EnteroB (Noble laboratory). For EnteroA, filters were extracted using the RNeasy mini kit (Qiagen Cat. No.74106) and QIAvac 24 vacuum manifold (Qiagen Cat. No.19403). The extraction protocol was modified from the manufacturer's instructions as follows: 1ml lysis buffer RLT (with 10μl β-mercaptoethanol) was added directly into each Whirl-Pak bag, allowed to soak the filter for ten minutes, and the resulting extracts (lysates) were carefully removed by pipet into 2 ml microcentrifuge tubes (droplets hanging in the bag and water clinging to the filter were first squeezed to the bottom corner of the bag by manually applying pressure to the outside of the bag). If there was visible filter or sample debris, the particulate matter was removed by brief centrifugation. Then one volume of 70% ethanol (usually 1 ml) was added to the extract and mixed by pipetting. Samples were transferred to the RNeasy spin columns, filtered through with the QIAvac at approximately 500 mm Hg vacuum, and were washed on the manifold once with 700 μl RW1 solution, and twice with 500 μl RPE solution to remove contaminants. The columns were cleared of remaining droplets of buffer by centrifugation into a 2 ml collection tube (14,000 rpm, Eppendorf 5415 microfuge, 2 minutes), and the buffer discarded. The RNA was eluted from the columns into a 1.5 ml collection tube with 50 µl volumes of RNase free water by centrifugation (Eppendorf 10,000 rpm, 2 min.), after allowing the water to stay in the column 1 min. This filter extraction step typically took up to two hours for 15 samples.

For each PCR reaction, 5 µl of the 50 µl RNA was analyzed by QRTPCR on a Mx3000P Thermal Cycler (Stratagene, Inc.). The PCR protocol was modified from the single-tube RT-PCR method previously developed for sludge samples by Monpoeho et al. (2001). Primers and probe, not changed from that original published method (except for the BHQ quencher), were reverse primer Ev1 [5'-GATTGTCACCATAAGCAGC-3'], forward primer Ev2 [5'-CCCCTGAATGCGGCTAATC-3'], synthesized by Qiagen and Ev-probe [5'-FAM-CGGAACCGACTACTTTGGGTGTCCGT-BHQ-Phosphor-3'], synthesized by Sigma Genosys. A GenBank BLAST search done on 3 June 2004 revealed that only human (not other animal) enteroviruses matched all three primer and probe sequences. Each PCR reaction contained 5 µl RNA extract and 20 µl master mix, each 20 µl master mix contained: 1X Taq gold buffer (ABI), 5.5mM $MgCl_2$ (ABI), 500uM dNTPs (ABI), 6% glycerol (Sigma Chemical Co.), 2% PVP 40 (polyvinylpyrrolidone, av. MW 40,000, Sigma Chemical Co.), 500nM Ev1, 400nM Ev2, 120nM Ev-probe, 1.5µg T4 gene 32 protein (Ambion), 10 units of RNAsin (ABI), 2.5 units of AmpliTaq gold (ABI) and 5 units MULV reverse transcriptase (ABI). Each RNA extract was analyzed in duplicate. Enterovirus RNA was transcribed into cDNA at 50°C for 45 minutes, the cDNA was amplified by PCR, after a 95°C 10 minute hot start, for 50 cycles at 94°C for 15 sec and 60°C for 1min. Fluorescence measurements were made during the extension step, every cycle at 60°C. Calculations for quantification were done by the Stratagene QPCR software in real time, with raw data saved for possible reanalysis. Parameters (e.g. fluorescence threshold) were set manually after PCR was done to generate a standard curve with optimal statistics (usually r^2>0.95, slope around 3.3) and unknowns were calculated based on that standard curve. Standards were prepared using the poliovirus stock described above. Standards used in the high concentration set were 10-fold dilutions ranging from high to low concentration. For EnteroB, a similar approach was used. Samples were extracted using the RNeasy mini kit (Qiagen Cat. No.74106), with additional of 2.0% polyvinylpyrrolidone (PVP)-40 (final concentration) and the filter fully homogenized in the screw cap tube. After homogenization, approximately 700µl of the RLT/filter slurry was applied to a QiaShredder column (until the Qiashredder was full) and spun at max speed, ≥ 8000 x *g*, for 2 minutes. It was often necessary to perform two spins to ensure the entire volume of RLT/filter slurry was shredded. The supernatant fluid was then carefully removed and placed into a new 1.5 ml tube. The volume of solution in each tube was estimated by pipetting and 0.4 volumes of potassium acetate were added. Tubes were mixed by inversion and incubated on ice for 15 minutes. The mixture was then spun at 4°C for 15-30 minutes and the supernatant transferred to a new 1.5 ml microfuge tube. Following this, the protocol for the Qiagen RNeasy Plant and Fungi RNA isolation was followed starting at step 5. Five µl of extracted RNA from the previous procedure was added to 5X RT Buffer, 6 mM MgCl2, 500 nM dNTPs (final concentration), 700 nM EV1 Reverse primer, 700 nM EV1 Forward primer, and 300 nM EV-BHQ TaqMan probe, 10 units of RNAsin, 2.5 units of Taq polymerase, and 5 units MULV reverse transcriptase. The Cepheid Smart Cycler® was programmed to: 1 hour

RT at 37°C followed by a 15 minute hold at 95°C for *Taq* activation, then 45 cycles of 94°C 15 seconds (denature), 60°C 1 minute (anneal/extension-optics on).

QRTPCR results were available three hours after the start of analysis, making the total PCR preparation and analysis time less than 5 hours for 15 samples. Results are reported as equivalent virus particles per unit sample volume, meaning that this is where the QRTPCR calculation indicated the sample appeared relative to the standard curve prepared from poliovirus standards.

Bacterial Analyses Using QPCR

The polycarbonate filters were processed for DNA extraction using the UltraClean™ Fecal DNA Isolation Kit (MoBio Laboratories, Inc., 12811-50) as per manufacturer's alternative protocol. Eluted DNA extracts were stored at –20°C until use.

Table 3. Primer and probe sequences for PCR detection of enterococci

Sequence Name	Nucleotide Sequence 5' to 3'	Length	GC (%)	T_m (°C)	Detection System*
ECST748F[1]	5'aga aat tcc aaa cga act tg-3'	20mer	35	51.2	
ENC854R[1]	5'-cag tgc tct acc tcc atc att-3'	21mer	47.6	57.9	
GPL813TQ[1]	5'Cy3-tgg ttc tct ccg aaa tag ctt tag ggc ta-BHQ-2-3'	29mer	44.8	65.3	Taqman

[1]Ludwig and Schleifer, 2000.

Total enterococci primers and probe were constructed using the rDNA regions around the target site of a well established enterococci group specific primer (ENC854R) (Table 3). The primer ECST748F targets enterococci, lactococci, and several clostridia. The target site of the probe GPL813TQ is present in rDNA from a variety of representatives of gram-positive bacteria with a low G+C DNA content (Ludwig and Schleifer, 2000).

Table 4. Master mix using individual reagents

Reagents	Final conc. (μM)	Initial vol (μl)
Water		3.9
10X Taq buffer (Mg^{++} free)	1	2.5
250mM MgCl2	5	0.5
10mM DNTPs	0.5	1.25
10μM ENC854R	1	2.5
10μM ECT748F	1	2.5
10μM GPL813 TQ Cy3 Probe	0.08	0.2
5U/u Taq polymerase	0.05	0.5

The Master Mix of reagents (Table 4) yields a final volume of 20 µl, to which 5 µl of sample (either DNA extract from an environmental sample, or 5 µl of lysed cell suspension or genomic equivalents) was added for a final volume of 25 µl. The samples were run under the following optimized assay conditions for PCR: 1 cycle initial hold at 95°C for 2 min, and 45 cycles of denaturation (94°C) for 15 seconds, and annealing (60°C) for 30 seconds, the optics were turned on during the annealing step. The Cepheid Smart Cycler was set with the following specific parameters for this assay. The Dye Set was set for FCTC25. The Ct analysis mode was set for growth curve (linear) analyses, with a manual threshold typically set at between 5 and 15 fluorescence units. The background subtract level was set at a minimum of 12 and a maximum of 40. The BoxCar averaging feature was set at 0. For quality control, combined *E. faecalis* and *E. faecium* were used as our calibration strain for the total enterococci primer and probe set. Control bacteria preparations were prepared by boiling bacteria for 5 minutes, centrifuging 1 min at 12,000 rpm in a Beckman Microcentrifuge, and immediate storage on ice. *E. faecalis* and *E. faecium* cells were enumerated using either SYBR Green I epifluorescence microscopy (Noble and Fuhrman, 1998) and/or using Enterolert® or the EPA 1600 methods (APHA 1992). This yielded information on both the cell numbers in the sample, and the number of metabolically active cells present in the sample. Serial dilutions of the standards were made in duplicate in DEPC-treated sterile water, and four point standard curves are run in concert with the unknown samples on the Smart Cycler II instrument. Total enterococci primers were tested with all 19 validly described species of the genus enterococci, and demonstrated amplification of rDNA of all strains, with varying efficiencies.

Bacteroides sp. Using Conventional PCR

Amplification of the human-specific Bacteroides/Prevotella marker generally followed the procedure of Bernhard and Field (2000), with PCR primers that amplify partial 16S rRNA from the human fecal (HF) specific group. DNA was extracted a MoBio Ultra Clean fecal extraction kit. A range of extracted DNA quantities (2 – 5 µl, representing 1-70 ng per assay, with most samples in the range of 5-20 ng) was tested to avoid problems with inhibition. DNA was amplified with Bacteroides-Provotella specific primers Bac708r CAATCGGAGTTCTTCGTG and HF183f ATCATGAGTTCACATGTCCG. Each 50-µl PCR mixture contained the following reagents: 1 X Taq polymerase buffer (Promega), each primer at a concentration of 1µM, each deoxynucleoside triphosphate at a concentration of 200µM, 1.25U of Taq polymerase (Promega), 0.64 µg of bovine serum albumin (Sigma) per µl and 1.5mM $MgCl_2$. The thermal cycler was run under the following conditions, 2 min 95°C, then 25 cycles of 95°C for 30 sec, 60°C for 30 sec and 72 °C for 30 sec followed by a 5-min extension at 72°C. Then 1µ of each PCR product was re amplified using the same conditions as above for another 25 cycles. PCR products were visualized in a 2% agarose gel stained with 1X SYBR Gold (Molecular Probes) and compared to a 100bp DNA ladder (Promega). Positive results had 525 bp products. The positive control was human fecal sample extracted with a QIAamp stool kit. Negative controls use water instead of sample. All negative samples are spiked (in a second PCR run) with 0.1 ng of positive control to determine possible inhibition. Inhibited samples are re-run with less DNA.

RESULTS

Ballona Creek

Total volume discharged from Ballona Creek during the six-hour sampling period was 13,390 m^3 (Figure 2). Of this volume, 97% was attributed to monitored inputs from Cochran, Fairfax, Adams and Benedict, and Sepulveda tributaries. The largest volume was contributed at Cochran Avenue where the creek daylights from beneath downtown Los Angeles. Flow remained relatively stable over the study period at all sites with little variation or pattern in discharge. For example, the coefficient of variation for flow at the most downstream site, Inglewood Avenue, was less than 8% approaching the resolution of our flow monitoring devices.

The flux of fecal indicator bacteria remained relatively constant moving downstream in Ballona Creek (Figure 3). The average flux of *E. coli* ranged from 1.1×10^{10} to 5.3×10^{10} cells/hr at the six mainstem sites. The average flux of enterococcus ranged from 6.6×10^{8} to 1.4×10^{9} cells/hr at the six mainstem sites. In both cases, there was no discernable increase in bacterial flux; no two mainstem sites were significantly different from one another for either *E. coli* or enterococcus.

The flux of fecal indicator bacteria decreased over time (Figure 4). The average flux of enterococcus was highest at 9:00 AM (2.9×10^{9} cells/hr) and monotonically decreased throughout the study period. The lowest flux was measured at 2:00 PM (3.0×10^{9} cells/hr). Similar patterns were observed for *E. coli* (data not shown). In contrast to the culture-based methods, the QPCR method for measuring enterococcus did not decrease over time. The flux of enterococcus ranged from 2.7×10^{10} to 4.7×10^{10} cells/hr with the 9:00 AM and 2:00 PM samples being nearly equivalent.

The relative pattern of enterococcus contributions between tributaries was similar at all time periods (Figure 5). Benedict tributary always had the greatest flux of fecal indicator bacteria followed by Sepulveda, Fairfax and Adams tributaries. A similar pattern was also observed for *E. coli*. The flux of enterococcus from Benedict tributary ranged from 4.1×10^{9} to 1.4×10^{10} cells/hr throughout the sampling period while the flux of enterococcus from Adams tributary ranged from 3.7×10^{5} to 4.4×10^{6} cells/hr. On average, Benedict tributary contributed 81% of the enterococcus loading from all four tributaries.

The hourly flux of enterococcus (using culture-based methods) from each of the four main tributaries approximated the load being passed down Ballona Creek (Figure 5). Regardless of hour, the flux from each of the tributaries was within a factor of 10^{1} compared to its nearest downstream site on the mainstem of Ballona Creek. The only exception was the Adams tributary, which was as much as four orders of magnitude less than its nearest downstream site. The mainstem showed virtually no response to any of these tributary inputs, including Adams. Enterococcus flux remained virtually unchanged from upstream to downstream of each of the tributary inputs (Figure 5, Figure 3).

Measurements of *Bacteroides* sp. and enterovirus indicated the presence of human fecal contamination throughout the system (Table 5). *Bacteroides* sp. was present in 12 of 36 mainstem samples (33%). Enterovirus was present in 14 of 36 mainstem samples (44%). The concordance among these measurements was nearly complete; almost every location that detected *Bacteroides* sp. was also positive for enterovirus. Only two samples were positive for enterovirus and not *Bacteroides* sp. These two samples were furthest downstream or latest in the day.

Table 5. Number of enterovirus genomes (per 100 ml) detected.

Distance Upstream (km)	Time of Day					
	9:00	10:00	11:00	12:00	1:00	2:00
6.3	106*	71*	93*	70*	67*	
5.4		41*	19**	25*		
4.7		17*		113*	51	
2.6				79*		
1.5				13*		39
0						

* Human Bacteroides marker also detected.
** PCR reaction for human Bacteroides marker inconclusive due to inhibition.

Spatial and temporal patterns in enterovirus concentration were evident in the Ballona Creek system (Table 3). Main channel locations in the upper reaches of the study area were more likely to be positive for enteroviruses than downstream sites. The most consistently positive site was Cochran Ave., where 89% of the samples contained measurable levels of enterovirus. In addition, the highest concentrations of enterovirus were measured at Cochran Ave. during four of the six time periods. A general pattern in enterovirus detection was observed during the course of the day. Enterovirus was detected earliest in the day at upstream sites. Enterovirus was detected most frequently late in the day at the downstream sites. The 12:00 sampling interval had the most frequent detection of enterovirus with the highest concentrations observed at the middle sites in the watershed. Enterovirus was not detected in high concentrations in any of the tributaries; only Adams tributary had any detectable enterovirus.

Malibu Creek

Malibu Creek had a similar pattern of fecal indicator bacteria concentrations at each sampling event throughout the study period (Figure 6). Concentrations decreased along the mainstem as it flowed from Cold Creek to Cross Creek, then increased as it flowed through the estuary until it discharged into the ocean at Malibu Beach. The increase in fecal indicator bacteria through the lagoon averaged 10^2 MPN/100 ml for both enterococcus and *E. coli*. The dilution factor from the discharge to the shoreline as a result of wave induced mixing averaged 0.86 for *E. coli* and 0.34 for enterococcus. Despite the increase in fecal indicator bacteria concentrations, none of the Malibu samples were positive for enteroviruses or *Bacteroides* sp.

BMP's

Both of the BMPs that incorporated UV treatment systems were more effective than the constructed wetland at removing fecal indicator bacteria (Table 6). Albeit concentrations were low in the influent, the constructed wetland did not reduce concentrations of *E. coli* or enterococcus using either culture-based or QPCR methods in the effluent. Both UV treatment systems, however, reduced influent concentrations of *E. coli* and enterococcus in the effluent to near or below method reporting levels. Enterococcus concentrations by QPCR were reduced by an order of magnitude, which was not as great as the culture-based method. No enterovirus or *Bacteroides* sp. were detected in any of the BMP influent or effluent samples analyzed.

Table 6. BMP effectiveness for indicator bacteria removal measured by culture-based (chromogenic substrate, CS) or quantitative polymerase chain reaction (QPCR) methods.

Indicator	Constructed Wetland		Filtration+UV		Filter+DAF+UV	
	Influent	Effluent	Influent	Effluent	Influent	Effluent
E. coli (CS) (MPN/100 ml)	<10	36	58	20	147	<10
Enterococcus (CS) (MPN/100 ml)	<10	47	184	15	42	<10
Enterococcus (QPCR) (Cells/100 ml)	163	110	5004	729	No Data	No Data
Enterovirus (genomes/100 ml)	-	-	-	-	No Data	No Data

* no *Bacteroides* sp. detected
- no enterovirus detected

DISCUSSION

The Ballona Creek watershed is a system severely impacted by fecal pollution. The flux of fecal indicator bacteria was as high at the head of the watershed as it was at the mouth of the creek where it discharges into SMB. Although we focused on flux of these fecal indicator bacteria, it is important to note that 92% of all samples collected from Ballona Creek in this study, including 100% of the samples just upstream of SMB, exceeded the water quality thresholds established by the State of California. The presence of human enterovirus and human specific markers of *Bacteroides* sp. further documents the fecal inputs and should increase an environmental manager's awareness of the possible human health risks associated with these discharges.

Our study is not the first to examine the presence of viruses in urban runoff entering shorelines in SMB and other southern California urban watersheds. For example, Gold *et al.* (1990) and Gold *et al.* (1992) found viruses in repeated samples from multiple storm drains to SMB using both cell culture and RTPCR techniques. Haile *et al.* (1999) detected human specific viruses in all three storm drains tested in their epidemiology study of SMB. Noble and Fuhrman (2001) found human enteric virus genomes in the nearshore marine waters of SMB. Jiang et al (2001) found human adenovirus in samples collected at 12 sites between Malibu and the Mexican border.

The multi-tiered approach used in this study can assist watershed managers in determining sources and efficiently abating the most significant inputs of fecal indicator bacteria. If managers relied solely on the patterns in fecal indicator bacteria from Ballona Creek, then the only option would be to treat the entire 37 m^3/s discharge furthest downstream at Inglewood Ave. because the flux of fecal indicator bacteria was similar from all sources. The use of multiple tools, however, allows managers to prioritize the most important sources. In this case, the presence of human enterovirus was greatest from the Cochran Ave. site, where the system daylights from the underground storm drain system beneath Los Angeles and the discharge volume is one-third the volume at Inglewood Ave. Since Cochran Ave. had the most frequent occurrence and highest concentrations of enterovirus, this source would appear to be the most likely candidate for future management actions. The co-occurrence of the human *Bacteroides* sp. marker at most of the locations and time periods where enterovirus was quantified, most notably in all of the Cochran Ave. samples, provides the reassurance most managers would need before planning future management steps.

The lack of correlation between bacterial indicator levels and levels of human pathogenic viruses has been observed in previous studies (Dufour, 1984; Elliott and Colwell, 1985) and demonstrates the value of a multi-tiered approach used herein for source identification. For example, analysis of wild shellfish from the Atlantic coast of France indicated no significant correlation between fecal coliforms and enteroviruses or hepatitis A virus (LeGuyader et al., 1993; Leguyader et al., 1994), and viruses have sometimes been found in oysters without coliform contamination (Goyal et al., 1984; Yamashita et al., 1992). Noble and Fuhrman (2001) detected enterovirus in 35% of the 50 shoreline samples they examined over a five year period and no significant statistical relationship to any of the standard bacterial indicators was found. Noble *et al* (2000) measured virus and fecal indicator bacteria in dry weather urban runoff in drains along 300 km of shoreline from Santa Barbara to San Diego. Despite 46% of the storm drains containing detectable enterovirus, there was no correlation with fecal indicator bacteria concentrations.

The results of this study indicated that Ballona Creek presents a greater risk to human health than Malibu Creek. There were no enterovirus or *Bacteroides* sp. detected in any sample from the Malibu Creek watershed. The bacterial concentrations were lower at Malibu Creek than at Ballona Creek; none of the Malibu Creek samples from the bottom of the watershed (at Cross Creek) exceeded water quality thresholds established by the State of California. Interestingly, fecal indicator bacteria concentrations increased as water flowed through the lagoon at the base of the Malibu watershed. No enterovirus or *Bacteroides* sp. was detected in these samples either, although other studies have detected human specific sources of viruses in this discharge (John Griffith *personal communication*).

The use of QPCR to measure fecal indicator bacteria presents unique opportunities and challenges. The advantage of QPCR for measuring fecal indicator bacteria is speed potentially providing measurements in less than four hours (Griffith et al 2004). However, culture-based methods only quantify viable bacteria, while QPCR measures the DNA from both cultivable and noncultivable microbes. This was most apparent in the temporal trends from Ballona Creek. Samples of enterococcus using culture-based methods generally decreased as the day progressed, most likely as the result of degradation from sunlight (Noble et al. 2004). Ballona Creek is a 40m wide concrete-lined channel concentrating solar energy into the shallow creek in the channel invert. The QPCR results, however, remained steady indicating that the bacterial DNA was still intact even though the enterococci were not viable.

The data from this study suggested the UV treatment systems were more effective than the constructed wetland at reducing fecal indicator bacterial concentrations. We suspected the UV treatment system would be effective since this method is a well-known mechanism for degrading bacteria (Fujioka et al. 1981, Davies and Evison, 1991, Davies-Colley et al. 1994, Noble et al 2004). Not only did the UV system reduce concentrations of enterococci using culture-based techniques , but it also degraded its DNA as shown by large reductions in enterococcus by QPCR. On the other hand, the effectiveness of the treatment wetland remains incompletely quantified. Although levels of fecal indicator bacteria were similar before and after flowing through the wetland, concentrations were very low to begin with. Monitoring by others at this treatment wetland suggest that it has been effective at reducing fecal indicator bacteria concentrations using culture-based methods (Nancy Palmer, City of Laguna Niguel *personal communication*). More study, particularly with the QPCR, will be needed before the wetland effectiveness can be fully quantified.

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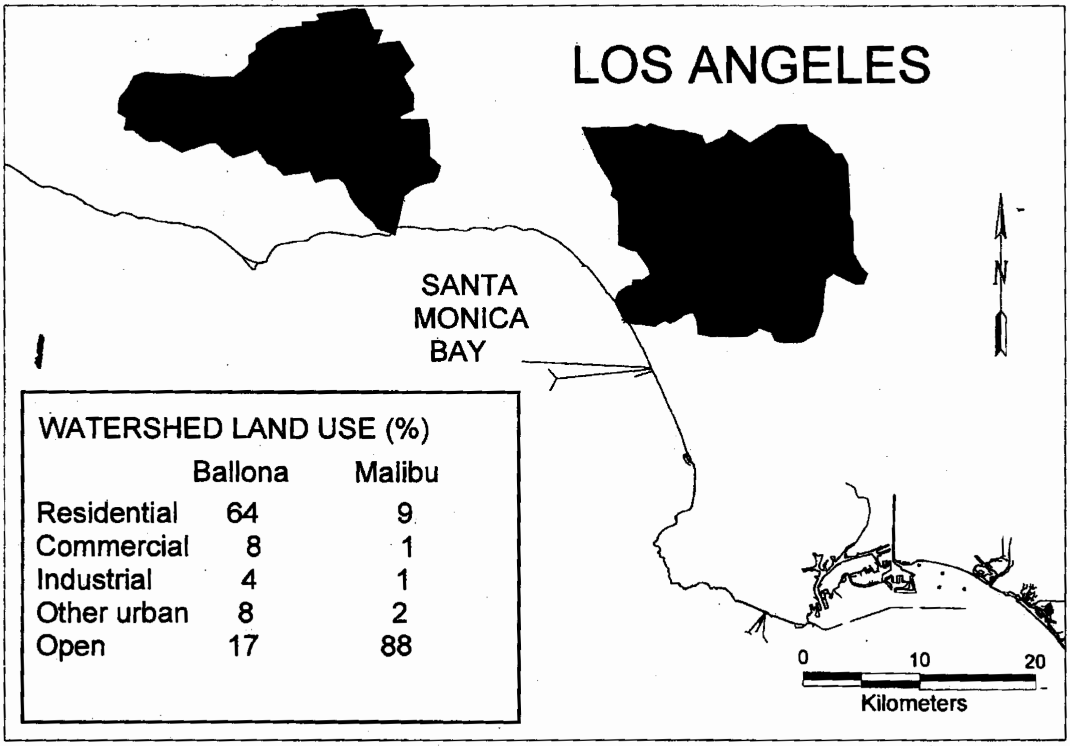


Figure 1: Map of Santa Monica Bay, CA indicating the locations and land use distribution for Ballona Creek and Malibu Creek watersheds.

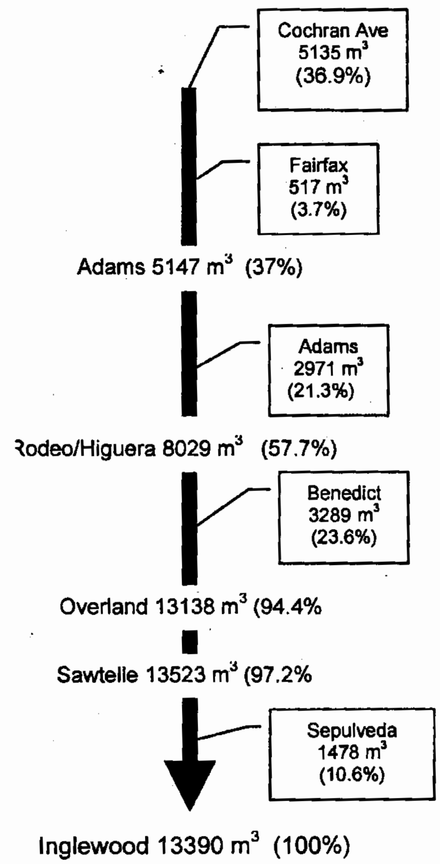


Figure 2. Schematic diagram depicting additive flow in main channel and percent contribution from each tributary.

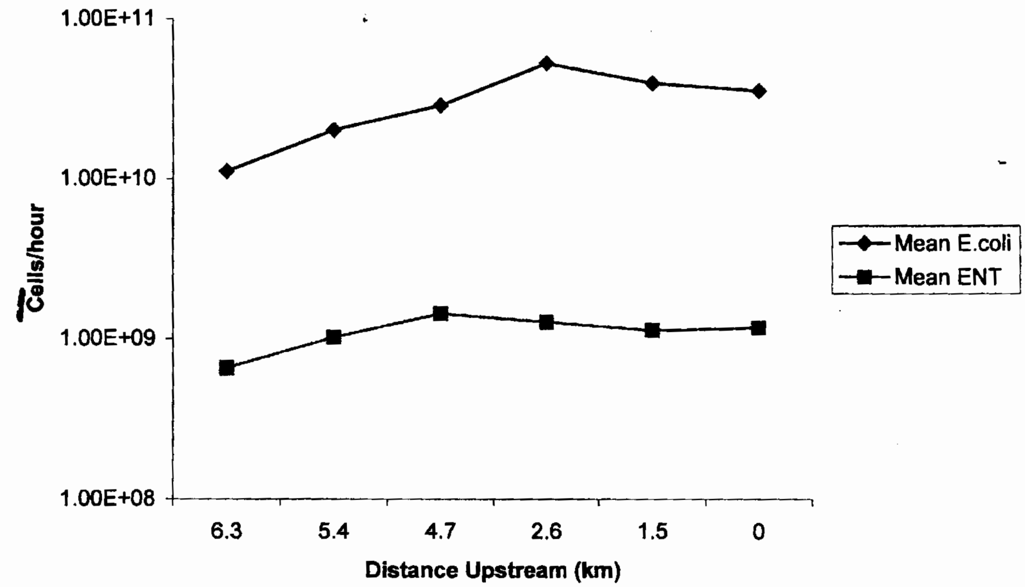


Figure 3. Mean hourly flux of *E. coli* and enterococcus at each station in main channel of Ballona Creek measured using the IDEXX™ method.

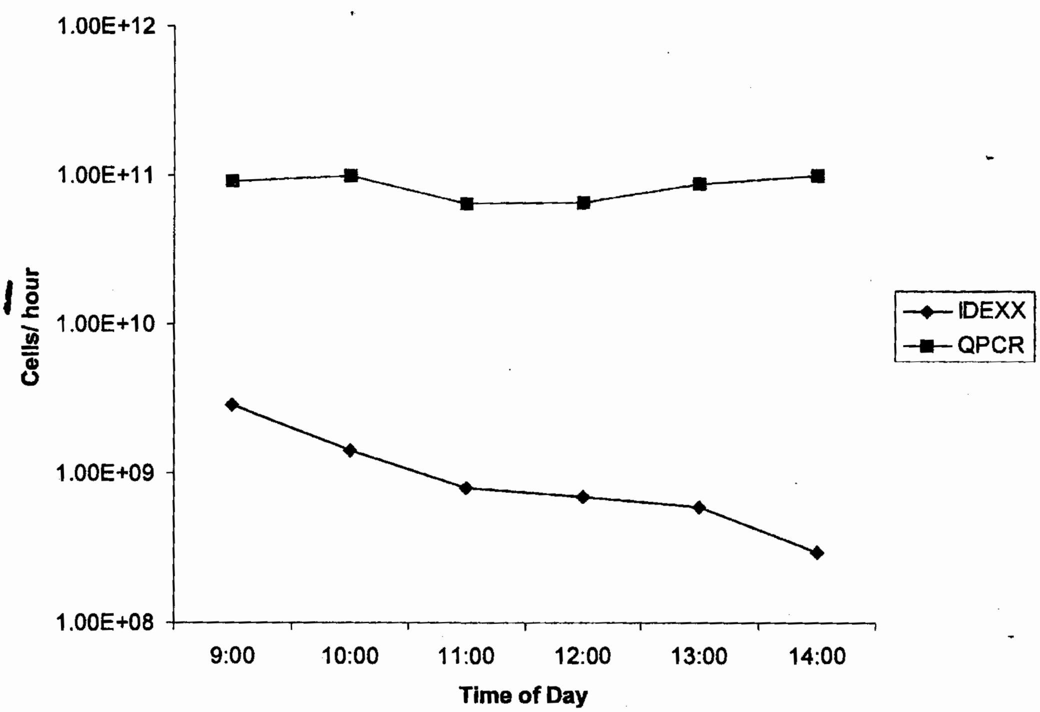


Figure 4. Mean hourly flux of enterococcus along the main channel of Ballona Creek as measured using both IDEXX the QPCR methods.

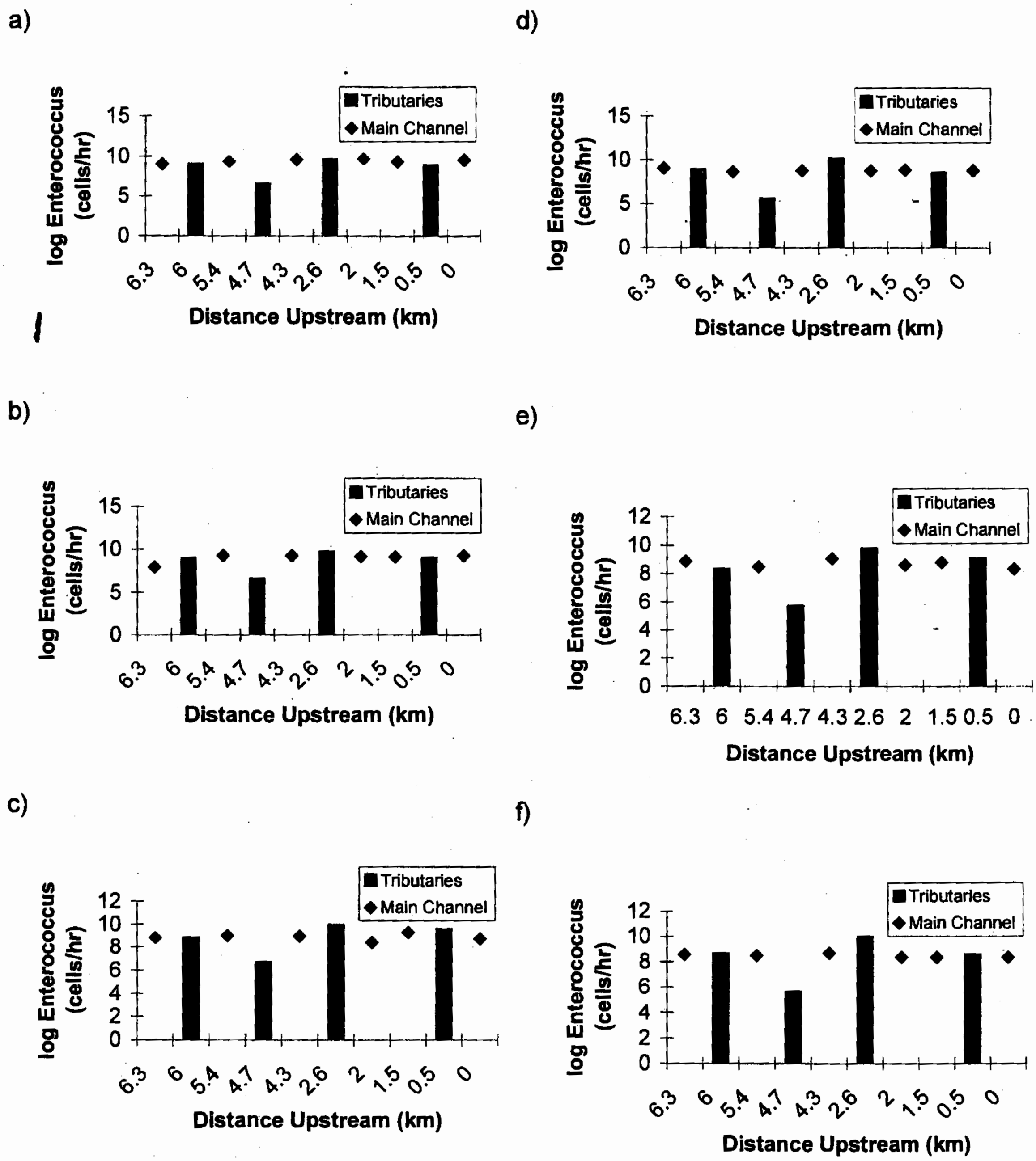
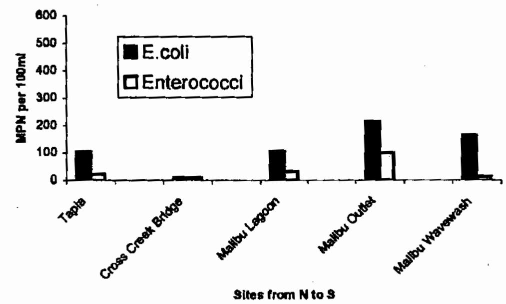
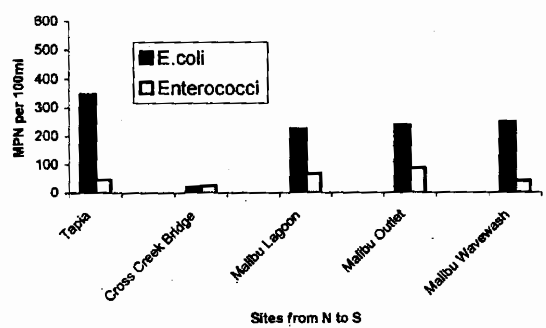


Figure 5. Enterococcus loading in main channel and tributaries of Ballona Creek at a) 9:00, b) 10:00, c)11:00, d) 12:00, e)13:00, f)14:00.

a)



b)



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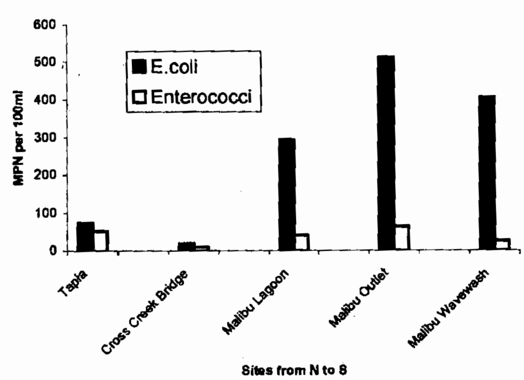

Figures 6. Fecal indicator bacteria concentrations in Malibu Creek on a) 11/10/04 b) 11/11/04 and c) 11/12/04

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Modeling the dry-weather tidal cycling of fecal indicator bacteria in surface waters of an intertidal wetland

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Abstract

Recreational water quality at beaches in California and elsewhere is often poor near the outlets of rivers, estuaries, and lagoons. This condition has prompted interest in the role of wetlands in modulating surface water concentrations of fecal indicator bacteria (FIB), the basis of water quality standards internationally. A model was developed and applied to predict the dry-weather tidal cycling of FIB in Talbert Marsh, an estuarine, intertidal wetland in Huntington Beach, California, in response to loads from urban runoff, bird feces, and resuspended sediments. The model predicts the advection, dispersion and die-off of total coliform, *Escherichia coli*, and enterococci using a depth-integrated formulation. We find that urban runoff and resuspension of contaminated wetland sediments are responsible for surface water concentrations of FIB in the wetland. Model predictions show that urban runoff controls surface water concentrations at inland sites and sediment resuspension controls surface water concentrations near the mouth. Direct wash-off of bird feces into the surface water is not a significant contributor, although bird feces can contribute to the sediment bacteria load. The key parameters needed to accurately predict FIB concentrations, using a validated hydrodynamic model, are: the load due to urban runoff, sediment erodibility parameters, and sediment concentrations and surface water die-off rates of enteric bacteria. In the present study, literature values for sediment erodibility and water column die-off rates are used and average concentrations of FIB are predicted within 1/2 log unit of measurements. Total coliform are predicted more accurately than *E. coli* or enterococci, both in terms of magnitude and tidal variability. Since wetland-dependent animals are natural sources of FIB, and FIB survive for long periods of time and may multiply in wetland sediments, these results highlight limitations of FIB as indicators of human fecal pollution in and near wetlands.

Keywords: Enteric bacteria; Intertidal wetland; Coastal; Water quality; Sediment

1. Introduction

Fecal indicator bacteria (FIB) groups such as total coliform (TC), fecal coliform (FC), *Escherichia coli* (EC), and enterococci (ENT) are utilized world wide to measure health hazards in bathing and shellfish harvesting waters (Thomann and Mueller, 1987). Water samples at popular beaches and harvesting waters are

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routinely tested for FIB, which are thought to signal the presence of pathogens but are not necessarily pathogenic (US EPA, 1986). Chronic exceedances of California criteria have placed coastal water bodies such as Tomales Bay, Moss Landing Harbor, Morro Bay, Ventura Harbor, Marina Del Rey Harbor, Newport Bay, and Mission Bay on lists of pathogen impaired water bodies (CalEPA, 2002). Exceedances are also common at open ocean beaches, particularly near the outlets of storm drains, rivers, estuaries, and lagoons. Numerous coastal water bodies are impaired worldwide according to such standards.

Pathways by which FIB enter coastal waters include urban and agricultural runoff, waste water discharges, sewage leaks and spills, and fecal deposits by wildlife, notably birds. A complex web of processes influence the distribution of FIB in surface waters including flushing by ocean water, die-off, predation, sedimentation and resuspension, and regrowth on sediments, vegetation, and debris (Savage, 1905; Goyal et al., 1977; Roper and Marshall, 1979; Jensen et al., 1979; LaBelle et al., 1980; Grimes et al., 1986; Thomann and Mueller, 1987; Davies et al., 1995; Oshiro and Fujioka, 1995; Anderson et al., 1997; Byappanahalli and Fujioka, 1998; Solo-Gabriele et al., 2000; Grant et al., 2001). Use of FIB as indicators of human pathogens is complicated by these processes, particularly in wetlands where wildlife is abundant and nutrient rich sediments support growth of bacteria. So long as FIB remain the basis of regulations governing coastal water quality, a need will exist to identify the forcing factors (river inputs, storm drains, etc.) supporting FIB populations so that appropriate and cost-effective management measures can be implemented.

Several researchers have recently reported on models to predict FIB concentrations in coastal waters. Use of such models in coordination with field monitoring programs can help to identify the relative impact of various sources (e.g., a river versus a storm drain), characterize the mechanisms governing the fate of these organisms (e.g., flushing versus die-off) and predict the efficacy of a range of potential management measures. Kashefipour et al. (2002) used a model consisting of depth-integrated continuity, momentum, and transport equations to predict FIB concentrations in the Ribble Estuary, England. Fiandrino et al. (2003) used a model consisting of three dimensional continuity, momentum, and transport equations to predict FIB concentrations in Thau lagoon, France. Steets and Holden (2003) used a one-dimensional model to predict FIB concentrations in Arroyo Burro lagoon, California.

In this study we use a model to simulate dry-weather tidal cycling of TC, EC, and ENT concentrations in surface waters of Talbert Marsh, an intertidal wetland in Huntington Beach, California. Runoff from an urbanized watershed drains to the marsh, the marsh accommodates a high concentration of shore birds, and high sediment concentrations of FIB have been measured. Grant et al. (2001) reported that Talbert Marsh was a net source of ENT to coastal waters and hypothesized that it was due to a combination of bird feces and interactions with sediments and vegetation. Sediments act as a reservoir of FIB (Goyal et al., 1977, e.g.), and suspension and deposition cycles are germane to the estuarine environment (Mehta and Dyer, 1990). In Talbert Marsh, it is not clear whether FIB concentrations are predominantly controlled by urban runoff, erosion of contaminated sediments, bird feces, or some combination of these factors. Therefore, the model is applied to examine and rank the influence of these "forcing factors." The modeling effort described in this paper is unique relative to previously published studies in that non-point loads of FIB (bird feces, erosion of contaminated sediments) are incorporated into a multi-dimensional, time-dependent formulation for the first time.

The model in this study consists of depth-integrated continuity and momentum equations to simulate circulation, and depth-integrated transport equations to simulate surface water concentrations of FIB resulting from urban runoff, bird droppings and resuspended sediments. The model is parameterized using either in situ data or previously published values of model parameters. The model is applied to predict FIB over a 15 day period beginning May 2, 2000, coincident with an extensive field monitoring effort previously reported (Grant et al., 2001, 2002). This work demonstrates the power of first-principle models to elucidate the mechanisms and pathways by which near-shore coastal waters are polluted by FIB.

2. Methods and materials

2.1. Site description

Talbert Watershed, shown in Fig. 1, is a 3300 ha catchment along the southern California coastline in the cities of Huntington Beach and Fountain Valley. On average, the watershed receives 29 cm of rainfall, over 90% of which falls between November and April. Daily high/low temperatures average 23/17 °C in September and 17/8 °C in January. The watershed slopes mildly (10^{-4}) towards the ocean and is drained by a network of channels that, due to the low elevation and mild slope of the watershed, are flooded by tides. Talbert Channel is the main stem of the network. Inland 2 km from the mouth, Huntington Beach Channel branches west and extends 5 km inland; and 8 km from the mouth, Fountain Valley Channel branches east. High tide floods Talbert Channel to the Fountain Valley Channel junction and the length of the Huntington Beach channel. Depths in the channels are comparable to the

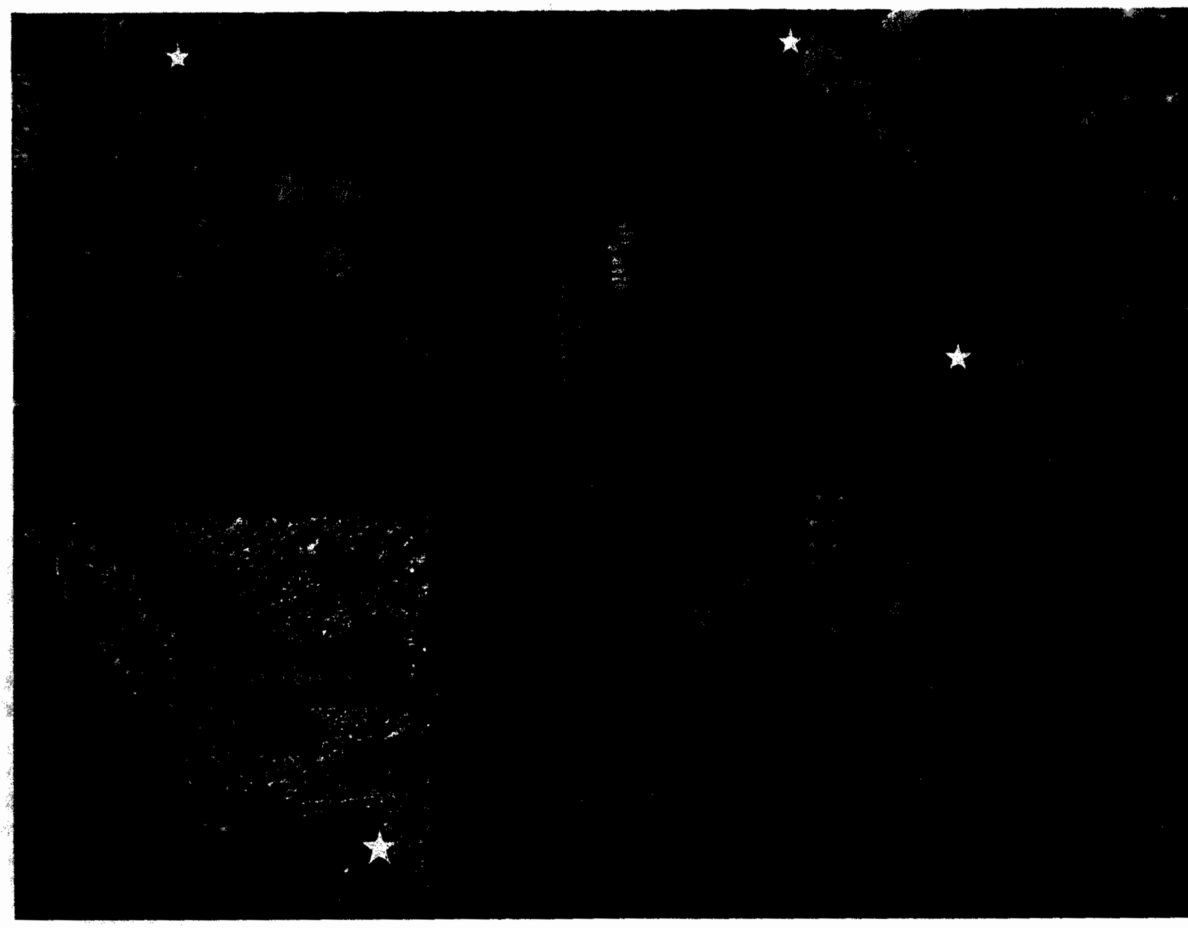

Fig. 1. View of Talbert Marsh, channel network, and surrounding watershed as low tide. Channels and watershed extends several kilometers further inland than indicated in the figure. At high tide, the southwestern and southern portions of Talbert Marsh are flooded. PCH, BRK, and AES indicate monitoring stations.

tidal amplitude, roughly 1 m. Near the outlet, Talbert Marsh occupies roughly 10 ha of what used to be an extensive (1200 ha) tidal marsh environment that was filled for development over the past century. Talbert Marsh was created in 1990 when remnant marsh was flooded following the removal of a Talbert Channel levee. The channel bed consists of beach sand and silts near the outlet and within a flood delta that penetrates a short distance into the marsh. Further inland, the marsh and channel bed consists of organic rich silts and muds, except the upper reaches of Talbert Channel and Fountain Valley Channel where the bed is lined with concrete. In this study, the Talbert Marsh and tidal channels are collectively referred to as the wetland. From a perspective of flushing the wetland may be divided into two zones: a poorly mixed zone inland where residence times are at least a week, and a well-mixed zone near the mouth that is flushed each tide cycle with ocean water. The interface between these zones oscillates with the ebb and flow of the tides.

The watershed is heavily developed as is common to the greater Los Angeles basin, and it contains separate networks of storm and sanitary sewers. Storm sewers direct runoff into street drains that funnel to the wetland. In the lower half of the watershed where the topography is lowest, runoff collects in one of several roughly 500 m^3 forebays that are intermittently drained by pump stations. A program is now in place to divert dry-weather runoff from the storm sewer to the sanitary sewer for treatment. This program began on a limited basis in Fall 1999 and encompassed the entire watershed by Summer 2001. During the 15 day period that is the focus of this study, pump stations were operated in two different modes. During the first 8 days, pumpstations were not activated so runoff either collected in the forebay or was diverted to the sanitary sewer system.

During the remaining 7 days, pumpstations intermittently discharged untreated runoff to the channel network. Over the entire 15 day period, there was dry-weather baseflow in Talbert Channel that entered the wetland.

Monitoring stations referenced in this paper include Pacific Coast Highway (PCH), Brookhurst Street (BRK), and AES Corp. (AES). These are shown in Fig. 1.

2.2. FIB modeling

A hydrodynamic model was developed to simulate surface water concentrations of FIB in the wetland, from the outlet of Talbert Marsh to the head of the Huntington Beach Channel and, along Talbert Channel, to the Fountain Valley Channel junction. The model consists of depth-integrated continuity, momentum, and transport equations (Arega and Sanders, 2004), similar to the approach adopted by Kashefipour et al. (2002). The flow equations (continuity and momentum) were forced by the ocean tide just offshore of the marsh, and by runoff flowing into the upper reaches of the wetland. Ocean tide forcing was based on tide levels recorded at NOAA station 9410660, Los Angeles and archived online at `http://tidesonline.nos.noaa.gov/`. The discharge of runoff at the Talbert Channel inflow boundary, Q_R, was assumed steady over the study period. To model pumpstation operations, the discharge of runoff from each pumpstation, Q_P, was assumed uniform and steady over the final seven days of the study period, but zero over the first eight days. Seven pumpstations that discharge directly into the wetland were incorporated into the model. Runoff data (Q_R and Q_P) were obtained from other reports (Grant et al., 2001, 2002; Chu, 2001) and appear in Table 1. Topographic data necessary for flow predictions were obtained from as-built plans of the concrete-line portions of the channels and a field survey of the Talbert Marsh (Chu, 2001). A uniform Manning coefficient was used to account for bed resistance (Arega and Sanders, 2004).

Simultaneous with the flow prediction described above, surface water FIB were predicted by solving the following transport equations:

$$\begin{aligned}\frac{\partial}{\partial t}(hc_i) + \frac{\partial}{\partial x}(\bar{u}hc_i) + \frac{\partial}{\partial y}(\bar{v}hc_i) &= \frac{\partial}{\partial x}\left(hE_{xx}\frac{\partial c_i}{\partial x} + hE_{xy}\frac{\partial c_i}{\partial y}\right) \\ &\quad + \frac{\partial}{\partial y}\left(hE_{yx}\frac{\partial c_i}{\partial x} + hE_{yy}\frac{\partial c_i}{\partial y}\right) \\ &\quad - hl_i + a_i + \sum_{k=1}^{N_{PS}} \mathcal{L}_{ik}\,\delta(x - x_s^k, y - y_s^k),\end{aligned} \tag{1}$$

where h = depth [m] and $\bar{u}$, $\bar{v}$ = components of the depth-averaged fluid velocity [m/s], E_{xx}, E_{xy}, E_{yx}, and E_{yy} = elements of the dispersion tensor [m²/s], c_i, $(i = 1, \ldots, N_b)$ = water column concentration of FIB [MPN/m³], N_b = number of FIB groups tracked by the model, l_i = water column loss rate [MPN/m³/s], a_i = flux of FIB to water column at sediment/water interface [MPN/m²/s], and $\mathcal{L}_{ik}$ = FIB loading rate of the ith FIB group at the kth inflow point [MPN/s], N_{PS} is the

Table 1
Measured, cited, and computed parameters used to estimate loading and die-off models

Parameter	Units	Total coliform		*E. coli*		Enterococci	
		Value	Uncertainty	Value	Uncertainty	Value	Uncertainty
k[a]	m²/Watts/h	0.0018	±10%	0.0017	±10%	0.00097	±10%
c_R[b]	MPN/100 mL	1.5×10^4	$2.2\times10^4/1.0\times10^4$	9.8×10^2	$1.4\times10^3/7.1\times10^2$	1.8×10^3	$2.4\times10^3/1.3\times10^3$
r[b]	MPN/bird/day	2.8×10^7	$8.4\times10^7/2.1\times10^6$	1.5×10^7	$1.0\times10^8/1.2\times10^7$	7.2×10^6	$2.6\times10^7/5.2\times10^6$
s[b]	MPN/g	5.2×10^3	$1.3\times10^4/2.0\times10^3$	2.1×10^2	$8.5\times10^2/5.1\times10^1$	6.8×10^2	$1.6\times10^3/2.9\times10^2$
Parameter	Units	Value	Uncertainty (%)	Parameter	Units	Value	Uncertainty (%)
Q_R	m³/d	1000	±50	$\overline{n_b}$	—	174	±50
Q_P	m³/d	300	±50	$\langle\bar{\tau}\rangle$	Pa	0.08	±50
$\overline{A_S}$	ha	32	±50	τ_0	Pa	0.75	±50
E_0[c]	kg/m²/s	1×10^{-4}	±50	τ_c[c]	Pa	0.25	±50

Except where noted, a conservative estimate of 50% uncertainty was adopted. Note that the mathematical model is presented using SI units, so conversion factors need not appear in model equations. Commonly used units are presented here to facilitate comparison with previous works and other studies.

[a]Die-off rates based on Sinton et al. (1999).

[b]Measured in situ, uncertainty based on standard error.

[c]Erodibility rates based on Uncles and Stephens (1989).

number of inflow points where runoff is added to the wetland (pump stations and tributary inflow), x_s^k and y_s^k = coordinates of each inflow point [m], and δ = Dirac delta function [1/m²]. The dispersion tensor accounts for longitudinal dispersion (Elder, 1959) and transverse mixing (Ward, 1974), and it is computed locally depending on the orientation of the currents (Arega and Sanders, 2004). Note that SI units are adopted for the purpose of presenting the mathematical model, so conversion factors need not appear in model equations. However, many model parameters are reported in Table 1 with commonly used units to facilitate comparison with previous works and other studies.

Eq. (1) was solved using $N_b = 9$ to predict the distribution of TC, EC, and ENT resulting from urban runoff, bird feces, and sediment resuspension. Groups 1–3 correspond to TC, EC, and ENT concentrations resulting from runoff sources, 4–6 from bird sources, and 7–9 from sediment sources. All model predictions account for surface water die-off using first order kinetics as follows:

$$l_i(x, y, t) = k_i I(t) c_i(x, y, t), \tag{2}$$

where k_i = die-off rate constant [m²/Watts/s] based on Sinton et al. (1999), and $I(t)$ = solar intensity [Watts/m²]. Die-off rates used in the model were taken from Sinton et al. (1999), and solar intensity data for the study period were obtained from Grant et al. (2001).

The model does not account for settling. Suspended sediments in the 1–10³ μm size range are typical of intertidal wetlands adjacent to sandy ocean beaches, but FIB in southern California coastal waters are either free-living (planktonic, roughly 1 μm in size) or associated with very fine sediments, probably in the 10 μm range or less (Ahn et al., 2005). The relative influence of settling and die-off is defined by the ratio $w_s/k_i I h$, where w_s is the settling velocity. Using Stokes Law to model the settling velocity in terms of particle size (e.g. Nazaroff and Alvarez-Cohen, 2001, Chapter 4), the average solar radiation rate for the study period (288 Watts/m²), die-off rates reported by Sinton et al. (1999), and a depth of 1 m which is typical for the wetland, this ratio is unity for ENT when particle diameter d = 10 μm and for TC and EC when d = 13 μm. When d = 5 μm, this ratio is 0.3 for ENT and 0.2 for TC and EC. The nonlinear dependence is due to the quadratic relationship between settling velocity and particle size. Without a clear understanding of the partitioning of FIB between free-living and particle-associated states, and knowledge of the median diameter of particles with attached FIB, selecting an appropriate settling velocity is difficult. Certainly, without settling terms the model will underestimate water column FIB losses if these organisms are associated with particles in the 10–20 μm range or larger. Therefore, this assumption should be reconsidered if the model significantly overpredicts FIB concentrations.

For all predictions, the concentration of FIB in water entering the wetland from the ocean was set to zero. For the urban runoff predictions (i = 1–3), point loads of FIB were specified at runoff inflow points and the non-point loading term, a_i, was set to zero. The loading rate was set equal to the volumetric flow rate multiplied by the concentration of FIB in runoff, c_{R}, which was specified based on average Talbert Watershed urban runoff concentrations reported by Reeves et al. (2004).

FIB loading to surface waters by bird feces (i = 4–6) was modeled as a spatially distributed (around the water line) and temporally variable non-point source. It was assumed that all bird feces fell exclusively on the shoals of the marsh, were subject to sunlight induced die-off, and upon flooding by the tide were instantaneously and completely transferred to the water column. Hence, loading in the model occurs at water's edge during the rising tide. This approach was motivated by bird surveillance data, which showed birds congregated on shoals during low tides (Grant et al., 2001). The following mass balance equation was solved to track the build-up an die-off of FIB on the shoals of the marsh,

$$\frac{\mathrm{d}m_i(x, y, t)}{\mathrm{d}t} = d_i(t) - k_i I(t) m_i(x, y, t), \tag{3}$$

where m_i = the surficial FIB density [MPN/m²] and d_i = FIB loading rate [MPN/m²/s]. Note that the die-off rate constant for the marsh banks is identical to that used for surface water. The FIB loading rate was computed as,

$$d_i(t) = n_b(t) r_i / A_{\mathrm{IT}}(t), \tag{4}$$

where $A_{\mathrm{IT}}(t)$ = the exposed (or dry) inter-tidal surface area [m²], $n_b(t)$ = bird population measured hourly in the marsh and r_i = rate of FIB loading per bird [MPN/bird/s]. The exposed inter-tidal surface area (or area of the exposed shoals) was determined from the marsh topography as the difference between the exposed surface area of the marsh and the exposed surface area under high spring tide conditions. This varied from 0 to 4.5 ha depending upon the tide stage. Table 1 presents bird loading rates used in the model, which were based upon samples collected Talbert Marsh. The sampling methodology is described in (Grant et al., 2001), but only ENT concentrations are reported. TC and EC were quantified from the same samples using defined substrate tests (IDEXX, Westbrook, Maine), but the data have not previously been reported.

FIB loading rates of birds vary widely depending upon species, habitat, diet, and feeding habits. Hussong et al. (1979) reported fecal coliform loading rates for wild swan and Canadian geese of 10^6–10^9 and 10^4–10^7 MPN/bird/day, respectively, Gould and Fletcher (1978) reported fecal coliform loading rates for several gull species in the range of 10^6–10^7 MPN/bird/day. Alderisio and DeLuca (1999) reported fecal coliform loading rates of roughly 10^8 and 10^5 MPN/bird/day for ring-billed gulls and Canadian geese, respectively. Rates reported in Table 1 for shore birds in Talbert Marsh are similar, roughly 10^7 MPN/bird/day for all three indicator groups. During the study period bird populations ranged from 0 to 1180 (Grant et al., 2001).

After being flooded by the rising tide, the wash-off of surficial bacteria from the marsh banks contributes to the sediment/water interface loading rate, a_i appearing in Eq. (1), as follows:

$$a_i(x, y, t) = m_i(x, y, t)\delta(t - t_f), \tag{5}$$

where t_f = the instant land is flooded by the rising tide [s] and δ = Dirac delta function [1/s]. Hence, the transfer of surficial FIB from the banks of the marsh to surface waters is modeled as an instantaneous exchange that is triggered by moment the bank is flooded by the rise of the tide. After transfer to surface waters, $m_i = 0$ until the banks are again dry at which point the build-up process resumes.

FIB loading to surface waters by sediments ($i = 7$–9) was modeled as a spatially distributed and temporally variable non-point. The non-point loading term a_i in Eq. (1) was formulated to account for the transfer of FIB to the water column that occurs when FIB laden particulate matter and pore water on the bed is mobilized by turbulent shear. The mobilization of estuarine sediments occurs after a threshold in turbulent shear has been exceeded, and in proportion to the excess of turbulent shear above the threshold (Partheniades, 1965; Mehta and Dyer, 1990). Whether or not the same is true for FIB is not clear, for FIB may be free living in sediment pore water, attached to sediment grains, or incorporated into microbial biofilms; and how these phases of FIB respond to shear is not known. Therefore, a novel approach was taken. The FIB loading term was developed by dimensional analysis with the following conditions in mind: (a) that the transfer rate of FIB from sediments to surface waters be proportional to the shear rate; and (b) that FIB liberated from the sediments over a tide cycle be equal to FIB present (either attached to particles or free-living in pore water) in the erodible layer of surficial sediments. Therefore, the following rate expression was used,

$$a_i(x, y, t) = s_i E \frac{\tau(x, y, t)}{\tau_0}\left(\frac{\tau_0}{\tau_c} - 1\right), \tag{6}$$

where s_i = geometric mean concentration of FIB per mass of sediment [MPN/kg], E = entrainment rate parameter [kg/m^2/s], τ = spatially and temporally varying shear stress at the bed [Pa] computed by the hydrodynamic model, τ_c = critical shear stress for erosion [Pa], and τ_0 = reference stress [Pa] representative of erosive conditions in the wetland.

The reference stress was computed based on water level and velocity data collected at BRK (Arega and Sanders, 2004). BRK serves as a good reference point due to its central location. Using a drag coefficient of 0.003 which is typical of estuaries, a fluid density of 1 g/cm^3, and a velocity of 0.5 m/s, the reference stress was estimated to be $\tau_0 = 0.75$ Pa. A velocity of 0.5 m/s was used for this calculation since the peak flood velocity varies from 0.4 to 0.6 m/s over the spring-neap cycle, while the peak ebb velocity varies from 0.1 to 0.4 m/s. Site specific entrainment rate and critical shear parameter estimates were not available, so values reported in the literature by Uncles and Stephens (1989) and Tattersall et al. (2003) were used. All model parameters are reported in Table 1.

Note that measured concentrations of FIB in Talbert Marsh sediments were utilized to estimate s_i. No attempt was made to model the cycling of FIB in submerged sediments. To estimate the concentration of FIB in sediments, cores were collected at low tide within the inter-tidal zone and immediately transported to the laboratory. Overlying water was siphoned off the top and the cores were sectioned in 1 cm intervals with an extruder. For the few cores with a high sand content, sediment was scraped from the core tube in specified intervals to avoid slumping. Each sediment section was homogenized. A 5 g sample was suspended with 45 ml of a 0.5 M mono potasium phosphate buffer solution in a sterilized glass centrifuge tube for enteric bacteria analysis (APHA, 1992, Methods 9221 and 9050C). The sample was agitated for 1 min with a vortex mixer, then centrifuged at 2000 rpm for 5 min. The supernatant was then analyzed for TC, EC, and ENT using defined substrate tests with dilutions to the supernatant made with DI water (IDEXX, Westbrook, Maine). The remaining sediment from each 1 cm section was oven dried at 50 °C, and stored for analysis of grain size. The concentration s_i was taken as the geometric mean of FIB concentrations in the top 1 cm of each sample, and is reported in Table 1.

An important assumption of this formulation is that sediment concentrations are constant over the two-week study period. Unpublished sediment data collected on a daily to weekly basis in nearby Santa Ana River wetlands show sediment concentrations of FIB increase at least one log unit immediately following storms, and subsequently decrease over a period of several days to weeks; but during dry-weather periods sediment concentrations are relatively uniform (Ambrose, 2004). This assumption would no longer be appropriate were the model used for wet-weather conditions or to predict variability on seasonal time scales.

The hydrodynamic equations, FIB transport equations, and mass balance equation for FIB build-up/

die-off on inter-tidal mudflats were integrating using a common time step of 0.2 s on an unstructured grid of 11732 quadrilateral cells encompassing all the wetted and inter-tidal portions of the channel network shown in Fig. 1. The flow and transport equations were solved by a finite volume numerical method described and validated for this study site by Arega and Sanders (2004). The build-up/die-off model for the load due to bird feces was solved using a backwards Euler discretization, for stability purposes and without concern for time-stepping errors due to the very small time step. The time of flooding, t_f appearing in Eq. (5) is determined in the model as the moment that all four nodes of a cell first become submerged by the rising tide. The solution of this model gives a spatially and temporally varying prediction of FIB concentrations in the wetland resulting from loading by urban runoff, bird feces, and sediment resuspension.

To summarize, nine different FIB concentration fields were predicted for the 15 day period beginning May 2, 2000 based on three different sources of three different FIB groups. Urban runoff loads were modeled by several point sources located at inland sites. Bird feces loads were modeled by a build-up, wash-off model: bacteria concentrations build up on inter-tidal mudflats and wash off (to surface waters) with the rising tide. Sediment loads were modeled by a non-point source that is scaled by the shear stress on the bed. For all nine predictions, the model accounts for FIB advection, dispersion, and die-off. Initial conditions for the model were obtained by a spin-up procedure. Starting with an FIB concentration of zero, predictions were made for two sequential 15 day periods, and results of the second 15 day period were saved and used for analysis purposes. Forcing data such as the ocean tide record, solar radiation data, and bird census data were simply duplicated into 30 day records. Finally, predictions were compared to FIB measurements at PCH and BRK monitoring stations (Fig. 1) reported by Grant et al. (2001, 2002). Water level, velocity, and turbidity data for PCH and BRK reported by Grant et al. (2001) were also utilized for model validation purposes.

2.3. *Uncertainty in Model Predictions*

Uncertainty in FIB predictions is due to several factors including: (a) approximations inherent to the mathematical representation of FIB transport processes; (b) errors incurred during the numerical solution of the mathematical model; and (c) uncertainty in model parameters and in particular, parameters that characterize point and non-point loads of FIB. Uncertainties in parameter values were estimated based on standard errors or literature reported values, where possible. Otherwise, a conservative estimate of 50% was used. Table 1 presents uncertainty estimates. In cases involving FIB concentrations, uncertainties may be 200–500%. By comparison, uncertainty associated with the mathematical model and numerical method are relatively small, roughly 20% and 1%, respectively, based on previous modeling efforts (Arega and Sanders, 2004). Therefore, the propagation of uncertainty in the model was ignored for the purpose of determining uncertainties in predicted FIB concentrations, and emphasis was placed on the uncertainty in loading terms (Holman, 1978). Hence, the relatively uncertainty in FIB predictions was assumed to be equal to the relative uncertainty in the corresponding FIB load. Based on the preceding model formulation for urban runoff, bird, and sediment loads of FIB, spatially and temporally averaged loading rates follow as:

$$L_R = (Q_R + 7Q_P)c_R, \tag{7}$$

$$L_B = \overline{n_b} r, \tag{8}$$

$$L_S = sE \frac{\langle \overline{\tau} \rangle}{\tau_0} \left(\frac{\tau_0}{\tau_c} - 1 \right) \overline{A_S}, \tag{9}$$

where the overbar notation indicates a time-average value, the angled brackets indicate a spatial average, A_S represents the submerged surface area of the wetland, and the subscripts R, B, and S denote loads from runoff, bird droppings, and sediments, respectively. The upper limit of uncertainty was estimated by a conventional variational method (Taylor and Kuyatt, 1994), but this method predicted negative loads at the lower limit. Hence, the lower limit of the loads were estimated by computing the load based on lower limit parameter values. After upper and lower uncertainties for each of the nine FIB loads were estimated, these were normalized by the corresponding load to obtain relative uncertainties.

3. Results

Model predictions of water level and velocity during the study period compare well to measurements, as shown in Fig. 2. This indicates that the dominant circulation pattern in the wetland, which drives the mixing and flushing of FIB, is resolved. The spatial distribution of TC predictions at mid-flood tide are shown in Fig. 3 for the case of loading by bird feces (left panel), urban runoff (center panel) and sediment resuspension (right panel). For the case of loading by urban runoff, where FIB enter the wetland far inland along the channels and transport to the marsh during the ebb, the mid-flood condition highlights the transport of (assumed to be) FIB-free ocean water into the main channel of the marsh while remnant wetland water is displaced either into the fringes of the marsh or inland along the channels (note the gradient in FIB between the

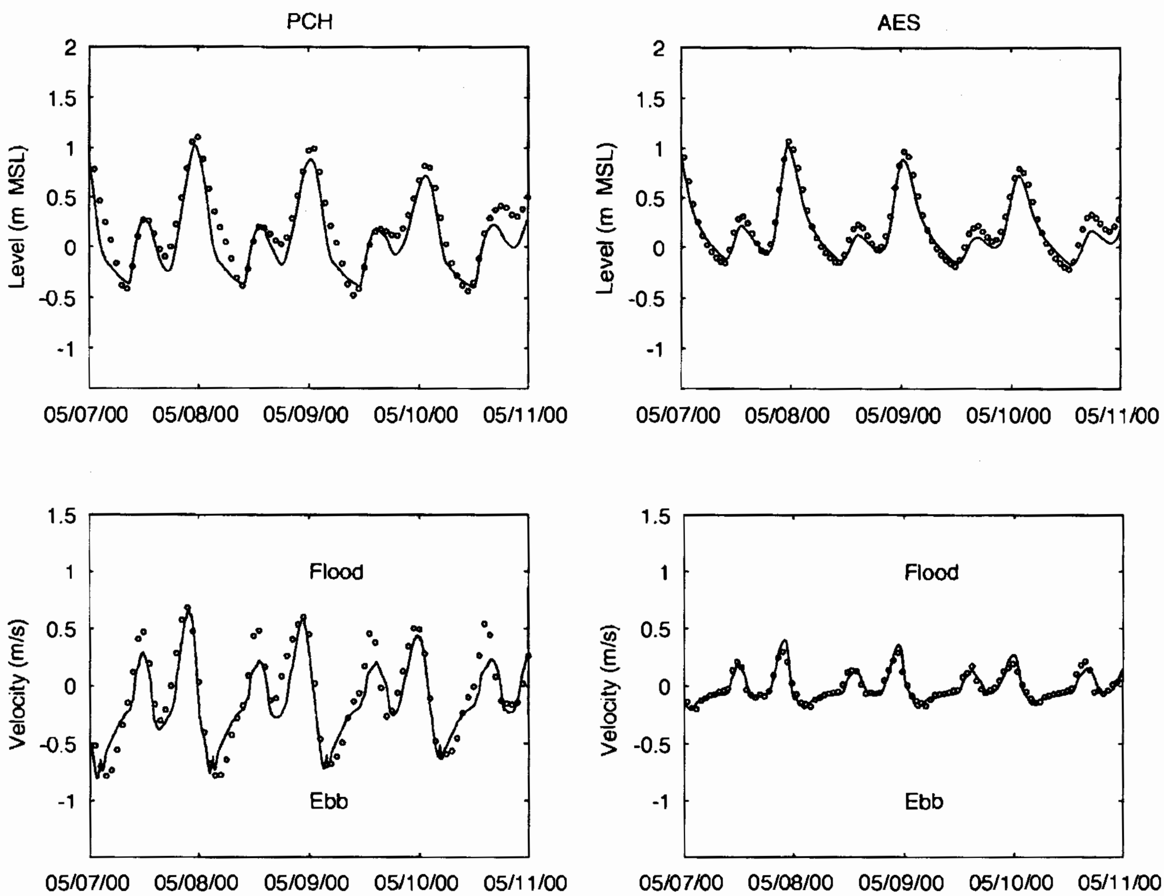

Fig. 2. Comparison of model predicted water level (top) and velocity (bottom) to data reported by Grant et al. (2001). Solid line corresponds to model prediction, symbols correspond to data.

main channel and the fringes of the marsh). For the case of loading by bird feces, model predictions illustrate the concentration of TC near the banks and over the shoals of the marsh. This is an expected response since FIB loading is modeled at the interface between wet and dry land. For the case of loading by sediment resuspension, FIB concentrations are relatively uniform across the marsh, compared to forcing by urban runoff or bird droppings. A similar distribution is predicted for EC and ENT.

Model predictions and measurements of FIB for the two-week study period are shown for BRK and PCH in Figs. 4 and 5, respectively, along with water level and turbidity. The tide record shows the spring-neap-spring transition. Note that water levels in the marsh do not drop far below -0.5 m–MSL due to hydraulic choking which occurs during the ebb at the outlet, where the minimum bed elevation is close to -0.7 m–MSL. FIB predictions vary considerably depending upon the type of loading, both in terms of magnitude and variability, particularly at 1 and 2 cycles per day. In addition, the variability of each prediction appears unique. Therefore, the phasing and magnitude of FIB predictions for each load type (i.e., urban runoff, bird feces, or sediment) can be utilized to help determine the contribution towards observed FIB concentrations. Pearson correlation coefficients were computed to quantify how well each prediction captured the variability, or phasing, of measured FIB concentrations and are shown in Table 2. Mean values of each prediction, and uncertainty based on loading rate uncertainty, are listed in Table 3. Mean values of measured FIB, along with standard errors based on $N = 360$ are also shown for comparison purposes. The "combined" FIB time series referenced in Tables 2 and 3 represent the sum of the three FIB predictions (i.e., urban runoff, bird feces, and sediment), a valid operation for linear transport equations. That is, the combined FIB time series is precisely what the model would have predicted had each of the forcing factors been incorporated into a single

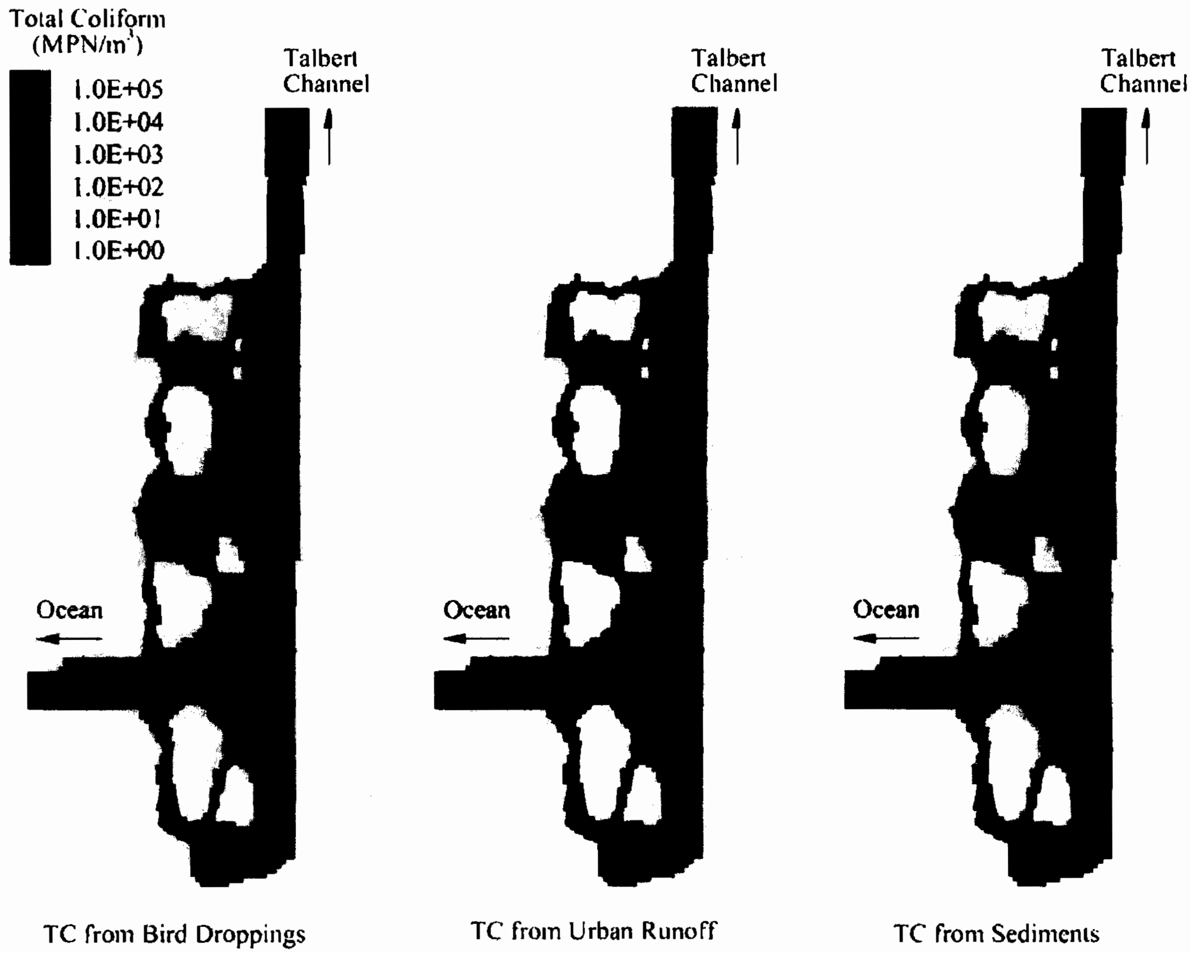

Fig. 3. Contours of total coliform in Talbert Marsh predicted by the model for mid-flood tide. Black lines indicate velocity direction and relative magnitude.

simulation. To obtain the mean value, the combined time series was first log-transformed. The combined series is not shown in Figs. 4 and 5, but at any given instant it basically tracks the largest of the three curves representing different forcing factors.

TC at PCH are predicted remarkably well based on loading by sediment resuspension, as shown in Fig. 5. The mean of log transformed measurements, log 10(TC) $= 2.17(\pm 0.04)$, or "log mean", compares well with the log mean of predictions log 10(TC) $= 2.25(+0.45/-1.02)$; and there is a moderate correlation ($R^2 = 0.58$, $p_{N=360} < 0.01$) between log transformed predictions and measurements on an hourly basis. Predictions based on loading by urban runoff compare best to measurements at the end of the ebb tide, particularly during the second week of the study when pump stations contributed runoff to the channels, but not at other phases of the tide and this is reflected by a weaker but significant correlation ($R^2 = 0.37$, $p_{N=360} < 0.01$). Predictions based on bird feces loading appear at least three orders of magnitude too small to account for observed TC.

Similar trends can be observed at BRK. Predictions based on both urban runoff and sediment loading are large enough to account for measured FIB, though in this case measurements correlate better to the prediction based on runoff ($R^2 = 0.56$, $p_{N=360} < 0.01$) than sediment resuspension ($R^2 = 0.26$, $p_{N=360} < 0.01$). The prediction based on bird feces loading is too small to account for observed TC. When predictions based on all three forcing factors are added together (valid for linear tranport equations), the prediction at BRK correlates slightly better ($R^2 = 0.58$, $p_{N=360} < 0.01$) and the magnitude of the signals compare well (Table 3).

For ENT and EC, trends in model predictions are similar to TC. However, trends in measured FIB differ. Both ENT and EC measurements compare best to predictions based on sediment resuspension loading, both in terms of geometric mean concentrations

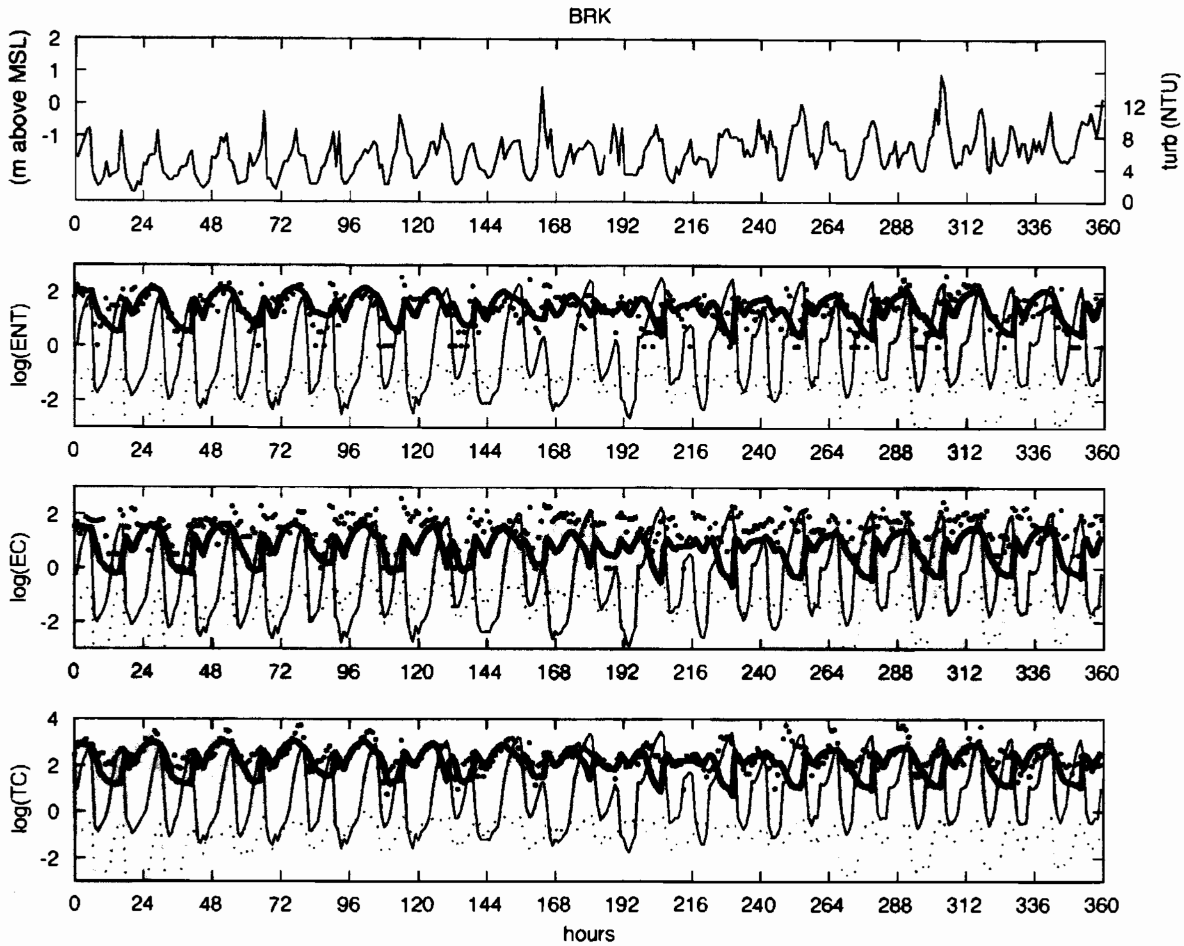

Fig. 4. BRK results. Water level and turbidy reported by Grant et al. (2001) shown in top panel. Bottom three panels show FIB concentrations: data from Grant et al. (2001, 2002) (dots), prediction based on sediment loading (heavy line), prediction based on runoff loading (light line), and prediction based on bird loading (broken line). FIB concentrations reported as log 10 (MPN/100 ml).

(Table 3) and the correlation coefficient (Table 2). Predictions based on bird feces loading are several log units too small to account for measured concentrations. Predictions based on urban runoff loading are comparable in magnitude only at the end of the ebb tide, and do not correlate to measurements.

Correlations between turbidity measurements and FIB measurements over the first six days were also computed and these appear in Table 4 (Due to drift in the turbidity data, the second week of data was excluded.) Turbidity correlates best to TC, compared to ENT and EC, and the correlation is stronger at BRK than PCH. Correlations between turbidity measurements and FIB predictions based on loading by urban runoff and sediment resuspension were also computed. Predictions based on urban runoff loads serve as an index of particulate material transported from upstream (fine mineral particles, detritus, and plankton) where flow is quiescent, while predictions based on sediment loads serve as an index of material eroded locally in the lower reaches of the wetland where the shear is greatest. At BRK the turbidity signal correlates better with FIB predictions based on runoff forcing ($R^2 = 0.70$, $p_{N=144} < 0.01$) than FIB predictions based on sediment resuspension forcing ($R^2 = 0.19$, $p_{N=144} < 0.01$). At PCH the turbidity signal correlates slightly better with the prediction based on sediment resuspension ($R^2 = 0.57$, $p_{N=144} < 0.01$) than the prediction based on runoff ($R^2 = 0.47$, $p_{N=144} < 0.01$).

4. Discussion

Hydrodynamic model predictions show that tidal cycling of TC, EC, and ENT in Talbert marsh surface waters is driven primarily by two processes: advection of

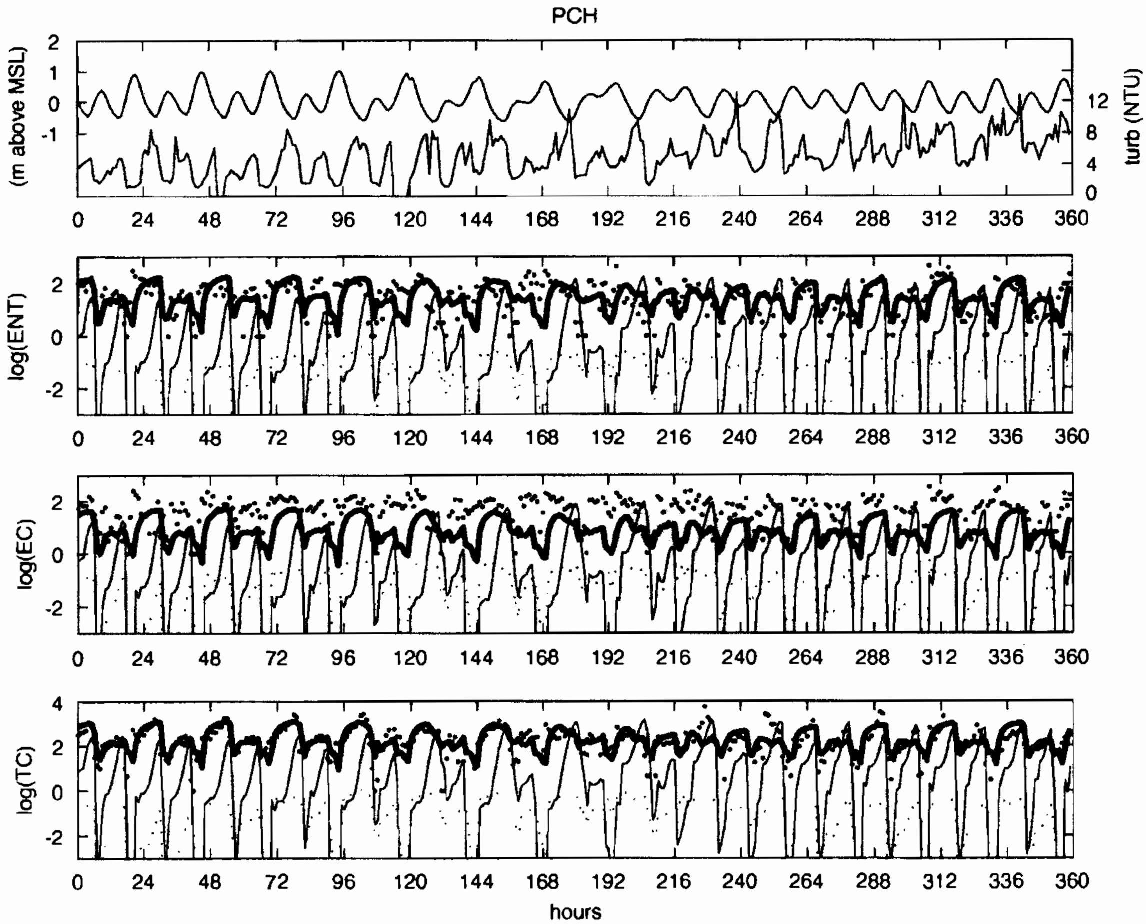

Fig. 5. PCH results. Water level and turbidy reported by Grant et al. (2001) shown in top panel. Bottom three panels show FIB concentrations: data from Grant et al. (2001, 2002) (dots), prediction based on sediment loading (heavy line), prediction based on runoff loading (light line), and prediction based on the bird loading (broken line). FIB concentrations reported as log 10 (MPN/100 ml).

FIB from inland sources (urban runoff) and entrainment of FIB from sediments. Loads of FIB from urban runoff control surface water concentrations inland within the poorly flushed zone while tidal resuspension controls surface water concentrations in the well-flushed zone near the mouth. Therefore, water quality models for FIB in hydrodynamically active wetland surface waters should at minimum account for loads from point sources (storm drains, channels, etc.), loads from resuspended sediments, transport by advection and turbulent dispersion/diffusion, and die-off. The present model captures tidal variability of TC better than EC or ENT suggesting either that processes important to EC and ENT transport are not included in the model, or perhaps the model oversimplifies one or more of the processes that are included in the model. For example, the spatial distribution of EC and ENT in sediments may differ substantially from the TC distribution due to differences in survival and/or regrowth rates. Many studies have shown that FIB can survive for long periods or regrow attached to sediments and vegetation (Savage, 1905; Roper and Marshall, 1979; LaBelle et al., 1980; Davies et al., 1995; Desmarais et al., 2002). In tropical watersheds, regrowth has been cited as the dominant factor affecting bacteria loading in streams (Hardina and Fujioka, 1991; Fujioka et al., 1999). The ability of bacteria to secrete extracellular polymers (collectively termed microbial biofilms) may be one reason why survival and regrowth of FIB is enhanced in sediments (Decho, 2000). A model capable of simulating sediment concentrations of FIB, accounting for these factors, might lead to better EC and ENT predictions. In cases where the size of particles with attached FIB is known, settling can also be included in the model if size

Table 2
Pearson correlation between log transformed enteric bacteria measurements and model predictions ($N = 360$)

	Station	Bird source	Sed. source	Runoff source	Combined
Total	BRK	0.36*	0.26*	0.56*	0.58*
coliform	PCH	0.40*	0.58*	0.37*	0.55*
E. coli	BRK	0.33*	0.35*	0.04	0.39*
	PCH	0.28*	0.33*	0.10	0.22*
Enterococci	BRK	0.27*	0.47*	−0.02	0.36*
	PCH	0.23*	0.34*	0.04	0.24*

*Significant at the 0.01 level (2-tailed).

Table 3
Comparison between predicted and measured geometric mean bacteria concentrations [log10(MPN/100 ml)]

	Station	Bird source	Sed. source	Runoff source	Combined	Measured
Total	BRK	−1.12 (+0.49/ − 0.43)	2.14 (+0.45/ − 1.02)	0.81 (+0.20/ − 0.47)	2.42 (+0.45/ − 1.02)	2.38 (±0.03)
coliform	PCH	−1.39 (+0.49/ − 0.43)	2.25 (+0.45/ − 1.02)	−0.18 (+0.20/ − 0.47)	2.33 (+0.45/ − 1.02)	2.17 (±0.04)
E. coli	BRK	−1.38 (+0.83/ − 0.40)	0.76 (+0.63/ − 1.21)	−0.36 (+0.20/ − 0.44)	1.10 (+0.63/ − 1.21)	1.49 (±0.03)
	PCH	−1.65 (+0.83/ − 0.40)	0.86 (+0.63/ − 1.21)	−1.35 (+0.20/ − 0.44)	0.98 (+0.63/ − 1.21)	1.53 (±0.03)
Enterococci	BRK	−1.56 (+0.56/ − 0.44)	1.39 (+0.43/ − 0.98)	−0.11 (+0.18/ − 0.44)	1.61 (+0.43/ − 0.98)	1.34 (±0.03)
	PCH	−1.85 (+0.56/ − 0.44)	1.42 (+0.43/ − 0.98)	−1.10 (+0.18/ − 0.44)	1.49 (+0.43/ − 0.98)	1.38 (±0.04)

Uncertainty of predictions is shown along with standard error of measurements ($N = 360$).

Table 4
Pearson correlation between turbidity measurements and bacteria predictions and measurements for first six days of study ($N = 144$)

	Station	Sed. source	Runoff source	Combined	Measured
Total	BRK	0.19	0.70*	0.51*	0.56*
coliform	PCH	0.57*	0.47*	0.59*	0.41*
E. coli	BRK	0.20	0.70*	0.56*	0.20
	PCH	0.57*	0.48*	0.60*	0.14
Enterococci	BRK	0.26*	0.70*	0.53*	0.31*
	PCH	0.58*	0.47*	0.60*	0.14

*Significant at the 0.01 level (2-tailed).

dependent settling rates are also known. This would be particularly important if FIB were associated with particles larger than 10–15 μm, in which case accurate settling data would be crucial for reliable predictions.

Both turbidity and FIB are generally associated with fine particles, but in this as well as previous studies (Goyal et al., 1977; Jensen et al., 1979) a strong association between the two has not been observed. In Talbert Marsh, peaks in turbidity and TC are observed at low tide, when brackish water from the upper reaches of the wetland is translated furthest seaward (Figs. 4 and 5). Hence, urban runoff is clearly contributing to the TC signal. On the other hand, there are not clearly defined peaks in the EC and ENT measurements and in many cases EC and ENT are elevated when turbidity values are relatively small. If sediments are the source of these FIB, a possibility strongly supported by model predictions shown here, shear stresses on the bed must be large enough to disturb and saltate surficial sediments, large enough to mix small particles, colloidal matter, and FIB through the water column, but not large enough to suspend the sandy sediments more than a short distance above the bed. Recall that sediments consist of beach sands and silts near the outlet. Hence, water quality models designed to account for the effects of sediment resuspension should be sensitive to differences between the rate of sediment entrainment, and the rate of FIB entrainment. Sediment entrainment formulations adopt the notion that mass transfer occurs when the shear stress on the bed exceeds a certain threshold (Mehta and Dyer, 1990). The entrainment of FIB in surficial pore water or incorporated into microbial biofilms may occur at a much smaller threshold.

The significance of loading due to sediment resuspension explains why tidal wetlands serve to "generate" FIB, as was reported by (Grant et al., 2001). That is, FIB associated with sediment particles, colloidal organic matter, or free living in porewater are supplied to the water column when bottom sediments are disturbed and/or scoured by tidal currents. FIB input to wetlands from wet or dry weather surface water runoff may be temporarily stored in sediments and later resuspended during storm events or during tidal scouring. The relative magnitude of resuspension effects versus die-off and settling effects is likely to control whether or not coastal wetlands are net generators or net accumulators. The results of this study are important to temper expectations that hydrodynamically-active wetlands such as estuaries or streams can provide passive treatment of urban runoff with high concentrations of FIB.

Reeves et al. (2004) reported that over 99% of the annual load of FIB from Talbert Watershed runoff is shed during storm events, while less than 1% is shed during dry-weather periods. It is therefore likely that sediments serve to couple FIB loads from storm water runoff to dry-weather water quality. Additional studies are warranted to characterize the variability of FIB in sediments over seasonal to tidal time scales and in response to storm events, to characterize the spatial variability of FIB, and to understand the mechanisms driving this variability. Do these organisms die-off, deposit, stimulate regrowth, and/or pass through the wetland? Microbiological source tracking methods (DNA fingerprinting, etc.) could also be applied to assess whether FIB in sediments are linked to human sources of fecal pollution (Simpson et al., 2002; Scott et al., 2002).

5. Conclusions

This study successfully employed a first-principle model to predict the dry-weather tidal cycling of FIB in Talbert Marsh, an estuarine, intertidal wetland in Huntington Beach, California. Model predictions show that surface water concentrations of TC, EC, and ENT in the wetland are driven by loads from urban runoff and resuspended wetland sediments. The model more accurately predicts TC than EC or ENT.

The crucial role that sediments play in the cycling of FIB is highlighted by this study. Sediments function as a reservoir of FIB that may accumulate FIB due to regrowth or settling, or shed FIB when tidal currents or storm flows scour away or even just disturb surficial particles. This finding is important to temper expectations that hydrodynamically-active wetlands serve to "treat" FIB from runoff and other sources, and it also explains why wetlands can function as net generators of surface water FIB. That is, generation occurs when the entrainment rate exceeds the rate of die-off and settling.

Additional studies should be conducted to characterized the "memory" of sediments relative to FIB. Knowing the extent to which dry-weather sediment concentrations of FIB are linked to wet-weather runoff loads, dry-weather runoff loads, regrowth or other factors such as bird droppings would help determine which factors predominatly control dry-weather water quality. Additional studies should also be conducted to evaluate the size and settling velocities of particles associated with FIB, and the partitioning of FIB between free-living and particle-associated states. Improved predictions of FIB might result from separately modeling free-living and particle-associated FIB.

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Modeling the dry-weather tidal cycling of fecal indicator bacteria in surface waters of an intertidal wetland

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Abstract

Recreational water quality at beaches in California and elsewhere is often poor near the outlets of rivers, estuaries, and lagoons. This condition has prompted interest in the role of wetlands in modulating surface water concentrations of fecal indicator bacteria (FIB), the basis of water quality standards internationally. A model was developed and applied to predict the dry-weather tidal cycling of FIB in Talbert Marsh, an estuarine, intertidal wetland in Huntington Beach, California, in response to loads from urban runoff, bird feces, and resuspended sediments. The model predicts the advection, dispersion and die-off of total coliform, *Escherichia coli*, and enterococci using a depth-integrated formulation. We find that urban runoff and resuspension of contaminated wetland sediments are responsible for surface water concentrations of FIB in the wetland. Model predictions show that urban runoff controls surface water concentrations at inland sites and sediment resuspension controls surface water concentrations near the mouth. Direct wash-off of bird feces into the surface water is not a significant contributor, although bird feces can contribute to the sediment bacteria load. The key parameters needed to accurately predict FIB concentrations, using a validated hydrodynamic model, are: the load due to urban runoff, sediment erodibility parameters, and sediment concentrations and surface water die-off rates of enteric bacteria. In the present study, literature values for sediment erodibility and water column die-off rates are used and average concentrations of FIB are predicted within 1/2 log unit of measurements. Total coliform are predicted more accurately than *E. coli* or enterococci, both in terms of magnitude and tidal variability. Since wetland-dependent animals are natural sources of FIB, and FIB survive for long periods of time and may multiply in wetland sediments, these results highlight limitations of FIB as indicators of human fecal pollution in and near wetlands.

National Center For Environmental Research

Final Report: Identification and Control of Non-Point Sources of Microbial Pollution in a Coastal Watershed

EPA Grant Number: R828011
Title: Identification and Control of Non-Point Sources of Microbial Pollution in a Coastal Watershed
Investigators: Sanders, Brett , Grant, Stanley B. , Horne, Alex , Keller, Robin , Sobsey, Mark D.
Institution: **University of California - Irvine** , University of California - Berkeley , University of North Carolina at Chapel Hill
EPA Project Officer: Stelz, Bill
Project Period: August 1, 2000 through July 31, 2003 (Extended to January 31, 2005)
Project Amount: $895,234
RFA: Water and Watersheds (1999)
Research Category: Water and Watersheds

Description:

Objective:

The objectives of this study were to: (1) characterize the magnitude and variability of fecal indicator bacteria (FIB) loads in the watershed along an inland to coastal gradient that includes street gutters, storm channels, tidal channels, and the surf-zone at Huntington Beach; (2) examine linkages between FIB and other indicators of human pathogens; (3) develop strategies to control FIB loads during nonstorm periods; and (4) aid decisionmaking by examining the perspectives of stakeholders, including beachgoers, environmentalists, local businesses, public health officials, and wastewater utility managers on various aspects of beach pollution problems, such as the causes, health risks, and responsibility to pay.

California beaches are a critical component of the culture and economy of California and are threatened by coastal pollution. Beach recreation in California accounts for $5.5 billion of the Gross State Product (King and Symes, 2003). Nowhere has there been greater attention on beach pollution than at Huntington Beach in southern California.

Huntington Beach, consisting of Huntington State Beach and Huntington City Beach, is located along a northwest to southeast striking section of the Pacific coastline between Los Angeles and San Diego, in Orange County, California. Several areas of Huntington State Beach have suffered chronic beach postings and closures over the past several years as a result of elevated concentrations of FIB in the surf zone (Kim and Grant, 2004). This beach is very popular (more than 5 million visitors per year), and the combination of surf zone pollution and significant beach usage implies that a large number of people (perhaps as many as 50,000) may acquire highly credible gastroenteritis from swimming and surfing in this area each year (Turbow, et al., 2003). FIB pollution at Huntington State Beach is thought to be caused by a combination of sources, including dry and wet weather runoff from the surrounding community, bird droppings deposited in the Talbert Marsh, and regrowth of bacteria on vegetation and marsh sediments (Grant, et al., 2001; Reeves, et al., 2004). Additional potential sources of FIB include the offshore discharge of partially treated sewage effluent (Boehm, et al., 2002a), the offshore discharge of power plant cooling water that contains FIB from plant wash-down and other activities (Boehm, et al., 2002b), resuspension of contaminated sediments (Sanders, et al., 2004), bather shedding, the accumulation of bird droppings along the shoreline and offshore, the exfiltration of sewage-contaminated groundwater, and contributions from watershed outlets located north and south of the study area, including the Los Angeles River, the San Gabriel River, and outlets for Huntington Harbor and Newport Bay (Kim, et al., 2004).

This project focuses on the Talbert Watershed in Huntington Beach and Fountain Valley, California, which drains to Huntington Beach and is a significant stressor of Huntington Beach water quality. The Talbert Watershed encompasses 3,400 hectares in the cities of Huntington Beach and Fountain Valley. The watershed is urbanized and consists of residential developments, commercial districts, plant nurseries, and light industry. This area of southern California has separate storm water and sanitary sewer systems, therefore, dry and wet weather runoff flows to the ocean without treatment. Runoff from the Talbert Watershed is conveyed along street gutters to inlets that connect to underground storm water pipelines. These pipelines connect to a network of three flood control channels (Fountain Valley, Talbert, and Huntington Beach) that converge near the ocean at a constructed wetland known as the Talbert Marsh. Ocean water floods both the Talbert Marsh and the lower reaches of the open channels during rising tides (flood tides), and a brackish mixture of ocean water and runoff drains from the system during falling tides (ebb tides). The Talbert Watershed is nearly flat and only a few feet above sea level. This geographical setting hinders drainage by gravity alone, so a system of transfer stations is used in the lower reaches of the Talbert Watershed to pump runoff into the open channels from storm water pipelines. Each transfer station, or pump station, consists of a forebay, where runoff can be stored, and several pumps. Pumping of runoff to the channels occurs intermittently during dry weather periods and continuously during storms. Talbert Marsh is a 10-hectare remnant of what used to be an extensive (1,200 hectare) saltwater wetland and dune system in coastal Orange County. The majority of this wetland system was drained and filled over the past century for agricultural reclamation and urban development. Most of what remained of the historical wetland, including Talbert Marsh, was cut off from tidal flushing by the construction of the Pacific Coast Highway and channelization of the surrounding area for flood control. As part of a habitat restoration effort, tidal flushing in the Talbert Marsh was restored in 1990 when a new tidal inlet was constructed. Since its restoration, Talbert Marsh has become a typical southern California tidal saltwater marsh with open water, wetland, and upland habitats (Grant, et al., 2001). Pickle weed (*Salicornia virginica*) is the dominant macrophytic vegetation, and the marsh is utilized by several special-status bird species, including the California least tern, brown pelican, and Beldings savannah sparrow.

Summary/Accomplishments (Outputs/Outcomes):

To achieve the objectives, extensive monitoring of Talbert Watershed surface waters was conducted to measure the spatio-temporal variability of FIB loads (total coliform, *Escherichia coli*, and *Enterococcus*) and analysis was performed to examine the factors that control fate and transport. Monitoring also was performed to examine the association between FIB and other indicators of fecal pollution. Both one-dimensional and two-dimensional hydrodynamic models were developed to analyze the FIB loads in tidal channels and into the surf-zone and to develop a predictive tool that can be used to examine how bacteria loads would be altered by operational changes to the infrastructure. Surveys were performed to measure stakeholder preferences in the context of multi-stakeholder, multi-objective beach pollution problems and to support decisionmaking analysis.

Closure and posting of Huntington Beach, California, during the study period was the source of widespread media attention. In response, members of the research team redirected efforts and/or engaged in a number of additional studies to better understand the factors controlling surface water quality in the Huntington Beach surf zone, as well as the response of stakeholders to the unfolding pollution problem. For example, co-principal investigator (PI) Keller focused attention on the decisionmaking of beachgoers (to swim or not to swim) in response to warning signs posted on the beach. Co-PI Keller also focused attention on the decisionmaking of public agencies, who were under great public pressure to remedy the pollution problem but had little understanding of its cause. To better understand the pollution problem, co-PI Grant analyzed short- and long-term FIB monitoring data to identify trends in Huntington Beach bathing water quality. The observed variability was examined in the context of historical management measures, such as passage of the Clean Water Act, construction of a new ocean outfall, and efforts to prevent urban runoff from draining directly to the beach. Co-PI Grant also developed a method to identify and rank the sources of pollution to the surf-zone using high-frequency monitoring data collected along the beach. PI Sanders teamed with University of California (UC) Irvine and UC San Diego researchers to examine the potential for Orange County Sanitation District effluent, discharged roughly 7 km offshore of Huntington Beach, to be transported onshore by internal tides. After the Talbert Marsh was identified as a contributor of FIB to the Huntington Beach surf zone, co-PI Sobsey focused attention on potential health risks associated with water contaminated with bird feces. In particular, marsh bird feces and surface water was examined for *Campylobacter*, *Salmonella,* and male-specific coliphages.

During dry weather, concentrations of FIB were highest in inland urban runoff, intermediate in tidal channels harboring variable mixtures of urban runoff and ocean water, and lowest in ocean water at the base of the watershed. This inland-to-coastal gradient is consistent with the hypothesis that urban runoff from the watershed contributes to coastal pollution. On a year-round basis, the vast majority (> 99%) of FIB loading occurs during storm events when runoff diversions, the management approach of choice, are not operating. During storms, the load of FIB in runoff follows a power law of the form $L \sim Q^n$, where L is the loading rate (in units of FIB per time), Q is the volumetric flow rate (in units of volume per time), and the exponent n ranges from 1 to 1.5. This power law and the observed range of exponent values are consistent with the predictions of a mathematical model that assumes FIB in storm runoff originate from the erosion of contaminated sediments in drainage channels or storm sewers. (Reeves, et al., 2004)

During dry weather periods, urban runoff controls surface water concentrations of FIB in channels where flushing is weak, and resuspension of FIB from the sediment/water interface controls surface water concentrations near the mouth where flushing by ocean water occurs once per day. The reservoir of FIB at the sediment/water interface is probably linked to settling of bacteria from both dry and wet weather urban runoff, deposition of animal feces, decaying vegetation, and bacterial regrowth. It is not clear whether the FIB are primarily attached to sediments, suspended in pore water, or incorporated into microbial biofilms. Nevertheless, surface water concentrations of FIB are rapidly amplified as turbulence in water column increases. A result is that dry weather urban runoff has little direct impact on surf zone water quality, but significant indirect impact given FIB loads from runoff accumulate at the sediment/water interface and are subsequently resuspended and exported to the surf-zone by tidal currents (Grant, et al., 2001; Arega and Sanders, 2004; Sanders, et al., 2004).

During the project period, dry-weather diversions of urban runoff to the sanitary sewer system were implemented to mitigate impacts to the surf-zone, at a cost of at least $6 million to the County of

Orange and City of Huntington Beach. The efficacy of this approach is unclear, because the vast majority of watershed loads are shed during wet weather, whereas during dry weather, the tidal channels and marsh serve to dissipate loads by promoting die-off and settling. On the other hand, diversions presumably serve to reduce loads of other contaminants, including oil, grease, heavy metals, and so forth and, therefore, may be justified on these grounds. To evaluate whether the diversions are justified on the basis of FIB control, a better understanding of the cycling of FIB in sediments is needed. The alternative is to focus management efforts on wet weather controls. For example, if erosion of sediments is driving the loading of FIB, then regular removal of contaminated sediments accumulating in the storm sewer system might be an appropriate management strategy. The creation of distributed wetland treatment systems, in which contaminants in urban runoff are removed near their source, might also prove useful for reducing downstream impacts (Reeves, et al., 2004).

Research lead by PI Sanders shows that numerical modeling can be performed to predict FIB loads in tidal wetlands, analytes that are notoriously difficult to model because of poorly characterized non-conservative processes. The key parameters needed for accurate predictions of FIB loads, using a validated hydrodynamic model, are: (1) the load as a result of urban runoff; (2) sediment erodibility parameters; and (3) sediment concentrations and surface water die-off rates of enteric bacteria. For channels in the Talbert Watershed, literature values for sediment erodibility and water column die-off rates were used and average concentrations of indicator bacteria were predicted within one-half log unit of measurements. Total coliform were predicted more accurately than *E. coli* or enterococci, both in terms of magnitude and tidal variability. This work is important because it represents the first case where first-principle models were successfully applied to predict FIB in an estuarine setting with significant nonpoint sources. The approach adopted here is highly transferable and could benefit both wetland restoration and water quality compliance efforts on a widespread basis (Sanders, et al., 2004).

Plume tracking studies conducted by UC Irvine and UC San Diego researchers, including PI Sanders, show that Orange County Sanitation Department (OCSD) effluent occasionally moves shoreward toward Huntington Beach into water less than 20 m deep. Analyses of current and temperature observations indicate cold water is regularly advected crossshelf, into and out of the nearshore, at both semi-diurnal and diurnal frequencies. Isotherms typically associated with the wastefield near the outfall are observed just outside the Huntington Beach surf zone, where the total depth is less than 6 m, highlighting the extent of the cross-shelf transport. This advection is attributed to a mode 1 internal motion, or internal tide. Based on this analysis, it is not possible to rule out the possibility that the OCSD plume contributes to poor bathing-water quality at Huntington Beach (Boehm, et al., 2002a). Concerned over potential shoreline impacts, OCSD began a disinfection program in 2002 and initiated a roughly $300 million program to build the necessary infrastructure for full secondary treatment.

Analysis of Huntington Beach monitoring data lead by co-PI Grant shows that the concentration of FIB varies over time scales that span at least seven orders of magnitude, from minutes to decades. Sources of this variability include historical changes in the treatment and disposal of wastewater and dry weather runoff, El Niño events, seasonal variations in rainfall, spring-neap tidal cycles, sunlight-induced mortality of bacteria, and nearshore mixing. On average, total coliform concentrations have decreased over the past 43 years, although point sources of shoreline contamination (storm drains, river outlets, and submarine outfalls) continue to cause transiently poor water quality. These transient point sources typically persist for 5 to 8 years and are modulated by the phase of the moon, reflecting the influence of tides on the sourcing and transport of pollutants in the coastal ocean. Indicator bacteria are very sensitive to sunlight; therefore, the time of day when samples are collected can influence the outcome of water quality testing. These results demonstrate that coastal water quality is forced by a complex combination of local and external processes and raise questions about the efficacy of existing marine bathing water monitoring and reporting programs (Boehm, et al., 2002b). Further analysis led by co-PI Grant reveals that protocols used to decide whether to post a sign are prone to error. Errors in public notification (referred to here as posting errors) originate from the variable character of pollutant concentrations in the ocean, the relatively infrequent sampling schedule adopted by most monitoring programs (daily to weekly), and the intrinsic error associated with binary advisories in which the public is either warned or not. We derived a probabilistic framework for estimating posting error rates, which at Huntington Beach range from 0 to 41 percent, and show that relatively high sample-to-sample correlations (> 0.4) are required to significantly reduce binary advisory posting errors. Public misnotification of coastal water quality can be reduced by utilizing probabilistic approaches for predicting current coastal water quality, and adopting analog, instead of binary, warning systems (Kim and Grant, 2004).

Research lead by co-PI Sobsey on the potential health risks of bathing water contaminated by bird feces has lead to only preliminary findings. Specifically, *Campylobacter* and male specific coliphages were identified in Talbert Marsh bird feces and in marsh surface waters near the marsh. *Salmonella* was found only in bird feces samples and not water samples. Analysis continues to understand the relationship between microbes in bird feces and surrounding surface waters, and potential health impacts.

Research lead by co-PI Keller indicates that stakeholders share diverse opinions about the causes of beach pollution, the risks to beachgoers, and the responsibility to pay. In the context of a multi-objective decision model, stakeholders disagree on the appropriate weights of objectives. For example, local businesses heavily weigh economics whereas beachgoers heavily weigh health risks. Stakeholders also disagree on the severity of pollution problems. For example, environmentalists believe the probability of an environmental health problem is high when beaches are posted, but beachgoers do not. Relative to beachgoers' perceptions of potential health risks, surveys showed a peer effect: decisions to enter the water at posted beaches were strongly affected by whether or not others were in the water (Biswas and Keller, 2004; Biswas, et al., 2004).

Conclusions:

The vast majority of FIB loads in runoff from the Talbert Watershed are shed during storms and are associated with particles that appear to be scoured from the water collection system, including street gutters, storm pipes, and storm channels. Loads in runoff during dry weather periods account for roughly 1 percent of the annual runoff load and dissipate within the tidal channels by a combination of die-off and settling.

Loads exported from the watershed to the surf zone during dry weather period are deflected along the shoreline by wave driven currents and can cause exceedances of water contact recreation standards. Model predictions show the origin of such loads is the scouring by tidal currents of FIB at the sediment/water interface of tidal channels and Talbert Marsh. FIB at the sediment/water interface are linked to urban runoff FIB loads during both dry and wet weather periods, bird droppings, decaying vegetation, and bacterial regrowth. Because intertidal wetlands are to some extent natural generators of FIB, these results call into question the exclusive use of FIB as the basis of water contact recreation standards at beaches near the outlet of these water bodies.

On the basis of FIB control, the efficacy of dry weather diversions in Talbert Watershed is unclear, although diversions presumably serve to mitigate other types of pollution as well. A better understanding of the cycling of FIB between the water column and sediments is needed to evaluate the linkages between wet weather and dry weather loads in relation to sediment interactions.

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Type	Citation	Project	Document Sources
Journal Article	Arega F, Sanders BF. Dispersion model for tidal wetlands. *Journal of Hydraulic Engineering* 2004;130(8):739-754.	R828011 (Final)	not available
Journal Article	Boehm AB, Sanders BF, Winant CD. Cross-shelf transport at Huntington Beach. Implications for the fate of sewage discharged through an offshore ocean outfall. *Environmental Science & Technology* 2002;36(9):1899-1906	R828011 (2001) R828011 (Final)	• Full-text: ACS Publications Full Text EXIT Disclaimer • Other: ACS Publications PDF EXIT Disclaimer
Journal Article	Grant SB, Sanders BF, Boehm AB, Redman JA, et al. Generation of enterococci bacteria in a coastal saltwater marsh and its impact on surf zone water quality. *Environmental Science and Technology* 2001;35(12):2407-2416.	R828011 (2000) R828011 (2001) R828011 (Final)	not available
Journal Article	Reeves RL, Grant SB, Mrse RD, Copil-Oancea CM. Scaling and management of fecal indicator bacteria in runoff from a coastal urban watershed in southern California. *Environmental Science & Technology* 2004;38(9):2637-2648.	R828011 (Final)	• Full-text: ACS Full Text EXIT Disclaimer • Other: ACS PDF EXIT Disclaimer
Journal Article	Sanders BF, Arega F, Sutula M. Modeling the dry-weather tidal cycling of fecal indicator bacteria in surface waters of an intertidal wetland. *Water Research*. 2005;39(14):3394-3408.	R828011 (Final)	not available

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urban runoff, non-point sources, coastal wetlands, flood control channels, active control, passive control, decision model, coastal watershed, contaminant transport, decision making, ecosystem modeling, indicator organisms, man-made wetlands, microbial pollution, non-point sources, pathogens, pollution identification and control, pump stations, recreational area, runoff, stakeholders, storm water, stormwater drainage, suburban watersheds, tidal influence, urban runoff, , Water, Geographic Area, Scientific Discipline, RFA, Water & Watershed, Ground Water, Wet Weather Flows, Watersheds, Environmental Chemistry, Environmental Monitoring, Engineering, State, runoff, water quality, California (CA), stakeholders, fecal coliform, coastal watershed, fate and transport, escherichia coli (e. coli), decision model, indicator organisms, ecosystem modeling, stormwater drainage, decision making, active control, pump stations, enterocci, man-made wetlands, storm water, pollution identification and control, community values, contaminant transport, suburban watersheds, recreational area, pathogens, flood control, urban runoff, microbial pollution, non-point sources, bacteriophage, clostridium, forebay water

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Enviro science & Technology

Bird Droppings Are Blamed for Bacteria

By Stanley Allison June 02, 2001 in print edition B-9

A team of UC Irvine researchers has concluded that waterfowl and other animal droppings from a saltwater marsh and the Santa Ana River are a significant source of bacteria contaminating the ocean waters off Huntington Beach.

In a report that will be published in the June 15 issue of Environmental Science and Technology, the researchers point to inherent flaws in the design of the man-made saltwater Talbert Marsh.

Stanley Grant, the UCI professor who led the 18-month study of the ocean contamination problem at Huntington Beach, said water containing fecal bacteria, pesticides, nutrients and other materials filters through the marsh and then flows into the ocean in about 40 minutes– which is too fast.

For the marsh to act as a natural cleanser and remove contaminants, the water must spend at least a week filtering through the wildlife preserve, Grant said.

Even though other sources such as urban runoff from the Santa Ana River may have contributed to the contamination that resulted in four miles of beach closures for most of the summer of 1999, the levels of bacteria from the marsh were hundreds of times more than the state limits, the researchers said.

The team's conclusions contradict the accepted environmental theory that wetlands purify contaminated water flowing into the ocean.

The findings suggest that approximately 4.6 million saltwater marshes in the U.S. could be similarly affected, Grant said.

Mark Gold, a spokesman for the conservation group Heal the Bay, said that finding animal droppings in a nature preserve is nothing new, and insists that marshes still serve as a cleanser for other, more hazardous, contaminates.

"It's not surprising that wetlands are sources of fecal bacteria," Gold said. "What wetlands are great at doing is removing nutrients and metals."

The 25-acre wetlands preserve is on the inland side of Pacific Coast Highway at Brookhurst Street. Part of the Talbert watershed that encompasses 12 square miles in Huntington Beach and Fountain Valley, it attracts thousands of migratory birds and other wildlife each year.

The UCI researchers also say that the nearby AES power plant contributes to the shore's contamination. The study suggests that partly treated sewage released four miles offshore from the Orange County Sanitation District treatment plant is being pulled back to the shore by tides and the plant as it draws water to cool its towers.

Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams

SCCWRP

Established 1969

Liesl L. Tiefenthaler

Eric D. Stein

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Southern California Coastal Water Research Project

Technical Report 542 - January 2008

Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams

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January 2008

Technical Report 542

ABSTRACT

High levels of fecal indicator bacteria (FIB) in surface waters is a common problem in urban areas that often leads to impairment of beneficial uses such as swimming or other contact recreation. Once impaired, common management and regulatory solutions include development of Total Maximum Daily Loads (TMDLs) and other water quality management plans. A critical element of these plans is establishment of a "reference" level of exceedances against which to assess management goals and TMDL compliance. Unfortunately, existing "background" or reference data on contributions of FIB from undeveloped catchments during dry weather is limited to a small number of locations measured at few time points. The goal of this study was to provide information on indicator bacteria contributions from natural streams in undeveloped catchments throughout southern California during dry weather, non-storm conditions. Specific questions addressed were: a) What are the "background" ranges of concentrations of FIB associated with dry weather flow from reference areas? b) What is the frequency with which reference FIB levels exceed relevant water quality standards? c) How does seasonality influence stream FIB levels associated with reference areas? and d) How do the ranges of FIB concentrations associated with reference areas compare with those associated with urban (developed) areas? To help establish a regional reference data set, bacteria levels (i.e. *Escherichia coli* (*E. coli*), enterococci and total coliforms)) were measured from 15 unimpaired streams in 11 southern California watersheds weekly for one full year. A total of 590 water samples were collected from spring 2006 through spring 2007. Results were compared with data from the developed Ballona Creek watershed and to established State of California bacteria standards. Concentrations measured from reference areas were typically between one to two orders of magnitude lower than levels found in developed watersheds. The absence of *B. thetaiotaomicron* indicated that the FIB in reference streams were likely of non-human origin. Nearly 82% of the time, samples did not exceed daily and monthly bacterial indicator thresholds, demonstrating good bacteriological water quality in natural streams throughout southern California. *E. coli* had the lowest daily percent exceedance (1.5%). A total of 13.7% of enterococci exceeded daily thresholds. The average measured enterococci levels of these exceedances was 292 MPN/100 ml, with a maximum of 2098 MPN/100 ml and a minimum of 160 MPN/100 ml. Indicator bacteria levels fluctuated seasonally with an average of 79% of both enterococci and total coliforms exceedances occurring during summer months (June-August). Temperature, at all sites, explained about one-half the variation in total coliforms density suggesting that stream temperatures regulated bacterial populations. Studies of human health risk associated with natural bacteria levels have not been conducted, but the levels observed in this study are below those reported to cause risk in freshwater systems with known human sources of FIB. Accounting for natural background levels will allow for management targets that are more reflective of the contributions from natural sources. Additional monitoring during wet weather is warranted to further characterize background bacterial contamination in southern California reference waterbodies.

Keywords: Dry Weather Water Quality, Indicator Bacteria, Reference Condition, Background Water Quality, TMDL

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TABLE OF CONTENTS

ABSTRACT i
ACKNOWLEDGEMENTS ii
TABLE OF CONTENTS iii
LIST OF TABLES iv
LIST OF FIGURES v
INTRODUCTION 1
METHODS 2
Sampling Sites 2
Sampling 2
Laboratory Analysis 3
Data Analysis 3
RESULTS 5
Background Bacteria Concentrations and Fluxes 5
Frequency of Exceedance of Bacteria Standards at Natural Sites 5
Temporal and Spatial Patterns in FIB Levels 6
Perennial vs. Non-perennial Streams 6
Relationship of Bacteria Levels to Environmental Variables 6
DISCUSSION 8
Conclusion and Future Research 10
REFERENCES 12
APPENDIX A - SUMMARY BACTERIA DATA FOR ALL NATURAL STREAM SITES 30
APPENDIX B - SUMMARY OF PHYSICAL PARAMETERS AT ALL NATURAL STREAM SITES 39
APPENDIX C - INTERLABORATORY CALIBRATION RESULTS 41

LIST OF TABLES

Table 1. List of natural stream sampling sites, characteristics and their median monthly fecal indicator bacteria densities (MPN/100 ml). 16

Table 2. State of California marine water quality standards for fecal indicator bacteria as established in Assembly Bill 411. Currently a freshwater quality standard for total coliforms does not exist. 17

Table 3. Assessment of percent exceedances between counties in southern California during the present study. A [1] represents those counties in which samples were collected only during spring and/or summer due to intermittent streams with less stable flow regimes. 18

Table 4. Percent single-sample exceedance of fecal indicator bacteria (FIB) levels in natural streams during dry weather from May 2006-May 2007. Numbers in bold are significantly different (p <0.01). 19

Table 5. Correlation table (r^2 values) between water quality variables and fecal indicator bacteria (FIB) during dry weather in natural streams in southern California between May 2006-May 2007. Significant correlations (p<0.04) are shown in bold, while significant correlations (p<0.001) are both bolded and in italics. 20

Table A1. List of natural stream sampling sites, characteristics and their daily fecal indicator bacteria densities (MPN/100 ml). 31

Table A2. Monthly *E. coli* geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 32

Table A3. Monthly enterococci geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 33

Table A4. Monthly total coliforms geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 34

Table A5. Dry season *E. coli* geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 35

Table A6. Dry season enterococci geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 36

Table A7. Dry season total coliforms geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 37

Table A8. Annual dry season fecal indicator bacteria geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA. 38

Table B1. Annual dry season averages of measured physical parameters in natural streams during May 2006-May 2007 in southern California, USA. 40

Table C1. List of participating laboratories and counties involved in the reference bacteria/watershed interlaboratory calibration 43

Table C2. List of the six common samples and their representative sewage dilutions in (ml) which each laboratory received for the interlaboratory calibration. 43

LIST OF FIGURES

Figure 1. Map of natural stream sampling sites and their respective catchments within southern California. 21

Figure 2. Comparison of dry weather log10 fecal indicator bacteria (FIB) densities (± standard deviations) between natural streams in undeveloped watersheds and developed Ballona creek watershed from May 2006-May 2007 in southern California, USA. 22

Figure 3. Dry season fecal indicator bacteria cumulative density frequency plots (CDFs) of natural streams relative to freshwater quality standards from May 2006 to May 2007 in southern California, USA 23

Figure 4. Mean monthly temperature (°C) and dissolved oxygen (mg/L) comparison (a) and geomean total coliform densities in natural streams in southern California (b) between May 2006 and May 2007. Summer months (June-August) were substantially higher than all other seasons ($p < 0.01$). E. coli and enterococci exhibited similar results. The dotted line indicates the 30-d geomean for total coliforms equal to 1,000 MPN/100 ml. All points above the line represent bacteria water quality exceedances. 24

Figure 5. *E. coli* a) and enterococci b) geomean densities in natural streams in southern California between May 2006 and May 2007. Summer months (June-August) were substantially higher than all other seasons. The dashed line indicates the monthly water quality standard equal to 235 MPN/100 ml and 104 MPN/100 ml for *E. coli* and enterococci respectively. All points above the line represent bacteria water quality exceedances 25

Figure 6. Perennial and non-perennial stream comparison of log10 fecal indicator bacteria densities (MPN/100 ml) in southern California during the present study. The dotted line indicates the State single-sample bacterial water quality criterion. Significant differences in indicator densities existed between streams but ranges generally overlapped ($p < 0.05$). Boxplots show mean, median, 25th and 75th percentiles. 26

Figure 7. Natural stream temperatures in southern California versus total coliform densities (MPN/100 ml) during dry weather for an entire year. Solid line indicates the exponential trend line ($r^2 = 0.48$). 27

Figure 8. Distribution of log *E. coli* a); enterococci b); and total coliforms c) concentrations in natural streams, streams with minor perturbations, and in developed Ballona Creek watershed in southern California, USA. Natural streams were significantly lower then all other streams ($p < 0.001$). Minor perturbation streams were significantly lower than developed Ballona Creek ($p < 0.001$). 28

Figure 9. Distribution of log *E. coli* a); enterococci b); and total coliforms c) concentrations in natural streams during dry weather (present study) compared to wet weather (Natural Loadings; 2003-2005 and Los Angeles River watershed; 2001-2005) studies in southern California, USA. Dry weather bacteria concentrations were significantly lower then wet weather concentrations ($p < 0.001$) 29

Figure C1. Laboratory comparison results for log transformed total coliform data at Santiago Creek, Orange County. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count. 44

Figure C2. Laboratory comparison results for *E. coli* using a 3 ml sewage dilution. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count........ 45
Figure C3. Laboratory comparison results for Enterococcus using a 1 ml sewage dilution. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count........ 46

INTRODUCTION

The presence of fecal indicator bacteria (FIB) in surface waters is a prevalent concern for many municipalities, health departments, and regulatory agencies. Persistent or excessive bacteria levels often result in reduced opportunities for beneficial uses such as swimming, and may lead to waterbodies being listed as impaired under Section 303(d) of the Clean Water Act. Approximately 280 waterbodies are listed as impaired in the Los Angeles, Santa Ana, and San Diego regions (http://www.swrcb.ca.gov/tmdl/303d_lists.html). Management of impaired water bodies may involve development of Total Maximum Daily Loads (TMDLs), issuance of National Pollutant Discharge Elimination System (NPDES) permits, or development of water quality plans that are intended to reduce bacteria levels to a point where water quality standards are met and beneficial uses are protected. An important step in the development of TMDLs and other water quality management plans is to identify all sources of the constituent(s) of concern in order to accurately quantify loads and set appropriate management or regulatory targets. One of the challenges in developing appropriate targets is accounting for biogenic inputs, or the natural contribution from undeveloped catchments.

Most watersheds consist of both developed and undeveloped areas, both of which can contribute bacteria to streams via surface runoff. Bacteria associated with runoff from urban surfaces are well documented (Gore & Storrie Ltd. and Proctor & Redfern Ltd. 1981, USEPA 1993). For example, (Stein *et al.* 2007) observed that recreational (horse) and agricultural land uses in Los Angeles, CA contributed substantially higher storm fluxes for *Escherichia coli* (*E. coli*). Additional investigations by Bay and Schiff (1998), Noble *et al.* (2000) and Stein and Tiefenthaler (2005) found freshwater outlets such as storm drains to be especially high contributors of dry-weather FIB contamination.

Natural areas can also be a source of bacteria originating from wildlife, including birds and mammals, pets, and livestock (Griffith *et al.* 2006). Grant *et al.* (2001) found that enterococci bacteria generated in a restored wetland had greater effect on coastal water quality than dry season urban runoff. The presumed sources of these bacteria were birds that used the tidal salt marsh as habitat. (Ahn *et al.* 2005) also recognized that natural sources could be significant contributors to total bacteria levels in urban storm water in southern California. However, most previous studies have focused on either short measurements during or immediately following storm water runoff or on bacteria in coastal waters (beaches). Few studies have attempted to quantify naturally occurring background levels of bacteria in streams during baseflow (i.e. non-storm) conditions over an extended period of time. This data gap is critical because the non-storm period is when streams and the coastal waters they drain to receive the most human use and thus the potential risk is highest.

The goal of this study is to establish a "reference" level of bacteria that can be used to set appropriate water quality management targets. More specifically, we address the following questions: a) What are the "background" ranges of concentrations of FIB associated with dry-weather runoff from natural areas? b) What is the frequency with which reference FIB levels exceed relevant water quality standards? c) How does seasonality influence stream FIB levels associated with reference areas? and d) How do the ranges of FIB concentrations associated with reference areas compare with those associated with urban (developed) areas?

METHODS

The overall approach to the study was to characterize dry weather bacteria levels at a set of sites that is representative of existing natural conditions in southern California. The specific study design consisted of an intensive sampling regime with collection of weekly dry weather bacteria data for an entire year.

Sampling Sites

Fifteen sites were selected for inclusion in the study based on criteria developed by Stein and Yoon (2007, Stein and Yoon In press). Criteria were designed to ensure that sampling would capture natural conditions without influence from any land-based anthropogenic input. The criteria included: 1) contributing drainage area should be at least 95% undeveloped. 2) sites should be in a relatively homogenous setting in terms of underlying geology and landcover, 3) sites should have either year-round or prolonged dry-weather flow to allow sampling during at least a portion of the dry season, and 4) sites should not be within watersheds that have burned during the previous three years. Although fire can be a natural occurrence, inclusion of sites in burned catchments would have added a confounding factor and, therefore, were excluded. Catchment land use was determined by plotting watershed boundaries over (year 2003) land cover maps from the (National Oceanographic Administration (NOAA) 2003) Coastal Change Analysis Program (CCAP) - http://www.csc.noaa.gov/crs/lca/ccap.html. The 15 selected sites are located across five counties (Los Angeles, Orange, Riverside, San Bernardino and San Diego) and ten different watersheds: Los Angeles River, Los Alisos Canyon, Malibu Creek, Soltice Canyon, San Juan Creek, Santa Ana River, San Jacinto, Cucamonga, Santa Margarita, and San Dieguito (Figure 1, Table 1, and Appendix A).

Sampling

Weekly dry-season sampling was conducted at all 15 sites from May 15, 2006 through May 31, 2007. A site was eligible for sampling if it had not received measurable rainfall for at least 24 h and flow was no more than 20% above baseflow. Weekly sampling continued as long as there was measurable stream flow. For intermittent streams, sampling was suspended once the stream was too low to sample. Based on these criteria, the duration of sampling ranged from 9 to 55 weeks (Table 1). Water samples were collected as composite grab samples, with equivalent volumes collected from three different points across the stream (approximately 10, 50, and 90% distance across). These samples were taken from the flowing portion of the streams at a depth sufficient to exclude surface scum without introducing bottom sediment. A replicate water sample was collected in the same way after completion of the initial water sample for approximately 25% of the samples. A field blank sample was also collected at each site once a month. All water samples were collected in presterilized 125 ml high-density polyethylene (HDPE) sample bottles. Collected water samples were immediately placed on ice and transported to the laboratories within 6 h of sample collection for subsequent analyses.

At each sampling location and during each round of sample collection, water quality readings (i.e. temperature (°C), dissolved oxygen (DO) mg/L, pH, turbidity, and conductivity (μS/cm)) were measured using hand held field probes (i.e. Orion 125, YSI 63 and Horiba U-10). Measurements were taken in triplicate at each transect. In addition, physical and biological parameters of the site and general climatic conditions were recorded and documented (using both data forms and photo documentation). Stream discharge was measured as the product of the channel cross-sectional area and flow velocity. Channel cross sectional area was measured in the field. At each sampling event, velocity was measured using a Marsh-McBirney Model 2000 flow meter (Frederick, MD). The velocity, width, and depth were measured at three points along each transect. Flow for each transect subsection was computed and summed for a total flow for the transect. Values from three transects were averaged to estimate overall flow at each site (Rantz 1982).

Laboratory Analysis

Water quality samples were analyzed for four bacteria indicators; *E. coli*, enterococci, total coliforms and *Bacteroides thetaiotaomicron*. Enterococci, total coliforms and *E. coli* were measured by the chromogenic substrate method using Enterolert® for enterococci and Colilert® for *E. Coli* and total coliforms (Idexx 24 h, Inc.). This commercially available product uses a Multiple Tube Fermentation (MTF) type format with defined substrate technology to detect the presence or absence of bacteria indicator density in a water sample. In this medium, the detection of coliform densities is based upon a color change caused by the reaction of a fluorogen with a bacterial enzyme. This assay is read within 24 hours and coliform densities are reported as most probable number (MPN)/100 milliters (ml). Given the large geography covered by the study and the short holding time required for bacterial analysis, eight laboratories cooperated on sample analysis. Laboratory intercalibration studies were completed to ensure consistent methodology, data quality, and repeatability between laboratories. All laboratories had had good repeatability for all three bacterial indicators and all results fell within the median log comparability criteria. The low variability between labs indicated that interlab differences should not be a confounding factor in interpreting the results of the study. Details of the laboratory intercalibration study are provided in Appendix C.

Bacteroides thetaiotaomicron are anaerobic bacteria that comprise the majority of microorganisms that inhabit the human digestive tract. As such, they may be a more reliable measure of human fecal matter or pathogens than *E. coli* (Bernhard and Field 2000a,b). Samples were analyzed for either presence or absence of *B. thetaiotaomicron* as a negative control for human bacteria sources. This analysis was initiated at a sampling site when the State of CA single-sample water quality thresholds for both *E. coli* and enterococci were exceeded for two consecutive weeks. The presence of *B. thetaiotaomicron* would suggest that bacteria observed in the surface waters were predominantly of human origin. *B. thetaiotaomicron* was measured by DNA extraction followed by polymerase chain reaction (PCR) as described by (Brinkman *et al.* 2003).

Data Analysis

Three analyses were used to characterize FIB levels from natural streams. First the 30-d geomeans, variances, and ranges of concentrations, and fluxes were calculated to provide an estimate of expected baseline bacterial levels. Flux estimates facilitated region wide comparisons among watersheds of varying sizes. Flux was calculated as the ratio of the 30-d geomean or mean yearly bacterial concentration (MPN/100 ml) and contributing watershed area (km^2) at a specific site. Second, dry weather FIB concentrations were compared with the state of CA standards for single-sample and 30-d geomean maximum allowable densities (Table 2).

Cumulative density frequency plots (CDFs) were produced to compare observed bacterial concentrations to the CA quantitative standards and to calculate accumulated relative exceedance percentages. Third, water quality statistics from natural sites were compared with previous data collected from watercourses draining developed areas of the greater Los Angeles basin to determine if significant differences existed between natural and developed areas (Stein *et al.* 2007, Stein and Yoon 2007).

Bacteria data were analyzed for differences between perennial vs. intermittent streams, between developed and undeveloped watersheds, and to assess temporal patterns. Differences in concentration or flux were tested using a one-way analysis of variance (ANOVA), with a significance level $p < 0.05$ (Sokal and Rohlf 1995). Differences based on flow regime were assessed using a Tukey-Kramer post-hoc test for multiple comparisons; differences between developed and undeveloped sites were investigated by comparing median values using a Kruskal-Wallis one-way ANOVA on ranks.

Spatial and temporal patterns were also investigated using Pearson's r correlation coefficient to determine if there were strong associations between FIB concentrations and continuous variables (i.e. temperature and flow; Helsel and Hirsch 2002); the null hypothesis, in this case, is that the correlation coefficient is zero.

RESULTS

Background Bacteria Concentrations and Fluxes

Annual median bacteria fluxes from the natural sites were 2 ± 1.4 MPN/100 ml/km^2, 3 ± 1.7 MPN/100 ml/km^2, and 106 ± 61.4 MPN/100 ml/km^2 for *E. coli*, enterococci, and total coliforms, respectively. *E. coli* and enterococci, median density values at the natural sites (based on single-sample measurements) were 10 MPN/100 ml and 20 MPN/100 ml respectively, while median density values in Ballona Creek are typically in the 10^3 range. Densities and fluxes were significantly lower for all indicator bacteria at the natural sites relative to data from developed areas ($p < 0.001$, Figure 2).

Only two sites exceeded State water quality standards for both *E. coli* and enterococci for two or more weeks during the yearlong study. During the period of exceedance, *E. coli* levels ranged from 327 to 9804 MPN/100 ml while enterococci ranged from 388 to 7270 MPN/100 ml. Repeat exceedances were seen most commonly for enterococci. In both cases, the *B. thetaiotaomicron* samples were negative, suggesting that the bacterial populations represented by the FIB were probably derived from non-human sources.

Frequency of Exceedance of Bacteria Standards at Natural Sites

A total of 18.2% of the indicator bacteria samples (for all three indicators) from the natural sites exceeded daily (single sample) water quality standards. Approximately 14% of enterococci exceeded the daily threshold of 104 MPN/100 ml (Figure 3). The average enterococci level of these exceedances was 292 MPN/100 ml, with a maximum of 2098 MPN/100 ml (Orange County) and a minimum of 160 MPN/100 ml (San Bernardino County). For *E. coli*, 1.5% of the measurements exceeded the single sample standard of 235 MPN/100 ml with a maximum and a minimum of 5500 MPN/100 ml and 241 MPN/100 ml, respectively (Orange County). For total coliforms, 3% exceeded the single sample standard of 10,000 MPN/100 ml.

A total of 39% of enterococci samples from the natural sites exceeded the 30-d geomean water quality standard of 33 MPN/100 ml. The average enterococci level of these exceedances was 47 MPN/100 ml, with a maximum of 744 MPN/100 ml and a minimum of 3 MPN/100 ml. For *E. coli*, approximately 1% exceeded the 30-d geomean threshold of 126 MPN/100 ml with a maximum and a minimum of 146 MPN/100 ml and 1 MPN/100 ml, respectively (Orange County). For total coliforms, 45% exceeded the 30-d geomean of 1000 MPN/100 ml with a maximum and a minimum of 5040 MPN/100 ml and 23 MPN/100 ml, respectively.

Seventy-five percent of enterococci and 83% of total coliforms exceedances occurred during the summer months (June-August, Table 4). In August all indicator thresholds were exceeded with 12.5%, 62.5% and 75% of *E. coli*, enterococci and total coliforms samples exceeding monthly thresholds, respectively (Table 4).

Temporal and Spatial Patterns in FIB Levels

Bacteria levels for all three indicators were significantly higher during the summer than during all other seasons (Table 4, $p < 0.01$). For example, 30-d geomeans for total coliforms were near the water quality standard in May 2006 with levels approximately 878 MPN/100 ml ± 3.2 SD, increased substantially during the summer, exceeding the criterion, peaking in July at 2586 MPN/100 ml ± 3.1 SD (Figure 4b). Total coliform geomeans decreased gradually throughout the winter nearing zero in February, 2007 (289 MPN/100 ml ± 4.2 SD), as stream temperatures fell below 10°C, before gradually returning to baseline geomeans throughout spring, 2007 (Figure 4a and b). Similar seasonal patterns were observed for *E. coli* and enterococci (Figure 5a and b).

Orange County had the highest daily and monthly water quality exceedances for both *E. coli* and total coliforms (12.9%; 25% and 3.2%; 100%, respectively, Table 3). For enterococci, approximately 47% of the San Diego County samples exceeded the daily threshold and 100% exceeded the monthly standard (Table 3). However, the Orange County and San Diego County streams had no flow in winter due to an unusually low 2006-2007 rainfall season, so the results are from only the spring and early summer months and do not represent annual averages that may occur in perennially flowing streams.

Perennial vs. Non-perennial Streams

Background bacteria levels differed based on the duration of stream flow (Table 1, Appendix A). *E. coli* and enterococci densities were significantly different in perennial vs. intermittent streams ($p < 0.05$, Figure 6). Mean $\log_{10}$ concentrations for *E. coli* and enterococci at perennial streams were 1.0 ± 0.4 and 1.3 ± 0.5, respectively. Intermittent streams had higher mean $\log_{10}$ concentrations for *E. coli* and enterococci (1.6 ± 0.5 and 1.8 ± 0.6, respectively). There were no statistical differences between stream types for total coliform densities (mean 2.7 ± 0.6 vs. 3.3 ± 0.4).

Relationship of Bacteria Levels to Environmental Variables

Of the five environmental variables measured (temperature, conductivity, dissolved oxygen, pH, turbidity), only stream temperature exhibited a significant correlation with seasonal FIB levels. Water temperature varied by about 5-10°C at each of the sites, reaching a maximum of 28°C on warm sunny afternoons. Streams located in the foothills (Mill Creek, San Bernardino Co.) or where the creek was significantly shaded had the lowest average temperatures (Table 1, Appendix B). For example streams in San Bernardino County ranged from 650 m to 1200 m in elevation and averaged 12.7°C. The highest monthly average water temperatures (20.4 °C) were recorded in Orange County where streams were approximately 200 m in altitude. Stream temperature and total coliforms were significantly positively correlated (Table 5, $p < 0.001$, $r^2 = 0.48$). A weaker, but still significant, positive correlation existed between stream temperature and *E. coli* or enteroccoci ($p < 0.04$, $r^2 = 0.20$ and $p < 0.04$, $r^2 = 0.26$, respectively). The Pearson's r for these two correlations was between 0.2 and 0.3 suggesting that similar processes may have controlled the relationship between stream temperature and FIB. A strong negative correlation existed between dissolved oxygen and both conductivity or stream temperature (Table 5, $p < 0.05$, $r^2 = -0.5$; $p < 0.001$, $r^2 = -0.84$, respectively). However, few statistically significant relationships existed among the other physical variables.

Total coliform densities increased exponentially at temperatures above 10°C (Figure 7, $r^2 = 0.48$). Dissolved oxygen concentrations varied inversely with stream temperatures throughout the study (Figure 4a). Monthly mean DO concentrations decreased sharply to approximately 8 mg/L at stream temperatures above 15°C, and concentrations increased to approximately 11 mg/L at stream temperatures below 10°C.

DISCUSSION

Enterococci, *E. coli* and total coliforms (FIB) are commonly used indicators of the possible presence of pathogenic (disease-causing) microorganisms in streams and the ocean. As shown in this study, these FIB can be found in natural streams, with populations increasing during warm summer months and persisting through winter. However, the densities observed in natural streams were usually below State water quality objectives, which are set below levels typically thought to impair beneficial uses (Geldreich 1978, Toranzos 2007). Furthermore, the absence of *B. thetaiotaomicron* indicated that the FIB in reference streams were likely of non-human origin (Carson *et al.* 2005). There are three possible sources of FIB observed in natural streams: External inputs from sources such as waterfowl, animals, or soil erosion; internal sources of bacterial growth and colonization within the stream associated with decomposition of organic matter; or a combination of the two (Byappanahalli *et al.* 2003, Toranzos 2007).

Higher bacteria levels observed during the summer suggest that factors existed which promote bacteria growth and regrowth in streams. The positive relationship between temperature and bacteria levels suggests that heat induced growth may be a contributing factor to seasonally high bacteria levels. In addition, warmer temperatures influence the dissolved oxygen content of the water. Decreased oxygen solubility associated with higher temperature may combine with lower dissolved oxygen levels producing algal blooms, which have been shown in previous studies to support growth of *E. coli* and enterococci in freshwater (Byappanahalli *et al.* 2003, Byappanahalli *et al.* 2007). These conditions may in turn accelerate death and decomposition of organic matter in the stream, further enhancing in situ bacterial growth. Increases in organic decomposition have been shown to increase survival and regrowth of enteric bacteria and viruses (Novotny and Olem 1994). This hypothesis is further supported by the negative correlation observed between conductivity and dissolved oxygen. Conductivity is closely correlated with total dissolved solids, which are typically comprised of inorganic and organic substances, a potential source of biological oxygen demand (BOD).

Higher FIB densities and incidence of water quality standard exceedences during the summer is consistent with the observations of others such as Noble *et al.* (2000) and Sieracki (1980). Nuzzi and Burhans (1998) compared the responses among indicator bacteria at 143 New York beach sites and found that survival was longer in the summer, but that the duration could be mediated by exposure to UV radiation from sunlight. More recently, growth or regrowth of fecal indicator bacteria in tropical and temperate soils during the summer months has also been reported (USEPA 2000, Ishii *et al.* 2006). Whitman *et al.* (1999) attributed a gradual increase of *E. coli* bacteria in water and sand at beaches during summer to higher survival and growth at warmer temperatures.

Another explanation for higher FIB levels during the summer could be higher external sources due to different patterns of use by wildlife and birds. A number of studies have shown that wildlife and other animals can be sources of bacteria in run-off (Baxter-Potter and Gilliland 1988, Bagshaw 2002, Stein *et al.* 2007). Previous studies have quantified that wildlife and bird feces contain high levels of FIB. Cox *et al.* (2005) measured fecal coliform levels of 10^3 - 10^5 CFU/g from native wildlife in Australian watersheds. Ricca and Cooney (1998) reported that droppings from feral populations of pigeons, geese and herring gulls from the environment around Boston Harbor, MA, USA contained up to 10^8 CFU/100 ml of enterococci. Bacteria from wildlife and birds can be associated with FIB levels in streams used by these animals. Noblet *et al.* (2004) found that birds were a likely source of intermittently high levels of FIB observed in the lower Santa Ana River watershed and the nearby surf zone in southern California. Similarly, Harwood *et al.* (2000) reported that animals were the dominant sources of indicator bacteria at Florida sample sites with relatively low anthropogenic impact. Bacterial source tracking studies conducted in Michigan suggested that feces from pets and raccoons were important contributors to FIB levels in streams and storm sewers (Ram *et al.* 2007). Moreover, levels increased in the late summer and fall coincident with increased raccoon den mobility following breeding.

Decreased stream flow may have also contributed to higher bacteria levels during the summer months. Although there was no statistically significant relationship between flow and bacterial densities, in all cases densities increased exponentially when stream flow decreased below approximately 0.5 m^3/s (2 cubic feet/sec). In addition, median annual bacterial densities were higher in intermittent streams than in perennial, with the differences being mainly due to high levels in the period immediately prior to streams drying up. Despite the differences between perennial and intermittent streams, the annual ranges of observed bacteria levels overlapped substantially. Therefore, the combined range of bacteria levels for perennial and intermittent streams observed in this study should reflect expected levels in natural streams throughout southern CA.

Relatively minor perturbations in the contributing watershed can cause sites to quickly deviate from background conditions. Four sites originally considered, but later rejected from the study had bacteria levels 2-3 log units greater than the natural sites retained, but significantly lower than levels observed in the developed Ballona Creek watershed (Figure 8). The watersheds of these four sites were almost entirely natural open space, but had small portions subject to agricultural or transportation related runoff. In one instance, a portion of the contributing watershed was affected by a recent fire. These small perturbations in the watershed led to dramatic changes in bacteria levels that moved sites away from reference conditions. Although these sites were not included in the analysis of background conditions, they provide valuable insight into the sensitivity of natural watersheds to small increases in anthropogenic sources.

Although this study focused on background FIB levels during dry weather (non-storm) conditions, comparison of these results to background levels in storm water is important because FIB are major constituents of concern in storm water runoff that can result in impairment of receiving waters (Noble *et al.* 2003, Schiff *et al.* 2003, Stein and Tiefenthaler 2005). Stein and Yoon (2007) reported geometric mean FIB levels from natural streams during storms of 125, 140, and 4,460 MPN/100 ml for *E. coli*, enterococci and total coliforms, respectively. These levels are generally 1.5 - 2 log units higher than geomean levels observed in this study during dry weather conditions (Figure 9). As is the case in urban areas, bacteria levels in natural systems are significantly lower during dry weather conditions than during storms, although the higher levels observed during storms are much more transient in nature. Griffith *et al.* (2006) reported that one-fifth of all samples collected within three days of rainfall from beaches at the bottom of natural catchments exceeded water quality thresholds for at least one bacterial indicator.

Analogous measurements collected three days following recorded rainfall in natural streams is warranted to further characterize "background" bacterial contamination in southern California reference waters following storms.

The results of this study indicated that streams in undeveloped watersheds contain low levels of FIB of non-human origin. An important management question is whether the levels observed pose a potential health risk. Wade *et al.* (2003) reviewed 27 studies and concluded that *E. coli* levels between 45 and 170 CFU/100 ml in freshwater pose a relative human health risk level of 1.22 (i.e. low level risk). We observed 30-day geomean *E. coli* levels ranging from 2 – 138 MPN/100 ml, with an overall 30-day geometric mean of 41 ±20 MPN/100 ml. Because the mean levels observed in this study were below the "low risk" range reported by Wade *et al.* (2003), it could be concluded that background levels in natural streams have a low likelihood of posing a human health risk. However, this conclusion should be made with caution because previous exposure and risk studies were conducted in areas known to receive wastewater or storm water discharges containing human fecal sources. In contrast, the FIB levels observed in this study were of non-human origin, so the actual risk is unknown.

Conclusion and Future Research

This study yielded the following conclusions about FIB levels in natural streams during dry weather conditions:

1. ***Fecal indicator bacteria typically occur in natural streams during dry weather conditions at levels below State water quality standards.*** Annual mean concentrations (both single sample and 30-day geometric mean) were below established water quality criteria for all three indicators. A total of 18.2% of the indicator bacteria samples (for all three indicators) from the natural sites exceeded daily (single sample) water quality standards. Approximately 1.5%, 14%, and 3% of *E. coli*, enterococci, and total coliforms, respectively, exceeded single sample water quality criteria.

2. ***Fecal indicator bacteria in natural streams are most likely of non-human origin.*** All samples tested for the presence of *B. thetaiotaomicron* were negative, indicating non-human sources in natural streams. FIB levels in natural streams likely result from a combination of natural inputs, such as wildlife, birds, and soil erosion and instream bacterial growth facilitated by high summer temperatures and presence of decaying organic matter.

3. ***Dry weather fecal indicator bacteria in natural streams are typically two orders of magnitude lower than those observed in streams draining developed watersheds.*** Data from the developed Ballona Creek watershed were typically in the 10^3 MPN/100 ml range for *E. coli* and enterococci. Even slight watershed modifications appear to result in a relatively rapid departure from background FIB levels.

4. ***Fecal indicator bacteria levels exhibit seasonal patterns.*** Mean bacteria levels and frequency of exceedance of water quality standards were higher during the warmer summer months for all three bacteria indicators. This suggests that summer is a critical period for assessing background bacteria levels. Past studies indicate that fecal indicator

bacteria levels in natural streams during storms are one to two orders of magnitude higher than those observed during dry weather conditions; however, the duration of these elevated levels is unknown. Studies of water quality at beaches at the bottom of natural watersheds indicate that high bacteria levels may persist for up to three days following storms. Analogous measurements collected three days following recorded rainfall in natural streams is warranted to further characterize the persistence of "background" bacterial contamination in southern California reference waters following storms.

5. ***Bacteria levels in natural streams were generally higher during lower flow conditions.*** For all three indicators, densities increased exponentially when stream flow decreased below approximately 0.5 m^3/s (2 cubic feet/sec). In addition, median annual bacterial densities were higher in intermittent streams than in perennial, with the differences being mainly due to high levels in the period immediately prior to streams drying up. Despite the differences between perennial and intermittent streams, the annual ranges of observed bacteria levels overlapped substantially.

6. ***Dry weather fecal indicator bacteria levels were one to two orders of magnitude lower than those observed in natural streams during storm conditions.*** Past studies of water quality at beaches at the bottom of natural watersheds indicate that high bacteria levels may persist for up to three days following storms. Analogous measurements collected three days following recorded rainfall in natural streams is warranted to further characterize the persistence of "background" bacterial contamination in southern California reference waters following storms.

7. ***Fecal indicator bacteria in natural streams occurred at levels below those reported to pose health risks due to freshwater contact recreation.*** However, past risk assessments have all occurred in waters that are known to receive bacteria inputs of human origin. No epidemiology studies have been conducted on FIB of non-human origin, so the precise risk is unknown.

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Table 1. List of natural stream sampling sites, characteristics and their median monthly fecal indicator bacteria densities (MPN/100 ml).

Site Name	Watershed	County	Catchment Size (km^2)	Number Sampling Weeks/Yr	Mean Flow (m^3/sec)	Geomean (30-d) *E. coli* (MPN/100 ml)	SD	Geomean (30-d) Enterococci (MPN/100 ml)	SD	Geomean (30-d) Total coliforms (MPN/100 ml)	SD
Arroyo Seco	LA River	Los Angeles	41.50	47	0.04	15.24	2.22	20.48	2.45	1291.90	2.85
Cold Creek	Malibu Creek	Los Angeles	1.43	49	0.00	13.59	1.89	15.33	2.42	443.30	4.33
Lachusa Canyon	Los Alisos Canyon	Los Angeles	3.86	49	0.01	16.08	2.24	20.55	2.26	1486.50	2.14
Solstice Canyon	Solstice Canyon	Los Angeles	8.74	49	0.01	16.97	2.28	20.64	2.43	1109.21	2.68
Chesebro Creek	Malibu Creek	Los Angeles	7.55	49	0.00	90.30	5.49	68.25	4.24	2940.41	2.88
Bell Creek	San Juan	Orange	17.97	12[a]	0.02	80.45	4.30	164.60	5.48	2008.67	3.16
San Juan Creek	San Juan	Orange	99.94	9[a]	0.03	74.66	2.46	25.25	3.29	2848.15	1.66
Santiago Creek	Santa Ana	Orange	17.02	10[a]	0.02	22.99	2.84	34.75	3.06	1869.15	1.98
Hurkey Creek	San Jacinto	Riverside	29.73	29	0.01	18.89	4.38	36.92	4.75	688.57	3.33
Mill Creek	Santa Ana	San Bernardino	15.21	55	0.08	2.06	2.68	12.74	3.32	75.00	2.98
Cucamonga Creek	Cucamonga	San Bernardino	24.10	52	0.14	11.14	1.66	26.35	3.33	399.64	2.39
Day Creek	Santa Ana	San Bernardino	11.70	55	0.32	11.02	1.58	25.18	2.87	545.71	2.41
Cajon Creek	Santa Ana	San Bernardino	82.82	52	0.08	54.98	3.18	159.21	2.49	4794.47	2.04
Stone Creek	Santa Margarita	San Diego	7.00	50	0.00	138.18	3.86	52.72	3.58	1728.44	3.21
Boden Creek	San Dieguito	San Diego	19.81	18[a]	0.01	45.33	6.14	98.26	2.86	1658.46	2.54
		Mean	25.89	39	0.05	40.79	3.15	52.08	3.26	1592.51	2.70
		SD	14.54	9	0.04	19.84	0.71	25.32	0.47	622.94	0.34

[a]Intermittent stream

Table 2. State of California marine water quality standards for fecal indicator bacteria as established in Assembly Bill 411. Currently a freshwater quality standard for total coliforms does not exist.

	CA Maximum Allowable Density (MPN/100 ml)	
Fecal Indictor Bacteria	**single-sample**	**30-day geometric mean**
Enterococci	104	33
E. coli	235	126
Total coliforms	10,000	1000

Additional Indicator

Bacteroides thetaiotaomicron Presence / absence of a human source

Table 3. Assessment of percent exceedances between counties in southern California during the present study. A [1] represents those counties in which samples were collected only during spring and/or summer due to intermittent streams with less stable flow regimes.

	Exceedance (%)		
	E. coli	Enterococci	Total Coliforms
Daily			
Los Angeles County	0.0	6.3	0.0
Orange County[1]	12.9	38.7	3.2
San Bernardino	0.0	13.1	0.0
San Diego[1]	5.3	47.4	0.0
Monthly			
Los Angeles County	0.0	7.7	46.2
Orange County[1]	25.0	75.0	100.0
San Bemardino	0.0	23.1	0.0
San Diego[1]	0.0	100.0	80.0

Table 4. Percent single-sample exceedance of fecal indicator bacteria (FIB) levels in natural streams during dry weather from May 2006-May 2007. Numbers in bold are significantly different (p <0.01).

	Exceedance (%)		
	E. coli	Enterococci	Total coliforms
Season			
Spring 06	0.0	41.7	75.0
Summer	**12.5**	**75.0**	**83.3**
Fall	0.0	0.0	28.6
Winter	0.0	0.0	11.1
Spring 07	0.0	22.2	44.4
Month			
May 2006	0.0	27.3	45.5
June 2006	0.0	66.7	75.0
July 2006	0.0	**72.7**	**90.9**
August 2006	**12.5**	**62.5**	**75.0**
September 2006	0.0	42.9	57.1
October 2006	0.0	0.0	14.3
November 2006	0.0	0.0	28.6
December 2006	0.0	0.0	14.3
January 2007	0.0	0.0	0.0
Febuary 2007	0.0	12.5	25.0
March 2007	0.0	22.2	11.1
April 2007	0.0	11.1	44.4
May 2007	0.0	25.0	62.5
Annual	1.0	26.4	41.8

Table 5. Correlation table (r^2 values) between water quality variables and fecal indicator bacteria (FIB) during dry weather in natural streams in southern California between May 2006-May 2007. Significant correlations (*p*<0.04) are shown in bold, while significant correlations (*p*<0.001) are both bolded and in italics.

			Pearson r^2-values		
	DO	**Flow**	***E. coli***	**Enterococci**	**Total Coliform**
Parameter	(mg/L)	(m^3/s)		(MPN/100 ml)	
Conductivity	**-0.50**	***0.48***	***0.22***	**0.01**	***0.19***
Dissolved Oxygen	-	0.12	***0.18***	**0.21**	***0.16***
pH	0.32	***0.09***	***0.11***	**0.02**	**0.04**
Flow	0.12	-	-0.06	-0.02	**-0.08**
Temperature (°C)	***-0.84***	**0.02**	***0.20***	***0.26***	***0.48***
Turbidity	0.19	0.00	0.02	1.44	**0.07**

Bolded values = p<0.05

Bolded italic values = p<0.001

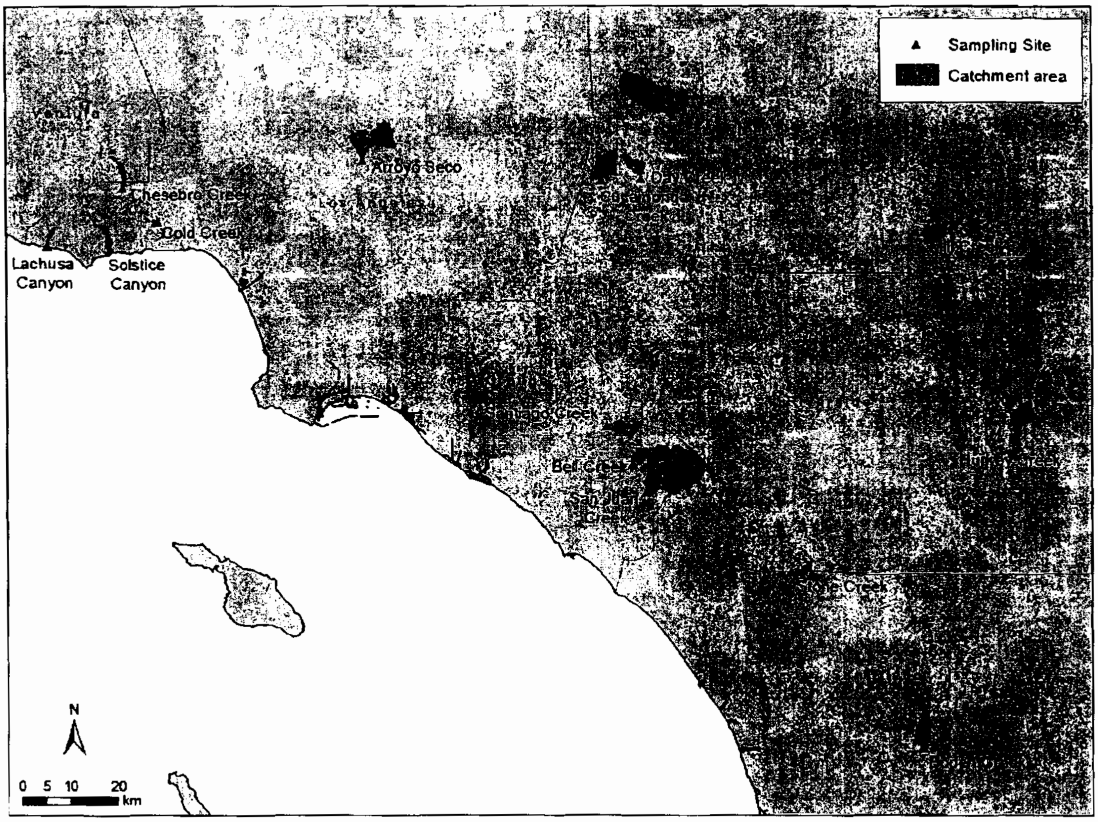

Figure 1. Map of natural stream sampling sites and their respective catchments within southern California.

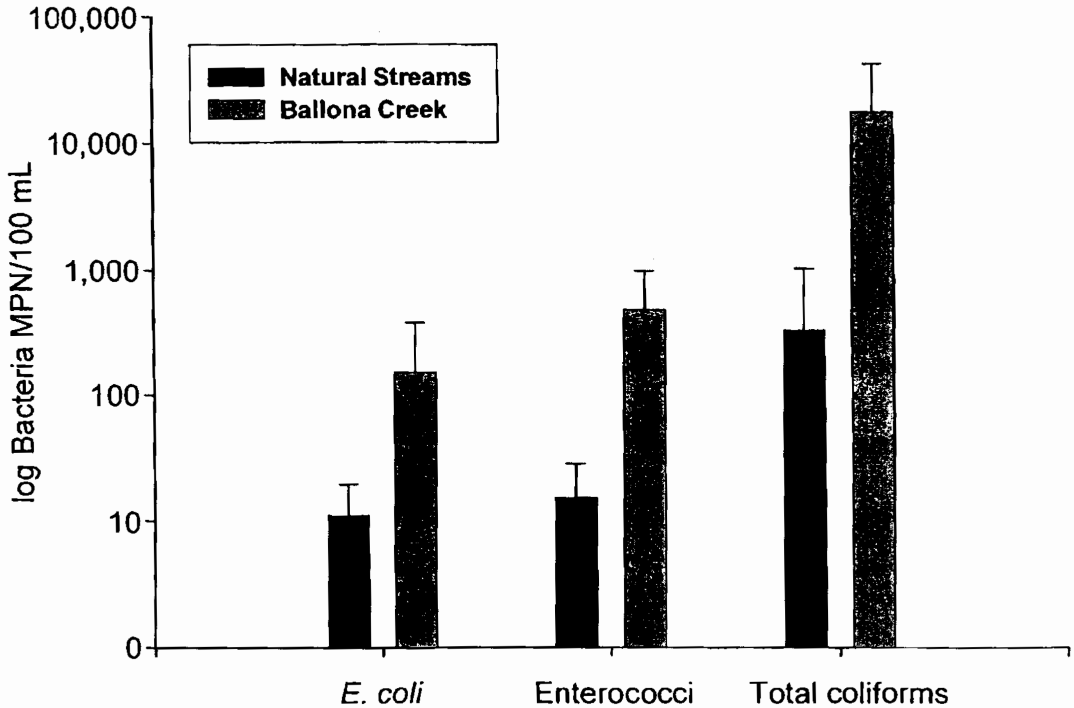

Figure 2. Comparison of dry weather log10 fecal indicator bacteria (FIB) densities (± standard deviations) between natural streams in undeveloped watersheds and developed Ballona creek watershed from May 2006-May 2007 in southern California, USA.

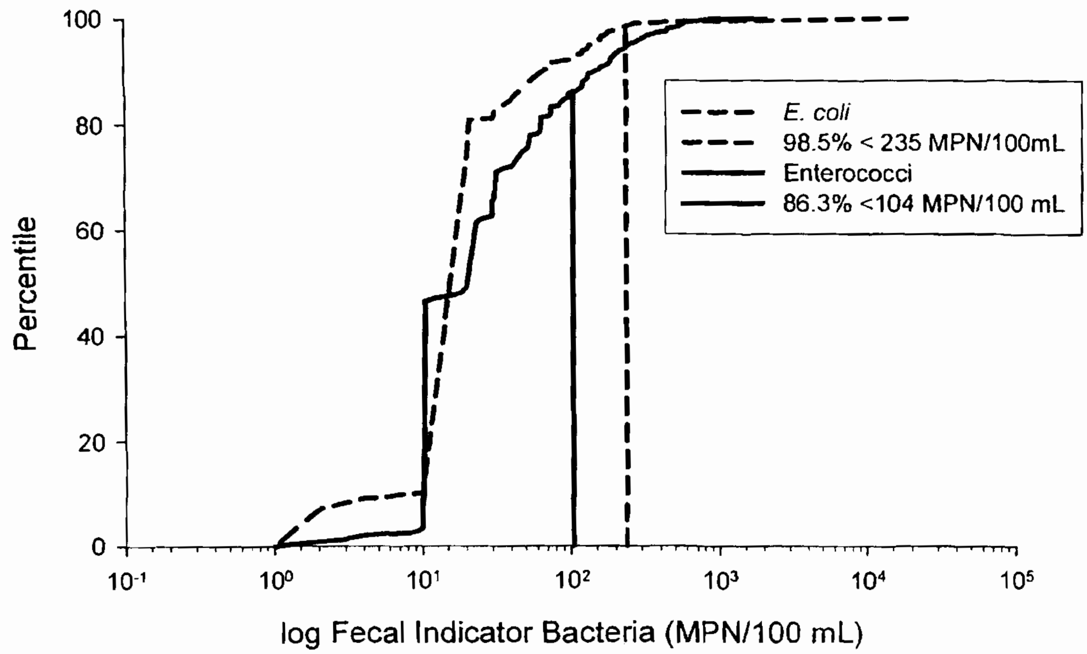

Figure 3. Dry season fecal indicator bacteria cumulative density frequency plots (CDFs) of natural streams relative to freshwater quality standards from May 2006 to May 2007 in southern California, USA.

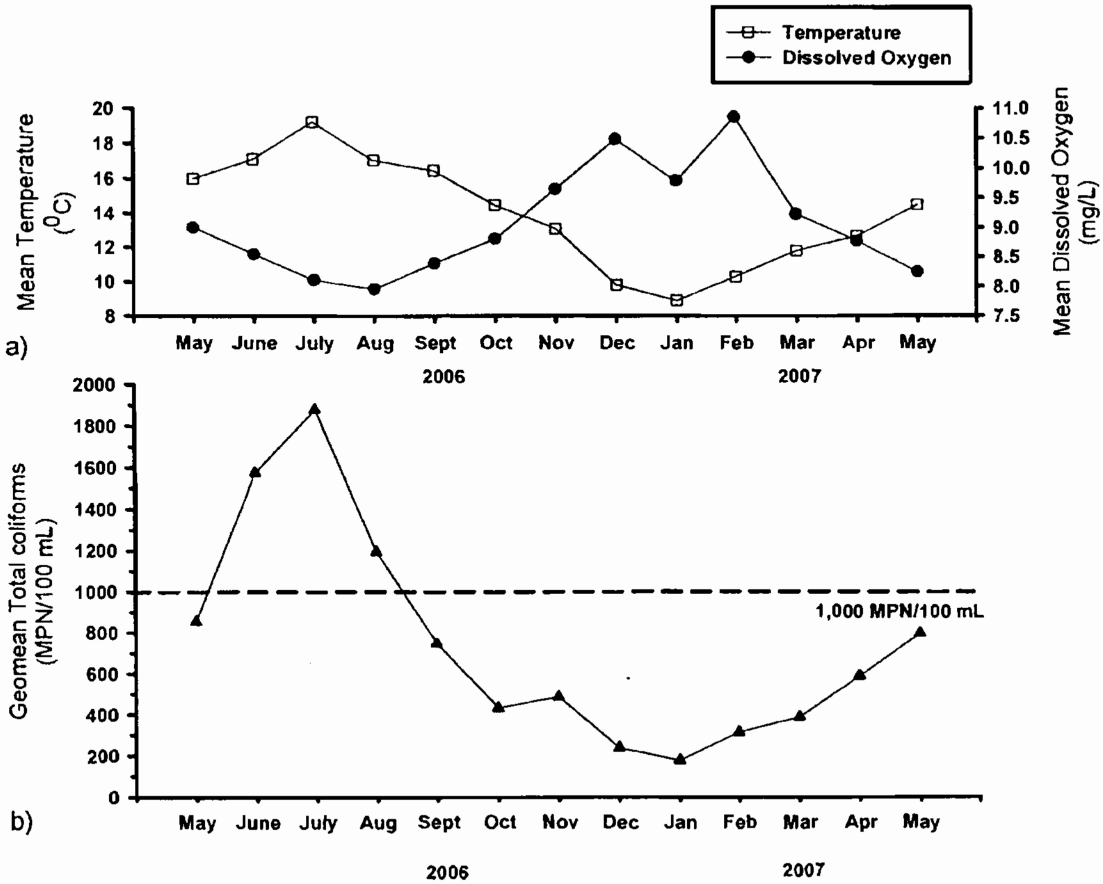

Figure 4. Mean monthly temperature (°C) and dissolved oxygen (mg/L) comparison (a) and geomean total coliform densities in natural streams in southern California (b) between May 2006 and May 2007. Summer months (June-August) were substantially higher than all other seasons ($p < 0.01$). *E. coli* and enterococci exhibited similar results. The dotted line indicates the 30-d geomean for total coliforms equal to 1,000 MPN/100 ml. All points above the line represent bacteria water quality exceedances.

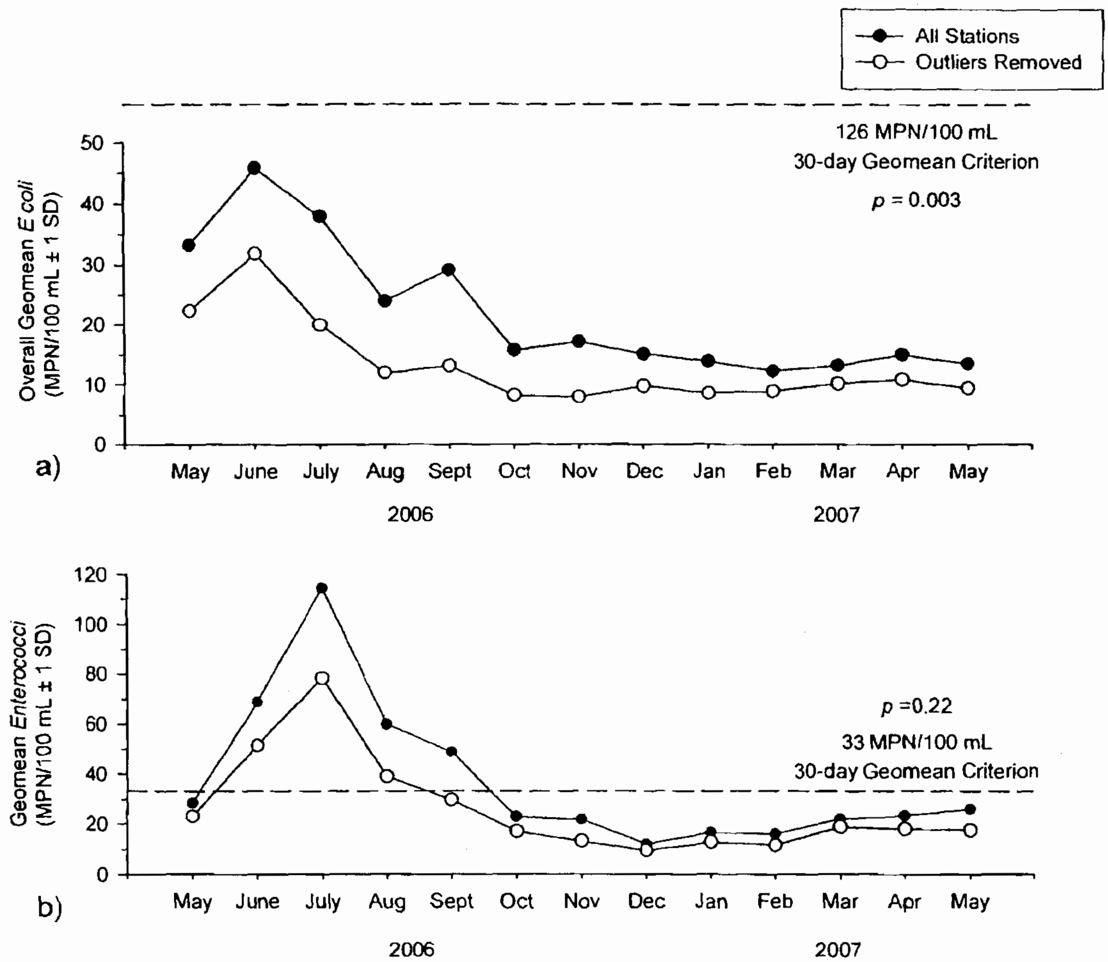

Figure 5. *E.coli* a) and enterococci b) geomean densities in natural streams in southern California between May 2006 and May 2007. Summer months (June-August) were substantially higher than all other seasons. The dashed line indicates the monthly water quality standard equal to 235 MPN/100 ml and 104 MPN/100 ml for *E. coli* and enterococci respectively. All points above the line represent bacteria water quality exceedances.

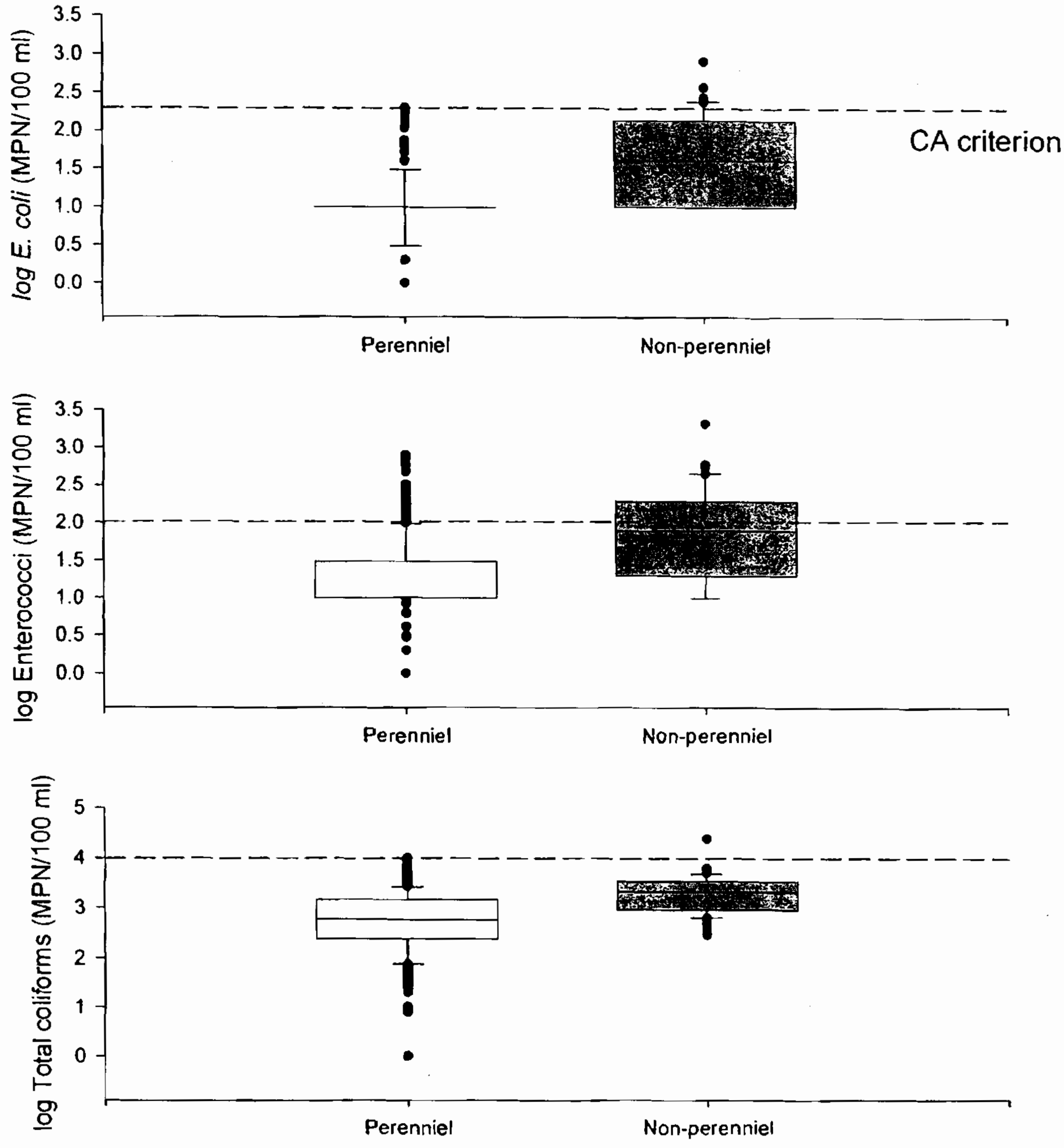

Figure 6. Perennial and non-perennial stream comparison of log10 fecal indicator bacteria densities (MPN/100 ml) in southern California during the present study. The dotted line indicates the State single-sample bacterial water quality criterion. Significant differences in indicator densities existed between streams but ranges generally overlapped ($p < 0.05$). Boxplots show mean, median, 25th and 75th percentiles.

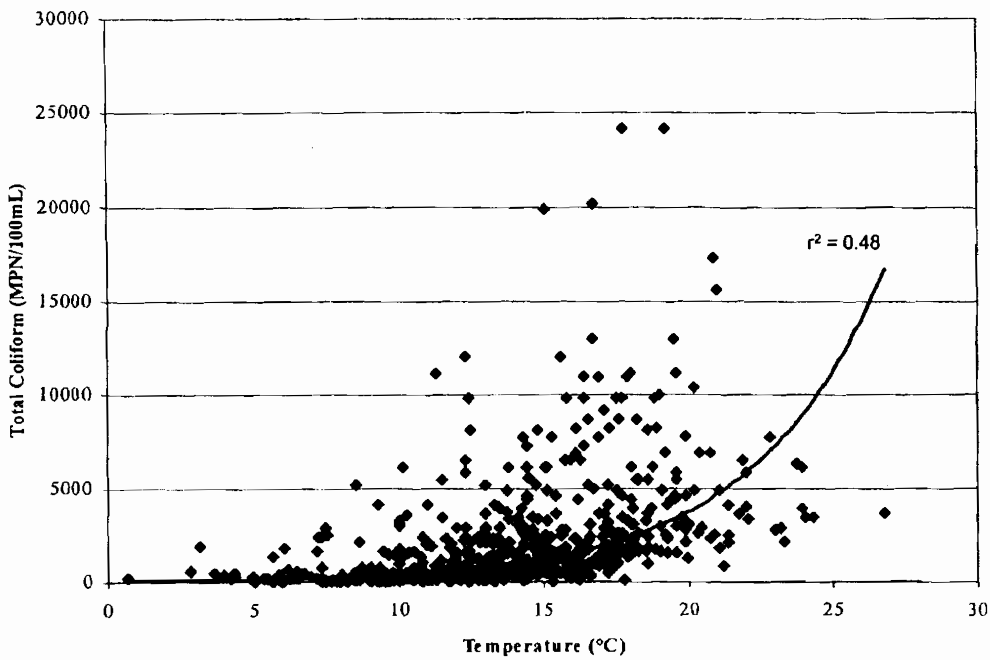

Figure 7. Natural stream temperatures in southern California versus total coliform densities (MPN/100 ml) during dry weather for an entire year. Solid line indicates the exponential trend line (r2 = 0.48).

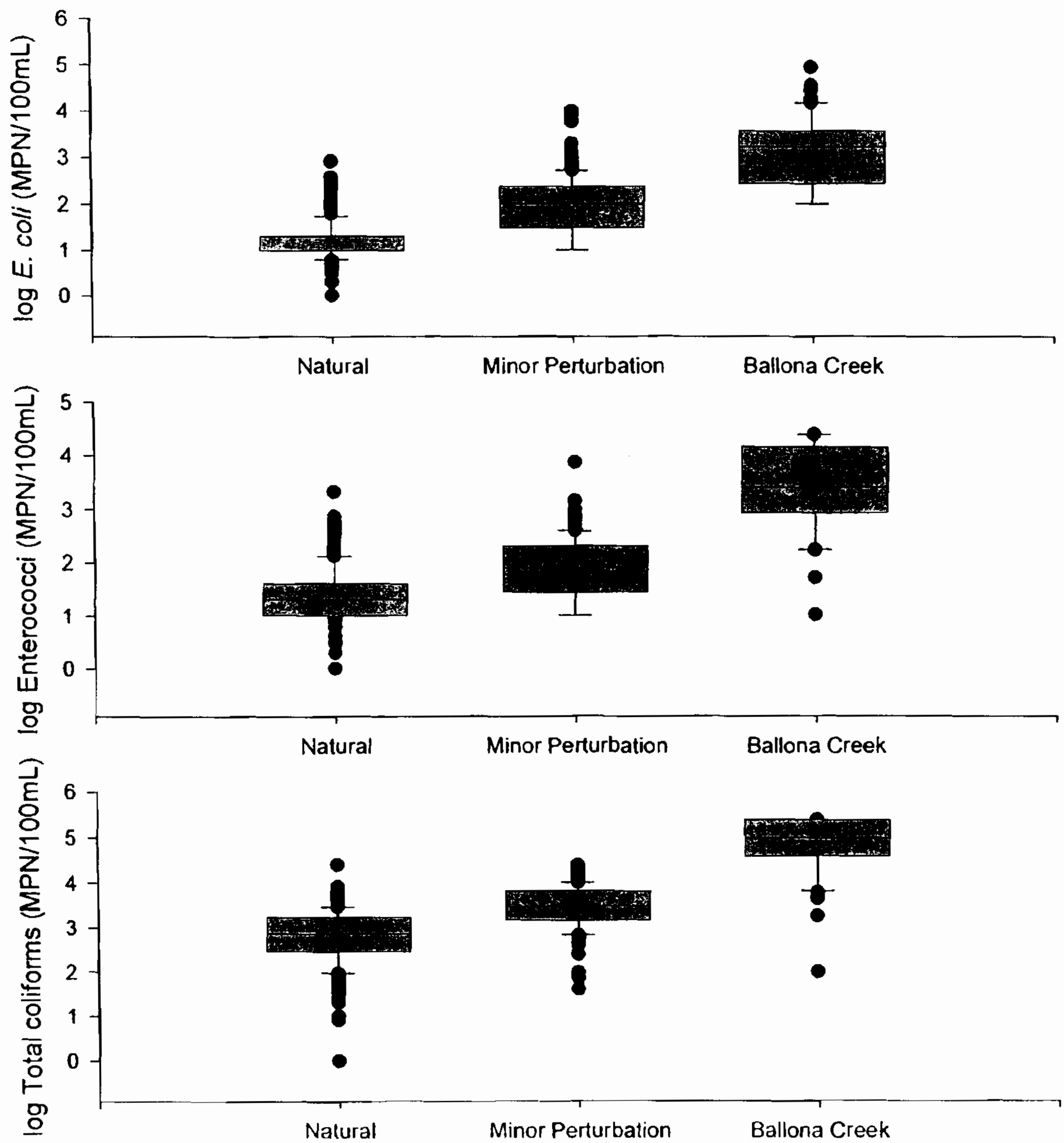

Figure 8. Distribution of log *E. coli* a); enterococci b); and total coliforms c) concentrations in natural streams, streams with minor perturbations, and in developed Ballona Creek watershed in southern California, USA. Natural streams were significantly lower then all other streams ($p < 0.001$). Minor perturbation streams were significantly lower than developed Ballona Creek ($p < 0.001$).

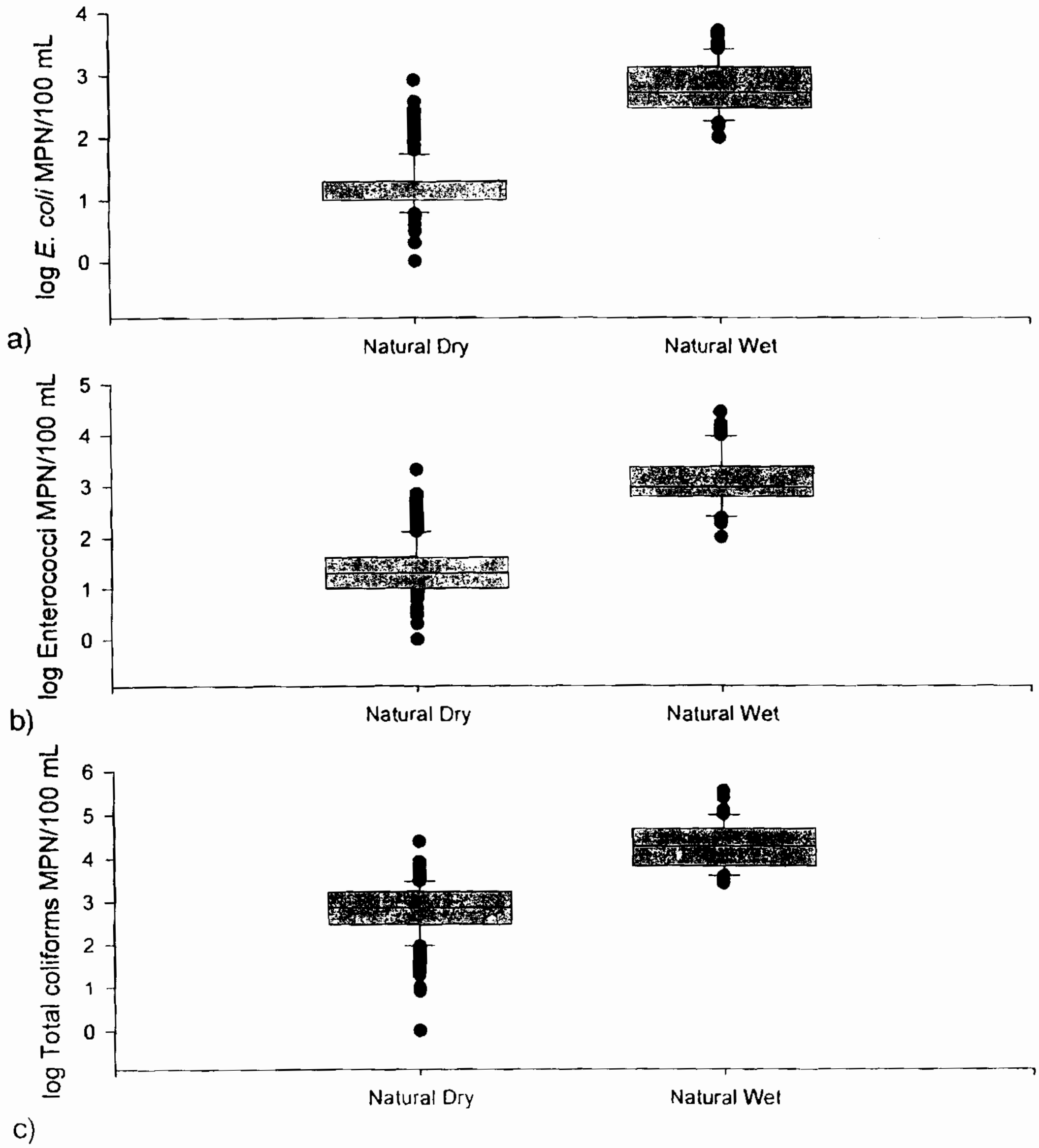

Figure 9. Distribution of log *E. coli* a); enterococci b); and total coliforms c) concentrations in natural streams during dry weather (present study) compared to wet weather (Natural Loadings; 2003-2005 and Los Angeles River watershed; 2001-2005) studies in southern California, USA. Dry weather bacteria concentrations were significantly lower then wet weather concentrations ($p < 0.001$).

APPENDIX A - SUMMARY BACTERIA DATA FOR ALL NATURAL STREAM SITES

Table A1. **List of natural stream sampling sites, characteristics and their daily fecal indicator bacteria densities (MPN/100 ml).**

		Concentration (MPN/100 ml)								
		E. coli			**Enterococci**			**Total coliforms**		
Sampling site	Watershed	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Arroyo Seco	LA River	10	15.2	148	10	20.5	250	10	1291.9	6867
Cold Creek	Malibu Creek	10	13.6	108	10	15.3	480	10	443.3	6131
Lachusa Canyon	Los Alisos Canyon	10	16.1	161	10	20.6	197	146	1486.5	8164
Solstice Canyon	Solstice Canyon	10	17.0	200	10	20.6	262	10	1109.2	5475
Chesebro Creek	Malibu Creek	10	90.3	9804	10	68.2	7270	96	2940.4	24192
Bell Creek	San Juan	10	80.5	820	10	164.6	2098	292	2008.7	24196
San Juan Creek	San Juan	20	74.7	259	10	25.2	299	1664	2848.2	6294
Santiago Creek	Santa Ana	10	23.0	134	10	34.7	228	469	1869.1	3873
Hurkey Creek	San Jacinto	10	18.9	5500	10	36.9	780	210	688.6	7700
Mill Creek	Santa Ana	1	2.1	20.9	1	12.7	190	1	75.0	435
Cucamonga Creek	Cucamonga	6	11.1	180	10	26.3	580	10	399.6	2000
Day Creek	Santa Ana	4	11.0	160	10	25.2	240	31	545.7	9800
Cajon Creek	Santa Ana	10	55.0	520	20	159.2	960	730	4794.5	13000
Stone Creek	Santa Margarita	10	138.2	5830	10	52.7	1408	40	1728.4	15530
Boden Creek	San Dieguito	10	45.3	18600	10	98.3	563	388	1658.5	20140
Mean		9.40	40.79	2829.66	10.07	52.08	1053.67	273.80	1592.51	10253.13
StDev		2.04	19.84	2662.11	1.82	25.32	911.35	222.68	622.94	3837.71

Table A2. Monthly *E. coli* geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	*E. coli* Geomeans												
	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07
Arroyo Seco	10.0	37.5	56.1	11.5	26.0	12.5	10.0	10.0	10.0	10.0	10.0	16.5	10.0
Lachusa Canyon	82.8	30.7	20.0	12.5	28.5	10.0	10.0	14.1	10.0	10.0	16.0	10.0	25.1
Cold Creek	14.4	42.1	10.0	27.6	10.0	14.2	10.0	10.0	10.0	10.0	10.0	10.0	20.0
Solstice Canyon	32.2	59.6	11.9	15.2	29.9	10.0	10.0	40.0	12.6	10.0	15.2	10.0	20.0
Chesebro Creek	150.3	276.0	444.2	233.5	1336.8	111.3	27.1	58.7	11.9	25.3	65.8	28.9	10.0
Bell Creek	25.9	125.6	104.0	146.0									
San Juan Creek	36.0	121.6	84.2										
Santiago Creek	10.0	22.8	53.6										
Hurkey Creek	5500.0	18.9	14.1						22.6	10.0	10.0	10.0	
Cucamonga Creek	10.0	10.0	10.0	12.4	10.0	10.0	10.0	20.6	10.0	13.2	10.0	10.0	10.0
Mill Creek	10.0	10.0	5.0	2.6	2.8	1.4	1.0	1.0	1.1	2.0	1.0	1.0	1.0
Day Creek	10.0	20.0	10.0	11.0	10.0	13.2	10.0	10.0	10.0	11.9	10.0	10.0	10.0
Cajon Creek	38.3	180.1	146.9	104.1	225.3	96.6	76.1	42.4	35.3	12.6	12.6	10.0	10.0
Stone Creek	65.7	129.2	269.5	134.6		156.1	441.1	57.8	240.1	82.8	20.2	99.4	112.1
Boden Creek	1082.5	26.1									21.5	63.5	30.7

Table A3. **Monthly enterococci geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.**

	Enterococci Geomeans												
Sampling site	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07
Arroyo Seco	41.0	63.0	105.7	23.9	54.6	18.1	11.9	10.0	10.0	10.0	10.0	10.0	14.1
Lachusa Canyon	20 2	13.2	15.1	17.4	21.6	20.1	11.5	14.1	14.6	34.0	82.3	24.7	17.6
Cold Creek	12.6	18.8	115.6	16.6	16.5	10.0	10.0	10.0	10.0	10.0	11.5	17.6	10.0
Solstice Canyon	25.1	23.8	39.8	61.0	47.5	16.9	13.2	10.0	12.6	10.0	12.5	10.0	35.1
Chesebro Creek	59.0	200.3	563.1	146.5	252.2	31.1	41.1	24.9	11.9	29.0	51.5	26.8	62.0
Bell Creek	12.6	402.1	467.8	158.0									
San Juan Creek	20.2	47.5	10.0										
Santiago Creek	14.6	59.0	40.8										
Hurkey Creek	380.0	121.6	744.2						18.9	10.0	10.0	19.5	
Cucamonga Creek	33.9	90.2	241.1	85.8	31.2	14.3	10.0	14.1	10.0	11.9	12.6	18.4	10.0
Mill Creek	10.0	10.0	20.2	35.8	16.5	23.2	14.8	4.0	16.1	3.2	22.6	25.8	3.9
Day Creek	21.5	43.3	125.8	92.1	42.4	18.8	24.6	11.9	11.5	21.4	10.0	11.9	14.1
Cajon Creek	87 1	307.1	486.6	367.7	253.0	157.0	217.8	56.6	66.9	100.3	74.1	95.2	200.0
Stone Creek	53.6	163.0	192.3	133.8	79.0	31.8	53.4	12.6	46.1	18.5	11.9	45.9	74.2
Boden Creek	143.4	208.4									69.4	44.9	98.4

Table A4. **Monthly total coliforms geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.**

Sampling site	*Total coliforms* Geomeans												
	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07
Arroyo Seco	708.0	1854.8	4200.8	1859.1	2506.6	1480.0	1155.9	534.0	134.9	588.4	1547.1	1843.3	2926.5
Lachusa Canyon	1611.2	1825.6	2724.7	3350.6	2074.7	998.6	1139.4	1206.9	725.0	1655.0	807.2	1009.0	2176.8
Cold Creek	997.6	1743.3	3567.4	1312.3	1347.5	488.0	250.7	109.2	70.7	78.3	123.9	218.3	277.4
Solstice Canyon	1064.2	1404.8	2278.4	2998.4	1048.4	499.8	550.8	654.2	761.3	1218.5	529.5	1783.9	2549.3
Chesebro Creek	2546.1	4655.0	9044.6	8141.9	8332.1	4770.4	2142.9	1017.2	789.6	1085.4	1515.9	1722.6	2540.4
Bell Creek	518.6	4780.6	2513.8	1483.0									
San Juan Creek	1748.1	3406.8	4139.9										
Santiago Creek	1189.6	1846.4	2985.1										
Hurkey Creek	6500.0	2102.0	5040.8						348.1	224.5	326.7	347.1	
Cucamonga Creek	419.1	688.2	1334.1	650.0	740.5	362.5	364.9	122.4	155.4	253.2	318.7	434.9	720.0
Mill Creek	170.6	224.0	126.4	139.1	35.3	91.9	151.7	27.5	30.8	24.0	48.3	52.0	115.7
Day Creek	311.1	746.5	1146.1	1320.5	668.1	267.3	417.4	374.0	232.4	569.0	450.4	498.0	2674.7
Cajon Creek	5915.7	8730.8	7512.4	3300.6	7335.3	9693.4	2667.5	3993.7	2747.3	2242.1	2946.6	5461.8	8200.0
Stone Creek	347.3	3493.6	4887.8	5727.9	7310.9	2482.6	1959.5	321.2	734.3	617.5	673.7	1610.4	1151.6
Boden Creek	7229.3	3207.2									603.5	1295.2	1302.1

Table A5. Dry season *E. coli* geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	**Watershed**	*E. coli* Dry Season Geomeans				
		Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07
Arroyo Seco	LA River	25.0	22.4	13.7	10.0	13.3
Lachusa Canyon	Los Alisos Canyon	45.9	15.9	13.4	12.0	13.7
Cold Creek	Malibu Creek	24.8	16.5	11.2	10.0	11.9
Solstice Canyon	Solstice Canyon	49.7	19.7	12.6	12.6	13.0
Chesebro Creek	Malibu Creek	213.3	531.7	56.0	21.5	32.8
Bell Creek	San Juan	48.3	115.8			
San Juan Creek	San Juan	74.2	75.2			
Santiago Creek	Santa Ana	16.8	31.4			
Hurkey Creek	San Jacinto	119.5	16.9		15.3	10.0
Cucamonga Creek	Cucamonga	10.0	10.8	12.7	11.1	10.0
Mill Creek	Santa Ana	10.0	4.2	1.2	1.3	1.0
Day Creek	Santa Ana	17.4	10.3	10.9	10.6	10.0
Cajon Creek	Santa Ana	84.7	126.2	102.7	20.1	11.2
Stone Creek	Santa Margarita	95.1	181.5	292.4	80.7	82.9
Boden Creek	San Dieguito	148.1	14.1		10.0	43.1

Table A6. Dry season enterococci geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	Watershed	Enterococci Dry Season Geomeans				
		Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07
Arroyo Seco	LA River	54.6	49.4	15.6	10.0	11.0
Lachusa Canyon	Los Alisos Canyon	15.9	17.1	14.2	30.6	35.0
Cold Creek	Malibu Creek	15.2	35.0	10.0	10.0	14.5
Solstice Canyon	Solstice Canyon	22.1	52.9	14.7	12.2	13.7
Chesebro Creek	Malibu Creek	118.8	365.1	33.7	21.1	46.1
Bell Creek	San Juan	60.1	338.0			
San Juan Creek	San Juan	26.8	23.4			
Santiago Creek	Santa Ana	24.2	49.9			
Hurkey Creek	San Jacinto	127.2	386.5		14.2	14.9
Cucamonga Creek	Cucamonga	47.0	138.9	14.1	11.3	16.5
Mill Creek	Santa Ana	10.0	20.6	11.4	12.4	8.0
Day Creek	Santa Ana	28.7	77.4	20.5	13.7	11.9
Cajon Creek	Santa Ana	140.7	383.2	145.4	89.6	96.7
Stone Creek	Santa Margarita	83.1	151.8	40.0	22.0	51.2
Boden Creek	San Dieguito	154.0	305.7		28.6	81.6

Table A7. **Dry season total coliforms geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern** California, USA.

		Total coliforms Dry Season Geomeans				
Sampling site	**Watershed**	Spring 06	Summer 06	Fall 06	Winter 06-07	Spring 07
Arroyo Seco	LA River	1066.8	2610.9	1230.6	422.2	2163.9
Lachusa Canyon	Los Alisos Canyon	1663.9	2899.9	1092.8	1034.7	1099.7
Cold Creek	Malibu Creek	1069.4	2133.9	295.8	97.2	180.3
Solstice Canyon	Solstice Canyon	1278.2	2165.1	543.3	616.5	1900.3
Chesebro Creek	Malibu Creek	3776.6	8814.0	2535.0	889.0	2281.4
Bell Creek	San Juan	1169.5	2955.9			
San Juan Creek	San Juan	2001.5	4426.6			
Santiago Creek	Santa Ana	1417.1	2465.3			
Hurkey Creek	San Jacinto	2952.6	3345.5		326.8	310.5
Cucamonga Creek	Cucamonga	508.0	958.8	254.1	216.2	500.4
Mill Creek	Santa Ana	185.3	104.5	82.8	31.6	79.5
Day Creek	Santa Ana	425.2	1001.3	374.8	348.5	795.6
Cajon Creek	Santa Ana	6926.3	5634.3	5220.2	2595.1	5267.6
Stone Creek	Santa Margarita	1343.4	5682.0	2193.0	516.7	1361.0
Boden Creek	San Dieguito	5146.1	2216.8		514.8	1163.2

Table A8. Annual dry season fecal indicator bacteria geomeans (MPN/100 ml) in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	Watershed	*Annual* Dry Season Geomeans		
		E. coli	Enterococci	Total Coliforms
Arroyo Seco	LA River	15.2	20.5	1291.9
Lachusa Canyon	Los Alisos Canyon	16.1	20.6	1486.5
Cold Creek	Malibu Creek	13.6	15.3	443.3
Solstice Canyon	Solstice Canyon	17.0	20.6	1109.2
Chesebro Creek	Malibu Creek	90.3	68.2	2940.4
Bell Creek	San Juan	80.5	164.6	2008.7
San Juan Creek	San Juan	74.7	25.2	2848.2
Santiago Creek	Santa Ana	23.0	34.7	1869.1
Hurkey Creek	San Jacinto	18.9	36.9	688.6
Cucamonga Creek	Cucamonga	11.1	26.3	399.6
Mill Creek	Santa Ana	2.1	12.7	75.0
Day Creek	Santa Ana	11.0	25.2	545.7
Cajon Creek	Santa Ana	55.0	159.2	4794.5
Stone Creek	Santa Margarita	138.2	52.7	1728.4
Boden Creek	San Dieguito	45.3	98.3	1658.5

APPENDIX B - SUMMARY OF PHYSICAL PARAMETERS AT ALL NATURAL STREAM SITES

Table B1. Annual dry season averages of measured physical parameters in natural streams during May 2006-May 2007 in southern California, USA.

Sampling site	Physical Parameter Averages					
	Conductivity	DO	Flow Rate	pH	Temperature	Turbidity
	□s	mg/L	m^3/s		°C	
Arroyo Seco	411.9	na	0.038	na	13.8	na
Lachusa Canyon	1431.1	na	0.006	na	16.2	na
Cold Creek	604.0	na	0.005	na	13.8	na
Solstice Canyon	1051.6	na	0.011	na	15.4	na
Chesebro Creek	3089.0	na	0.005	na	11.9	na
Bell Creek	738.8	8.7	0.018	8.0	18.7	1.1
San Juan Creek	518.8	10.4	0.028	8.2	21.1	0.7
Santiago Creek	636.9	9.6	0.017	8.1	22.2	0.5
Hurkey Creek	129.9	na	0.006	7.8	11.6	na
Cucamonga Creek	9.8	9.8	0.138	8.0	12.3	na
Mill Creek	0.7	9.4	0.080	8.0	10.6	12.3
Day Creek	13.7	9.9	0.317	8.0	12.6	1.8
Cajon Creek	37.7	8.7	0.082	7.9	15.7	8.0
Stone Creek	1171.6	7.2	0.002	7.5	16.4	16.1
Boden Creek	1012.0	7.5	0.005	7.8	15.3	6.1

APPENDIX C - INTERLABORATORY CALIBRATION RESULTS

RESULTS

SCCWRP is currently coordinating an investigation of bacteria levels in reference drainages throughout southern California. This is a cooperative study involving multiple jurisdictions that are each contributing to the project through combinations of in-kind services and direct funding. Because numerous analytical labs will be participating in analysis of fecal indicator bacteria, it was necessary to conduct a laboratory intercalibration study to ensure that comparable results could be achieved from all participating laboratories. This memo summarizes the results of this intercalibration study.

Eight laboratories from five counties participated in the calibration exercise, a performance-based approach used to evaluate analytical accuracy, reproducibility of results and to ensure that data from participating laboratories were comparable (Table C1). The calibration exercise occurred on March 22th, 2006 and consisted of each lab receiving six common samples for analysis (Table C2). Necessary dilutions or aliquot volumes were processed to insure that reportable values could be determined. Bacterial results were reported for total coliform, *Escherichia coli* (*E. coli*), and enterococcus as organism type per 100 ml of sample. Precision was examined by assessing repeatability variance (based on intralaboratory data) and reproducibility variance (based on interlaboratory data). All participating labs were required to fall within a +/- 0.5 median log count comparability goal (Noble *et al.* 2000).

All laboratories had low repeatability variability for all three constituents and all results fell within the median log comparability criteria. Based on all results there were not large variations between the laboratories (i.e. neither of the laboratories were consistently higher or lower for any parameters) in a given sample or for all samples. However, one lab (CSD) reported higher values than the rest, but this can be explained by their inadvertent double diluting of the sample. Also, both Truesdail and Weck laboratories tended to report lower values than the rest. These laboratories should be extra cautious and invest extra efforts in data interpretation in order to not bias the results of bacterial concentrations on the low side.

Figures C1-3 are an example of how the laboratories compared with the different analyses and how well the laboratories were able to reproduce results. These plots are representative of all the data and illustrated good comparability between the analytical labs. As a result of this study we conclude that there should be no bias introduced into the dataset due to sample analysis by different laboratories. All the data and plots are available from SCCWRP upon request.

Table C1. List of participating laboratories and counties involved in the reference bacteria/watershed interlaboratory calibration.

Laboratory Name	County
E. S. Babcock, & Sons, Inc.	Riverside
City of San Diego	San Diego
CRG Marine Laboratories, Inc.	Los Angeles
HCA Public Health Laboratory	Orange
Truesdale Laboratories, Inc.	Orange
Weck Laboratories	Los Angeles
Aquatic Bioassay & Consulting Laboratory (ABC)	Ventura
Weston Solutions, Inc.	San Diego

Table C2. List of the six common samples and their representative sewage dilutions in (ml) which each laboratory received for the interlaboratory calibration.

Media	Dilution (ml)
DI Water	-
Santiago Creek	-
Sewage Dilution 1	3
Sewage Dilution 2	1.5
Sewage Dilution 3	1
Sewage Dilution 4	0.5

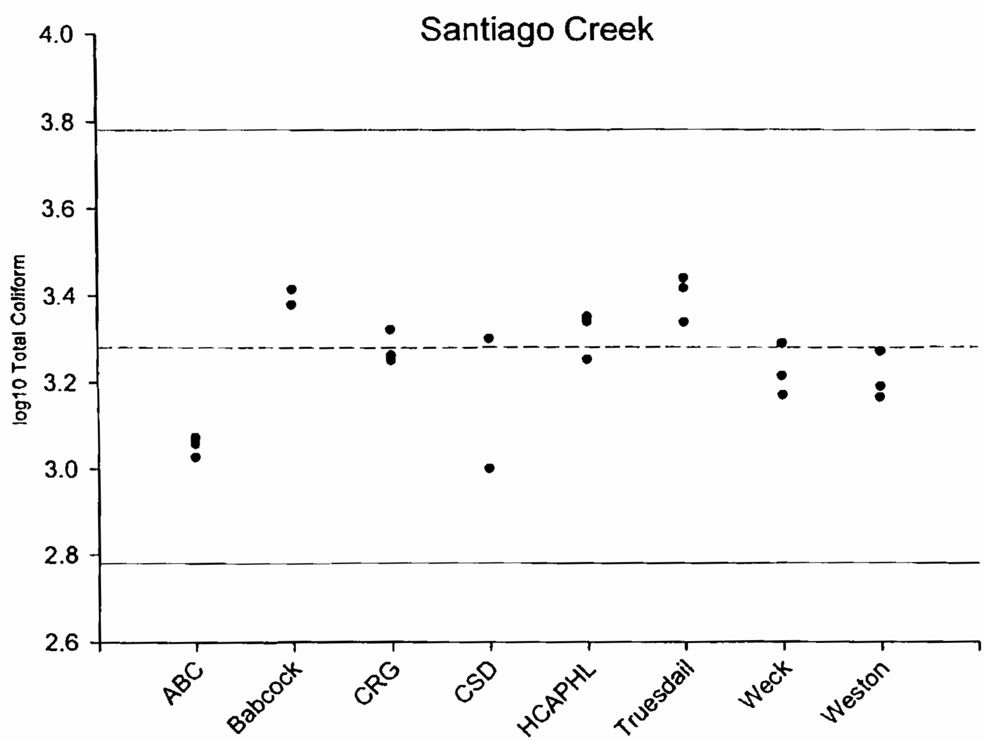

Figure C1. Laboratory comparison results for log transformed total coliform data at Santiago Creek, Orange County. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count.

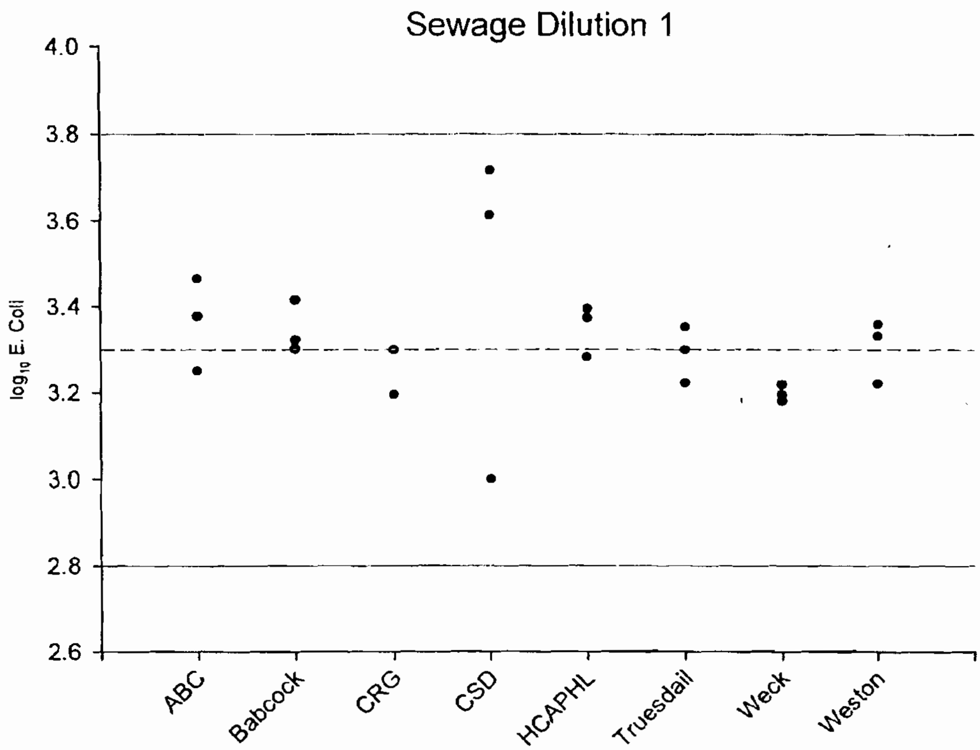

Figure C2. Laboratory comparison results for *E. coli* using a 3 ml sewage dilution. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count.

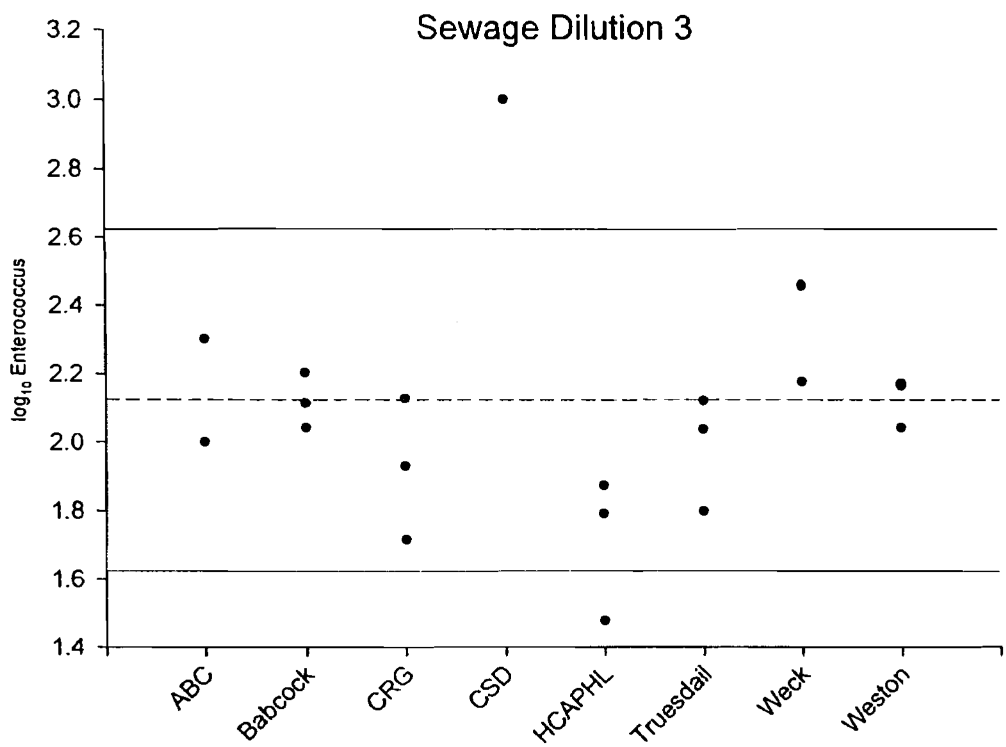

Figure C3. Laboratory comparison results for Enterococcus using a 1 ml sewage dilution. The dotted red line represents the median log criteria, while the solid blue lines are +/- 0.5 median log count.

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Coastal groundwater dynamics off Santa Barbara, California: Combining geochemical tracers, electromagnetic seepmeters, and electrical resistivity

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ABSTRACT

This paper presents repeat field measurements of ^{222}Rn and $^{223,224,226,228}Ra$, electromagnetic seepage meter-derived advective fluxes, and multi-electrode, stationary and continuous marine resistivity surveys collected between November 2005 and April 2007 to study coastal groundwater dynamics within a marine beach in Santa Barbara, California. The study provides insight into magnitude and dynamics of submarine groundwater discharge (SGD) and associated nutrient loadings into near-shore coastal waters, where the predominant SGD drivers can be both spatially and temporally separated. Rn-222 and $^{223,224,226,228}Ra$ were utilized to quantify the total and saline contribution, respectively, of SGD. The two short-lived $^{224,223}Ra$ isotopes provided an estimate of apparent near-shore water mass age, as well as an estimate of the Ra-derived eddy diffusion coefficient, K_h ($^{224}Ra = 2.86 \pm 0.7\ m^2\ s^{-1}$; $^{223}Ra = 1.32 \pm 0.5\ m^2\ s^{-1}$). Because ^{222}Rn ($t_{1/2} = 3.8$ day) and ^{224}Ra ($t_{1/2} = 3.66$ day) have comparable half-lives and production terms, they were used in concert to examine respective water column removal rates. Electromagnetic seepage meters recorded the physical, bi-directional exchange across the sediment/water interface, which ranged from −6.7 to 14.5 cm day^{-1}, depending on the sampling period and position relative to the low tide line. Multi-day time-series ^{222}Rn measurements in the near-shore water column yielded total (saline + fresh) SGD rates that ranged from 3.1 ± 2.6 to 9.2 ± 0.8 cm day^{-1}, depending on the sampling season. Offshore ^{226}Ra ($t_{1/2} = 1600$ year) and ^{222}Rn gradients were used with the calculated K_h values to determine seabed flux estimates (dpm m^{-2} day^{-1}), which were then converted into SGD rates (7.1 and 7.9 cm day^{-1}, respectively). Lastly, SGD rates were used to calculate associated nutrient loads for the near-shore coastal waters off Santa Barbara. Depending on both the season and the SGD method utilized, the following SGD-derived nutrient inputs were computed (mol per day per meter of shoreline): NH_4^+ = 0.06–0.29 mol day^{-1} m^{-1}; SiO_4 = 0.22–0.29 mol day^{-1} m^{-1}; PO_4^{3-} = 0.04–0.17 mol day^{-1} m^{-1}; [NO_2^- + NO_3^-] = 0–0.52 mol day^{-1} m^{-1}; dissolved inorganic nitrogen (DIN) = 0.01–0.17 mol day^{-1} m^{-1}, and dissolved organic nitrogen (DON) = 0.08–0.09 mol day^{-1} m^{-1} Compared to the ephemeral nature of fluvial and marine inputs into this region, such SGD-derived loadings can provide a sustained source of select nutrients to the coastal waters off Santa Barbara, California that should be accounted for in mass balance estimates.

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1. Introduction

It is now well accepted that submarine groundwater discharge (SGD), an almost ubiquitous coastal process, may substantially impact certain near-shore material budgets (Capone and Bautista, 1985; Moore, 2006; Burnett et al., 2006; Swarzenski, 2007; Charette et al., 2008). While the contribution of SGD-derived nutrients, bacteria, carbon, and select trace elements such as Ba or U (Charette and Sholkovitz, 2006; Swarzenski and Baskaran, 2007) can vary widely depending on both local hydrogeologic conditions and anthropogenic perturbations, accurate assessments of the spatial and temporal distribution of SGD along a particular coastline remain rare (Burnett et al., 2002; Dulaiova et al., 2006b). This paucity of reliable data stems in large part in that SGD remains the 'hidden' vector in water and material transport from land to the sea, and that the physical drivers of SGD are complex, often inter-related, and still poorly constrained (Taniguchi, 2002; Michael et al., 2005; Robinson et al., 2007a,b). Furthermore, the discharge of submarine groundwater is usually expressed not through well-defined marine springs (Swarzenski et al., 2001), but rather through diffuse discharge that is often ephemeral and patchy in nature (Burnett et al., 2002; Taniguchi et al., 2003).

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Nonetheless, significant advances have recently been made in the application of select U/Th-series radionuclides as quantitative tracers of SGD (Moore, 1996, 2000a,b; Moore and de Oliveira, 2008; Burnett et al., 2001, 2002, 2003; Charette et al., 2001, 2008; Dulaiova and Burnett, 2004, 2006; Dulaiova et al., 2005, 2006a,b). Such tracer techniques can yield unprecedented information on: (i) SGD 'hotspots'; (ii) the source waters for SGD; (iii) the magnitude and dynamics of SGD rates; and (iv) the relative composition of SGD (i.e., fresh versus saline contributions). As proxies for fluid exchange these tracers are limited by how well they move with a mixed-salinity water parcel, and local quantification of fluid exchange is still most directly measured by some seepage meter device (Mulligan and Charette, 2006). Seepmeters, outfitted with autonomous salinity, temperature, and pressure sensors, can measure the bi-directional exchange of fluid across the sediment/water interface with high resolution (Taniguchi and Fukuo, 1993; Taniguchi et al., 2003, 2007). Such datasets can provide useful constraints on the geochemical tracer-derived SGD results (Burnett et al., 2006; Swarzenski et al., 2007a). An additional complementary tool to study the movement of the fresh water/salt water interface and to map the geographic extent of a coastal SGD zone is stationary (land-based) electrical resistivity (Swarzenski et al., 2006a, 2007a,b; Taniguchi et al., 2007).

In environments that are fresh water limited or have low hydraulic gradients, the submarine exchange of groundwater often contains a large component of recycled sea water (Colbert and Hammond, 2007a,b; Colbert et al., 2008a,b; Weinstein et al., 2007). In such systems, even though the net discharge may be small or even negative (i.e., sea water infiltration), this continuous cycle of recharge and discharge, driven by waves and tides, may still significantly impact the flow of nutrients from land to the sea. In this paper, we address the exchange of groundwater with sea water at West Beach in Santa Barbara, California (Fig. 1), using a suite of geochemical tracers and electrical geophysical techniques. From

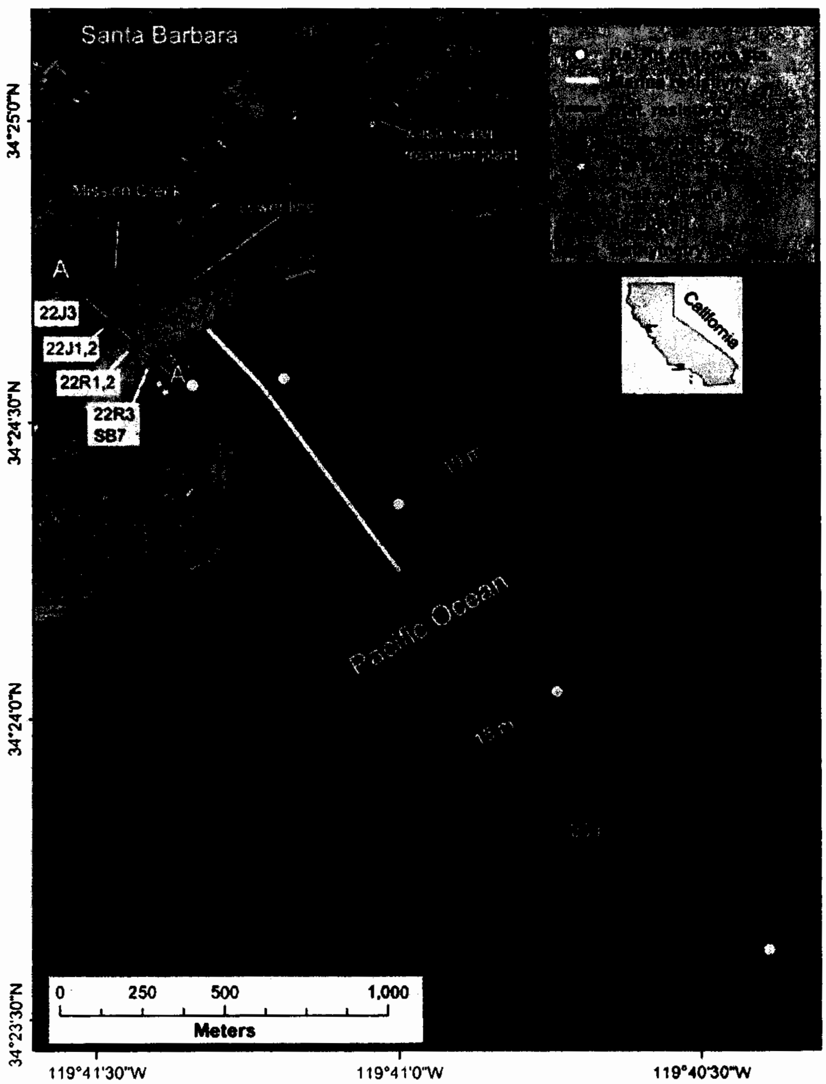

Fig. 1. West Beach, Santa Barbara, California showing the position of the electromagnetic seepmeters, time-series Rn deployments, offshore transect sites (Rn and Ra) and the streamer location for land-based, multi-electrode and the marine continuous resistivity profile. Also shown is the shore-parallel running sewer line (which may be a source of excess nutrients and bacteria to the beach), the nearby waste water treatment plant, and the position of the hydrogeologic transect (A–A′) shown in Fig. 3.

calculated fluid exchange rates per season, we are able to derive SGD nutrient loading estimates. On the basis of our results, we have determined that the wave/tide-driven exchange of shallow groundwater with coastal sea water can convey a sustained load of select nutrients and trace elements to the near-shore waters off Santa Barbara, California, even without a net flow of fresh groundwater towards the sea.

2. Study site

Field data were collected at a meso-tidal, sandy beach ('West Beach') adjacent to Santa Barbara, California (Fig. 1), where fecal indicator bacteria (FIB) in the surf zone are occasionally present at high enough concentrations to necessitate beach warnings or closures (Izbicki et al., in review). Three beach and water column sampling campaigns targeted spring tide (November 2005, April 2007) and neap tide (May/June 2006) cycles, as well as seasonal variations (Fig. 2). Mission Creek, which discharges adjacent to West Beach, is an obvious potential source for FIB, as are subaerial and submarine groundwater discharge (Boehm et al., 2004; Paytan et al., 2004; Boehm and Weisberg, 2005; Boehm, 2007; Yamahara et al., 2007) and any possible leakage from the shore-parallel municipal sewer line that lies buried beneath the landward edge of West Beach. While a companion report addresses the various sources of FIB and their hydrologic forcing in coastal Santa Barbara (Izbicki et al., in review), here we examine the marine effects (i.e., tides) on groundwater exchange and associated nutrient loading to the coastal waters of Santa Barbara Harbor. Details on the hydrogeologic setting of this study site can be found in Muir (1968), Martin (1984), and Freckleton et al. (1998).

Santa Barbara, located about 150 km northwest of Los Angeles along the Pacific coast of the United States, has a Mediterranean-

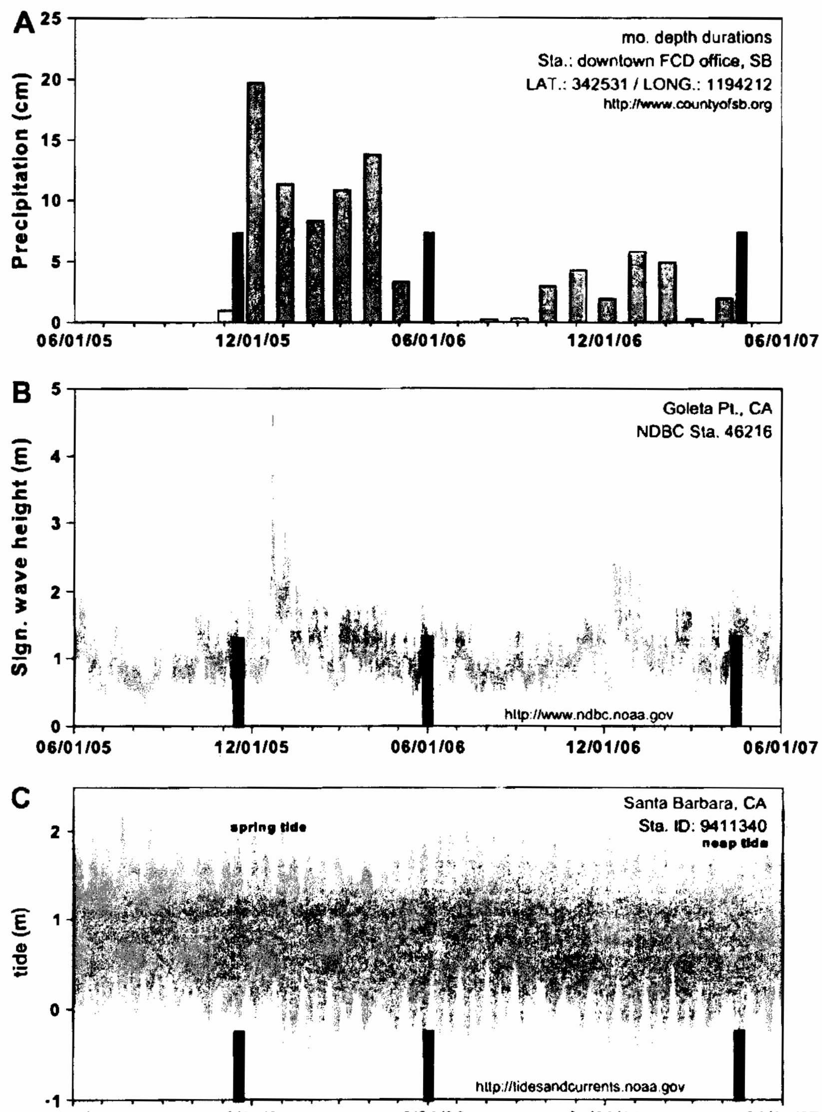

Fig. 2. Black bars denote sampling events as a function of: (A) the monthly precipitation record for down-town Santa Barbara, California; (B) significant wave height (m); and (C) the verified tide record (m) from 06/2005 to 06/2007. Sampling events were coordinated around maximum tides and seasons.

type climate characterized by relatively dry and mild summers and winter months that can be periodically cool and wet. Temperatures are moderated by the sea; mean winter temperatures are ~13 °C, while summer temperatures average 18 °C. The population of Santa Barbara exceeded 90,000 in 2004 (http://www.santabarbaraca.gov) and is confined along a narrow (~5 km wide) but highly developed coastal strip that is bounded to the north by the Santa Ynez coastal mountains. Average annual rainfall in Santa Barbara is ~45 cm and about 95% falls between November and March (Fig. 2). The Santa Barbara watershed is drained by several streams that are mostly intermittent along their lower reaches, including Mission Creek, which flows through the town's center and discharges into the Pacific Ocean within the study site (MacFadden et al., 1991).

Nearly all groundwater recharge and surface water flow is derived from precipitation within the region (Martin, 1984). Principal groundwater-bearing deposits of the regional aquifer system include the alluvium (terrace deposits, poorly-sorted sands, gravel, silt and clay) and the Santa Barbara Formation (marine origin, fine to coarse sands, gravel, silt and clays) (Freckleton et al., 1998). Historically, some groundwater has been locally artesian. Under sustained and heavy groundwater pumping along the coast, salt water intrusion is likely to occur wherever the water table of a coastal aquifer approaches sea level. In Santa Barbara, since the early 1960s, the groundwater levels at the coast have been below sea level, and salt water has locally intruded the shallow deposits as water levels have declined. In the late 1970's, groundwater levels declined by more than 30 m in response to increased municipal pumping, and salt water subsequently intruded deeper water-bearing deposits close to the coast. Presently, salt water intrusion along coastal Santa Barbara is carefully monitored (Martin, 1984).

Winter precipitation events can deliver substantial amounts of dissolved and particulate nitrogen, phosphate, and carbon to the coastal ocean, particularly from watersheds heavily influenced by agriculture and urban development (Beighley et al., 2008). During winter months, marine nitrogen inputs tend to be low, which contributes to a strong seasonality in both physical and geochemical signals in the coastal waters off Santa Barbara (Warrick et al., 2005; McFee-Shaw et al., 2007).

3. Field and analytical methods

3.1. Groundwater

A set of shallow monitoring wells, located either along a shore-perpendicular beach transect (Fig. 3), or within close proximity of the beach, were sampled in mid-November 2005, late May/early June 2006, and in mid-April 2007 for groundwater ^{222}Rn, ^{223,224,226,228}Ra, nutrients (NH_4^+, SiO_4, PO_4^{3-}, [NO_2^- + NO_3^-], DIN, TDN, and DON). For the duration of the study, groundwater levels in these monitoring wells were continuously recorded with pressure transducers and manually confirmed using a hydro-tape (Izbicki et al., in review). During each of the three sampling efforts, the monitoring wells were sampled following standard USGS protocols that included purging at least three well volumes before sample collection. In April 2007, a temporary well ('tempwell') was installed just landward of the high tide line by excavating sand to a depth of 1.5 m and installing a 10 cm diameter slotted irrigation pipe that was also screened to exclude larger-sized particulates. This tempwell was instrumented with a Solinst CTD DIVER to monitor salinity, temperature, and water levels (pressure), and also continuously (30 min updates) sampled for ^{222}Rn using one RAD7 ^{222}Rn monitor. The tempwell was sampled for a suite of nutrients and trace metals, before, during, and after a low tide event. The tempwell groundwater time-series was also complemented with simultaneous water column grab samples collected in the adjacent swash zone ('surface water'), as well as with a suite of time-series samples collected in the adjacent shallow groundwater well SB7 (see Fig. 3 for locations of SB7, tempwell, and surface water sites). Nutrients were immediately preserved in the field and analyzed at the Woods Hole Oceanographic Institution (WHOI) nutrient facility as per methods described in Charette and Buesseler (2004).

3.2. Surface water column

The near-shore coastal waters adjacent to Santa Barbara harbor and beach were sampled to achieve the following three objectives: (1) continuous ^{222}Rn surveys were first used to identify potential SGD 'hotspots' where elevated ^{222}Rn might reveal enhanced

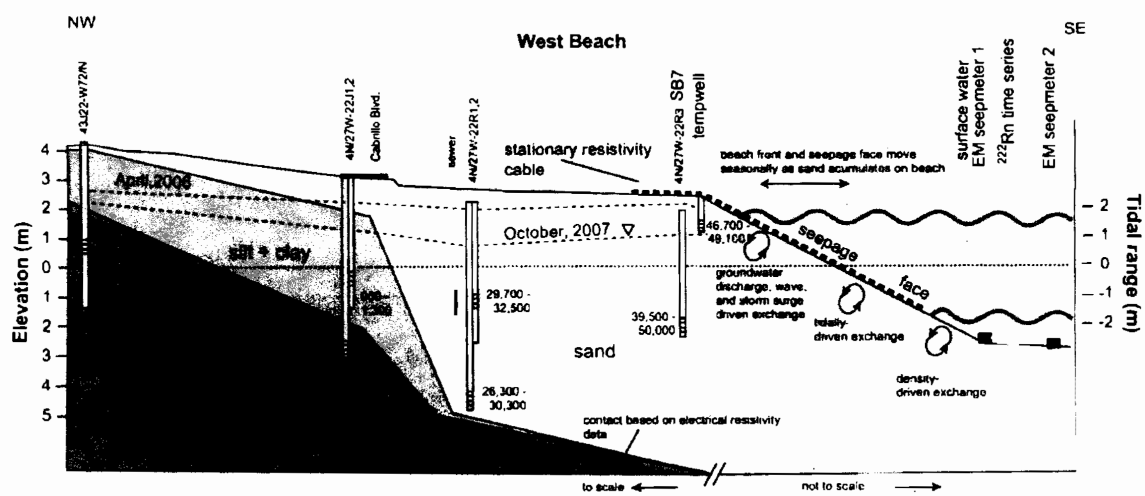

Fig. 3. Idealized shore-perpendicular cross-section, showing approximate configuration of clay, silt + clay, and sand layers relative to the land/sea interface. The position of the stationary, shore-perpendicular resistivity line, shown in Fig. 5, is illustrated, as are the relative positions of the two EM seepmeters (Fig. 6) and the 2007 time-series sampling sites for the tempwell, surface water sampling sites, and SB07 (Figs. 7 and 10). Observed groundwater/surface water exchange within this beach front can be expressed as density-, tidal-, or groundwater/wave-driven exchange, or a combination thereof. Ranges in specific conductivity per well reported in mS cm^{-1} from 2006 and 2007 sampling data.

advective exchange across the sediment/water interface; (2) ^{222}Rn time-series measurements just seaward of the low tide line off the beach were used to derive total (fresh + saline) SGD rates from a mass balance model; and (3) ~3 km long offshore transects of ^{222}Rn and $^{223,224,226,228}Ra$ were used to examine offshore constituent gradients, water mass mixing coefficients (K_h), apparent Ra ages, and ultimately, a more regional assessment of SGD.

The surface water column was sampled during November 2005, May/June 2006, and April 2007 using a submersible pump that was either attached to a weight placed on the seafloor (near-shore ^{222}Rn time-series) or suspended 0.5 m from the water surface off a small boat's gunwale (^{222}Rn surveys and offshore transects). During the first field campaign (November 2005), multi-day radon surveys were conducted prior to the installation of time-series stations and were used as a guide in their placement relative to shore. For the ^{222}Rn time-series measurements, a dedicated tender anchored just seaward of the low tide line housed two RAD7 ^{222}Rn detectors plumbed in parallel into a single air–water exchanger (Burnett et al., 2001, 2003, 2006; Dulaiova et al., 2005) that was fed by an instrumented (YSI-multi-probe) bottom water stream via a submersible bilge pump. Air from the exchanger was routed to one or more RAD7 detectors that quantified ^{222}Rn from the decay of its two alpha-emitting daughter isotopes, ^{214}Po ($t_{½}$ = 3.03 min) and ^{218}Po ($t_{½} = 1.6 \times 10^{-4}$ s). During each sampling event, ^{222}Rn was also measured in ambient air using one dedicated RAD7 detector. For Ra isotope analyses, large volumes (20–100 L) of water were passed through individual MnO_2 impregnated acrylic fiber cartridges (Moore, 2000a; Moore and de Oliveira, 2008). Ra-223,224 activities were quantified from partially dried fibers using delayed coincidence counters (Moore and Arnold, 1996; Moore, 2000b). An ultra-low background HPGe well gamma counter was subsequently used to quantify $^{226,228}Ra$ (351.42, 609.31, 338.42, and 911.16 keV, respectively) from the same fiber sample after a chemical elution and $BaSO_4$ co-precipitation (Swarzenski et al., 2007c). Reported errors for Ra and Rn are typically <10%. Water column nutrient and trace element samples were collected following clean sampling procedures, including in-line filtration (individual 0.4 μm cartridge filters) and cold storage.

3.3. Electrical resistivity

The use of electrical resistivity to examine the fresh water/salt water interface in coastal groundwater is well established (cf. Manheim et al., 2004) and has been enhanced by recent improvements in streamer configuration, as well as data acquisition and processing firmware and software (Swarzenski et al., 2006a,b, 2007a,b). In Santa Barbara, both land-based, stationary resistivity (56 electrodes, spaced 2 m apart) and marine continuous resistivity profiling (two current, nine potential electrodes, spaced 10 m apart) surveys were conducted during each field campaign. To help define the shallow hydrogeology at the site, only one land-based time-series survey (high and low tide comparison) and one adjacent continuous resistivity profile are presented here.

In stationary mode, an Advanced Geosciences Inc. (AGI) external switching box connected to an R8 SuperSting multi-channel receiver controlled the current flow along the 56-electrode cable (Swarzenski et al., 2006a, 2007b). The 112 m stationary cable was oriented either shore-parallel or shore-perpendicular, and each electrode was pinned to the underlying sediment by a stainless steel 35 cm spike. The relative elevation of each electrode was measured using a laser level and the topography/bathymetry data were then incorporated into inverse modeling routines (AGI EarthImager). In continuous marine mode, the 120 m cable was pulled at a speed of ~3–4 kts on the surface of the water column (Swarzenski et al., 2006b). Real-time GPS data was simultaneously logged into the SuperSting receiver. Polyethylene floats attached to the streamer cable between each electrode were used to keep the cable buoyant on the water surface. Real-time continuous water column salinity/temperature measurements were recorded on an YSI multi-meter, while water depth and the ship's position were recorded on a separate GPS-enabled fathometer system.

3.4. Electromagnetic seepage meters

Electromagnetic (EM) seepage meters (Rosenberry and Morin, 2004; Swarzenski et al., 2004) were also deployed continuously for 4–5 days during each field season in the shallow coastal waters off West Beach to physically measure water exchange rates across the sediment/water interface. These meters were pushed into the sandy sediments >15 cm to assure a complete seal around the base of the meter and were generally positioned in a shore-perpendicular configuration such that 1 m (EMS1) was just seaward of the low tide line, and the other meter (EMS2) was positioned slightly further offshore (Fig. 3) in deeper water. The meter display/control panels and power supplies (12 vDC or 120 vAC) were placed on the offshore ^{222}Rn time-series tender. The EM seepage meters were outfitted with internal- and external-mounted Solinst CTD DIVERS to continuously monitor the salinity, pressure, and temperature both inside and outside the seepage meter domes. Each meter recorded the bi-directional (+ or −) flow rate once every minute.

4. Results and discussion

A compilation of the range in specific conductivity, and $^{223,224,226,228}Ra$ and ^{222}Rn activities, from a suite of monitoring well samples (November 2005, May/June 2006, April 2007), the 2007 tempwell samples, and from the adjacent sea water column are listed in Table 1. Groundwater collected from the wells exhibited a broad range (0.8–47.9 mS cm^{-1}) in specific conductivities

Table 1
Compilation of specific conductivity (mS cm^{-1}) and ^{222}Rn and $^{223,224,226,228}Ra$ activities (dpm m^{-3}) from select monitoring wells, a temporary well (tempwell), and near-shore surface sea water. The reported error for Ra and Rn is <10%. (x) denotes number of samples reported.

	Spec. Cond. (mS cm^{-1})	^{222}Rn	^{226}Ra	^{228}Ra	^{223}Ra	^{224}Ra
		(dpm m^{-3})				
Groundwater						
Wells[a]	0.8–47.9	15,000–134,000 (30)	190–650 (9)	400–3640 (9)	170–430 (9)	360–14100 (9)
April 2007 tempwell	46.7–49.1	257,000–570,500 (90)	260–360 (3)	900–1350 (3)	200–310 (3)	420–8200 (3)
Sea water						
November 2005	40.5–43.6	700–8150 (135)	–	–	–	–
May/June 2006	50.0–54.5	580–11,300 (587)	55–120 (8)	23–150 (8)	3–37 (8)	30–530 (8)
April 2007	39.1–51.4	1190–7380 (414)	81–130 (8)	11–210 (8)	17–120 (6)	12–140 (6)

[a] All samples (November 2005, May/June 2006, and April 2007).

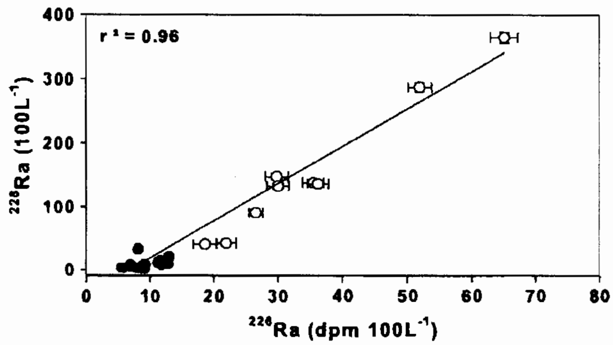

Fig. 4. Plot of combined (November 2005, May/June 2006, and April 2007) ^{226}Ra versus ^{228}Ra activities (dpm $100\,L^{-1}$) in coastal surface (●) and ground water (o) samples at Santa Barbara, California.

depending on distance from the shoreline and screen depths, and approached the upper limit of observed sea water values (39.1–54.4 mS cm^{-1}). Specific conductivities and water level data from wells along the shore-perpendicular transect (Fig. 3) revealed no significant net discharge of shallow, fresh groundwater to the coastal ocean during the dry season. During winter months, enhanced runoff and precipitation can collect along the upper beach in surface pools that eventually discharge along the beach seepage face as brackish fluxes (Izbicki et al., in review).

Fig. 4 shows a plot of all near-shore surface water and groundwater $^{228,226}Ra$ activities. Surface waters were typically elevated in the two Th-series Ra isotopes ($^{228,224}Ra$) relative to the two U-series Ra isotopes ($^{226,223}Ra$). There is a strong linear trend in both sets of $^{226,228}Ra$ samples, suggesting that Ra is diluted in surface waters from a common groundwater source. The four Ra isotope activities ($^{223,224,226,228}Ra$) were generally much higher in the surrounding monitoring well samples than in the shallow tempwell samples. This attribute illustrates the hydrogeologic controls on groundwater radionuclide activity, including changes in the subsurface salinity and residence (flushing) times. In contrast, ^{222}Rn activities were highest in the tempwell (mean = 463 ± 61 dpm L^{-1}) and attained values up to two orders of magnitude greater than near-shore surface waters (mean = 4 dpm L^{-1}). Nonetheless, these near-shore surface waters adjacent to West Beach were enriched in the two short-lived $^{223,224}Ra$ and ^{222}Rn relative to more distal sea water.

Groundwater and surface water nutrient (NH_4^+, SiO_4, PO_4^{3-}, $[NO_2^- + NO_3^-]$, dissolved inorganic nitrogen (DIN = $[NH_4^+ + NO_2^- + NO_3^-]$), dissolved organic nitrogen (DON), and total dissolved nitrogen (TDN)) concentrations per sampling campaign are summarized in Table 2. In general, there is little inter-annual variation in groundwater nutrient concentrations, although in April 2007 the shallow beach well (SB07) and the tempwell exhibited distinctly different nutrient concentrations from those found in the monitoring wells. As expected, near-shore surface waters contained much lower nutrient concentrations than the adjacent groundwater, although this trend did not hold for DON, which was slightly greater in the surface water.

Electromagnetic seepmeter results yielded rates that were both positive (net upward flow = submarine groundwater discharge) and negative (net downward flow = sea water infiltration), depending on the meter's location relative to shore, the tidal stage, time of year (frequency and intensity of precipitation), and occurrence of antecedent storms. The observed range (−6.7 to 14.5 cm day^{-1}) in advective rates, while low in comparison to other coastal sites (Swarzenski et al., 2007a), did reveal inter-annual variations (Table 3).

Table 3

Summary of mean submarine groundwater discharge rates (in cm day^{-1}), as calculated from stationary ^{222}Rn time-series (*ts*) deployments in the near-shore surface water column, electromagnetic seepmeters (EMS1 was always positioned closer to the low tide line than EMS2), and from excess ^{226}Ra and ^{222}Rn transect (*trans.*) measurements (see Section 4.3 for discussion).

	^{222}Rn (*ts*)	EMS1	EMS2	^{226}Ra (*trans.*)	^{222}Rn (*trans.*)
	cm day^{-1}				
November 2005	3.1 ± 2.6	−0.3 ± 1.6	6.0 ± 4.2	–	–
May/June 2006	0.2 ± 0.8	−6.7 ± 3.5	8.8 ± 5.2	–	–
April 2007	6.5 ± 9.0	–	14.5 ± 55.4	9.6	7.8

4.1. Electrical resistivity

Only two examples of electrical resistivity surveys are presented here; one (Fig. 5A,B) consists of a land-based time-series (low tide/high tide) comparison across the beach face (see Figs. 1 and 3 for approximate orientation of the land-based streamer), while the other (Fig. 5C) is an adjacent marine continuous resistivity profile (CRP). The CRP data was collected by placing the streamer end at the shoreline and then running a shore-perpendicular 853 m transect offshore (see Fig. 1 for CRP transect location). Resistivity values are reported in Ohm-m.

Multi-electrode resistivity provides a useful means of examining the subsurface salinity structure to depths >20 m. Because the position of the land-based streamer is fixed during the high tide/low tide time-series and the data collection/inversion parameters remain constant, the observed change in resistivity must be due only to tidally modulated pore-fluid exchange. From Fig. 5A, the highest resistivity values (i.e., freshest groundwater) appear focused under the high tide water line, at a depth of about

Table 2

Mean groundwater and near-shore surface water nutrient concentrations (μM). Location of groundwater well sites described in Izbicki et al. (in review). Relative position of the surface water, tempwell, and SB07 time-series* samples relative to the beach face provided in Fig. 3.

	NH_4^+	SiO_4	PO_4^{3-}	$[NO_2^- + NO_3^-]$	DIN	DON	TDN	*n*
	(μM)							
Groundwater								
November 2005	64.7 ± 8.4	145.6 ± 15.6	36 ± 2.4	0.1 ± 0.2	64.8 ± 8.5	-	-	9
May/June 2006	62.1 ± 2.8	200.5 ± 5.1	37.5 ± 3.6	0.1 ± 0	62.1 ± 2.8	20.5 ± 2.1	82.6 ± 4.1	11
April 2007 tempwell*	17.4 ± 2.4	122.7 ± 35.5	11.6 ± 3.3	158.6 ± 42.9	176 ± 41.3	24.2 ± 24.9	200.2 ± 61.4	14
April 2007 SB07*	39.5 ± 2.4	272.2 ± 31.8	54.9 ± 6.8	0.1 ± 0	39.5 ± 2.5	28.2 ± 4.1	67.7 ± 3.6	14
Mean	45.9 ± 4	185.2 ± 22	35 ± 4	39.7 ± 10.8	85.6 ± 13.8	24.3 ± 10.3	116.8 ± 23	
Sea water								
November 2005	8.7 ± 7.7	15 ± 4.1	2.2 ± 1.5	0.3 ± 0.2	9 ± 7.7	–	–	9
April 2007*	13 ± 13.7	30.3 ± 9.2	3.2 ± 2.8	17.4 ± 7.8	30.4 ± 14.1	33.3 ± 60.5	63.7 ± 69.1	14
Mean	10.9 ± 10.7	22.6 ± 6.6	2.7 ± 2.2	8.9 ± 4	19.7 ± 10.9	-	-	

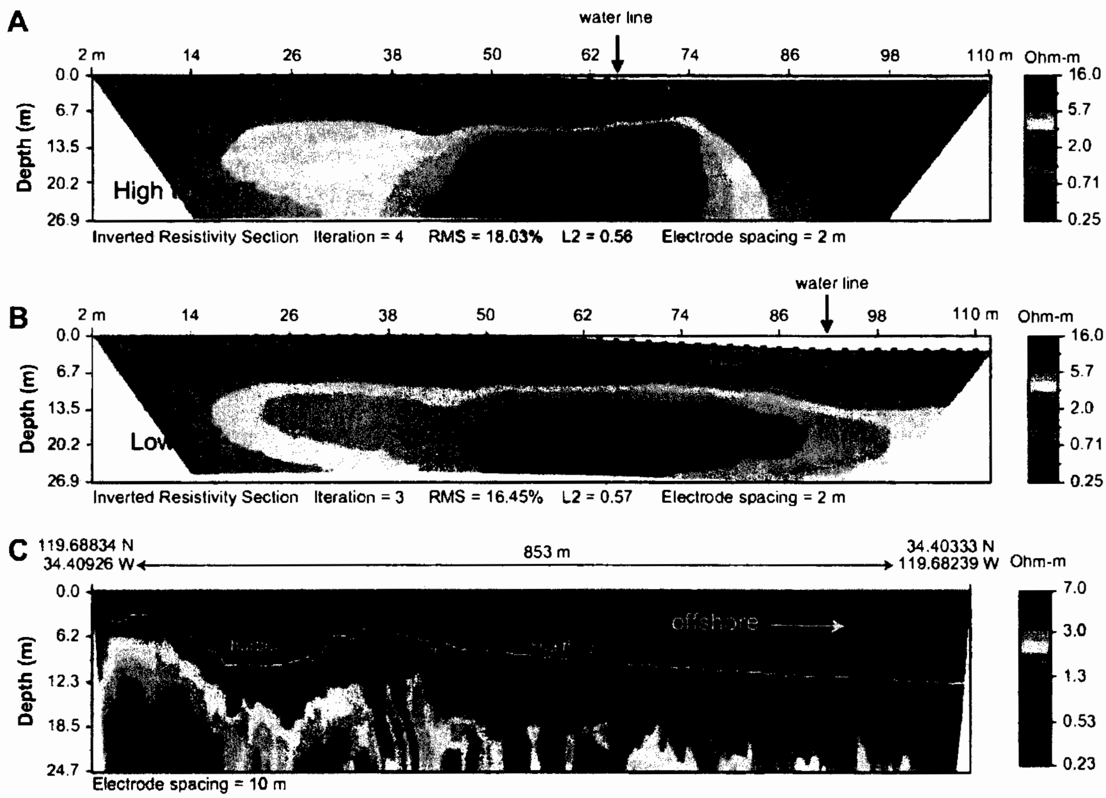

Fig. 5. Inverted resistivity image of the beach face during high (A); and low (B) tide. The tidal range was ~2 m. Approximate position of the shore-perpendicular oriented land-based streamer cable relative to the beach face is shown in Fig. 3. (C) Shows a marine continuous resistivity profile (CRP) survey of an 853 m line adjacent to the A–A′ primary transect. Location of this transect line is illustrated in Fig. 1.

15 m. In contrast, at low tide (Fig. 5B), the zone of higher resistivity is stretched much further offshore, past the low tide water line (~50 m). The resistivity images show a shallow saline water wedge positioned on top of the water table and provide further evidence that there is likely no significant discharge of freshened groundwater along the beach face within the depths studied. Instead, it appears that the saline pore fluids respond more to tidal forcing; during high tide, incoming sea water pushes against the groundwater lens which consequently gets backed up close to the high tide line. At low tide, this pressure is released by a falling water table and the groundwater lens can migrate further seaward, inducing mixing within a zone of enhanced SGD that extends 50 m or so from shore. This tidally driven exchange likely discharges some SGD into the water column during every low tide event that is captured by the ^{222}Rn time-series and the EM seepmeters.

Marine continuous resistivity profiling (CRP) surveys were conducted in November 2005 and May/June 2006 in concert with the Rn surveys, and allow large datasets of subsurface resistivity to be collected (boat speed ~3–4 kts). However, without additional groundtruthing measures (i.e., core logs, pore water salinities, sediment resistivities), it is often difficult to extract more than qualitative information from such data. The modeled resistivity image shown in Fig. 9C shows an expected 'freshening' closest to shore at a depth >15 m. The CRP resistivity range is comparable to values derived from the land-based surveys (Fig. 5A,B), and confirms that no obvious discharge of reduced-salinity groundwater occurs beyond ~50 m from shore.

4.2. Time-series

To develop a mass balance model for submarine groundwater discharge, a time-series of excess ^{222}Rn in near-shore surface water was utilized (Burnett and Dulaiova, 2003; Burnett et al., 2003, 2006, 2007, 2008; Dulaiova et al., 2005, 2006a,b; Swarzenski et al., 2006b, 2007a; Weinstein et al., 2007). The premise of this technique relies on converting near-continuous excess ^{222}Rn (accounting for a mean parent ^{226}Ra water column activity) measurements (dpm m^{-3}) into inventories (dpm m^{-2}) using real-time water-level data. Rn-222 inventories are subsequently converted into hourly fluxes (dpm m^{-2} h^{-1}) and then corrected for both tidal radon exchanges (positive as offshore ^{222}Rn brought in by an inflowing tide and negative as ^{222}Rn lost during an outflowing tide) and atmospheric ^{222}Rn losses.

Fig. 6D shows a representative example of a multi-day ^{222}Rn time-series in November 2005, as a function of (Fig. 6A) tidal water level variations and specific conductivity. During this time-series, each low tide event was marked with a pulse of heightened SGD, as recorded also by the EM seepage meters (Fig. 6B,C) as well as the specific conductivity record that revealed that the salinity of the shallow groundwater was actually higher than the near-shore waters. Interestingly, EM seepage meter 1 showed distinct low tide-coincident pulses in spite of mostly net negative SGD rates and that slightly more saline water escaped the sediment/water interface at low tide relative to the surface water salinities. While the overall pattern of SGD, as quantified by the two EM seepage meters, shows some similar features, the mean rates (EM seepage meter $1 = -0.3 \pm 1.0$ cm day^{-1}; EM seepage meter $2 = 6.0 \pm 4.2$ cm day^{-1}) reflect the different placement of the two seepmeters

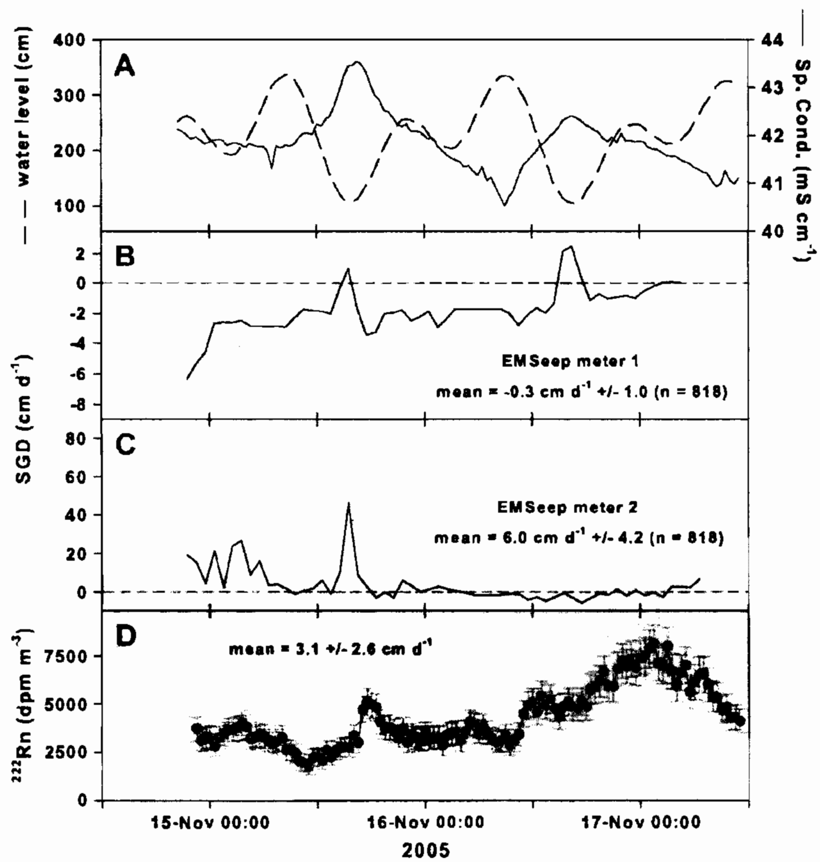

Fig. 6. Water column time-series (November, 2005), showing: (A) water level (tide), specific conductivity (mS cm^{-1}); (B, C) advective SGD rates derived from electromagnetic (EM) seepmeters (cm day^{-1}); and (D) ^{222}Rn activities (dpm m^{-3}). Note low tide coincident pulses in specific conductivities, EM seepmeter derived advective rates, and ^{222}Rn.

relative to the shoreline, and thus water depth. EMS1 was positioned further inshore, just seaward of the low tide line, than EMS2. From both EM seepage meter records, one can infer subtle nuances in SGD. For example, it is likely that EMS1 responded more to tidally-modulated shallow exchange processes that occurred within the beach face as shallow saline circulation cells (Robinson et al., 2007b) (see Fig. 3). Such discharge could have both physical and hydrologic controls. The passage of a high-energy storm just prior to sampling could push sea water much further up the beach face where recharge, subsurface flow, and eventual offshore discharge would influence the salinity and flow rates of SGD.

To be able to convert near-shore total ^{222}Rn fluxes (dpm m^{-2} h^{-1}) into advective exchange rates (cm^3 cm^{-2} day^{-1}), a representative groundwater endmember activity must be quantified. A groundwater ^{222}Rn time-series was collected within the high tide line tempwell, which was also monitored for continuous water levels and specific conductivities (Fig. 7). Fig. 7A shows tidally-driven, water level variations of near-shore surface waters, while a record of tempwell water levels and specific conductivities is shown in Fig. 7B. A slight increase in the salinity in the tempwell appears coincident with the first low tide event, but sustained pumping ran the tempwell temporarily dry, and the interruption in the water flow was recorded as a break in ^{222}Rn and specific conductivity values. Accounting for this interruption, the groundwater ^{222}Rn within the tempwell ranged (Fig. 7C) from ~360 to 570 dpm L^{-1}, with a mean of 463 ± 61 dpm L^{-1} ($n = 90$). This value is considerably higher than the range in ^{222}Rn observed (15–134 dpm L^{-1}) within the suite of groundwater monitoring wells adjacent to West Beach and does reflect more closely the water that is actually involved in the near-shore exchange. Dividing the total ^{222}Rn fluxes by this groundwater ^{222}Rn value results in a mean SGD rate of 3.1 ± 2.6 cm day^{-1}. Such SGD rates were also calculated for the 2006 and 2007 ^{222}Rn time-series deployments and are reported in Table 3. If we estimate from land-based resistivity data a narrow seepage face of ~50 m, then these advective rates would correspond to 1.5–4.6 m^3 of groundwater exchanged per day, per meter of shoreline. These results compare favorably to similar values obtained from the EM seepmeters, which yield a flux of 0.5–7.3 m^3 m^{-1} day^{-1}.

4.3. Offshore Ra and Rn transects

In coastal waters where water mass mixing is more a function of eddy diffusion than advection processes, it has been shown (Moore, 2000a) that the two short-lived Ra isotopes (^{223}Ra = 11.3 day; ^{224}Ra = 3.66 day) can be used effectively to obtain Ra-derived apparent water mass ages (Fig. 8A) and eddy diffusion coefficients, K_h (m^2 s^{-1}). The premise of this method is that all Ra inputs occur only at the shoreline (i.e., surface water column is stratified) and Ra losses occur only as a function of radioactive decay. Water mass mixing rates can then be derived from the slope of a natural logarithm of either Ra isotope as a function of distance from shore. During the April 2007 sampling, the near-shore surface water column was stratified due to thermal heating (http://www.lternet.

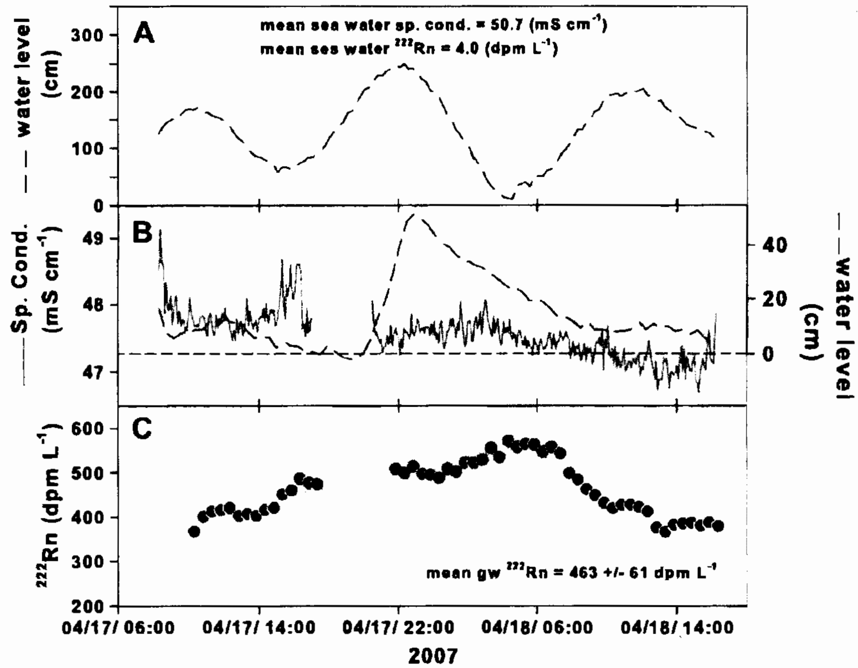

Fig. 7. Groundwater ^{222}Rn time-series (C) from a temporary 1.5 m deep well ('tempwell'), positioned just landward of the high tide line (see Fig. 3 for relative location). The tempwell water level decline (B) is reflected in a both Rn and specific conductivity (mS cm^{-1}). A mean groundwater ^{222}Rn activity (●) of 463 ± 61 dpm L^{-1} is used for water column time-series and offshore transect ^{222}Rn-derived SGD derivations. Note mean near-shore surface water ^{222}Rn activity of 4.0 dpm L^{-1} and near-shore tidal fluctuation (A).

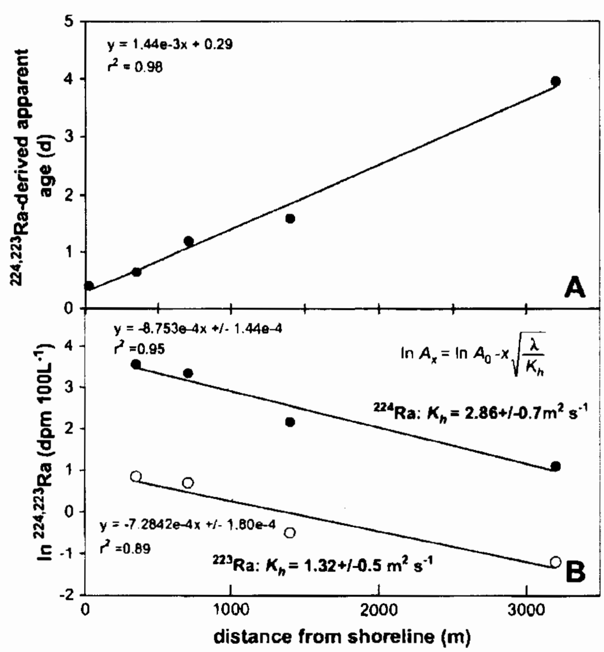

Fig. 8. (A) Plot of $^{223,224}Ra$-derived apparent water mass ages ("Ra-ages") as a function of distance offshore (m); and (B) ln $^{223,224}Ra$ activity as a function of distance from shore used to derive eddy diffusion coefficients, K_h. The offshore transect was conducted in June 2006. At 3200 m (the distal station), the water depth was 34.2 m and the surface water column was stratified due to thermal heating and wind mixing (http://sbc.lternet.edu/data).

edu/sites/sbc/). Fig. 8B shows a plot of ln $^{223,224}Ra$ versus distance from the West Beach shoreline collected during the April 2007 field season. The ln^{223}Ra regression had a slope of $-7.28e\text{-}1 \pm 1.80e\text{-}1$ km^{-1} from which a mixing coefficient K_h of 1.32 ± 0.5 $m^2\ s^{-1}$ was calculated using Eq. (1):

$$\text{slope} = \sqrt{\frac{\lambda}{K_h}}. \tag{1}$$

A K_h of 2.86 ± 0.7 $m^2\ s^{-1}$ can be similarly calculated from ln^{224}Ra. Differences in these two K_h values reflect the difference in the half-lives of $^{223,224}Ra$. Nonetheless, these K_h values are comparable to other such estimates, as calculated for example off close-by Huntington Beach, California (Boehm et al., 2004; Colbert and Hammond, 2007a,b).

Once these eddy diffusion coefficients have been calculated, one can re-examine the offshore ^{226}Ra distribution to derive another measure of SGD (e.g., Moore and de Oliveira, 2008; Burnett et al., 2008). The flux of ^{226}Ra away from our study site at West Beach can be expressed as a product of ^{223}Ra-derived K_h multiplied by the offshore ^{226}Ra gradient and the thickness of the mixed layer. A linear ^{226}Ra gradient of -13.79 ± 5.6 dpm m^{-3} per km was calculated along a 3.2 km transect using a mean near-shore surface water ^{226}Ra activity of 125.48 ± 6.5 dpm m^{-3} ($n = 3$) and an offshore value of 82 ± 0.5 dpm m^{-3} ($n = 3$). In the absence of rivers or streams that could introduce 'new' Ra into the coastal waters, the calculated offshore ^{226}Ra flux of $1.6 \pm 0.8 \times 10^6$ dpm km^{-1} day^{-1} using the ^{223}Ra-derived K_h and a water parcel depth of 1 m must be balanced by an equal groundwater exchange term. Three groundwater ^{226}Ra values (mean $^{226}Ra = 328.1 \pm 53.5$ dpm m^{-3}) were obtained from the tempwell. Dividing the offshore ^{226}Ra flux by this groundwater term yields a groundwater exchange rate of 4.8 ± 3 $m^3\ m^{-1}\ day^{-1}$, which corresponds to 9.6 cm day^{-1}, if we assume again that Ra enters the water column within a 50 m wide band, as defined earlier by land-based resistivity. This SGD rate is very close to the similarly calculated SGD rate ($\sim$6–13 $m^3\ m^{-1}\ day^{-1}$) obtained at Huntington Beach, California by Boehm et al. (2006).

During the offshore transect Ra sampling, the surface waters were also continuously analyzed for ^{222}Rn using four RAD7s. As each Ra sampling event lasted over 1 h, the RAD7s simultaneously recorded the ^{222}Rn concentration at each Ra station. The distribution of ^{222}Rn along the same shore-perpendicular transect can be similarly examined to obtain further SGD and mixing rate information, including combined atmospheric loss and radioactive decay terms. Based on an average Rn value obtained from multiple readings observed at each offshore station, a linear ^{222}Rn activity gradient of -1.17 dpm m^{-3} per m was obtained using the April 2007 near-shore ^{222}Rn time-series data (mean = 4040 ± 1171 dpm m^{-3}) and a mean offshore ^{222}Rn activity of 330 dpm m^{-3}. Atmospheric loss terms were negligible relative to the radon inventories. Multiplying this linear ^{222}Rn gradient by the ^{223}Ra-derived K_h yields a total offshore flux of 1.80×10^6 dpm $m^{-1}\ day^{-1}$, or 1503 dpm $m^{-2}\ h^{-1}$ if one integrates this flux across the 50 m wide SGD zone. This ^{222}Rn flux rate compares well to the mean mixing loss term (1290 dpm $m^{-2}\ h^{-1}$) calculated from the corresponding surface water column ^{222}Rn time-series data. Dividing this flux rate by the mean groundwater ^{222}Rn activity observed in the tempwell (Fig. 7: 463,000 dpm m^{-3}) results in a groundwater exchange rate of 3.9 $m^3\ m^{-1}\ day^{-1}$ (i.e., 7.8 cm day^{-1}) – a value very similar to the rate obtained using ^{226}Ra. The similarity of these two independent SGD estimates across a single shore-pendicular transect confirms the utility of these two tracers of SGD, and that in these coastal waters off Santa Barbara, SGD consists of mostly of recycled sea water without a significant fresh water component.

As the half-lives of ^{224}Ra (3.66 day) and ^{222}Rn (3.8 day) are so similar, and their respective production rates in sediment are constant and quantifiable, one can use their unique geochemical characteristics in coastal waters to define differential mixing loss terms (Dulaiova and Burnett, 2006). While both ^{224}Ra and ^{222}Rn are conveyed into coastal waters by SGD (Ra may have a small additional seasonal riverine source), their estuarine fate is tied directly to water mass mixing and radioactive decay. Additionally, ^{222}Rn, as a noble gas, can escape the air /sea interface. Because of its strong concentration gradient across this interface in coastal waters, this isotope has been used frequently to study air–water gas exchange. Atmospheric evasion of ^{222}Rn is usually modeled as a function of molecular diffusion, taking into account Ostwald's solubility coefficient (α) and an estimate of the gas transfer velocity, k, which has been shown to vary complexly as a function of wind speed, temperature, water currents, and water depth (Macintyre et al., 1995). Dulaiova and Burnett (2006) elegantly developed an approach that quantifies the atmospheric ^{222}Rn loss term independently from a combined $^{222}Rn/^{224}Ra$ isotope method. The premise of this approach is that the $^{222}Rn/^{224}Ra$ ratio should change only as a function of gas evasion terms, including wind speed, currents, water depth, and temperature.

Observed $^{224}Ra/^{223}Ra$ activity ratios along a shore-perpendicular surface water transect and in representative groundwater can be used to estimate apparent ('Ra') water mass ages (Moore 2000). Fig. 8A shows a plot of these 'Ra ages' as a function of distance traveled away from shore. Following the Dulaiova and Burnett's (2006) approach, we decay-normalized the ^{224}Ra data to the slightly longer-lived ^{222}Rn and then plotted both isotopes against the $^{224}Ra/^{223}Ra$-derived apparent ages (Fig. 9). As expected, the ^{222}Rn slope is much steeper than the ^{224}Ra slope, indicating preferential radon losses across the air / water interface. To quantify this loss, the ^{224}Ra line equation is multiplied by a ratio of the two y-intercepts

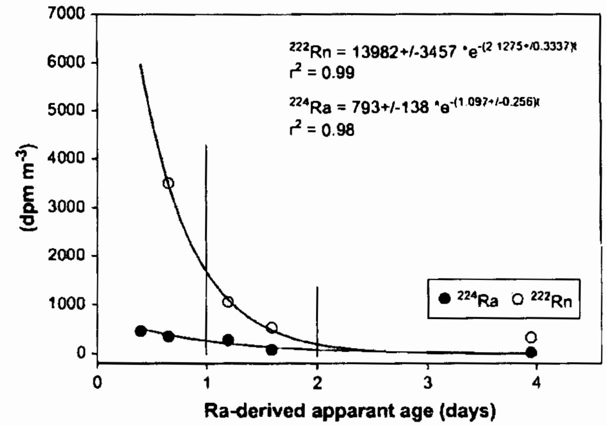

Fig. 9. A plot of decay-normalized ^{222}Rn (○) and ^{224}Ra (●) (dpm m^{-3}) as a function of apparent radium ages along an offshore transect (June, 2006) used to estimate the preferential rate of ^{222}Rn loss from the water column over time (dpm $m^{-3}\ day^{-1}$) due to atmospheric evasion. Since the two nuclides have similar sources and half-lives, the radon air–water exchange rate can be estimated from the difference in the slopes of the ^{222}Rn and ^{224}Ra horizontal distributions.

(13,982/793) and the slope of each line thus represents a total loss rate per time (dpm $m^{-3}\ day^{-1}$) along the transect. The difference in the ^{224}Ra and ^{222}Rn slopes yields an estimate of the ^{222}Rn evasion rate, which ranged up to 1400 dpm $m^{-3}\ day^{-1}$ closest to shore, and compared well theoretical model (Macintyre et al., 1995) results.

4.4. SGD-derived nutrient loading

While the geochemical tracers and the electrical resistivity images provide insight into the scales and patterns of total SGD off West Beach, the lack of a significant fresh water component in this SGD signal does not necessarily rule out the possibility that SGD-derived nutrient loadings to these coastal waters must be insignificant. Table 2 provides a summary of the mean nutrient concentrations in a suite of groundwater samples and adjacent surface water from our study site. The tempwell, which was located close to the high tide line (see Fig. 3 for time-series sampling locations along the beach face), had vastly different nutrient concentrations than the suite of surrounding monitoring wells, including nearby SB07 (Fig. 1). For example, mean PO_4^{3-}, SiO_4 and NH_4^+ concentrations from the tempwell time-series were all considerably lower than what was observed in the monitoring wells. In contrast, mean $[NO_2^- \cdot NO_3^-]$ concentrations approached 0 μm in the monitoring well samples (i.e., strongly reducing nature of the regional aquifer deposits), while in the tempwell $[NO_2^- + NO_3^-]$ exceeded a mean value of 150 μm. Time-series nutrient data (Fig. 10) show tidally modulated NH_4^+, PO_4^{3-} and SiO_4 pulses in the surface waters that appear coincident with a low tide event. The absence of a corresponding $[NO_2^- + NO_3^-]$ peak suggests saline groundwater discharge. Thus, such nutrient profiles provide information as to redox state and residence times of these coastal groundwaters, as well as possible source terms. The position of the tempwell close to the high tide line suggests that $[NO_2^- + NO_3^-]$ inputs may also be locally derived. For example, just above the high tide line a heavy kelp line was actively scavenged by shoreline birds.

Table 2 also summarizes the adjacent sea water nutrient concentrations per season; all are substantially lower than mean near-shore groundwater nutrient concentrations. Such a scenario

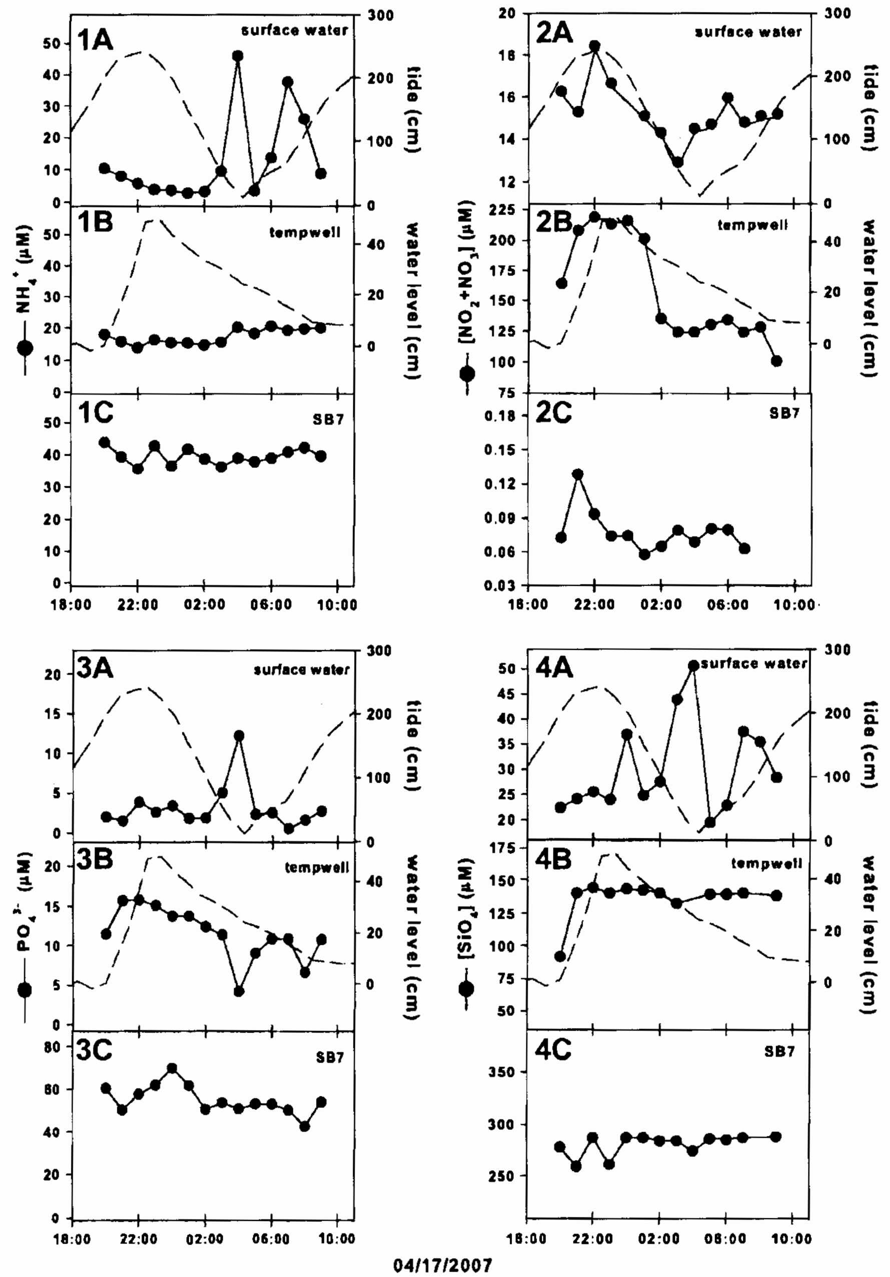

Fig. 10. Time-series of dissolved nutrient concentrations (μM) (1A–C: NH_4^+, 2A–C: $[NO_2^- + NO_3^-]$, 3A–C: PO_4^{3-}, and 4A–C: SiO_4) collected concurrently in near-shore surface water, tempwell, and well SB07 as a function of water level (dashed line). Note scales held constant wherever feasible. Location of tempwell and SB07 relative to high tide line shown in Fig. 3.

sets up a positive concentration gradient that can drive nutrients into near-shore coastal waters with SGD. A summary of calculated SGD rates (cm day^{-1}) is shown in Table 3. Acknowledging conservative nutrient behavior during beach-face transport, one can multiply above SGD rates by the mean groundwater nutrient concentrations to yield the following SGD-derived nutrient loading estimates: 0.06–0.29 mol day^{-1} m^{-1} (NH_4^+), 0.22–0.92 mol day^{-1} m^{-1} (SiO_4), 0.04–0.17 mol day^{-1} m^{-1} (PO_4^{3-}), 0.10–0.57 mol day^{-1} m^{-1} (DIN), and 0.08–0.09 mol day^{-1} m^{-1} (DON). Such loadings (Table 4) are expectedly lower than similarly computed estimates for sub-tropical Tampa Bay, Florida (Swarzenski et al., 2007c) or temperate Hood Canal, Washington (Swarzenski et al., 2007a), but similar in magnitude to SGD-derived DIN (0.12 moles day^{-1} m^{-1}) and SRP (0.005 moles day^{-1} m^{-1}) loadings calculated for the coastal waters off Huntington Beach (Boehm et al., 2006). Such results also suggest that a sustained flux of SGD-derived nutrients can be delivered to the near-shore coastal waters off Santa Barbara, California, where riverine nutrient loads are highly seasonal (Warrick et al., 2005; Beighley et al., 2008) and generally much less than the marine-derived nutrient contributions

Table 4
Combined SGD-derived nutrient loading estimates (mol day^{-1} per meter of shoreline) for the near-shore coastal waters off Santa Barbara. Cumulative uncertainty includes range in SGD rates and seasonality.

	NH_4^+	SiO_4	PO_4^{3-}	$[NO_2^- + NO_3^-]$	DIN	DON	TDN
	(mol day^{-1} m^{-1})						
Range	0.06–0.29	0.22–0.92	0.04–0.17	0–0.52	0.10–0.57	0.08–0.09	0.38–0.65
Mean	0.15	0.51	0.09	0.17	0.32	0.09	0.52
±	0.10	0.30	0.06	0.24	0.01	0.08	0.14

(McFee-Shaw et al., 2007), but where there is no large fresh water SGD component.

4.5. Summary

Repeat geochemical and geophysical measurements have been made on a marine beach and the coastal waters of Santa Barbara, California, to study coastal exchange processes across the land/sea margin, including submarine groundwater discharge (SGD) and associated nutrient loading estimates. The following findings have resulted from this research:

1) the geochemical tracers ^{222}Rn and $^{223,224,226,228}Ra$ are present at much greater activities in the shallow groundwater of our study site than in adjacent near-shore sea water. This attribute allows us to use these radionuclides as quantitative tracers of coastal groundwater discharge. Calculated SGD rates ranged from 3.1 ± 2.6 to 9.2 ± 0.8 cm day^{-1}, depending on which tracer approach was used and on the sampling season. There was very little difference between Ra- and Rn-derived SGD rates, suggesting that the saline component of SGD obtained from Ra accounts for most of total SGD signal;
2) within the constraints of a first-order model, the exponential distribution of $^{223,224}Ra$ and ^{222}Rn in surface waters along a shore-perpendicular transect from the marine beach to >3 km offshore (water depth = 34.2 m) was used to estimate an eddy diffusivity coefficient, K_h (^{223}Ra: $K_h = 1.32 \pm 0.5$ m^3 sec^{-1}; ^{224}Ra: $K_h = 2.86 \pm 0.7$ m^3 s^{-1}). Since ^{224}Ra and ^{222}Rn have similar sources and half-lives, the radon air–water exchange rate can also be estimated from the difference in the slopes of the ^{222}Rn and ^{224}Ra horizontal distributions. Combined $^{222}Rn/^{224}Ra$ water column removal terms yield observed air/sea evasion rates that are very similar to theoretical model (Macintyre et al., 1995) results;
3) electromagnetic seepage meter deployments in the near-shore waters recorded both discharge (positive) and recharge (negative) events that are tidally modulated, and ranged from -0.3 ± 1.0 to 14.5 ± 55.4 cm day^{-1}, depending on the position of the meter relative to shoreline and the sampling season. Low tide coincident pulses in EM seepmeter data also showed a spike in salinity. Such discharge is likely also driven by past sea water intrusion events during storms and subsequent seepage of saline groundwater;
4) nutrients (NH_4^+, SiO_4, PO_4^{3-}, $[NO_2^- + NO_3^-]$, DIN, TDN, and DON) were also quantified in shallow groundwater and the near-shore coastal waters and used to calculate SGD-derived nutrient loading estimates. Depending on the sampling season and on the particular the SGD tracer used, the following nutrient loads were calculated: $NH_4^+ = 0.06$–0.29 mol day^{-1} m^{-1}; $SiO_4 = 0.22$–0.29 mol day^{-1} m^{-1}; $PO_4^{3-} = 0.04$–0.17 mol day^{-1} m^{-1}; $[NO_2^- + NO_3^-] = 0$–0.52 mol day^{-1} m^{-1}; dissolved inorganic nitrogen (DIN) = 0.01–0.17 mol day^{-1} m^{-1}, and dissolved organic nitrogen (DON) = 0.08–0.09 mol day^{-1} m^{-1};
5) electrical resistivity surveys (marine CRP and land-based, stationary) were used to examine the movement of the fresh water/salt water interface in response to the lunar tide, as well as to map the offshore extent of the SGD zone. The land-based, tidal resistivity surveys were used to delineate the zone of active SGD (50 m).

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J.A. Izbicki et al., Annals of Environmental Science / 2009, Vol 3, 139-178

SOURCES OF FECAL INDICATOR BACTERIA IN URBAN STREAMS AND OCEAN BEACHES, SANTA BARBARA, CALIFORNIA

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ABSTRACT

Fecal indicator bacteria (FIB) indicative of fecal contamination in urban streams and recreational ocean beaches in Santa Barbara, California often exceed recreational water-quality standards. During low flow, FIB and human-specific *Bacteroides* concentrations in urban streams were associated with point discharges. FIB concentrations varied three-fold during diurnal sampling as a result of small variations in these discharges. During stormflow, FIB concentrations were higher than during low flow and varied over three orders of magnitude. FIB in stormflow were associated with non-point sources, and concentrations decreased as fecal contamination was washed from the urban watershed. Sources of fecal contamination to near-shore ocean water included surface discharges from urban streams, and fecal material from birds associated with sand, and to a lesser degree kelp, along the beachfront. FIB concentrations varied over three orders of magnitude during daily tidal cycles. Concentrations were higher during ebb tides and decreased to less than the detection limit during low tide when seepmeter and ^{222}Rn data show groundwater discharge to the ocean was greatest. Groundwater discharge and leakage from a sewer line buried in the sand were not large sources of FIB contamination to near-shore waters. Interpretations of the sources of FIB from Principal Component Analysis (PCA) of genetic (Terminal-Restriction Fragment Length Polymorphism, T-RFLP, data), molecular (PhosphoLipid Fatty Acid, PLFA, data), and chemical data (such as caffeine, fecal sterols, and detergent metabolites) were similar and consistent with interpretations supported by physical measures of water flow. The most robust PCA results were from PLFA data which explained 97 percent of the total variance within the first and second principal components. In contrast PCA analysis of chemical and T-RFLP data, explained 34 and 32 percent of the total variance, respectively. However, T-RFLP and chemical tracers captured relations not apparent in PLFA data, and certain compounds, especially the fecal sterols, lent themselves to specific interpretations of the origin of fecal contamination.

Keywords: fecal indicator bacteria, submarine groundwater discharge (SDG), surface water, groundwater, bacterial source-tracking

1. INTRODUCTION

Direct measurement of human pathogens in recreational water is not commonly made because these assays are time consuming and expensive. In addition, assays for many human pathogens are not available for routine application. Instead, fecal indicator bacteria (FIB) are used as a surrogate for pathogens to determine fecal contamination and potential health hazards associated with recreational waters. FIB are used as a surrogate because they are 1) easily and relatively rapidly measured using standardized tests, 2) they are present at high concentrations in human waste, and 3) epidemiological studies have linked high FIB concentrations to gastrointestinal and respiratory illness in humans [1-6]. Some of the most commonly used FIB are fecal coliform, *Escherichia coli* (*E. coli*), and enterococci. Although not necessarily fecal in origin, total coliform bacteria also are commonly used

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with FIB to assess microbial contamination of recreational waters.

The use of FIB to determine health hazards associated with recreational waters is complicated by their presence in warm-blooded animals other than humans, including seabirds living along shorelines, farm animals, pets, rodents and other animals common in urban and recreational areas. In addition to human and animal feces, growth or extended survival of FIB can occur in streambed sediments [7-10], in biofilms along stream channels and urban drains [11], and in beach sands [12-16]. The source of fecal contamination is important since it is widely believed that human feces pose a greater human-health risk than animal feces. This is because fecal contamination from non-human sources does not contain human-specific viral pathogens [17].

Fecal contamination to urban streams and recreational beaches from urban drains as incidental discharges during baseflow, and from larger discharges during stormflow, has long been known and has been the focus of much research in recent years [11,18-21]. Streamflow and other surface discharges to the ocean have been shown to be a source of fecal contamination to near-shore ocean water extending as much as 5,000 m along the shoreline from the discharge point - with dilution rather than death, predation, or other bacterial inactivation processes being the primary attenuation mechanism [22]. Recent studies have implicated groundwater discharge as a possible source of fecal contamination to recreational ocean beaches [23-25].

In recent years, a wide range of genetic, molecular, and chemical tracer techniques have become available to supplement traditional measurements of FIB concentrations in water and to aid in determining the source of fecal contamination [26,27]. These tracer techniques include, but are not limited to, 1) direct measurement of fecal microorganisms such as *Bacteroides* or enteroviruses [28-35], 2) genetic and molecular characterization of microbial populations associated with different fecal sources [31,36-40], and 3) measurement of low-concentrations of chemicals commonly associated with human wastewater [34,41-43], including fecal sterols [44-47].

The use of tracer techniques, especially genetically-based tracers, to determine the source of fecal contamination in recreational waters has expanded rapidly in recent years. However, only a few studies have attempted to constrain assessment of fecal contamination sources by integrating FIB data with multiple tracer techniques [30,32,36]. Even fewer studies have integrated FIB and tracer techniques with hydrologic data that quantify the movement of water from different sources [11,36] or with groundwater exchange in beach settings over tidal cycles [32,48]. The combined use of FIB and multiple alternative tracers of fecal contamination constrained by an understanding of the movement of water may be a powerful approach for identifying FIB contributions from human and nonhuman sources.

The Santa Barbara area, 150 km northwest of Los Angeles, California (Figure 1) was selected to test the use of FIB data with multiple tracers of fecal contamination, constrained by an understanding of the physical hydrology, to determine the source of fecal contamination in an urban setting along the Pacific Ocean. The study area includes urban streams and ocean beaches. The urban streams are potentially subject to point and non-point FIB contamination from leaking sewer lines and laterals, discharges from urban baseflow, and stormflow runoff. Although not used as recreational waters, urban streams in the area are subject to incidental recreational use by the local population, and possible contamination by a transient homeless population. Ocean beaches in Santa Barbara are used for recreation and are potentially subject to fecal contamination from point and non-point sources similar to those affecting urban streams. Of particular concern was the potential for leakage from a sewer line underlying West Beach, less than 100 m inland from the high tide line. In addition, the ocean beaches also are potentially subject to fecal contamination from 1) shorebirds and other marine wildlife, 2) human use, including bathing and boating, and 3) discharges from streams and coastal estuaries known to contain high concentrations of FIB.

1.1. Purpose and Scope

The purpose of this study was to determine the source of fecal contamination to urban streams and to near-shore ocean water in Santa Barbara, California between April 2005 and April 2007. The scope of the study included: 1) measurement of stream discharge and sample collection along an urban stream during baseflow and stormflow, 2) measurement of water levels and sample collection from water-table wells installed at selected locations in the urban area, near the stream, and at the beachfront, and 3) measurement of water exchange and FIB concentrations at the beachfront during selected tidal cycles. Water exchange at the beachfront was evaluated on the basis of changes in water levels in wells, seepmeter data, and isotopic data. Potential sources of fecal contamination were evaluated using genetic, molecular, and chemical data from surface water, groundwater, near-shore ocean water, wastewater, and from kelp and sand. Interpretations of the sources of fecal contamination based on these data, constrained by physical measures of water flow, were compared and contrasted.

1.2. Hydrologic Setting

The study area is in Santa Barbara, California, about 150 km northwest of Los Angeles (Figure 1). The city is located on a narrow coastal strip about 5 km wide, flanked by mountains more than 1,300 m in altitude. In 2000, the population of Santa Barbara was 95,300, and the area is highly developed and urbanized. The study area has a Mediterranean climate with warm, dry summers and cool, wet winters. Most precipitation on the coastal strip, about 430 mm annually, falls during the rainy season from November to March.

The study area is drained primarily by Mission Creek and its tributaries. Mission Creek originates in the Santa Ynez Mountains to the north and discharges to the Pacific Ocean (Figure 1).

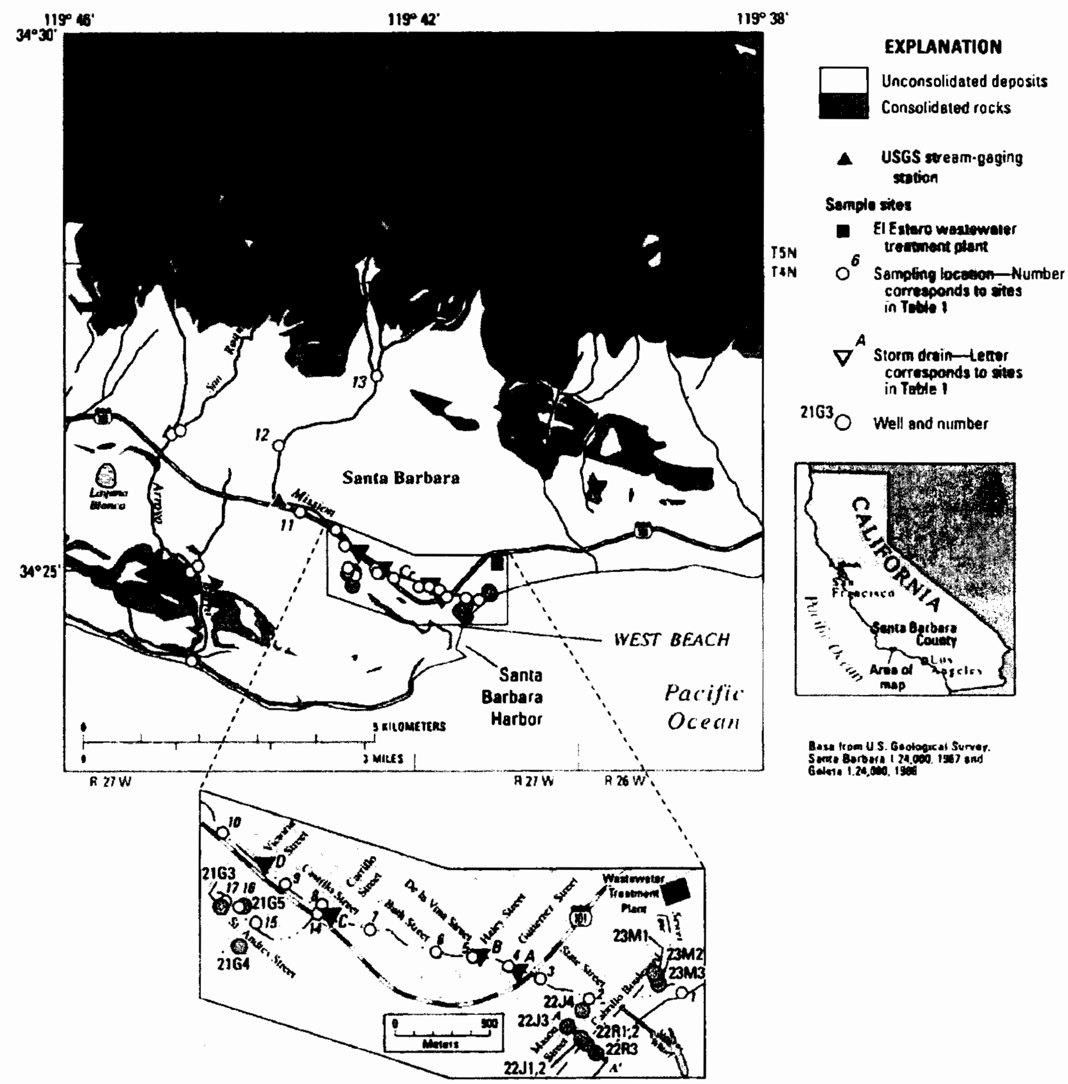

Figure 1 Location of study area

Mission Creek is perennial along its lower reaches, where groundwater discharge sustains flow during the dry season [49]. In addition, base flow in the perennial downstream reach is sustained by flow from urban drains and dewatering wells used to lower water levels near highway underpasses and larger buildings. Much of the city was built in the early part of the 20th century. Although the sewer infrastructure has been updated, laterals connecting individual homes to the sewer may date from the time of original construction. The potential for sewage from leaking sewer lines or laterals to enter shallow groundwater and discharge to streams is increased by the high water table underlying much of the city.

Discharge from Mission Creek to the ocean is not continuous. During the dry season the mouth of the creek is impounded by a sand berm built by wave action along the beachfront to form a coastal estuary or "lagoon". Water from the lagoon either discharges as small flows across the berm, or as infiltration through the berm. In recent years, water has been diverted from the lagoon to the El Estero wastewater treatment plant (WWTP). Occasionally the berm breaches, rapidly releasing a large amount of water to the ocean. These breaches commonly occur as a result of increased streamflow from precipitation and subsequent runoff into Mission Creek.

West Beach is a south facing ocean beach west of the mouth of Mission Creek. Discharges from Mission Creek may be a source of fecal contamination to West Beach. In addition, a sewer line runs the length of the beach about 100 m from the high tide line. There is concern that leakage from the sewer may contaminate shallow groundwater that subsequently discharges to the ocean. In addition, stormwater runoff from city streets discharged to the beach sand and direct discharges from commercial and recreational boats in the nearby harbor are other potential sources of fecal contamination to West Beach. West Beach is relatively protected from wave action because of its south facing position along the Santa Barbara Channel and the nearby harbor. Kelp and sand along protected beach areas may harbor FIB [14] and contribute to fecal contamination of near-shore ocean water [48].

2. METHODS

2.1. Field Methods

Grab samples were collected from streams and urban drains in the center of flow during April 2005 and August 2005 (Figure 1 and Table 1). Flow measurements were made at the time of collection using current meters, flumes, or calibrated containers depending on site conditions. Automated samplers, equipped with Teflon sample lines were used to collect time-series data on Mission Creek at Gutierrez Street (site 4 in Figure 1) for diurnal sampling in August 2005, and stormflow sampling during January 2006. Intakes for water samplers were located in the center of flow and sample lines were rinsed three times prior to collection of each sample. Stream stage was measured using pressure transducers placed near the sample intake. For samples collected during August 2005, changes in stage were converted to flow from concurrent discharge measurements. Discharge measurements needed to convert stream stage to stream flow were not collected during stormflow.

Thirteen, 2-inch diameter PVC wells (Figure 1 and Table 1) installed using an auger drill rig were sampled in November 2005, May-June 2006, and April 2007. Wells were assigned numbers according to their position in the Public Land Survey System. In Tables and Figure titles, the complete well number including township, range, section, and sequence number is provided (for example 4N/27W-22R3). In the text a shortened form of the well number including only the section and sequence number (22R3) is used. Pressure transducers were installed on selected wells and data are available in the National Water Information System (NWIS-Web) and an online computer database operated by the U.S. Geological Survey. Prior to sample collection, wells were purged using portable pumps. Pumps were cleaned using Liquinox and distilled water between wells to minimize cross contamination. After purging, water samples from the wells were collected using peristaltic pumps. New nylon tubing (with a short length of Tygon tubing near the pump head) was used for each well and then discarded after use. Samples for trace organic and fecal sterol analysis were collected from wells using new glass bailers after the pumped samples were collected. Bailers were discarded after use. Most wells were sampled three times during the study. Well, 22R3, along the West Beach cross-section at the high-tide line (Figure 1) was sampled hourly during selected ebb tides in November 2005, May-June 2006, and April 2007. An additional well was installed and sampled at the beachfront during April 2007 to supplement data from Well 22R3, which because of sand accumulation on the beach was no longer located at the high tide line. Well 21G3 (Figure 1), was destroyed during the study and was only sampled twice.

Grab samples of near-shore ocean water were

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collected in the "swash zone", approximately between ankle and mid-calf in depth, so that the sample depth remained approximately constant but the location varied with the ebb and flow of the tide. Boehm, [22] showed little difference in FIB concentrations in samples collected at ankle and waist depth for at beach near Avalon, California. Grab samples of influent to the El Estero WWTP (Figure 1) were collected using sampling equipment available on site.

Kelp and sand from the upper 0.5 cm were collected from near the high tide line along West Beach. Samples were collected with stainless steel implements and placed in stainless steel buckets. Implements and buckets were cleaned and baked at 800°C prior to use. The buckets were discarded after use and sample implements were thoroughly cleaned and rinsed with organic-free water between sample collection. The mass of the sample was determined in the field by subtracting the weight of the bucket from the weight of the sample plus the bucket. Samples of kelp and sand were washed with organic-free water adjusted to seawater salinity using organic-free NaCl. Organic-free NaCl was prepared by baking reagent grade NaCl at 800°C for 24 hours. The baked NaCl was stored in baked glass containers and added to the organic-free water immediately before use in the field. The supernatant was decanted from the buckets and stored in appropriate bottles using sample handling and preservation procedures described below.

pH and specific conductance were measured in the field using portable meters. Dissolved oxygen also was measured in the field using the indigo-carmine method (CHEMetrics, Inc., Calverton, VA). Water samples for selected anions, cations, and nutrients were filtered in the field though 0.45 μm pore sized filters, placed in plastic bottles and chilled. Samples for cation analysis were preserved in the field using nitric acid. Samples for FIB were unfiltered, placed in sterile bottles, and chilled. Samples for human-specific *Bacteroides* and enteroviruses, T-RFLP, PLFA, were unfiltered, placed in 1 L glass bottles, and chilled. Samples for trace organic compounds were unfiltered, placed in 1-L glass bottles, preserved in the field using 10 mL of dichloromethane, and chilled. Aluminum foil lined caps were used to seal sample bottles intended for trace organic analysis. All 1-L glass bottles were baked at 800°C prior to use.

Most FIB samples and samples for *Bacteriodes*, enteroviruses, and T-RFLP were delivered to respective labs for analysis within 8 hours of coll-ection. Stormflow samples and samples from diurnal studies that were collected after 2:00 PM were delivered to the lab the next morning. All other samples were shipped on the day of collection by overnight delivery to their respective laboratories for analysis.

2.2. Analytical Methods

Total coliform and *E. coli* were analyzed by Colilert and enterococci were analyzed using Enterolert (IDEXX, Westbrook MN) at the City of Santa Barbara Water Resources Laboratory. A range of dilutions was used to ensure proper quantification of samples in accordance with the manufacturers' specifications.

Samples for human-specific *Bacteroides* [50], and enteroviruses were analyzed at the University of Southern California in Los Angeles, California. These samples were filtered in the laboratory within 8 hours of collection onto 47-mm 0.2-μm pore size Durapore filters. For surface-water and groundwater samples, the volume filtered ranged from 120 to 1,000 mL depending on the suspended sediment in the sample. Samples from the wastewater treatment plant and water rinses from kelp were difficult to filter and volumes ranged from 12 to 80 mL. Filters were frozen after filtration and thawed prior to extraction and analysis. DNA was extracted from all samples using the MoBio Ultraclean Fecal DNA kit and eluted in 50μL. The extracted DNA was quantified using the Molecular Probes dsDNA Quantitation Kit. *Bacteroides* levels were determined by SYBR Green-based quantitative Polymerase Chain Reaction (qPCR) [51]. For samples with DNA levels >0.2 ng/L, 2 ng of DNA were used as the template for the qPCR reaction. For samples with less than 0.2 ng DNA, 4 μL of eluted DNA was used. All samples were run in duplicate with a standard curve having a range of 10^2 to 10^8 copies from a plasmid containing the target gene fragment. Samples for enteroviruses were filtered in the laboratory within 8 hours of collection and the frozen. The volume filtered for each sample ranged from 25 to 1,000 mL depending on the ease of filtration. RNA was extracted using the Qiagen RNeasy Mini Kit (tissue protocol) with the QIAvac Manifold. Reverse Transcription and the qPCR were done in a single reaction [50]. All samples were run in duplicate with additional duplicate samples spiked with vaccine-type poliovirus to test for inhibition. A standard curve was run simultaneously with a range 3.3×10^1 to 3.3×10^5 poliovirus particles per assay.

Samples for Terminal Restriction Fragment Length Polymorphism (T-RFLP) measurements were analyzed by the University of California at Santa Barbara. Samples were filtered in the lab within 8 hours of collection, and microbial cells were separated from particulate material using methods described by

LaMontagne and Holden [52]. Cells were concentrated by centrifugation and DNA within the cells was extracted and purified using commercially available kits (UltraClean DNA; MoBio Laboratories Inc., Solana Beach, California) as specified by the manufacturer. After extraction and purification, the DNA was stored at -80°C until analysis [52]. 16rRNA genes from the purified DNA were amplified using Polymerase Chain Reaction (PCR) with eubacterial primers 8F hex (fluorescently labeled forward primer) [53] and 1389R [54]. PCR reaction mixtures were processed on a PCRSprint thermal cycler (Hybaid US, Franklin, Mass.) using analytical and quality control procedures described by LaMontagne et al. [55]. PCR products were purified with the High Pure Kit (Boehringer Mannheim, Indianapolis, IN) and digested with H-ha1 and Msp1 restriction enzymes. The restriction enzymes were inactivated by heating (65°C for 10 min) and the length of the fluorescently labeled fragments was determined with an Applied Biosystems Instruments Model 373A automated sequencer (ABI: Foster City, California).

Samples for phospholipid fatty acids (PLFAs) were analyzed by Microbial Insights in Rockford, Tennessee Samples were chilled and shipped in coolers on the day of collection for overnight delivery. Upon arrival at the lab, lipids were recovered using a modified Bligh and Dyer method [56]. Extractions were performed using one-phase chloroform-methanol-buffer extractant. Lipids were recovered, dissolved in chloroform, and fractionated on disposable silicic acid columns into neutral-, glyco-, and polar-lipid fractions. The polar lipid fraction was transesterified with mild alkali to recover phospholipid fatty acids (PLFA) as methyl esters in hexane. PLFA were then analyzed by gas chromatography with peak confirmation performed by electron impact mass spectrometry (GC/MS).

Samples for selected wastewater indicators were analyzed by the U.S. Geological Survey National Water Quality Laboratory (NWQL) in Denver, Colorado Samples were preserved in the field using 10 mL of reagent grade dichloromethane (DCM), chilled, and shipped in coolers on the day of collection for overnight delivery to the lab. The DCM inhibited microbiological degradation and began the extraction of nonpolar organic compounds within the sample. Analysis was by Continuous Liquid–Liquid Extraction and Capillary-Column Gas Chromatography/Mass Spectrometry [57]. Samples for nutrient analysis were field filtered, chilled and shipped to the U.S. Geological Survey National Water Quality Laboratory in Denver, Colorado for analysis by various methods described by Fishman et al. [58].

2.3. Methods to Measure Exchange of Ocean Water with Groundwater

Seepmeter, radon-222 (^{222}Rn), and direct-current marine-resistivity data were collected to assess the magnitude, variability, and timing of exchange of near-shore ocean water with shallow groundwater. Direct-current resistivity data were collected from a boat along West Beach, near the mouth of Mission Creek, and along the beach to the east to determine the representativeness of seepmeter and ^{222}Rn data collected in more limited areas along the beachfront.

The seepmeters used in this study focus water through a 2.5-cm-diameter orifice at the top of a 1.2-m-diameter dome emplaced in the beach sand just below the low-tide line [59]. An electromagnetic (EM) flowmeter embedded within the orifice measures velocity according to Faraday's Law, where the voltage generated by movement of water through an induced magnetic field is proportional to the velocity of water flowing through the field [60]. The small diameter of the orifice constricts flow, thereby increasing the velocity of the water and increasing the sensitivity of the seepmeter. Positive values reflect discharge of water from the beach to the ocean; negative values reflect movement of water from the ocean into the beach deposits. Seepmeters must be deployed in a relatively calm environment as waves and currents may dislodge the meter and produce inaccurate results [61,62]. For this reason it is often difficult to operate seepmeters for extended periods. Seepmeter data are point measurements, and measurements can vary spatially and with depth [63].

^{222}Rn is produced by the decay of radium-226 (^{226}Ra) in the uranium-238 decay series and has a half-life of 3.8 days. Radon is the heaviest of the noble gases, does not react chemically with aquifer surfaces, and is highly mobile in groundwater [64]. ^{222}Rn concentrations in groundwater are commonly several orders of magnitude higher than in ocean water. Diffusion of ^{222}Rn from sediments is small [65], and increasing ^{222}Rn activities in near-shore ocean water reflect discharge of shallow groundwater [64,66] and exchange of water between the ocean and beach deposits [64,67]. ^{222}Rn was measured on an almost continuous basis using a water/air exchanger and a radon-in-air monitor [67,68]. In addition, ^{222}Rn data average groundwater discharge over larger volumes than the point measurements obtained from seepmeters and are often a better indicator of exchange between groundwater and the ocean [68].

Direct-current marine-resistivity data were collected using a 112-m cable containing a 56-electrode array [68,69]. For marine applications, GPS data were logged, while water depth and the ship's position were recorded on a separate GPS-enabled fathometer. Continuous salinity and temperature data also were recorded.

3. RESULTS

3.1. Fecal Indicator Bacteria, *Bacteroides*, and Enteroviruses in Urban Streams

Streamflow and FIB concentrations were measured during baseflow in Mission Creek (including its tributary, Old Mission Creek) and Arroyo Burro, another urban stream, on April 19-21, 2005 and August 2-4, 2005 (Figure 1). On the basis of those data, 24-hour sample collection was done August 3-4, 2005 at Mission Creek at Gutierrez Street (Site 4, Figure 1) to determine temporal variability in FIB concentrations in the downstream urbanized reach of Mission Creek. Stormflow samples also were collected at Mission Creek at Gutierrez Street during January 1-3, 2006 to determine FIB concentrations and sources during stormflow.

3.1.1 Seasonal and Spatial Distribution of Fecal Indicator Bacteria, *Bacteroides*, and Enteroviruses

Streamflow and FIB concentrations measured in Mission Creek during April 19-20 and August 2-4, 2005 provide a synoptic (snap-shot in time) view of streamflow and FIB concentrations under base flow conditions during spring and late summer (Figure 2 and Table 1).

Flow near the mouth of Mission Creek during April was as high as 0.1 m^3/s. Streamflow during August was almost an order of magnitude less than flow during April. Discharge from Old Mission Creek, groundwater, storm drains, and dewatering wells used to lower the water table near highway underpasses contributed to flow along the downstream reaches of Mission Creek during both April and August (Figure 2). The upstream reach of Mission Creek where groundwater discharge and other sources of water were not present was dry during August, 2005 (Figure 2).

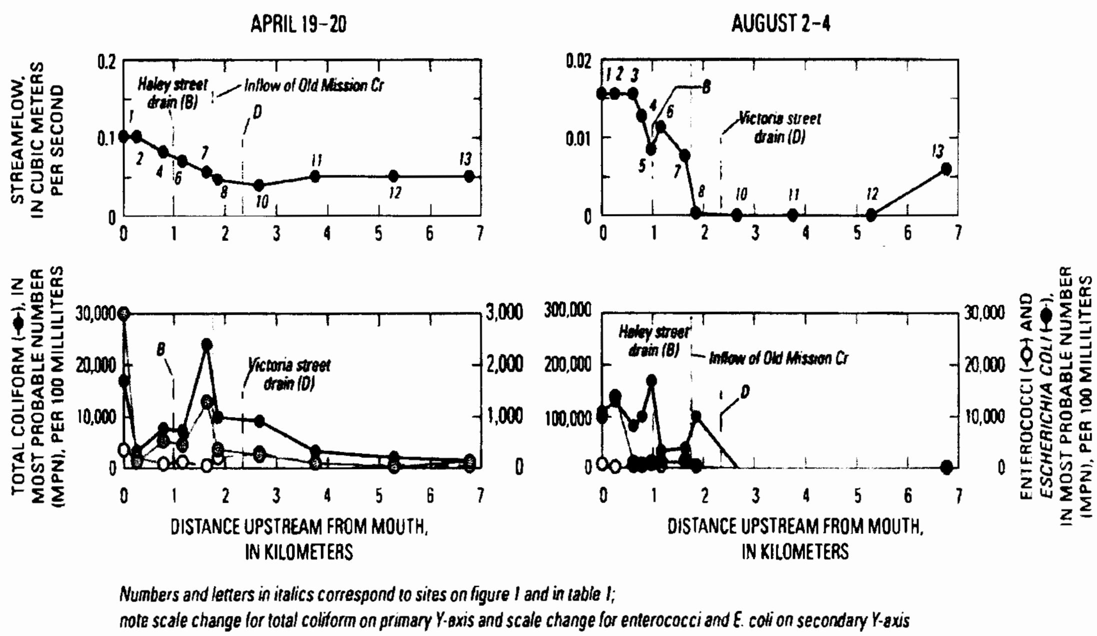

Figure 2 Streamflow and fecal indicator bacteria (FIB) concentrations at selected sites along Mission Creek, Santa Barbara, California April 19-20 and August 2-4, 2005.

Table 1 Selected surface water sample sites, including stormdrains tributary to Mission Creek, Santa Barbara, California. [Number or letter corresponds to number or letter on Figure 1. Distance, in kilometers, corresponds to data shown on Figure 2. Additional sites shown on Figure 1 that are not specifically discussed in the paper are not listed.]

Number	Site name	Distance upstream from mouth (kilometers)
1	Mission Creek at mouth	0
2	Mission Creek at Mason Street	0.26
3	Mission Creek at Montecito Street	0.63
4	Mission Creek at Gutierrez Street	0.79
5	Mission Creek at Haley Street	0.99
6	Mission Creek at Bath Street	1.16
7	Mission Creek at Cannon Perdido	1.64
8	Mission Creek upstream from mouth of Old Mission Creek	1.85
9	Mission Creek at Anapamu Street	2.13
10	Mission Creek at Michel Torina Street	2.66
11	Mission Creek at West Mission Street	3.76
12	Mission Creek at Dela Vina Street	5.29
13	Mission Creek at Rocky Nook Park	6.77
14	Old Mission Creek at mouth	1.80
15	Old Mission Creek at Anapamu Street	2.32
16	Old Mission Creek at Bohnett Park	2.40
17	Old Mission Creek at West Victoria Street	2.50
A	discharge from drain at Highway 101	0.70
B	discharge from drain at Haley Street	0.99
C	discharge from drain at Carrillo Street	1.81
D	discharge from drain at Victoria Street	2.28
E	inflow to drain at Cabrillo Boulevard	--

During April 19-20, 2005, total coliform bacterial concentrations at selected sites along Mission Creek ranged from 1,500 to >24,000 MPN per 100 mL. At the same time, *E. coli*, and enterococci concentrations ranged from 31 to 3,000 and 41 to 360 MPN per 100 mL, respectively (Figure 2). During August 2-4, 2005, total coliform concentrations were higher than the April measurements, and ranged from 1,500 to 170,000 MPN per 100 mL (Figure 2). Similarly, *E. coli* and enterococci concentrations also were higher in August and ranged from 200 to 14,000 and 31 to 1,600 MPN per 100 mL, respectively. During both the April and August, 2005 sample collection periods, the lowest FIB concentrations were near the mountain front upstream from the urbanized area (site 13). Although FIB concentrations generally increased downstream, these increases were not monotonic and FIB concentrations varied along the stream reach.

FIB concentrations measured in the discharge from four sampled drains tributary to Mission Creek (Figure 1, sites A, B, C, and D) were generally higher than those in the creek during both the April and August, 2005 sample periods. Total coliform concentrations in these four drains were as high as >240,000 MPN per 100 mL. *E. coli* and enterococci concentrations ranged from 540 to 29,000 and <10 to >240,000 MPN per 100 mL, respectively (data not shown on Figure 2). FIB concentrations from all sampled drains were higher during August than April. FIB concentrations were highest from the drain near Victoria Street (Site D), although the FIB loads to Mission Creek were higher from the Haley Street drain (Site B) because discharge was greater. FIB concentrations were lowest from the drain at Highway 101 (site A)

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that contains a high fraction of shallow groundwater from dewatering wells.

Human-specific *Bacteroides* was detected in samples from the mouth of Mission Creek (site 1) and from three drains tributary to Mission Creek (sites B,C, and D) (Table 2). Although most concentrations were low, concentrations in the Haley drain on June 2, 2006 (Site B) were four orders of magnitude higher than other detections and were within 2-orders of magnitude of the concentrations in wastewater influent (Table 2). Enterovirus also were detected in samples from the Haley Drain (site B) (Table 2) and, with the exception of the El Estero WWTP, Haley drain was the only site where enterovirus was detected.

3.1.2 Diurnal Variations in Fecal Indicator Bacteria

Data were collected from Mission Creek at Gutierrez Street (Site 4) over a 24-hour period during August 3-4, 2005, after an extended period of baseflow, to measure diurnal variations in FIB concentrations.

Streamflow in Mission Creek at Gutierrez Street during August 3-4, 2005 ranged from 0.009 to 0.01 m^3/s (Figure 3). If streamflow was maintained only by groundwater discharge, there should be only small diurnal variations from transpiration by riparian vegetation. These variations would produce a sinusoidal variation in flow, with lower flows during the day and higher flows during the night. However, streamflow abruptly increased at about 6 AM - lagging early morning increases in municipal water deliveries by less than an hour (Figure 3). The increased streamflow preceded increased inflow into the WWTP by only about 0.5 hour. However, streamflow did not continue to increase over the next 3 hours in the same manner as WWTP inflow (Figure 3). It is possible that the increase in early morning streamflow is the result of increased urban flow through lawn watering or other outdoor uses rather than leaking sewer lines. Urban contributions to Mission Creek at Gutierrez Street continued throughout the day and include discharge from storm drains, discharge from dewatering wells, leaking pipes or sewer lines, and runoff from lawn watering and other outdoor uses.

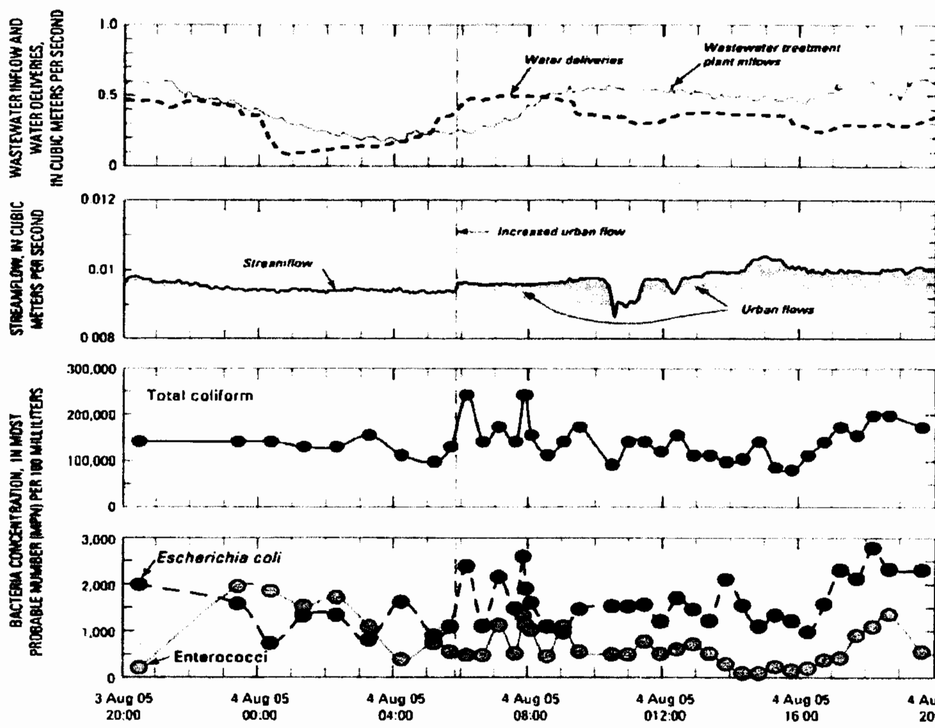

Figure 3 Streamflow and fecal indicator bacteria (FIB) concentrations in Mission Creek at Gutierrez Street, Santa Barbara, California, August 3-4, 2005.

Table 2 Human-specific *Bacteroides* and *Entrovirus* results for selected samples from urban stream and recreational beaches, Santa Barbara, California [±, plus or minus 1 standard deviation, for the purposes of this paper ± 2 standard deviations are considered as statistically significant result]

Site ID*	Station name	Date	Time	*Bacteroides*, in target copy number per liter	enteroviruses, in viral particles per liter
	Stream sites				
1	Mission Creek at Mouth	6/1/06	13:00	47.1 ± 11.8	<0.1 ± 0.1
		4/17/07	12:30	<0.1 ± 0.1	<0.1 ± 0.1
4	Mission Creek at Gutierrez	8/4/05	07:45	<0.1 ± 0.1	<0.1 ± 0.1
14	Old Mission Creek at Mouth	8/4/05	09:00	<0.1 ± 0.1	<0.1 ± 0.1
					<0.1 ± 0.1
--	Arroyo Burro Creek at mouth	8/4/05	07:45	<0.1 ± 0.1	<0.1 ± 0.1
					<0.1 ± 0.1
	Drain sample sites				
B	Haley drain discharge at Mission Creek	8/4/05	08:30	[2/] --	89 ± 0.1
				[2/] --	22 ± 0.1
		6/2/06	08:00	$7.1 \pm 1.5 \times 10^4$	<0.1 ± 0.1
D	Victoria drain discharge at Mission Creek	6/6/06	11:30	294 ± 139	<0.1 ± 0.1
--	Cabrillo Street drain inflow	4/20/07	06:00	9.3 ± 0.8	<0.1 ± 0.1
	Near-shore ocean sample sites				
--	West Beach at cross-section	6/1/06	02:00	38.3 ± 11.0	<0.1 ± 0.1
		6/1/06	10:00	557 ± 515	<0.1 ± 0.1
		4/17/07	21:00	20 ± 0.8	0.11 ± 0.11
		4/18/07	00:00	4.2 ± 2.7	<0.1 ± 0.1
		4/18/07	04:00	6.7 ± 6.7	<0.1 ± 0.1
		4/20/07	10:00	23 ± 10	<0.1 ± 0.1
		4/20/07	13:00	86 ± 40	<0.1 ± 0.1
--	[1/]West Beach at Mission Creek	8/4/05	--	<0.1 ± 0.1	<0.1 ± 0.1
					<0.1 ± 0.1
--	[1/]Arroyo Burro Beach	8/4/.05	--	<0.1 ± 0.1	<0.1 ± 0.1
					<0.1 ± 0.1
	Well sample sites				
21G3	4N/27W-21G3	6/2/06	09:00	0.2 ± 0.2	<0.1 ± 0.1
21G4	4N/27W-21G4	4/20/07	11:00	<0.1 ± 0.1	<0.1 ± 0.1
22R2	4N/27W-22R2	6/1/06	11:2	<0.1 ± 0.1	0.3 ± 0.3
		4/18/07	11:45	0.43 ± 0.21	0.19 ± 0.19
22R3	4N/27W-22R3	6/1/06	02:00	<0.1 ± 0.1	<0.1 ± 0.1
		6/1/06	10:00	6.7 ± 6.7	<0.1 ± 0.1
		4/17/07	21:00	1.2 ± 1.2	<0.1 ± 0.1
		4/18/07	00:00	0.11 ± 0.004	<0.1 ± 0.1
		4/18/07	04:00	<0.1 ± 0.1	<0.1 ± 0.1
22J2	4N/27W-22J2	6/2/06	13:30	0.5 ± 0.5	<0.1 ± 0.1
		4/17/07	09:30	<0.1 ± 0.1	<0.1 ± 0.1
22J3	4N/27W-22J3	6/2/06	13:20	<0.1 ± 0.1	<0.1 ± 0.1

*Site identification (Figure 1, Table 1); [1/] Sample collected by Heal the Ocean, Hillary Houser, written communication, August, 2005; [2/] Poor recovery from samples spiked with *Bacteroides* DNA suggesting that interference may have masked detection of *Bacteroides*

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Table 2 (continued) Human-specific *Bacteroides* and *Entrovirus* results for selected samples from urban stream and recreational beaches, Santa Barbara, California [±, plus or minus 1 standard deviation, for the purposes of this paper ± 2 standard deviations are considered as statistically significant result]

Site ID	Station name	Date	Time	*Bacteroides*, in target copy number per liter	enteroviruses, in viral particles per liter
23M1	4N/27W-23M1	5/31/06	09:30	<0.1 ± 0.1	<0.1 ± 0.1
		4/19/07	12:30	<0.1 ± 0.1	0.26 ± 0.26
23M2	4N/27W-23M2	5/31/06	14:10	24 ± 24.0	<0.1 ± 0.1
		4/19/07	10:45	<0.1 ± 0.1	<0.1 ± 0.1
		4/19/07	10:46	<0.1 ± 0.1	<0.1 ± 0.1
23M3	4N/27W-23M3	5/31/06	12:30	4.7 ± 4.7	<0.1 ± 0.1
	Special source				
--	El Estero WWTP	6/2/06	10:00	$1.73 \pm 0.25 \times 10^6$	28.4 ± 26
		4/17/07	10:00	$3.35 \pm 3.7 \times 10^6$	682 ± 40
--	Kelp extract from West Beach	4/16/07	12:30	<0.1 ± 0.1	<0.1 ± 0.1
		4/19/07	13:00	63 ± 63	<0.1 ± 0.1
--	Sand extract from West Beach	4/17/07	13:00	1.1 ± 1.1	<0.1 ± 0.1

*Site identification (Figure 1, Table 1); [1/] Sample collected by Heal the Ocean, Hillary Houser, written communication, August, 2005; [2/] Poor recovery from samples spiked with *Bacteroides* DNA suggesting that interference may have masked detection of *Bacteroides*

Total coliform bacteria concentrations in Mission Creek at Gutierrez Street measured during August 3-4, 2005 ranged from about 81,000 to greater than 240,000 MPN per 100 mL. *E. coli* and enterococci concentrations ranged from 730 to 2,800, and 100 to 2,000 MPN per 100 mL, respectively. FIB concentrations were higher and more variable during the day, especially in the early morning when runoff from lawn watering and other outdoor uses contributed to streamflow (Figure 3). After the early morning measurements, the magnitude and variability of FIB concentrations decreased during the day presumably as fecal material that accumulated on streets was washed into the stream. An increase in FIB concentrations occurred in the evening beginning at about 1700 hrs. This increase occurred at about the same time as evening increase inflows to the wastewater treatment plant (Figure 3). Direct leakage of sewer lines into the stream was not observed during this study and did not appear to occur in the morning hours, but unpermitted discharge to urban drains could cause changes in FIB concentrations measured in Mission Creek and would be consistent with the presence of human-specific *Bacteroides* in these drains.

Total coliform and *E. coli* concentrations were positively correlated (r = 0.64), while the correlation was less for total coliform and enterococci (r = 0.37). The correlation between *E. coli* and enterococci (r = 0.06) was not statistically significant. The lack of correlation between *E. coli* and enterococci concentrations suggests that these bacteria may be contributed to the stream from different sources in the watershed, each having different environmental and hydrologic histories that contribute to differential survival of FIB.

3.1.3 Fecal Indicator Bacteria in Stormflow

FIB concentrations were measured in Mission Creek at Gutierrez Street during a series of stormflows between January 1-3, 2006 (Figure 4). Total precipitation during this period was about 95 mm. Stormflow from a preceding storm that produced 44 mm of precipitation on December 31, 2005 was not sampled. The December 31st stormflow probably washed much of the highly mobile FIB and other material from the watershed that had accumulated in streets, storm-drains, and stream channels since the previous storm in September 2005. As a consequence, contributions from sanitary sewer lines, which could pressurize and leak as a result of increased flow during storms, were thought to be more easily detected during the sampled stormflow.

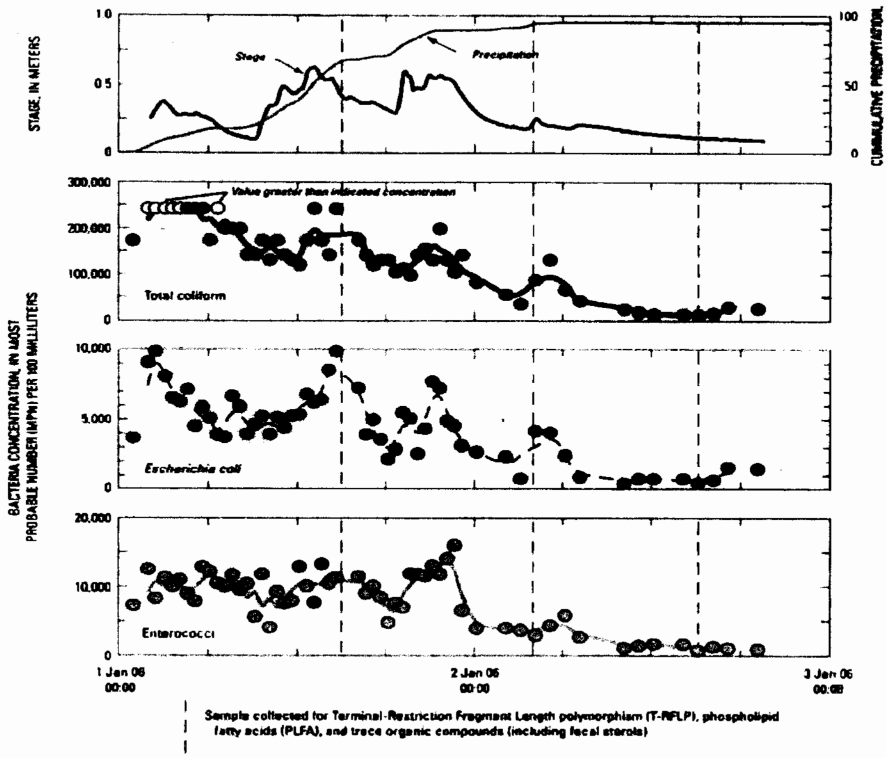

Figure 4 Precipitation, stream stage, and fecal indicator bacteria (FIB) from stormflow in Mission Creek at Gutierrez Street, Santa Barbara, California, January 1-2, 2006.

Stream stage increased in distinct peaks as a result of precipitation during January 1-3, 2006 (Figure 4). Total coliform, *E. coli*, and enterococci concentrations were as high as >242,000, 9,870 and 16,100 MPN per 100 mL, respectively. FIB concentrations generally decreased during the sample period although FIB concentrations increased during stormflow peaks. This decrease in concentrations during the storm is more consistent with successive stormflows washing material from the watershed than with repeated leaking from sanitary sewers during successive stormflow. FIB concentrations in stormflow samples were highly correlated with each other, having correlation coefficients ranging from 0.81 to 0.71 and suggesting a more uniform source and environmental history for FIB during stormflow than for diurnal variations discussed previously.

3.2. Fecal indicator Bacteria, *Bacteroides*, and Enteroviruses in Shallow Groundwater

Depth to water in sampled wells ranged from less than 1 to 5.3 m below land surface. Depths to water were greater inland in the upland residential areas, and less along Old Mission Creek and near the ocean.

Total coliform was detected at least once in every well installed as part of this study. The median concentration was 295 MPN per 100 mL, for samples having detections (data not shown). The highest total coliform concentration (>240,000 MPN per 100 mL) was measured in a sample collected from well 23M2 near the mouth of Mission Creek in November 2005. *E. coli* and enterococci were detected in 7 and 8 of the 13 sampled wells, respectively. The highest *E. coli* and enterococci values were 1,300 and 13,000 MPN per 100 mL in water from wells 23M1 and 23M3, respectively, near the mouth of Mission Creek.

E. coli and enterococci concentrations were lowest in water from wells in the inland residential areas (21G3-5). *E. coli* was not detected in any of these wells and enterococci was detected once in water from well 21G5 adjacent to Old Mission Creek. Low FIB occurrence in shallow groundwater in this area suggests that leakage from lateral lines connecting older residential development to the sewer has not resulted in extensive FIB contamination of shallow groundwater in this part of the city. This is consistent with streamflow and FIB data from Mission Creek that shows diffuse sources of FIB contamination associated with discharging groundwater were less important than point sources associated with urban drains.

Human-specific *Bacteroides* were detected at low levels in water from wells 22R2 and 22R3 during the April 2007 sample collection (Table 2). Well 22R2, adjacent to the sewer line along West Beach well, is closer to the beachfront. However, neither of these detections were associated with high FIB concentrations. Recent work has shown *Bacteroides* to be poorly correlated with detections of traditional FIB [70].

3.3. Fecal Indicator Bacteria, *Bacteroides*, and Enteroviruses in Near-Shore Ocean Water

FIB data were collected from near-shore ocean-water at West Beach over three tidal cycles during November 14-18, 2005, May 30-June 3, 2006, and April 16-22, 2007 (Figures 5-7). The November 2005 and April 2007 sample periods bracketed a "spring" tide (highest high and lowest low monthly tides). The June 2006 sample period bracketed a neap tide (the lowest monthly tidal fluctuation). FIB data were collected hourly in near-shore ocean water and from well 22R3 during ebb of the spring and neap tides. The three data sets reflect dry, non-precipitation periods, with the exception of after April 20, 2007 when about 25 mm of precipitation fell during a late-season storm.

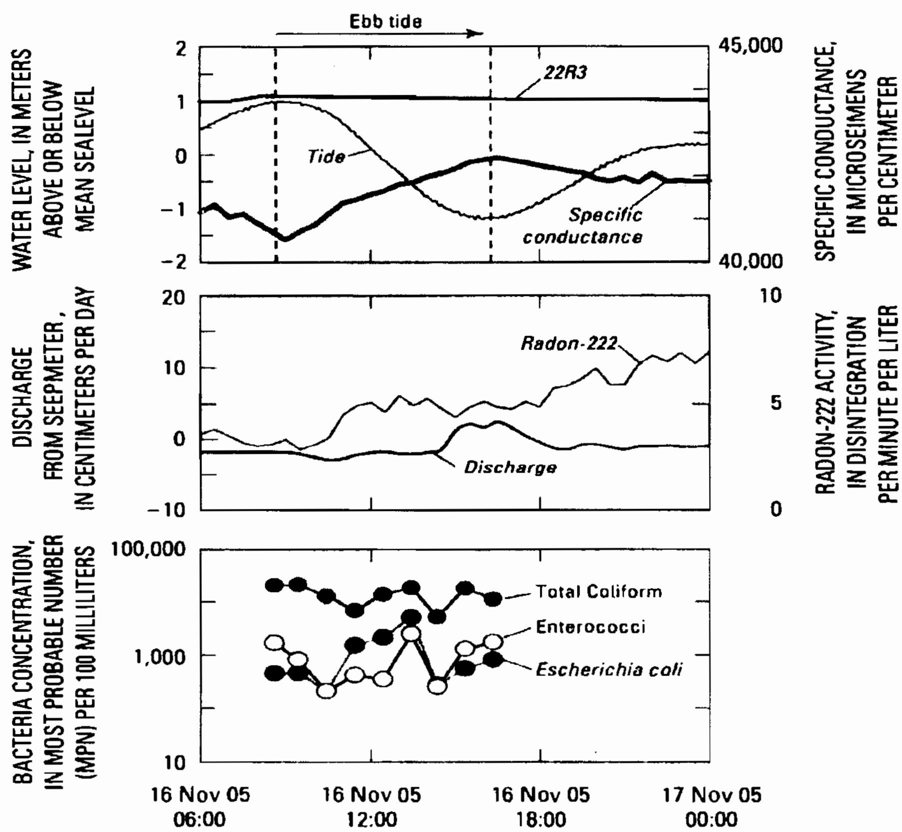

Figure 5 Groundwater levels at well 4N/27W-22R3, tides, groundwater discharge, specific conductance of groundwater discharge, radon-222 concentrations, and fecal indicator bacteria concentrations in near-shore ocean water, West Beach, Santa Barbara, California, during ebb-tide November 16-17, 2005.

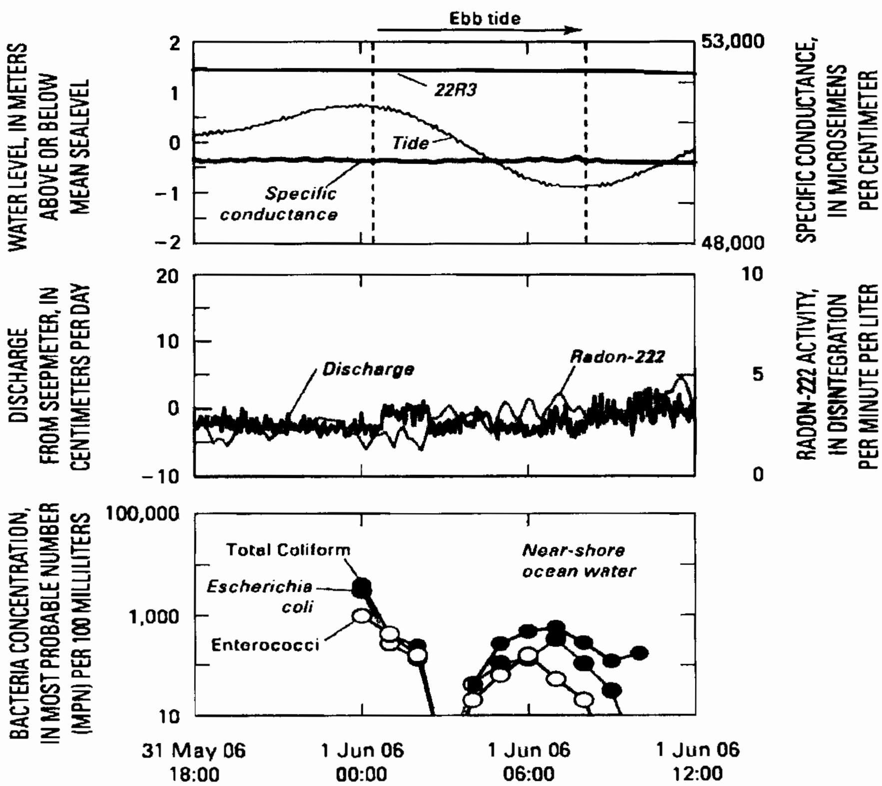

Figure 6 Groundwater levels at well 4N/27W-22R3, tides, groundwater discharge, specific conductance of groundwater discharge, radon-222 concentrations, ammonia, and fecal indicator bacteria concentrations in near-shore ocean water, West Beach, Santa Barbara, California, during ebb-tide May 31-June 1, 2006.

Total coliform concentrations in near-shore ocean water during the three sampled tides ranged from less than the detection limit of 10 to 21,000 MPN per 100 mL. *E. coli* and enterococci concentrations in near-shore ocean water ranged from less than 10 to 5,200 and less than 10 to 2,500 MPN per 100 mL. About 45 percent of enterococci samples exceeded the California state marine recreational contact single sample standard of 104 MPN per 100 mL [71]. Similar large variations in FIB concentrations over short time intervals were observed at other sites in California [72]. Samples for regulatory purposes are collected once daily without regard for hydrologic conditions such as tides. FIB data collected during this study suggest that samples collected without reference to ambient conditions, such as tides, may be inadequate to characterize FIB concentrations at recreational ocean beaches.

Human-specific *Bacteroides* was present in low concentrations in the near-shore ocean water at West Beach in 6 of 7 samples (Table 2). Enteroviruses were not detected in any of those samples. *Bacteroides* samples were not collected at the same frequency as FIB, but the high frequency of detection suggests that low-levels of human fecal material were consistently present and could be at least partly responsible for at least some of the FIB detected on West Beach.

3.4. Possible Sources of Fecal Indicator Bacteria

Possible sources of FIB to near-shore ocean water at West Beach include 1) groundwater discharge contaminated with sewage from the nearby sewer line, 2) sewage from commercial and recreational boats in the nearby harbor, 3) guano contaminated sand, kelp, and debris on the beach, and 4) discharge from Mission Creek.

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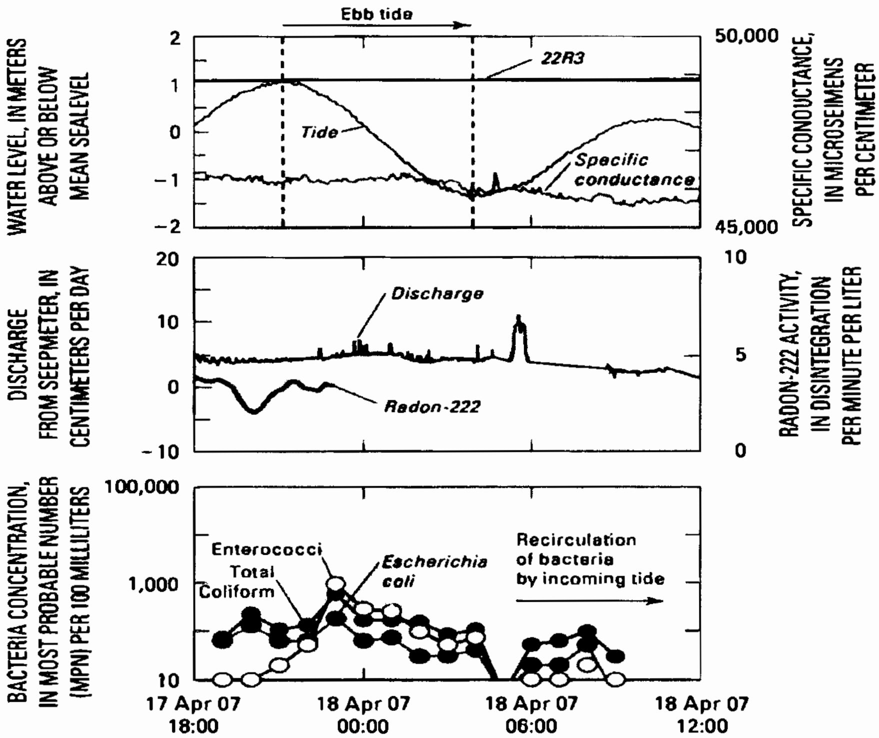

Figure 7 Groundwater levels at well 4N/27W-22R3, tides, groundwater discharge, specific conductance of groundwater discharge, radon-222 concentrations, and fecal indicator bacteria concentrations in near-shore ocean water, West Beach, Santa Barbara, California, during ebb-tide April 17-18, 2007.

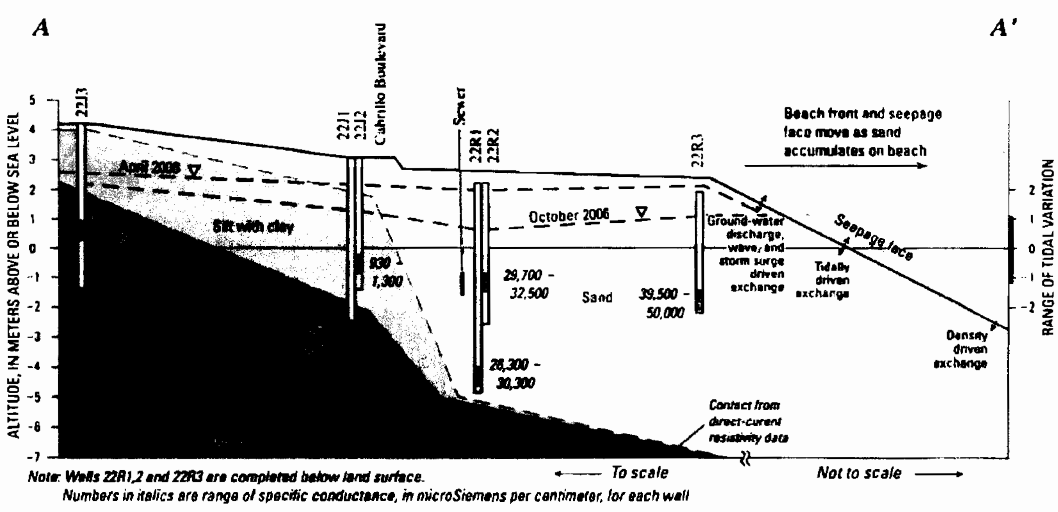

Figure 8 Section A-A' perpendicular to West Beach, Santa Barbara, California.

Groundwater discharge to West Beach near well 22R2 along Cabrillo Boulevard (Figure 8) was a considered a possible FIB source because of the proximity of the sewer line to the beachfront. Recent work at similar sites has suggested that groundwater discharge contaminated with sewage, especially at low tide, may be a source of FIB to ocean beaches [23,24,48]. Total coliform, enterococci, and *E. coli* concentrations in water from well 22R3 were generally less than the detection limit, and maximum FIB concentrations from this well (630, 85, and 63 MPN per 100 mL, respectively) were lower than concentrations in near-shore ocean water. Low levels of human-specific *Bacteroides* were detected once in water from well 22R3, during the April 2007 sample collection, after waves associated with a south swell drove water into the beach.

FIB concentrations in the nearby harbor (Figure 1) have been monitored at seven locations by the City of Santa Barbara since 2001 (City of Santa Barbara, written commun., 2007). Data show low-levels of FIB that do not approach standards for recreational water or concentrations measured at West Beach. In addition to monitoring within the harbor, sewer lines on the wharf near the harbor are routinely inspected to ensure their integrity. Monitoring within the harbor and inspection of infrastructure does not exclude the possibility of discharges from commercial or recreational boats outside the harbor. If these discharges occur they would be expected to contain human-specific *Bacteroides* and other indicators of human fecal contamination consistent with sewage.

Kelp present at the high spring tide line and guano contaminated beach sands had high concentrations of FIB (Table 3). These materials may be a source of FIB at the ocean-beach interface especially during the spring tide when high tides wash material that has accumulated on the beach during the past month. Kelp and beach sands did not contain detectable levels of human-specific *Bacteroides* or enteroviruses (Table 2). These materials contain unique molecular and trace organic assemblages that will be discussed later in this paper.

Samples collected for this study indicate that the mouth of Mission Creek contains high concentrations of FIB (Figure 2) and occasionally detections of human-specific *Bacteroides* (Table 2). Mission Creek was discharging to the ocean during the ebb tides sampled in November 16-17, 2005 and May 31-June 1, 2006 and was a potential source of FIB at those times. Mission Creek was not discharging during the April 17-18, 2007 ebb tide.

Table 3 Fecal indicator bacteria concentrations in water extractions from kelp, and guano contaminated beach sands, West Beach, Santa Barbara, California April 17-19, 2007 [MPN per 100 ml, Most Probable Number per 100 milliliters; kg, kilogram; <, less than; >, greater than]

Sample	Date	Mass of sample, in kg	[a]Mass of extractant, in kg			Fecal indicator bacteria (FIB), in MPN per 100 ml	Phospholipid fatty acids (PLFA), in picomoles per liter
				Total coliform	*Escherichia coli*	Enterococci	
Kelp	4/16/07	12	7.0	12,000	8,660	>24,200	17,600,000
				9,800	7,270	>24,200	--
[b]Kelp	4/19/07	12	11.4	15,500	7,270	3,450	14,300,000
				17,300	8,160	2,480	--
Sand	4/16/07	0.5	7.0	15,500	3,450	9,800	65,000
Blank	4/16/07	--	--	<10	<10	<10	<100
Trip blank	4/16/07	--	--	<10	<10	<10	<100

[a]Extractant was organic free water adjusted in the field to a salinity of 35 grams per kilogram with reagent-grade sodium chloride. The sodium chloride was baked at 200°C for 24 hours to volatilize organic material; [b]Sample material was very dry and recovery of extract was poor.

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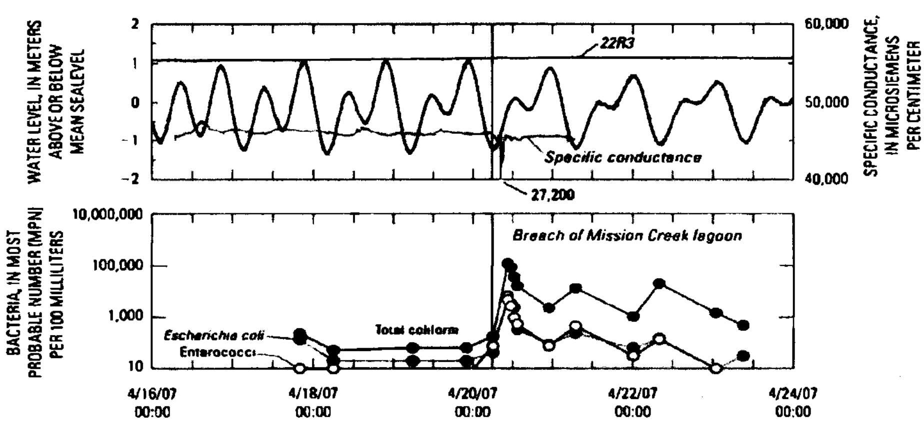

Figure 9 Tides, specific conductance, and fecal indicator bacteria (FIB) concentrations in near-shore ocean water, West Beach, Santa Barbara, California, April 16-23, 2007.

However, Mission Creek discharged rapidly beginning about 07:30 on April 20 after runoff from the storm breached the berm at the mouth of the creek. After the breach, FIB concentrations at West Beach increased rapidly as water discharged to the ocean (Figure 9). Total coliform, *E. coli*, and enterococci concentrations at West Beach, 3 hours after the breach of the berm, were 120,000, 6,500, and 4,600 MPN per 100 mL, respectively, and human-specific *Bacteroides* was present in near-shore ocean water (Table 2). At this time, specific conductance was 27,200 µS/cm, about half that of seawater - consistent with a large influx of fresh water from Mission Creek. FIB concentrations gradually declined to more normal values and specific conductance increased to near seawater values during the 3 days following the breach of the berm (Figure 9).

3.5. Physical and Isotopic Measures of the Exchange of Shallow Groundwater and Ocean Water

Water-level data from shallow wells in the cross-section perpendicular to West Beach, direct measures of groundwater discharge from seepmeters, and indirect measures of groundwater discharge from naturally occurring radioactive isotopes were used to evaluate the exchange of shallow groundwater and near-shore ocean water along West Beach. These data were supplemented with direct-current resistivity data collected along West Beach to extend interpretations from data collected at West Beach to other locations along the beachfront.

3.5.1 Groundwater Levels

Water-level data in wells perpendicular to West Beach show an oceanward gradient from the farthest inland well 22J3 toward well 22R2, adjacent to the sewer line (Figure 10). However, because the shallow deposits inland from the sewer line are predominately low permeability silt and clay (Figure 5), the groundwater flux toward the sewer line from inland areas was small. Water-level data show an inland gradient from well 22R3 near the beachfront toward well 22R2 adjacent to the sewer line (Figure 10).

Increases in water levels measured in wells 22J1 and 22J3 in early 2006 corresponded to precipitation events (Figure 10) and the water-level rises were consistent with the precipitation amount and the expected porosity of the deposits. When examined closely, increases in water levels measured in well 22R2 during the same periods were greater than expected solely from precipitation, and probably result from the discharge of stormflow runoff from adjacent streets to the beach. Runoff from streets adjacent to West Beach may be a potential source of FIB to shallow groundwater underlying the beach that was not considered at the onset of this study. Despite the water-level rise measured in well 22R2 in response to the precipitation and runoff, water levels in well 22R2 did not exceed water levels in well 22R3 at the beachfront, and the water-level gradient between wells 22R2 and 22R3 was inland toward the sewer line even during the rainy season (Figure 10).

Long-term net-infiltration of water from the ocean into the beach is indicated by the near-seawater specific conductance of water from wells 22R2 and 22R3 on the ocean side of the sewer, which ranged from 29,700 to 50,000 μS/cm (Figure 8). In contrast, the specific conductance of water from wells 22J1 and 22J2 on the inland side of the sewer line ranged from 930 to 3,530 μS/cm. Video logs show groundwater seepage into the sewer during dry periods, confirming water level and specific conductance data that show the sewer is a drain for shallow groundwater in the beach sands (City of Santa Barbara, Rebecca Bjork, written commun, 2006). As a consequence of the direction of water movement, FIB bacteria associated with the sewer line or infiltrated from stormflow runoff into beach sands could not discharge to the ocean. However, exchange of water between the ocean and beach sands (Figure 8) could contribute FIB to near-shore ocean water during daily and longer tidal cycles. This exchange includes both discharge and recharge components, and is often referred to as submarine groundwater discharge (SGD) [62,68,73-75].

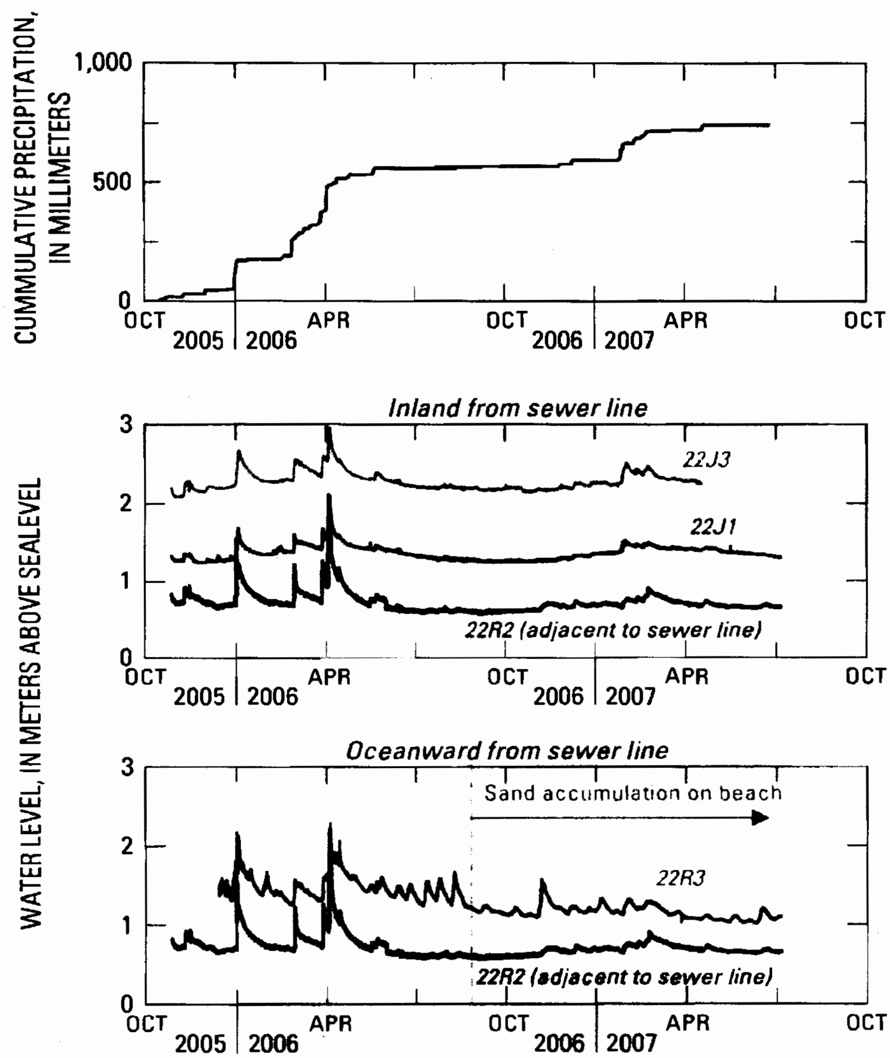

Figure 10 Water-level data in selected wells along section A-A' perpendicular to West Beach, Santa Barbara, California November 2005 to July, 2007.

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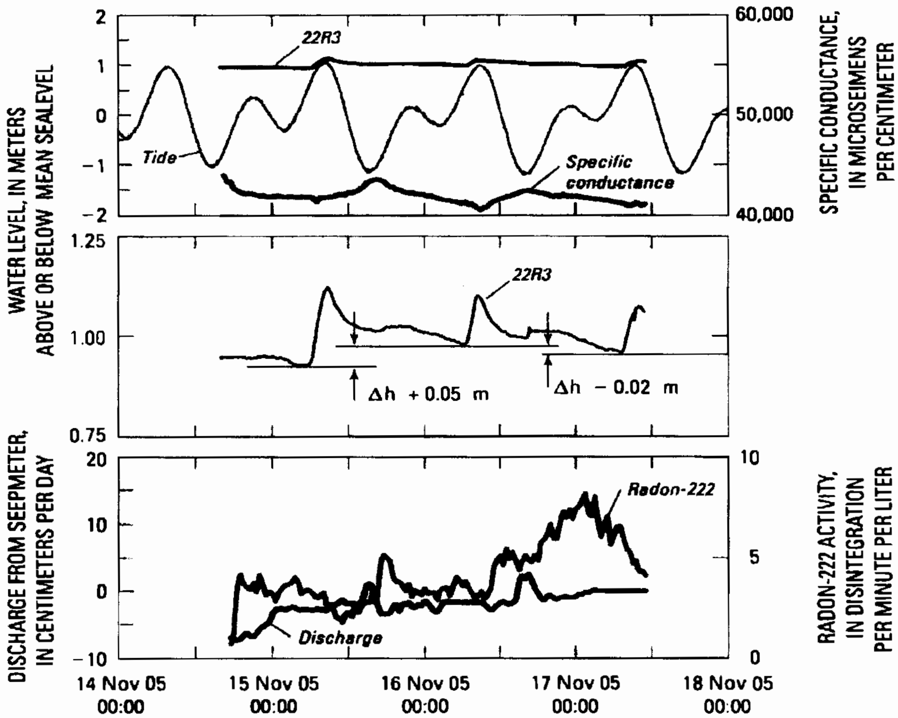

Figure 11 Groundwater levels at well 4N/27W-22R3, tides, groundwater discharge, and specific conductance of groundwater discharge, and radon-222 concentrations in near-shore ocean water, West Beach, Santa Barbara, California, November 14-18, 2005.

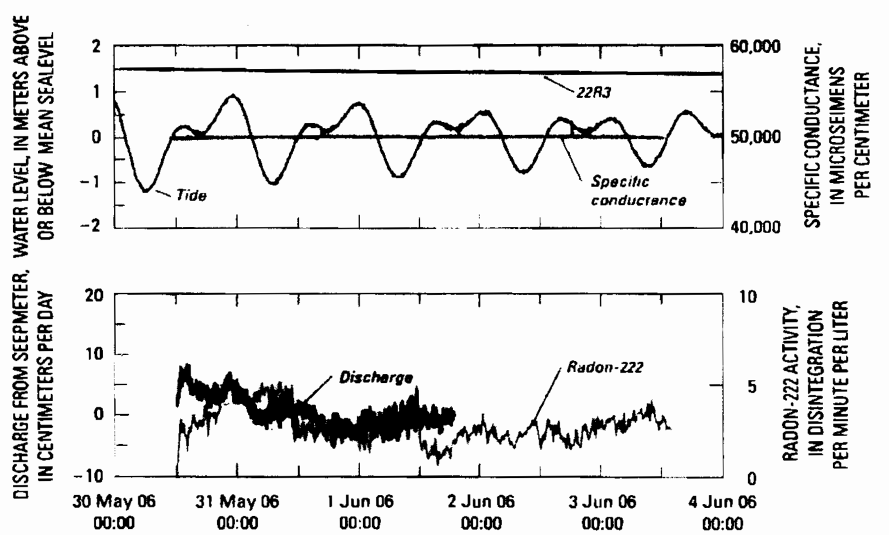

Figure 12 Groundwater levels at well 4N/27W-22R3, tides, quantity, direction, and specific conductance of groundwater discharge, and radon-222 concentrations in near-shore ocean water, West Beach, Santa Barbara, California, May 30-June 4, 2006.

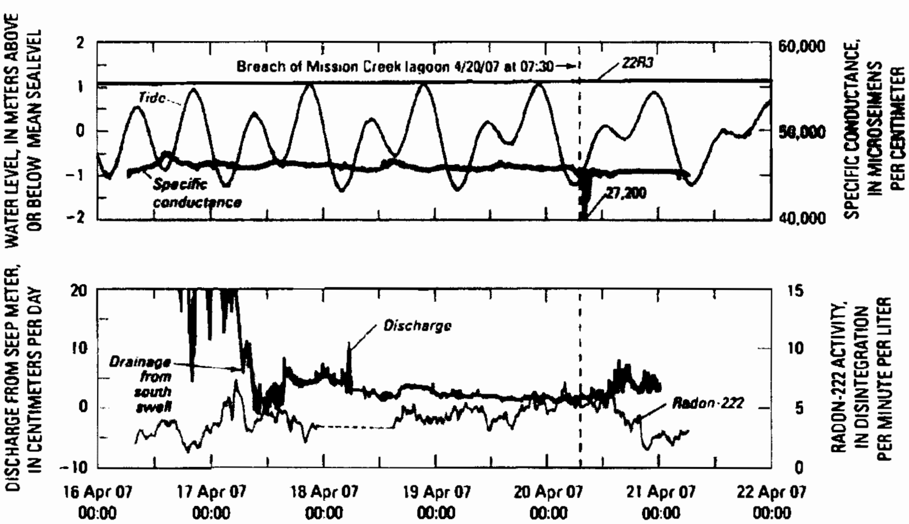

Figure 13 Groundwater levels at well 4N/27W-22R3, tides, quantity, direction, and specific conductance of groundwater discharge, and radon-222 concentrations in near-shore ocean water, West Beach, Santa Barbara, California, April 16-22, 2007.

3.5.2 Seepmeter and Radon-222 Data

Seepmeter and radon-222 (^{222}Rn) data were collected during two spring tides, and during a neap tide to assess the magnitude, variability, and timing of the exchange of shallow groundwater with near-shore ocean water. ^{222}Rn data were used in conjunction with seepmeter data to address spatial variability and to cover potential data gaps resulting from disturbance of the meters during deployment. Specific conductance was measured in water from the seepmeter to assess changes in salinity as shallow groundwater exchanged with ocean water. Although the water-level gradient from the ocean to the sewer line was inland, water levels measured in well 22R3 during the three measurement periods were always higher than the high tide, indicating the potential for groundwater discharge at the beachfront (Figures 11-13). Groundwater discharge and nutrient fluxes to near-shore ocean water along West Beach estimated from seepmeter data and ^{222}Rn data collected as part of this study are discussed in detail by Swarzenski and Izbicki [76].

Discharge from EM seepmeter data measured during November 14-17, 2005 reflect net infiltration of water from the ocean into the beach prior to the spring tide followed by net discharge of water to the ocean after the spring tide (Figure 11). These values correspond with increasing and decreasing water levels in well 22R3 (Δh, on Figure 11). The largest magnitude positive values were measured during low tide, reflect the largest discharge of water from the beach to the ocean (Figure 11).

During the November, 2005 measurement period, discharge data were collected using seepmeters at two different depths to determine if there was a difference in groundwater flow with depth. The shallowest seepmeter (data shown on Figure 11) was placed at the low tide line and the second meter was placed about 1 m below the low tide line. The deeper meter recorded negative values throughout the period, indicating movement of water from the ocean into the beach (data not shown). This difference in water movement with depth is believed to be the result of density-driven flow driving circulation between ocean and beach deposits, even as groundwater discharges from beach sands to the ocean at shallower depths [77]. The data suggest that exchange of shallow groundwater with near-shore ocean water driven by tidal forces extends from the high tide line to a depth of less than 1 meter below the low tide line (Figure 5).

Discharge data collected during neap tide, May 31 to June 31, 2006 (Figure 12) show smaller magnitude discharges from the beach to the near-shore ocean the throughout the daily tidal cycle. These discharges cease as the neap tide approached and the monthly

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tidal cycle changed toward higher amplitude tides.

During the April 16-22, 2007 period, seepmeter data showed water moving from the beach sands into the ocean (positive values) throughout almost the entire measurement period irrespective of the daily tidal cycle (Figure 13).The greatest discharge, exceeding 300 cm/d, was measured on April 16, 2007 (not shown on Figure 13). These high values result from drainage of water driven into the beach sands by waves during a south swell prior to the measurement period.

^{222}Rn activities in near-shore ocean water along West Beach ranged from 0.6 to 8 dpm/L (disintergrations per minute per liter) (Figure 11-13). In contrast, ^{222}Rn activities in wells along West Beach were as high as 1,300 dpm/L with a median activity of 610 dpm/L. Low ^{222}Rn activities in near-shore ocean water at West Beach are consistent with water-level and seepmeter data that show little net groundwater discharge to the ocean. ^{222}Rn activities measured in near-shore ocean water along West Beach are almost an order of magnitude lower than values in areas where groundwater is actively discharging to the ocean [72], and activities were similar to values measured in areas where beach deposits are underlain by impermeable crystalline rock that conduct only small amounts of groundwater to the ocean [62].

Despite the low values, ^{222}Rn activities were positively correlated with groundwater discharge data from seepmeters, and ^{222}Rn activities in the near-shore ocean increased during the lowest daily tide (Figures 11 and 12). However, the maximum ^{222}Rn activity lagged the peak discharge measured by the seepmeter by several hours, possibly as water having longer contact with beach sediments and therefore higher ^{222}Rn activities discharged to the ocean (Figure 11). Similar lags between groundwater discharges and peak ^{222}Rn activities are apparent in data from the Florida, Mediterranean and Brazilian coasts [62,78]. Abrupt decreases in ^{222}Rn activity were measured on the turning tide as near-shore ocean water containing a high fraction of discharging groundwater was displaced by ocean water on the incoming flood tide (Figure 12). Over the monthly tidal cycle, ^{222}Rn activities in near-shore ocean water increased after the spring tide as groundwater having longer contact time with beach sediments discharged to the ocean (Figure 11).

Low ^{222}Rn activities were associated with the high groundwater discharges measured after a south swell on April 16-17, 2007 (Figure 10). These low ^{222}Rn activities probably result from drainage of ocean water only recently infiltrated into beach sands by wave action. This water had not been in contact with beach sand long enough to equilibrate with ^{222}Rn derived from radioactive decay of ^{226}Ra sorbed on the sands. Increased specific conductance during low tides during this period is consistent with the discharge of recently infiltrated ocean-water (Figure 13). Similar increases in specific conductance of near-shore ocean water, measured during low tide on November 14-18, 2005 (Figure 11), suggest that this type of wave-driven exchange occurs frequently.

3.5.3 Exchange of Water at the Beachfront and Fecal Indicator Bacteria Concentrations

Measurements of FIB concentrations during the ebb of the spring and neap tides, coupled with physical and isotopic data collected at the ocean-beach interface, were used to understand the variation, timing and sources of FIB to near-shore ocean water. If groundwater were a source of FIB, on the basis of seepmeter and ^{222}Rn data the highest FIB concentrations would be expected on a daily basis shortly after low tide, with monthly maxima at neap tide when discharge from the beach sand to the ocean is greater.

FIB concentrations varied by as much as 2-orders of magnitude during the sampled ebb tides and the timing of the measured increases in FIB concentrations were consistent with contributions from the beach (Figures 5-7). However, groundwater has low FIB concentrations. Another source of FIB, capable of delivering high concentrations to near-shore ocean water during the ebb tide and turning tides, must be present along West Beach.

Kelp, and guano contaminated sands on West Beach near the high tide line contain high concentrations of FIB (Table 3). Drainage from these materials after the high tide may be a potential source of FIB. However FIB from these sources cannot explain low levels of human-specific *Bacteriodes* that were consistently present in near-shore ocean water at West Beach. Because *Bacteroides* were not detected in kelp or guano contaminated beach sand other human-derived sources also contribute to FIB concentrations at West Beach. The potential for FIB from these sources is discussed in greater detail in the following section.

3.5.4 Direct-current Resistivity Data

Direct-current resistivity data were collected from a boat along West Beach, near the mouth of Mission Creek, and along the beach to the east. The data were

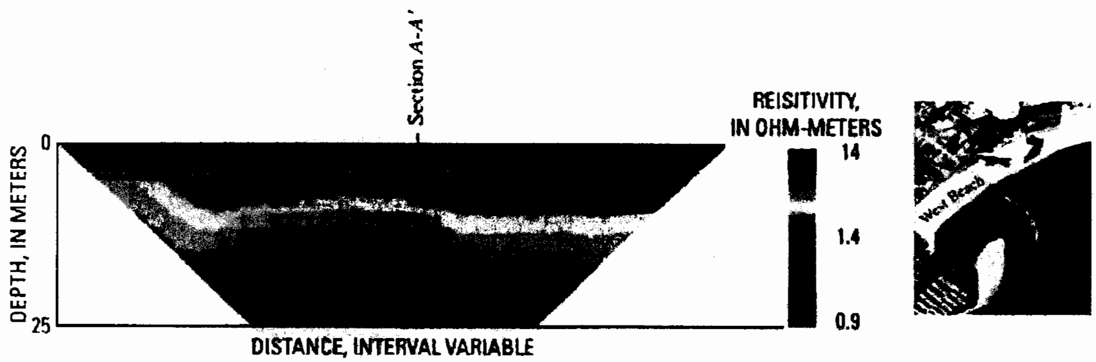

Figure 14 Shore parallel direct-current resistivity data, offshore from West Beach, Santa Barbara, California, November 15, 2005.

used to assess the variability of subsurface lithology and pore fluid resistivity off West Beach, and to evaluate the representativeness of data collected at Section A-A' to other areas along the beachfront.

Shore parallel direct-current resistivity data collected offshore from West Beach show lower resistivity (high conductance) material at shallow depths beneath the ocean, and higher resistivity (low conductance) material at depths greater than about 10 m (Figure 14). These data agree with results of test drilling, well installation, and sample collection along section A-A' (Figure 8) that show sand containing saline water overlying clay containing fresh water.

The direct-current resistivity data show that the sands thin toward the harbor, but that subsurface conditions are otherwise relatively uniform along West Beach. These data are consistent with diffuse exchange of groundwater and near-shore ocean water and do not show evidence of focused discharge from submarine springs. In contrast, shore parallel direct-current resistivity data collected near the mouth of Mission Creek (data not shown) suggest complex, highly-focused exchange of saline and fresh water through beach sands at the mouth of the stream. Focused discharge of fresh water also was observed near the mouths of streams to the east of Mission Creek.

3.6. Tracers of Fecal Indicator Bacteria Sources

Genetic, molecular, and trace organic tracers were used to evaluate potential sources of FIB collected from different hydrologic settings throughout the study area. Thirty-six samples from surface water (including Mission Creek and its estuary, urban drains, and stormflow), wells, and near-shore ocean water at West Beach were compared and contrasted. Six additional samples from special sources including the influent to El Estero WWTP, and from kelp and sand collected near the high tide line also were included in this analysis.

Principal Component Analysis (PCA) was used to analyze the tracer data. PCA is a multivariate statistical technique that transforms a set of intercorrelated variables into a new coordinate system. The transformed variables, known as principal components, are uncorrelated linear combinations of the original variables. They have a mean of zero and the same variance as the original data set [79,80]. The values of the principal components are known as scores, and the scores are calculated on the basis of the contribution of each variable to the principal component [81]. The magnitude and direction (plus or minus) of the contribution of each variable to the principal-component score is described by an eigen-vector. PCA presents differences in the tracer assemblage that is reflective of differences in the microbial community structure, and allows for a comparison and contrast of different samples [53].

Comparison of results from different tracers is intended to confirm, refine, or refute interpretations derived from individual tracers - thereby producing a more robust interpretation of the sources of FIB in the study area. PCA results were compared to and contrasted with the physical hydrology in the study area to ensure interpretations from tracer data are plausible. Detailed analysis of the contributions of individual eigenvectors to the principal component scores often yields increased understanding of the distribution of these tracers in the environment [11].

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However, this level of analysis and subsequent discussion would preclude the comparisons between tracers and to the physical hydrology and were beyond the scope of this paper.

3.6.1 Terminal-Restriction Fragment Length Polymorphism Data

Genetic diversity in microbial populations was assessed using Terminal-Restriction Fragment Length Polymorphism (T-RFLP). T-RFLP uses restriction enzymes to break genetic material within the hypervariable region of mitochondrial DNA into smaller fragments know as amplicons. Amplicons having different numbers of base pairs (amplicon length) represent different microorganisms. However, the sequence of base pairs within amplicons of the same length may be greatly different, and more than one type of microorganism may be represented. Two restriction enzymes, H-ha1 and M-sp1, were used in this study. Each breaks the mitochondrial DNA at different locations, and produces a different assemblage of amplicons (Figure 15). Quantitative Polymerase Chain Reaction (qPCR) was used to amplify the DNA to measurable concentrations, and the peak area is a measure of the abundance of an amplicon and the microorganism(s) it originated from.

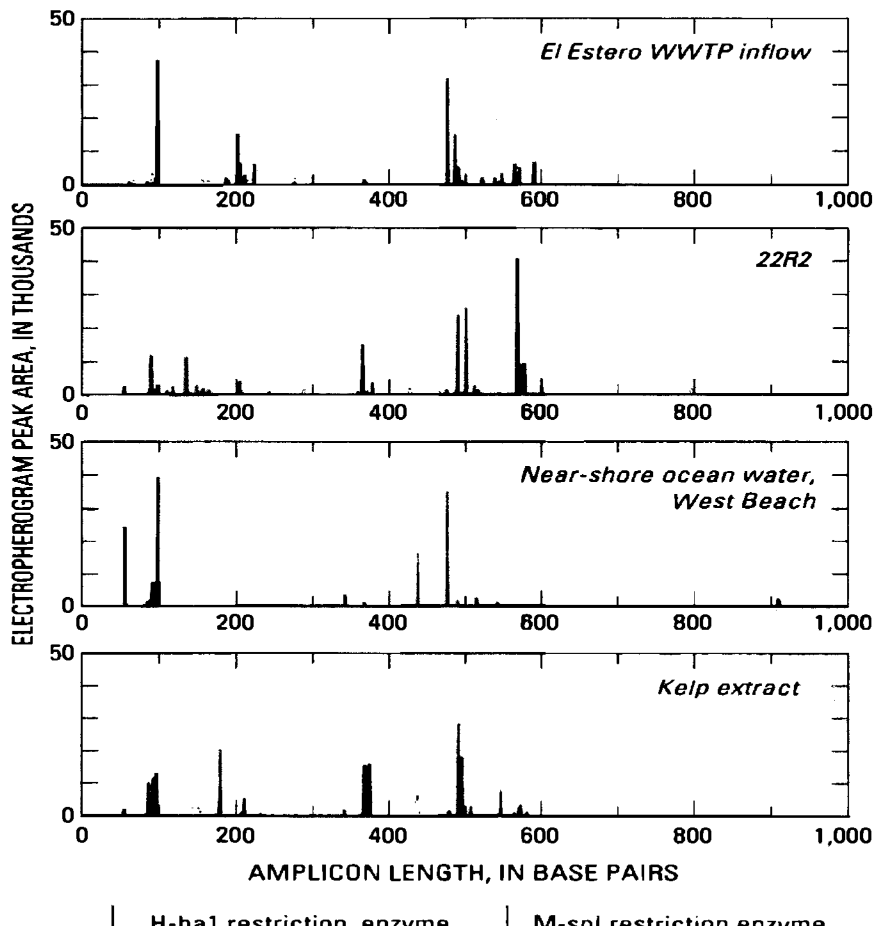

Figure 15 Representative Terminal-Restriction Fragment Length Polymorphism (T-RFLP) amplicons produced using H-ha1 and M-sp1 restriction enzymes from selected samples, Santa Barbara, California, August 2005-April 2007.

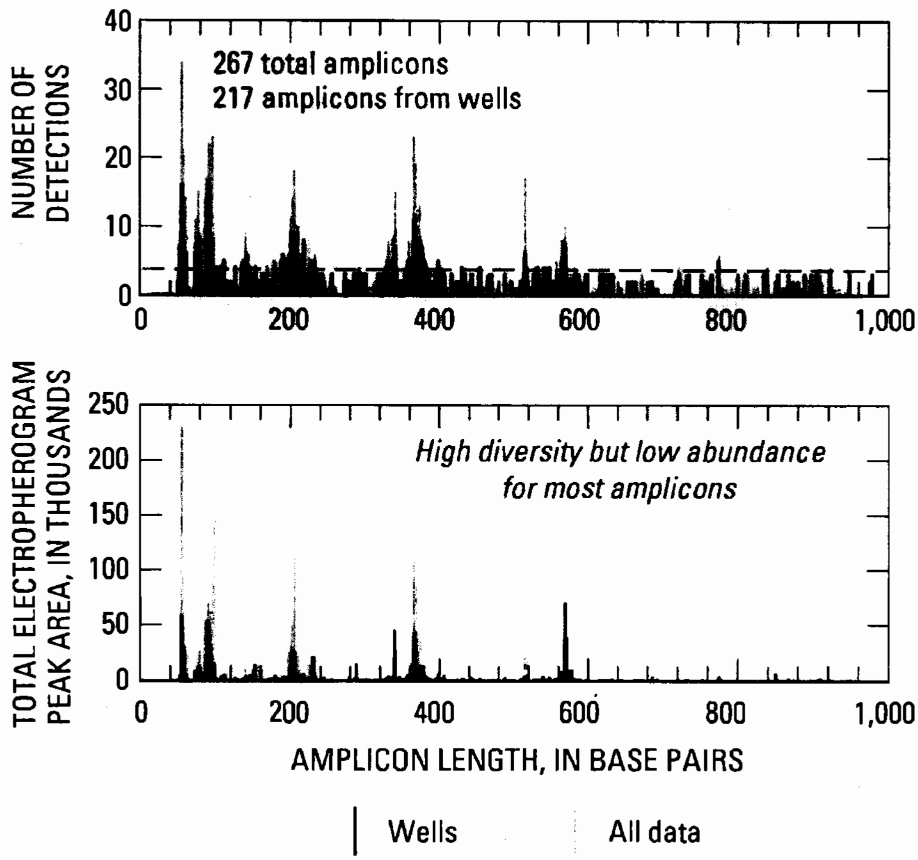

Figure 16 Terminal–Restriction Fragment Length Polymorphism (T-RFLP) H-hal amplicons in samples surface water (including storm drains), near-shore ocean water, water from wells and from selected sources, Santa Barbara, California, August 2005 to April 2007.

Amplicons that appear in more than one sample are common to those samples. Amplicons that appear in only one sample are unique. For example, only H-hal amplicons having 91, 94, and 367 base pairs and M-spl amplicons having 86 and 490 base pairs, respectively, are common to all four samples shown in Figure 15. In contrast, for samples shown in Figure 15, more than 20 amplicons from H-hal and M-spl enzymes were unique to water from the inflow to El Estero WWTP - and presumably represent at least 20 microorganisms not found in the other samples. Comparison, either visually or statistically, of the occurrence and distribution of amplicons from different sources is used to identify similarities and differences in microbial populations from those sources and to infer relations between those sources. As the numbers of samples and the number of amplicons increases, the problem becomes increase-ingly complex and a statistical approach such as PCA is needed to analyze the data.

At least 267 amplicons were isolated using the H-hal restriction enzyme and 676 amplicons were isolated using M-spl restriction enzyme in samples collected as part of this study (Figure 16). More than 217 H-hal and 634 M-spl amplicons were present in water from wells, with 21 and 230 amplicons, respectively, unique to water from wells. Although most of these amplicons are present only at low abundances, this result is surprising because groundwater is not normally considered to be rich in its diversity of microorganisms. Examination of the data shows that most of the amplicons (178 amplicons) were detected in water from four wells: 22R2, and 23M1-3. The shallow groundwater in these

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areas is recharged by surface runoff (22R2) or infiltration from Mission Creek (23M1-3). These wells also are near the main sewer line beneath West Beach serving that part of the city and may have a small component of sewage. These four wells have higher FIB concentrations than other wells sampled as part of this study.

The large numbers of amplicons detected in water from wells exert a high influence on the PCA results. This is especially true given the large number of unique amplicons in the four wells discussed above. These amplicons caused large magnitude differences in the principal component scores for T-RFLP data from these wells that differentiated these wells from all other data. Groundwater moves slowly and organisms in groundwater have probably been there for a considerable period of time. The lack of similarity between the data from the four wells and sources of FIB such as stormflow, inflow to the El Estero WWTP, or from kelp and beach sands may result from changes in the microbial community through death and regrowth of different organisms as the microbial community adapts to the groundwater environment.

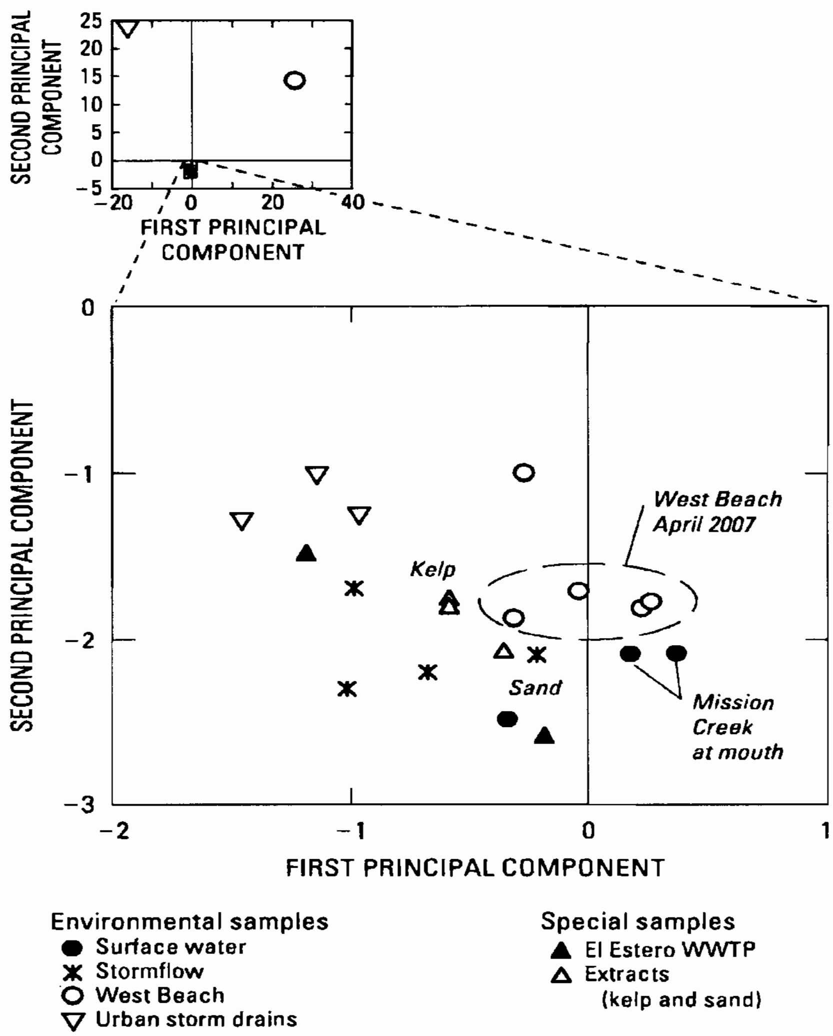

Figure 17 Results of Principal Component Analysis (PCA) for Terminal-Restriction Fragment Length Polymorphism (T-RFLP) data from surface water, near-shore ocean water, influent to El Estero WWTP, and from selected sources, Santa Barbara, California, August 2005 to April 2007.

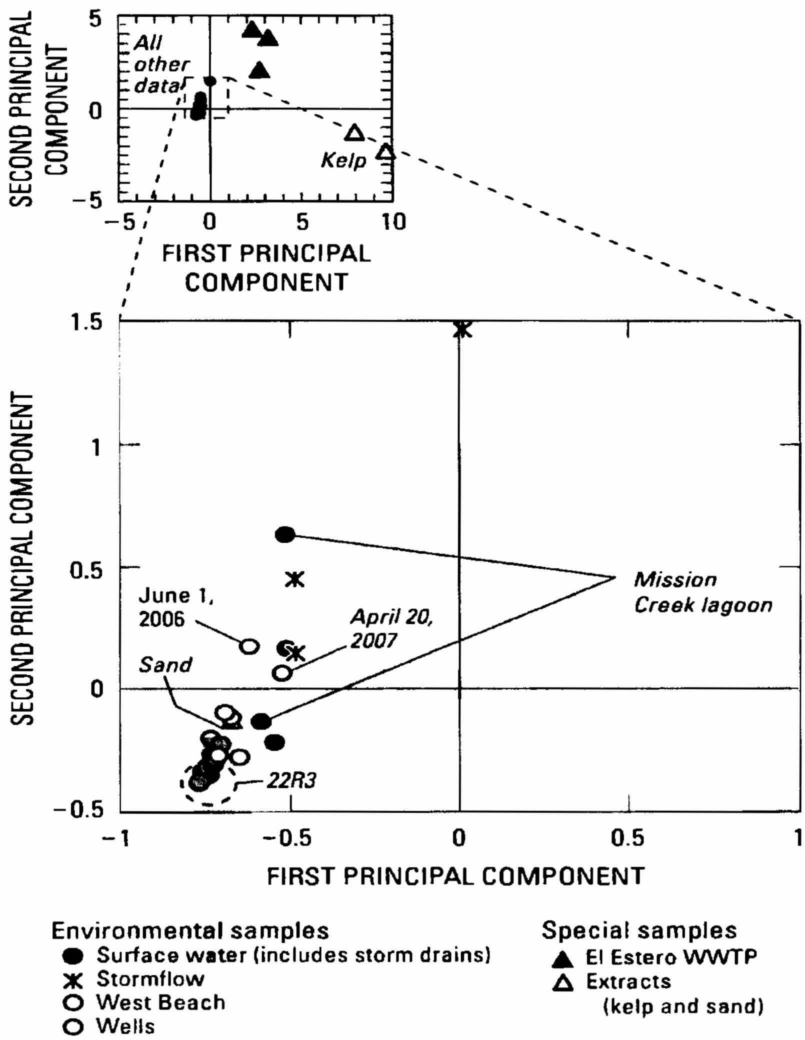

Figure 18 Results of Principal Component Analysis (PCA) for phospholipid fatty acid (PLFA) structural groups in surface water, water from wells, near-shore ocean water, influent to El Estero WWTP, and from selected sources, Santa Barbara, California, August 2005 to April, 2007.

If water from wells is excluded, the first and second principal components for the remaining 23 samples explain 32 percent of the variability in H-hal digested T-RFLP data (Figure 17). The first and second principal components in this smaller data set are dominated by large magnitude scores for samples collected from the Haley Drain and from near-shore ocean water at West Beach. These samples have the highest human-specific *Bacteroides* values sampled as part of this study (Table 2). Although these samples do not closely resemble sewage influent to the El Estero WWTP, these samples appear to have been impacted by human fecal material.

The remaining samples plot within a compareatively small range on Figure 17. However, PCA preserves the variable of the original data set and differences in principal component scores within this range reflect real differences within the data. Within this small range there was considerable variability PCA scores for samples from influent to the El Estero

WWTP, and those samples span the range in scores for samples from stormdrains and surface water, including stormflow.

The PCA scores for near-shore ocean water at West Beach in April 2007 and from kelp and sand and water from Mission Creek lagoon are similar (Figure 17). Compared to influent to the El Estero WWTP, these samples fall within a small range and are similar to samples collected from the near-shore ocean water at West Beach during the ebb tide and after the breach of the lagoon.

Although not discussed specifically in this paper, results of PCA analysis of M-spl enzyme-digested T-RFLP data were similar to results of the H-hal digested data.

3.6.2 Phospholipid Fatty Acid Data

Fatty acids are components of all living cells. At the cellular level, they may be used for energy storage or they may be part of cellular organelles and structures where they participate in metabolic activity [82]. Individual phospholipid fatty acids (PLFA's) are associated with metabolic activities by a wide-rage of microorganisms rather than indicators of specific organisms [83-87]. Because PLFA's contain phosphorus, they are rapidly degraded in the environment and are typically associated with living (or recently living) organisms [56,88].

PLFA concentrations and composition were analyzed on the same samples as T-RFLP data. Total PLFA concentrations ranged from 314 to 17.6 x 10^6 picomoles per liter (pmole/L) (Figure 18) and 38 individual fatty acids were identified. Higher concentrations reflect higher microbiological biomass. Concentrations were highest in kelp and lowest in water from wells. Total PLFA concentrations in samples from the El Estero WWTP ranged from 2.6 x 10^6 to 3.2 x 10^6 pmole/L. Concentrations in surface-water samples from Mission Creek and its tributaries ranged from 8,200 to 320,000 pmoles/L, with the highest concentrations measured during stormflow. Concentrations in excess of 100,000 pmole/L also were measured in the lagoon near the mouth of Mission Creek. Concentrations in near-shore ocean water at West Beach ranged from 22,700 to 226,000 pmoles/L, with the highest concentrations measured April 20, 2007 after the lagoon at the mouth of Mission Creek breached and discharged to the ocean.

Total PLFA concentrations in water from wells ranged from 314 to 28,000 pmoles/L, although concentrations in water from most wells were less than 880 pmoles/L. This is consistent with the low T-RFLP abundance in water from wells. Over the very broad range of concentrations sampled, PLFA concentrations were positively correlated with FIB concentrations ($r = 0.43$). PCA analysis of the PLFA concentrations was simplified by grouping the fatty acids according to their structure into saturated, monounsaturated, branched saturated fatty acids, terminally branched saturated fatty acids, mid-chain branched fatty acids, and polyunsaturated fatty acids [86]. The concentration of each structural group was used to calculate the principal component scores and eigenvectors to provide a simplified analysis of the changes in PLFA concentration and composition of microbial communities from different sources. These structural groups, and the fatty acids within those groups, are commonly associated with metabolic functions common to a wide range of organisms sharing similar environments (for example anaerobic versus aerobic) or metabolizing similar substrates rather than specific species. Use of structural groups for PCA analysis was very robust and the first and second principal components explained 97 percent of the total variance within the data set (Figure 18). Unlike the PCA analysis of T-RFLP data, it was not necessary to exclude water from wells to obtain interpretable results.

Kelp and samples of influent to the El Estero WWTP had highly positive first principal component scores but differed in magnitude in their second principal component scores - reflecting the different microbial communities residing in the two sources (Figure 19). Unlike T-RFLP data, principle component scores show little variability in samples from influent to the El Estero WWTP (Figures 17-18) suggesting that although the specific microorganisms within sewage may vary greatly, the metabolic processes they carry out in this environment are relatively constant and therefore sewage contamination would be traceable on the basis of PLFA compositions. Also unlike T-RFLP data, principle component scores show little similarity between kelp and near-shore ocean water at West Beach (Figures 17 and 18). This result suggests that although kelp on West Beach contains high concentrations of FIB, it is not the primary source of FIB to near-shore ocean water. In contrast, the composition of PLFAs in sand was very similar to PLFAs in near-shore ocean water, suggesting FIB in sand is a likely source of fecal bacteria to near-shore ocean water.

Principal component scores of stormflow samples tend toward the PLFA composition in samples from influent to the El Estero WWTP. This similarity decreased later in the stormflow, suggesting the possible presence of wastewater in initial stormflow runoff. However, wastewater indicator data, discussed later in this paper, show that El Estero WWTP influent was not present in the stormflow samples. Animal or human wastes (from leaking laterals or the homeless populations) released directly to the environment and washed into the stream during stormflow may be the cause of PLFA composition in stormwater samples collected early in the storm.

The PLFA composition of samples of near-shore ocean water collected from West Beach varied with discharge from Mission Creek. PLFA scores from West Beach samples collected when Mission Creek was discharging to the ocean (June 1, 2006 and April 20, 2007) were more similar to water sampled from the estuary at the mouth of the creek (Mission Creek lagoon). In contrast, the PLFA composition of samples from West Beach collected when Mission Creek lagoon was not discharging to the ocean were more similar to the PLFA composition of guano contaminated beach sand and less similar to water from the creek. As previously discussed, the PLFA composition of near-shore ocean water showed little similarity to the PLFA composition of kelp (Figure 18). However, it is important to remember that the kelp is not the source of FIB, but rather fecal material deposited on the kelp by birds feeding along the shoreline or other sources are the source of FIB. The PLFA signature of the bird droppings may be overwhelmed by the large microbial populations residing on the kelp.

PCA also was conducted using the concentrations of the 38 individual fatty acids identified in samples from this study (results not shown). This analysis also was very robust and the first, second, and third principal components explained 91 percent of the variability within the data set. Interpretations derived from PCA of the individual fatty acids were similar to interpretations derived from analysis of the structural groups.

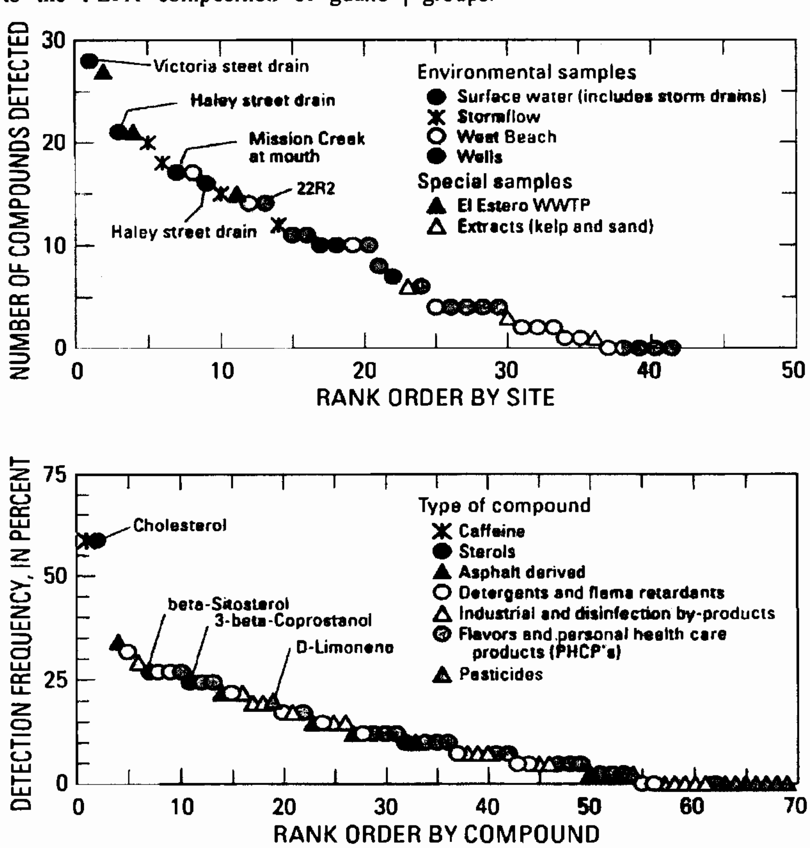

Figure 19 Trace organic compound abundance in surface water, water from shallow wells, near-shore ocean water, and from selected sources, Santa Barbara, California, August 2005 to April 2007.

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3.6.3 Trace Organic Compounds

A suite of 69 organic compounds was measured as part of this study to help identify the source or sources of FIB in the near-shore ocean water. The compounds can be divided into a number of categories on the basis of their use and origin (Table 4). Reporting limits for most analyzed compounds were within the part per trillion range, and concentrations were below thresholds for public health or environmental concerns. Compounds analyzed as part of this study are anthropogenic and do not occur naturally. Data are available on the U.S. Geological Survey on-line data base NWIS-Web.

At least one trace organic compound was detected in 88 percent of all samples. Not surprisingly, compounds were detected more frequently and at the higher concentrations in samples of wastewater influent to the El Estero WWTP (Figure 19). Large numbers of compounds also were detected in urban stormdrains and stormflow samples, and in near-shore ocean water at West Beach following the April 20, 2007 stormflow and subsequent discharge from the lagoon at the mouth of Mission Creek. Smaller numbers of compounds were detected in kelp and guano contaminated sands. Almost two-thirds of samples from wells had two or fewer compounds detected, and no compounds were detected in almost 25 percent of sampled wells. However, more than ten compounds were present in water from wells 22R2 and 23M2. These wells were discussed previously because of their high FIB concentrations, high diversity of microorganisms, and connection with surface sources of contamination.

Caffeine and cholesterol were the most commonly detected compounds and were present in almost 60 percent of the environmental samples (Figure 19). Caffeine and the various sterols were positively correlated, and these compounds were positively correlated with many personal-care products, flame retardants, flavors/fragrances, and d-limonene. In contrast, caffeine and sterols were poorly correlated with most industrial, and asphalt-derived compounds. Caffeine is associated with human use and consumption. Caffeine concentrations in samples from the El Estero WWTP influent ranged from 18 to 84 μg/L. High concentrations, 8 and 4 μg/L, also were measured in the Cabrillo and Haley Street storm drains tributary to Mission Creek, respectively. As previously discussed, both sites had measurable human-specific *Bacteroides*. Caffeine concentrations in samples from kelp were as high as 67 μg/L. This caffeine concentration was surprisingly high, although these samples contained high concentrations of FIB, neither sample contained human-specific *Bacteroides*.

Sterols tend to degrade under aerobic conditions and have been interpreted as evidence of recent fecal contamination [89]. Four sterols (listed in order of abundance) were measured as part of this study, cholesterol, beta-sitosterol, 3-beta-coprostanol, and stigmastanol. Cholesterol is associated with wide range of sources, including human dietary cholesterol, but is not necessarily fecal in origin. 3-beta-coprostanol is a fecal sterol produced in the gut of some mammals (including humans, pigs, and cats) by the microbially mediated reduction of cholesterol under anaerobic conditions. Although the sterol content of bird feces can be highly variable, they do not generally contain the proper bacteria to reduce cholesterol to 3-beta-coprostanol [90]. The absence of 3-beta-coprostanol in kelp and guano contaminated sand from West Beach is consistent with fecal contamination from birds rather than human or other mammalian fecal material (Table 5). Although 3-beta-coprostanol was absent, cholesterol and beta-sitosterol were present in samples of kelp- and guano-contaminated beach sands. Beta-sitosterol occurs in some plants and, as a consequence, in human dietary cholesterol and in the gut of birds.

At least one personal health-care product, detergent metabolite, flame-retardant, or asphalt-derived compound was present in 75 percent of environmental samples, although many compounds within these groups were detected only infrequently or not at all.

Most pesticides were notably absent compared to their abundance in urban surface water and stormflow in other parts of California [91]. However, d-limonene, an "environmentally-friendly" substitute for traditional pesticides used for termite control, was detected in 20 percent of environmental samples. Low pesticide detections may reflect local restrictions on pesticide use and sales.

There was concern that high concentrations of FIB present during stormflow in Mission Creek could result from discharge of wastewater from sewer lines near the stream if those lines flow under pressure during stormflow. This discharge might not occur during low-flow conditions. PCA analysis of PLFA data suggest there may be such a connection. However, stormflow samples collected from Mission Creek at Gutierrez Street did not contain detectable levels of the sterols 3-beta-coprostanol, beta-sitosterol, and beta-stigmastanol, but all of these sterols are present at high concentrations in wastewater. In contrast, stormflow samples contained high concentrations of the detergent metabolites NPEO-1 and NPEO-2. These compounds were not present in wastewater influent to the El Estero WWTP. Furthermore, the detergent metabolite 4-nonylphenol, which is present at high concentrations in wastewater, was absent in stormflow from Mission Creek. These data are not consistent with direct discharge of sewage to Mission Creek from leaking sewer pipes during stormflow.

Table 4 Detections of trace organic compounds in surface water (including storm drains), water from wells, near-shore ocean water, wastewater treatment plant influent, and other sources, Santa Barbara, California August 2005-April 2007. [Concentrations are in micrograms per liter. WWTP, wastewater treatment plant; MC, Mission Creek; (sf), stormflow sample. Environmental samples are the sum of surface water, wells and West Beach samples.]

Compound	Reporting level	Surface water (11)	Water-table wells (17)	West Beach (7)	Environmental samples (35)	El Estero WWTP influent (3)	Extract samples (3)	Maximum concentration	Source
Caffeine	1	8	6	4	18	3	3	83.3	El Estero WWTP
	Sterols								
3-beta-Coprostanol	2	3	3	1	7	3	0	308	El Estero WWTP
Beta-Sitosterol	2	3	1	1	5	3	3	42.8	El Estero WWTP
Beta-Stigmastanol	2	1	6	0	7	3	3	6.0	El Estero WWTP
Cholesterol	2	7	6	5	18	3	3	244	El Estero WWTP
	Flavors and fragrances								
Acetophenone	0.5	2	2	0	4	0	0	1.46	Cabrillo drain inflow
Benzophenone	0.5	0	1	1	2	3	0	0.793	El Estero WWTP
Galaxoide (HHCB)	0.5	0	0	0	0	2	0	3.6	El Estero WWTP
Indole	0.5	1	0	0	1	1	3	10.6	El Estero WWTP
Isoborneol	0.5	0	0	0	0	1	0	2.4	El Estero WWTP
Menthol	0.5	2	1	0	3	2	0	22.5	El Estero WWTP
Menthyl-1H-indol	1	0	1	0	1	2	0	4	El Estero WWTP
Triethyl citrate	0.5	0	0	0	0	1	0	0.9	El Estero WWTP
Tonalide		1	0	0	1	1	0	0.9	El Estero WWTP
	Personal health-care products								
Camphor	0.5	6	0	3	9	1	0	1.7	El Estero WWTP
3,4-Dichlorophenyl isocyanate	0.5	2	1	1	4	0	0	10.5	4N/27W-22R2
1,4-Dichlorobenzene	0.5	0	0	1	1	1	0	0.7	El Estero WWTP
Carbazole	0.5	1	0	0	1	0	0	0.074	MC at Gutierrez (sf)
DEET	0.5	3	5	0	8	2	0	1.01	El Estero WWTP
Naphthalene	0.5	2	4	0	6	2	0	1.29	4N/27W-21G4
Pentachlorophenol	2	2	0	2	4	0	0	0.62	West Beach
Tricolsan	1	1	0	0	1	2	0	4	El Estero WWTP
p-Cresol	1	5	1	1	4	3	1	70.6	El Estero WWTP
	Detergent metabolites								
4-n-Octylphenol	1	1	0	0	1	1	0	0.75	El Estero WWTP
4-tert-Octylphenol	1	0	0	0	0	1	1	0.75	El Estero WWTP
Diethoxynonyl-phenol NPEO-2	5	9	1	0	10	1	0	77.5	Victoria drain
Diethoxynonyl-phenol OPEO-2	1	3	0	1	4	0	0	0.8	MC at Gutierrez (sf)

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Table 4 (continued) Detections of trace organic compounds in surface water (including storm drains), water from wells, near-shore ocean water, wastewater treatment plant influent, and other sources, Santa Barbara, California, August 2005-April 2007. [Concentrations are in micrograms per liter. WWTP, wastewater treatment plant; MC, Mission Creek; (sf), stormflow sample. Environmental samples are the sum of surface water, wells and West Beach samples.]

Compound	Reporting level	Surface water (11)	Water-table wells (17)	West Beach (7)	Environmental samples (35)	El Estero WWTP influent (3)	Extract samples (3)	Maximum concentration	Source
Ethoxynonylphenol NPOE-1	2	6	0	0	6	1	0	17.6	Victoria drain
Ethoxyoctylphenol OPEO-1	1	2	0	0	2	1	0	3	El Estero WWTP
4-Nonylphenol	5	3	4	0	7	3	1	24.8	El Estero WWTP
	Flame retardants								
Tris-2-butoxyethylphosphate	0.5	5	3	3	11	2	0	6.38	El Estero WWTP
Tris-2-chloroethylphosphate	0.5	5	1	1	7	2	0	0.201	El Estero WWTP
Tris-dichloroisopropylphosphate	0.5	2	2	0	4	2	0	0.49	Victoria drain
	Asphalt derived compounds								
Methylnapthalene	0.5	2	1	0	3	1	0	0.186	4N/27W-21G4
2,6-Dimethylnaphthalene	0.5	0	1	0	1	0	0	0.115	4N/27W-21G4
2-Methylnaphthalene	0.5	3	1	0	4	1	0	0.31	4N/27W-21G4
Benzo(a)pyrene	0.5	1	1	1	3	2	0	0.17	Haley drain
Fluoranthene	0.5	9	1	2	12	2	0	0.9	Haley drain
Phenanthrene	0.5	6	1	0	7	2	0	0.31	El Estero WWTP
Pyren	0.5	9	1	2	12	1	0	0.5	El Estero WWTP
	Pesticides, insecticides, and herbicides								
Carbaryl	1	1	0	0	1	0	0	0.32	Victoria drain
d-Limonene	0.5	4	0	1	5	2	0	18	El Estero WWTP
	Industrial compounds								
Anthraquinone	0.5	3	0	0	3	0	0	0.37	MC at Gutierrez
Bisphenol-A	0.1	3	5	2	10	1	0	69.3	MC at mouth
Bis-2-ethylhexylphthalate	2	2	3	3	8	1	0	49.9	Victoria drain
Diethylphthalate	0.5	1	3	0	4	3	0	15	El Estero WWTP
Isophorone	0.5	1	1	0	2	0	0	0.14	Cabrillo drain inflow
Methyl salicylate	0.5	2	0	0	2	1	0	1.6	El Estero WWTP
Phenol	0.5	1	1	0	2	2	2	38	El Estero WWTP
Triphenyl phosphate	0.5	2	0	0	2	1	0	0.14	El Estero WWTP
5-Methyl-1H-benzotriazole	2	0	0	1	1	1	0	30	West Beach
Tetrachloroethene	0.5	3	1	2	6	2	0	0.48	MC at mouth
Tribromomethane	0.5	1	0	5	6	0	2	0.588	Kelp extract

Table 5 Summary of caffeine and fecal sterol data for surface water, wells, near-shore ocean water, El Estero wastewater treatment plant, and extracts from kelp and sand, Santa Barbara, Calif. August 2005 to April 2007. [All concentrations in micrograms per liter. Number is maximum concentration, number in parenthesis is number of detections. If constituent detected in all samples minumun and maximum values are given. --, not detected.]

	Number of samples	Caffeine	Cholesterol	3-beta-Coprostanol	beta-Sitosterol	beta-Stigmastanol
			Environmental samples			
Wells	17	0.93 (6)	1.6 (6)	0.95 (3)	0.82 (1)	--
Near-shore ocean water, West Beach	7	0.48 (4)	2.0 (5)	1.0 (1)	--	--
Surface water, includes stormflow and urban drains	11	8.0 (8)	4.3 (6)	4.1 (3)	2.9 (3)	1.2 (1)
			Other samples			
El Estero WWTP	3	18-84	43-244	20-309	2.9-43	1.2 (1)
Kelp extracts	2	67-68	3.6-7.2	--	1.8-2.0	0.86 (1)
Sand extracts	1	0.28	28	--	5.2	0.81
[a]Reporting limit	41	0.2	0.8	0.8	0.8	0.8
[a]Lowest detection	41	0.03	0.2	0.62	0.82	0.81

[a]Reporting limit is the lowest defensible, quantification of an analyte concentration. The value is usually set near the lowest calibration standard during method development for Environmental Laboratory Approval Program (ELAP) certification. The detection limit is the lowest reasonable estimate of the presence of an analyte. The detection limit is variable depending on instrument setting and sample matrix effects and is greater than 10 percent of the spiked concentration in a sample run. (California Department of Health Services, http://www.dhs.ca.gov/ps/ls/elap/pdf/MethodDetectionLimits.pdf, accessed December 4, 2007)

However, the results are consistent with FIB contributions from non-point sources indicated by changing FIB concentrations during successive stormflows (Figure 4).

The distribution of trace organic compounds was analyzed using PCA in the same manner as T-RFLP and PLFA. The first principal component explained 20 percent of the variability in the data, while the second principal component explained 14 percent. Unsurprisingly, influent to the El Estero WWTP had highly positive first principal component scores and large magnitude (positive and negative) second principal component scores (Figure 20). The range in second principal component scores suggests that concentrations of some trace organic compounds varied widely in influent to the WWTP. As a group, the personal health care products and industrial compounds (Table 4) had the largest magnitude second principal component eigenvectors, suggesting that their use and discharge to the sewers may be highly variable.

Examination of the distribution of the first and second PCA scores (Figure 20) shows that stormflow samples plot on a mixing line with water from the Haley Street drain just upstream from the Gutierrez Street collection site. In contrast, runoff along Cabrillo Street exerts a strong influence on the trace organic composition of water from shallow water-table wells along Cabrillo Street (22J1) in the beach where this water is discharged (22R2). With the exception of samples collected after the breach of Mission Creek, the trace organic compounds in shallow groundwater from well 22R3 were nearly indistinguishable from near-shore ocean water along West Beach.

4. DISCUSSION

This study addressed fecal contamination from a variety of different sources to urban streams and near-shore ocean water near Santa Barbara, California Streamflow measurements, water-level data, samples from wells, seepmeter and radon-22 measurements of groundwater discharge were effective at evaluating the

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movement of water and consequently important for determining the sources of fecal contamination. These data were supplemented with genetic (T-RFLP), molecular (PLFA), and chemical tracers (including caffeine, fecal sterols, and detergent metabolites) to indentify similarities and differences between samples collected from different sources during this study.

At the beginning of this study, leaking sewer lines and laterals connecting homes to sewer lines were believed to be an important source of FIB in much of the older residential area underlying the City of Santa Barbara.

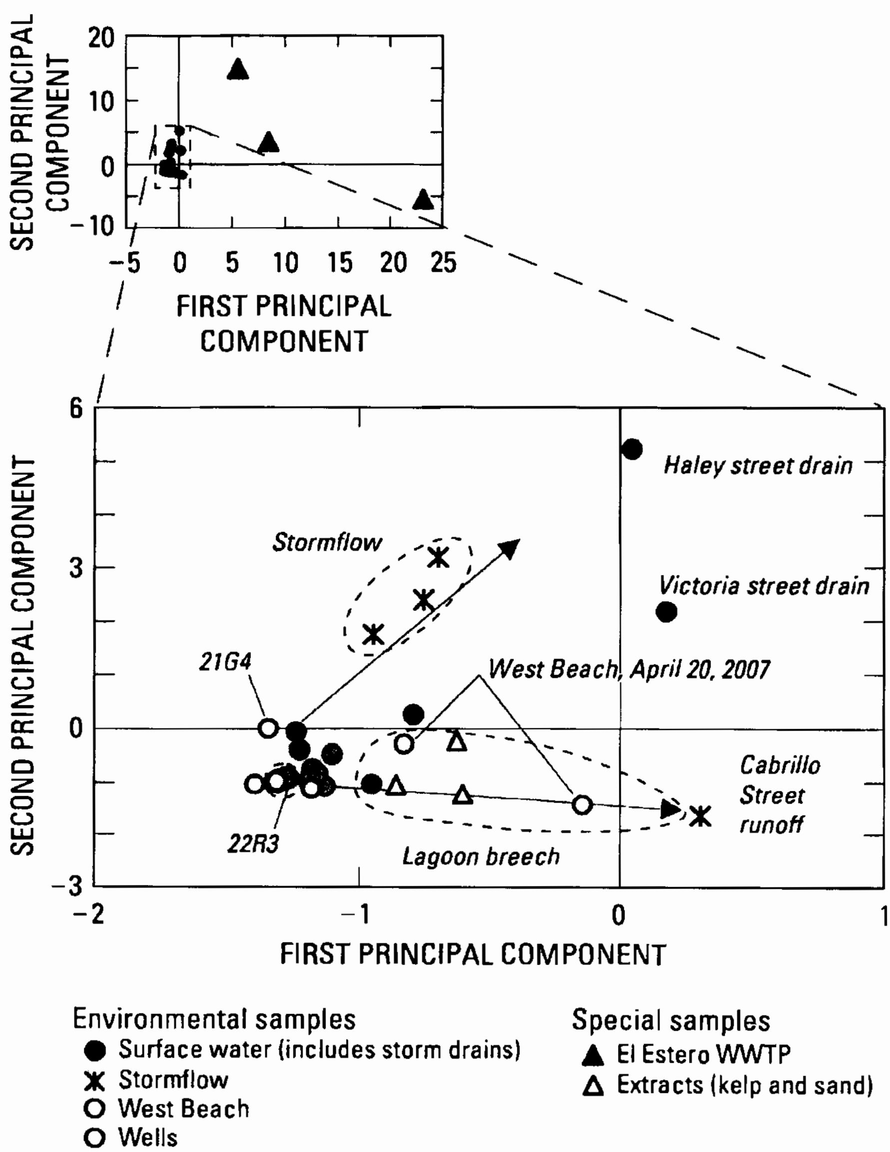

Figure 20 Results of Principal Component Analysis (PCA) for selected trace organic compounds in surface water (including urban stormdrains), water from wells, near-shore ocean water, influent to El Estero WWTP, and from selected sources, Santa Barbara, California, August 2005 to April 2007.

The absence of FIB in water-table wells installed in the urban area suggests that while leaking laterals may be locally important, they have not resulted in areally extensive FIB contamination of groundwater. Consistent with this result, synoptic measurements of streamflow and FIB concentrations along Mission Creek showed urban drains tributary to Mission Creek contributed more to the FIB concentrations than groundwater discharge during dry periods. The presence of human-specific *Bacteroides* in some urban drains, especially the Haley Street drain, is indicative of human fecal contamination. This is consistent with recent results showing dry weather flows can contribute fecal contamination in urban areas [92].

Comparison of FIB concentrations in streamflow over a diurnal cycle indicated that FIB concentrations varied in a manner consistent with runoff from lawn watering and other urban flows. The lack of correlation in streamflow and FIB concentrations with WWTP inflows suggests that direct leakage from sewer lines into the stream is not the source of FIB concentrations during baseflow. FIB concentrations collected during successive stormflows decreased with runoff, consistent with contributions from non-point sources within the urban watershed.

The highest FIB concentrations in near-shore ocean water at West Beach were associated with stormflow discharges from nearby Mission Creek. High FIB concentrations persisted in near-shore ocean water for several days after the stormflow discharges to the ocean. This is consistent with a wide range of studies that show stream discharges can contaminate near-shore ocean water for considerable distances from the discharge point [11, 18-22]. However, during dry periods FIB concentrations in near-shore ocean water increased consistently during the ebb of sampled spring and neap tides. Groundwater discharge measured by seepmeters and ^{222}Rn data was small [76] and because groundwater in wells on the beach did not contain high concentrations of FIB, discharging groundwater cannot explain near-shore ocean beach FIB concentrations. This is different from a number of recent studies that suggest groundwater is a possible source of fecal contamination to near-shore ocean water [23-25]. The timing of high FIB concentrations in the near-shore ocean water can be explained, in part, as drainage from kelp and guano-contaminated sand having high FIB concentrations at the high-tide line, consistent with work showing kelp and sand along protected beach areas may harbor FIB [14,48]. However, high FIB concentrations in kelp and sand cannot explain the consistent low-levels of human-specific *Bacteroides* detected in near-shore ocean water at West Beach and additional sources of FIB contamination also must be present. Human-specific *Bacteriodes* in near-shore ocean water at West Beach may be associated with discharges from urban streams [92].

Genetic, molecular, and chemical data provided additional information on the sources of FIB and support interpretations derived from traditional hydrologic data. Principal Component Analysis (PCA) was used to interpret these data and identify similarities and differences between samples from different sources. All three types of data showed a high degree of similarity between samples from Mission Creek and samples collected in near-shore ocean water at West Beach, and suggest a common a common source of FIB at West Beach when Mission Creek is discharging to the ocean. The most robust PCA results were from molecular (PLFA) data, which captured 97 percent of the total variance in the data set within the first and second principal components. In contrast, the PCA analysis for T-RLFP data explained only 32 percent of the total variance within the first and second principal components. Neither genetic, molecular, nor chemical tracers show a strong similarity between samples from influent to the El Estero WWTP and samples collected in near-shore ocean water along West Beach. This is consistent with water-level data and specific conductance data from wells along the beachfront that show that the predominant direction of groundwater movement in the beach sands is from the beach towards the sewer line and that sewage contaminated groundwater does not discharge at the beachfront.

PCA analysis of the three types of tracer data did not always produce the same interpretation of the FIB sources in the near-shore ocean water. For example, PCA analysis of genetic and chemical data showed a similarity between samples collected from near-shore ocean water and kelp and guano-contaminated sand. PCA analysis of PLFA data suggest only a similarity between near-shore ocean water and sand and that PLFA contributions from kelp were greatly different. These data suggest that guano-contaminated sand is a more important source of FIB to near shore ocean water than FIB in kelp - despite the very high FIB concentrations in kelp. Differing interpretations of FIB sources from tracer data illustrate the need to use multiple tracers in conjunction with hydrologic data collected at appropriate spatial and temporal scales to identify sources of FIB.

In addition to the results from PCA analysis, a wide range of other information can be extracted from the tracer data collected as part of this study. For example, although FIB were not present in water from wells, genetic and molecular data indicate a unexpectedly large diversity of organisms present at low concentrations in groundwater where surface runoff was discharged to beach sands. Chemical tracer data also are consistent with street runoff in water from some wells. Similarly, assemblages of waste water indicator compounds in stormflow, especially the presence of certain detergent metabolites and the absence of personal-health-care products (PHCP), flame retardants, and other compounds commonly present in waste water influent to the El Estero WWTP suggest that leakage of sewer lines is not an important source of FIB to Mission Creek during stormflow.

5. CONCLUSIONS

Point sources dominated FIB contamination to streams during baseflow and non-point sources dominated FIB contamination to stream during stormflow. In most areas FIB concentrations in shallow groundwater were low, suggesting that leakage from sewer lines and laterals connecting sewer lines to residences, although locally important, were not a regional source of FIB contamination. Groundwater flow at West Beach was toward a regional sewer line, which acted as a drain. Sewage from the sewer could not move toward the beachfront and groundwater discharge at the beach-front was small. The timing of FIB concentrations during the ebb of the spring and neap times is consistent with FIB from guano contaminated kelp and beach sand. Discharge from nearby streams also contributed FIB to West Beach, especially after stormflow. Results of this study show the combined use of FIB and multiple tracers of fecal contamination, constrained by an understanding of the movement of water, is a powerful approach for identifying FIB sources to streams and near-shore ocean water.

1. FIB concentrations in the environment are highly variable and range over three-fold in streams during baseflow, over three-orders of magnitude during stormflow, and over 2-orders of magnitude in near-shore ocean water over tidal cycles.
2. Increases in FIB concentrations in near-shore ocean water after stormflow were large and concentrations remained high for at least three days after the cessation of stormflow.
3. Traditional hydrologic data, collected at appropriate timescales, were the most valuable information for guiding interpretations on the sources of FIB to streams, shallow groundwater, and near-shore ocean-water.
4. Water-level, seepmeter and isotopic data captured the magnitude and direction of groundwater exchange with near-shore ocean water and were valuable in explaining FIB variations at the beachfront.
5. Tracer data captured aspects of FIB contamination sources that could not be obtained from hydrologic data alone.
6. The most robust PCA results were from PLFA data which explained 97 percent of the total variance within the first and second principal components. Smaller fractions of the total variance were explained by genetic (T-RFLP) and chemical data, with 32 and 34 percent of the total variance, respectively, explained in the first and second principal components.
7. Certain compounds used in this study as tracers of FIB sources, especially the fecal sterols, lent themselves to specific interpretations of the origins of FIB. The presence or absence of individual compounds were more easily interpreted than the presence of absence of amplicons and fatty acids also used as tracers.

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October 29, 2009

Mr. James Thorsen,
City Manager,
City of Malibu,
23815 Stuart Ranch Road,
Malibu, California 90265

Dear Mr. Thorsen;

This letter summarizes preliminary results of our cooperative water-resources study to identify the source of fecal indicator bacteria in the Malibu Lagoon and ocean beaches near Malibu, California. The study was cooperatively funded by the City of Malibu and the U.S. Geological Survey. The study was done under the direction of Dr. John Izbicki in our San Diego Projects Office.

Previous work has shown that fecal indicator bacteria (FIB), indicative of fecal contamination, are present in Malibu Lagoon and at ocean beaches near Malibu, California at concentrations that exceed recreational water-quality standards. The source, or combination of sources, of fecal material to the lagoon and near-shore ocean water is not precisely known but may include: (1) groundwater containing residential or commercial septage; (2) natural sources either directly deposited by birds and other wildlife, or indirectly mobilized as tides and waves wash beach sands and material accumulated at the high-tide line (rack line) along the beach; and/or (3) surface flow into the Malibu Lagoon. FIB present in the lagoon could be a source of contamination to the near-shore ocean by surface flow from the lagoon to the ocean or by groundwater flow from the lagoon through the berm separating the lagoon from the ocean. Data were collected during a falling monthly tidal cycle during the dry summer season from July 21-27, 2009 and reflect conditions present at that time.

The purpose of this letter is to provide a summary of preliminary results from the July 21-27, 2009 sample period. Data collected during the sampling period included: (1) groundwater-level data; (2) Radon-222 (^{222}Rn) data and direct-current (DC) resistivity data to estimate groundwater discharge to Malibu Lagoon and the near-shore ocean; (3) fecal indicator bacteria concentrations in groundwater, Malibu Lagoon, and near-shore ocean water; and (4) bacterial source tracking data (including genetic, molecular, and chemical data. Most data collected as part of the study are publically available in the U.S. Geological Survey's on-line data base NWIS-Web other data are on-file at the U.S.

Geological Survey office in San Diego and are publically available on request. The information presented in this letter is for internal planning and program development purposes. Interpretations presented in this letter have not been reviewed within the U.S. Geological Survey, and as such are preliminary and are not intended for public release.

Although results of this study are preliminary, and reflect the conditions during the sample period, FIB were present at only low concentrations, in 10 of 11 sampled water-table wells. In contrast, high concentrations of FIB were present in Malibu Lagoon. Given the general absence of FIB in groundwater, measured rates of groundwater discharge to the lagoon, and other hydrologic conditions at the time of sample collection groundwater discharge was not a likely source of FIB to the lagoon. Enterococcus concentrations in excess of the U.S. Environmental Protection Agency single sample standard for recreational water (104 MPN per 100 ml) in near-shore ocean water near the lagoon berm were related to movement of water through the berm at the mouth of the lagoon during low tide. FIB concentrations in near-shore ocean water at three sampled beaches were higher at high tide and are more consistent with FIB associated with wave run-up washing fecal material from beach sands and the rack line at high tide, than with discharge of groundwater contaminated with septic wastewater which would be expected to be greater at low tide. Enterococcus concentrations occasionally exceeded the U.S. Environmental Protection Agency single sample standard for recreational water at the three beaches during the sample period.

As stated previously, data collected as part of this study reflect conditions present during sample collection and may not reflect conditions at other times. The results of this initial study are preliminary and will be used to develop a more detailed proposal for future work to address these issues. If you have any questions concerning the study results, do not hesitate to contact me at (619) 225-6127 or Dr. John Izbicki at (619) 225-6131. The U.S. Geological Survey looks forward to working with the City of Malibu on future water-resource investigations.

Sincerely,

Peter Martin
Program Chief

Introduction

Previous work has shown that fecal indicator bacteria (FIB), indicative of fecal contamination, are present in Malibu Lagoon and at ocean beaches near Malibu, California at concentrations that exceed recreational water-quality standards (Ambrose and Orme, 2000; Stone Environmental, 2004). The source, or combination of sources, of fecal material to the lagoon and near-shore ocean water is not precisely known but may include: (1) groundwater containing residential or commercial septage; (2) natural sources either directly deposited by birds and other wildlife, or indirectly mobilized as tides and waves wash beach sands and material accumulated at the high-tide line (rack line) along the beach; and/or (3) surface flow into the Malibu Lagoon. In addition, FIB present in the lagoon could be a source of contamination to the near-shore ocean by surface flow from the lagoon to the ocean, or by groundwater flow from the lagoon through the berm separating the lagoon from the ocean.

Data were collected in the Malibu area during a falling monthly tidal cycle during the dry summer season from July 21-27, 2009. Previous investigations of microbial contamination at beaches near Santa Barbara, California showed that groundwater discharge to the near-shore ocean is greater during the low tides of the falling monthly tidal cycle (Swarzenski and Izbicki, 2009; Izbicki et al., 2009). Data collected during the sampling period included: (1) groundwater-level data; (2) Radon-222 (^{222}Rn) data and direct-current (DC) resistivity data to estimate groundwater discharge to Malibu Lagoon and the near-shore ocean; (3) fecal indicator bacteria concentrations in groundwater, Malibu Lagoon, and near-shore ocean water; and (4) bacterial source tracking data (including genetic, molecular, and chemical data. Sample site locations are shown on figures 1 and 2. Not all data collected during the study period were available for inclusion in this letter.

Groundwater levels

As part of this study, groundwater levels were continuously measured at four wells (SMBRP-12, SMBRP-13, C-1, and P-9) to help determine the interaction between groundwater and the near-shore ocean. Tide, ocean swell, and groundwater-level data are shown in (fig. 3).

Water-levels in wells SMBRP-13 and SMBRP-12 (fig. 3c) in Malibu Colony respond to tidal fluctuations in the ocean. The tidal efficiency (amplitude of tidally affected water levels in the well divided by the tidal amplitude in the ocean) of well SMBRP-13 on the east side of Malibu Colony was 0.13; whereas, the tidal efficiency of well SMBRP-12 near the center of Malibu Colony was about 0.005. Higher tidal efficiency indicates that tides have greater influence on water levels in affected wells. Malibu Colony is protected by a seawall consisting of wooden pilings driven into the sand to a depth of about 15 ft. (fig. 4). The pilings act as a barrier to the interaction between the ocean and groundwater inland of the seawall. Well SMBRP-13 is closer to the eastern edge of the seawall; therefore, the seawall has less effect on the water levels than in well SMBRP-12.

In addition to tidal effects, the water levels in wells SMBRP-12 and SMBRP-13 also were affected by a south swell during the measurement period. The swell produced wave heights of about 5.5 ft between July 25-26, 2009 (fig. 3b) at the Santa Monica Basin bouy (46025), about 20 miles offshore. Wave heights on the beach at Malibu were greater and were reported in excess of 12 feet during this period. Water levels in well SMBRP-13 increased during the swell and reached their peak during the swell (fig. 3c). The maximum water-level response in well SMBRP-12 (fig. 3c) occurred about 1 day after the peak swell intensity and the effect of the swell persisted longer than in well SMBRP-13.

Water levels in wells C-1 and P-9 respond to water-level fluctuations in Malibu Lagoon in addition to tidal fluctuations in the ocean (fig. 3d). The combination of tides and swells caused the ocean to overtop the berm separating the lagoon from the ocean between July 22-25. This allowed ocean water to enter the lagoon at high tide, increasing water levels in the lagoon and in wells C-1 and P-9 during the sample period (fig. 3d). The ocean did not overtop the berm after July 25 and water levels in the lagoon and wells C-1 and P-9 began to decline at that time (fig. 3d).

Groundwater discharge to Malibu Lagoon

^{222}Rn data were collected to estimate groundwater discharge to Malibu Lagoon. Radon is a noble gas, and consequently it is non-reactive and highly mobile in groundwater. ^{222}Rn is radioactive, produced by the decay of radium-226 as part of the uranium-238 decay series, and has a half-life of 3.8 days. ^{222}Rn is present at concentrations several orders of magnitude higher in groundwater than in surface water or ocean water (Swarzenski and Izbicki, 2009). If the average ^{222}Rn concentration in groundwater discharging to a surface water body is known, and the ^{222}Rn concentration of the surface water is known, then the groundwater discharge rate can be calculated. Calculations account for exchange with atmospheric ^{222}Rn and mixing with seawater having low ^{222}Rn concentrations.

^{222}Rn concentrations ranged from 650 to 1,370 dpm/L (disintegrations per minute per liter) in the eight wells sampled for this study (Table 1). In addition to groundwater samples, ^{222}Rn samples were collected continuously from two locations in the lagoon (ML-Upper and ML-Lower, fig. 2) by equilibrating water pumped from the lagoon with air in an enclosed chamber. The radioactive decay of ^{222}Rn in the chamber was measured and the water concentration was calculated according to Henry's law (Swarzenski and Izbicki, 2009). ^{222}Rn concentrations in lagoon water ranged from 8 to 62 dpm/L during the sample period (fig. 5c). ^{222}Rn concentrations in the lagoon were higher at the beginning of the sample period and decreased as seawater (having low ^{222}Rn concentrations) entered the lagoon during high tides.

Preliminary analysis of ^{222}Rn data show groundwater discharge to the upstream part of Malibu Lagoon averaged 2.8 cm/d between July 21-26. Groundwater discharge rates to the upper lagoon decreased during the sample period from about 15 cm/d (6-hour moving average) on July 21-22, to 2.3 cm/d (6-hour moving average) on July 24-25 (fig. 5d). Groundwater discharge rates to the lagoon increased after July 26 after seawater no longer overtopped the berm during high tide (fig. 5d). Groundwater discharge to the downstream part of the lagoon (ML-Lower) was less than discharge in the upstream part of the lagoon and averaged 0.8 cm/d on July 22-23 (not shown in figure 5).

Groundwater discharge to the near-shore ocean

The original study plan included collecting ^{222}Rn data with seepage meter data to measure groundwater discharge along the Malibu Colony beach. However, high surf conditions during the sample period prevented the collection of these data. It was possible to collect DC-resistivity data along the Malibu Colony beachfront near well SMBRP-12 (fig. 1) to determine the location of groundwater discharge to the ocean (fig. 6). The resistivity data shows a thin lens of resistive material, presumably sand containing fresh groundwater, at a depth of about 15 ft below land surface. As stated previously, the seawall pilings extend to a depth of about 15 ft below land surface. Therefore, groundwater must flow beneath these pilings to discharge to the ocean. The lens of resistive material is overlain and underlain by more conductive material, presumably sand containing saline groundwater. The shallower saline groundwater is probably ocean water emplaced in the sand at the base of the seawall during high tides and swells. The deeper saline groundwater probably results from the density contrast between seawater and fresh water, which creates a wedge of seawater extending beneath fresh groundwater within the alluvial deposits.

Occurrence of fecal indicator bacteria

Fecal indicator bacteria (FIB) measured as part of this study included *Escherichia coli* (*E. coli*) and enterococci. Although not necessarily fecal in origin, total coliform bacteria also were measured to assess microbial contamination of sampled water. Total coliform and *E. coli* were analyzed by Colilert and enterococci were analyzed using Enterolert (IDEXX, Westbrook MN). Samples were analyzed within 6 hours after collection in a temporary laboratory established in the study area. A range of dilutions were used to ensure proper quantification of samples in accordance with the manufacturers' specifications.

Fecal indicator bacteria in groundwater

FIB samples were collected from 11 shallow wells in the study area (fig.1 and Table 1). Total coliform, *E. coli*, and enterococcus bacteria were less than the detection limit or were present at low concentrations in water from 10 of the 11 wells sampled (Table 1). FIB were detected in water from well CCPE (Table 1), which is in a commercial area adjacent to Malibu Lagoon (fig, 1). The sample from the well was saline (specific conductance of 10,800 μS/cm), which is similar to water in the lagoon at the time of sample collection. FIB present in the lagoon during the sampling period could be the source of the FIB in well CCPE. However, FIB were not detected in well C-1, adjacent to Malibu Lagoon, which also has saline water that may have originated from the lagoon. FIB also were not detected in well P-9, adjacent to the lagoon. Water from well P-9 is fresh (specific conductance of 2,000 µS/cm) and more similar to groundwater than to water from Malibu Lagoon. FIB also were not detected in water from wells SMBRP-12 and SMBRP-13 in Malibu Colony near the ocean.

Fecal indicator bacteria in Malibu Creek

Malibu Creek was not flowing and as a consequence was not an important source of FIB to the lagoon during the sample period. However, pools of water were present in the stream channel upstream from the lagoon (fig. 2). Total coliform, *E. coli*, and enterococcus concentrations in a sample collected on July 24 from one of these pools were 14,100, 10, and 280 MPN per 100 ml, respectively.

Fecal indicator bacterial in Malibu Lagoon and the adjacent near-shore ocean

Samples from the Malibu Lagoon were analyzed for FIB during the high and low tide at the downstream site near the berm of the lagoon (ML-Berm). FIB concentrations in the lagoon at that site were higher than concentrations in samples from wells or surface water collected during the study period. Total coliform concentrations in Malibu Lagoon ranged from <1,000 to 650,000 MPN per 100 ml (Most Probable Number per 100 milliliters) (fig. 7). *E. coli* concentrations ranged from <10 to 130,000 MPN per 100 ml (fig. 7d). Total coliform and *E. coli* concentrations generally decreased during the sample period as a result of dilution as ocean water overtopped the berm and entered the lagoon during high tide (fig. 7d). The decrease in total coliform and *E. coli* concentrations was accompanied by an increase in water level and specific conductance of water in the lagoon (figs. 7b and 7c). Total coliform and *E. coli* concentrations increased during the later part of the sample period when ocean water was no longer entering the lagoon during high tide. Enterococcus concentrations ranged from <10 to 3,400 MPN per 100 ml (fig. 7d). Enterococcus concentrations in Malibu Lagoon commonly exceeded the U.S. Environmental Protection Agency single sample standard for (marine) recreational water of 104 MPN per 100 ml (U.S. Environmental Protection Agency, 2003). Unlike total coliform and *E. coli* concentrations, enterococcus concentrations did not consistently decrease during the sample period. Instead, enterococcus concentrations show a diurnal pattern with the lowest concentrations in samples collected later in the day (fig.7d), possibly as a result of inactivation of bacteria by UltraViolet (UV) radiation in sunlight.

Ocean water entering Malibu Lagoon during high tide has a higher salinity than lagoon water. As a consequence, ocean water is denser and will tend to sink to the bottom of the lagoon stratifying water in the lagoon by density (fig. 8). Initially it was expected that saline water at the bottom of the lagoon, which originated from the ocean, would have low bacteria concentrations. However, data collected from this study indicate that the deeper saline water had higher bacteria concentrations than near surface water (fig. 8). A possible explanation is that ocean water enters the lagoon during high tide and the denser ocean water sinks to the bottom of the lagoon. As the dense ocean water moves to the lagoon bottom sediment and associated bacteria are resuspended into the water column.

Surface discharge from Malibu Lagoon to the ocean did not occur during the sample period. To determine if water and associated FIB from the lagoon can flow through the sand berm to the near-shore ocean at low tide, data were collected during a 24-hour tidal cycle on July 23-24 from the lagoon, the sand berm separating the lagoon from the ocean, and in the near-shore ocean (fig. 9). The specific conductances of (1) near-shore ocean water adjacent to the berm and at several nearby beaches, (2) Malibu Lagoon, and (3) water from pieziometers and seepage samplers in the berm are shown in figure 9b. The enterococcus concentrations of near-shore ocean water and water from Malibu Lagoon are shown in figure 9c. The enterococcus concentrations of water from pieziometers and seepage samplers in the berm are shown in figure 9d.

During the falling tidal cycle specific conductance of near-shore ocean water adjacent to the berm (ML-Berm-OF, fig. 9b) decreased and reached a minimum about one hour after low tide. This decrease is the result of water from the lagoon discharging through the berm. As a consequence of this discharge, the specific conductance of near-shore ocean water adjacent to the berm (ML-Berm-OF, fig. 9b) was lower than near-shore ocean water at nearby beaches sampled as part of this study (OF-A, OF-B, and OF-C, fig. 9b). As water from the lagoon discharged to the ocean, enterococcus concentrations increased in near-shore ocean water adjacent to the berm (ML-Berm-OF, fig 9c). Enterococcus concentrations were highest about 1 hour after low tide when the specific conductance of near-shore ocean water was lowest. Enterococcus concentrations exceeded the U.S. Environmental Protection Agency (2003) single sample standard for recreational water at that time. A similar pattern was observed in total coliform and E. coli concentrations (not shown on fig. 9).

Increases in enterococcus concentration also were observed during the falling tide in the pieziometer driven into the berm adjacent to Malibu Lagoon at a depth of 5 ft below land surface (Pz 5ft, fig. 9d). However, enterococcus concentrations were low in water from samplers emplaced in the seepage face along the berm near the secondary high-tide line (Seepage-Shallow, fig. 9d) and the secondary low-tide line (Seepage-Deep, fig. 9d). The specific conductance of water from the sampler near the secondary high-tide line (Seepage-Shallow, fig. 9b) was consistent with ocean water emplaced in the berm during the previous high tide. The specific conductance of water from the sampler near the secondary low-tide line was consistent with water from Malibu lagoon (Seepage-Shallow, fig. 9b).

DC-resistivity sections were collected across the berm, perpendicular to the ocean, on July 24 at low tide and at the secondary high tide (fig. 10a and 10b). The DC-resistivity data show water from the lagoon (delineated as less saline on fig. 10) in a thin layer within the sand berm discharging to the ocean near the low tide line (fig. 10). This layer is overlain by more saline water emplaced in the berm during high tide when ocean water flowed over the top of the berm into the lagoon. The less saline water is underlain by water from deeper parts of the lagoon containing moderately saline water originating from the ocean during previous high tides. The DC-resistivity data suggest that most of the water from the lagoon is moving through the berm slightly below the deepest sampler on the seepage face (Seepage-Deep, fig. 10). This result suggests that the enterococcus bacteria present in the near-shore ocean probably moved through the berm with the lagoon water near the altitude of the low tide line, at a depth below the deepest seepage sampler.

Fecal indicator bacteria in the near-shore ocean

FIB concentrations were measured in near-shore ocean water at the Malibu Colony beach (OF-B), a beach about 3 miles to the west Malibu Colony (OF-A), and a beach about 0.25 miles east of the Malibu Lagoon (OF-C) between July 12-26, 2009 (fig. 11). Samples were collected at the high, secondary-high, low, and secondary-low tidal stands. Figure 11 shows the tidal range (11a), ocean swell height (11b), specific conductance of near-shore ocean water (11c), and total coliform, E. coli, and enterococcus concentrations (11d, 11e, and 11f, respectively) at the sampled beaches.

Total coliform and *E. coli* concentrations were generally lower at all tidal stands at the Malibu Colony beach (OF-B) than at the other sampled beaches (fig. 11d, and 11e). Enterococcus concentrations exceeded the U.S. Environmental Protection Agency (2003) single sample standard for recreational water at all three sampled beaches during the sample period, with the most exceedances at the OF-A site to the west of the Malibu Colony beach (fig. 11f). A health advisory, associated high FIB concentrations, was posted for the beach east of OF-C near the beginning of the sample period.

Prior to the high surf associated with the south swell that occurred from July 24-26, total coliform and *E. coli* concentrations were higher during high tide and lower during low tide (fig. 11d and 11e). This pattern is consistent with bacterial contributions from wave run-up on the beach during high tide. The pattern is not consistent with bacteria from groundwater discharge containing septage because groundwater discharge to the near-shore ocean is greatest at low tide. Tidally associated changes in bacteria concentrations also were present for enterococcus but were less pronounced (fig. 11f).

The specific conductance of near-shore ocean water was the lowest at the onset of high surf associated with the south swell beginning July 24 (fig. 11c). Presumably the high surf disturbed the discharge of groundwater to the ocean along the beachfront, although the high surf did not affect tidally associated FIB concentrations in near-shore ocean water until after the swell subsided. After the swell subsided, total coliform, *E. coli*, and enterococcus concentrations were higher during low tide than at high tide (fig. 11d, 11e, and 11f). This may represent drainage of ocean water emplaced in the beach sand during the swell rather than discharge of groundwater from onshore alluvial deposits.

Fecal indicator bacteria in septage water and other sources

FIB concentrations were sampled in the discharge from a traditional septic system (MC-OLD-Septic, fig. 2) and an advanced septic system (MC-ADV-Septic, fig. 2) containing (1) biological treatment media, (2) an aeration tank, and (3) UV disinfection.

Samples were collected October 1, 2009 and bacteria were analyzed within 24 hours of collection at the U.S. Geological Survey office in San Diego. Advanced septic systems in the Malibu area differ in their construction and consequently the quality of water discharged from these systems also may differ. The data show a 2-log-order reduction in FIB concentrations in water discharged from advanced systems compared to more traditional systems (Table 2). FIB concentrations in the discharge from the advanced septic system were generally lower than FIB concentrations in Malibu Lagoon during the July sample period.

FIB were extracted from about 0.5 kg of sand collected on the berm at Malibu Lagoon on October 1, 2009 using about 4 L of water adjusted to seawater salinity. The samples were collected from recently wetted beach sand along the rack line about 1 hour after high tide. Although birds were actively feeding in the area, the sample was not obviously contaminated by guano. Total coliform and *E. coli* concentrations in the extract were low, 10 MPN per 100 ml, while enterococcus concentrations were high, 230 MPN per 100 ml.

Bacterial Source-Tracking

Genetic, molecular, and chemical data were collected to determine the source of FIB to groundwater, Malibu Lagoon, and near-shore ocean water. Genetic material from bacterial cells were analyzed by Terminal-Restriction Fragment Length Polymorphism (T-RFLP) at University of California Santa Barbara (UCSB). Human-specific Bacteroides also were analyzed by UCSB. Molecular data consisted of phospholipid fatty acids (PLFA) from bacterial cells. PLFA are associated with specific metabolic activities by a range of organisms rather than specific organisms. PLFA data were analyzed by a contract laboratory (Microbial Insights, Rockford, Tenn.). Chemical data included a suite of 69 organic compounds including caffeine, fecal sterols, detergent metabolites and other compounds collectively known as wastewater indicators. Chemical data were analyzed by the U.S. Geological Survey National Water Quality Laboratory (NWQL) in Denver. Colo. Samples were delivered to the UCSB laboratory by currier on the day of collection. Samples were shipped on the day of collection to the contract laboratory and the NWQL by overnight delivery. Only PLFA results were available at the time this letter was prepared.

The distribution of PLFA structural groups was analyzed using principal component analysis (PCA). PCA is a multivariate statistical technique that transforms a set of intercorrelated variables into a set of uncorrelated variables having a mean of zero and the same variance as the original data set. The new uncorrelated variables are known as principal components and the value of the principal component are known as scores. Analysis of the transformed principal component scores, rather than the original data, allows for statistically unbiased comparison and contrast of samples from different sources.

The first three principal components explain 91 percent of the total variability in the PLFA data. PCA results show differences in the PLFA composition of microbial communities in samples from water-table wells and from near-shore ocean water (fig. 11). Samples from piezometers and seepage samplers in beach sands are intermediate in composition, and samples from Malibu Lagoon are similar to samples from the near-shore ocean. The first and second principle components for sample collected from near-shore ocean water near Malibu Lagoon at low tide (ML-Berm-OF) are almost identical in PLFA composition to water from the lagoon (ML_Berm), consistent with seepage from the lagoon as a likely source of the enterococcus bacteria in the near-shore ocean water near the lagoon at low tide.

Additional interpretation of PLFA data, with genetic (T-RFLP) and wastewater indicator data is warranted before final conclusions can be drawn.

Summary

Groundwater level, radon-222, direct current resistivity, FIB, and bacterial-source tracking data were collected during a falling monthly tidal cycle during the dry summer season from July 21-27, 2009 near Malibu, California. These data reflect conditions present during the study period and may not reflect conditions at other times. Preliminary results of the study are:.

1. FIB concentrations were less than the detection limit or were present at low concentrations in samples from 10 of the 11 water-table wells sampled. FIB from septic-tank discharge was not a major source of FIB contamination to groundwater sampled by the wells during the study period.

2. Shallow groundwater was discharging to Malibu Lagoon during high tidal stands at an average rate of 2.8 cm/d during the sample period. Discharge rates as high as 15 cm/d (6 hour average) were measured during high tidal stands at the beginning of the sample period. Discharge to the lagoon declined during the sample period as a result of increased water levels in the lagoon resulting from ocean water overtopping the berm of the lagoon during high tide.

3. High concentrations of fecal indicator bacteria were present in Malibu Lagoon during the sample period. Total coliform and *E. coli* concentrations decreased during the sample period as a result of dilution by ocean water entering the lagoon at high tide. Enterococcus concentrations showed a daily variation consistent with inactivation by UV radiation during the day. Enterococcus concentrations rebounded to high concentrations during the night.

4. Water movement through the berm of Mailbu Lagoon was a source FIB, especially enterococcus, to the near-shore ocean at the mouth of the lagoon during low tide. Enterococcus concentrations exceeded the U.S. Environmental Protection Agency single sample standard for recreational water (104 MPN per 100 ml) in near-shore ocean water near the lagoon berm during low tide.

5. FIB concentrations increased during high tide at three sampled beaches. These increases were consistent with wave run-up on the beach washing FIB from the rack line and beach sands. FIB concentrations did not increase in near-shore ocean water during low tide when groundwater discharge to the ocean would be the greatest. As a result, groundwater discharge did not appear to be a source of FIB concentrations to the near-shore ocean at three sampled beaches. Enterococcus concentrations occasionally exceeded the U.S. Environmental Protection Agency single sample standard for recreational water at the three beaches during the sample period.

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List of Figures

Figure 1.—Location of sampled wells and direct-current (DC) resistivity lines, Malibu, California, July 21-27, 2009

Figure 2.—Location of surface water sample sites, hand-driven pieziometers, seepage samplers, and other samples, Malibu, California, July 21-27, 2009

Figure 3.—Predicted tides, surface swell, and water-level data for selected wells, Malibu Calif., July 6 to August 5, 2009

Figure 4.—Photograph showing seawall at Malibu Colony, Malibu, California.

Figure 5.—Radon-222 (^{222}Rn) concentrations and calculated groundwater discharge to Malibu Lagoon (ML-Upper), Malibu, California, July 21-27, 2009.

Figure 6.—Direct current (DC) resistivity section along Malibu Colony beachfront, Malibu California, July 26, 2009. (Location of section shown on figure 1)

Figure 7.—Water level, specific conductance, and fecal indicator bacteria of water in Malibu Lagoon (ML-Berm), Malibu, California, July 21-26, 2009

Figure 8.—Specific conductance and fecal indicator bacteria concentrations with depth in Malibu Lagoon, July 23, 2009

Figure 9.—Specific conductance and fecal indicator bacteria concentrations in water from Malibu Lagoon, piezometers and seepage samplers in the berm separating Malibu Lagoon from the ocean, and in adjacent near-shore ocean water, Malibu, California, July 23-24, 2009.

Figure 10.—Direct current (DC) resistivity section through the berm separating Malibu Lagoon from the ocean, July 24, 2009. (Location of section shown on figure 1)

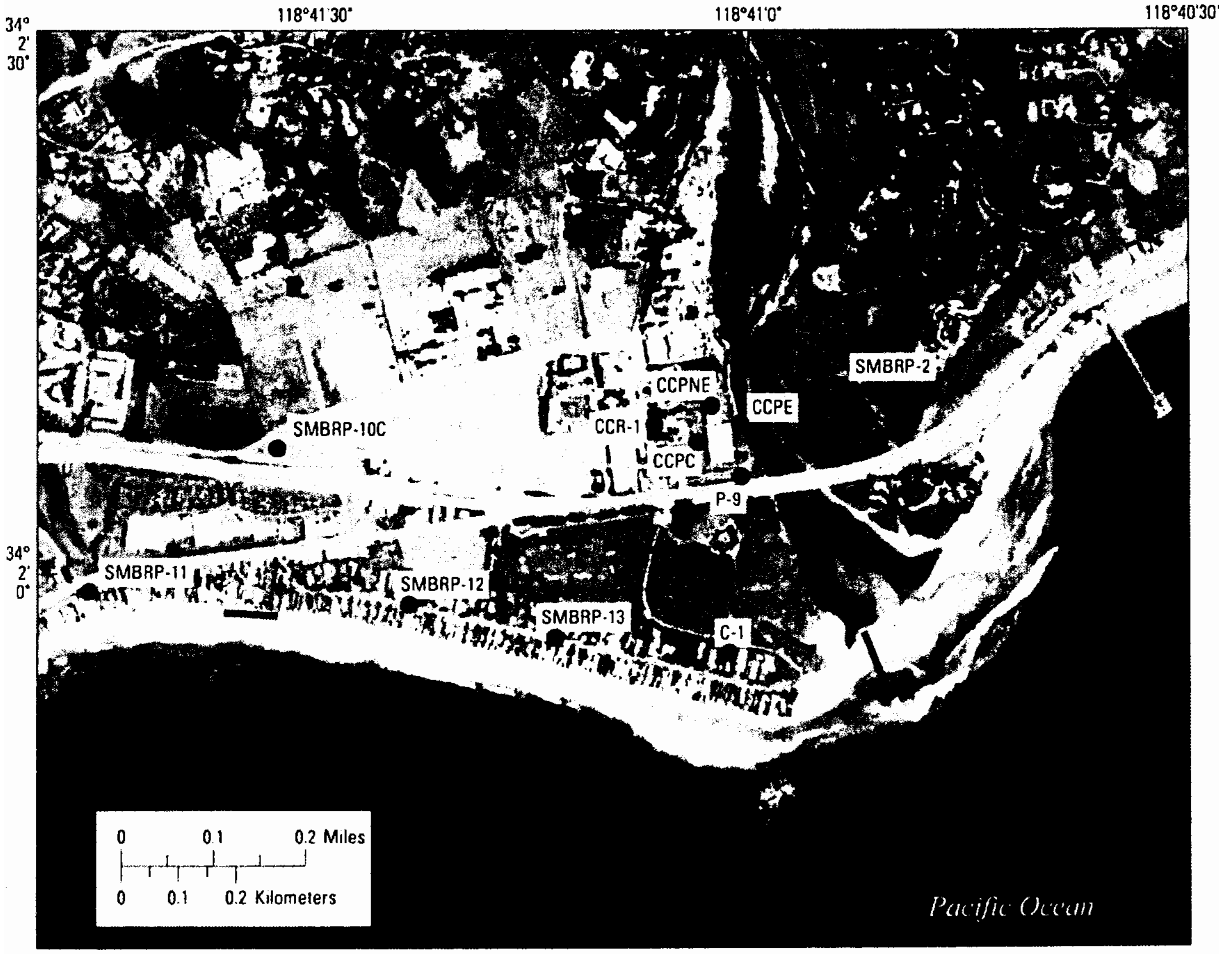
Figure 11.—Specific conductance and fecal indicator bacteria concentrations in near-shore ocean water at selected beaches near Malibu, California, July 21-26, 2009

Figure 12.—Results of Principal Component Analysis (PCA) for phospholipid fatty acid (PLFA) structural groups in water from wells, Malibu Lagoon, and near-shore ocean water, Malibu, California, July 21-26, 2009

List of Tables

Table 1.—Fecal indicator bacteria (FIB) concentrations in water from selected water-table wells, Malibu, California, July 21-26, 2009

Table 2.—Fecal indicator bacteria (FIB) concentration in discharge water from a traditional septic system and from an advanced septic system, Malibu, California, October 1, 2009.



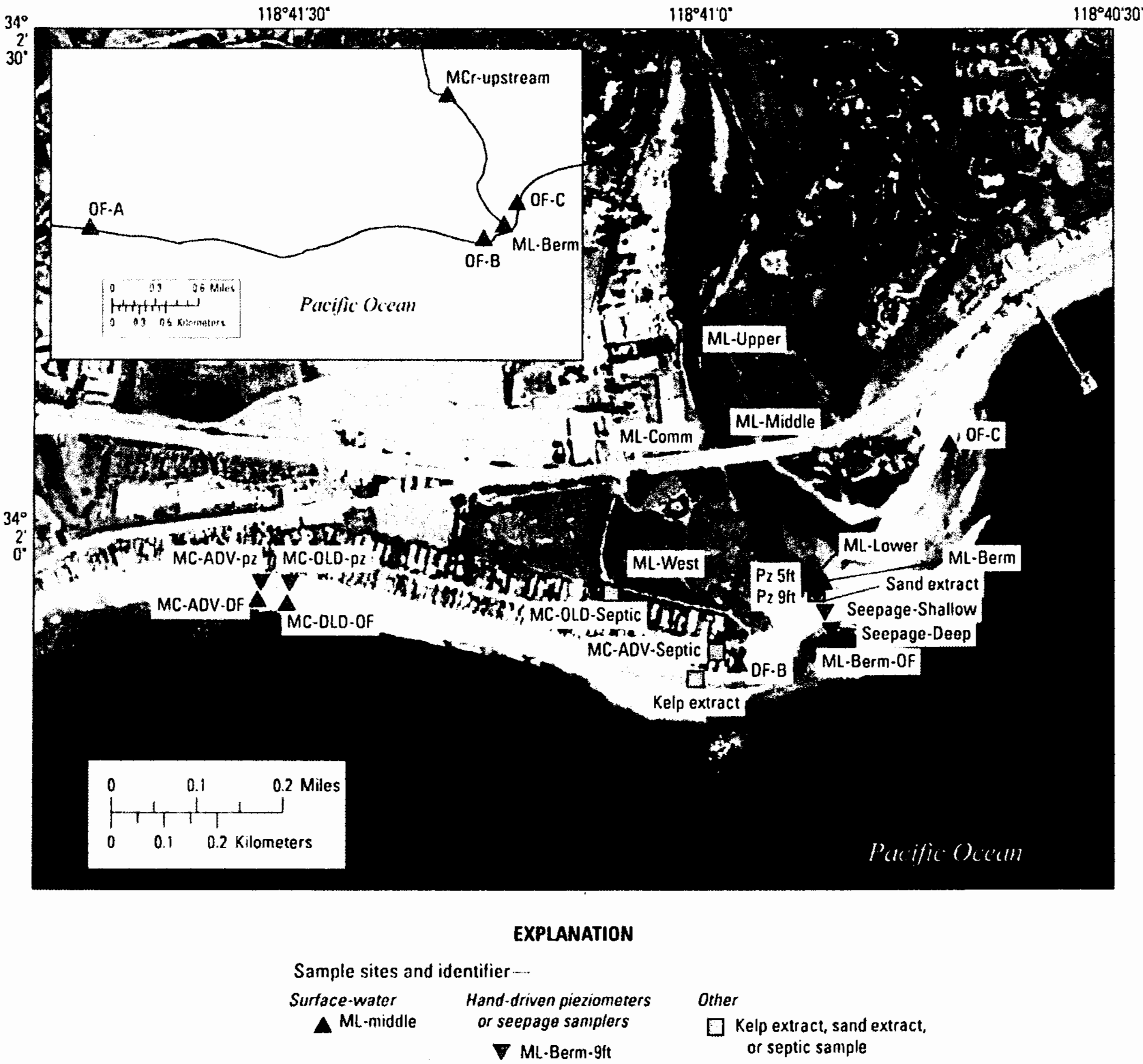
EXPLANATION

Resistivity line

Sampled wells and identifier—

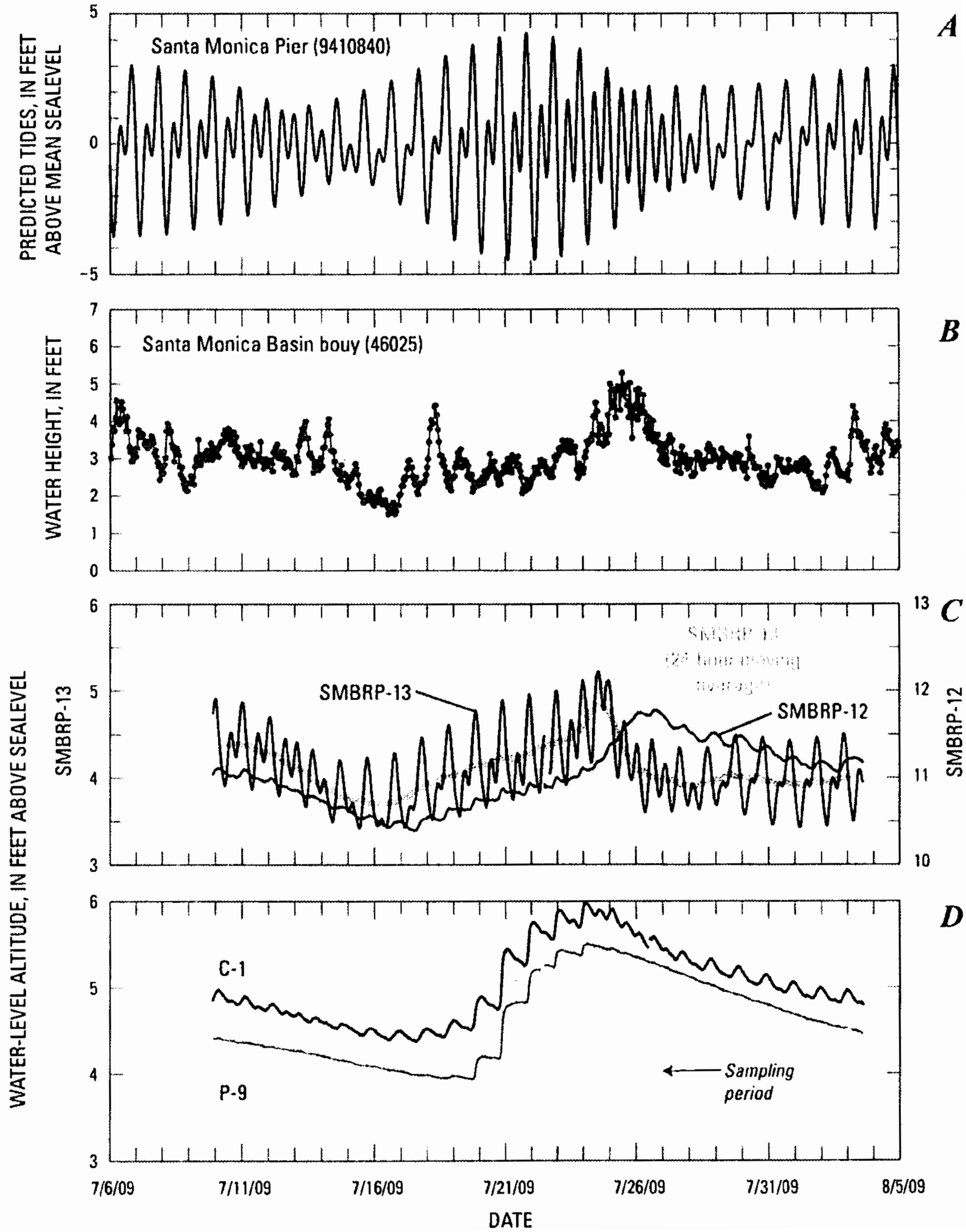
C-1

Figure 01



34° 2' 30"
118°41'30"
118°41'0"
118°40'30"
34° 2' 0"
MCr-upstream
OF-A
OF-C
ML-Berm
OF-B
Pacific Ocean
ML-Upper
ML-Middle
ML-Comm
OF-C
ML-Lower
ML-Berm
ML-West
Pz 5ft
Pz 9ft
Sand extract
Seepage-Shallow
Seepage-Deep
MC-ADV-pz
MC-OLD-pz
MC-ADV-OF
MC-OLD-OF
MC-OLD-Septic
MC-ADV-Septic
OF-B
ML-Berm-OF
Kelp extract
0 0.1 0.2 Miles
0 0.1 0.2 Kilometers
Pacific Ocean
EXPLANATION
Sample sites and identifier—
Surface-water
ML-middle
Hand-driven piezometers or seepage samplers
ML-Berm-9ft
Other
Kelp extract, sand extract, or septic sample

Figure 02



A
Santa Monica Pier (9410840)
PREDICTED TIDES, IN FEET ABOVE MEAN SEALEVEL
5
0
−5
B
Santa Monica Basin bouy (46025)
WATER HEIGHT, IN FEET
7
6
5
4
3
2
1
0
C
SMBRP-13
SMBRP-12
6
5
4
3
13
12
11
10
D
C-1
P-9
Sampling period
6
5
4
3
WATER-LEVEL ALTITUDE, IN FEET ABOVE SEALEVEL
7/6/09
7/11/09
7/16/09
7/21/09
7/26/09
7/31/09
8/5/09
DATE

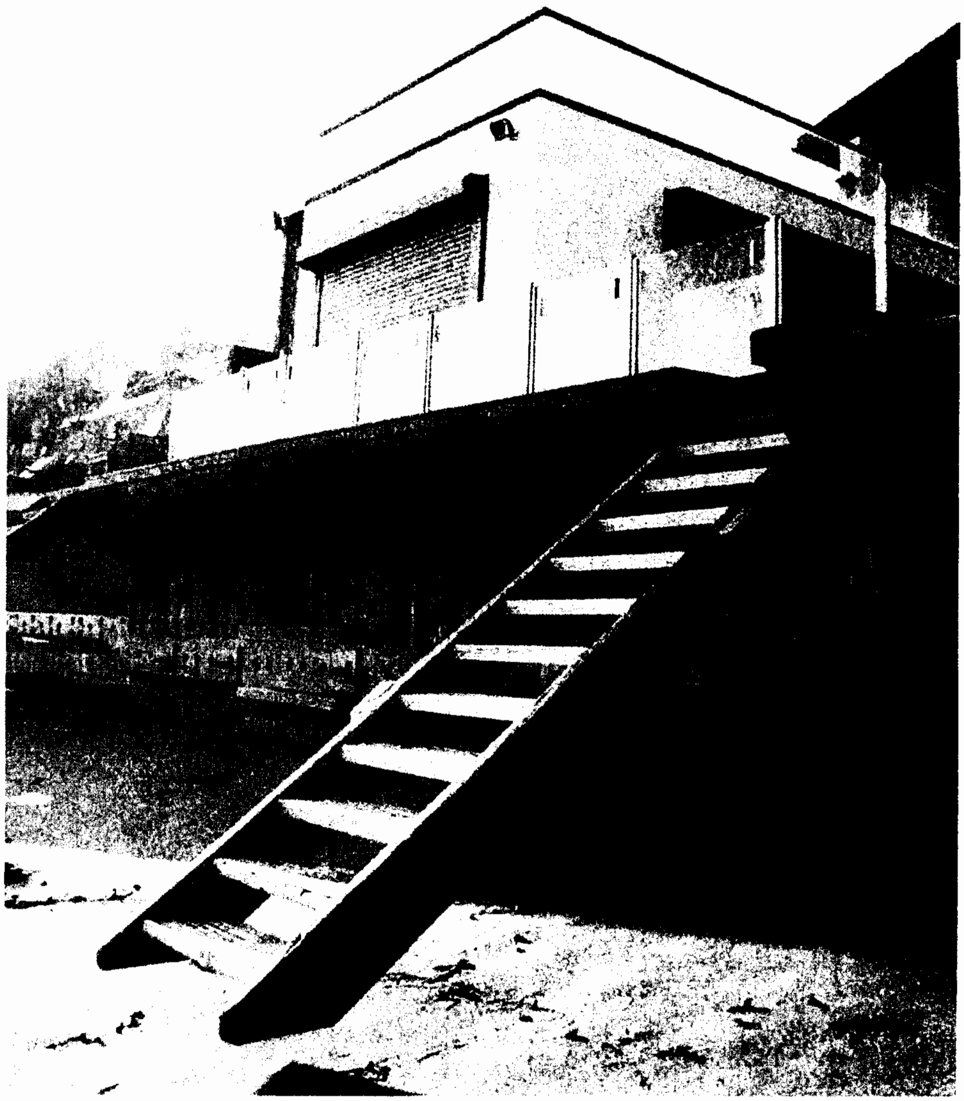


Figure 04

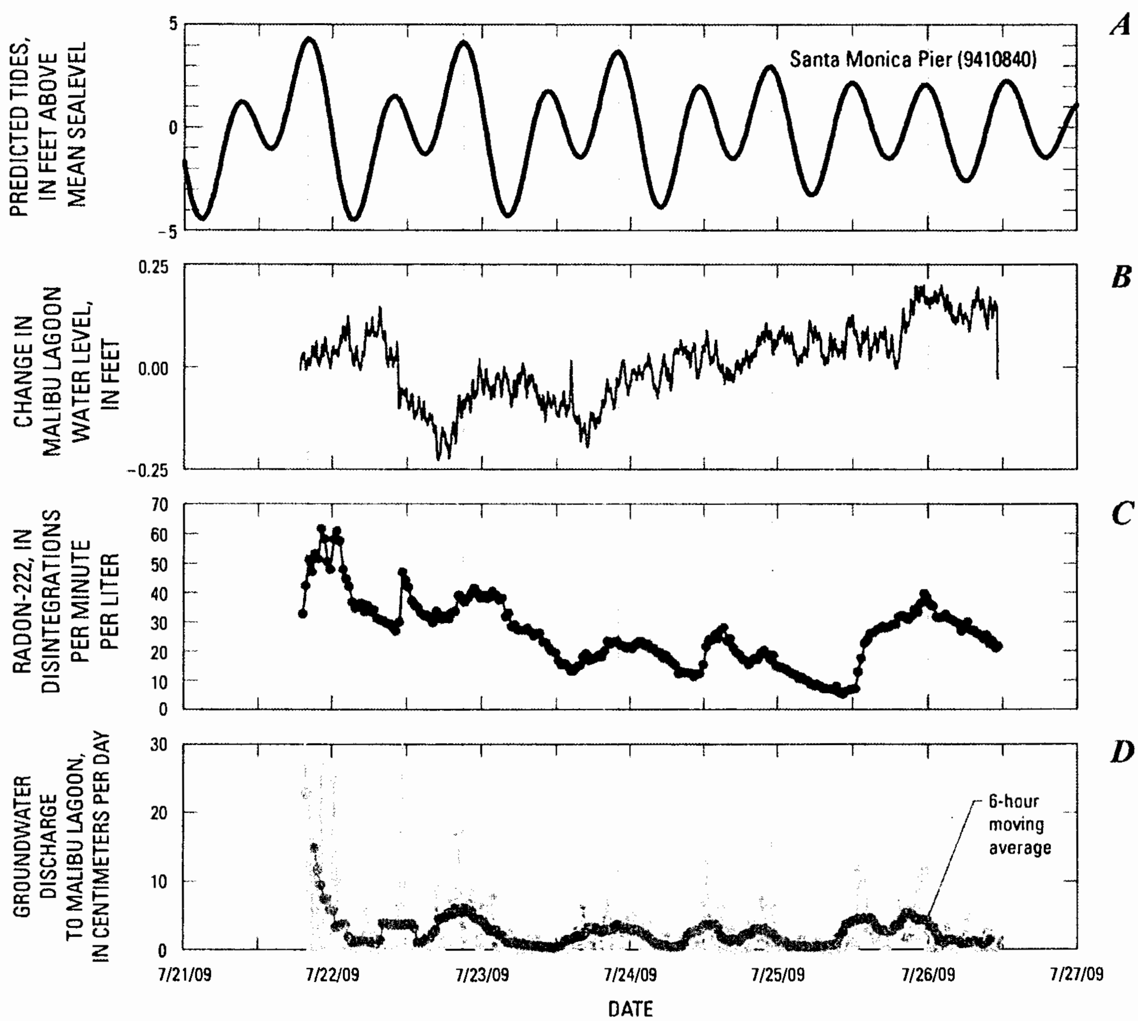
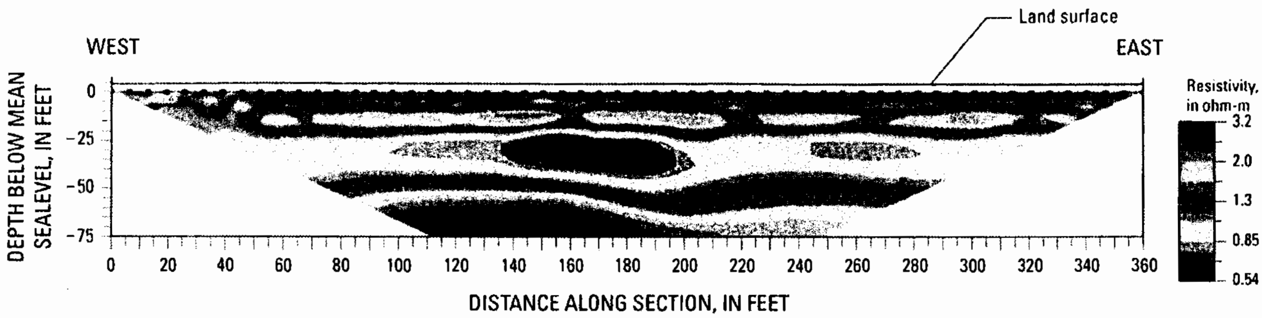

A
B
C
D
PREDICTED TIDES, IN FEET ABOVE MEAN SEALEVEL
Santa Monica Pier (9410840)
5
0
-5
CHANGE IN MALIBU LAGOON WATER LEVEL, IN FEET
0.25
0.00
-0.25
RADON-222, IN DISINTEGRATIONS PER MINUTE PER LITER
70
60
50
40
30
20
10
0
GROUNDWATER DISCHARGE TO MALIBU LAGOON, IN CENTIMETERS PER DAY
30
20
10
0
6-hour moving average
7/21/09
7/22/09
7/23/09
7/24/09
7/25/09
7/26/09
7/27/09
DATE

Figure 05


Land surface
WEST
EAST
DEPTH BELOW MEAN SEALEVEL, IN FEET
0
-25
-50
-75
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
DISTANCE ALONG SECTION, IN FEET
Resistivity, in ohm-m
3.2
2.0
1.3
0.85
0.54

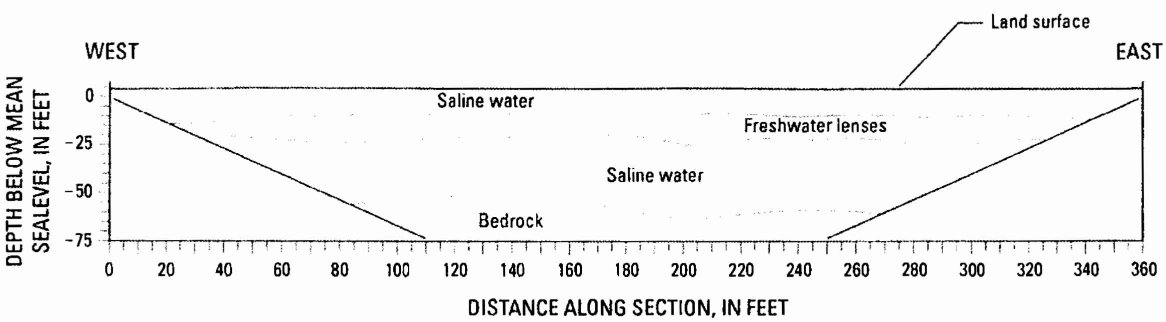

Land surface
WEST
EAST
DEPTH BELOW MEAN SEALEVEL, IN FEET
0
-25
-50
-75
Saline water
Freshwater lenses
Saline water
Bedrock
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
DISTANCE ALONG SECTION, IN FEET

Figure 06

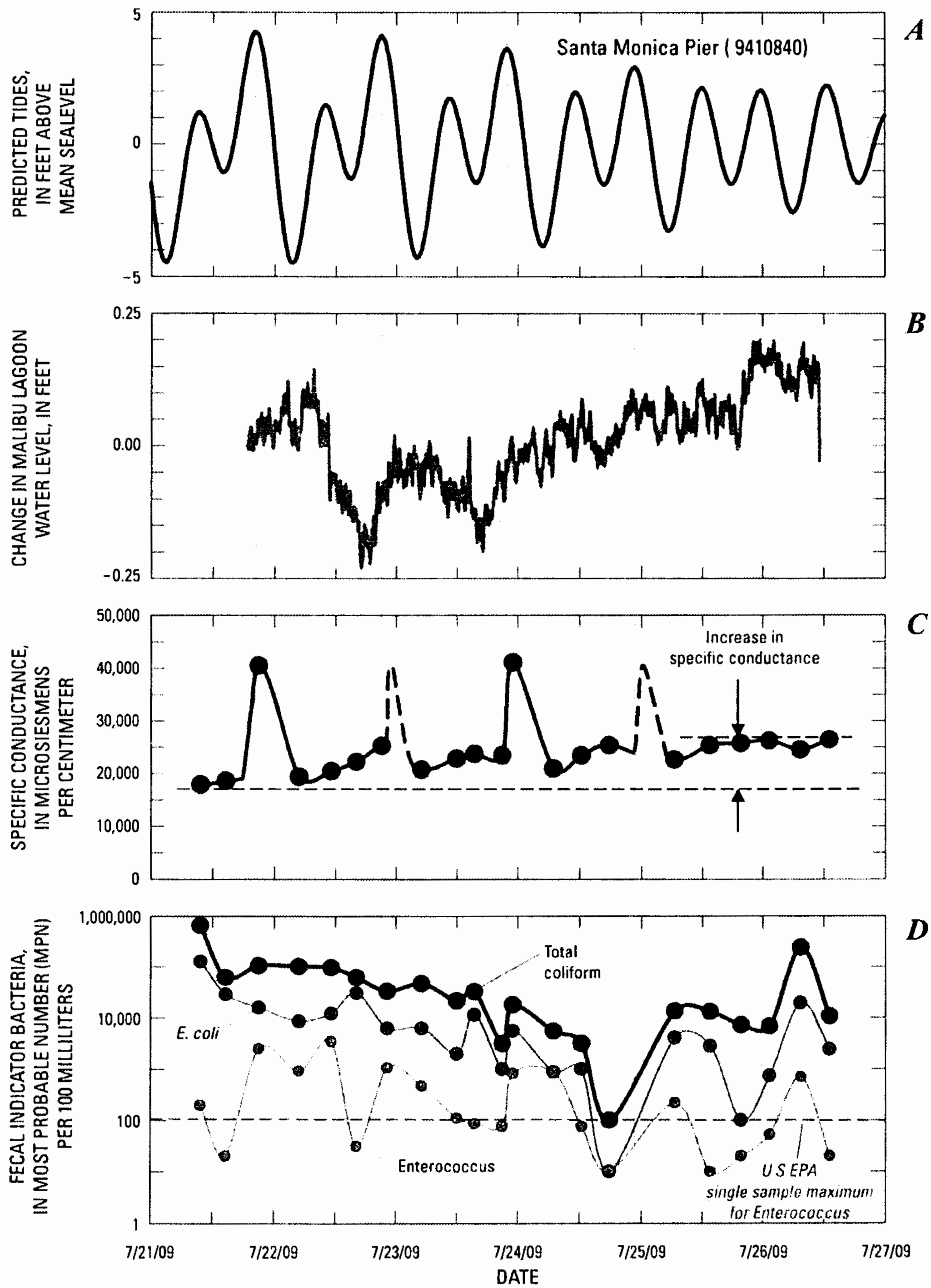

A
Santa Monica Pier (9410840)
PREDICTED TIDES, IN FEET ABOVE MEAN SEALEVEL
5
0
-5
B
CHANGE IN MALIBU LAGOON WATER LEVEL, IN FEET
0.25
0.00
-0.25
C
SPECIFIC CONDUCTANCE, IN MICROSIESMENS PER CENTIMETER
50,000
40,000
30,000
20,000
10,000
0
Increase in specific conductance
D
FECAL INDICATOR BACTERIA, IN MOST PROBABLE NUMBER (MPN) PER 100 MILLILITERS
1,000,000
10,000
100
1
Total coliform
E. coli
Enterococcus
U S EPA single sample maximum for Enterococcus
7/21/09
7/22/09
7/23/09
7/24/09
7/25/09
7/26/09
7/27/09
DATE

Figure 07

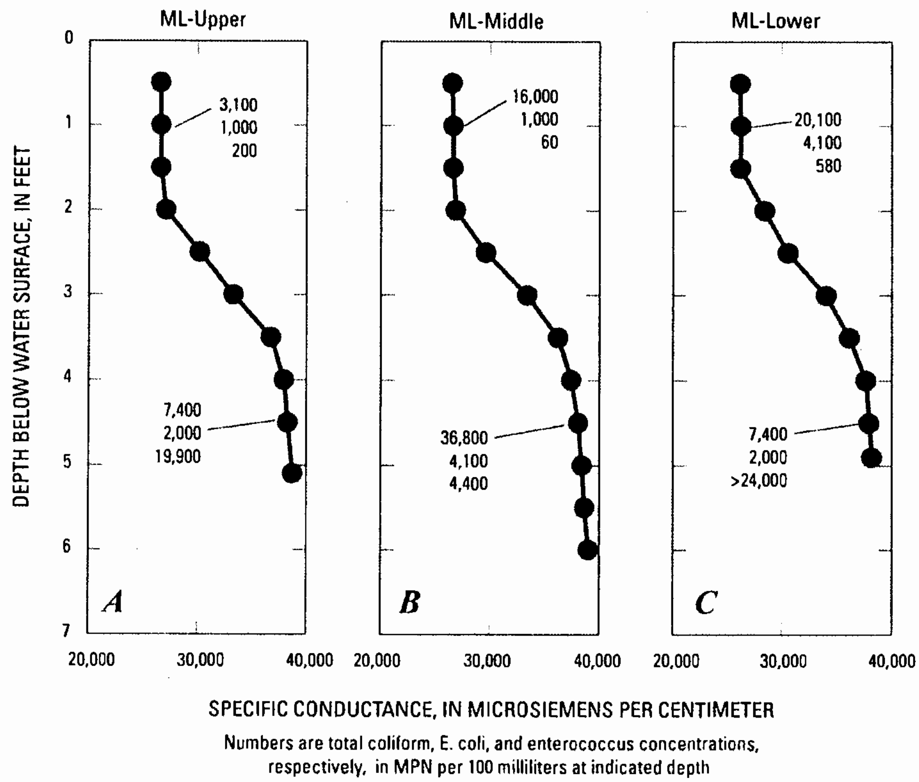
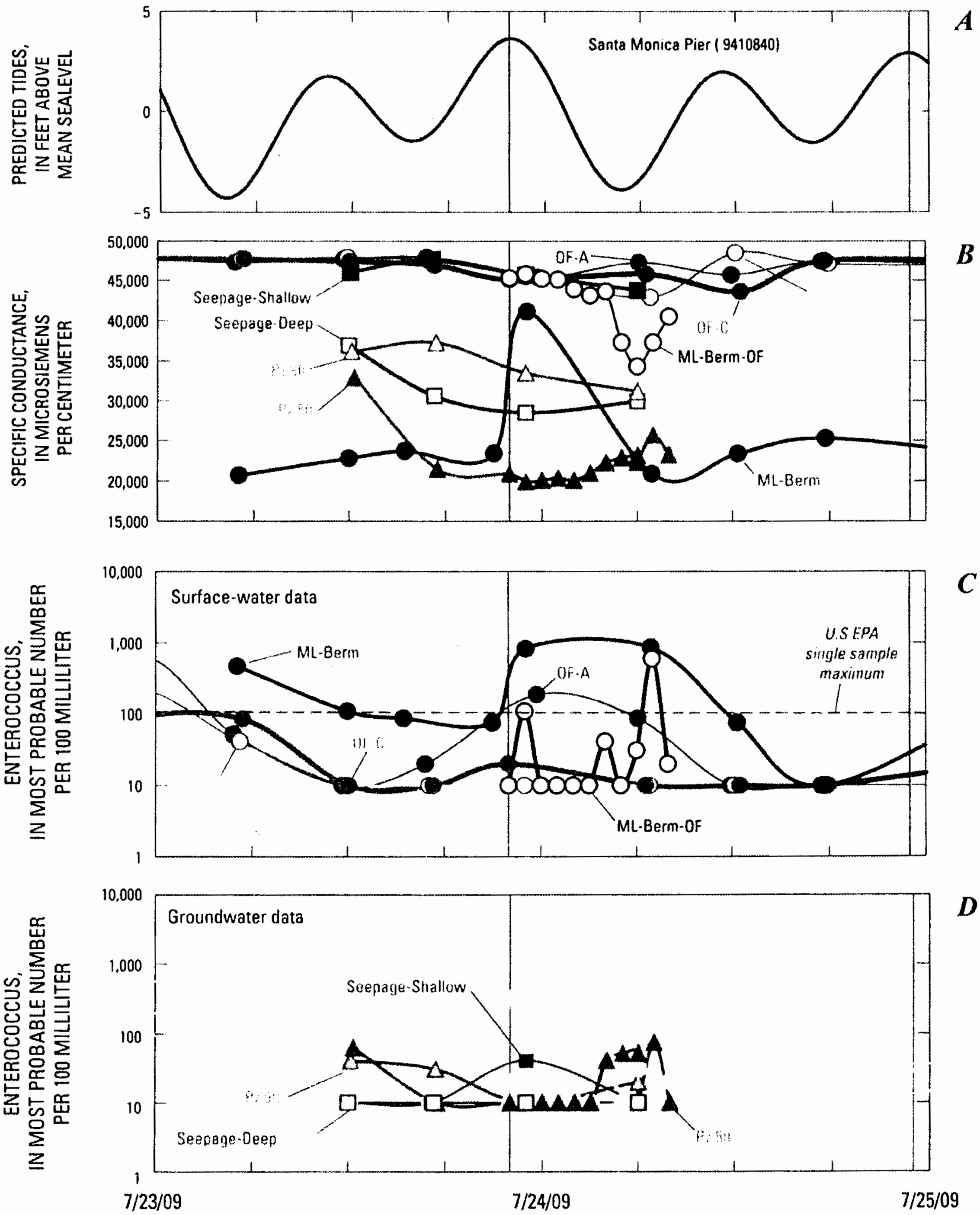
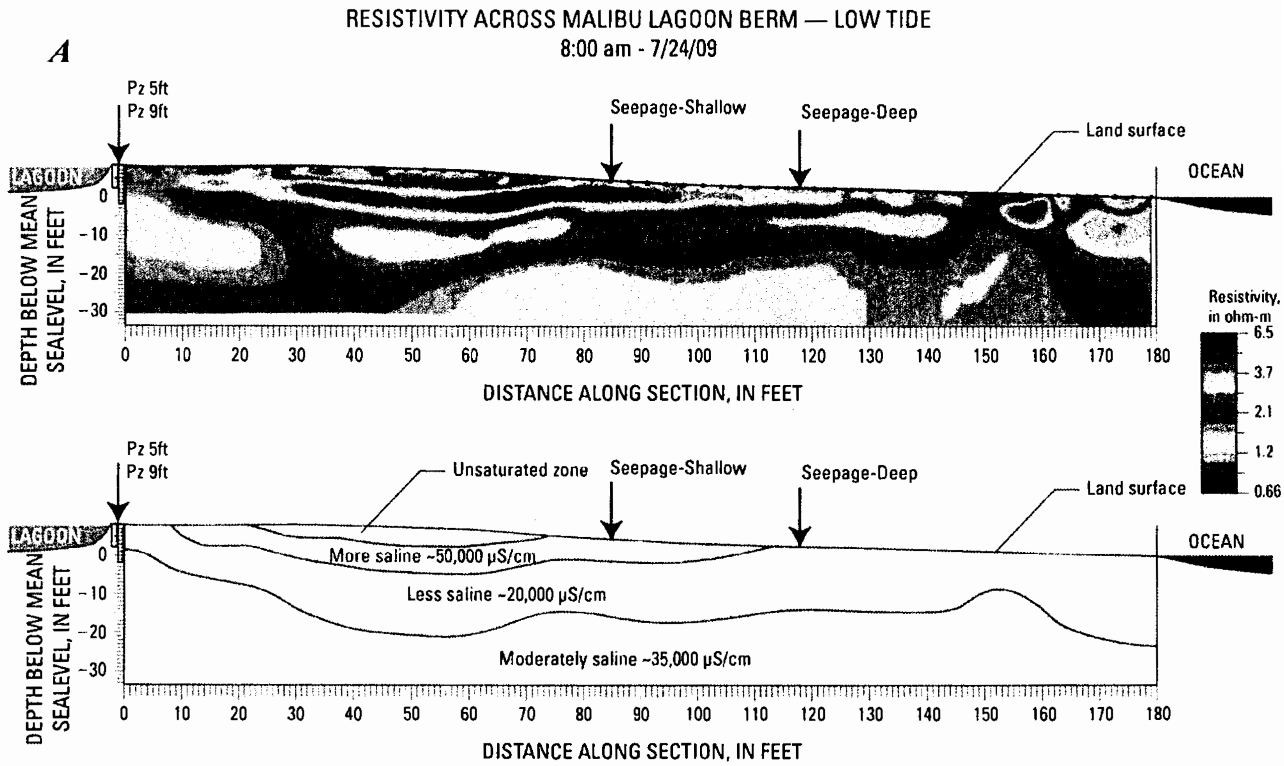

ML-Upper
ML-Middle
ML-Lower
DEPTH BELOW WATER SURFACE, IN FEET
0
1
2
3
4
5
6
7
3,100
1,000
200
7,400
2,000
19,900
16,000
1,000
60
36,800
4,100
4,400
20,100
4,100
580
7,400
2,000
>24,000
A
B
C
20,000
30,000
40,000
20,000
30,000
40,000
20,000
30,000
40,000
SPECIFIC CONDUCTANCE, IN MICROSIEMENS PER CENTIMETER
Numbers are total coliform, E. coli, and enterococcus concentrations, respectively, in MPN per 100 milliliters at indicated depth

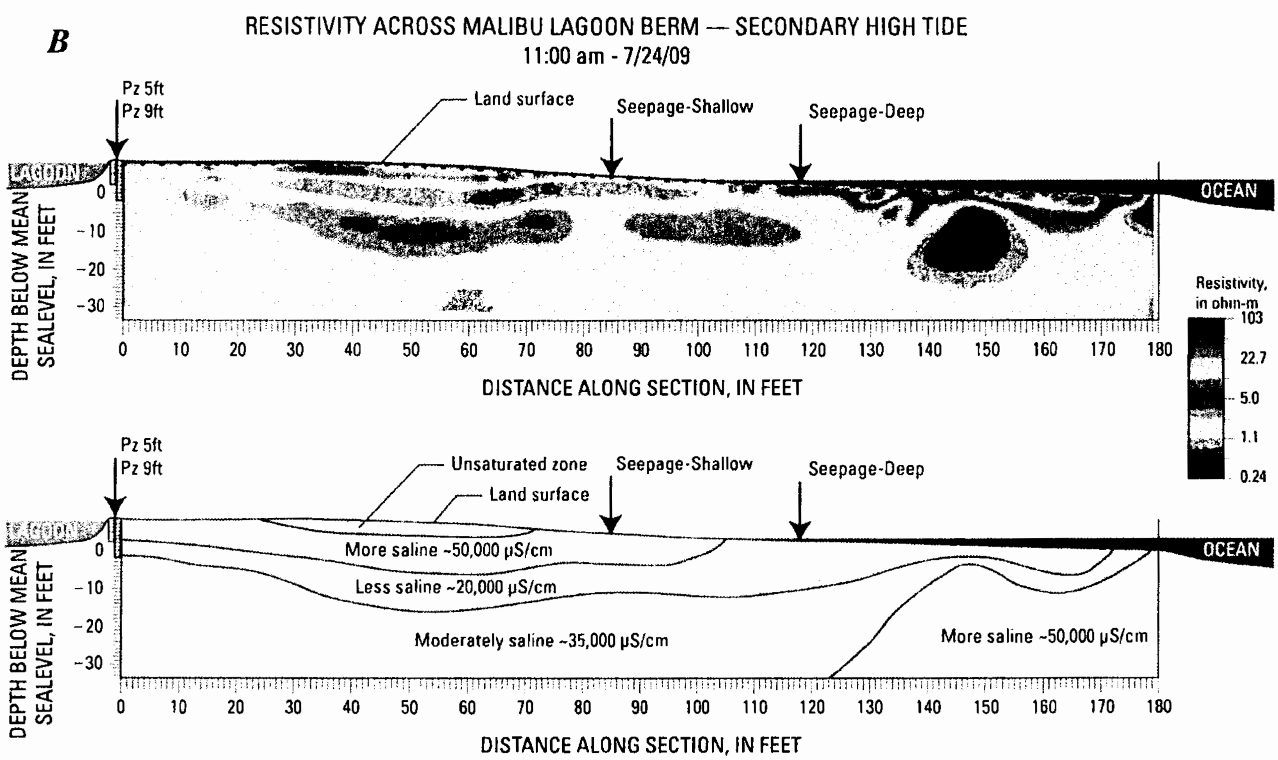
Figure 08



PREDICTED TIDES, IN FEET ABOVE MEAN SEALEVEL
Santa Monica Pier (9410840)
A
SPECIFIC CONDUCTANCE, IN MICROSIEMENS PER CENTIMETER
OF-A
Seepage-Shallow
Seepage-Deep
OF-C
ML-Berm-OF
ML-Berm
B
ENTEROCOCCUS, IN MOST PROBABLE NUMBER PER 100 MILLILITER
Surface-water data
ML-Berm
OF-A
U.S EPA single sample maximum
ML-Berm-OF
C
Groundwater data
Seepage-Shallow
Seepage-Deep
D
7/23/09
7/24/09
7/25/09

Figure 09


A
RESISTIVITY ACROSS MALIBU LAGOON BERM — LOW TIDE
8:00 am - 7/24/09
Pz 5ft
Pz 9ft
Seepage-Shallow
Seepage-Deep
Land surface
LAGOON
OCEAN
DEPTH BELOW MEAN SEALEVEL, IN FEET
DISTANCE ALONG SECTION, IN FEET
Resistivity, in ohm-m
6.5
3.7
2.1
1.2
0.66
Unsaturated zone
More saline ~50,000 μS/cm
Less saline ~20,000 μS/cm
Moderately saline ~35,000 μS/cm


B
RESISTIVITY ACROSS MALIBU LAGOON BERM — SECONDARY HIGH TIDE
11:00 am - 7/24/09
Pz 5ft
Pz 9ft
Land surface
Seepage-Shallow
Seepage-Deep
LAGOON
OCEAN
DEPTH BELOW MEAN SEALEVEL, IN FEET
DISTANCE ALONG SECTION, IN FEET
Resistivity, in ohm-m
103
22.7
5.0
1.1
0.24
Unsaturated zone
More saline ~50,000 μS/cm
Less saline ~20,000 μS/cm
Moderately saline ~35,000 μS/cm
More saline ~50,000 μS/cm

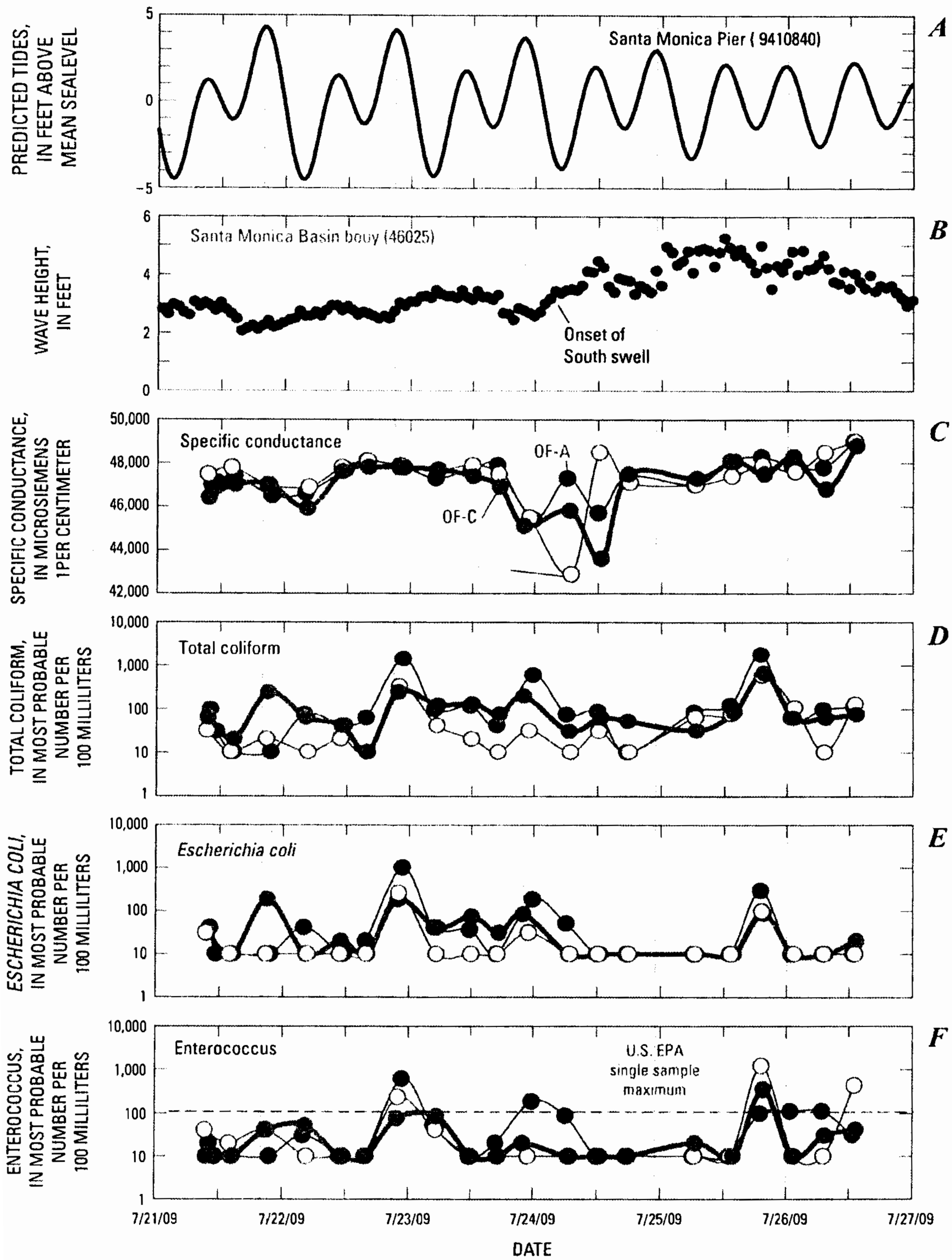

PREDICTED TIDES, IN FEET ABOVE MEAN SEALEVEL
Santa Monica Pier (9410840)
A
WAVE HEIGHT, IN FEET
Santa Monica Basin bouy (46025)
Onset of South swell
B
SPECIFIC CONDUCTANCE, IN MICROSIEMENS 1PER CENTIMETER
Specific conductance
OF-A
OF-C
C
TOTAL COLIFORM, IN MOST PROBABLE NUMBER PER 100 MILLILITERS
Total coliform
D
ESCHERICHIA COLI, IN MOST PROBABLE NUMBER PER 100 MILLILITERS
Escherichia coli
E
ENTEROCOCCUS, IN MOST PROBABLE NUMBER PER 100 MILLILITERS
Enterococcus
U.S. EPA single sample maximum
F
7/21/09
7/22/09
7/23/09
7/24/09
7/25/09
7/26/09
7/27/09
DATE

Figure 11

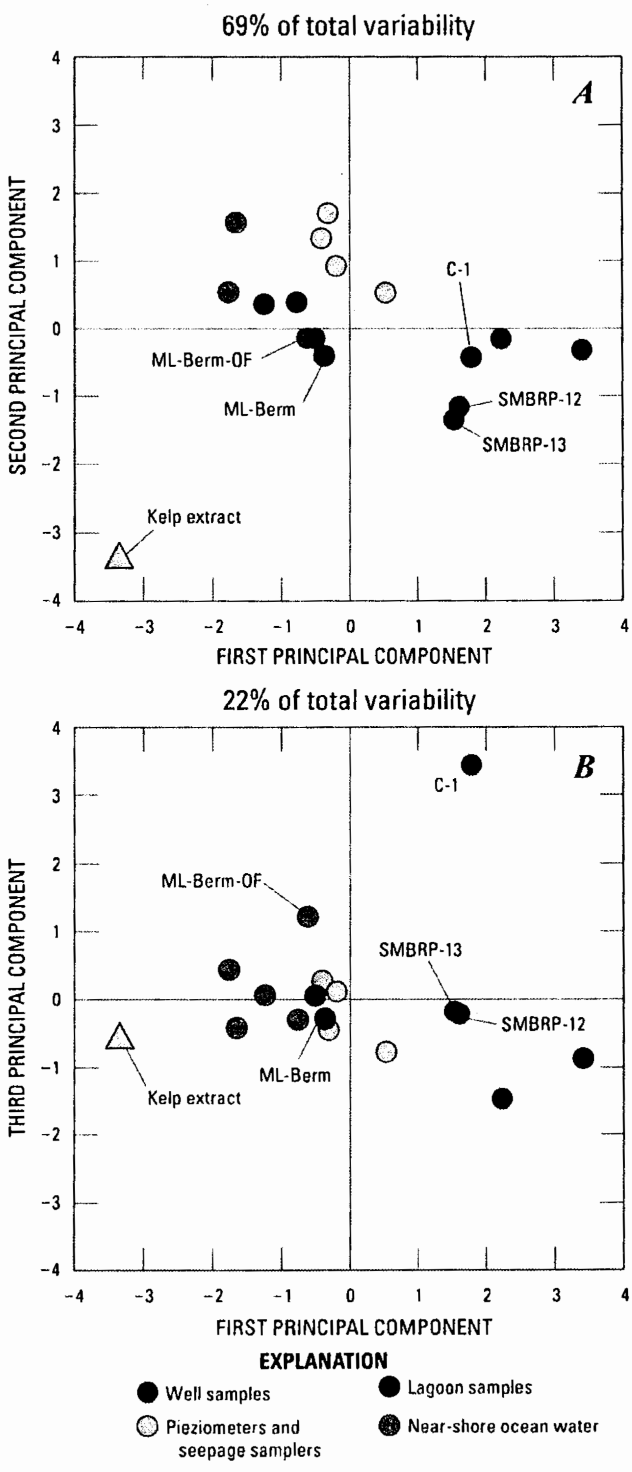

69% of total variability
A
SECOND PRINCIPAL COMPONENT
FIRST PRINCIPAL COMPONENT
C-1
ML-Berm-OF
ML-Berm
SMBRP-12
SMBRP-13
Kelp extract
22% of total variability
B
THIRD PRINCIPAL COMPONENT
FIRST PRINCIPAL COMPONENT
C-1
ML-Berm-OF
SMBRP-13
SMBRP-12
ML-Berm
Kelp extract
EXPLANATION
Well samples
Lagoon samples
Piezometers and seepage samplers
Near-shore ocean water

Figure 12

Table 1. Fecal indicator bacteria (FIB) concentration in water from selected water-table wells, Malibu, California, July 21-26, 2009.

[The five-digit parameter code below the constituent name is used by the U.S. Geological Survey to uniquely identify a specific constituent or property. C, Celsius; dpm/L, disintegrations per minute per liter; ft, feet; LSD, land surface datum; mg/L, milligrams per liter; mL, milliliters; MPN, most probable number; nc, not collected; µS/cm microsiemens per centimeter; <, less than;]

Well Identification No.	Date (m/dd/yyyy)	Time (24 hour)	Water level (ft below LSD)	Well depth (feet)	Dissolved oxygen, (mg/L) (00300)	pH (standard units) (00400)
SMBRP-10C	7/21/2009	14:45	6.12	25	2.9	7.2
SMBRP-11	7/21/2009	11:45	8.40	20	1	6.4
SMBRP-2	7/22/2009	13:15	5.34	11	0.4	7.1
SMBRP-12	7/22/2009	10:30	6.97	25	0.2	7.1
SMBRP-13	7/22/2009	14:30	7.47	20	1.7	7.3
P-9	7/22/2009	10:00	nc	12	0.3	7.1
CCR-1	7/24/2009	9:00	5.69	19	0.1	7.4
CCPE	7/23/2009	14:30	4.97	53	0.2	NR
CCPNE	7/23/2009	9:00	6.03	25	0.2	NR
CCPC	7/23/2009	10:25	5.76	22	0.2	NR
C-1	7/26/2009	11:45	4.47	14	0.1	7.3

Well Identification No.	Specific conductance (µS/cm at 25°C) (00095)	Total coliforms (MPN/100 mL) (50569)	*Escherichia coli* (MPN/100 mL) (50468)	*Enterococci* (MPN/100 mL) (99601)	Radon-222 (dpm/L)
SMBRP-10C	12,700	< 10	< 10	< 10	nc
SMBRP-11	2,960	< 10	< 10	< 10	nc
SMBRP-2	3,360	< 1	< 1	< 1	1,220 ± 189
SMBRP-12	3,820	< 1	< 1	< 1	650 ± 141
SMBRP-13	2,450	< 1	< 1	< 1	850 ± 158
P-9	2,000	< 1	< 1	< 1	1,340 ± 198
CCR-1	2,080	2	< 1	2	1660 ± 163
CCPE	10,800	11	65	1,600	1,050 ± 139
CCPNE	1,960	1	< 1	7.5	1,370 ± 160
CCPC	2,020	< 1	< 1	< 1	950 ± 134
C-1	22,300	< 10	< 10	< 10	nc

Table 2. Fecal indicator bacteria (FIB) concentration in discharge water from a traditional septic system (OLD) and from an advanced septic system (ADV), Malibu, California, October 1, 2009.

[The five-digit parameter code below the constituent name is used by the U.S. Geological Survey to uniquely identify a specific constituent or property. C, Celsius; mL, milliliters; MPN, most probable number; μS/cm, microsiemens per centimeter]

Site Identification No.	Date (mm/dd/yyyy)	Time (24 hour)	pH (standard units) (00400)	Specific conductance (μS/cm at 25°C) (00095)
MC-OLD-Septic	10/1/2009	12:30	6.9	1160
MC-ADV-Septic	10/2/2009	11:00	7.5	990

Site Identification No.	Total coliforms (MPN/ 100 mL) (50569)	*Escherichia coli* (MPN/100 mL) (50468)	Enterococcus (MPN/ 100 mL) (50569)
MC-OLD-Septic	610,000	220,000	7,300
MC-ADV-Septic	16,000	1,400	52

Received 02/18/2010

Title: Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu, California
Cooperating Agency: City of Malibu
Project Chief: John A. Izbicki
Period of Project: 2010-2011

Problem: Malibu Lagoon and near-shore ocean water in Malibu, Calif. have concentrations of fecal indicator bacteria (FIB) that occasionally exceed public health standards for recreational water. Discharge of water from commercial and residential septic systems, and subsequent transport through shallow groundwater to the lagoon or near-shore ocean has been proposed as a possible source of FIB to the lagoon and the near-shore ocean. Other possible sources include direct deposition of fecal material and FIB from birds and other wildlife. The problem is complicated by the possibility of sustained survival or regrowth of FIB in the lagoon, especially during the summer months when water temperatures are warm.

Objective: The purpose of this study is to evaluate the occurrence, distribution, and sources of FIB and nutrients in shallow groundwater, Malibu Lagoon, and near-shore ocean water near Malibu, Calif.

Benefits: The study will determine the source of FIB and nutrients in a hydrologically complex coastal setting. Results of this study will have significant transfer value to recreational ocean beaches impacted by FIB contamination in California and elsewhere. This study addresses issues 1, 2, and 8 from the Strategic Directions for the Water Resources Division, 1998-2008. Specifically, this study will address the effects of urbanization and suburbanization on water resources (issue 1), the effects of land use and population increases on water resources in the coastal zone (issue 2), and surface-water and ground-water interactions as related to water-resource management (issue 8). The study will facilitate integration of physical and isotopic hydrologic data with genetic, molecular, and chemical tracers of fecal contamination to determine the source of FIB in coastal areas.

Approach: The scope of the study includes detailed synoptic sample collection and time-series data collection in shallow groundwater, Malibu Lagoon, and the near-shore ocean. The study uses a combination of physical and isotopic hydrologic techniques coupled with state-of-the-art genetic, molecular, chemical, and optical tracers to determine the source of fecal contamination. Preliminary data collected during the summer and fall of 2009 were used to determine which techniques and tracers were suitable for use in this study.

On the basis of the preliminary data, synoptic and time-series data collection strategies were developed. The synoptic data collection will include collection of traditional physical and isotopic hydrologic data coupled with genetic, molecular, and chemical tracers of fecal contamination. Data will be collected from shallow groundwater, Malibu Lagoon, and the near-shore ocean shortly after the rainy season to contrast with data collected during the dry summer season (summer 2009 data). Time-series data will be collected from selected wells, Malibu Lagoon, and the near-shore ocean at approximately bimonthly intervals for one year to provide information of groundwater quality and FIB concentrations under hydrologic conditions not sampled during synoptic data collection.

Isotopic data are proposed to trace the source of water ($\delta^{18}O$ and δD) and discharge of groundwater to Malibu Lagoon and the near-shore ocean (^{222}Rn). Genetic (Terminal-Restriction Fragment Length Polymorphism, and human-specific *Bacteroidales* data), molecular (Phospholipid fatty acid data), and chemical data (wastewater indicator compounds) are proposed to trace the movement of bacteria and fecal contamination through the hydrologic flow system. Other tracers are proposed evaluate changes in the chemical composition of nutrients ($\delta^{15}N$ of nitrate and ammonia, and $\delta^{18}O$ of nitrate) and dissolved organic carbon (Ultraviolet absorbance and Excitation Emission Spectroscopy) as water flows through the system. No single hydrologic or bacteriological source tracking technique provides a truly unique identification of the source or hydrologic history of water sample or bacteria. As a consequence, interpretations from tracer data, used in both the synoptic and time-series data collection, are constrained by interpretations derived from traditional hydrologic and microbiological data.

Sources of Fecal Indicator Bacteria and Nutrients to Malibu Lagoon and Near-Shore Ocean Water, Malibu, California

By: John A. Izbicki

PROBLEM AND STUDY AREA

Malibu Lagoon and near-shore ocean water near Malibu, Calif. (fig. 1) have concentrations of fecal indicator bacteria (FIB) that occasionally exceed public health standards for recreational water. Discharge of water from commercial and residential septic systems and subsequent transport through shallow groundwater to the lagoon or to the near-shore ocean is a possible source of FIB. Concern over septic discharges has prompted regulatory agencies to impose a ban on septic discharges to shallow groundwater in the area (Los Angeles RWQCB, 2009). As part of this ban, no new septic systems are permitted and existing commercial and residential discharges are to be sewered and treated prior to discharge outside the Civic Center area. Historical data show FIB concentrations in shallow wells in the Malibu area are highly variable (Stone Environmental Inc., 2004). Recent data collected during July 2009 as part of this work show FIB concentrations in water from most shallow wells to be less than method detection limits for total coliform, *Escherichia coli* (*E. coli*), and enterococcus. These results suggest other sources may contribute FIB to Malibu Lagoon and the near-shore ocean.

In addition to septic discharges, other possible sources of FIB to Malibu Lagoon and near-shore ocean water include direct deposition of fecal material from birds and other wildlife to the lagoon, beach, and near-shore ocean. Surface discharges from Malibu Lagoon also have been shown to be a source of FIB contamination to the near-shore ocean, and groundwater movement through the berm of the lagoon at low-tide also may contribute FIB to the near-shore ocean. Uncertainty concerning the source of FIB to the lagoon and near-shore ocean is complicated by the possibility of sustained survival or regrowth of FIB, especially during the summer months when water temperatures are warm (Ferguson and others, 2005).

Study area—The study area is the Civic Center area of Malibu, Calif., including Malibu Lagoon and the near-shore ocean (fig. 1). The area contains unsewered residential and commercial development adjacent to Malibu Lagoon and the near-shore ocean. The area is underlain by alluvial deposits in places more than 150 ft thick. Depth to water is less than 10 feet in some areas underlying commercial and residential development. Groundwater in the alluvial deposits discharges to Malibu Lagoon or to the ocean. Groundwater in the area is not pumped for public supply.

Malibu Lagoon is open to the ocean during wet periods, especially after stormflows in Malibu Creek. Surface flow in Malibu Creek is not perennial and flow ceases shortly after permitted seasonal discharges from upstream wastewater treatment plants cease in mid-April. While open to the ocean, water-levels in the lagoon vary with ocean tides and have near-ocean water salinities (fig. 2). During dry periods a sand berm develops at the mouth of the lagoon, separating the lagoon from the ocean. After closure of the sand berm, water-levels in the lagoon rise as a result of surface inflow from Malibu Creek and from groundwater discharge to the lagoon. During the summer months, high tides occasionally overtop the berm allowing seawater to enter the lagoon. The influx of seawater increases the water levels and salinity in the lagoon. After the high tidal stands, water levels and salinity decrease as saline water drains to the near-shore ocean through the berm and is replaced by fresh groundwater discharging to the lagoon.

Data from the Los Angeles RWQCB show FIB concentrations in Malibu Lagoon during 2009 were highly variable and enterococcus concentrations in the lagoon occasionally exceed the U.S. Environmental Protection Agency single sample standard for marine recreational water of 104 colonies (or equivalent) per 100 mL (U.S. Environmental Protection Agency 2003; Federal Register, 2004). Enterococcus concentrations in Malibu Lagoon were generally less than the detection limit of 10 Most Probable Number per 100 milliliters (MPN per 100 mL) when the berm at the mouth of the lagoon was open to the ocean and seawater could readily exchange with water in the lagoon during daily tidal cycles. Enterococcus concentrations as high as 6,100 MPN per 100 mL were present during stormflows, and concentrations were as high as 2,900 MPN per 100 ml during the dry season when the berm of the lagoon was closed to the ocean. Dry season enterococcus concentrations decreased to below the recreational water standard as a result of the influx of seawater into the lagoon during high tidal stands. After the influx of seawater, enterococcus concentrations in the lagoon increased to higher concentrations until diluted by seawater during the next high tidal stand. Between high tides, low enterococcus concentrations persist for several weeks if water temperatures in the lagoon remain low. Enterococcus concentrations were higher during summer when lagoon water temperatures were higher, and concentrations decreased during late summer through early fall as lagoon water temperatures declined. This pattern suggests strong hydrologic controls on FIB concentrations in Malibu Lagoon, coupled with possible regrowth of FIB in the warm water of the lagoon during the summer months.

Previous work, show FIB concentrations in near-shore ocean water also are highly variable. Concentrations in near-shore ocean water are affected by surface discharges from streams and rivers (Boehm et al., 2005), and also can depend on solar and tidal cycles (Boehm, 2007). High tides can wash FIB from beach sand and from debris accumulated along the high tide (wrack) line (Yamahara and others, 2007; Boehm and Weisberg, 2005; Izbicki and others, 2009). Groundwater discharge has been implicated as a source of FIB to the near-shore ocean during low tide (Paytan and others, 2004; Boehm and others, 2004 and 2006). If groundwater discharge is a source of FIB, concentrations in the near-shore ocean may increase during low tide when groundwater discharge is greater. These increases may be greater during falling monthly tidal cycles (Izbicki and others, 2009).

PURPOSE AND SCOPE

The purpose of this study is to evaluate the occurrence, distribution, and possible sources of FIB and nutrients in shallow groundwater, Malibu Lagoon, and near-shore ocean water near Malibu, Calif. The scope of the study includes detailed synoptic sample collection and time-series data collection in shallow groundwater, Malibu Lagoon, and the near-shore ocean. The study uses a combination of physical and isotopic hydrologic techniques coupled with state-of-the-art genetic, molecular, chemical, and optical tracers to determine the source of fecal contamination.

RELEVANCE AND BENEFITS

The study addresses the highly emotional issue of fecal indicator bacteria contamination in surface water and near shore ocean water. Contamination and closure of recreational beaches has lowered the perceived quality of life for southern California residents and has cost local economies millions of dollars in lost tourist revenue over the last several years. Results of this study are expected to have transfer value to recreational ocean beaches impacted by FIB contamination elsewhere in California and in other parts of the United States.

This study addresses issues 1, 2, and 8 from the Strategic Directions for the Water Resources Division, 1998-2008. Specifically, this study will address the effects of urbanization and suburbanization on water resources (issue 1), the effects of land use and population increases on water resources in the coastal zone (issue 2), and surface-water and ground-water interactions as related to water-resource management (issue 8).

The study uses a combination of physical and isotopic hydrologic data coupled with genetic, molecular, and chemical tracers of fecal contamination to determine the source of fecal contamination. The genetic, molecular, and chemical data collected as part of this study have been widely applied as research tools, and are beginning to be used by resource managers and regulators responsible for the management of recreational water and for the control fecal contamination. This study will provide an important link between the research community developing new genetic and molecular techniques and water-resource managers responsible for applying those techniques.

APPROACH

Preliminary data were collected during the summer of 2009 to: 1) evaluate temporal and spatial sampling strategies that would be effective in this hydrologic setting (including the high-energy surf zone), 2) evaluate ancillary hydrologic and isotopic data useful to the understanding the movement of water, FIB, and nutrients in the study area, and 3) evaluate genetic, molecular, and chemical tracers useful to understand the occurrence, distribution, and sources of FIB. Data collection and analysis described in this proposal were developed on the basis of preliminary data collected during the summer of 2009 and include coupled synoptic and time-series data collection.

Preliminary Data Collection

Groundwater level, radon-222 (^{222}Rn), direct-current resistivity, FIB, and bacterial-source tracking data were collected during a falling monthly tidal cycle in the dry summer season from July 21-27, 2009 near Malibu, California. Data collection was coordinated with an epidemiological study of FIB occurrence and human health coordinated by the Southern California Coastal Waters Research Program (SCCWRP) and University of California Berkeley. Additional data were collected from septic systems and the near-shore ocean in the fall of 2009 to provide end-members for interpretation of the July data, and to verify the ability to collect ^{222}Rn data in the high-energy surf of the near-shore ocean near Malibu. Preliminary data provided a snap-shot in time of the occurrence, distribution and movement of FIB, nutrients, and other constituents in shallow groundwater, Malibu Lagoon (including its tributary Malibu Creek) and near-shore ocean water. In addition, preliminary data collection provided an opportunity to asses: 1) which data collection strategies (including the spatial and temporal distribution of samples) would be successful, and 2) which ancillary data would be useful in this complex hydrologic setting. Data collection issues were of special concern given the high surf conditions commonly present in the near-shore ocean near Malibu. Groundwater and surface water samples sites sampled are shown in figures 3 and 4, respectively.

Preliminary data collection showed:

1. Groundwater levels were affected by tides, ocean swells, and water levels in Malibu Lagoon (fig. 5). The seawall along Malibu Colony (fig. 6), which consists of wooden pilings driven to a depth of about 18 feet below land surface, may have damped tidal effects on water levels in well SMBRP-12 (fig. 5).

2. FIB concentrations (total coliform, *E. coli*, and enterococcus) were less than the detection limit, or were present at only low concentrations, in samples from the 10 of 11 water-table wells sampled (Table 1). The highest concentrations were in water from well CCPE in the commercial district near Malibu Lagoon. Water from well CCPE was saline and possibly impacted by water from Malibu Lagoon rather than septic systems. Nitrate and ammonia concentrations in shallow groundwater also were low with average concentrations of 1.5 and 1.7 mg/L as nitrogen, respectively. The highest nitrate concentration of 6.4 mg/L as nitrogen in water from well SMBRP-11 in unsewered residential development near Malibu Colony is less than the Maximum Contaminant Level (MCL) for nitrate in drinking water of 10 mg/L as nitrogen. The highest ammonia concentration was 12.2 mg/L as nitrogen in water from well SMBRP-12 in Malibu Colony. Ammonia was the primary form of nitrate in 3 sampled wells.

3. On the basis of ^{222}Rn data, shallow groundwater was discharging to Malibu Lagoon at an average rate of 2.8 cm/d during the July 2009 sample period (fig. 7). Discharge rates as high as 15 cm/d (6-hour average) were measured during high tidal stands at the beginning of the sample period. Discharge to the lagoon declined during the sample period because of increased water levels in the lagoon resulting from ocean water overtopping the berm separating the lagoon from the ocean during high tide.

4. High concentrations of FIB were present in Malibu Lagoon during the sample period (fig. 8). Total coliform and *E. coli* concentrations decreased during the sample period as a result of dilution by ocean water entering the lagoon at high tide. Enterococcus concentrations decreased during the day (consistent with inactivation by UV radiation in sunlight) and rebounded to higher concentrations at the night (fig. 8).

5. Water movement through the berm of Mailbu Lagoon was a source of FIB, especially enterococcus, to the near-shore ocean near the mouth of the lagoon during low tide (fig. 9). Enterococcus concentrations exceeded the U.S. Environmental Protection Agency single sample standard for (marine) recreational water (104 MPN per 100 ml) in near-shore ocean water near the lagoon berm at this time.

6. FIB concentrations increased during high tide at three sampled beaches (fig. 10). These increases were consistent with wave run-up on the beach washing FIB from kelp and other debris in the wrack line and from beach sands. FIB concentrations did not increase in near-shore ocean water during low tide when groundwater discharge to the ocean, measured on the basis of ^{222}Rn

data, was greatest. Detailed sample collection during a falling tidal cycle in November 2009 confirmed this observation.

Proposed data collection

Data from July 2009 show low FIB concentrations in groundwater, high FIB concentrations in Malibu Lagoon, high FIB in the near-shore adjacent to Malibu Lagoon at low tide, and high FIB concentrations in the near-shore ocean at other sampled beaches during high tide. Additional data collection is intended to confirm results from July 2009. Additional data collected also is intended to determine how the distribution and sources of FIB, nutrients, and other constituents change under different hydrologic conditions. The proposed data collection includes both synoptic and time-series data collection. The proposed data collection also includes detailed collection of field parameters, FIB, and nutrients from selected wells during purging to evaluate the performance and representativeness of data from those wells. Understanding of the processes controlling FIB occurrence obtained from these data will be used to interpret regulatory data having longer periods of record, but less analytical, temporal and spatial detail.

Synoptic data collection from groundwater, Malibu Lagoon (including its tributary Malibu Creek), and near-shore ocean water will be done during a falling monthly tidal cycle under wet conditions prior to closure of the berm at the mouth of the lagoon. These data will be contrasted with preliminary data collected in July 2009 under dry conditions when the lagoon was not discharging to the ocean. Time-series data will be collected from selected wells and surface water sites in the lagoon and near-shore ocean. Time-series data will allow assessment of the range in variability for measured constituents for hydrologic conditions not specifically addressed during synoptic sample collection. Samples collected as part of synoptic and time-series data collection will be analyzed for a range of constituents including: FIB, major-ions and nutrients, and a suite of tracers including 1) selected isotopes, 2) genetic, molecular, and chemical tracers of wastewater, and 3) dissolved organic carbon and optical property data.

Task 1: ***Synoptic sample collection:*** Synoptic data collection from groundwater, Malibu Lagoon (including its tributary Malibu Creek), and near-shore ocean water will be done during a falling monthly tidal cycle under wet conditions prior to closure of the berm at the mouth of the lagoon. The purpose of synoptic sample collection is to provide a snap-shot in time of the occurrence and distribution of FIB, nutrients, and other constituents in shallow groundwater, Malibu Lagoon (including its tributary Malibu Creek) and near-shore ocean water. Hydrologic, isotopic, and geophysical data collected during synoptic sample collection are intended to evaluate the movement of water between groundwater, lagoonal, and near-shore ocean environments. These data will be supplemented with genetic, molecular, and chemical data used to determine the source of FIB in these environments. The design of synoptic sample collection is similar to the design used for preliminary data collection during the summer of 2009, and the two synoptic data sets are expected to be comparable. Groundwater and surface water samples sites sampled during summer 2009 are shown in figures 2 and 3, respectively. On the basis of previous experience, data collection will require about 1 week.

Shallow groundwater—Five selected wells will be instrumented with pressure transducers to determine changes in water levels several weeks prior to, during, and for several weeks after the sample period. Water level data from these wells will be compared to and contrasted with tidal data, ocean swell data, and water-level data from Malibu Lagoon (fig. 5) to determine the effects of tides, ocean swells, and changes in lagoon water levels on the discharge of shallow groundwater to Malibu Lagoon and the near-shore ocean. Fifteen wells will be sampled. This represents and increased in the number of wells compared to the July 2009 synoptic sample collection. The increase is intended to allow additional wells to be sampled in the commercial area near Malibu Lagoon and in the Sierra Retreat area. Wells will be sampled for field parameters (pH, specific conductance, and dissolved oxygen), FIB (total coliform, *E. coli*, and enterococcus), major-ion and nutrient concentrations (Table 2), the stable isotopes of oxygen and hydrogen (oxygen-18 and deuterium), ^{222}Rn activity, and dissolved organic carbon and optical property data (including full-spectrum ultraviolet absorbance and excitation emission spectroscopy). Ten sampled wells will be analyzed for a more complete list of constituents including δ^{15}N and δ^{18}O of nitrate (or the δ^{15}N of ammonia where appropriate), and bacterial source-tracking data including genetic (Terminal-Restriction Fragment Length Polymorphism, and human-specific *Bacteoidales*), molecular (Phospholipid fatty Acids), and wastewater indicator (Table 3) data. Observation wells will be purged and sampled using peristaltic pumps. As many as four peristaltic pumps will be used to purge observation wells thereby minimizing purge times. Tubing and hoses used during purging and sample collection will be discarded after each use to prevent cross-contamination between sampled wells.

Malibu Lagoon—Samples from Malibu Lagoon will be collected from three sites in the lagoon (ML-West, ML-Comm, and ML-Berm, fig. 4) to evaluate to spatial distribution of field parameters, FIB, chemistry and nutrients (including nitrogen isotopes), dissolved organic carbon (including optical properties), and genetic, molecular, and chemical bacterial source-tracking data. Additional samples will be collected at different depths from other three sites (ML-Upper, ML-Middle, and ML-Lower, fig. 4) within the lagoon to determine the vertical distribution of field parameters, FIB, nutrients, and dissolved organic carbon (including optical properties) with depth (fig. 11). Continuous monitoring of lagoon water levels, field parameters, and ^{222}Rn activity will be done at two of these three sites (ML-Upper and ML-Lower) to evaluate groundwater discharge to the lagoon. ^{222}Rn samples from observation wells will be used to evaluate the groundwater radon activity for calculation of groundwater discharge to the lagoon. Atmospheric ^{222}Rn and relevant meteorological parameters will be measured continuously during this period to evaluate atmospheric boundary conditions that constrain these calculations. Lagoon water levels, ^{222}Rn activity, and calculated groundwater discharge will be compared to water-level data from wells, tidal data, and ocean swell data to evaluate changes in discharge to the lagoon during the sample period (fig. 7). These data will we used to estimate FIB and nutrient fluxes from groundwater to the lagoon.

Samples also will be collected near the berm of the lagoon (ML-Berm, fig. 4) at high and low tidal stands (approximately four times each day) to determine variations in field parameters, and FIB during the synoptic sample collection period, about 1 week. These data will be evaluated to determine hydrologic processes that control FIB concentrations, and if there are diurnal variations in FIB concentrations (especially enterococcus) resulting from inactivation by UV radiation in sunlight (fig. 8). The data also will be compared and contrasted with similar data collected from the near-shore ocean (fig. 10).

Near-Shore Ocean Water—Near-shore ocean water will be sampled at high and low tidal stands (approximately four times each day) at three beach locations to determine how field parameters and FIB concentrations change with tidal fluctuations. The three sample sites (OF-A, AF-B, and OF-C) are located to the west of the unsewered residential development in Malibu Colony, near the berm of Malibu Lagoon, and the east of Malibu Lagoon, respectively (fig. 4). The data will be compared and contrasted with tidal and swell data and with similar data collected from Malibu Lagoon (fig. 10).

Near-shore ocean water also will be sampled during a falling tidal cycle (from high tide to low tide) at the berm at the mouth of Malibu Lagoon (ML-Berm-OF, fig. 4), adjacent to unsewered residential development where septage is discharged to shallow groundwater (MC-ADV-OF and MC-OLD-OF, fig. 4). Temporary pieziometers will be installed at selected locations and depths each site (PZ 5ft, PZ 9ft, MC-ADV pz and MC-OLD pz, fig 4) to permit collection of water levels and water samples from shallow groundwater in the beach sands. Seepage samplers (specially designed for this study) also will be installed at the mid low and low tide line (Seepage Shallow and Seepage Deep, respectively, fig. 4) to collect samples discharging from the seepage face to the ocean at low tidal stands. Malibu Lagoon, near-shore ocean water, pieziometers, and seepage samplers will be sampled hourly during a falling tidal cycle for field parameters, FIB, and optical property data. Water from near-shore ocean water, selected pieziometers, and selected seepage samplers will be analyzed for additional parameters including: chemistry and nutrients, dissolved organic carbon and optical properties, and genetic, molecular, and chemical source tracking data at high tide and low tide. ^{222}Rn will be measured continuously in near-shore ocean water and in water from selected pieziometers and seepage samplers during several tidal cycles prior to sample collection to estimate groundwater discharge to the ocean (fig. 12). For data collected near Malibu lagoon, discharge through the berm to the ocean also will be estimated from measured water-level data assuming reasonable hydraulic property values for the berm material. Estimated discharge from the lagoon through the berm to the near-shore ocean will be compared to groundwater discharge into the lagoon calculated from ^{222}Rn data to evaluate the lagoon water budget. If ocean conditions permit, electromagnetic seepage meters will be placed below the low tide line to provide point measurements of groundwater discharge to the near-shore ocean. Land-based direct-current resistivity data will be collected in shore-parallel and shore perpendicular configurations (depending on the site) to assess the distribution of fresh and saline water at high and low tidal stands (figs 13 and 14).

Other samples—Water from within a conventional and an advanced residential septic system and from within a commercial septic system will be sampled and analyzed for field parameters, FIB, chemistry and nutrients, dissolved organic carbon and optical properties, the stable isotopes of oxygen and hydrogen, and genetic, molecular, and chemical source tracking data. It may not be possible to resample the same septic systems that were sampled in 2009. Water extracts from kelp and beach sands (2 samples each) will be prepared in the field according to methods described by Izbicki et al. (2009). Extract water will be analyzed for FIB, nutrients, dissolved organic carbon and optical properties, and genetic, molecular, and chemical source-tracking data. Septic samples and water-extract data are important end-members for process oriented and statistical analysis of data collected in the study area.

TASK 2: ***Time-series data collection***—Data will be collected from wells, Malibu Lagoon, and the near-shore ocean to assess variation in FIB, nutrients, and other constituents over an annual cycle.

Water from five selected wells will be sampled bimonthly (every other month) and analyzed for field parameters, FIB, chemistry and nutrients, and the stable isotopes of oxygen and hydrogen, dissolved organic carbon and optical property data. These wells will be in areas of unsewered residential development (including Malibu Colony and the Sierra Retreat area), unsewered commercial development, and near Malibu Lagoon. Samples also will be analyzed for $\delta^{15}N$ and $\delta^{18}O$ of nitrate (or $\delta^{15}N$ of ammonia will be measured where appropriate), and tracer data. Water samples also will be collected bimonthly from Malibu Creek and Malibu Lagoon at the berm near the mouth of the lagoon. These samples will be analyzed for the same constituents as the groundwater time series. Additional samples will be collected from bed sediments at the bottom of the lagoon. Bed material will be analyzed for FIB, nutrient, dissolved organic carbon and optical property data, and bacterial source tracking data.

^{222}Rn data and associated FIB and nutrient data will be collected from the near-shore ocean at Malibu Lagoon and near Malibu Colony two additional times during the course of the study. These data will be collected at tidal stands not represented during synoptic data collection

TASK 3: Microcosm experiments—There is increasing evidence for extended survival and possible regrowth of FIB in environmental settings (Von Donsel, 1971; Matson and others, 1978; Myers and others, 1998; and Byappanahalli and others, 2003). Regrowth of FIB may be a possibility in Malibu Lagoon, given 2009 summer water temperatures as high as 31°C (fig. 2)—human body temperature is 36.7°C. To address the possibility of regrowth of FIB a series of microcosm experiments will be done at the USGS laboratory in San Diego. Microcosms will contain lagoon water or lagoon water with sediment, and will be incubated at ambient temperature, 27°C, 31°C, and 35°C for a total of 8 microcosms. Two negative controls prepared using sterilized lagoon water and sterilized sediment will be incubated at 35°C. If necessary, dissolved organic carbon and phosphorous will be added to the microcosms to maintain nutrients within an optimal range for bacterial growth (Toothman and others, 2009; Haller and others, 2009; Surbeck and others, 2010). Microcosms will be aerated, but other factors such as pH, salinity will not be controlled but will be monitored during the study.

Microcosms will be incubated in the dark for seven days and sampled at 12 hour intervals for the first 2 days and at 24 hours intervals for the remaining 5 days. High-frequency sampling will be done at 2 hour intervals for 12 hours after the first day and after the sixth day, to assess the effect of predation and development of periodic steady-state oscillations within the microcosms (Surbeck and others, 2010). The volume of the microcosm will be sufficiently large that subsampling does not appreciably affect the experiment. Samples will be run in duplicate and analyzed for *E. coli* and enterococcus bacteria using membrane filtration techniques—modified mTEC (*E. Coli*), and mEI medium (enterococcus).

Results of this experiment will be compared to published decay and regrowth rates from similar experiments. In general, FIB decay rates in water are rapid if regrowth does not occur (McFeter and others, 1974), and growth rates are significant for microcosm experiments that exhibit regrowth (Toothman and others, 2009; Haller and others, 2009; Surbeck and others, 2010). Published data suggest that measureable differences in bacterial decay or growth can be obtained from this experiment. Published results also suggest that FIB decay will be less and regrowth will be greater in the presence of sediment (Toothman and others, 2009; Haller and others, 2009; Surbeck and others, 2010).

Water-quality sample handling and analysis

Synoptic and time-series sample collection will generate a large number of chemical and microbiological samples that have specific sample handling requirements with strict holding times prior to analysis.

Sample collection and analyses—FIB samples collected during synoptic sample collection will be analyzed for total coliform, *E. coli*, and enterococcus using Colert-18 (for total coliform and *E. coli* in saline water) and Enterolert (for enterococcus). Samples will be collected in sterile, disposable bottles, placed in coolers, and chilled immediately after collection. Samples will be analyzed in a temporary field laboratory set up in an office building available in the study area. Use of a field laboratory will enable most samples to be analyzed within 6 hours of collection—the recommended holding time for FIB analysis to be used for regulatory purposes. Holding times for samples collected late at night will be slightly longer but are not expected to exceed 12 hours. Previous data collection suggests that analyzing the samples at 3 dilutions (10 to 1, 100 to 1, and 1000 to 1) will produce results within an acceptable range, although samples from Malibu Lagoon may require additional dilutions to obtain results in an acceptable range. Samples for Colert-18 and Enterolert will be incubated at the field laboratory in laboratory incubators for 18 to 20 hours and 22 to 26 hours, respectively. Sample quanti-trays will be counted in the field laboratory after incubation. A smaller number of samples will be analyzed using membrane filtration techniques m-ENDO (total coliform), modified mTEC (*E. Coli*), and mEI medium (enterococcus). The plated cultures will be incubated and counted in the field laboratory. Results of membrane filtration techniques will be compared with results from Colert-18 and Enterolert analysis. Laboratory process blanks will be run daily and replicate analysis will be done on 5 percent of the samples.

It will not be possible to incubate FIB samples collected as pert of time-series sample collection in a field laboratory. These samples will be either delivered to the USGS laboratory in San Diego California on the day of collection for analysis, or will be shipped overnight to the USGS laboratory in San Diego for analysis. Holding times for these samples are not expected to exceed 24 hours—the recommended holding time for FIB analysis to be used for scientific purposes.

Samples to be analyzed for Terminal-Restriction Fragment Length Polymorphism (T-RFLP), and human-specific *Bacteroidales* will be analyzed at the University of California Santa Barbara. These samples will be collected in 1-L baked amber glass bottles. Sample bottles will be stored in coolers and chilled immediately after collection. Samples will be delivered by courier or USGS personnel to the UCSB laboratory for filtration and extraction of DNA on the day of collection. Sample for T-RFLP will be analyzed by qPCR using methods described by LaMontagne and Holden (2003), Samples for human-specific *Bacteroidales* will be analyzed using methods described by Kildare and others (2007), using the Taqman qPCR assay to determine the lowest template dilution without inhibition (Haugland and others, 2005; Morrison and others, 2008).

Samples to be analyzed for Phospholipid Fatty Acids will be collected in 1-L baked amber-glass bottles. Sample bottles will be stored in coolers and chilled immediately after collection. Samples will be shipped overnight to a contract laboratory for analysis using a modified Bligh and Dyer method (White and others, 1979).

Samples for nutrients (NWQL Schedule 1034) will be filtered at the time of collection and placed in 125 mL amber plastic bottles. Samples for wastewater indicators (NWQL Schedule 4433) will be collected in 1-L baked amber-glass containers. Nutrient and wastewater indicator samples will be stored in coolers, chilled immediately after collection, and shipped overnight to the U.S. Geological Survey National Water Quality Laboratory (NWQL) for analysis. Nutrients will be analyzed using various methods described by Patton and Truitt (1992 and 2000) and Fishman and others (1993). Wastewater indicator samples will be analyzed by continuous liquid-liquid extraction and capillary-column gas chromatography/mass spectrometry (Zaugg and others, 2006). Extracts from selected wastewater indicator samples also will be analyzed for tentatively identified compounds (NWQL Laboratory Code 2753). Samples for major-ion, minor-ion, and trace element chemistry (NWQL Schedule 1261) and the stable isotopes of oxygen and hydrogen (NWQL schedule 1142) will be field filtered and preserved (as needed) at the time of collection, stored in coolers, and shipped to the NWQL (and the U.S. Geological Survey Isotope Laboratory in Reston, Va.) at the end of the field trip. Selected samples for $\delta^{15}N$ of nitrate and ammonia and $\delta^{18}O$ of nitrate will be field filtered through 0.2 mm pore-sized filter at the time of collection. Samples for $\delta^{15}N$ and $\delta^{18}O$ of nitrate and frozen prior to shipment to the U.S. Geological Survey Isotope Laboratory for analysis. Samples for $\delta^{15}N$ of ammonia will be preserved with reagent grade 4.5 N H_2SO_4 to pH < 2 at the time of collection. Samples for $\delta^{15}N$ and $\delta^{18}O$ of nitrate and $\delta^{15}N$ of ammonia will not be shipped until nitrate and ammonia results are available from the NWQL (U.S. Geological Survey Office of Water Quality Technical Memorandum 2008.04, June 26, 2008).

Samples for dissolved organic carbon and optical properties including full-spectrum ultraviolet (UV) absorbance and excitation-emission (EEM's) spectroscopy will be chilled, filtered as soon as practical after collection, and shipped to the USGS laboratory in Sacramento for analysis. DOC will be analyzed using UV-promoted persulfate oxidation (Brenton and Arnett, 1993). UV absorbance at wavelengths from 190 to 310 nm will be measured spectrometrically (American Public Health Association, 1992). Excitation Emission Spectroscopy data will be collected using a Jobin Horiba Fluoromax 4 spectrofluorometer with excitation wavelengths from 240-440 nm and emission wavelengths collected from 290–600 nm.

Quality Assurance Data—Approximately 10 percent of the laboratory analytical budget is reserved for quality assurance data. Quality assurance procedures for field microbiological data are discussed in the sample collection and analysis section. For other chemical and bacteriological analysis, quality assurance data will be distributed evenly between field blanks and replicate data. Field blank data will be used to assess the possibility of low-level contamination interfering with results. This is of special concern for many of the wastewater indicator analysis that can be easily contaminated during sample collection and handling. Replicate analysis will be used to assess the precision of sample collection and handling procedures. These data will be used to determine the precision of individual measurements and to ultimately constrain interpretation of the data. For many genetic and isotopic analyses, collection and analysis of field blank data does not make sense. Quality assurance for these data will be assessed on the basis of replicate analysis. If problems in field blank or replicate data are discovered during the course of this study sample collection or handling procedures will be altered if needed or the data will censored to appropriate levels prior to interpretation.

Quality assurance data for the two non-USGS laboratories used as part of this study will be compared with quality assurance data collected as part of previous work (Izbicki and others, 2009). Internal laboratory practices within those laboratories will be assessed on the basis of standard operating protocols provided by the laboratories.

One unexpected result from the preliminary data collection in July 2009 was the general absence of FIB in shallow groundwater. Historical data from sampled wells (Stone Environmental, 2004) suggests that FIB are present in water from some wells but that concentrations in wells are variable. The variation appears random although there may be some seasonality to the variability in some wells. To quality assure FIB data from wells, FIB and nutrient concentrations will be monitored in water from selected wells during well purging. The data will be used to determine the minimum purge volume required to collect a representative FIB sample and assess the effect of inadequate purging on FIB and nutrient concentrations.

Tracer Data

Isotopic, genetic, molecular, wastewater indicator data are proposed for this study to trace the movement of water and bacteria through the hydrologic flow system. Other tracers used in this study evaluate changes in the chemical composition of nutrients and dissolved organic carbon as water flows through the system. No single hydrologic or bacteriological source tracking technique provides truly unique identification of the source or hydrologic history of a water sample or of bacteria. As a consequence, tracer data, used in both the synoptic and time-series data collection, are intended to constrain interpretations derived from traditional hydrologic or microbiological data.

The following discussion provides information of the theoretical basis of each proposed tracer and examples of the application of these data from the preliminary 2009 data collection. Examples of applications of tracer data provided in this proposal are intended for illustrative purposes, and are not intended to be definitive interpretations of those data.

Isotopic data—Isotopes are atoms of the same element (atoms having the same number of protons) but different number of neutrons. Isotopes may be stable and their abundance does not change with time, or radioactive and their abundance changes through radioactive decay with time. The difference in atomic mass caused by the difference in the number of neutrons causes slight but measurable differences in the physical, chemical, and biological reactions of different isotopes. Radioactive decay, measured as the time it take for half of the isotope to change into another element (half-life), produces an atomic clock that can be used to measure physical, chemical, or biological reaction rates. Isotopic data collected and analyzed as part of this study will be used to determine the source and hydrologic history of water (oxygen-18 and deuterium), groundwater discharge rates (^{222}Rn), and processes effecting nitrate and ammonia concentrations ($\delta^{15}N$ and $\delta^{18}O$ of nitrate and $\delta^{15}N$ of ammonia).

Oxygen-18 and deuterium—Oxygen-18 and deuterium are naturally occurring stable (non-radioactive) isotopes of oxygen and hydrogen, respectively. Oxygen-18 and deuterium abundances are reported as ratios of the heavier isotope (oxygen-18 or deuterium) to the more common lighter isotope (oxygen-16 or hydrogen) using delta (δ) notation in per mil (parts per thousand) differences relative to the standard known as Vienna Standard Mean Ocean Water (VSMOW) (Gonfiantini, 1978). By convention the value of VSMOW is 0 per mil. $\delta^{18}O$ and δD ratios can be measured more accurately than absolute abundances, with precisions of about ± 1 per mil and ± 0.1 per mil, respectively. When using this notation samples having less-negative δ values contain more of the heavier isotope than samples having more-negative δ values.

Most of the world's precipitation originates as evaporation of seawater. As a result, the $\delta^{18}O$ and δD composition of precipitation throughout the world is linearly correlated and distributed along a line known as the meteoric water line (Craig, 1961). Atmospheric and hydrologic processes combine to produce broad global and regional differences in the $\delta^{18}O$ and δD composition of water. These processes provide a record of the source and hydrologic history of the water.

Water that condensed from precipitation in cooler environments at higher altitudes or higher latitudes is isotopically lighter, or more negative, than water that condensed in warmer environments or lower latitudes (International Atomic Energy Agency, 1981). In the study area, water imported for public supply from northern California or from the Colorado River is isotopically lighter than water derived from local precipitation (shown as the composition at Santa Maria, Calif.) (fig. 15). The more negative values in water from wells SMBRP-11 and SMBRP-12 suggest a higher fraction of imported water in those samples compared to water from other wells. Water from wells SMBRP-11 and SMBRP-12 also had the highest nitrate and ammonia concentrations of all sampled wells, respectively. Water from these wells was presumably used for public supply and discharged through septic systems to groundwater. In contrast, near zero values were measured in near-shore ocean water, and a less negative value was measured in saline water from well CCPE adjacent to Malibu Lagoon (fig. 15). Well CCPE is the only sample well that had significant concentrations of FIB (Table 1). Assuming the only source of salinity in water from well CCPE is ocean water (that entered shallow groundwater through Malibu Lagoon) water from well CCPE is about 0.18 seawater. Native water in this sample would have had an initial $\delta^{18}O$ and δD composition of about -5.4 and -40 per mil, respectively—similar to water from other wells in the commercial area near the lagoon. The $\delta^{18}O$ and δD composition of water from well CCPE and other wells in the commercial area is similar to the expected composition of groundwater recharged from local precipitation and heavier than the composition of imported water. These data suggests the presence of only a small fraction of imported water discharged from septic systems in the commercial area near the lagoon.

Additional $\delta^{18}O$ and δD will be used to establish the hydrologic link between imported water, discharged from septic systems or other sources, and FIB and nutrient concentrations. $\delta^{18}O$ and δD data collection, in the commercial area near Malibu Lagoon will help resolve the apparent absence of imported water having a septic history in this area.

Radon-222—Radon-222 (^{222}Rn) is a naturally-occurring radioactive isotope produced by the decay of radium-226 (^{226}Ra) in the uranium-238 (^{238}U) decay series. ^{222}Rn has a half-life of 3.8 days. Radon, the heaviest of the noble gases, does not react chemically and is highly mobile in groundwater (Swarzenski, 2007). ^{222}Rn concentrations in groundwater are commonly several orders of magnitude higher than concentrations in surface water or ocean water. Diffusion of ^{222}Rn from sediments is small and ^{222}Rn activities in surface water and near-shore ocean water reflect the discharge of shallow groundwater (Burnett and Dulaiova, 2003; Swarzenski and Izbicki, 2009). ^{222}Rn in surface water and near-shore ocean water will be measured on a near-continuous basis using an air/water exchanger and a radon-in-air monitor. ^{222}Rn data average groundwater discharge over larger volumes than point measurements (such as those obtained from seepmeters) and are often a better indicator of groundwater discharge than point measurements (Swarzwenski and Izbicki, 2009).

In July 2009, ^{222}Rn activities in water from 8 wells ranged from 650 to 1,370 dpm/L (disintegrations per minute per liter). ^{222}Rn activities in Malibu Lagoon ranged from 8 to 62 dpm/L. Preliminary analysis of ^{222}Rn data show groundwater discharge to the upstream part of Malibu Lagoon (ML-Upper, fig. 3) averaged 2.8 cm/d between July 21-26, 2009 (fig. 6). This value agreed well with a model derived average groundwater discharge rate to Malibu Lagoon of 3.2 cm/d. A lower groundwater discharge rate of 0.8 cm/d was obtained in the downstream part of the lagoon between July 24-25, 2009. ^{222}Rn activity data collected in the near-shore ocean adjacent to Malibu lagoon and adjacent to unsewered residential development near Malibu Colony in November 2009 showed increased groundwater discharge was associated with low tidal stands at both locations (fig. 12). FIB concentrations in the near-shore ocean adjacent to Malibu Lagoon increase during low tide (fig. 9 and 12) but did not increase during low tide adjacent to unsewered residential development in Malibu Colony.

Additional ^{222}Rn data, coupled with FIB and nutrient data, will be collected during falling tidal cycles to extend results obtained during 2009 sample collection to different hydrologic conditions. Groundwater discharge rates to Malibu Lagoon and to the near-shore ocean calculated from ^{222}Rn data will be used to determine the timing of groundwater discharge, and to calculate the flux of FIB and nutrients from groundwater to these environments using method described by Swarzenski and Izbicki (2009) and Izbicki and others (2009). Additional data collected in Malibu Lagoon will be used to bracket the range in average and maximum groundwater discharge rates under different hydrologic conditions.

Delta nitrogen-15 and delta oxygen-18 of nitrate, and delta nitrogen-15 of ammonia—There are two stable isotopes of nitrogen: nitrogen-14 (^{14}N) and nitrogen-15 (^{15}N). The average $^{15}N/^{14}N$ ratio in atmospheric air (1/272) is constant. Nitrogen isotope abundances are reported as ratios using delta (δ) notation in per mil differences relative to the $^{15}N/^{14}N$ ratio of nitrogen gas in atmospheric air (Coplen and others, 2001). By convention the $\delta^{15}N$ value of nitrogen gas in atmospheric air is 0 per mil. $\delta^{15}N$ isotope ratios can be measured with a precision of about $\pm$ 0.2 per mil. Positive $\delta^{15}N$ values contain more of the heavier isotope, and negative $\delta^{15}N$ values contain less of the heavier isotope than atmospheric nitrogen gas.

The biological reactivity and the wide range of oxidation states in nitrogen compounds results in a wide range in $\delta^{15}N$ isotopic compositions spanning more than 200 per mil relative to standard atmospheric nitrogen gas (Coplen et al., 2002). Despite this wide range, the $\delta^{15}N$ isotopic composition of ammonia in septage is relatively constant averaging 4.9 $\pm$ 0.4 per mil (Hinkle and others, 2008). The $\delta^{15}N$ isotopic composition of nitrate derived from septage varies more widely, averaging 7.2 $\pm$ 2.6 per mil (Hinkle and others, 2008). The range in $\delta^{15}N$ composition of nitrate derived from septic tank discharges is not random, instead higher $\delta^{15}N$ values of nitrate result from more extensive loss of nitrogen through biological processes during the conversion of ammonia in septic waste to nitrate and lower $\delta^{15}N$ values result from less loss of nitrogen. In the environment, the isotopic composition of nitrate from septic discharges can be further altered as a result of processes such as denitrification. As nitrate is converted to nitrogen gas during denitrification, nitrate is lost from the system and the $\delta^{15}N$ composition of residual nitrate increases as nitrate concentrations decrease. Interpretation of nitrogen isotope data from septic discharges is complicated by loss on nitrogen through the volatilization of ammonia, addition of nitrogen from other sources including fertilizer and animal wastes, and by the number and complexity of biological reactions that can alter the $\delta^{15}N$ isotopic composition of nitrate and ammonia. The $\delta^{18}O$ composition of oxygen in the nitrate molecule can be used to understand some of the complexity and in some cases to distinguish nitrate from septic and fertilizer sources (Kendall, 1998). The combination of chemical and isotopic data will be used to understand environmental processes controlling ammonia and nitrate concentrations in groundwater, Malibu Lagoon and near-shore ocean water.

In July 2009, the nitrogen concentrations (ammonia plus nitrate as nitrogen) in water sampled from a traditional and an advanced septic tank were 42.9 and 3.4 mg/L as nitrogen, respectively. The nitrogen was primarily in the form of ammonia and the $\delta^{15}N$ composition of ammonia was consistent with literature values and ranged from 5.3 to 5.4 per mil. At that time, the $\delta^{15}N$ range for ammonia in groundwater was between 19 to 23 per mil, the $\delta^{15}N$ composition of nitrate ranged from 15 to 102 per mil, and the $\delta^{18}O$ composition of nitrate ranged from 0.9 to 21 per mil. The average ammonia and nitrate concentrations in sampled wells were 1.7 and 1.5 mg/L as nitrogen. Decreases in ammonia and nitrate concentrations and changes in isotopic compositions in groundwater are consistent with nitrogen losses from septic discharges through denitrification or other processes.

Interpretation of chemical and nitrogen isotopic data is complicated by the wide, often overlapping range in concentration and isotopic composition of nitrate from different sources, and by the changing isotopic composition of nitrate as reactions proceed (Xue et al., 2009). Additional nitrogen isotope data will be used to evaluate nitrogen contributions form other sources, and to determine if denitrification or other processes are occurring in the groundwater system. If these processes are occurring, additional data will help determine the extent these processes act to reduce the nutrient discharges to Malibu Lagoon and the near-shore ocean.

Genetic, molecular, and wastewater indicator data—Genetic (Terminal-Restriction Fragment Length Polymorphism and human-specific *Bacteroidales*), molecular (phospholipid fatty acids), and wastewater indicator data will be used to evaluate to source of bacteria of the hydrologic history of a water sample with respect to septic discharges No single hydrologic or bacteriological source tracking technique provides truly unique identification of the source or hydrologic history of a water sample or bacteria. The combination of genetic, molecular, and chemical tracers used in conjunction with the isotopic data discussed previously is intended to confirm, refine, or refute possible interpretations on the movement of water and bacteria in this complex hydrologic setting. Additional data collection will extend results from the 2009 preliminary sample collection to a wider range of hydrologic conditions.

Genetic data—Genetic diversity in microbial populations is assessed using Terminal-Restriction Fragment Length Polymorphism (T-RFLP) data. T-RFLP uses restriction enzymes to break genetic material within the hypervariable region of mitochondrial DNA into smaller fragments known as amplicons. Amplicons having different number of base pairs (amplicon length) represent different microorganisms. However, the sequence of base pairs within amplicons of the same length may be greatly different, and more than one microorganism may be represented within a single amplicon. Quantitative polymerase chain reaction (qPCR) is used to amplify DNA in a water sample to measurable concentrations, and the electropherogram peak area is a measure of the abundance of an amplicon and the microorganism(s) from which it originated.

Amplicons that appear in more than one sample are common to those samples, and potentially represent the same organism. Amplicons that appear in only one sample are unique to that sample, and represent unique microorganisms. Comparison of common and unique amplicons in samples from different settings allows understanding of the similarities and differences in the microbial community in those settings. This approach is known as microbial community structure analysis (CSA).

Comparison of T-RFLP amplicons from Malibu Lagoon (ML-Berm), a peiziometer driven into the berm of the lagoon to a depth of 5 feet (ML-Berm-Pz5), and the near-shore ocean at low tide shows a number of different amplicons representing the microbial communities in each of these samples (fig. 16). Malibu Lagoon is the least diverse of the three communities and the microbial population is dominated by 2 amplicons having lengths of 520 and 690 base pairs (M-spl and H-ha1 restriction enzymes, respectively). These amplicons also are present in water sampled from the pieziometer and from the near-shore ocean at low tide. Common amplicons indicate the potential presence of the same organisms in each sample. This result is consistent with bacterial transport from the lagoon to in the near-shore ocean as seepage through the berm at low tide. In contrast, little similarity was observed in the amplicons representing microbial communities in septic tanks, shallow groundwater and the near-shore ocean at high and low tide near Malibu Colony. Those data suggest large differences in the microbial community between these samples. Although water may flow from the septic tanks to discharge at the near-shore ocean the microbial community is greatly altered and transport of individual bacteria is probably limited from septic tanks to the near-shore ocean is probably.

As the number of amplicons within individual samples and the number of samples being compared increases, microbial CSA becomes increasingly complex. Statistical approaches such as Principal Component Analysis (discussed later in this proposal) are used for these more complex microbial CSA.

Human-specific *Bacteroidales* is a tracer of the origin of fecal material and FIB in a water sample. Although fecal material from other mammals, birds, and in some cases even fish also may produce low positive detections of *Bacteroidales*; and dilution, sorption, or other processes may cause *Bacteroidales* concentrations to be below the detection limit even when small amounts of human fecal material are present—human-specific *Bacteroidales* is considered to be one of the most robust indicators of human fecal contamination.

Human-specific *Bacteroidales* were quantifiable in samples collected within the two septic systems sampled in Malibu Colony (MC-OLD-Septic and MC-ADV-Septic) (Table 4). Human-specific *Bacteroidales* concentrations were higher in the sample collected from within the traditional septic system (MC-OLD-Septic) than the sample collected within the advanced septic system (MC-ADV-Septic). High concentrations of human-specific *Bacteroidales* in samples from septic system are not unexpected. Human-specific *Bactertoidales* were present but not quantifiable from one well (P-9) near commercial septic discharges adjacent to Malibu Lagoon, and in water extracts from kelp and sand (Kelp extract and Sand extract). Well CCPE which had the highest FIB concentrations was not analyzed for *Bacteroidales*. Human-specific *Bacteroidales* were not detected in other groundwater samples, samples from Malibu Lagoon, and samples from near-shore ocean water. The absence of human-specific *Bacteroidales* in water from Malibu Lagoon is consistent with results by Ambrose and Orme (2000).

Molecular data—Fatty acids are components of all living cells. Because phospholipid fatty acids (PLFAs) contain phosphorus, they are rapidly degraded in the environment and are typically associated with living (or recently living) organisms. At the cellular level, they may be used for energy storage, or they may be part of cellular organelles and structures where they participate in metabolic activities (Tunlid and White, 1992). Individual PLFAs are associated with specific metabolic activities by a wide-rage of microorganisms (Haack and others, 1994). In contrast to genetic data which identify different microorganisms, PLFA data identify what the microorganisms are doing. PLFA data are highly robust and are often able to explain more of the variability in microbial community structure than genetic data (Izbicki, and others, 2009).

The distribution of PLFA structural groups in groundwater, Malibu Lagoon, and the near-shore ocean during July 2009 was analyzed using principal component analysis (PCA). The first three principal components explain 91 percent of the total variability in the PLFA data. PCA results show differences in the PLFA composition of microbial communities in samples from water-table wells and from near-shore ocean water (fig. 11). Samples from pieziometers and seepage samplers in beach sands are intermediate in composition, and samples from Malibu Lagoon are similar to samples from the near-shore ocean. The first and second principle components for samples collected from near-shore ocean water near Malibu Lagoon at low tide (ML-Berm-OF) are almost identical in PLFA composition to water from the lagoon (ML-Berm), consistent with seepage from the lagoon as a possible source of bacteria in the near-shore ocean water near the lagoon at low tide.

Wastewater indicator data—A suite of 69 organic compounds will be measured as part of this study. The compounds can be divided into a number of categories on the basis of their use and origin and include specific indicators of human septic contamination (Glassmeyer and others, 2005). Reporting limits for most analyzed compounds are within the part per trillion range, and detectable concentrations are generally below thresholds for public health or environmental concerns. Compounds analyzed as part of this study are anthropogenic and do not occur naturally. Many of these compounds, such as caffeine, fecal sterols, detergent metabolites, personal care products (PCPs), and pharmaceuticals lend themselves to specific interpretations of the origin of fecal contamination (Glassmeyer and others, 2005; Izbicki, and others, 2009).

Data collected during 2009 show the highest concentrations of wastewater indicator samples in the two sampled septic systems (MC-OLD Septic, and MC-ADV Septic), where more than 20 of these compounds were detected including caffeine, fecal sterols associated with human waste (such as 3-beta-corprastanol), several detergent metabolites, and a number of common PCPs and pharmaceuticals (such as DEET and triclosan). Fewer of these compounds were detected in pieziometers driven into the beach adjacent to the ocean and near the bottom of the seawall in Malibu Colony. However, the presence of caffeine, several detergent metabolites, and a wide range of PCPs suggest a possible wastewater origin to some of the sampled water—even though other indicators of septic contamination such as FIB and human-specific *Bacteriodales* were absent. Wastewater indicator compounds were almost completely absent in the near-shore ocean adjacent to Malibu Colony although one detergent metabolite and several PCPs associated with sunscreen use (such as DEET) were present at low tide. In contrast, wastewater compounds including caffeine, detergent metabolites, PCPs and pharmaceuticals were less than detection in Malibu Lagoon and in the near-shore ocean adjacent to the lagoon, and consequently do not suggest a wastewater origin—even though FIB concentrations in the lagoon exceed U.S. EPA single sample standards for recreational water.

Dissolved organic carbon and optical property data—Optical property data, including Ultraviolet (UV) absorbance, and Excitation Emission Spectroscopy, (EEM's) are use to evaluate to source of organic carbon in sample water (Leenheer, 2009; Izbicki and others, 2007).

Dissolved organic carbon data are important because of the high organic load associated with septic discharges. For example, water from the two sampled septic systems had DOC concentrations ranging from 19 to 23 mg/L. DOC concentrations of water from wells in unsewered residential areas near Malibu Colony (SMBPR-11, SMBRP-12, and SMBRP-13) ranged from 7.6 to 3.3 mg/L. These samples have been previously identified on the basis of their $\delta^{18}O$ and δD composition as containing a high fraction of imported water likely discharged to the groundwater through septic systems. Consistent with septic discharges, water from wells SMBRP-12 had the highest nitrate concentration of all sampled wells, 6.4 mg/L as nitrogen, and water from well SMBRP-13 had the highest ammonia concentration 12 mg/L as nitrogen. In contrast, water from wells in the commercial district near Malibu Lagoon that did not have $\delta^{18}O$ and δD compositions consistent with imported water had low dissolved organic carbon concentrations typical of native groundwater of about 1.8 mg/L. DOC concentrations in Malibu Lagoon were higher than those in shallow groundwater and ranged from 8.7 to 3 mg/L. Optical property data are intended to evaluate changes in DOC composition as concentrations decrease and to be used as tracers of DOC from different sources.

Statistical Analysis of Data—Principal Component Analysis (PCA) will be used to analyze tracer data collected as part of this study. PCA is a multivariate statistical technique that transforms a set of intercorrelated variables into a new coordinate system. The transformed variables, known as principal components, are uncorrelated linear combinations of the original variables. They have a mean of zero and the same variance as the original data set. The values of the principal components are known as scores, and the scores are calculated on the basis of the contribution of each variable to the principal component. The magnitude and direction (plus or minus) of the contribution of each variable to the principal-component score is described by an eigenvector. PCA presents differences in the tracer assemblage that is reflective of differences in the microbial community structure, and allows for a comparison and contrast of different samples. Comparison of results from different tracers is intended to confirm, refine, or refute interpretations derived from individual tracers—thereby producing a more robust interpretation of the sources of FIB and the hydrologic processes that control the occurrence of high concentrations of FIB in the study area.

Understanding of the processes controlling FIB occurrence will be used to interpret regulatory data having longer periods of record, but less analytical, temporal and spatial detail. Logistic regression will be used to attempt develop explanatory relationships between hydrologic processes such as tidal conditions and lagoon water levels. Many regulatory FIB data and supporting ancillary data sets in the area have sufficiently long periods of record to permit development of the regression equations with part of the data and subsequent testing the predictive power of the equations with the remainder of the data.

REPORTS

A journal article describing the results of preliminary data collection will be prepared during FY-10. A final report from this project will be prepared during FY-11. The final paper will compare and contrast the distribution and source of FIB in shallow groundwater, Malibu Lagoon, and near-shore ocean water near Malibu, California. Both papers will use processes identified as part of this study to interpret regulatory data having longer periods of record, but less temporal and spatial detail. The final paper will be submitted to an appropriate journal by September 2011.

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LIST OF FIGURES

Figure 1.—Study area location
Figure 2.—Ocean tides, Malibu lagoon water levels, salinity and temperature, streamflow in Malibu Creek, and precipitation data, near Malibu, California, 2009
Figure 3—Groundwater sample sites, Malibu, California, 2009
Figure 4.—Surface water sample sites, Malibu California, 2009
Figure 5.—Ocean tides, surface swell, and water level data for selected wells, Malibu California, July 6 to August 5, 2009
Figure 6.—Photograph showing seawall at Malibu Colony, Malibu California, July23, 2009
Figure 7.—Radon-222 (^{222}Rn) concentrations and calculated groundwater disharge to Malibu Lagoon (ML-Upper, figure 3), Malibu California, July 21-27-2009
Figure 8.—Water level, specific conductance, and fecal indicator bacteria (FIB) concentrations in water from Malibu Lagoon (ML-Berm, figure 3), Malibu California, July 21-26, 2009.
Figure 9.—Specific conductance and fecal indicator bacteria (FIB) concentrations in water from Malibu Lagoon (ML-Berm), pieziometers and seepage samplers in the berm separating Malibu Lagoon form the ocean, and in adjacent near-shore ocean water (ML-Berm-OF).
Figure 10.—Specific conductance and fecal indicator bacteria (FIB) concentrations in Malibu Lagoon and near-shore ocean water at selected beaches, Malibu Calif., July 21-26, 2009.
Figure 11.—Specific conductance and fecal indicator bacteria concentrations with depth in Malibu Lagoon, July 23, 2009
Figure 12.—Ocean tides, radon-222, specific conductance, and enterococcus data in the near-shore ocean adjacent to Malibu Lagoon, Malibu, Calif., November 9-11, 2009
Figure 13.—Shore perpendicular direct-current (DC) resistivity section through the berm separating Malibu Lagoon from the ocean, July 24, 2009 (location of section shown on figure 3)
Figure 14.—Shore parallel direct-current (DC) resistivity section along Malibu Colony beachfront, Malibu California, July 26, 2009 (Location of section shown of figure 3)
Figure 15.—delta Deuterium and a function of delta Oxygen-18 in water from selected wells and septic systems, Malibu California, 2009.
Figure 16.—Terminal-Restriction Fragment Length Polymorphism (T-RFLP) amplicons from selected sites in Malibu Lagoon, the berm separating the lagoon from the ocean, and the near-shore ocean adjacent to the lagoon, Malibu, Calif., July 25, 2009

LIST OF TABLES

Table 1.—Fecal indicator bacteria (FIB) concentrations in water from selected wells, Malibu, California, July 21-26, 2009
Table 2.—Major-ions, selected minor and trace elements, and nutrient concentrations to be determined as part of this study.
Table 3.—Wastewater indicators to be determined as part of this study.
Table 4.—Human-specific *Bacteroidales* concentrations near Malibu, California, July 2009

Figures

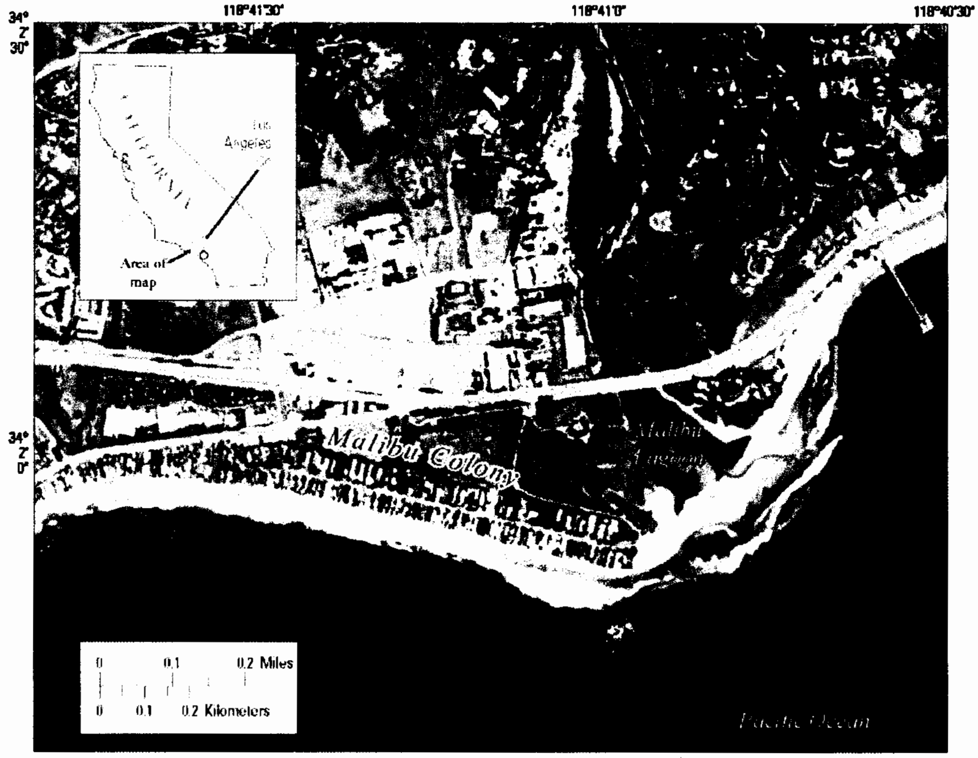


Figure 1.—Study area location

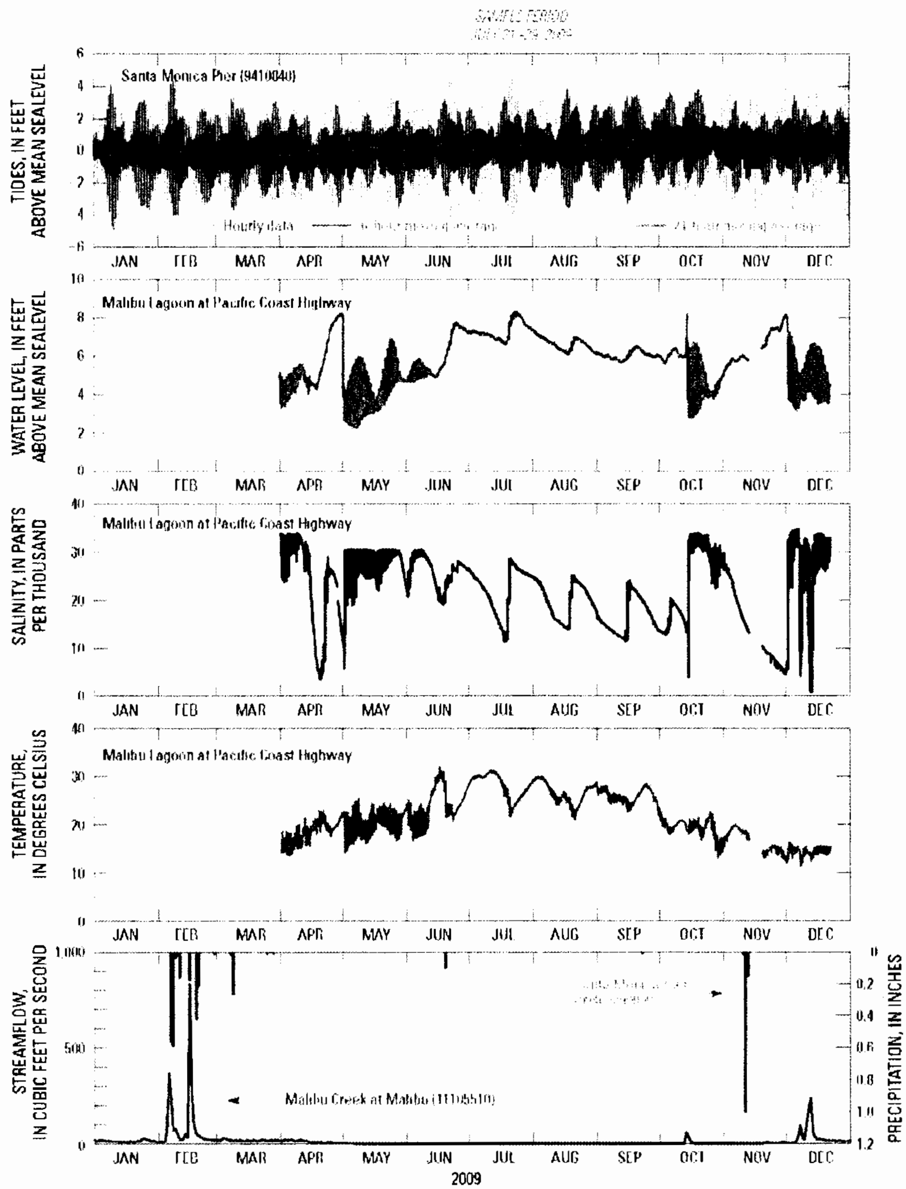


Figure 2.—Ocean tides, Malibu lagoon water levels, salinity and temperature, streamflow in Malibu Creek, and precipitation data, near Malibu, California, 2009

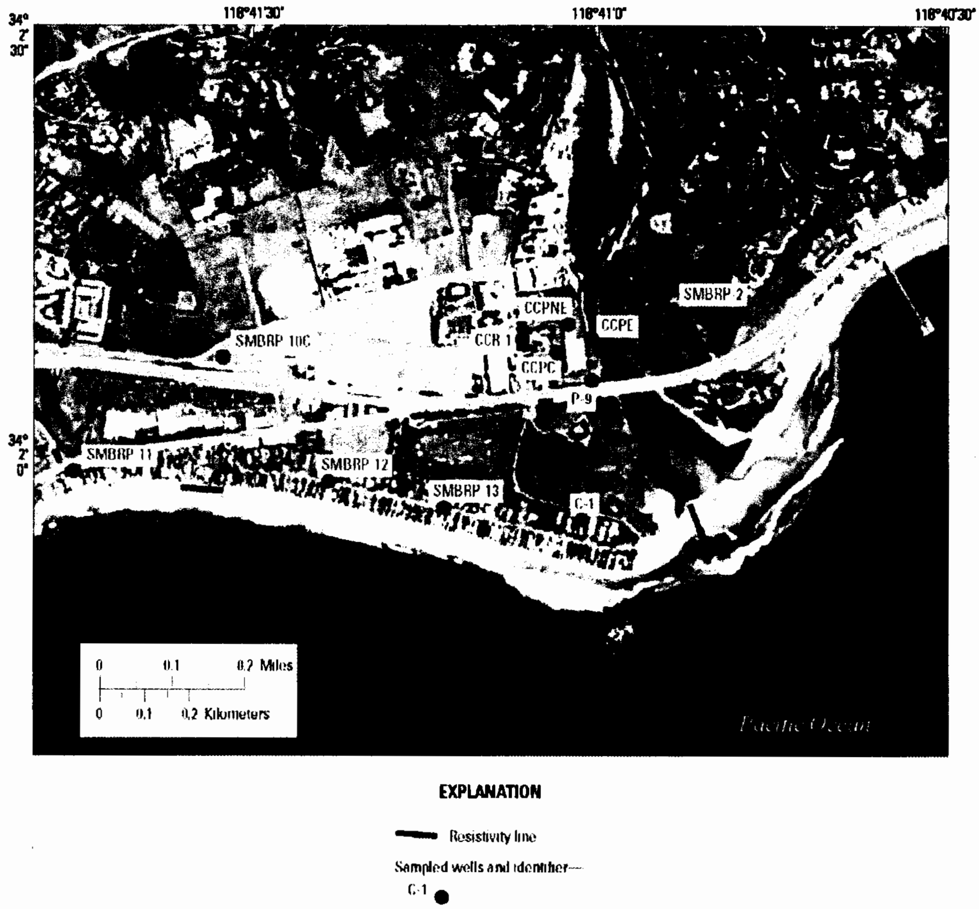


Figure 3—Groundwater sample sites, Malibu, California, 2009

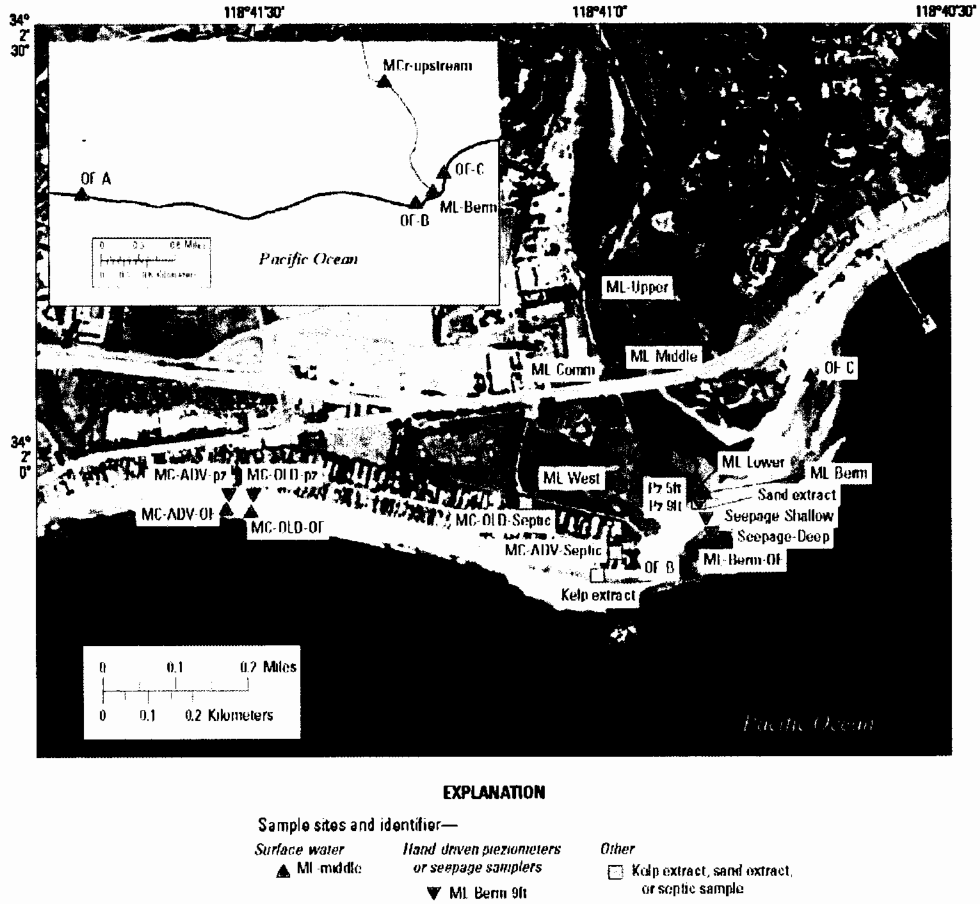


Figure 4.—Surface water sample sites, Malibu California, 2009

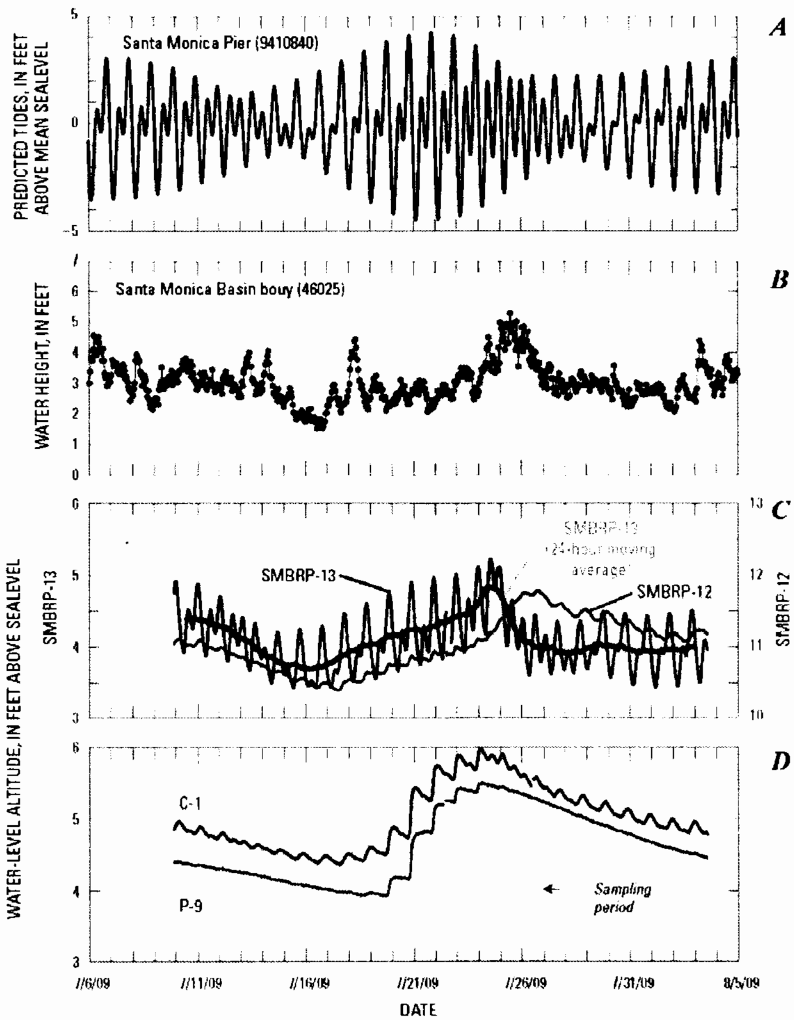


Figure 5.—Ocean tides, surface swell, and water level data for selected wells, Malibu California, July 6 to August 5, 2009

Figure 6.—Photograph showing seawall at Malibu Colony, Malibu California, July23, 2009

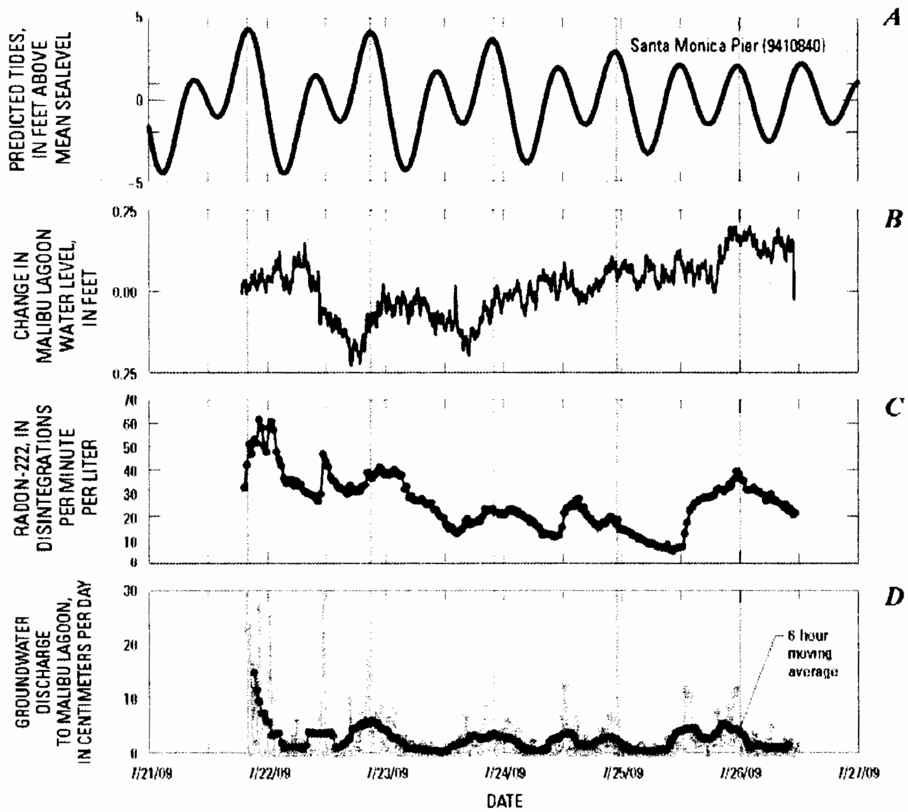


Figure 7.—Radon-222 (^{222}Rn) concentrations and calculated groundwater discharge to Malibu Lagoon (ML-Upper, figure 3), Malibu California, July 21-27-2009

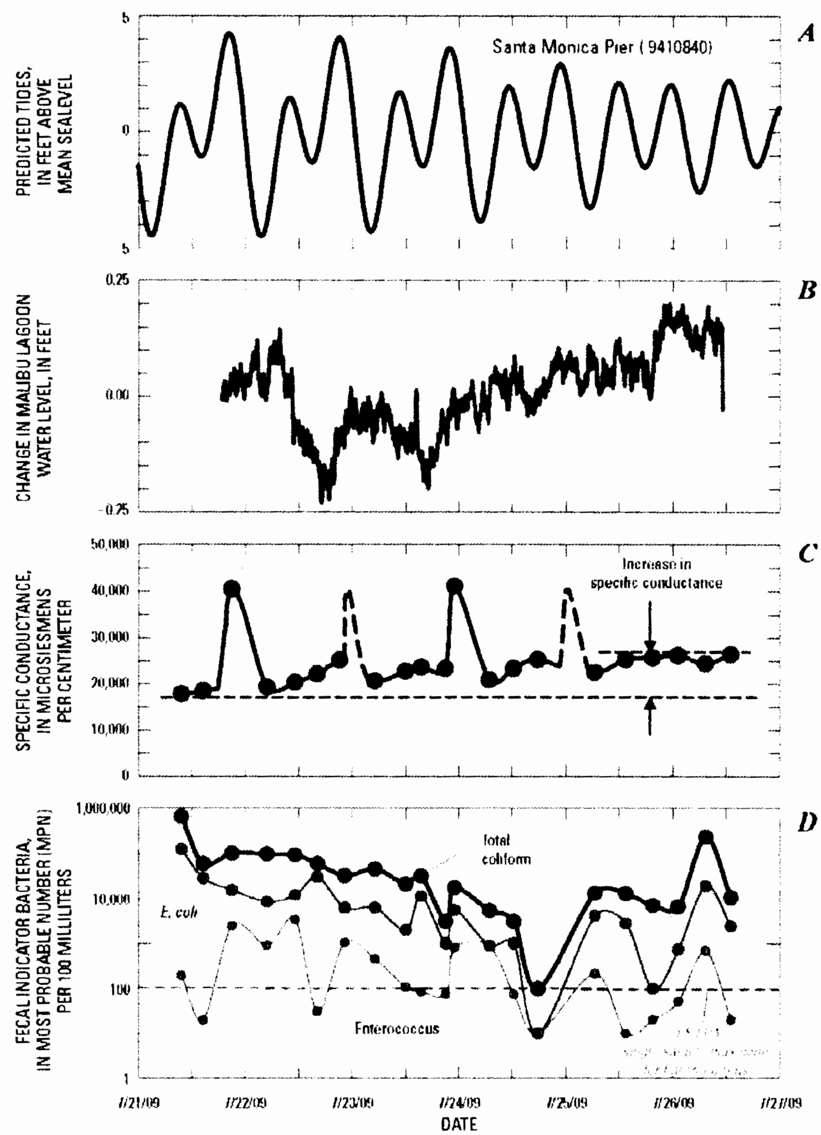


Figure 8.—Water level, specific conductance, and fecal indicator bacteria (FIB) concentrations in water from Malibu Lagoon (ML-Berm, figure 3), Malibu California, July 21-26, 2009.

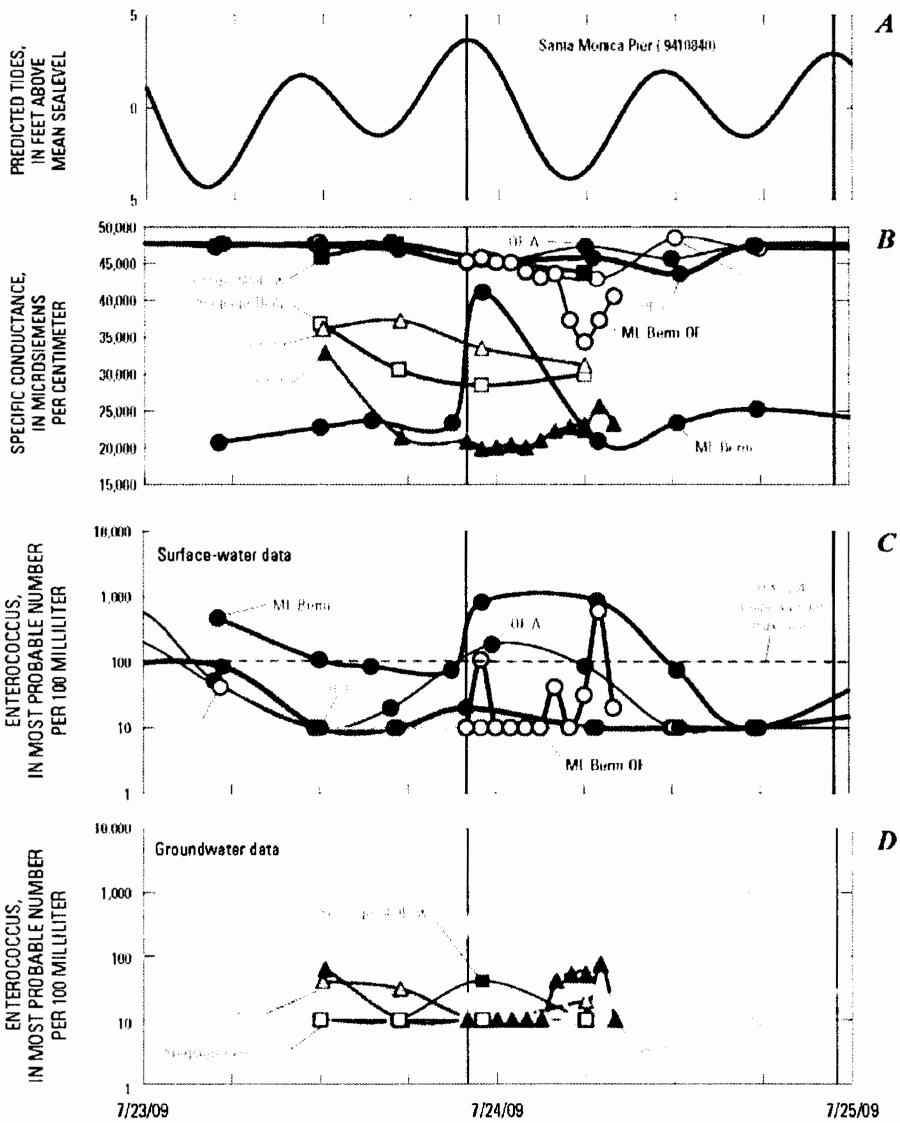


Figure 9.—Specific conductance and fecal indicator bacteria (FIB) concentrations in water from Malibu Lagoon (ML-Berm), piezometers and seepage samplers in the berm separating Malibu Lagoon form the ocean, and in adjacent near-shore ocean water (ML-Berm-OF).

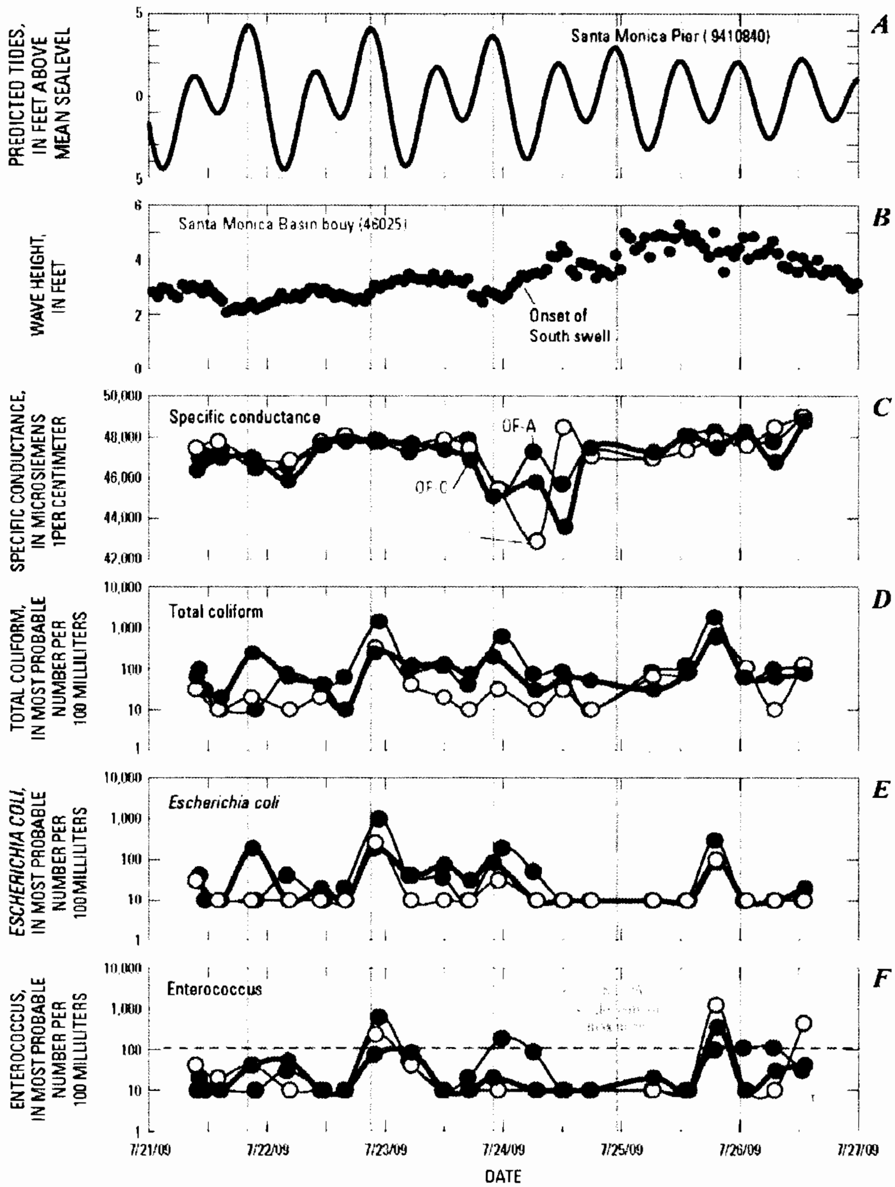


Figure 10.—Specific conductance and fecal indicator bacteria (FIB) concentrations in Malibu Lagoon and near-shore ocean water at selected beaches, Malibu Calif., July 21-26, 2009.

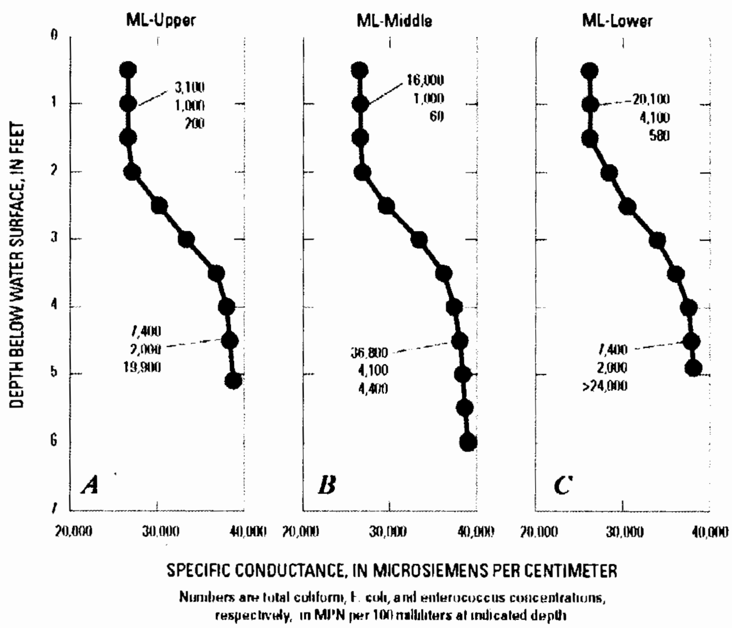


Figure 11.—Specific conductance and fecal indicator bacteria concentrations with depth in Malibu Lagoon, July 23, 2009

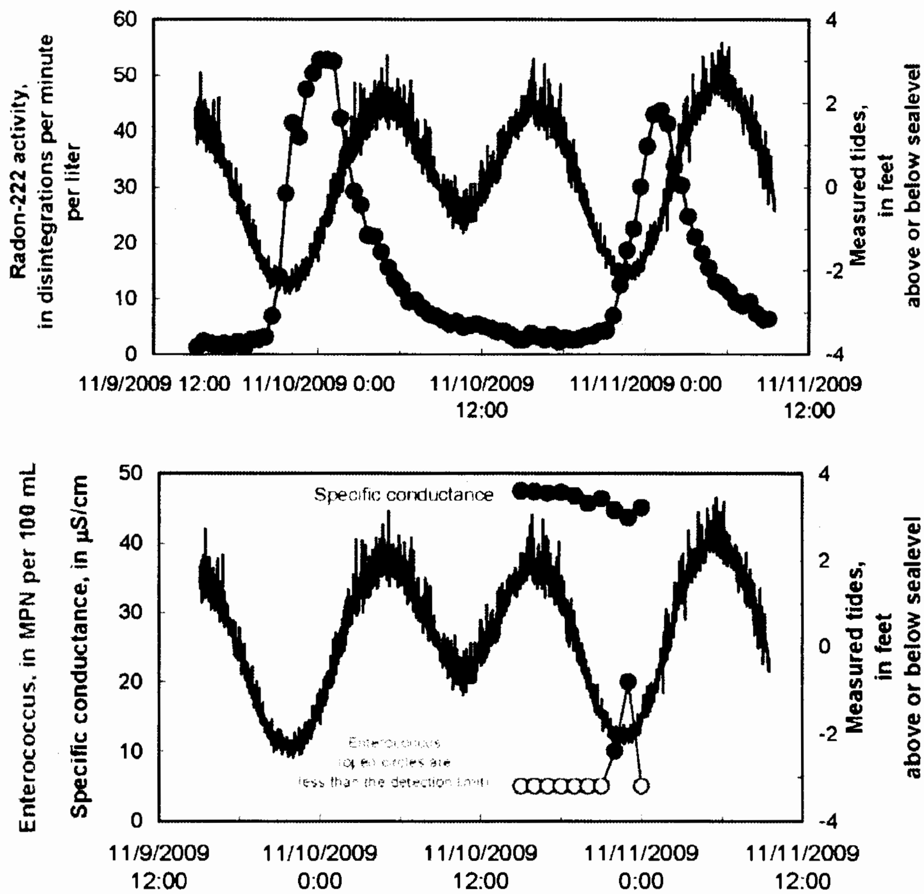


Figure 12.—Ocean tides, radon-222, specific conductance, and enterococcus data in the near-shore ocean adjacent to Malibu Lagoon, Malibu, Calif., November 9-11, 2009

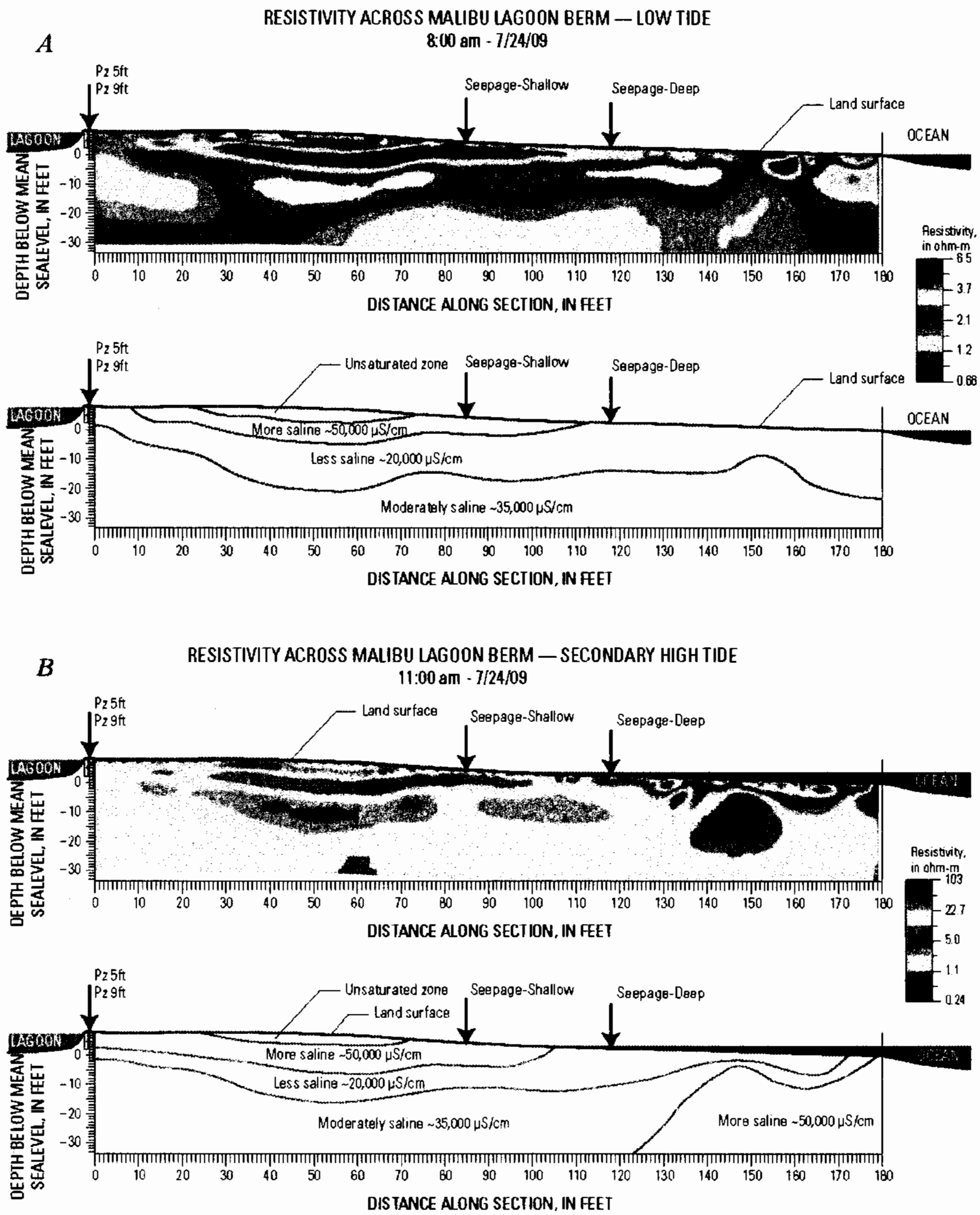


Figure 13.—Shore perpendicular direct-current (DC) resistivity section through the berm separating Malibu Lagoon from the ocean, July 24, 2009 (location of section shown on figure 3)

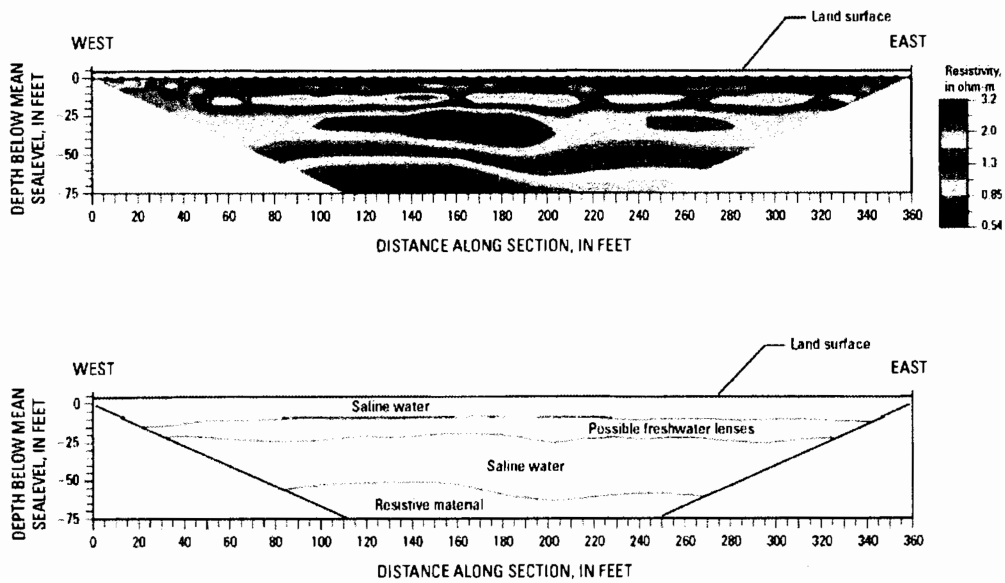


Figure 14.—Shore parallel direct-current (DC) resistivity section along Malibu Colony beachfront, Malibu California, July 26, 2009 (Location of section shown of figure 3)

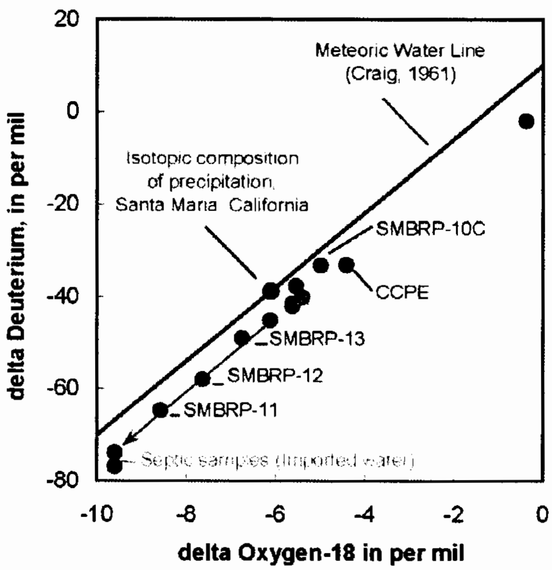


Figure 15.—delta Deuterium and a function of delta Oxygen-18 in water from selected wells and septic systems, Malibu California, 2009.

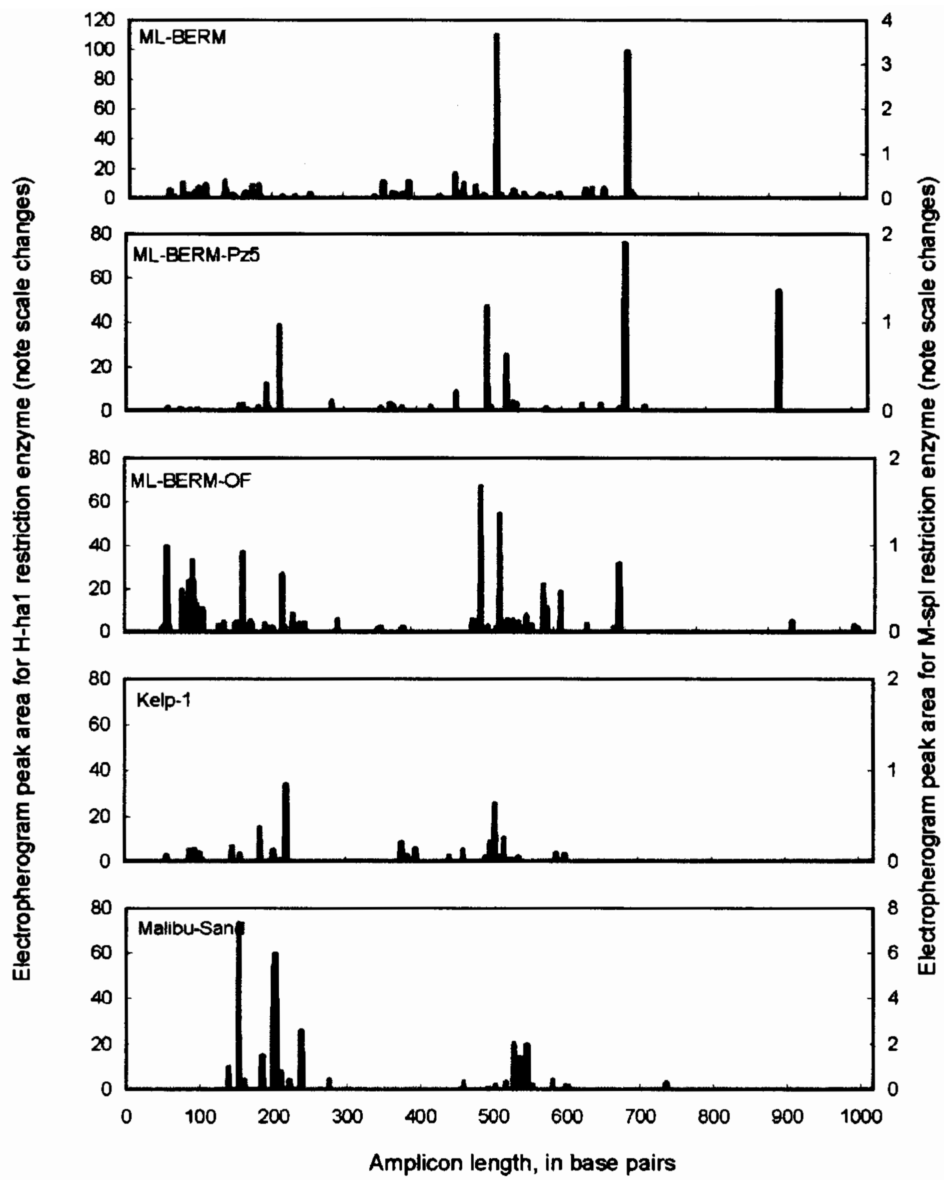


Figure 16.—Terminal-Restriction Fragment Length Polymorphism (T-RFLP) amplicons from selected sites in Malibu Lagoon, the berm separating the lagoon from the ocean, and the near-shore ocean adjacent to the lagoon, Malibu, Calif., July 25, 2009

Tables

Table 1.—Fecal indicator bacteria (FIB) concentrations in water from selected wells, Malibu, California, July 21-26, 2009

Table 1. Fecal indicator bacteria (FIB) concentration in water from selected water-table wells, Malibu, California, July 21-26, 2009.

[The five-digit parameter code below the constituent name is used by the U.S. Geological Survey to uniquely identify a specific constituent or property. C, Celsius; dpm/L, disintegrations per minute per liter; ft, feet; LSD, land surface datum; mg/L, milligrams per liter; mL, milliliters; MPN, most probable number; nc, not collected; µS/cm microsiemens per centimeter; <, less than;]

Well Identification No.	Date (m/dd/yyyy)	Time (24 hour)	Water level (ft below LSD)	Well depth (feet)	Dissolved oxygen, (mg/L) (00300)	pH (standard units) (00400)
SMBRP-10C	7/21/2009	14:45	6.12	25	2.9	7.2
SMBRP-11	7/21/2009	11:45	8.40	20	1	6.4
SMBRP-2	7/22/2009	13:15	5.34	11	0.4	7.1
SMBRP-12	7/22/2009	10:30	6.97	25	0.2	7.1
SMBRP-13	7/22/2009	14:30	7.47	20	1.7	7.3
P-9	7/22/2009	10:00	nc	12	0.3	7.1
CCR-1	7/24/2009	9:00	5.69	19	0.1	7.4
CCPE	7/23/2009	14:30	4.97	53	0.2	NR
CCPNE	7/23/2009	9:00	6.03	25	0.2	NR
CCPC	7/23/2009	10:25	5.76	22	0.2	NR
C-1	7/26/2009	11:45	4.47	14	0.1	7.3

Well Identification No.	Specific conductance (µS/cm at 25°C) (00095)	Total coliforms (MPN/100 mL) (50569)	*Escherichia coli* (MPN/100 mL) (50468)	*Enterococci* (MPN/100 mL) (99601)	Radon-222 (dpm/L)
SMBRP-10C	12,700	< 10	< 10	< 10	nc
SMBRP-11	2,960	< 10	< 10	< 10	nc
SMBRP-2	3,360	< 1	< 1	< 1	1,220 ± 189
SMBRP-12	3,820	< 1	< 1	< 1	650 ± 141
SMBRP-13	2,450	< 1	< 1	< 1	850 ± 158
P-9	2,000	< 1	< 1	< 1	1,340 ± 198
CCR-1	2,080	2	< 1	2	1660 ± 163
CCPE	10,800	11	65	1,600	1,050 ± 139
CCPNE	1,960	1	< 1	7.5	1,370 ± 160
CCPC	2,020	< 1	< 1	< 1	950 ± 134
C-1	22,300	< 10	< 10	< 10	nc

Table 2.—Major-ions, selected minor and trace elements, and nutrient concentrations to be determined as part of this study.

[CAS, Chemical Abstract Service; mg/L, milligrams per liter; µg/L, micrograms per liter]

Constituent	USGS Parameter Code	CAS Registry Number	Reporting Level	Units
Major ions, minor ions, and trace elements				
Alkalinity, laboratory	29801	471-34-1	8	mg/L
Aluminum	01106	7429-90-5	3.4	µg/L
Arsenic	01000	7440-38-2	0.044	µg/L
Barium	01005	7440-39-3	0.6	µg/L
Boron	01020	7440-42-8	2	µg/L
Bromide	71870	24959-67-9	0.02	mg/L
Calcium	00915	7440-70-2	0.044	mg/L
Chloride	00940	16887-00-6	0.12	mg/L
Fluoride	00950	16984-48-8	0.08	mg/L
Iodide	71865	7553-56-2	0.002	mg/L
Iron	01046	7439-89-6	6	µg/L
Lithium	01130	7439-93-2	0.06	µg/L
Magnesium	00925	7439-95-4	0.016	mg/L
Manganese	01056	7439-96-5	0.2	µg/L
pH, laboratory	00403		0.1	pH
Potassium	00935	7440-09-7	0.064	mg/L
Residue, 180 degrees Celsius (TDS)	70300		10	mg/L
Silica	00955	7631-86-9	0.2	mg/L
Sodium	00930	7440-23-5	0.10	mg/L
specific conductance, laboratory	90095		5	µS/cm
Strontium	01080	7440-24-6	0.4	µg/L
Sulfate	00945	14808-79-8	0.18	mg/L

Table 2 (cont.).—Major-ions, selected minor and trace elements, and nutrient concentrations to be determined as part of this study.

[CAS, Chemical Abstract Service; mg/L, milligrams per liter; µg/L, micrograms per liter]

Constituent	USGS Parameter Code	CAS Registry Number	Reporting Level	Units
Nutrients				
Nitrogen, ammonia as N	00608	7664-41-7	0.02	mg/L
nitrogen, ammonia + organic nitrogen	00623	17778-88-0	0.10	mg/L
nitrogen, nitrite	00613	14797-65-0	0.002	mg/L
nitrogen, nitrite + nitrate	00631		0.04	mg/L
Phosphorus	00666	7723-14-0	0.04	mg/L
phosphorus, phosphate, ortho	00671	14265-44-2	0.008	mg/L

Table 3.—Wastewater indicators to be determined as part of this study.
[CAS, Chemical Abstract Service; µg/L, micrograms per liter]

Compound	USGS Parameter code	CAS Registry Number	Reporting Level	Units
Cotinine	61945	486-56-6	0.8	µg/L
3,4-Dichlorophenyl isocyanate	63145	102-36-3	1.6	µg/L
4-Nonylphenol monoethoxylate, (sum of all isomers) aka NP1EO	61704		1.6	µg/L
4-tert-Octylphenol diethoxylate, aka OP2EO	62486		0.5	µg/L
4-tert-Octylphenol monoethoxylate, aka OP1EO	62485		1	µg/L
5-Methyl-1H-benzotriazole	61944	136-85-6	1.6	µg/L
Anthraquinone	62813	84-65-1	0.2	µg/L
Acetophenone	62811	98-86-2	0.4	µg/L
Acetyl hexamethyl tetrahydronaphthalene (AHTN)	62812	21145-77-7	0.2	µg/L
Anthracene	34220	120-12-7	0.2	µg/L
Atrazine	39630	1912-24-9	0.2	µg/L
1,4-Dichlorobenzene	34571	106-46-7	0.2	µg/L
Benzo[a]pyrene	34247	50-32-8	0.2	µg/L
Benzophenone	62814	119-61-9	0.2	µg/L
Bromacil	30234	314-40-9	0.8	µg/L
Bromoform	32104	75-25-2	0.2	µg/L
3-tert-Butyl-4-hydroxy anisole (BHA)	61702	25013-16-5	0.2	µg/L
Caffeine	81436	58-08-2	0.2	µg/L
Camphor	62817	76-22-2	0.2	µg/L
Carbaryl	39750	63-25-2	0.2	µg/L
Carbazole	77571	86-74-8	0.2	µg/L
Chlorpyrifos	38932	2921-88-2	0.2	µg/L
Cholesterol	62818	57-88-5	1.6	µg/L

Table 3 (cont.).—Wastewater indicators to be determined as part of this study.
[CAS, Chemical Abstract Service; μg/L, micrograms per liter]

3-beta-Coprostanol		62806	360-68-9	1.6	μg/L	
Isopropylbenzene		77223	98-82-8	0.2	μg/L	
N,N-diethyl-meta-toluamide (DEET)		61947	134-62-3	0.2	μg/L	
Diazinon		39570	333-41-5	0.2	μg/L	
Dichlorvos		30218	62-73-7	0.2	μg/L	
Bisphenol A		62816	80-05-7	0.4	μg/L	
Triethyl citrate (ethyl citrate)		62833	77-93-0	0.2	μg/L	
Tetrachloroethylene		34475	127-18-4	0.4	μg/L	
Fluoranthene		34376	206-44-0	0.2	μg/L	
Hexahydrohexamethylcyclopentabenzopyran (HHCB)		62823	1222-05-5	0.2	μg/L	
Indole		62824	120-72-9	0.2	μg/L	
Isoborneol		62825	124-76-5	0.2	μg/L	
Isophorone		34408	78-59-1	0.2	μg/L	
Isoquinoline		62826	119-65-3	0.2	μg/L	
d-Limonene		62819	5989-27-5	0.2	μg/L	
Menthol		62827	89-78-1	0.2	μg/L	
Metalaxyl		04254	57837-19-1	0.2	μg/L	
Metolachlor		82612	51218-45-2	0.2	μg/L	
Naphthalene		34696	91-20-3	0.2	μg/L	
1-Methylnaphthalene		81696	90-12-0	0.2	μg/L	
2,6-Dimethylnaphthalene		62805	581-42-0	0.2	μg/L	
2-Methylnaphthalene		30194	91-57-6	0.2	μg/L	
4-Nonylphenol diethoxylate, (sum of all isomers) aka NP2EO		61703		3.2	μg/L	
p-Cresol		77146	106-44-5	0.2	μg/L	

Table 3 (cont.).—Wastewater indicators to be determined as part of this study.
[CAS, Chemical Abstract Service; µg/L, micrograms per liter]

4-Cumylphenol		62808	599-64-4	0.2	µg/L	
para-Nonylphenol (total) (branched)		62829	84852-15-3	1.6	µg/L	
4-n-Octylphenol		62809	1806-26-4	0.2	µg/L	
4-tert-Octylphenol		62810	140-66-9	0.4	µg/L	
2,2',4,4'-Tetrabromodiphenylether (PBDE 47)		63147	5436-43-1	0.3	µg/L	
Phenanthrene		34461	85-01-8	0.2	µg/L	
Phenol		34694	108-95-2	0.2	µg/L	
Pentachlorophenol		39032	87-86-5	0.8	µg/L	
Tributyl phosphate		62832	126-73-8	0.2	µg/L	
Triphenyl phosphate		62834	115-86-6	0.2	µg/L	
Tris(2-butoxyethyl)phosphate		62830	78-51-3	0.2	µg/L	
Tris(2-chloroethyl)phosphate		62831	115-96-8	0.2	µg/L	
bis(2-Ethylhexyl) phthalate		39100	117-81-7	2	µg/L	
Diethyl phthalate		34336	84-66-2	0.2	µg/L	
Prometon		39056	1610-18-0	0.2	µg/L	
Pyrene		34469	129-00-0	0.2	µg/L	
Methyl salicylate		62828	119-36-8	0.2	µg/L	
Sample volume		99963			mL	
3-Methyl-1(H)-indole (Skatole)		62807	83-34-1	0.2	µg/L	
beta-Sitosterol		62815	83-46-5	1.6	µg/L	
beta-Stigmastanol		61948	19466-47-8	1.7	µg/L	
Triclosan		61708	3380-34-5	0.2	µg/L	
Tris(dichlorisopropyl)phosphate		61707	13674-87-8	0.2	µg/L	

Table 4. Human-specific *Bacteroidales* (HBM) concentrations near Malibu, California, July 2009

[ND = not detected. DNQ = detected but not quantifiable.]

Site identification (figs. 1 and 2)	Date	Time	qPCR Dilution (1:x)	HBM Copies per liter	HBM Standard error
Samples from wells and piezometers					
P-9	7/22/2009	10:00	5	DNQ	-
C-1	7/26/2009	11:45	5	ND	-
SMBRP-13	7/22/2009	14:30	10	ND	-
SMBRP-12	7/22/2009	10:30	5	ND	-
SMBRP-2	7/23/2009	13:15	5	ND	-
ML-BERM-Pz5'	7/23/2009	21:00	5	ND	-
Seepage-Deep	7/24/2009	6:00	5	ND	-
MC-ADV-Pz	7/25/2009	6:00	5	ND	-
MC-OLD-Pz	7/25/2009	6:00	10	ND	-
Samples from the near-shore ocean					
ML-BERM-OF (low tide)	7/24/2009	6:00	5	ND	-
MC-ADV-OF (low tide)	7/25/2009	6:00	10	ND	-
MC-OLD-OF (low tide)	7/25/2009	6:00	10	ND	-
MC-OLD-OF (high tide)	7/25/2009	13:00	10	ND	-
Samples from Malibu Lagoon					
ML-BERM	7/23/2009	21:00	10	ND	-
ML-Comm	7/24/2009	11:20	10	ND	-
ML-W	7/26/2009	12:45	5	ND	-
Samples from septic systems and special sources					
MC-OLD-Septic	10/1/2009	12:30	10	7.6E+07	1.3E+06
MC-ADV-Septic	10/1/2009	11:00	10/5*	4.2E+04	3.7E+03
Kelp extract	7/24/2009	17:00	10	DNQ	-
Sand extract	10/1/2009	8:00	5	DNQ	-

*Malibu Adv Septic, when run at 10 fold dilution was not within quantifiable range of the HBM qPCR assay. When run at 5 fold dilution, the sample results were within quantifiable range despite inhibition in this dilution in salmon testes qPCR.

DNQ—Detected but not quantifiable. Human-specific *Bacteroidales* is present in the sample but the concentration was less than the quantification limit obtainable from the laboratory standards. The DNQ concentration is dependent on sample volume, the amount of DNA extracted, and the dilution required to eliminate sample inhibition during the PCR reaction. The DNQ varied from sample to sample but the quantification limit would commonly be about 10^3 copies per liter.

ND—Not detected. Human-specific *Bacteroidales* was not detected in the sample. The ND concentration is dependent on sample volume, the amount of DNA extracted, and the dilution required to eliminate sample inhibition. The ND varied from sample to sample. Assuming 1 copy of *Bacteroidales* DNA per sample tray, a 5 to 1 dilution to eliminate inhibition during the PCR reaction, the addition of 2.5 µl of reagents, a 1-L sample containing 50 µg of DNA, and 100 percent efficiency in the PCR reaction—the limit of detection would be about 25 copies per liter. For a 10 to 1 dilution, the limit of detection would be about 50 copies per liter.

Summary of 2009 UCLA Study in Malibu Lagoon

Richard F. Ambrose
Jenny Jay
Vanessa Thulsiraj
Steven Estes

University of California, Los Angeles

Objectives

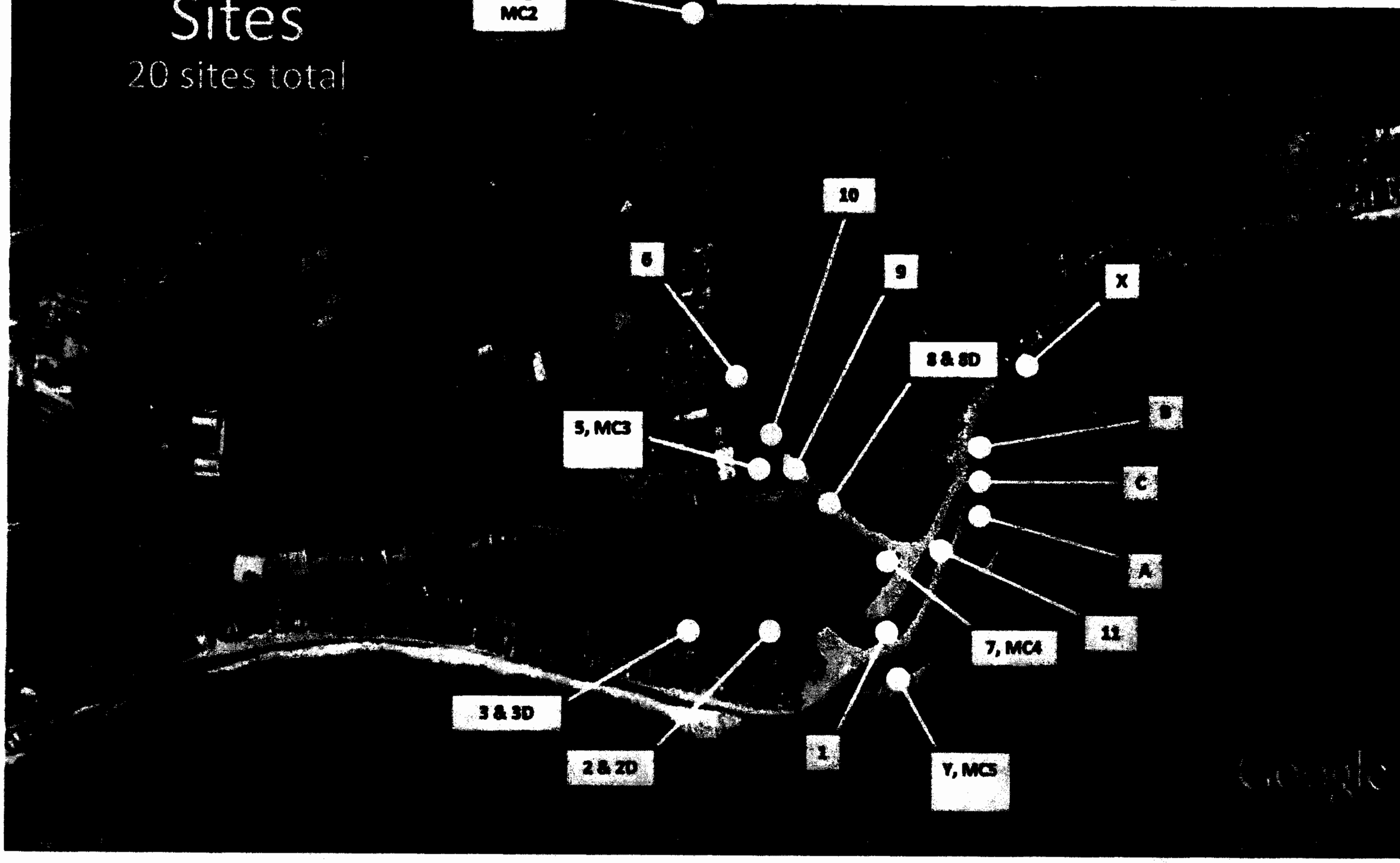
1) Determine Fecal Indicator Bacteria (FIB) and Human-specific Bacteriodes Marker (HBM) concentrations for the following environmental conditions

    a) Wet weather, open lagoon
    b) Dry weather, open lagoon
    c) Dry weather, closed lagoon

2) Compare traditional FIB concentrations to HBM concentrations

Map of Sample Sites

20 sites total



2 sites in Malibu Creek (site 4 & Bridge)
5 sites in Surfrider Beach (sites A, B, C, X, Y)
10 sites in Malibu Lagoon (sites 1-3, 5-11)
- 3 storm drains in Malibu Lagoon (2D, 3D, 8D)
- storm drains discharged during in wet weather

Study Design

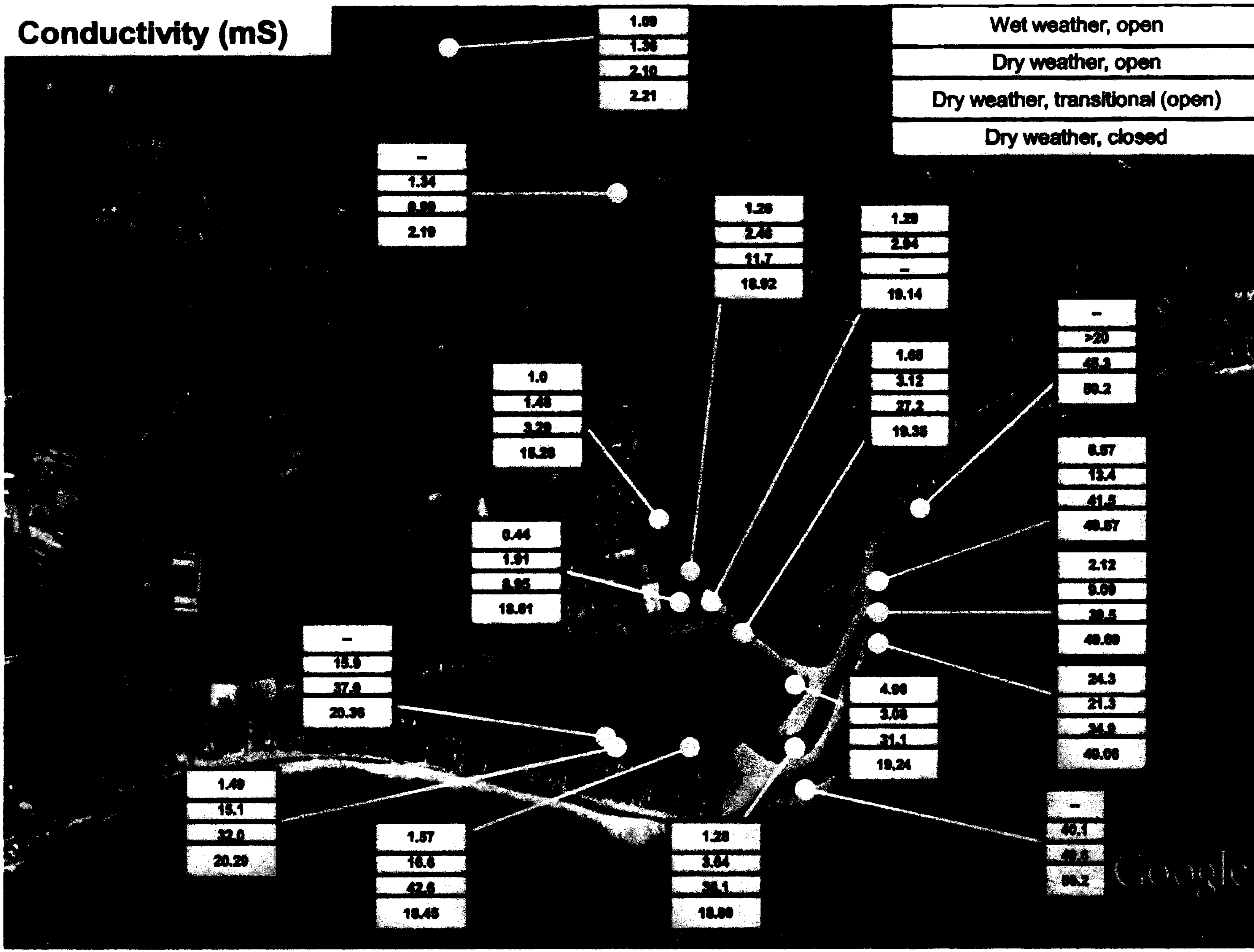
[redacted]

analyzed for HBM (1 sample had interference)

Additional City of Malibu Study

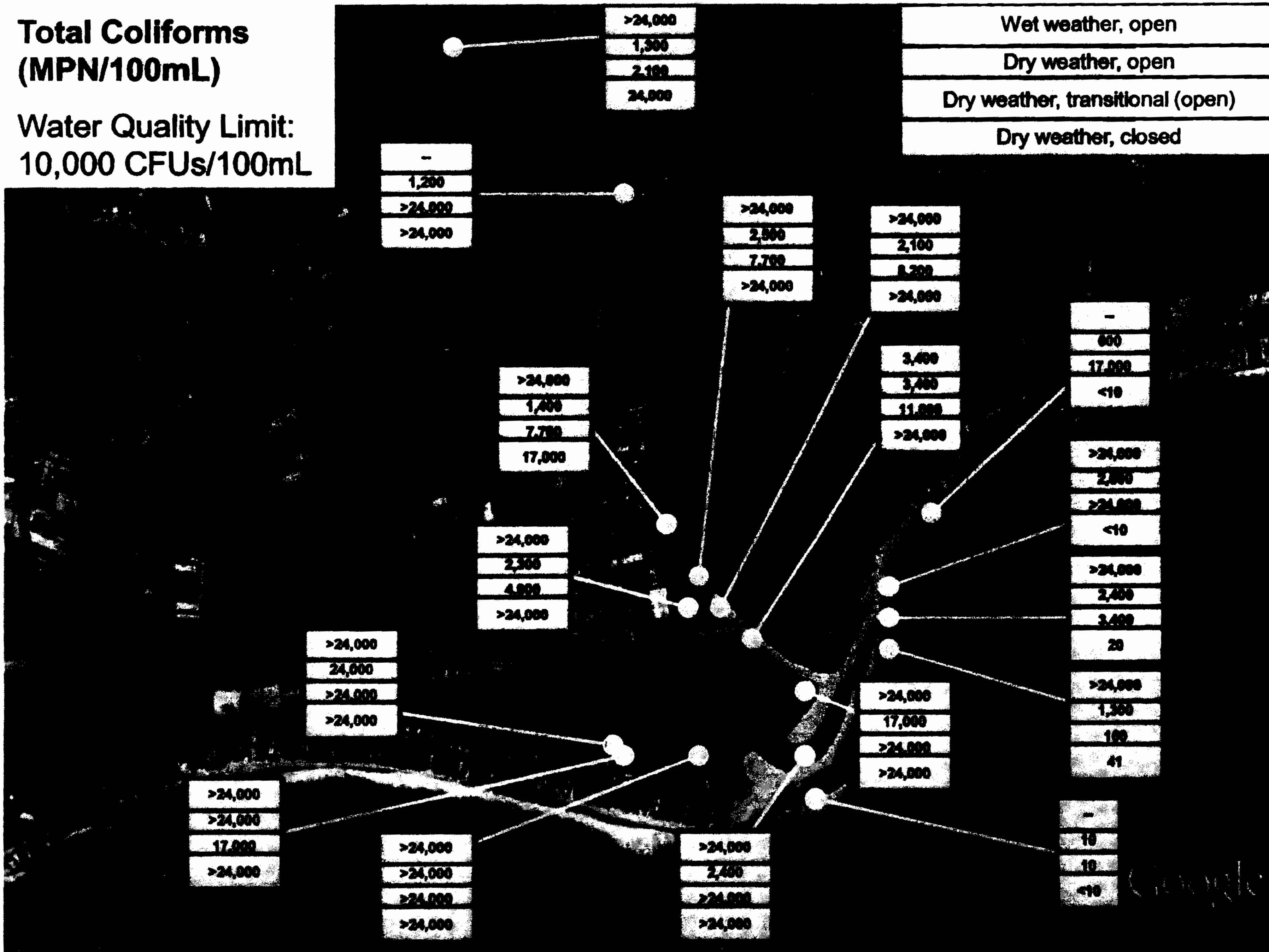
- 2 week study conducted in Malibu Creek and Lagoon
- 5 sample locations (MC1 – MC5) were further analyzed for presence of HBM
  - MC1 – MC4 sampled on 4/29
  - MC5 samples on 4/29, 4/30, 5/5, 5/7
  - No detection of HBM in any samples taken during this time (April/May)

Conductivity (mS)



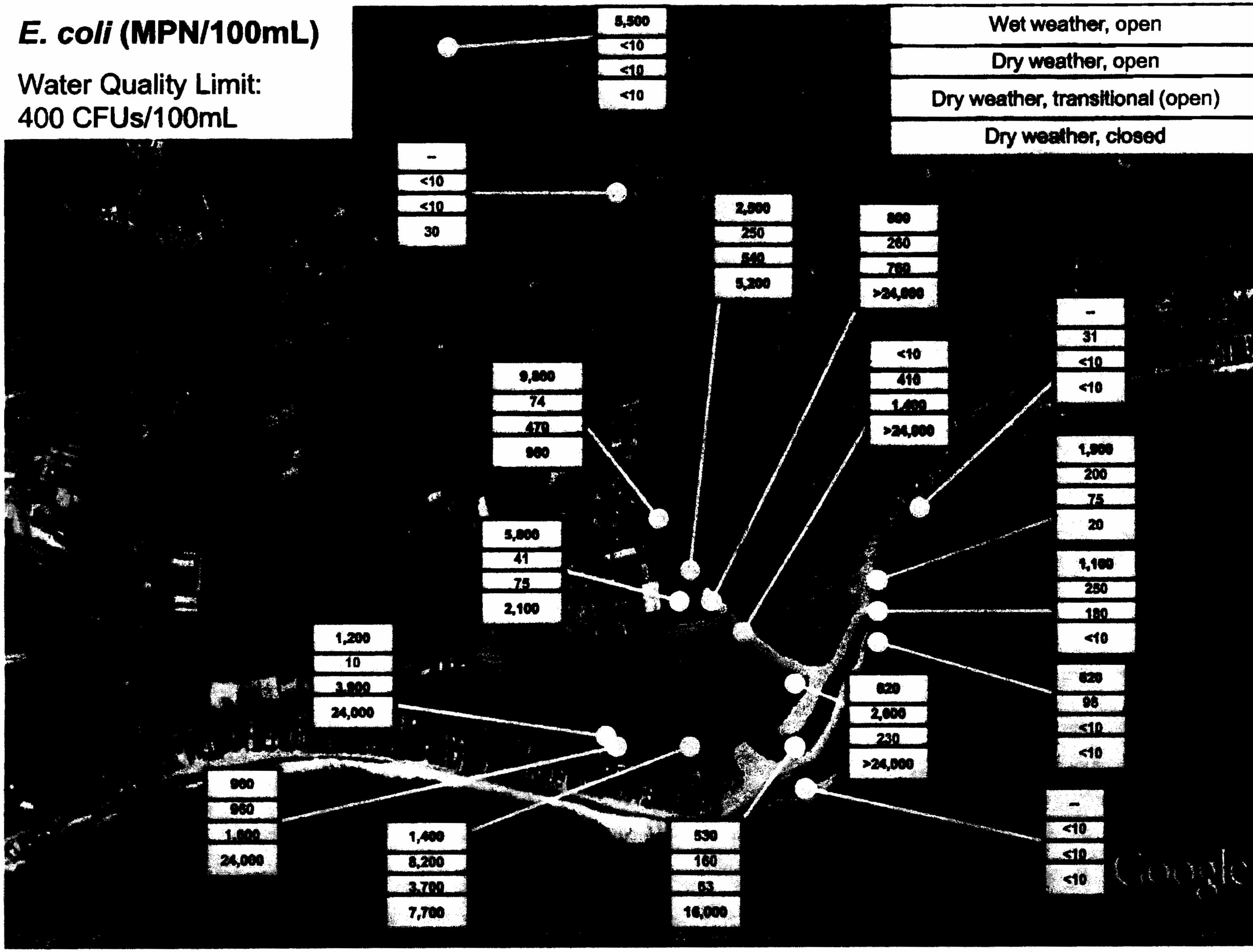
Total Coliforms (MPN/100mL)

Water Quality Limit:
10,000 CFUs/100mL



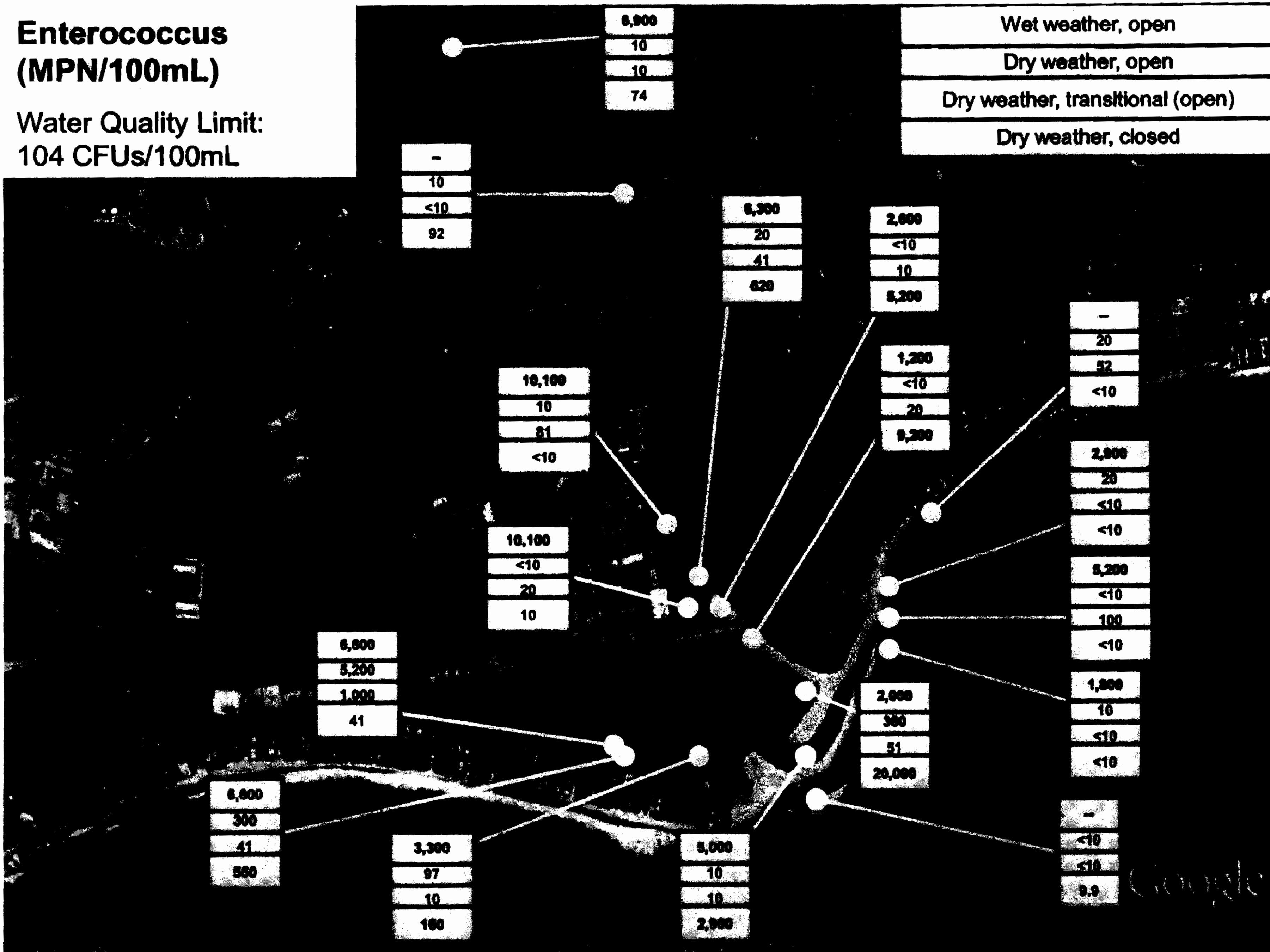
E. coli (MPN/100mL)

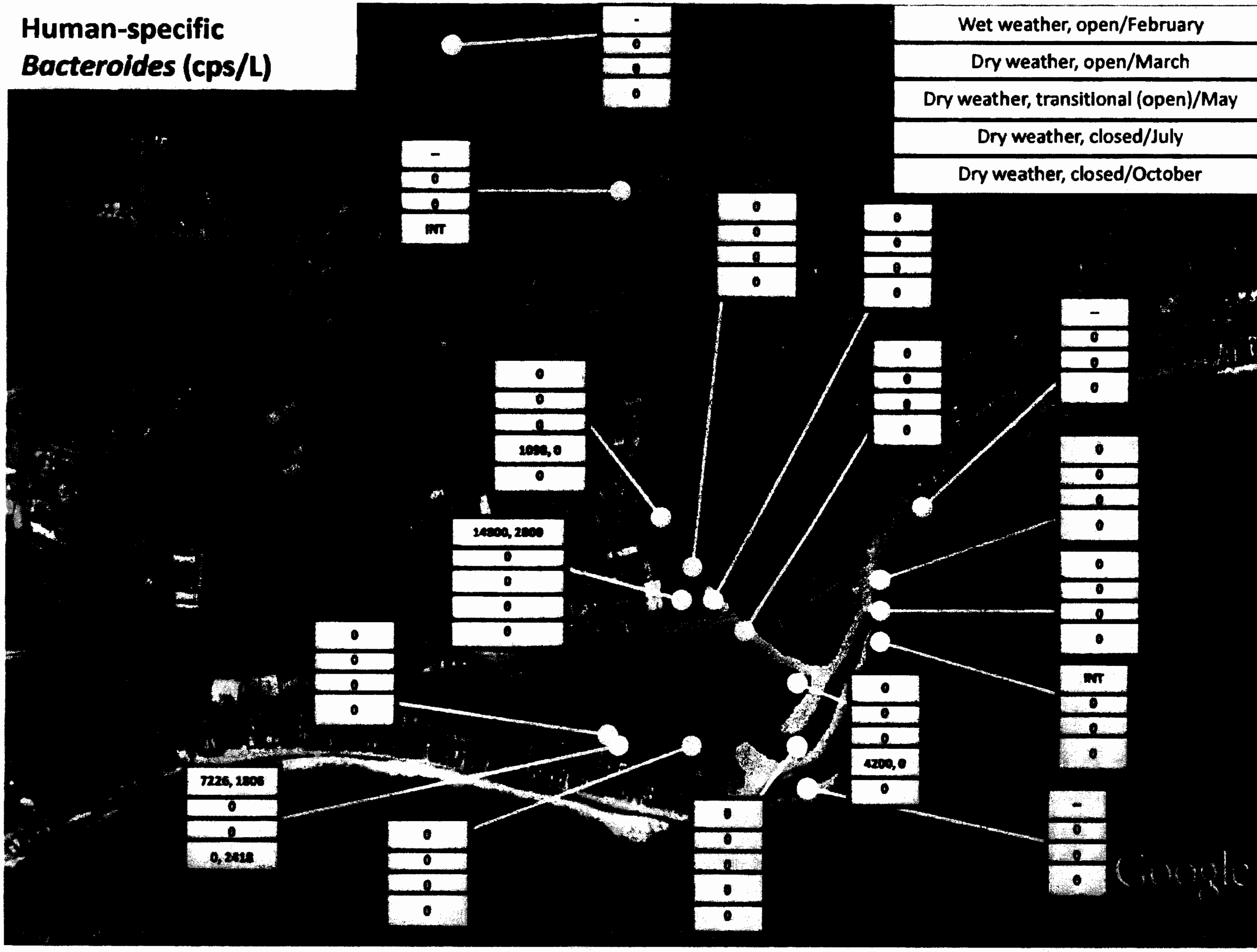
Water Quality Limit:
400 CFUs/100mL



Enterococcus (MPN/100mL)

Water Quality Limit:
104 CFUs/100mL




Human-specific
Bacteroides (cps/L)
Wet weather, open/February
Dry weather, open/March
Dry weather, transitional (open)/May
Dry weather, closed/July
Dry weather, closed/October
-, 0, 0, 0
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0, 0, 0, 0
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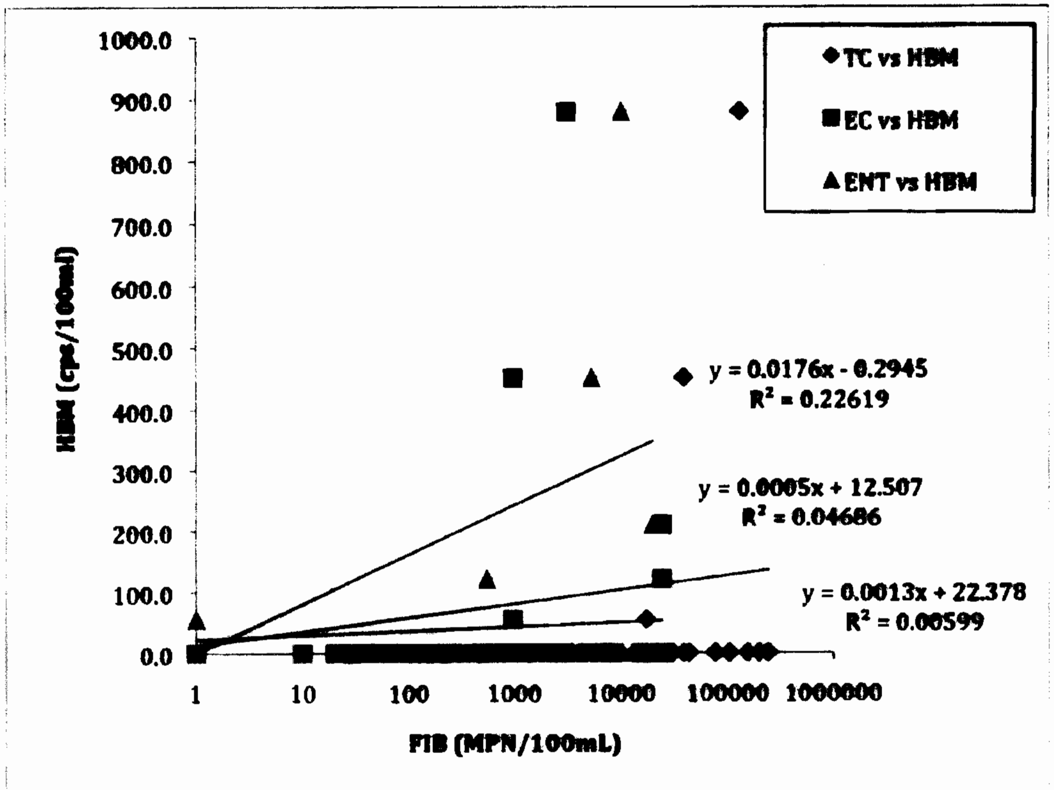
Google

Malibu Creek, Malibu Lagoon and Surfrider Beach 2009 Human Specific Bacteriodales

Site	2/16/09 Wet-Open	3/20/09 Dry-Open	4/29 & 4/30/09 Dry - Open	5/5 & 5/7/09 Dry-Open	5/21/09 Dry-Transitional Open	7/18/09 Dry-Closed	10/30/09 Dry-Closed	Total Samples
1	N	N	-		N	N	N	5
2	N	N	-		N	N	-	4
2D[1]	N	-	-		-	N	-	2
3	Y	N	-		N	Y	I	4
3D[1]	N	N	-		N	N	-	4
4 (MC1)	-	N	N		N	N	-	4
5 (MC3)	Y	N	N		N	N	N	6
6	N	N	-		N	Y	N	5
7 (MC4)	N	N	N		N	Y	N	6
8	N	N	-		N	N	-	4
8D[1]	N	N	-		-	-	-	2
9	N	N	-		N	N	-	4
10	N	N	-		N	N	-	4
11	-	-	-		N	N	-	2
A	I	N	-		N	N	-	3
B	N	N	-		N	N	-	4
C	N	N	-		N	N	-	4
Y (MC5)	-	N	NN	NN	N	N	-	7
X	-	N	-		N	N	-	3
Bridge (MC2)	-	N	N		N	I	-	3
	2 of 14	**0 of 18**	**0 of 6**	**0 of 2**	**0 of 18**	**3 of 18**	**0 of 4**	**5 of 80**

[1] No samples taken in dry weather from drains at 2 D, 3D or 8 D because there were – no dry weather discharges from drains. (*Although Ssamples at these sites were taken from where drains would outfall within the Lagoon if there had been discharge., no discharge was collected. Therefore these samples could be counted as duplicates samples of 3, 2 and 8 during dry weather. Samples were collected at 3D and 8D in March; 3D in May; and 2D and 3D in July.*

Relationship between FIB and HBM

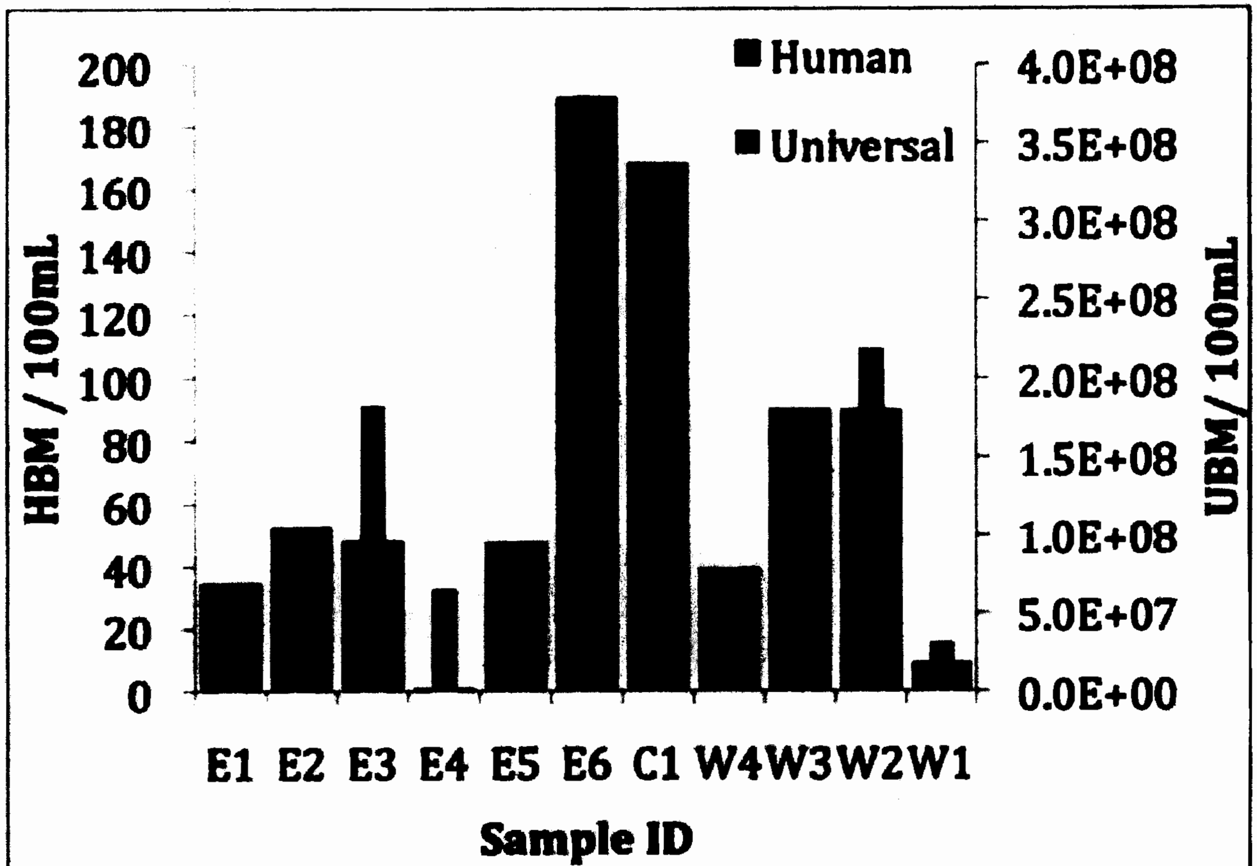


- Samples positive for HBM occurred only when FIB was high
- High FIB observed in absence of HBM

Other work by Jay Lab in Santa Monica Canyon (SMC)

- SMC carries runoff from residential areas and natural mountain watersheds to the ocean.
- In this watershed, HBM was quantifiable in more than 60% of samples in the channel draining the less urbanized subwatershed, and 35% of samples in the channel draining the more urbanized subwatershed.
- After rain events, FIB levels would increase by a factor of 2-18, while *Bacteroidales* was not observed to increase more than a factor of 2 at any location.
- Very little correlation was observed between human-specific or universal *Bacteroidales* and traditional FIB in the Santa Monica Canyon watershed(R^2<0.05).

Universal (UBM) and human-specific *Bacteroidales* (HBM) along Santa Monica Canyon



Samples W1-W4 are from the less urbanized channel. A storm drain located at E6 flowed regularly during sampling events.

Conclusions

- FIB concentrations were high throughout stream, lagoon and ocean after rainfall
  - Only time of high FIB upstream and in ocean
- FIB concentrations generally low when lagoon was open
  - Specific hot spot areas
- FIB concentrations were high throughout lagoon when lagoon closed
- Human-specific bacteroides marker (HBM) detected in 5 out of 80 samples
  - Only detected in Lagoon samples
  - Very weak relationship between FIB and HBM

Malibu Lagoon Bacteria Study
Synopsis with Preliminary Results
4-25-09

Richard F. Ambrose
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Monique Myers
Steve Estes
University of California, Los Angeles

1. Introduction

The purpose of the current UCLA study in Malibu Lagoon is generally to increase our understanding of the dynamics of bacteria in the Lagoon and adjacent ocean waters. We are interested in spatial and temporal patterns of bacteria concentrations as well as the bacteria sources. For this study, we are focusing on water samples only (not sediments).

2. Methods

To understand the spatial pattern of bacteria concentrations, samples are being collected from 18 sites in and around the Lagoon, including one site upstream of all development in Serra Retreat, four sites in the restored salt marsh, and five sites along the beach in or near the mouth of the Lagoon (Figure 1). The furthest upstream site provides information about bacteria entering the Lagoon from the upstream Malibu Creek watershed. The Lagoon samples include samples on the east and west banks of the main lagoon as well as samples from the restored wetland area (taken near outlets draining into that area). The beach samples include a sample where the lagoon water meets the ocean (when the lagoon is open) and two samples east and two samples west of this location. These samples represent exposure to ocean users. In addition to collecting water samples for bacteria, we are measuring other water quality parameters, particularly conductivity (salinity), which provides a useful indicator of how much mixing there has been between freshwater and ocean water at each site when we sample it.

To understand the temporal pattern of bacteria concentrations, samples are being collected at times that represent different important phases of Lagoon dynamics. Our first sample was during a major rainstorm (February 16, 2009) when the Lagoon was open to the ocean and dominated by fluvial (stream) processes. More than 1.5" of rain had fallen in the upper watershed when sampling occurred, with a total of about 2.3" for the storm. Although we call the February 16 sample a "wet weather" sample, it really represents storm conditions in the lagoon with significant runoff from upstream and the areas around the lagoon.

Our second sample (March 20, 2009) occurred while the lagoon was still open, but more than three weeks after a significant rain. Although the lagoon was open to the ocean, the outlet was near the downcoast (closer to the pier) limit of its normal migration as the lagoon closes. Interestingly, this was also the outlet location during the February 16 sampling despite the heavy rainfall.

We plan on sampling at least one more time, when the Lagoon is closed.

To understand the sources of bacteria in the Lagoon, we are analyzing our samples for human-specific and universal bacteroides as well as the traditional fecal indicator bacteria. The results of these analyses will provide an indication of how much of the indicator bacteria may be due to human sources. We will also look at markers for other sources (e.g. birds, dogs) if feasible. Although bacteroides samples were taken February 16 and March 20, those data are not yet available.

3. Preliminary Results

No attempt is made to provide a detailed description of the results in this preliminary report, but a general summary of results is given below. The presentation of the results follows a consistent approach for each parameter: First we present a map with parameter values for the February 16 sampling event, then we present a map with parameter values for the March 20 sampling event, and finally we present a map with values from both sampling periods on the same map.

The data for total coliform bacteria are shown in Figure 2, Figure 3 and Figure 4.

The data for *E. coli* are shown in Figure 5, Figure 6 and Figure 7.

The data for enterococcus are shown in Figure 8, Figure 9 and Figure 10.

For all indicator bacteria, nearly all stations had concentrations above water quality standards during the wet weather sampling event. The samples were taken after 1.5" of rain had fallen in the upper watershed and water flow rates were very high. The uppermost sample, taken a day later by Heal the Bay, still had high FIB concentrations. The one exception to sample exceedances was the station on the east side of the lagoon near the Pacific Coast Highway, which had concentrations of total coliforms and *E. coli* that were below the water quality standard. Interestingly, the enterococcus concentration at this station did exceed the water quality standard. All other stations exceeded the standards, but some stations had exceptionally high values. Three stations north of the PCH bridge and the westernmost station in the restored salt marsh (where the sample was taken from a running drain) had total coliform values >100,000 MPN/100 ml. The same three stations north of PCH had *E. coli* concentrations >2,300 MPN/100 ml. Two stations in the restored salt marsh and two ocean stations near the lagoon mouth had *E. coli* concentrations >1,000 MPN/100 ml. The same three stations north of PCH and two stations in the westernmost area of the restored salt marsh had enterococcus concentrations >6,000 MPN/100 ml.

The February 16 values reflected runoff with high FIB concentrations entering the lagoon from a number of different locations, including upstream from Malibu Creek, outlets draining into the restored marsh, and perhaps inputs into the main lagoon north of PCH. Runoff into the lagoon resulted in high FIB values throughout the lagoon and in the adjacent coastal water.

In contrast to the February 16 storm sampling event, when the lagoon was open during dry weather nearly all stations had FIB concentrations below the water quality standards. There were two exceptions. (1) Two or three stations in the restored salt marsh exceeded the standards for all three indicators. These samples were taken near culverts that drain into the marsh. (2) In addition, the station in the southeast portion of the main lagoon exceeded water quality standards for all three indicators. This station is adjacent to the Adamson house property, near the exposed shoals that routinely serve as a roosting area for hundreds of birds, and is isolated from the main water flow in and out of the lagoon because of the configuration of the lagoon outlet.

The March 20 sampling event identified two "hotspots" of high FIB concentrations in the lagoon. In the restored salt marsh, it seems likely that the sources of FIB are the pipes that drain into the sampled tidal creek. However, we do not know if the high values are due to continued input or FIB regrowth or survival in that area of the lagoon. The high FIB concentrations in the SE corner of the main lagoon may be due to the high concentrations of birds in that area coupled with relatively poor circulation, but we cannot conclude this definitively. The bacteroides results may help clarify the possible FIB sources in these two hotspots.

The conductivity data (Figure 11, Figure 12,and Figure 13) provide an indication of the amount of freshwater influence at the different stations. During the February 16 sampling event, the entire lagoon system was dominated by freshwater runoff. The only station that showed even moderate salinity was an ocean station by the lagoon mouth (although the other two ocean stations were largely freshwater). During the March 20 sampling event, most stations were still dominated by freshwater even though the lagoon was open to the ocean. This is not too surprising because we sampled around low tide, when the lagoon would be least influenced by ocean water. The ocean stations, of course, had higher salinities, although the stations near the outlet were much lower than full seawater and even the station near Malibu Pier was much lower than full seawater. The stations in the restored wetland, in contrast to all other lagoon stations, showed significant influence of seawater.

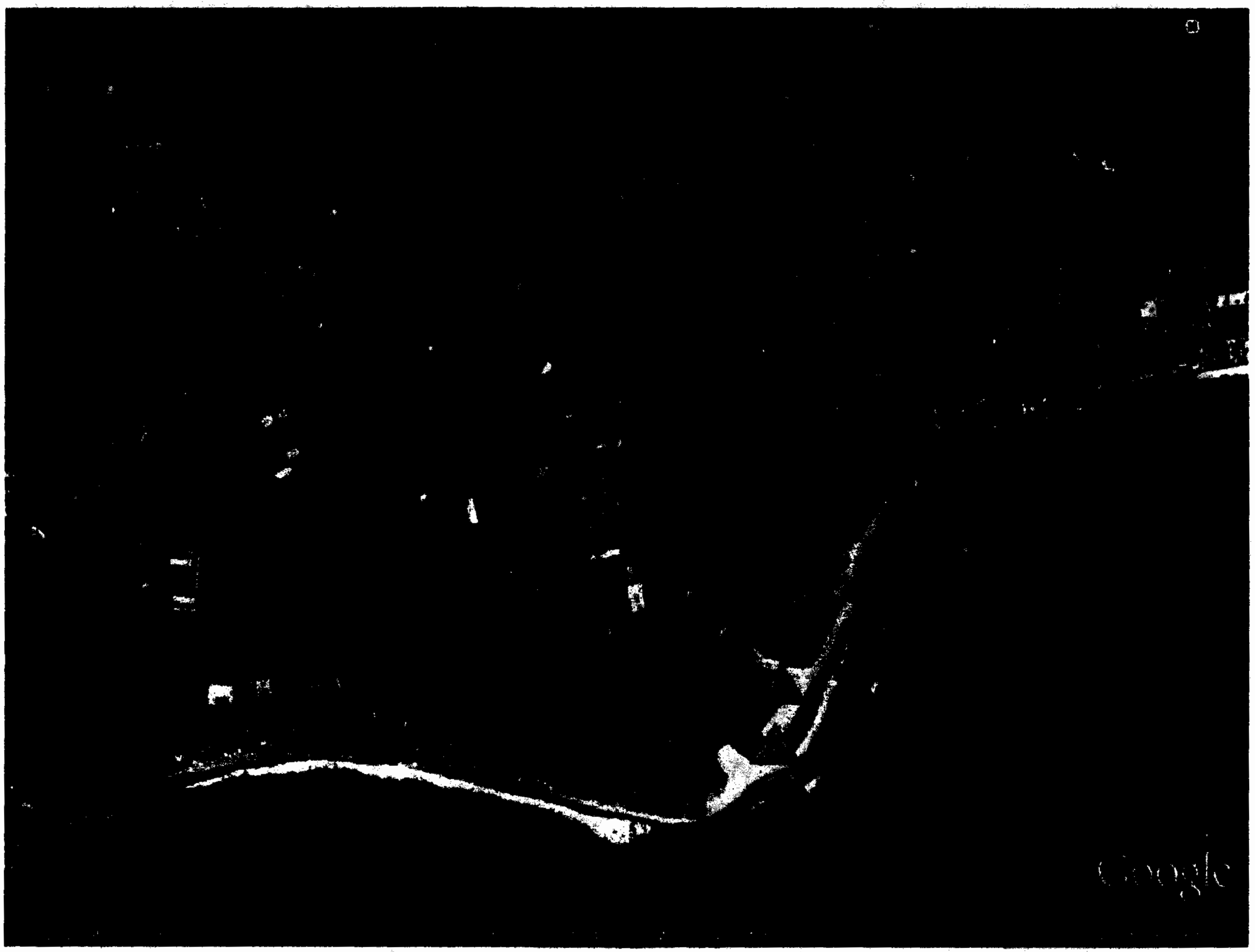

Figure 1. Location of Malibu Lagoon sampling sites.

The two farthest upstream sites (one upstream of Serra Retreat and one at Cross Creek Road) and the easternmost and westernmost beach samples were not included in the first sampling period.

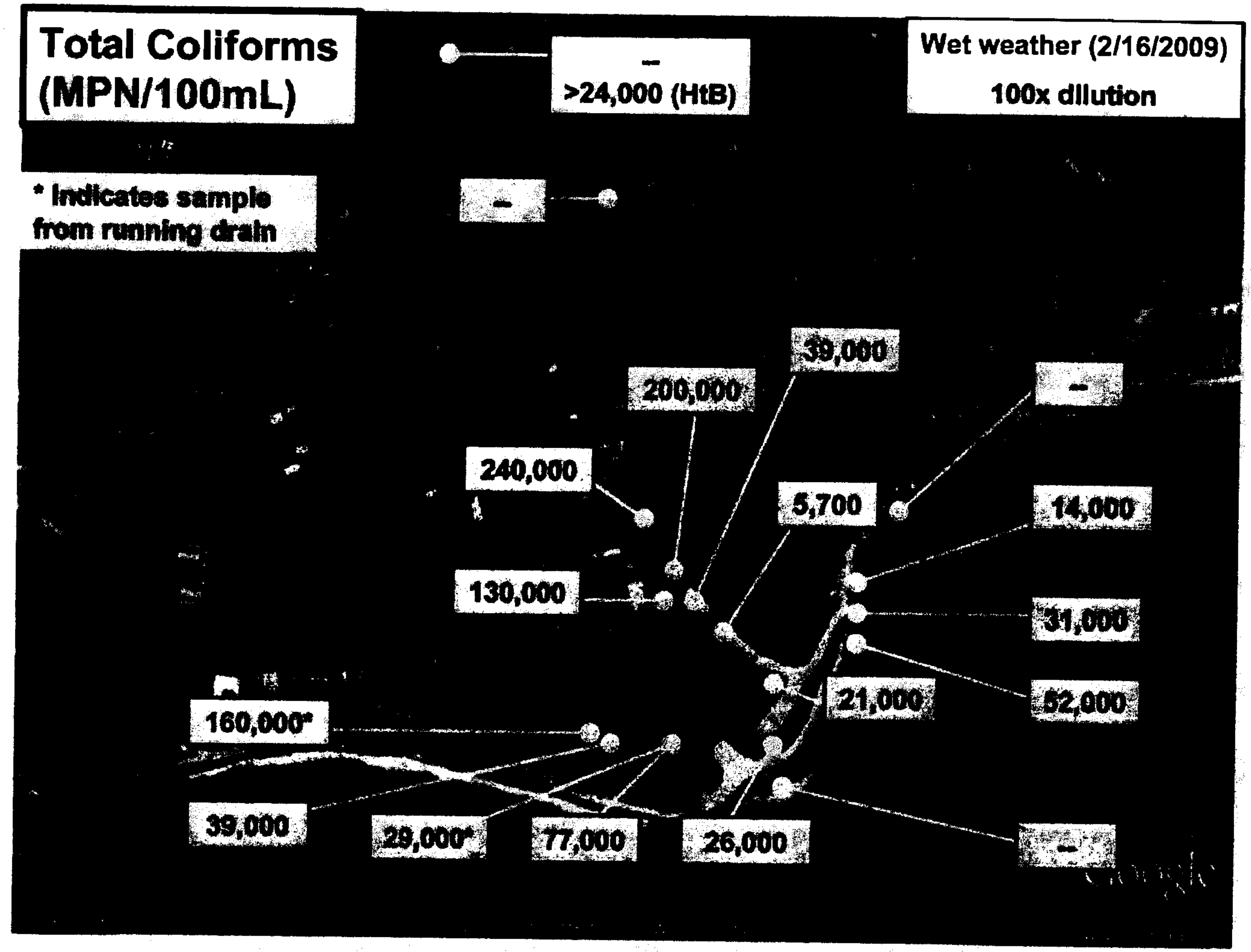

Figure 2. Total coliform concentrations during wet weather sampling period.

The single-sample water quality standard is 10,000 CFU/100 ml. The two upstream sites were not sampled, but data collected nearby by Heal the Bay one day after our samples were collected are shown.

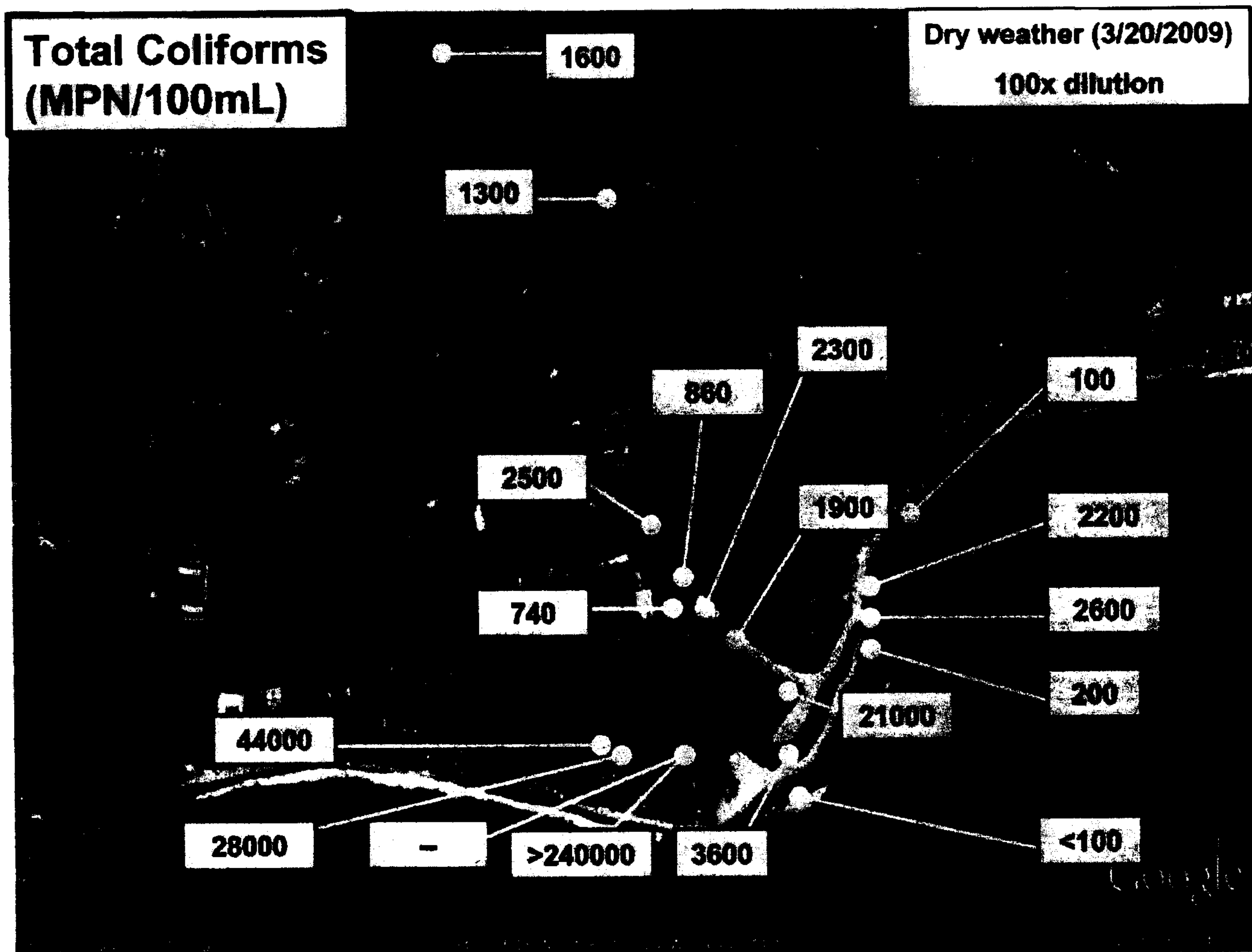

Figure 3. Total coliform concentrations during dry weather (lagoon open) sampling period.

The single-sample water quality standard is 10,000 CFU/100 ml.

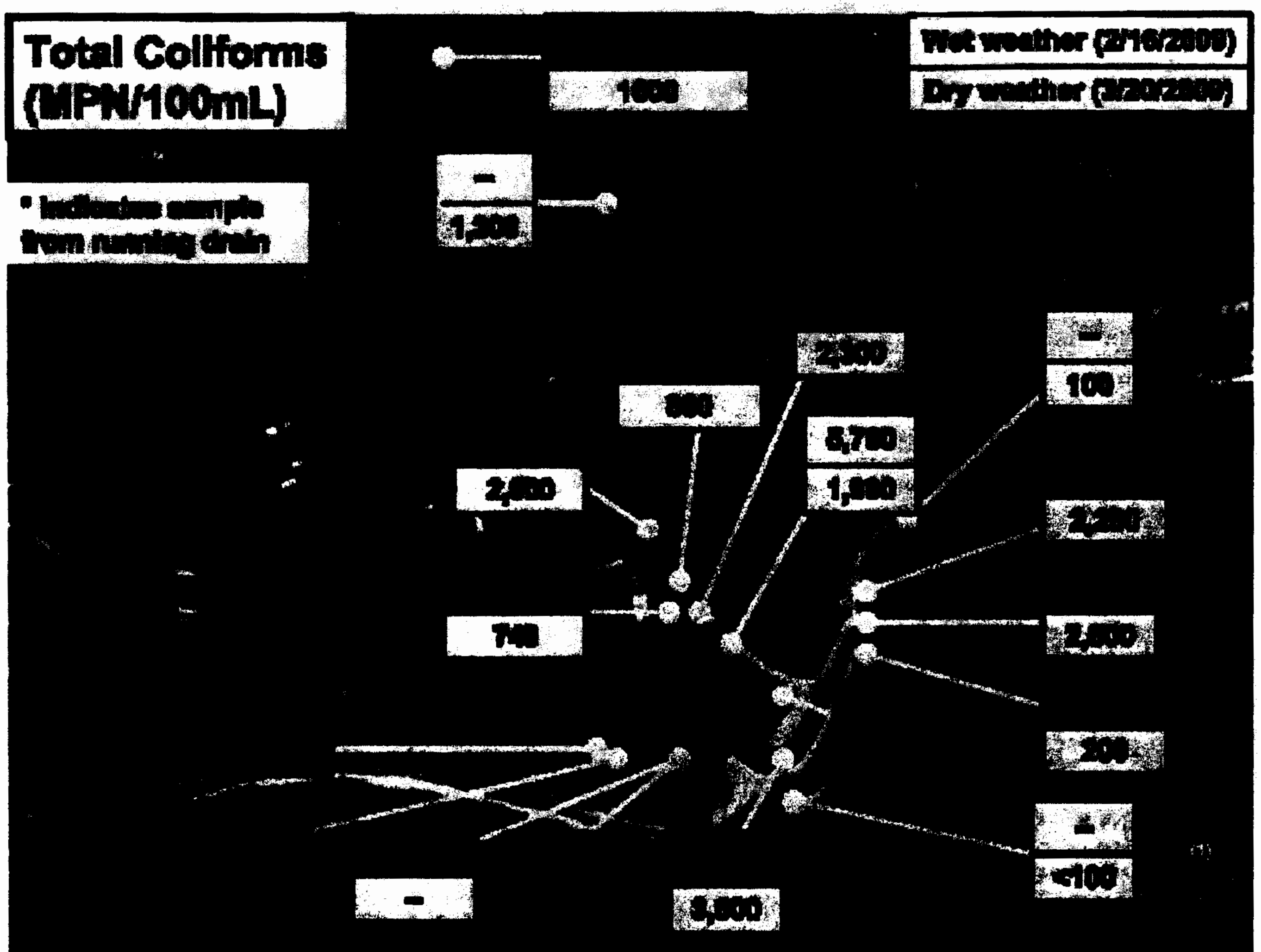

Figure 4. Comparison of total coliform concentrations during wet weather and dry weather (lagoon open) conditions.

The single-sample water quality standard is 10,000 CFU/100 ml. Red shading indicates values exceeding water quality standard.

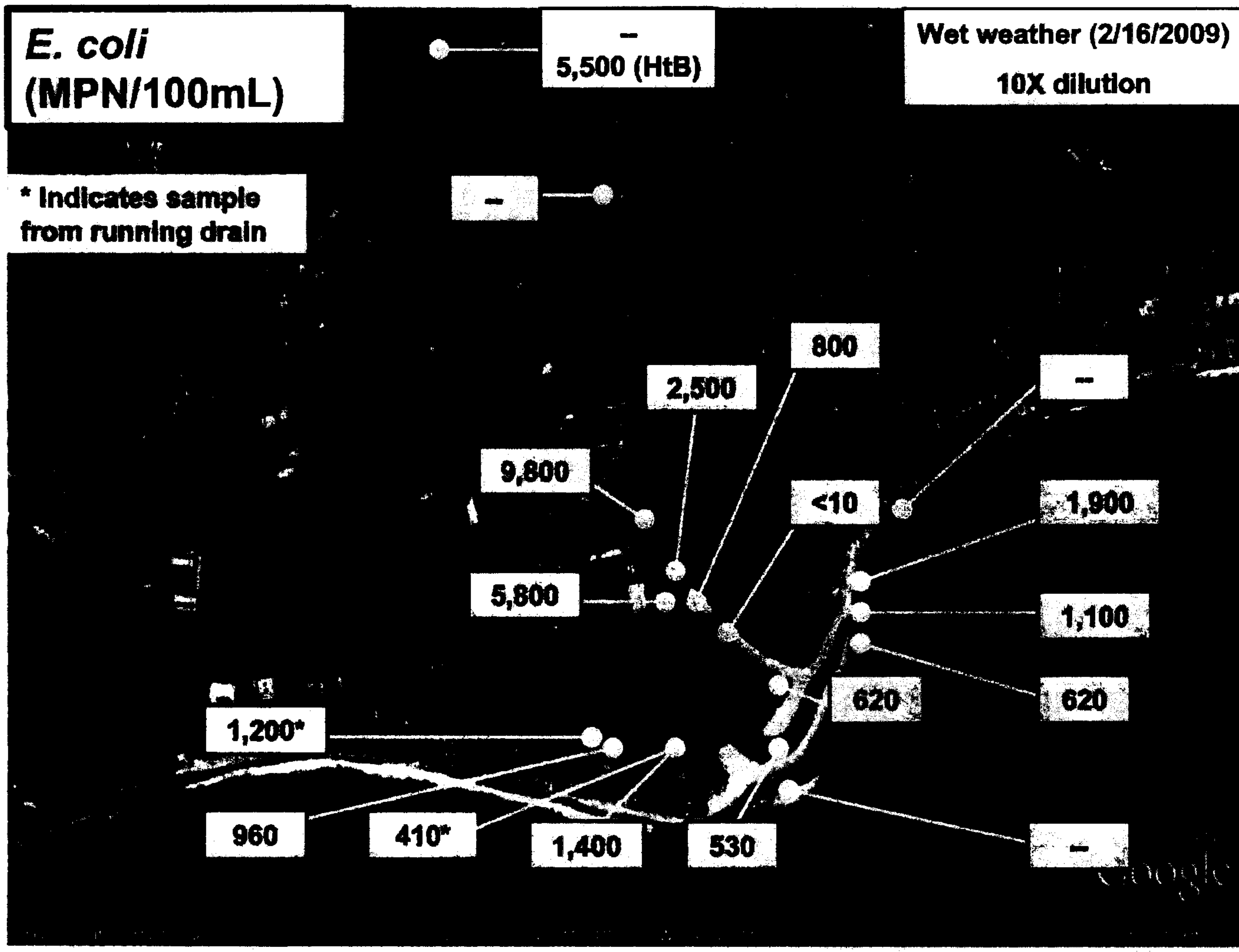

Figure 5. ***E. coli*** **concentrations during wet weather sampling period.**

The single-sample water quality standard is 400 CFU/100 ml. The two upstream sites were not sampled, but data collected nearby by Heal the Bay one day after our samples were collected are shown.

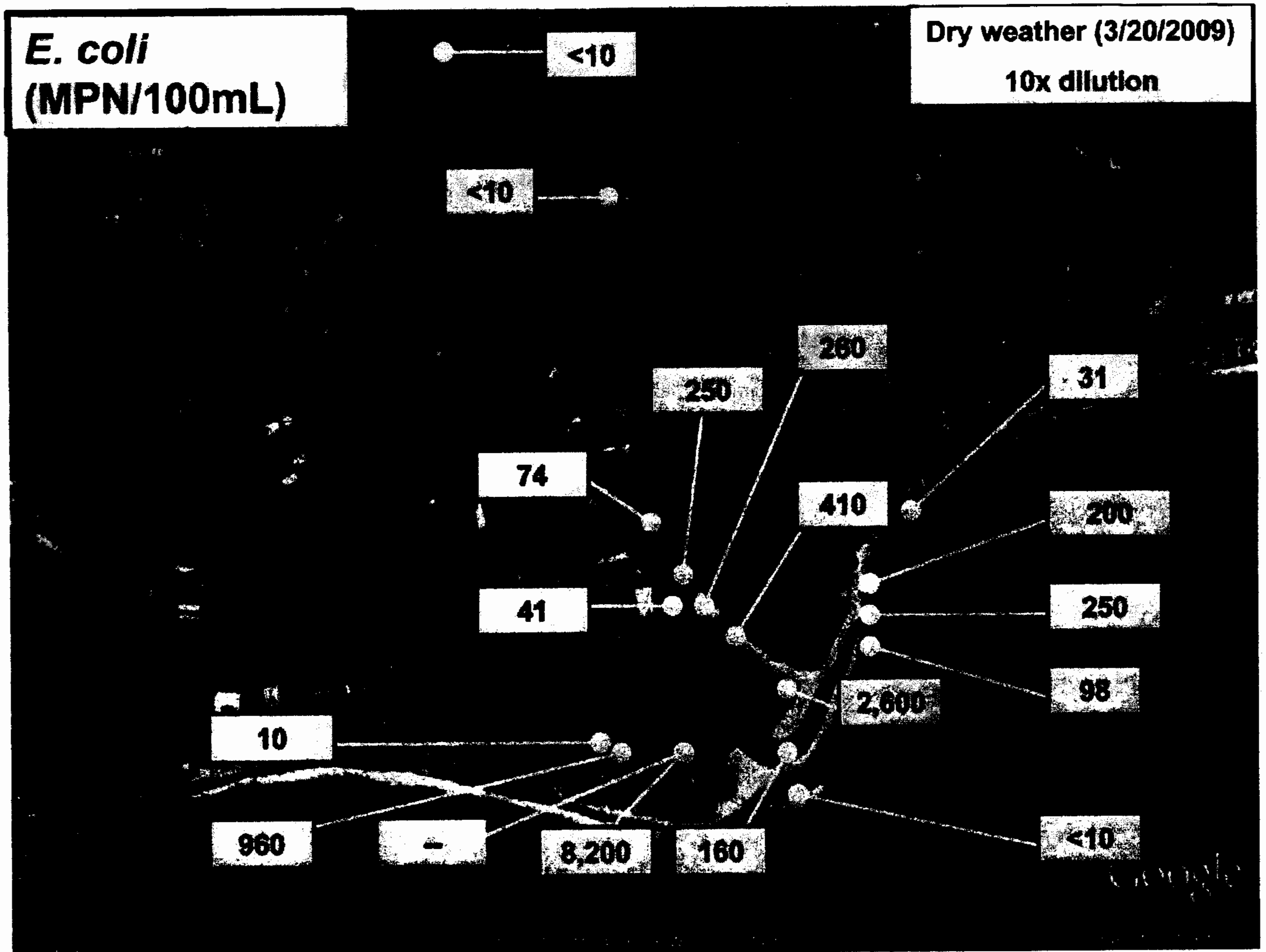

Figure 6. ***E. coli*** **concentrations during dry weather (lagoon open) sampling period.**

The single-sample water quality standard is 400 CFU/100 ml.

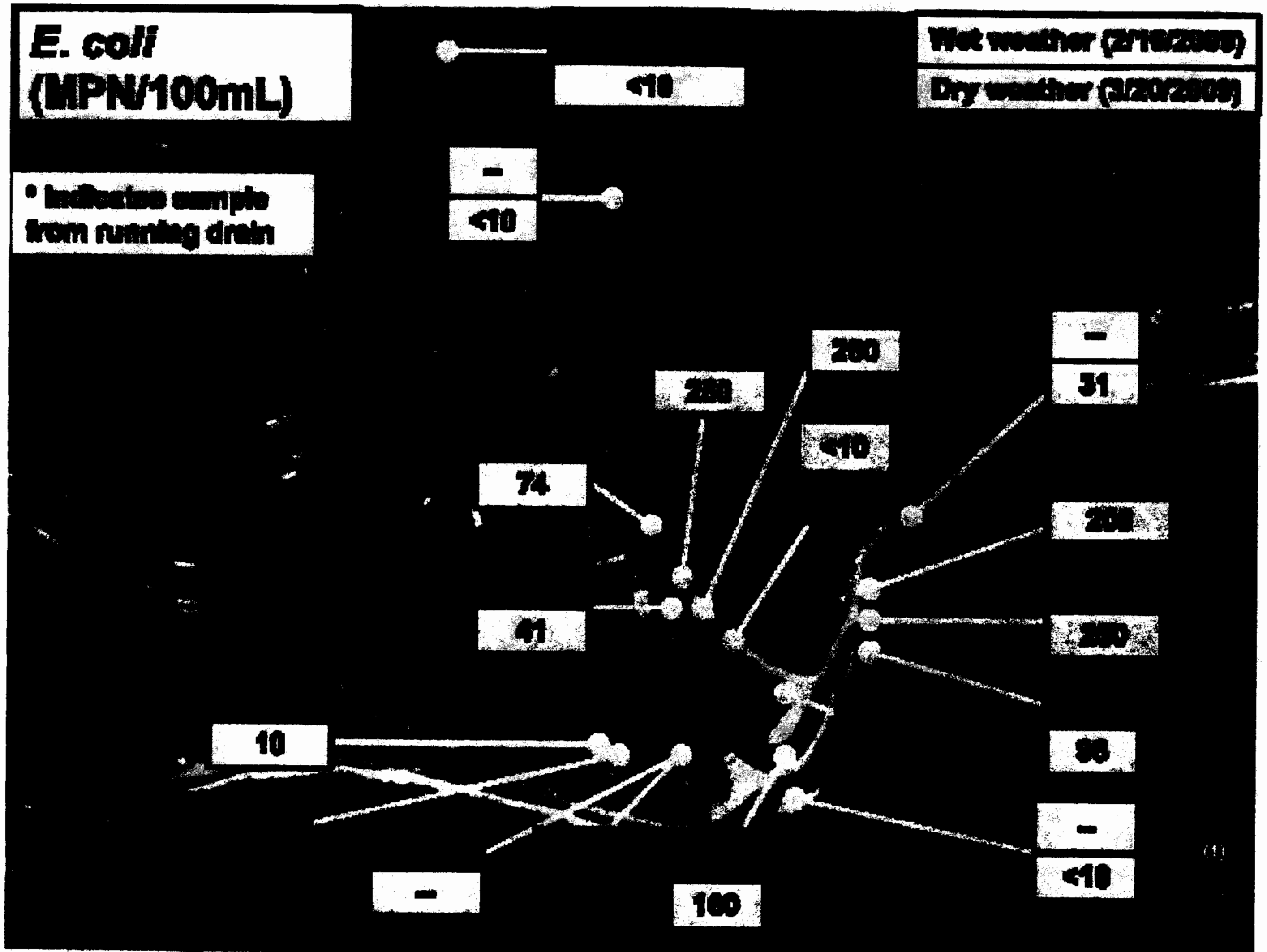

Figure 7. Comparison of *E. coli* concentrations during wet weather and dry weather (lagoon open) sampling periods.

The single-sample water quality standard is 400 CFU/100 ml. Red shading indicates values exceeding water quality standard.

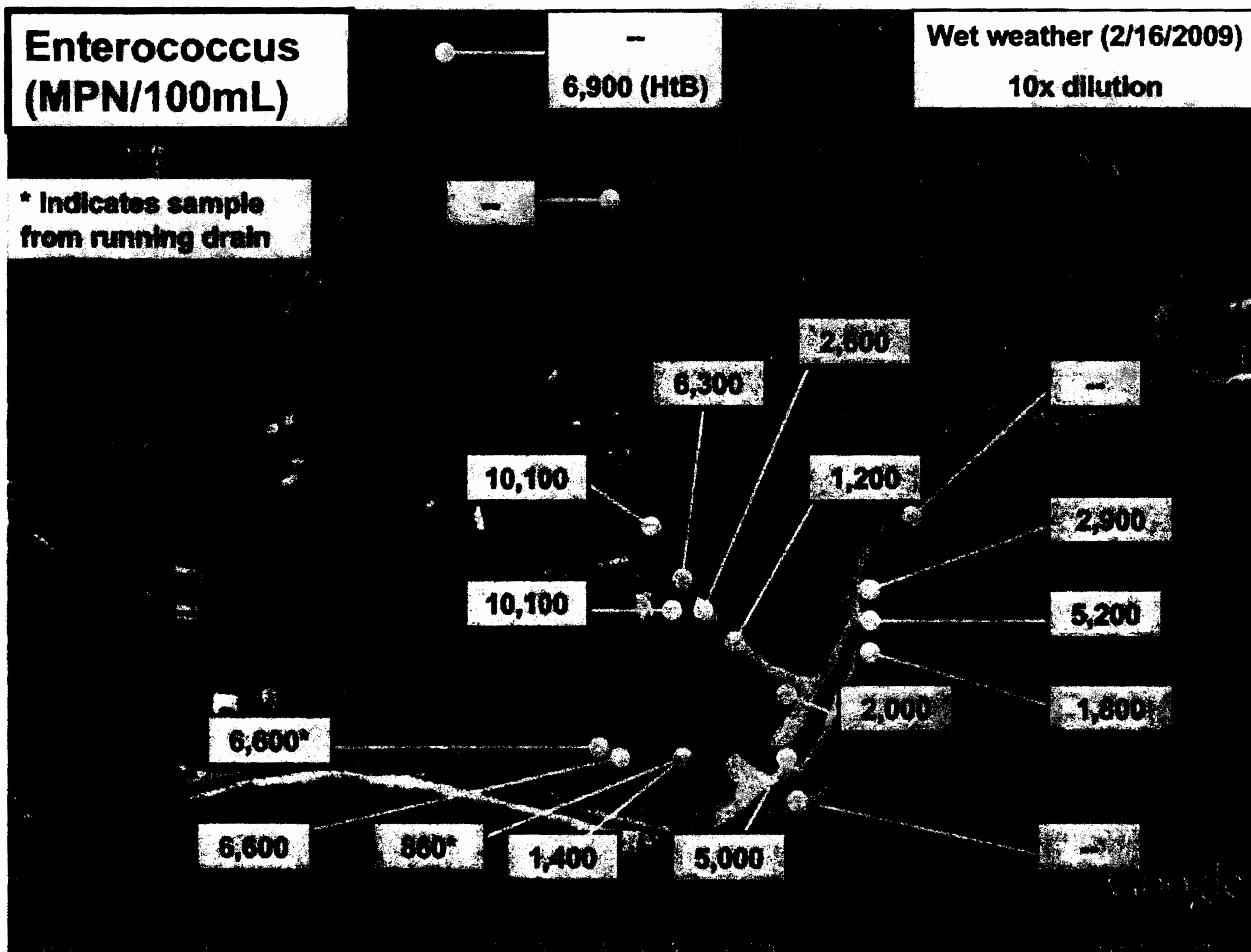

Figure 8. Enterococcus concentrations during wet weather sampling period.

The single-sample water quality standard is 104 CFU/100 ml. The two upstream sites were not sampled, but data collected nearby by Heal the Bay one day after our samples were collected are shown.

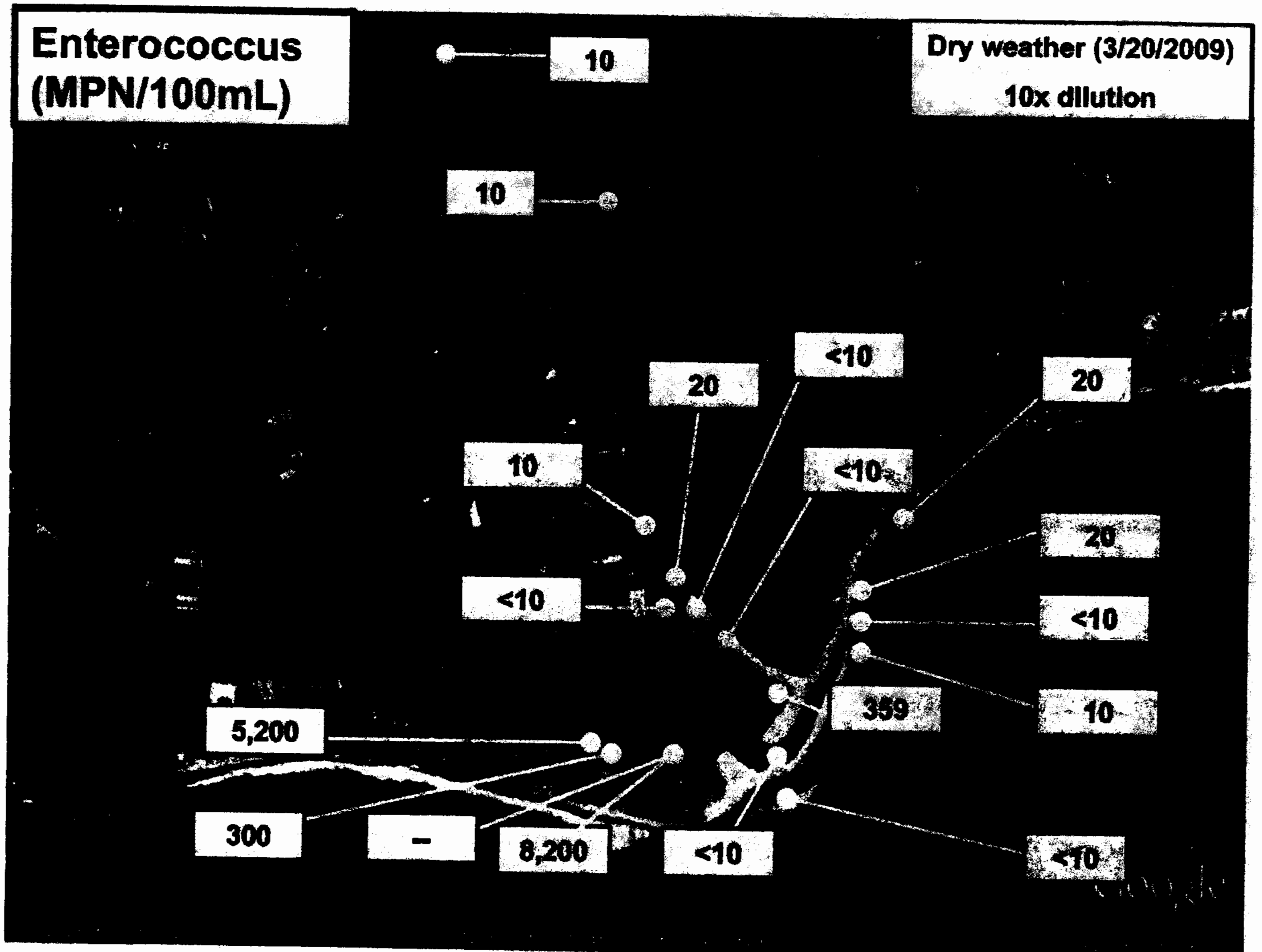

Figure 9. Enterococcus concentrations during dry weather (lagoon open) sampling period.
The single-sample water quality standard is 104 CFU/100 ml.

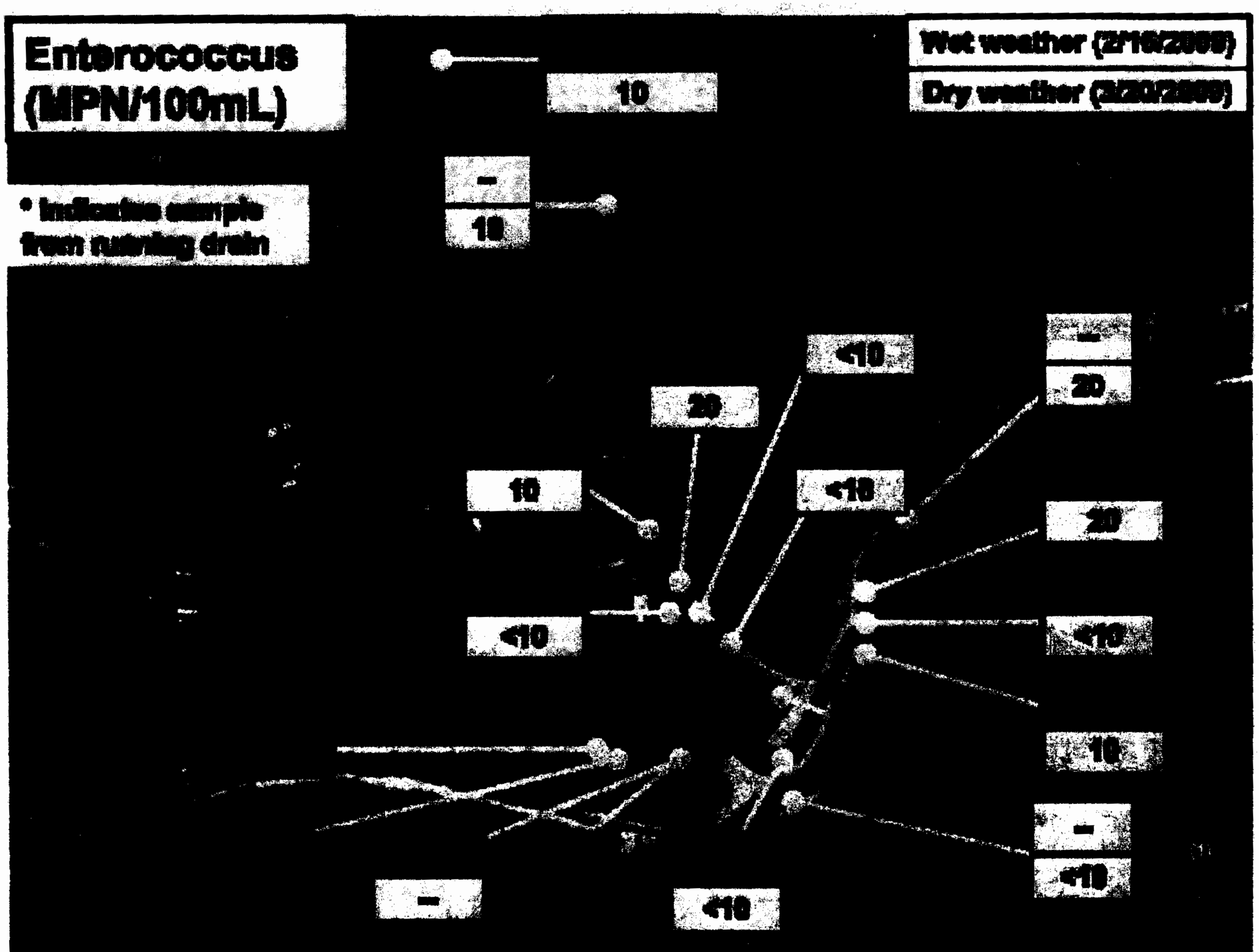

Figure 10. Comparison of Enterococcus concentrations during wet weather and dry weather (lagoon open) sampling periods.

The single-sample water quality standard is 104 CFU/100 ml. Red shading indicates values exceeding water quality standard.

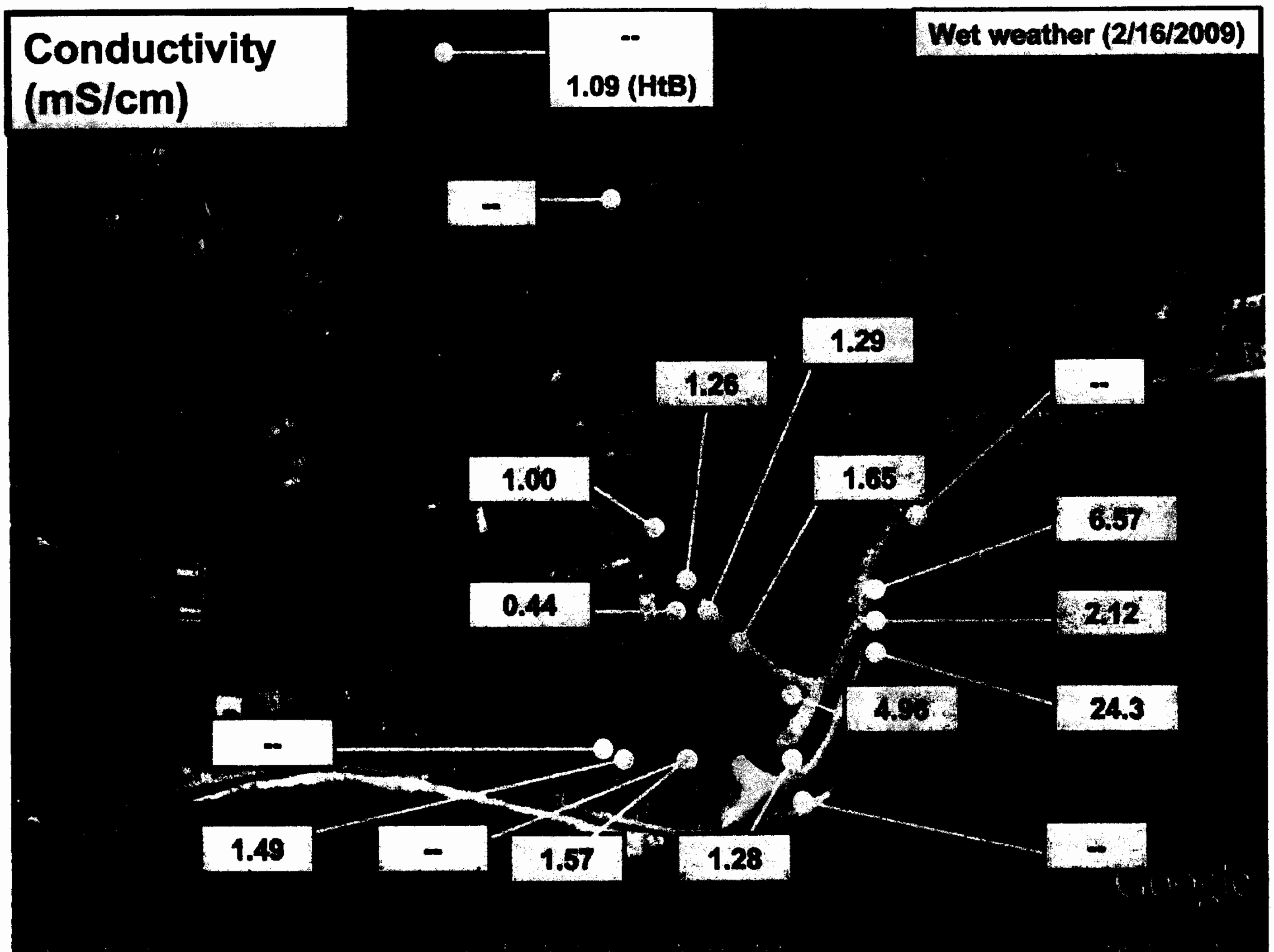

Figure 11. Conductivity values during wet weather sampling period.

The two upstream sites were not sampled, but data collected nearby by Heal the Bay one day after our samples were collected are shown.

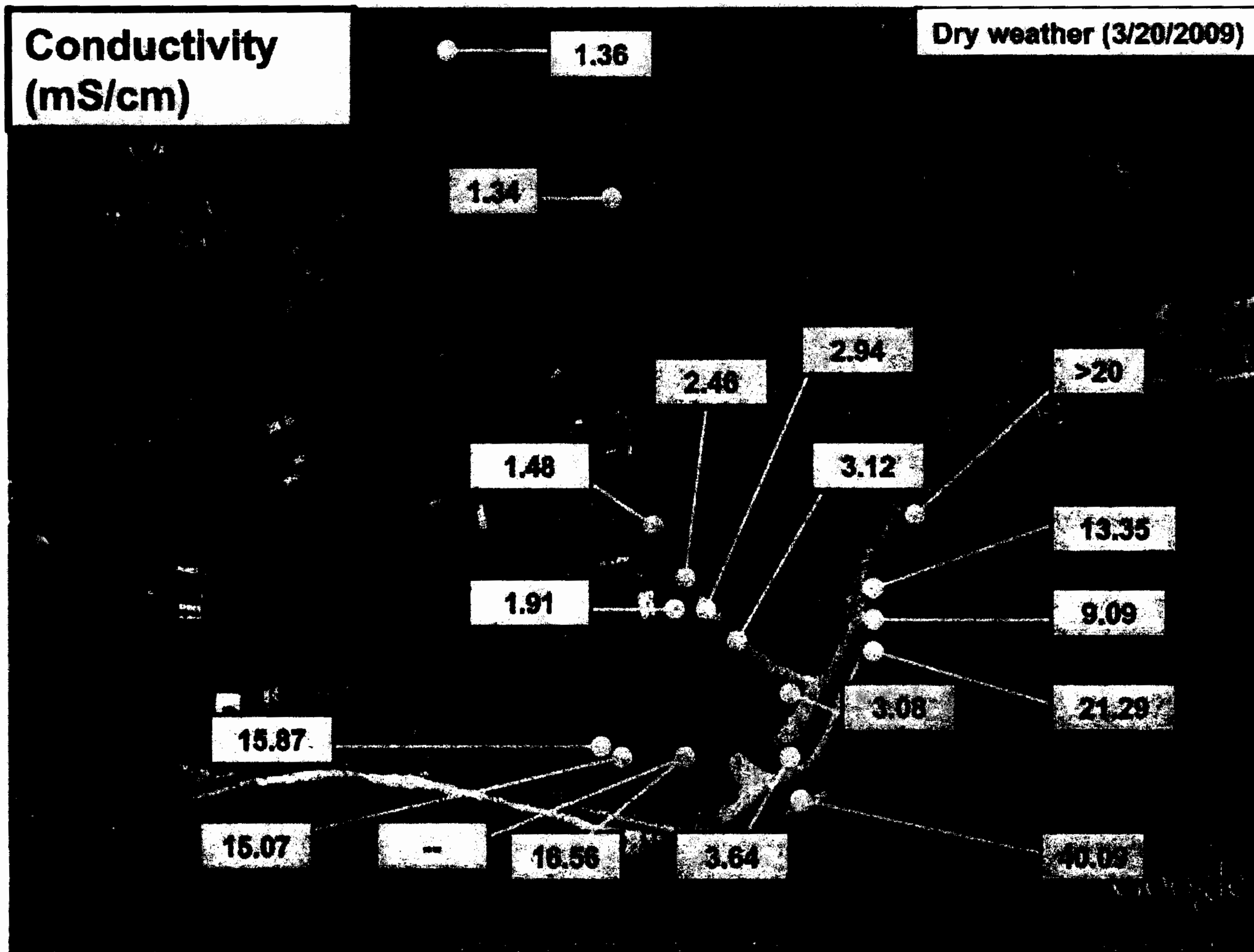

Figure 12. Conductivity values during dry weather (lagoon open) sampling period.

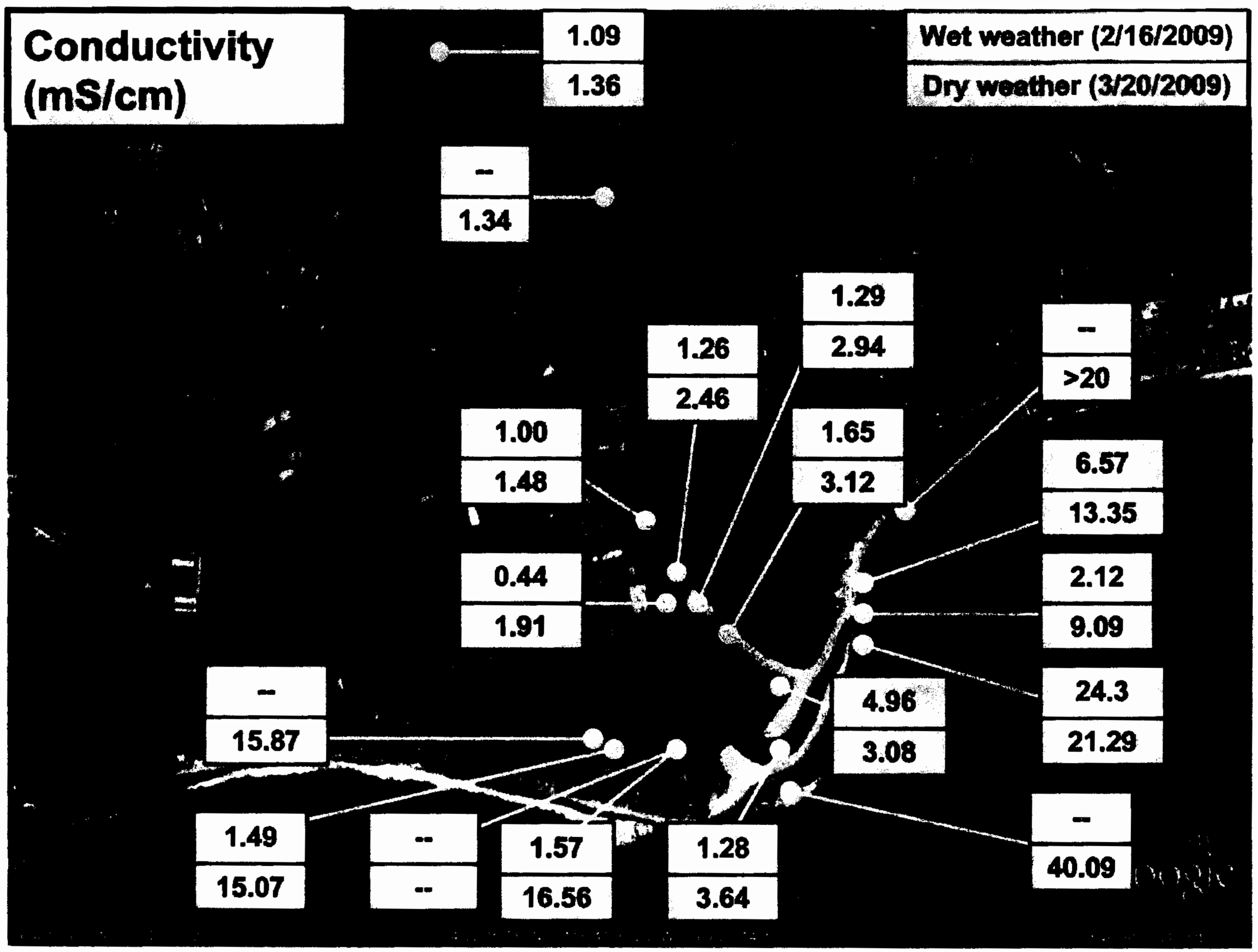

Figure 13. Conductivity values during wet weather and dry weather (lagoon open) sampling periods.

United States Department of the Interior

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June 25, 2010

Mr. James Thorsen,
City Manager,
City of Malibu,
23815 Stuart Ranch Road,
Malibu, California 90265

JUN 28 2010

Dear Mr. Thorsen;

This letter summarizes preliminary results from Task 1 (Synoptic sample collection) of our cooperatively funded water resources program to identify sources of fecal indicator bacteria (FIB) and nutrients to Malibu Lagoon and near-shore ocean water, Malibu, California. The purpose of the synoptic sample collection was to provide a snap-shot in time of the occurrence and distribution of FIB nutrients, and other constituents in shallow groundwater, Malibu Lagoon (including its tributary Malibu Creek) and near-shore ocean water. The study was done under the direction of Dr. John Izbicki in our San Diego Projects Office.

Data were collected as part of Task 1 from April 17-22, 2010. The sample period was selected to reflect conditions near the end of the rainy season for comparison and contrast with data previously collected during the dry summer season between July 21-27, 2009. The primary hydrologic differences between the July 2009 and April 2010 sample periods were:

1. During the July sample period, the sand berm at the mouth of Malibu Lagoon was closed and seawater water did not exchange freely with lagoon water during tidal cycles. However, during July, seawater overtopped the berm and entered the lagoon during high tide, and lagoon water moved through the sand berm at the mouth of the lagoon to discharge to the near-shore ocean during low tide. During the April sample period, the berm of the lagoon was open to the ocean and seawater flowed into the lagoon during high tide and water from the lagoon flowed into the ocean during low tide. Water levels in the lagoon were lower during the April sample period than during the July sample period.
2. Malibu Creek was not flowing during the July sample period, whereas, the creek was flowing during the April sample period. Streamflow measured at the U.S. Geological Survey streamgage upstream from the lagoon (Malibu Creek at Malibu, Calif 11105510) during April 17-19 varied daily from about 11 to 20 cubic feet per second (cfs) as a result of upstream discharges. Precipitation in the Malibu Creek

watershed, beginning late in the day on April 19, increased streamflow at the gage to a maximum of 30 cfs on April 20.

3. Groundwater levels in many of the sampled wells, especially wells near Malibu Lagoon, were lower in April 2010 than in July 2009.

More than 230 samples were collected during the April 2010 sample period. Samples were collected once from selected wells in the study area, from Malibu Creek upstream from residential and commercial development in the Malibu Civic Center area, and from selected sites in Malibu Lagoon. Samples also were collected daily during the sample period at high, low, mid-high, and mid-low tide from Malibu Lagoon, the discharge of the lagoon to the near-shore ocean, and from three selected recreational beaches. Additional samples were collected hourly during a falling tidal cycle from high to low tide from pieziometers and seepage samplers installed in the sand berm at the mouth of Malibu Lagoon and near Malibu Colony, and from associated sites in the lagoon and the near-shore ocean. Groundwater sample sites are shown in figure 1 and surface-water sites are shown in figure 2. On-site wastewater treatment systems sampled previously were not sampled during the April 2010 sample period, but will be sampled later as part of Task 1.

USGS staff set up a temporary laboratory in the Malibu Civic Center area and FIB were analyzed on site using Colilert and Enterolert. On most days, samples were analyzed within 6 hours after collection, the recommended holding time for sample collected for regulatory purposes. On some days, samples were held for slightly longer prior to analysis. All samples were analyzed within 24 hours of collection, the recommended holding time for samples collected for scientific purposes. In addition to routine laboratory Quality Assurance data, selected FIB samples analyzed within 6 hours after collection were reanalyzed 24 hours after collection to determine how differences in sample holding time may affect results, and selected samples analyzed for FIB using Colilert and Enterolert also were analyzed using membrane filtration to determine how different analytical methods may affect results. FIB data for water from wells, Malibu Lagoon, and the near-shore ocean are summarized in the following paragraphs.

Total coliform were detected at concentrations greater than the detection limit of 1 Most Probable Number (MPN) per 100 milliliters (ml) in water from 10 of 15 sampled wells, and concentrations were as high as 2,400 MPN per 100 ml in three wells during the April sample period. The frequency of detection and concentration of total coliform was greater during April 2010 than during July 2009; however, total coliform occur naturally in the environment and are not necessarily associated with fecal sources. Enterococci was detected in only four sampled wells at concentrations generally near the detection limit of 1 MPN per 100 ml. Well SMBRP-2, in the undeveloped riparian area east of the lagoon, had an enterococci concentration of 96 MPN per 100 ml. *Escherichia coli* concentrations were less than the detection limit of 1 MPN per 100 ml in samples from all wells. In general, Enterococcus and *E. coli* concentrations in water from wells sampled in April 2010 were similar to concentrations measured during July 2009.

During the April 2010 sample period, Total coliform, *E. coli*, and enterococcus concentrations in Malibu Lagoon were as high as 105,000, 8,400, and 19,900 MPN per

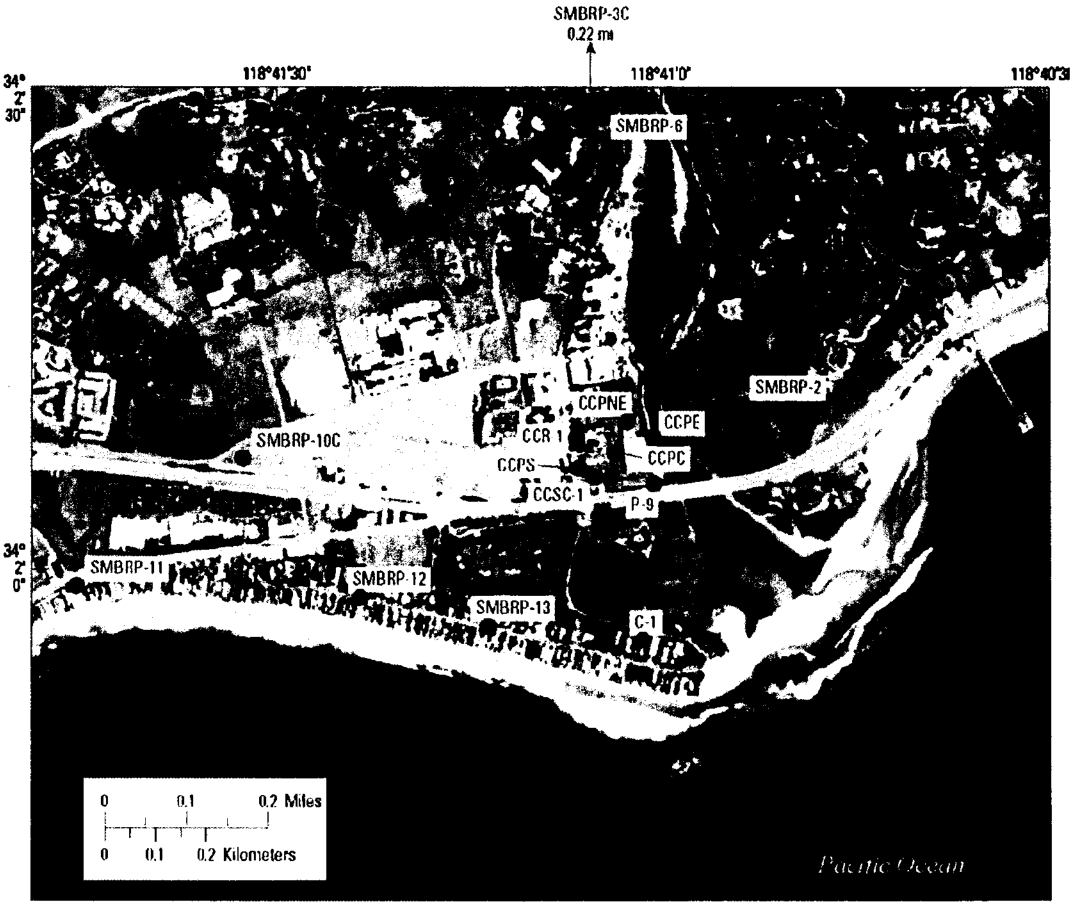
100 ml, respectively. In general, FIB concentrations were lower in the lagoon during April 2010 than during July 2009. FIB concentrations in the lagoon during both sample periods were several orders of magnitude greater than concentrations in water from sampled wells. During April 2010, FIB concentrations varied widely between low and high tide. Concentrations in the lagoon were low (often near the detection limit of 10 MPN per 100 ml for *E. coli* and enterococcus) during high tide when seawater having low FIB concentrations entered the lagoon. FIB concentrations increased to high values by the next low tide when water from the lagoon discharged to the ocean.

FIB concentrations in samples from the near-shore ocean at Puerco Beach (OF-A, fig. 2) and at Malibu Colony (AF-B, fig. 2) generally were less than the detection limit during low tide when radon-222 data collected as part of this study show that groundwater discharge to the ocean was occurring. FIB concentrations increased slightly during high tide when groundwater discharge to the ocean was not occurring. A similar increase in FIB at high tide also was observed in July 2009 and was attributed to wave run-up on the beach washing FIB from kelp accumulated at the wrack line. High FIB concentrations were measured in water extracts from kelp during both the July 2009 and April 2010 sample periods. Enterococcus concentrations in near-shore ocean samples collected at Puerco Beach or Malibu Colony during the April 2010 sample period did not exceed the U.S. Environmental Protection Agency (USEPA) single sample standard of 104 MPN per 100 ml. In contrast, enterococcus concentrations in near-shore ocean samples collected at at Surfrider Beach (site OF-C, fig. 2) west of Malibu Lagoon commonly exceeded the USEPA single sample standard for enterococcus in marine recreational water at low tide when the lagoon was discharging to the ocean. The occurrence and concentrations of FIB at Surfrider Beach closely parallel the occurrence and concentrations of FIB data collected from the discharge of the lagoon. Of the three beach sites sampled, FIB concentrations were lowest in the near-shore ocean adjacent to unsewered residential development in the Malibu Colony area in both the July 2009 and April 2010 sample periods.

FIB data collected during both July 2009 and April 2010 have been entered into the U.S. Geological Survey's computerized data base NWIS (National Water Information System) and are publicly available on line at http://waterdata.usgs.gov/nwis. Chemical, isotopic, and genetic analyses of samples collected during the April 2010 sample period have not yet been completed. Please contact me at 619-225-6127 or John Izbicki at 619-225- 6131 if you have any questions concerning these preliminary results. We look forward to working with you and your staff on the completion on this important study.

Sincerely,

for
Peter Martin
Program Chief



EXPLANATION

Sampled wells and identifier—
C-1 ●

Figure 1.—Sampled wells, July 2009 to April 2010, Malibu, California

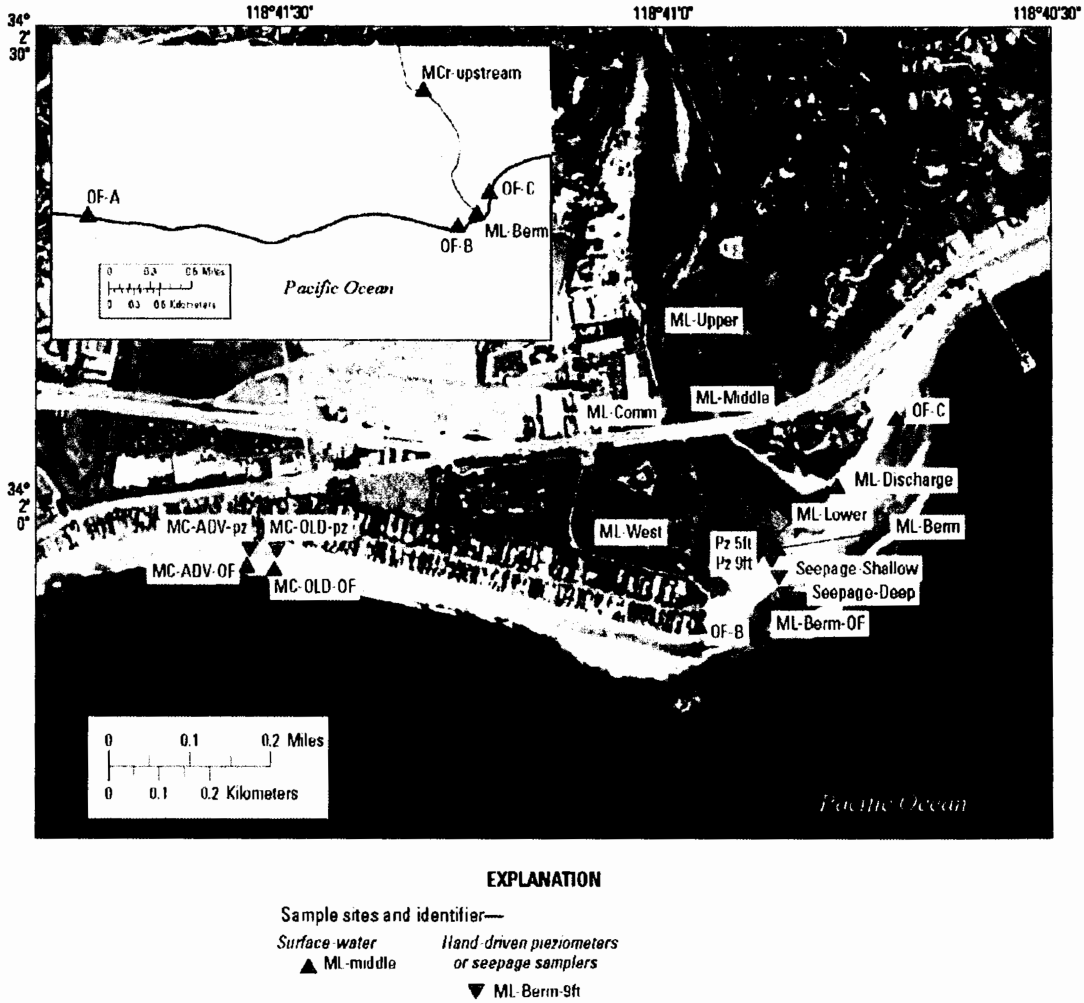


Figure 2.—Surface water sample sites, July 2009 to April 2010, Malibu, Calif.

2009 Investigation of Spatial and Temporal Distribution of Human-specific *Bacteroidales* marker in Malibu Creek, Lagoon and Surfrider Beach

University of California, Los Angeles Study
Principal Investigators: Jennifer Jay and Richard F. Ambrose
Graduate Student Researchers: Vanessa Thulsiraj and Steven Estes

Introduction

WQ impairment near urbanization & Malibu as an important site

Fecal pollution, human and non-human, is a major cause of water impairment in coastal areas. However, our understanding of fecal pollution in coastal ecosystems, as well as our ability to identify and mitigate its sources, is greatly limited by the uncertainties surrounding its behavior in two major reservoirs: wetlands and beach sediments. Fecal indicator bacteria (FIB) and pathogens can enter coastal creeks and rivers from upland sources, but near-shore beach sources are also significant reservoirs (Desmarais et al., 2002; Davies et al., 1995; Craig et al., 2004; Gerba and McLeod 1976), and coastal wetlands have been shown to both increase (Ferguson et al., 2005; Grant et al., 2001; Gersberg et al., 1995; Sanders et al., 2005) and decrease (Evanson and Ambrose 2006) the levels of FIB in water.

Understanding whether there is a relationship between populations of FIB and human-specific *Bacteroidales (*HSB) in wetlands is important for determining impact that these environments pose to human health in coastal bathing waters. Recent work in Southern California has shown that coastal wetlands can be a source of FIB due to wildlife congregation (Lu et al., 2008), regrowth of FIB in sediment (Lee et al., 2006; Davies et al., 1995), and scouring of sediment. Although contrasting conclusions exist it is important to obtain a better understanding of how coastal wetlands influence FIB. Malibu is an important study site and serves as a template to investigate how wetlands specifically influence human-specific factors. This information can assist managers and policymakers to better understand how wetland-related decisions impact beach closure days and consequently local economies and human health.

Our understanding of the fate of fecal pollution in coastal ecosystems, as well as our ability to identify and mitigate its sources, is greatly hindered by limitations in the detection of microbial contamination (in terms of analysis times and host-specificity) and by uncertainties surrounding its behavior in watershed and beach sediments. Both FIB and pathogens appear to have greater persistence in sediments than they do in water, and have been shown to grow in this environment (Lee et al., 2006; Desmarais et al., 2002). Present efforts to identify fecal contamination sources employ a tiered approach in which traditional fecal indicator bacteria (FIB) levels are used to inform advanced host-specific investigation. However, a persistent lack of correlation between FIB and human-specific *Bacteroidales* markers (HSM), high temporal variability in water quality parameters, and long analysis times obscure these endeavors. Rapid detection methods and alternative, host-specific fecal indicators are at the forefront of current coastal water quality protection efforts.

Use of Bacteroidales for fecal source identification

Rapid detection methods and alternative indicators are clearly needed for the development of effective recreational water initiatives (Gregory et al., 2006). Current techniques are primarily culture-based, requiring a minimum of 18 hours for analysis. This delay could result in swimmers being exposed to poor water quality or an unnecessary beach closure, thereby impacting their personal health or the local economy. Among these explored technologies are quantitative polymerase chain reaction (qPCR) (Khan et al., 2007; McDaniels et al., 2005; Shanks et al., 2008; Siefring et al., 2008), fluorescent in situ hybridization (Lee and Deininger 2004; Field and Samadpour 2007), enzymatic methods (Scott et al., 2002), flow cytometry (Griffith et al., 2003; Paster et al., 1994) and immumomagnetic separation/ATP quantification (Gerba 2000). Quantitative PCR is advantageous because it is one of the mentioned rapid processes (3-5 hour processing time), and host-specific.

Microbial source tracking (MST) is an actively growing and important area of research, as information on host-specific sources of fecal contamination can be the key to successful remediation efforts (Bernhard and Field 2000b; Dick et al., 2005a). Griffith et al (2003) compared twelve MST techniques and found detection of *Bacteroidales* to be the most effective method to detect human fecal pollution in various mixtures of fecal sources. Members of the order *Bacteroidales* are found exclusively in endothermic organisms, and reside within feces, the digestive tract, and other body cavities (Dick et al., 2005b). *Bacteroidales* levels in human sewage are orders of magnitude higher than levels of fecal coliform bacteria (Dick and Field 2004). These organisms are obligate anaerobes, and thus do not have the potential for regrowth in the environment that confounds the use of *E. coli* and enterococci as indicators (Seurinck et al., 2005). Most importantly, *Bacteroidales* organisms from different fecal sources exhibit distinct genetic sequences, thus allowing the development of host-specific nucleic acid-based assays. Significant research has been directed toward the development of conventional and quantitative PCR methods for *Bacteroidales* markers specific to human, bovine, pig, horse and dog as well as to universal *Bacteroidales* (Kildare et al., 2007; Shanks et al., 2008; Carson et al., 2005; Nobel et al., 2006; Santoro and Boehm 2006). These assays have been applied to fecal source tracking in many environments: urban watersheds coastal beaches (Boehm 2007; Boehm et al., 2002), freshwater lakes and rivers (Lund 1996), groundwater (Reischer et al., 2008), and agriculturally impacted estuaries and bays (Shanks et al., 2006; Gourmelon et al., 2007).

This study examines the spatial and temporal distribution of human-specific *Bacteroidales* marker (HBM) in lower Malibu Creek, Lagoon and Surfrider Beach under specific hydrologic conditions. Specifically, this work identifies the distribution of fecal indicator bacteria and HBM during wet and dry weather, when the lagoon is open and closed. We investigate whether detectable concentrations of HBM are present in the Lagoon, and if concentrations of HBM correlate with fecal indicator bacteria.

Materials and Methods

Site description of Surfrider Beach and Malibu Creek

The Malibu Creek watershed (109 mi^2) is partially developed (mixed use 17%, 83% open), with 90,000 residents in five cities and unincorporated Los Angeles County. Reaches of the creek are impaired for bacterial contamination, and Surfrider Beach, with over 10,000 visitors on a typical summer weekend day, has frequent postings for impaired water quality. Fecal sources include non point sources and wildlife. Possible human sources of fecal contamination include septic systems and disinfected discharge from Tapia Wastewater Reclamation Facility into Malibu Creek (discharging only in the winter). Malibu Creek ends in a 13-acre lagoon, so birds are likely an important fecal source at Surfrider Beach as well. The beach is currently sampled daily for FIB. Additionally, Heal the Bay's Stream Team has gathered long-term nutrient and FIB data at 17 locations throughout this watershed, showing increasing nutrient and FIB levels with distance downstream in each of four subwatersheds.

Sample design and collection

For this study, a snapshot of bacteria concentrations was measured from the lower Malibu Creek watershed. Surface water samples were collected from a total of 20 sample locations throughout Malibu Creek, Lagoon and Surfrider Beach (Fig 1). Water samples were collected with sterile 500mL Nalgene bottles attached to a sampling pole, or by submerging a sterile 2L Nalgene bottle. Samples taken from flowing storm drains collected end-of-pipe discharges. Samples were stored on ice and transported to the laboratory within 6 hours for immediate analysis. Samples were taken during wet and dry weather, while Malibu Lagoon was open and discharging to Surfrider Beach. Additional sampling occurred during a transitional phase where the Lagoon had been previously closed, but opened overnight and was open during time of sampling. The third hydrologic condition investigated was during dry weather while the Lagoon was closed due to the formation of a sand berm, which prevented flow from the Lagoon to the beach.

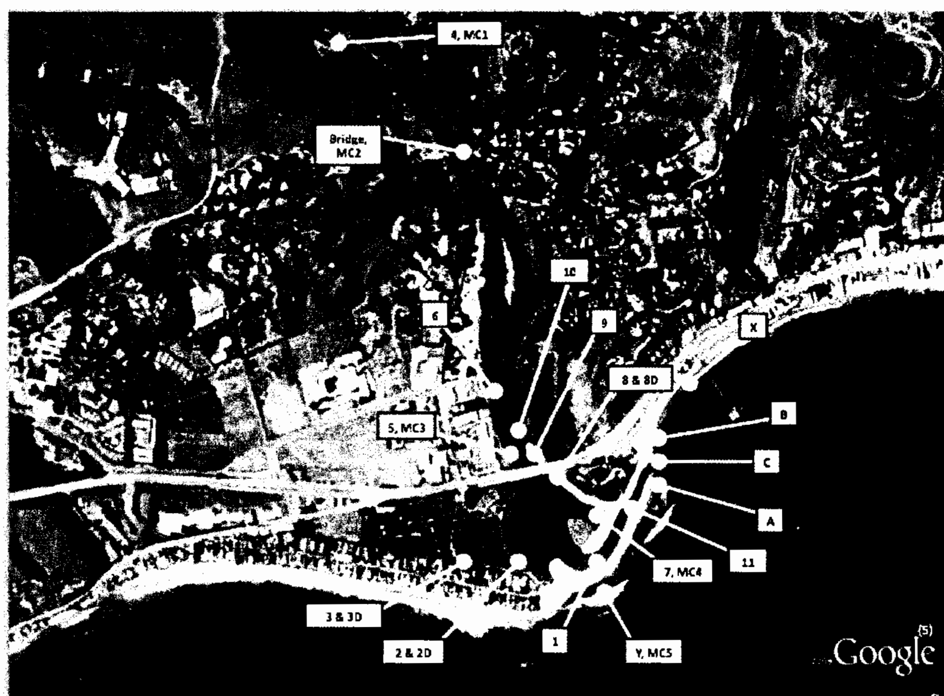


Fig. 1. Sampling locations within the Malibu Watershed. Samples were taken from Malibu Creek (Site 4, Bridge), Lagoon (Site 1-4, 5-11)Surfrider Beach (Site A, B, C, X, Y). Sample sites 2D, 3D, and 8D represent storm drain discharges.

FIB analysis by traditional methods

Water samples were measured for three types of fecal indicator bacteria including total coliform (TC), *Escherichia coli* (EC), and enterococci (ENT) using IDEXX Laboratories, Inc. (Westbrook, ME) defined substrate tests commercially known as Colilert-18 and Enterolert in a 97 well quantitray format. Ten fold and 100-fold dilutions of water samples were used as recommended by the manufacturer.

Geochemical analysis of water samples

Water samples were analyzed for nitrate and ammonia using the Hach Spectrophotometer (model DR 280). Combo by Hanna (model H 18130), a multi-parameter probe, was used to measure total dissolved solids (TDS), water temperature, electrical conductivity and pH. Dissolved oxygen concentrations were measured by the YSI 55 DO probe (model 55/12 FT). Water samples were also analyzed for total suspended solids (TSS) in the lab using Environmental Sciences Section Method 340.2.

Extraction of DNA

DNA was extracted from filters using the Mobio UltraClean Fecal DNA Kit. DNA was extracted according to manufacturer's protocol with the addition of 90 seconds of bead-beating in lieu of 10 minutes vortexing, as listed in the protocol. DNA extracts were stored at -20°C until they could be processed for human-specific *Bacteroidales*. The concentration of extracted DNA from each sample was measured fluorometrically (Stratagene, La Jolla, CA (Santoro and Boehm 2007)) using the Quant-It PicoGreen double-stranded DNA reagent kit (Invitrogen, Carlsbad, CA). Each sample was measured and total DNA(ng) was found by reference to Lambda DNA standards (n=8 ranging from 0.1 to 25 ng µl-1). Prior work in Jay lab has shown that superior DNA amount and quality are obtained with no further purification steps.

Quantitative PCR analysis of Bacteroidales

Detection of 16S rRNA gene markers for human-specific *Bacteroidales* were performed using qPCR (Stratagene, Inc., Mx3000P), by the SYBR Green-based method, with DNA primers HF183F and HF183R (Dick and Field 2005; Seurinck et al., 2005). Each qPCR mixture (total volume 25 µl) contained approximately1-2 ng DNA (diluted in known volume of RNase-free water) and ~13 µl master mix (2× SYBR Green, Stratagene, Inc.; 140 µM each primer, Operon Biotechnologies, Huntsville, AL). Sample were run in duplicate and converted to concentration by reference to *Bacteroidales* standards (a *Bacteroidales* plasmid DNA kindly provided from the Furman laboratory (n=8 ranging from 2×100 to 2×10^6 copies µl-1). Samples "spiked" (i.e., positive controls) with 1-µl (2×10^5 copies) *Bacteroidales* standard are used to estimate low rates of recovery and possible inhibition by contaminants in DNA extracts. In the case of interference, samples were diluted two-fold and reprocessed (Nobel et al., 2006). Negative controls were run with every reaction, and consist of all elements except target DNA.

Results

Fecal Indicator Bacteria Results

Over the entire study period (February to July 2009), a total of 70 water samples were taken from up to 20 different sample locations within lower Malibu Creek, Lagoon and Surfrider Beach. During this time, fecal indicator bacteria were above the water quality single sample standard in 50%, 54% and 39% for TC, EC and ENT. The greatest number of exceedances occurred at site 3 and 3D for total coliforms, however the single highest level (241957 MPN/100ml) for TC was measured from site 6 (lagoon) during wet weather on February 16, 2009. For *E. coli*, sites 2 and 3 showed the greatest number of exceedances, with 4/4 samples above the threshold for both sample locations. Several sites had maximum EC concentrations above the detection limit (>24196 MPN/100ml), including sites 7, 8 and 2D. The greatest number of exceedances for enterococci was measured at site 3D, however highest concentrations of ENT (19863MPN/100ml) was measured during wet weather from sample site 7, during dry weather when the lagoon was closed.

Fecal indicator bacteria concentrations were found to be high throughout the Malibu Creek, Lagoon and Surfrider Beach during a storm event on February16, 2009. This was the only time that elevated fecal indicator bacteria concentrations were measured upstream in Creek waters or in ocean water samples in this study. The mean concentration during wet weather was measured as 69280 MPN/100ml for TC, 1328 MPN/100ml for EC and 3755 MPN/100ml for ENT. Highest percent exceedance was measured during wet weather. Samples exceeded water quality standards 87% of the time for both TC and EC and 100% for ENT. All samples collected exceeded standards for all three indicators except for two samples. Water samples exceeded water quality standards 87% (13/15) and 100% (15/15) of the time for EC and ENT. Samples collected from site 8, taken within the lagoon, and site 2D, stormwater runoff did not exceed standards for total coliforms and *E. coli*.

In March 2009, field sampling occurred during dry weather while the lagoon was breached. FIB concentrations were typically below the health standard of 400MPN/100mL and 104MPN/100mL for *E. coli* and enterococci. However, specific hot spots were found within Malibu Lagoon under this hydrologic condition. Exceedances for FIB occurred at four sample locations (2, 3, 7, 8) within the lagoon and adjacent to two storm drains (3D and 8D) in March. FIB levels were above health limits in 22% (TC and ENT) and 28% (EC) of samples collected. Mean concentrations for this sampling field campaign were 19924 MPN/100ml TC, 699 MPN/100ml EC, and 371MPN/100ml ENT. However, median concentrations were all below the recreational water quality threshold (TC 2006, EC 168 and ENT 10 MPN/100ml).

During dry weather, transitional open lagoon conditions, elevated levels of FIB occurred in 10 sample locations resulting in 22%, 44% and 6% exceedance for TC, EC and ENT respectively. Slightly larger number of exceedances were observed for E. coli, however exceedances were much lower for enterococci in the May sampling event. Samples were above the health standard for E. coli at sites 2, 3, 6, 8-11, and 3D. Highest FIB concentrations were measured from site 3 (EC 1552 MPN/100ml) and site 3D (EC 2307MPN/100ml, ENT 1004 MPN/100ml). The largest number of exceedances occurred within Malibu Lagoon, although one ocean water sample (site X) and one upstream sample (site Bridge) were above the water quality limit for total coliforms. Both of these samples did not exceed the single sample standard for any other indicator organism. Mean sample concentrations were 12861 MPN/100ml TC, 531 MPN/100ml EC and 6

MPN/100ml ENT. Median concentrations were again lower than mean values, with values of 3189 MPN/100ml TC, 206 MPN/100ml ENT, and 20 MPN/100ml ENT.

After closure of the lagoon, fecal indicator bacteria concentrations increased, and higher level of exceedences were observed for all three indicators (74% for TC, 63% for EC, and 37% for ENT). Despite exceedances in the lagoon throughout the study period, FIB levels did not exceed health standards for samples collected in Malibu Creek and at Surfrider Beach. The lowest mean concentrations for Surfrider Beach ocean water samples were observed during the closed lagoon, dry weather condition in July 2009 (60 MPN/100ml TC, 20 MPN/100ml EC, and 2 MPN/100ml ENT). And although concentrations were intermediate to high (10^3 to $10^{4.7}$ MPN/100ml) for total coliforms in upstream locations, site 4 and Bridge, these sites never exceeded standards for either *E. coli* or enterococci throughout the sampling period. Mean concentrations for the closed lagoon, dry weather condition were 17096 MPN/100ml TC, 10297 MPN/100ml EC, and 2096 MPN/100ml ENT. Median concentrations were still high, with both TC and EC above the single standard sample threshold (24196 MPN/100ml TC, 5172 MPN/100ml EC and 74 MPN.100ml ENT).

Human-specific HF183 Bacteroidales Results

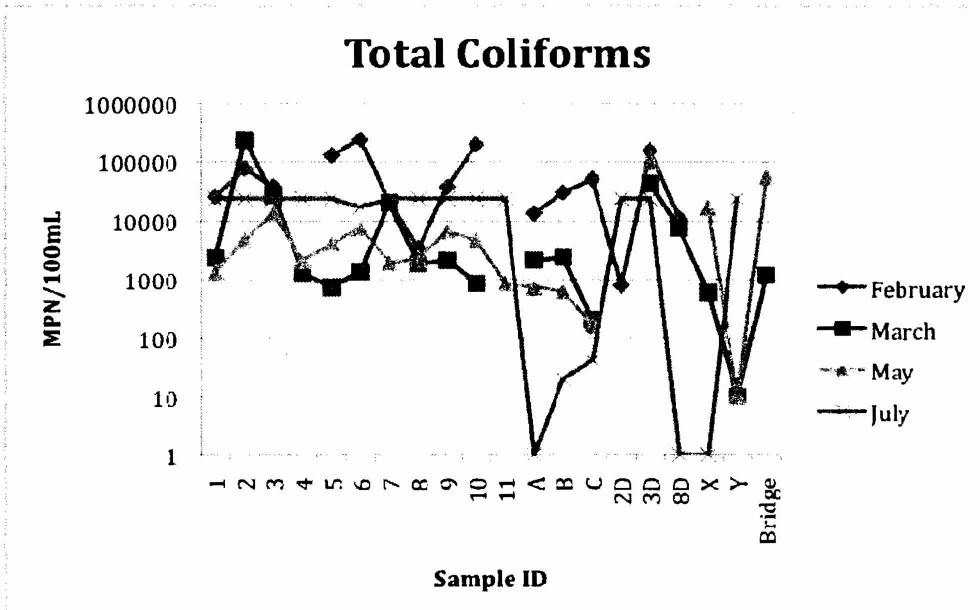
The human-specific HF183 *Bacteroidales* marker (HBM) concentrations were measured from water samples taken within the Malibu Creek, Lagoon and Surfrider Beach. The human-specific HF183 *Bacteroidales* marker was analyzed during open and closed lagoon, dry and wet weather conditions. Duplicate concentrations were averaged and reported as the value for positive samples. A total of 80 water samples were analyzed for the HBM. Forty-four samples were taken during dry weather while the lagoon was breached (open and transitional). Human-specific *Bacteroidales* marker was not detected in any of the samples taken during this condition. During wet weather open lagoon conditions in February 14.3% (2/14) of samples were positive for HBM. Concentrations of the HBM measured at sites 3 and 5 were 452 copies/100ml and 880 copies/100ml. In July, during dry weather closed lagoon conditions 3 of 22 (13.6%) samples were positive for the HBM. Sample locations 3, 6 and 7 all located within the Malibu lagoon had HBM concentrations of 121 copies/100ml, 55c opies/100ml and 210 copies/100ml.

In addition to the four field sampling days at the 20 locations throughout the watershed, 5 sample sites were measured during a two-week sampling campaign in the months of April and May. Samples were taken at sites 4, 5, 7, Y and Bridge on April 29 2009. Samples taken from sites 4, 5, 7, and the Bridge did not have detectable concentrations of the human-specific *Bacteroidales* marker. Sample site Y, an ocean water sample taken from Surfrider Beach at the mouth of the lagoon, was sampled on April 29 and 30th as well as May 5th and 7th. Site Y did not have detectable concentrations of HBM in the additional four samples taken during the two-week period.

Conclusion

Of the 80 water samples analyzed within the Malibu watershed, five samples were positive for the human-specific HF183 *Bacteroidales* marker. The five positive samples were measured from 4 sample locations, all located within the Malibu lagoon. Site 3 was positive for the HBM during wet and dry weather. Concentrations at this site ranged between 121 – 452 copies/100ml. Other sites that were positive for Malibu Lagoon included sites 5, 6, and 7. Concentrations at these sites ranged between 55 – 880 copies/100ml, which is equivalent to 0.00005 - .0009% sewage. The highest percent exceedance of FIB and HBM concentrations were measured during wet weather. During the study, 93.8% of the samples did not have detectable concentrations of HBM. These data do not rule out any particular potential sources of human fecal contamination. The human-specific *Bacteroidales* marker was not measured in any of the lower Malibu Creek samples and ocean water samples taken from Surfrider Beach.

Figures


Total Coliforms
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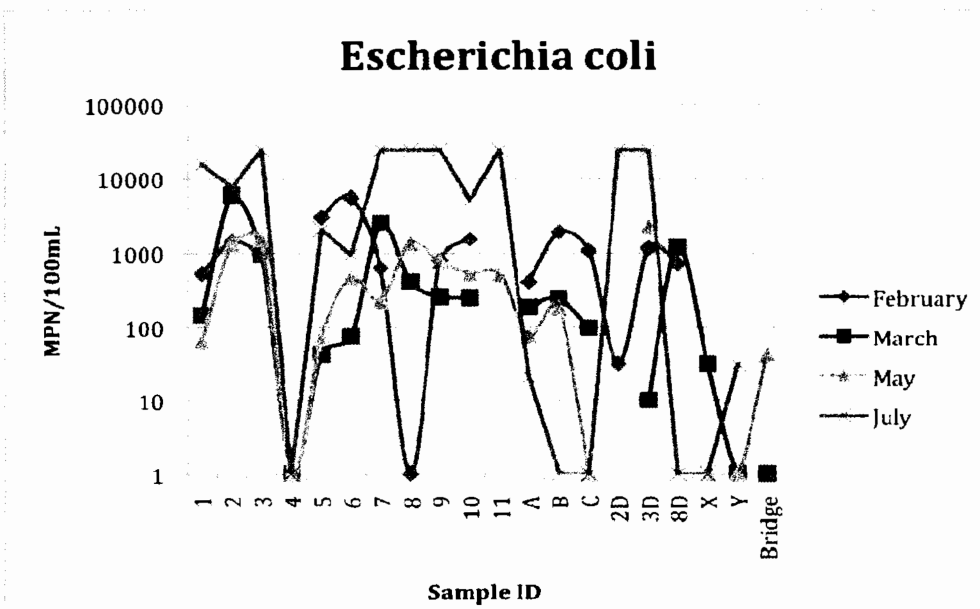
100000
10000
1000
100
10
1
MPN/100mL
1
2
3
4
5
6
7
8
9
10
11
A
B
C
2D
3D
8D
X
Y
Bridge
Sample ID
February
March
May
July


Escherichia coli
100000
10000
1000
100
10
1
MPN/100mL
1
2
3
4
5
6
7
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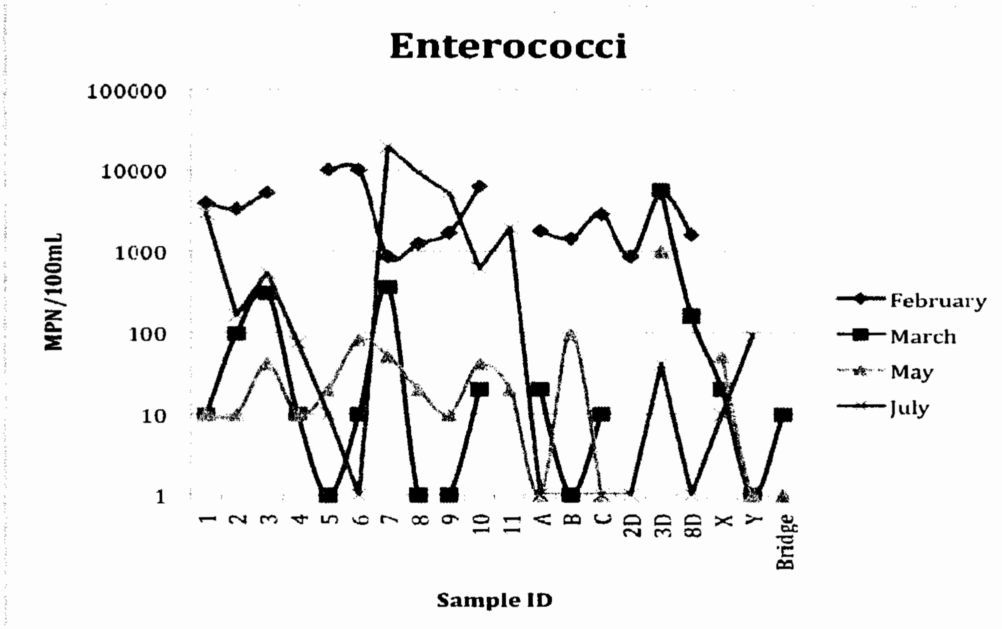
B
C
2D
3D
8D
X
Y
Bridge
Sample ID
February
March
May
July


Enterococci
MPN/100mL
100000
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1 2 3 4 5 6 7 8 9 10 11 A B C 2D 3D 8D X Y Bridge
Sample ID
February
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May
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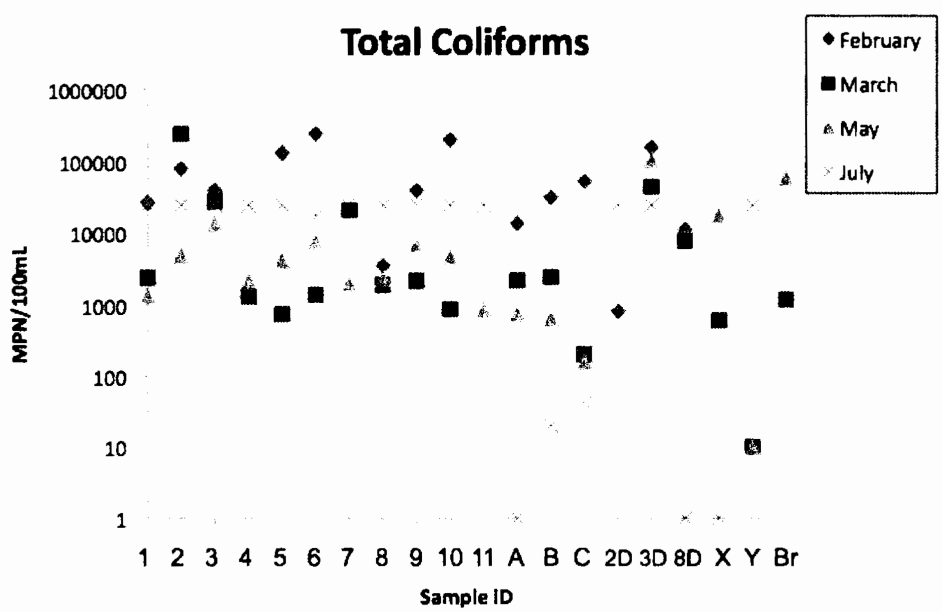
Total Coliforms
MPN/100mL
1000000
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1 2 3 4 5 6 7 8 9 10 11 A B C 2D 3D 8D X Y Br
Sample ID
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May
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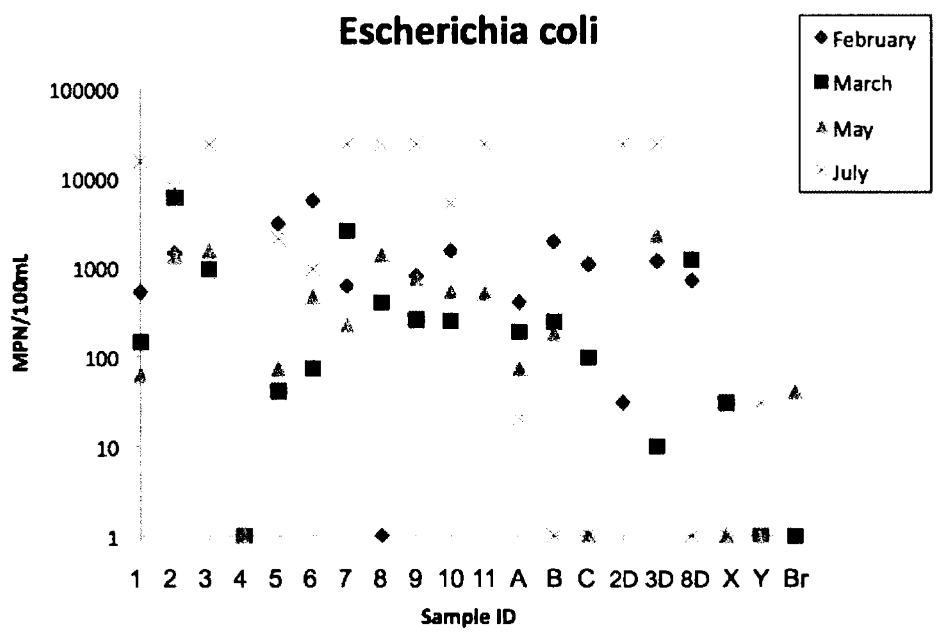
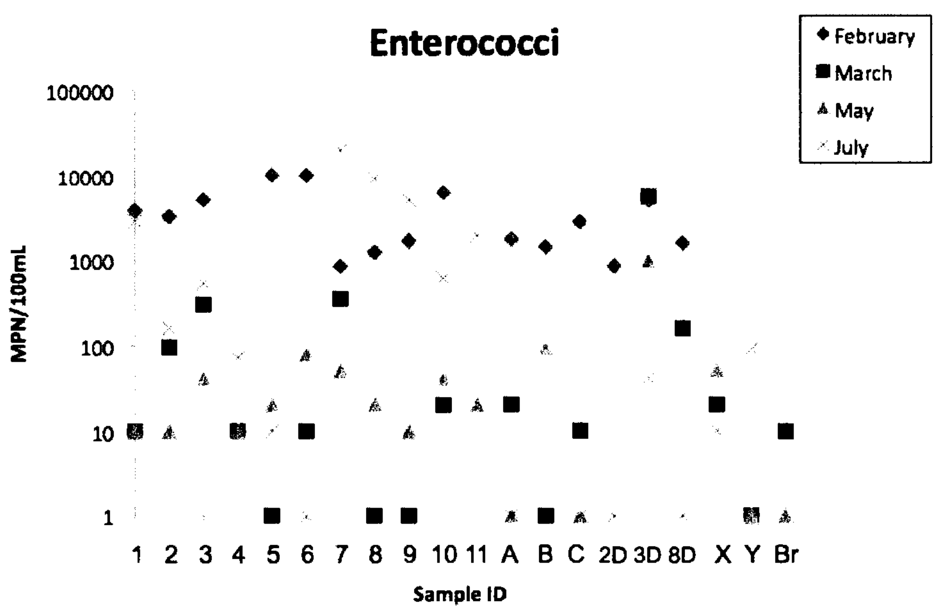
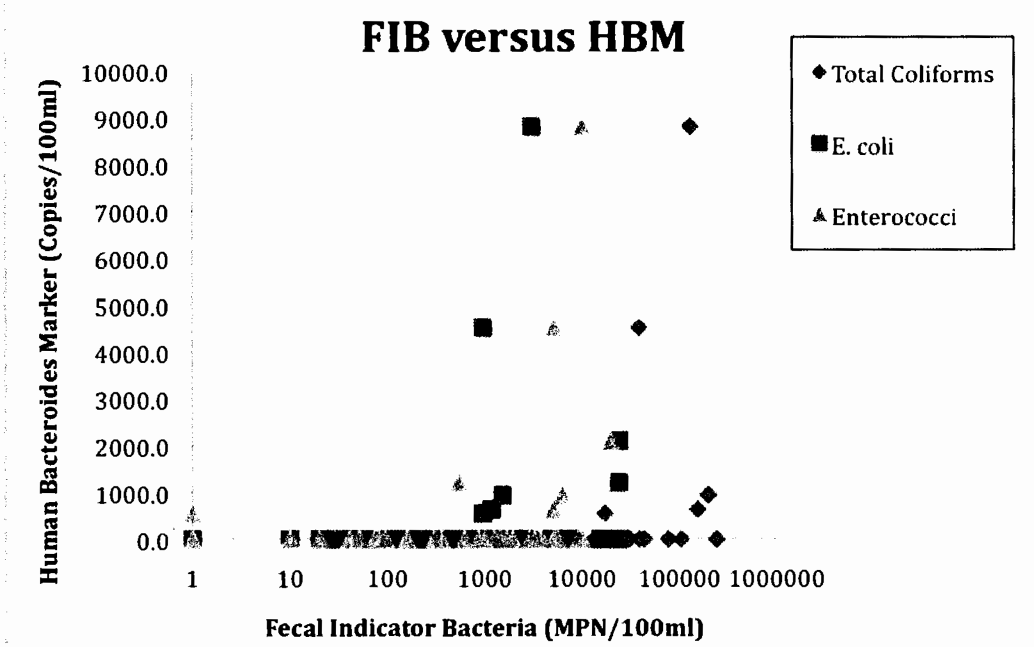


Escherichia coli
February
March
May
July
100000
10000
1000
100
10
1
MPN/100mL
1 2 3 4 5 6 7 8 9 10 11 A B C 2D 3D 8D X Y Br
Sample ID

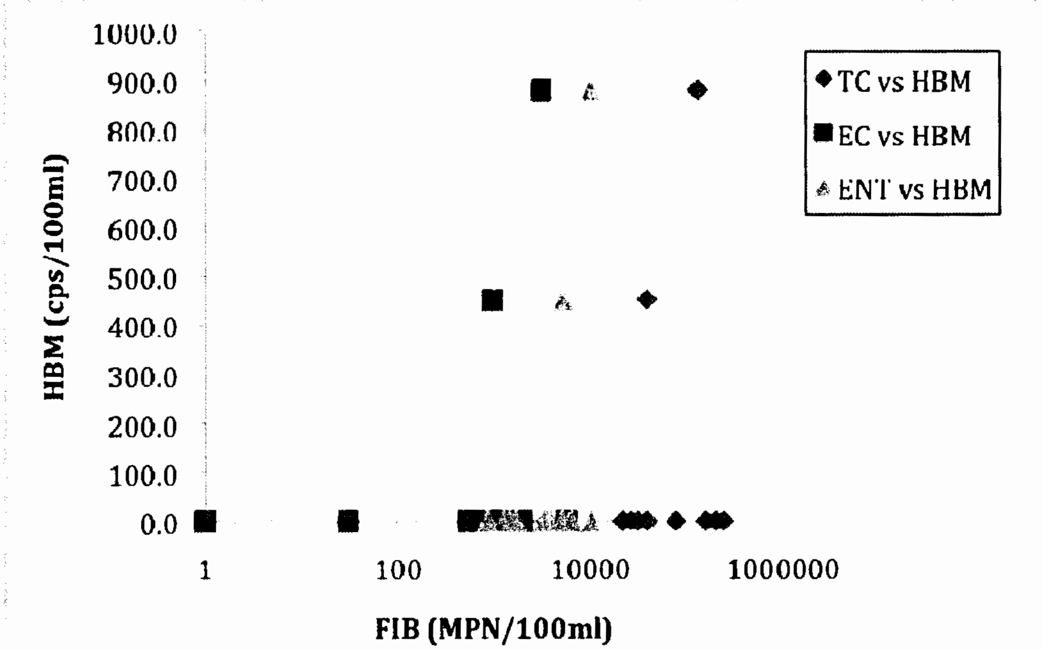


Enterococci
February
March
May
July
100000
10000
1000
100
10
1
MPN/100mL
1 2 3 4 5 6 7 8 9 10 11 A B C 2D 3D 8D X Y Br
Sample ID

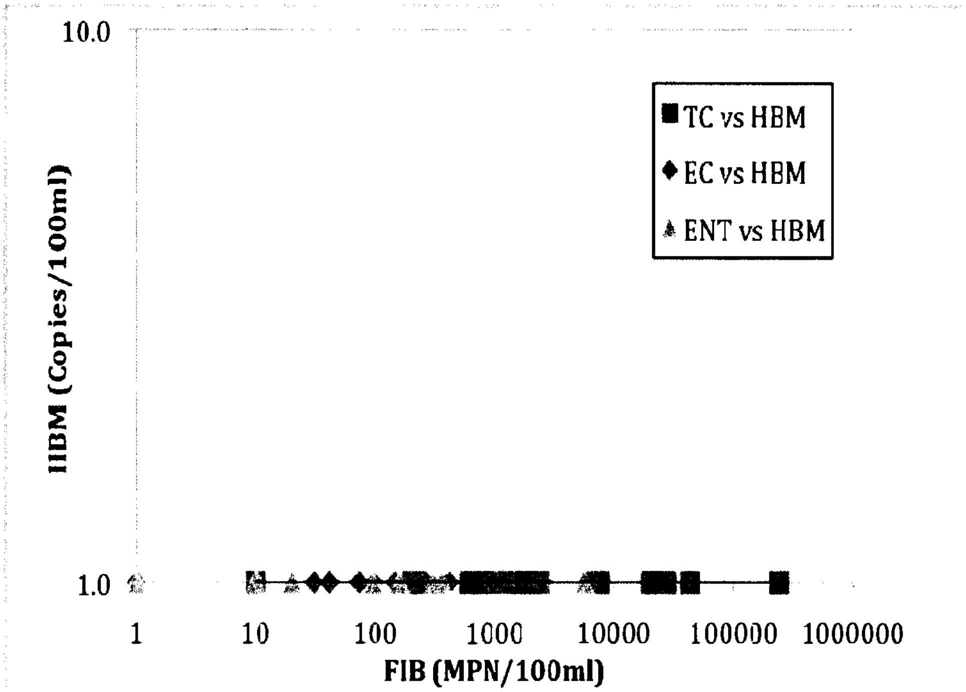
Fecal Indicator Bacteria Versus Human-specific *Bacteroidales* for entire study period



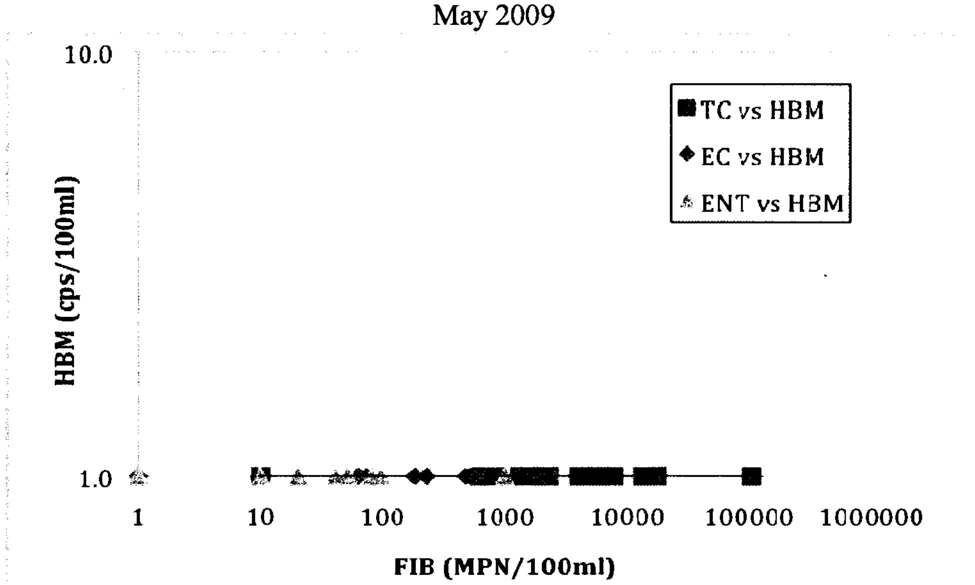
February 2009

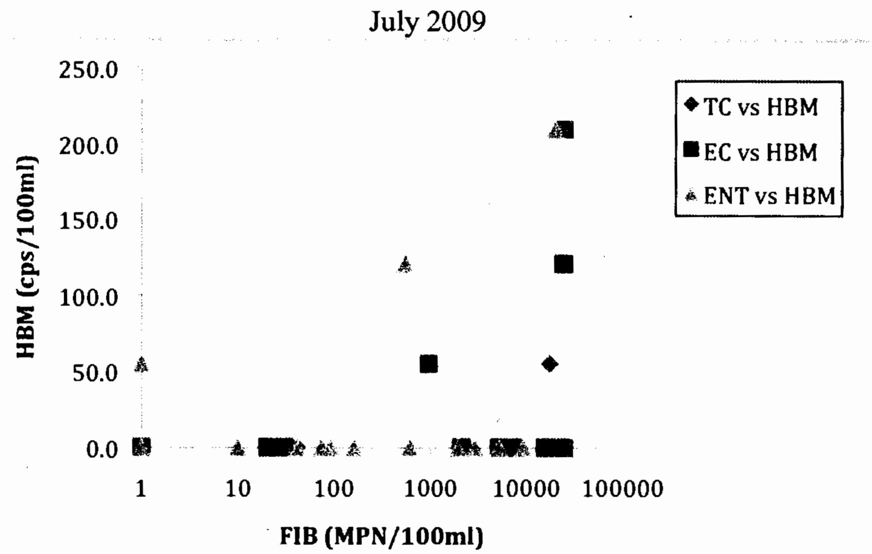


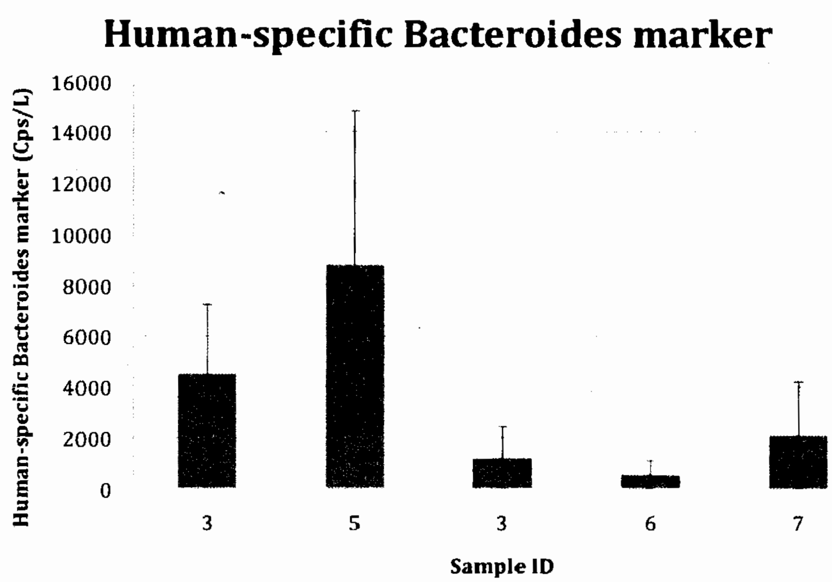
March 2009



May 2009







Average HBM concentrations from duplicates are graphed above. The error bars represent the minimum and maximum concentrations measured from each sample processed. (Sample 3 and 5 on the left were taken in February, and samples 3, 6 and 7 on the right were taken in July).

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Wetlands Defense Fund

W6a

CLEAN

COASTAL LAW ENFORCEMENT ACTION NETWORK
Projects of the International Humanities Center

Received at Commission Meeting
OCT 13 2010
From:

October 12, 2010

The Honorable Bonnie Neely, Chair,
The Honorable Mary Shallenberger, Vice Chair
& Jack Ainsworth, Deputy Director
California Coastal Commission
c/o Amber Tysor, Ventura Office ~
sent via email and facsimile and also distributed by hand to Commissioners

re: Application #4-07-098, Malibu Lagoon proposed project

Dear Commission Chair Neely, Vice Chair Shallenberger, Commissioners, Mr. Ainsworth and Ms. Tysor:

I write on behalf of Wetlands Defense Fund and CLEAN (Coastal Law Enforcement Action Network) to express our strong objection to approval of the item referenced above. We disagree with staff, both in its recommendation, as well as in its analysis. It seems clear, however, that staff did not have the benefit of input from a full rage of wetland experts and habitat specialists, and we hope by providing additional, relevant information, there might be room for a re-examination of the Project. Wetlands Defense Fund and CLEAN are nonprofit initiatives with the specific purpose to protect and enhance California wetlands

322 Culver Blvd., #317, Playa del Rey, CA 90293 ~ (310) 821-9045

EXHIBIT 7
R-4-07-098 (Malibu Lagoon Revocation Request)

and coastal habitats. Our prior engagements have included efforts to protect streamside Environmentally Sensitive Habitat Area (ESHA) in Stokes Canyon, rare vernal pool wetlands at Isla Vista in Santa Barbara, and more generally, endangered and rare species of native flora and fauna, including the endangered Least Tern at its breeding grounds in Los Angeles. We have also provided funding to California State Parks for positive solar installations, as well as a habitat restoration of raptors at Montana de Oro State Park as a result of settlement of a coastal litigation effort to insure proper mitigation by a large utility firm. While we are often completely supportive of California State Parks and its efforts, on this Project we find ourselves necessarily objecting to their plans due to the proposed Project's negative impacts to a functioning coastal lagoon, rare and fragile by its very nature.

BACKGROUND

Malibu Lagoon, as it exists today, is of great ecological significance. The lagoon is a 31-acre shallow water embayment at the terminus of the Malibu Creek at Surfrider Beach, and it is one of the last remaining coastal wetlands within Santa Monica Bay. There is no dispute that the lagoon currently provides an important coastal wetland resource for both avian and aquatic species.[1]

Yet, without fully recognizing existing ecological values, the Project proposes to remake the western complex of Malibu Lagoon with grading, dredging, and fill totaling 88,7000 cubic yards. This heavy-handed approach would have unavoidable and significant environmental impacts on the lagoon. The entire Project would occur in ESHA, and the majority of dredge and fill would occur in wetlands. Despite this development's obvious inconsistencies with the Coastal Act, project proponents consistently underestimate the full scope of significant wetland, biological, and other impacts.

Moreover, the Project poses to undermine benefits from prior restoration efforts. In 1983, the California Department of Parks and Recreation ("DPR") initiated a

[1] Jones & Stokes, *Biolgoical Assessment/Essential Fish Habitat Assessment for the Malibu Lagoon Restoration Project*, Nov. 2007, at 1.

restoration of the lagoon (the "1983 Restoration"), which involved the 60,000 cubic yards of excavation to create three wetlands channels, restore approximately 7 acres of lagoon (the "western complex"), and create a series of boardwalks to allow for public access.[2] In 1996, the California Department of Transportation ("Caltrans") funded another restoration plan to mitigate for impacts incurred from the Pacific Coast Highway Bridge Replacement Project; and that restoration program included a Tidewater Goby habitat enhancement project and a revegetation program. Both of these prior restorations resulted in successful enhancement of habitat for birds, the Tidewater Goby, and other species, and in improvement to public access to the sea. The Project would significantly impact these prior advances.

PUBLIC PROCESS

Contrary to the assertions of project advocates, the process of public participation has been flawed in several significant respects. In fact, Wetlands Defense Fund and CLEAN were not aware that that Phase II of the project (as opposed to just the Phase I parking lot renovation) was going to proceed at all until the Commission posted an agenda item early this past summer.

The genesis of the plan before the Commission was conceived of and planned largely behind closed doors, away from those of us who were informed and interested stakeholders of the Malibu Creek Watershed Council's Malibu Lagoon Task Force. When members of the public first became aware than a "technical" committee was planning this project without the benefit of the informed public's input, objections were raised.

In fact, the Malibu Lagoon Task Force agreed on a set of recommendations for action, which included moving the parking lot, removing nonnative plants and replacing with more appropriate natives (never considered doing with bulldozers or poisonous herbicides) and, most importantly, acquiring more land in the Malibu Creek floodplain, the details of which were articulated in a speech by

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[2] Coastal Development Permit No. P-79-5515

Suzanne Goode of California State Parks to the City of Malibu. Her speech is available for viewing at: http://www.youtube.com/watch?v=3LpzT1gPDhw

By reference, we incorporate Suzanne Goode's comments in this letter and ask that those comments be considered part of the official record. In addition, please refer to the Ambros/Orme UCLA study which underscores these land acquisitions as priorities for cleaning the waters which flow to Malibu Surfrider Beach due to the acknowledged need to clean the upstream flows before they reach the lagoon. A fine example of the results of those priorities being paid attention to is the City of Malibu's acquisition of the site formerly known as the "Chili Cookoff site" and now recently dedicated as "Legacy Park," which does, indeed plan for capturing storm water flows and cleansing these waters before their arrival at Malibu Lagoon and Surfrider Beach.

After repeated objections to this "out of the blue" proposal from Heal the Bay's engineering contractor, as mentioned above, by numerous stakeholders, finally two people were allowed to attend one of these meetings at the office of Heal the Bay, but those two of us (which I was one) were not allowed to speak, only listen. Heal the Bay had received a $250,000 grant from the State Coastal Conservancy to conceive of this plan, yet only Heal the Bay staffers, some selected advisors ("technical" committee) and agency representatives from State Parks and Coastal Conservancy were present.

It became apparent at that meeting that the plans this process had hatched would not be good for the lagoon's ecosystem. When the engineering firm presented these plans to the public, there was such outcry that the rest of the planning for this project apparently went even deeper underground.

A scoping notice for an environmental review process was sent out, which CLEAN commented on, but after that we never heard anything further about an environmental impact report, although one was completed and approved of. It is interesting to note that the main comment-makers on the EIR are government agencies, and it is surprising that more of the NGO stakeholders did not comment. Perhaps they were also not notified. We have inquired of adjacent residents and Malibu stakeholders like the Malibu Township Council and others, all of whom report they were not notified of the environmental review process.

In addition, no federal Environmental Impact Statement (EIS) was completed, even though Malibu Lagoon is designated as "Critical Habitat" for the endangered Tidewater Goby, the federally-endangered California Least Tern uses Malibu Lagoon (including the western arms where we have viewed this feeding behavior for years) for post-breeding dispersal foraging for adults and their young, and other species listed on the endangered species list, like the Southern Steelhead and Western Snowy Plover either use the lagoon or adjacent habitat, being potentially impacted by this drastic, highly industrial project which would alter the lagoon and its natural processes significantly.

We are grateful to have the opportunity to now raise our concerns before the Commission.

NEW INFORMATION

Malibu Lagoon has a terrific diversity of habitat values, many of which have never been acknowledged or for which Project impacts have never been examined. This year alone numerous additional bird species were documented by expert ornithologists, including the presence of more than 300 Black Skimmers (listed as rare and of "national conservation concern" by National Audubon Society), which began nesting behavior, and several Belding's Savannah Sparrows, a species on the State of California Endangered Species list. More than 200 bird species have been documented as having using Malibu Lagoon for some part of their life cycle, and numerous new species were sighted and documented this year, making the 2005 bird report which the EIR relied on outdated and in need of an update, especially due to the rare and endangered bird sightings this summer.

There are, thus, questions as to whether the National Environmental Policy Act (NEPA) was followed, whether the Endangered Species Act was properly complied with and whether the Migratory Bird Treaty Act would be violated if this project proceeds. And now, given the lack of comment on this process (due to staffing deficiencies) from the California Department of Fish & Game, California state laws protecting rare and endangered species have not been sufficiently analyzed.

Los Angeles Superior Court Judge James Chalfant has ruled that the Coastal Commission must consult with the California Department of Fish & Game in order to comply with CEQA, and the "sorry we can't comment letter due to staffing deficiencies" letter does not adequately address the very concerns DFG raised in their scoping comments for the EIR, which were not adequately addressed in the EIR either.

INCONSISTENT INFORMATION

Fish Kills?: While Project proponents and the Commission's staff report assert that this Project will fix a problem of low dissolved oxygen and "big fish kills," the science reports relied on for this assertion conclude the opposite. For instance: in an excerpt from Page 207 of the UCLA Ambrose & Orme study:

> Probably the most important water quality limitation in Malibu Lagoon is the dissolved oxygen (DO) concentration. Species such as topsmelt have been shown to be intolerant of low DO but a low DO level of >4 mg/L is generally recognized as necessary for most species. Some species, such as the negative indicator *Polydora nuchalis*, tolerate low DO, but the positive indicator species apparently cannot. There is no extensive monitoring record of DO in Malibu Lagoon. However, Ambrose, et al (1995) report periods of low DO in association with algal mats in the Lagoon. Heavy algal cover and the consequent low DO have been associated with fish kills in some systems. However, ***we have no well-documented records of extensive fish kills in Malibu Lagoon.*** During the Ambrose, et al, (1995) fish in traps on the bottom of the Lagoon were killed during low DO episodes, but ***widespread fish kills were not observed.***

Still Water for Tidewater Goby: It is disturbing that the Coastal Commission might consider approving a project that would be so destructive of critical habitat for the Tidewater Goby and functioning habitat without reviewing in its entirety the record as it now stands. According to the US Fish & Wildlife Service Critical Habitat report, the Tidewater Goby requires STILL WATER, not moving water, as this Project plans for.

NO TIME GOOD FOR CONSTRUCTION DUE TO ENDANGERED SPECIES

The US Fish & Wildlife Service and National Marine Fisheries Service determined that there would be times when such a massive construction project would not be good for the endangered species which depend on Malibu Lagoon for food, breeding and other habitat needs.

The attached chart, found in the Coastal Commission's Ventura office files, demonstrates that there is really no time at all when this Project should be allowed to proceed, yet the most important breeding time for the Tidewater Goby, a fish on the United States Endangered Species List, was selected for draining and dredging of the lagoon, and impacts (including injury and death) to this species which is on the brink of extinction will be assured.

WILL THIS PROJECT MEET THE GOALS OF THE PROJECT PLANNING BY MALIBU LAGOON TASK FORCE?

On page 552 of Malibu Creek Watershed UCLA study by Rich Ambrose and Anthony Orme, which was the consensus document which arose from the stakeholder processes planning for improvements to Malibu Lagoon, the agreed on priority for restoration at Malibu Lagoon was determined to be to acquire more land in the Malibu Creek floodplain.

"the acquisition of potentially restorable land should be the highest priority for restoration and the first step in restoring the Malibu Lagoon ecosystem".

"The principle of giving highest priority to the acquisition of land before it is developed has been adopted by the Scientific Advisory Panel for the Southern California Wetlands Recovery Project, a consortium of state and federal agencies concerned with wetland restoration in southern California."

Finally, we ask that you reject this project proposal and send the restoration idea back to California State Parks so that they can study and consider the genuine restoration alternative proposal put forth by expert wetland restoration scientist Wayne Ferren – a proposal that is based on the actual existing conditions of Malibu Lagoon and its important ESHA (Environmentally Sensitive Habitat Area) qualities which are required to be preserved and protected by law.

We remain hopeful that a project can move forward soon that will honor the ecological functions of Malibu Lagoon that apparently have been poorly misunderstood by many of those advocating for their destruction.

With best regards ~ and for the wetlands ~

Marcia Hanscom /s/

Marcia Hanscom
Director
Wetlands Defense Fund

&

Managing Director
CLEAN (Coastal Law Enforcement Action Network)

Wetlands Defense Fund and CLEAN are
Projects of the International Humanities Center
Pacific Palisades, California

State of California • Natural Resources Agency
DEPARTMENT OF PARKS AND RECREATION • P.O. Box 942896 • Sacramento, CA 94296-0001

Edmund G. Brown Jr., *Governor*
Ruth Coleman, *Director*

July 5, 2012

Dr. Charles Lester
Executive Director
California Coastal Commission
45 Freemont Street, Suite 2000
San Francisco, California 94105-2219

Dear Dr. Lester:

CALIFORNIA STATE PARKS RESPONSE TO THE JUNE 14, 2012 WETLANDS DEFENSE FUND AND COASTAL LAW ENFORCEMENT ACTION NETWORK *"REQUEST FOR HEARING TO CONSIDER REVOCATION OF COASTAL DEVELOPMENT PERMIT #4-07-098 'MALIBU LAGOON ENHANCEMENT PROGRAM'"*

This letter is sent on behalf of California State Parks ("State Parks"). This letter serves as State Parks' official response ("Response") to the Request For Hearing To Consider Revocation of Coastal Development Permit ("CDP") #4-07-098 ("Request") submitted on behalf of the Wetlands Defense Fund, and Coastal Law Enforcement Action Network ("Petitioners") on June 14, 2012.

BACKGROUND

State Parks filed an application with the California Coastal Commission ("Commission") on August 10, 2007[1] seeking a CDP in order to implement the Malibu Lagoon Restoration and Enhancement Project ("Project"). As a result of the CDP application, an environmental document was prepared pursuant to the California Environmental Quality Act ("CEQA"). The Commission approved the Project at the regularly scheduled business meeting on October 13, 2010.[2] The CDP for the Project was issued on May 21, 2012.

Project construction began on or around June 6, 2012, in accordance with the CDP and all other permits, including those issued by the United States Fish and Wildlife Service ("USFWS"), National Marine Fisheries Service ("NMFS"), Army Corps of Engineers ("ACOE"), California Department of Fish and Game ("DFG"), Regional Water Quality Control Board ("RWQCB"), among others. On June 14, 2012, Petitioners filed their Request asking the Commission to revoke the CDP. On that same day, Petitioners also requested that the Commission take enforcement action against State Parks for alleged violations of the CDP. As discussed in greater detail later in this Response, as a result

[1] Malibu Lagoon Restoration Project, Administrative Record ("AR") 1.
[2] Malibu Lagoon Restoration Project, AR 247.

EXHIBIT 8
R-4-07-098 (Malibu Lagoon Revocation Request)

of an inspection by the Commission's enforcement staff, it was concluded that no CDP violations were occurring or had occurred. The report of the investigation is attached as Exhibit A.

This Response addresses all of the issues and claims raised by the Petitioners in the Request. Wherever possible, this Response provides relevant citations to the administrative record prepared by the Commission for the litigation filed by the Petitioners against the Project, which is currently on appeal. Citations to that record are denoted as "AR (page number)".

ANALYSIS

I. <u>PURSUANT TO TITLE 14, CALIFORNIA CODE OF REGULATIONS SECTION 13106, PETITIONERS LACK THE REQUISITE LEGAL STANDING TO BRING A REQUEST FOR REVOCATION.</u>

The California Code of Regulations ("CCR") section 13106 states that "*[a]ny person who did not have an opportunity to fully participate in the original permit proceeding by reason of the permit applicant's intentional inclusion of inaccurate information or failure to provide adequate public notice as specified in Section 13105 may request revocation of a permit by application to the executive director.*"

The Petitioners have been active in the Malibu Lagoon restoration plans since discussions on the Project began. The earliest references to their participation in the Commission's administrative process date back to June 16, 2005.[3] The Petitioners have had every opportunity to raise all of the concerns identified in their Request and have fully participated throughout the entire permitting process. Because they have fully availed themselves of the opportunities to participate, they have no standing to make the Request.

II. <u>PETITIONERS' REQUEST FOR REVOCATION DOES NOT MEET THE LEGAL STANDARDS SET FORTH IN THE CALIFORNIA CODE OF REGULATIONS SECTION 13105 AND 13106.</u>

Although the Petitioners lack standing, as identified above, to bring their Request, Petitioners have also failed to meet the legal standard articulated under CCR section 13105(a) which sets forth the grounds required for revocation.[4] That provision states the "*[g]rounds for revocation of a permit shall be: (a) Intentional inclusion of inaccurate, erroneous or incomplete information in connection with a coastal development permit application where the commission finds that accurate and complete information would*

[3] Malibu Lagoon Restoration Project, AR 745 - 755. Letter from the Wetlands Action Network and the Coastal Law Enforcement Action Network regarding "*Malibu Lagoon and restoration plans*" dated June 16, 2005.
[4] California Code of Regulations Title 14, Division 5.5, Chapter 5, Subchapter 1, Article 16, section 13105(a).

have caused the commission to require additional or different conditions on a permit or deny an application."

As identified in numerous Commission staff reports, "*because of the impacts on an applicant, the grounds for revocation are necessarily narrow.*"[5] The elements requiring revocation are so narrow, that the regulation requires the applicant act with intent. An act is done intentionally if the "*actor desires to cause consequences of his act, or that he believes that the consequences are substantially certain to result from it.*"[6] Additionally, Commission staff have historically interpreted section 13105 as having three elements:

1) That the applicant provided incomplete, inaccurate or erroneous information; AND
2) That inaccurate, erroneous or incomplete information was supplied intentionally; AND
3) That if the Commission had known of the information, it would have denied the permit or imposed additional or different conditions."[7]

Accompanying the narrow grounds for revocation identified above, CCR section 13106 requires that a request for revocation "*specify with particularity, the grounds for revocation.*"[8] The Request submitted by Petitioners includes discussion on a multitude of subjects, but generally does not present a coherent argument of how State Parks intentionally supplied the Commission with inaccurate information and/or how that alleged intentional inaccuracy misled the Commission in its evaluation and decision making process. At best, the Request is a convoluted document where the reader must infer the Petitioners' arguments. The grounds for revocation are not specified with particularity as is required.

Since Petitioners have filed their Request with the Commission pursuant to CCR section 13105 *et seq.* asking the Commission to revoke CDP #4-07-098, State Parks presents this Response and attempts to address what State Parks believes to be each argument presented by the Petitioners.

A. PETITIONERS' ASSERTIONS REGARDING PROJECT TIMING ARE WITHOUT MERIT BECAUSE THE COMMISSION CONSIDERED THE CORRECT WORK WINDOW FOR THE PROJECT.

Petitioners' Request alleges inconsistencies in the record regarding the appropriate Project construction time frame. Petitioners seem to also assert that State Parks representatives intentionally misled the Commission and the public on when Project

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[5] December 8, 2008, Commission Staff Report: Revocation Request – Malibu Valley Farms, Inc., page 23. (See also; May 31, 2012, Staff Recommendation – Los Osos Wastewater Project; January 20, 2004, Staff Report: Revocation Request – SeaWorld of California).
[6] *Marich v. MGM/UA Telecommunications, Inc.*, (2003) 113 Cal.App.4th 415, at 422. (See also; *Korea Supply Company v. Lockheed Martin Corporation et al.*, (2003) 29 Cal.4th 1134; Restatement Second of Torts section 8A.)
[7] May 31, 2012, Staff Recommendation – Los Osos Wastewater Project, page 2.
[8] California Code of Regulations Title 14, Division 5.5, Chapter 5, Subchapter 1, Article 16, section 13106.

construction would take place. During the permitting process, State Parks worked with the Commission, USFWS, NMFS, ACOE, DFG, RWQCB and others to evaluate when the Project construction should begin and under what circumstances. Numerous studies were performed in order to determine the potential construction and overall project impact on various species.[9] As early as August of 2007, State Parks identified a proposed course of action to construct the Project in the months of June through October.[10] This construction window was considered and discussed in later Commission staff reports as well.[11] Ultimately, the USFWS determined that "*tidewater gobies are known to breed year round and the fact that the U.S. Army Corps of Engineers and California Department of Parks and Recreation have proposed to use the protective measure described in the biological opinion, we believe the change in construction activity timing from outside of May 1 through November 1 to this range of months will not result in additional effects to the California least tern or tidewater goby and its critical habitat beyond those already considered in the biological opinion.*"[12] Eventually the construction window of June 1, through October 15 was approved for the Project and incorporated into conditions of the CDP.[13]

A reading of the Project CDP, Commission staff reports, administrative record, and/or other documentation should have provided the Petitioners a clear understanding of the construction window for the Project; it was certainly clear to the Commission based on the plethora of references to this work window in the administrative record.[14] The above-referenced documentation is clear on the timing of the construction window for the Project. Petitioners have failed to show how State Parks intentionally provided inaccurate information to the Commission, which would have modified the Commission's ultimate decision on the Project.

B. PETITIONERS CLAIM STATEMENTS MADE BY STATE PARKS REPRESENTATIVES REGARDING THE POTENTIAL EXISTENCE OF SOUTHERN STEELHEAD TROUT CONFLICT WITH THE BIOLOGICAL ASSESSMENT, AND THAT THE STATEMENTS WERE MADE IN ORDER TO SUPPORT A CHANGE IN THE CONSTRUCTION WINDOW. BOTH CLAIMS ARE MERITLESS.

Petitioners claim State Parks representatives intentionally misled the Commission into believing that the Southern steelhead trout were present in the Malibu Lagoon when the Biological Assessment ("BA") found they were not, in order to modify the construction

[9] See, e.g., Malibu Lagoon Restoration Project, AR 876 - 905; (USFWS, Biological Opinion for the Malibu Lagoon Restoration and Enhancement Project), AR 1976 - 2155; (Malibu Lagoon: A Baseline Ecological Survey, Prepared by Sean Manion and Jean Dillingham), and 2185 - 2219 (Malibu Lagoon Fish Survey Results, Prepared by Rose Dagit and Dr. Camm Swift).
[10] Malibu Lagoon Restoration Project, AR 62 - 69. Section 401 Water Quality Certification Application Form, August 2007.
[11] Malibu Lagoon Restoration Project, AR 247 - 322, at 260 Commission Staff Report issued and September 29, 2010; pages 160, 174 Commission Staff Report issued July 29, 2010.
[12] Malibu Lagoon Restoration Project, AR 906-907, at 907.
[13] Malibu Lagoon Restoration Project, AR 160. CDP #4-07-098, See Special Conditions Item 3. Timing, Operations, and Maintenance Responsibilities.
[14] Malibu Lagoon Restoration Project, AR 63, 68, 160, 174, 260, 318, 358, 877, 4262, 4507.

window. In furtherance of this assertion, Petitioners state "*the Biological Assessment prepared by Jones & Stokes revealed that there no [sic] Southern Steelhead were found in Malibu Lagoon during surveys for the environmental review.*"[15]

Petitioners, at a minimum, mischaracterize the BA.[16] While the BA identified that there had not been a recent Southern steelhead trout sighting, the BA stated that occurrence of Southern steelhead trout is historically expected in the Project area during the months of February, March, April, October, November and December.[17] The information contained within the BA regarding the historical occurrences of the Southern steelhead trout is one of the pieces of evidence the Commission based their CEQA analysis and eventual decision upon. State Parks finds it disturbing that Petitioners make this claim since during the original CDP permitting proceeding, Petitioners themselves were also keenly aware of the presence or historical presence of Southern steelhead trout in the Malibu Lagoon. In a letter dated October 12, 2010, an attorney for the Petitioners, Mr. James M. Birkelund, stated, "*[t]he southern steelhead trout is a species… federal endangered, and its habitat would be degraded by the Project*" and that "*Malibu Lagoon is critical habitat for steelhead and recent studies indicate that species is repopulating the area.*"[18] In fact, and equally disturbing, the Wetlands Defense Fund Executive Director Ms. Marcia Hanscom herself expressed concern over the Project's impacts on Southern steelhead trout at a Commission meeting on the Project on October 13, 2010.[19]

If the Petitioners themselves also believe Southern steelhead trout are present or historically present during the months identified above, it is astonishing that Petitioners would now assert State Parks intentionally misled the Commission with that same information.

Moreover, Petitioners quote State Parks representatives Suzanne Goode and Mark Abramson as stating "*the reason [State Parks] sought a change in project construction timing was because it would be too expensive and unwieldy to maneuver bulldozers, dredgers and other heavy equipment in the muddy soils of the lagoon during winter storm season.*" This statement is simply false. Neither Ms. Goode nor Mr. Abramson ever made such a statement. There are no references to any such statement in the

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[15] Petitioners' Request page 3.
[16] Biological Assessment/ Essential Fish Habitat Assessment for the Malibu Lagoon Restoration Project – Prepared by Jones & Stokes, November 2007.
[17] Biological Assessment/ Essential Fish Habitat Assessment for the Malibu Lagoon Restoration Project – Prepared by Jones & Stokes, November 2007. Page 13, Table 1.
[18] Malibu Lagoon Restoration Project, AR 4592 - 4619, at 4600.
[19] Malibu Lagoon Restoration Project, AR 4711, Commission meeting of October 13, 2010, Executive Director of the Wetlands Defense Fund Ms. Marcia Hanscom, "*In terms of the endangered species, I want to point you to the chart that the Commission's Chair Shallenberger mentioned to you, attached to my letter that was given to you this morning. This chart talks about the tidewater goby, the California least tern, and the steelhead trout, and this chart was in the Commission's file, and you will see the yellow highlighting is where it was determined that the project would be done between June and October, and you will see that there are very serious concerns that were raised in the original biological opinion by the USFWS, as to whether or not this could be done at any time of year, and if you look at this chart you will see that there really is no time.*"

Commission's administrative record and they both vehemently deny making such a statement. (Goode, Abramson *pers. comm.*)

Further, a reading of the Project's administrative record as well as the citations provided herein, show that the BA, as well as other documentation, identified the historic occurrences of the Southern steelhead trout.[20] As a result, even if the Commission were to accept Petitioners' claims that the sole reason for the change in the construction window was to facilitate construction, those statements would have no relevance or bearing on the permitting endeavor. The largest available work window that avoids species breeding cycles and critical use of the lagoon habitat is between June 1 and October 15.[21] If State Parks had preferred to facilitate construction by performing it during a specific time of year, that preference would have absolutely no bearing on the Commission's decision. An applicant's preference on when to commence construction cannot contribute to or reduce an environmental effect. Therefore, since the administrative record properly reflects the historic occurrences of the Southern steelhead trout, even if Petitioners' assertions here were true, it could not have caused the Commission to require different conditions or deny the Project.

Petitioners have failed to show how State Parks intentionally provided inaccurate information to the Commission regarding the Southern steelhead trout, which would have modified the Commission's ultimate decision on the Project.

C. THE DAGIT & SWIFT STUDY IS PART OF THE ADMINISTRATIVE RECORD AND WAS CONSIDERED BY THE COMMISSION.

Petitioners claim the Dagit & Swift study was not provided to the Commission and the Commission did not have the opportunity to take the result of the study into consideration. On page three (3) of the Request, the Petitioners state, "[i]*f (the final conclusion of the Dagit & Swift report) had been considered by the Commission*" it would have changed the CDP conditions and timing.

These assertions are simply false. The Project EIR[22] and State Parks' Malibu Lagoon Restoration and Enhancement Plan[23] both cite to the Dagit & Swift survey, which is part of the record.[24] Petitioners also claim the Dagit & Swift study required that State Parks not conduct construction activities during the period of May through November.[25] The Dagit & Swift study is not a document that can impose conditions upon the Project,

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[20] Malibu Lagoon Restoration Project, AR 308, 922 – 923, 1219, 1312.
[21] Malibu Lagoon Restoration Project, AR 4262, January 2009 Malibu Lagoon Construction Dewatering Plan, (See also, AR 2211, 2213 Dagit & Swift Fish Study cited by the Petitioners).
[22] Malibu Lagoon Restoration Project, AR 3832, 3835, 3836.
[23] Malibu Lagoon Restoration Project, AR 1216, 1219, 1220.
[24] Malibu Lagoon Restoration project, AR 2185 et seq, Malibu Lagoon Fish Survey, (Dagit & Swift Survey), Prepared by Rosi Dagit Sr. and Dr. Camm Swift, July 20, 2005.
[25] Petitioners' Request, page 3 "*The certified EIR's mitigations required the project be constructed outside of May to November, and recommendations from the Dagit Swift fish report also required this timing.*"

only the Commission can. And the Commission did, with the full knowledge of the conclusions of this study.

The Petitioners' claims regarding the Dagit & Swift study are completely false and wholly without merit, as identified by the administrative record.

D. THE COMMISSION WAS AND IS AWARE THAT THE MALIBU LAGOON IS CONSIDERED CRITICAL HABITAT FOR THE TIDEWATER GOBY.

Petitioners claim that State Parks intentionally provided inaccurate, erroneous or incomplete information to the Commission regarding the Malibu Lagoon as being critical habitat for the Tidewater goby, and had the Commission been aware of that fact, it may have come to a different decision regarding the Project. The fact is that the Commission was plainly aware that Malibu Lagoon is considered critical habitat for the Tidewater goby.[26] In a Commission staff report, Commission Staff identified that the "*tidewater goby… is a federally endangered species and CDFG Species of Special Concern that was historically known to occur within the [Malibu] Lagoon.*"[27] The Project's Biological Opinion ("BO"), which was obtained prior to Commission approval, described the nature of the Malibu Lagoon as critical habitat for the Tidewater goby as well as the Project's potential effects on the Tidewater goby.

It is clear the Commission was made aware of the fact that the Malibu Lagoon is considered critical habitat for the Tidewater goby. Although State Parks did make the Commission aware of that fact, it is also readily identified within the record that the Commission was aware of Malibu Lagoon's status as critical habitat for the Tidewater goby. Indeed, because the administrative record reflects that the Commission was aware the Malibu Lagoon was Tidewater goby critical habitat, Petitioners have failed to show how State Parks intentionally provided inaccurate information to the Commission, which thereby would have modified the Commission's ultimate decision on the Project.

E. PUBLIC ACCESS TO MALIBU BEACH HAS BEEN AND IS AVAILABLE AS PLANNED FOR AND REQUIRED UNDER THE PROJECT'S CDP.

Pursuant to CDP #4-07-098, State Parks has submitted a public access plan to the Executive Director of the Commission for review and approval. Since such time, State Parks has provided public access to the beach in accordance with the public access program approved by the Commission's Executive Director.[28]

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[26] Malibu Lagoon Restoration Project, AR 308, 888, 892, 3202.
[27] Malibu Lagoon Restoration Project, AR 308, Commission Staff Report, October 13, 2010.
[28] Malibu Lagoon Restoration Project, AR 318, 319, 728.

Petitioners assert that during the week of June 14, 2012, public access to Malibu Lagoon State Beach was only available "*sporadically along the perimeter access road.*" This assertion is not true and was contradicted by the Commission's Enforcement Supervisor N. Patrick Veesart ("Supervisor Veesart"). Supervisor Veesart conducted a site visit to the perimeter access road on June 11, 2012, and June 20, 2012. On both occasions, Supervisor Veesart reported that public access to the beach via the perimeter road was, in fact, available.[29] In addition, Supervisor Veesart reported that on June 20, 2012, not only was beach access available via the perimeter access road, but a "*highly visible white sign with blue letters that says 'path to the beach*'" accompanied with a "*directional arrow*" was in place.[30]

While the Project is undergoing construction in accordance with the CDP #4-07-098, there will be times when the perimeter road will be closed for the safety of the public, whom would otherwise be walking through the middle of a construction zone. When the perimeter road is closed, public beach access will be available via the top of the dike, built to separate the western part of the lagoon from the main channel, all in accordance with the approved public access plan.

All of this information was and is readily available to the Commission. Petitioners have failed to show how State Parks intentionally provided inaccurate information to the Commission regarding public access, which would have modified the Commission's ultimate decision on the Project.

F. THE COMMISSION WAS MADE FULLY AWARE OF THE PLACEMENT OF THE SEPARATION DIKE OR BERM.

Petitioners state, "*[a]t no time during the permit approval process did the public understood [sic] or been informed [sic], nor was the Coastal Commission itself informed that public access to (the beach) would be atop a sand bag constructed dike...*" First and foremost, the dike is not made of sand bags; it is a compacted earthen dike, and sand bags are being utilized to hold the erosion fabric and turbidity curtain in place. Again, there are numerous instances in the administrative record where State Parks and the Commission identify and discuss the construction and location of a separation berm or dike (terms used interchangeably).[31] The Commission staff also knew of the berm and stated in a staff report, "*[t]he main lagoon channel will be temporarily separated from the western portion of the lagoon by a temporary berm... [a]ll grading and excavation of the western lagoon area will be separated from the surface*

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[29] *Malibu Lagoon Restoration and Enhancement Plan – Report of alleged violations of CDP #4-07-098* – N. Patrick Veesart Enforcement Supervisor (June 22, 2012), page 2.

[30] *Malibu Lagoon Restoration and Enhancement Plan – Report of alleged violations of CDP #4-07-098* – N. Patrick Veesart Enforcement Supervisor (June 22, 2012), page 2.

[31] Malibu Lagoon Enhancement Program CDP #4-07-098, AR 4507 (Slideshow at October 10 Meeting), 4673 (speaker at meeting); See also, January 2006 - Malibu Lagoon Restoration and Enhancement Plan EIR pages, AR 3761, 3762, 3851, 3853; September 20, 2007 – Letter from Mike Zumot Acting Chief of the Division of Safety of Dams to Steve Seville, Senior Civil Engineer at Jones & Stokes, AR 4130; January 2009, Malibu Lagoon Construction and Dewatering Plan, AR 4263, 4264, 4270, 4271, 4272, 4275, 4276.

connections to the existing lagoon by earthen berms."[32] The Project's approved public access plan makes clear that the dike will also be used for public access.

The administrative record for the Project clearly identifies that State Parks made the Commission aware of the dike and its potential location and use. Petitioners cannot make a showing of any of the grounds required for revocation regarding the existence of the dike nor its use for public access.

G. THE COMMISSION WAS FULLY AWARE OF THE UPSTREAM RIP-RAP PROJECT AT THE TIME IT CONSIDERED AND APPROVED THE PROJECT.

Within the Petitioners discussion of the Tidewater goby, it appears the Petitioners claim that the Commission should have analyzed the cumulative impacts of the Project's dike construction, and the *"nearby enforcement action"*[33] (or "upstream rip-rap project") on the Tidewater goby. Petitioners then allege that State Parks representative Mark Abramson had knowledge of the upstream rip-rap project and intentionally withheld that information from the Commission.

The Commission was well aware of the upstream rip-rap project at the time it approved the Project CDP. On February 20, 1998, the Commission's Executive Director authorized Emergency Coastal Development Permit #4-98-024-G, which allowed the Mariposa Land Company to *"place 500 linear feet of rock rip-rap revetment along the west bank of the lower Malibu Creek."*[34] On June 3, 1998, Mariposa Land Company submitted a regular CDP application that requested permanent authorization of the already installed rip-rap.[35] There were no changes nor physical action proposed by the Mariposa Land Company at that time. On or around October of 2007, Mariposa Land Company *"revised the proposed project to include planting of the rip-rap stream bank and top of the bank with riparian and upland species."*[36] At the point where the Mariposa Land Company revised their project to include physical modifications to the already installed rip-rap, State Parks EIR had been completed approximately a year and six (6) months prior, in March of 2006. It is sometimes the case that some future projects may be probable even though they may never be built; however, what matters is whether the potential future project appears foreseeable at the time of the EIR preparation.[37]

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[32] July 29, 2010, Commission Staff Report, page 175.
[33] Petitioners' Request, page 5. It is unclear exactly what *"nearby enforcement action"* the Petitioners' are referring to. State Parks is under the belief they are referencing Commission Application #4-09-013, Applicant: Mariposa Land Company, Project Location: 3728 Cross Creek Road, City of Malibu, Los Angeles County.
[34] July 22, 2009, Commission Staff Report – Mariposa Land Company CDP #4-09-013, page 1.
[35] July 22, 2009, Commission Staff Report – Mariposa Land Company CDP #4-09-013, page 12.
[36] July 22, 2009, Commission Staff Report – Mariposa Land Company CDP #4-09-013, page 13.
[37] *City of Antioch v. City Council of the City of Pittsburg*, (1986) 187 Cal.App.3d 1325, at 1337.

Petitioners' attempt to tie the above-referenced issue into this revocation proceeding by claiming that State Parks representatives did not identify the Mariposa Land Company project to Commission staff during the Project's permitting process. Regardless of whether or not State Parks can point to an exact location within the administrative record where State Parks representatives discussed the Mariposa Land Company project with the Commission and/or its staff; it is clear that the Commission was aware of the Mariposa Land Company application and project.[38]

Since the Commission was, at all times, aware of the upstream rip-rap project during the permitting of the Project, it simply cannot be said that if the Commission had known of the upstream rip-rap project it would have denied the State Parks project or imposed additional or different conditions. Therefore, Petitioners, by definition, cannot show how this issue meets the narrow grounds of revocation.

H. DEWATERING AND HUMAN HEALTH CONCERNS ASSOCIATED WITH MRSA ARE MERITLESS.

Petitioners have a fundamental misunderstanding of the Commission's process. At the time it approved the Project in October 2010, the Commission approved dewatering as a component of the Project.[39] All that was required prior to project implementation were the dewatering details addressing the site-specific project conditions at the time the Project was to begin. This dewatering plan is currently before the Commission staff for their consideration.

The concerns of the City of Malibu ("City") regarding human health were considered by the Commission. During the pendency of its administrative process, the City sent two letters to the Commission.[40] Both of these letters were considered at the time that the Commission prepared its staff report.

State Parks was aware of the unpublished studies regarding methicillin resistant Staphylococcus aureaus ("MRSA"). However, these studies were not presented to the Commission because they are completely unrelated to the Project. If MRSA exists "*dormant in the sand at Surfrider Beach*" as claimed by Petitioners, it will not be affected by the Project. As approved in State Parks' dewatering plan, the only discharge related to the Project will be below the mean high tide line, into the area where sand is already subject to wave action. So if MRSA exists, it is already being washed into the ocean via the lapping of waves. In fact, since the water discharged by the Project will be treated by the extensive filtration process, killing all bacteria and toxic material in that water, it will actually reduce the possibility of dormant MRSA that may exist within the lagoon being discharged.

[38] See; July 22, 2009, Commission Staff Report – Mariposa Land Company CDP #4-09-013, Page 12 -13. These two pages provide a factual background of the Mariposa Land Company Project CDP #4-09-013 and its lengthy history with the Commission.
[39] Malibu Lagoon Restoration Project, AR 261, 262, Commission Staff Report; AR 4255 - 4277, January 2009 Dewatering Plan.
[40] Malibu Lagoon Restoration Project, AR 420, 811.

State Parks has no obligation, legal or otherwise, to present to the Commission issues that are wholly unrelated to the Project. Imposing such a duty on project applicants would require them to dream up every imaginable issue to be sure the record addresses it. This standard would be impossible for applicants to meet.

I. THE COMMISSION WAS AWARE THAT CHLORINE WOULD BE USED IN THE FILTERING PROCESS DURING THE DEWATERING AND THAT THE TREATED WATER WOULD CONTAIN AN ENUMERATED THRESHOLD OF CHLORINE.

The Petitioners claim that chlorinated water will be discharged thereby harming tide pools. The Commission knew that chlorine was a byproduct of the filtration system.[41] Chlorine is being removed by activated carbon filters used in the dewatering process and is only released within permitted limits. Ensuring it is within permitted levels, chlorine is a constituent of the daily project monitoring.

J. RIP-RAP CONSTITUTES A BEST MANAGEMENT PRACTICE IN THE TIDAL AREA.

The dewatering plan includes a small amount of rip-rap at the discharge point. This rip rap constitutes a Best Management Practice ("BMP") to ensure that the discharge does not cause erosion of the beach. This BMP is not used for the purpose of holding the discharge pipe in place as asserted by Petitioners. At the time it issued the CDP, it was not necessary for the Commission to consider this BMP since it was a component of the dewatering plan required only at the time immediately before project implementation. Knowledge of this BMP would not have caused the Commission to not issue the CDP, nor to impose additional or different conditions on the permit.

III. IF THE CALIFORNIA COASTAL COMMISSION REVOKES THE CDP AT THIS STAGE, IT WOULD CAUSE SIGNIFICANT ENVIRONMENTAL DAMAGE.

In addition to rebutting Petitioners' claims within their Request, if the permit is revoked and project construction is stopped, significant environmental harm will occur, more than if the project continues through construction in accordance with its lawfully obtained permits.

If the permit is revoked and work is stopped, the ecological consequences would be severe with respect to habitat degradation and loss, poor reestablishment of wildlife and plant populations, erosion, sedimentation and pollution.

Over sixty (60) per cent of the western channels constituting the work area has been filled in, and partial grading of the new channel has begun. Almost all vegetation has been removed from the project footprint, leaving approximately twelve (12) acres of

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[41] Malibu Lagoon Restoration Project, AR 178, 195, 297.

bare and unprotected soil. While some grading and contouring has occurred, much of the soil would remain in a loose and unconsolidated state, subject to erosion by rainfall and storm water runoff. The temporary earthen dike that separates the work area from the main lagoon channel is not guaranteed to withstand heavy creek flows. If the stability of the dike were undermined, sedimentation and turbidity of the lagoon would result, with potential severe impacts to fish species and the birds that depend on them. Compromise of the earthen dike would allow water from the main lagoon channel and the ocean to re-enter the work area, necessitating additional fishing when the project resumes. Potential take of two federally endangered fish, the Tidewater goby and the Southern steelhead trout, would result. Currently, any harm to these species has been completely avoided and is expected to be avoided for the duration of the project, should it continue.

Any work stoppage of more than a couple of weeks at this point would delay the project for at least one year because the permit forbids work in the wetlands after October 15, the start of the rainy season. The contractor is currently on a very tight schedule to meet this requirement. The wildlife species that have been temporarily relocated to adjacent habitat would not be able to re-colonize the work site because all habitat has been removed, potentially jeopardizing successful re-establishment of wildlife populations. A lengthy project delay would cause animals that have been re-located to adjacent habitat to adjust their population density downward to utilize what is now available to them, leaving fewer animals to re-colonize the project site. The South Coast marsh vole, a California Species of Concern, is one species that would be affected by being slower to re-establish itself in the project area.

State Parks' native plant restoration would be jeopardized. Currently a growing contractor is propagating approximately seventy thousand (70,000) plants to be reintroduced to the site. Delay of the project would mean that some of these plants would have to be re-grown. If the plants get too large, they may become root-bound or grow too large for ready adaptation to the site when they finally are planted.

Public health and safety would be compromised. Storm water and ground water would accumulate and stagnate on the site, providing a breeding ground for mosquitoes that can carry diseases, such as West Nile virus. This would be exacerbated by drainage structures from adjacent property that were to have been discharged into vegetated bioswales and that would instead discharge directly onto the site. In between winter storms, some soils would dry out and, without vegetative cover, produce blowing dust to adjacent areas. No irrigation system that could alleviate this condition has yet been installed.

Residents of the Malibu Colony would not be protected from storm events because the raised viewing area that is to be built between the Colony and Malibu Creek has not yet been constructed. That area now consists of sand and other unconsolidated, easily erodible soil.

Public access would also be compromised by any erosion that would occur to the earthen dike. The dike is to be used for public access to the beach during part of the construction process. The planned ADA access to the beach would not be built.

IV. <u>IN THE EVENT THE COMMISSION IDENTIFIES AN ISSUE WITHIN PETITIONERS' REQUEST LEFT UNADDRESSED, STATE PARKS SHOULD BE PROVIDED ADDITIONAL TIME TO RESPOND SINCE PETITIONERS' REQUEST DOES NOT SPECIFY WITH PARTICULARITY THE GROUNDS FOR REVOCATION.</u>

As noted earlier in this Response, CCR Title 14, section 13106 requires that a request for revocation "*specify with particularity, the grounds for revocation*".[42] At times, it is difficult for State Parks to identify the claims set forth within the Petitioners' Request and/or potentially identify the Petitioners' claims in their entirety. If the Commission finds State Parks has not identified and responded to all of the claims put forth by the Petitioners, State Parks respectfully requests that the Commission identify that claim and grant State Parks additional time to respond in light of the Request not being pled with specificity and particularity as required pursuant to CCR section 13106.[43]

V. <u>SHOULD THE COMMISSION'S EXECUTIVE DIRECTOR GRANT A HEARING ON REVOCATION, STATE PARKS WILL SEEK TO RECOVER FROM PETITIONERS REASONABLE EXPENSES, INCLUDING ATTORNEY'S FEES INCURRED, PURSUANT TO GOVERNMENT CODE SECTION 11455.30(a).</u>

From a state agency and environmental perspective, State Parks has encouraged and continues to encourage public participation in any and all of the Department's projects involving environmental review. However, the Petitioners no longer seek to meaningfully participate in the project permitting endeavor, nor do they now bring real issues of merit before the Commission for adjudication. Instead, Petitioners' Request is tantamount to nothing more than a tactic intended to cause delay. Petitioners, in their Request, often seem confused about the facts within the administrative record relating to the Project permitting effort, as well as how those facts apply to the relevant law and this potential revocation proceeding. Much of the Petitioners' Request includes misstatements (put generously), improperly characterizes the administrative record, and seemingly attempts to confuse the Commission. A revocation proceeding has the potential for serious consequences and should not be used as the vehicle to help or guide a project opponent through the California permitting and/or legal process. At this point, State Parks, the Commission, and numerous other agencies and individuals have spent a considerable amount of time and resources permitting and carrying out the Project as well as addressing each of the Petitioners meritless claims embedded within their Request. Should Petitioners not withdraw their Request and should the Commission's Executive Director decide to initiate a revocation proceeding, State Parks

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[42] California Code of Regulations Title 14, Division 5.5, Chapter 5, Subchapter 1, Article 16, Section 13106.
[43] *Id.*

will seek to recover from Petitioners reasonable expenses, including attorney's fees incurred in defending and responding to the Petitioners' Request.

Pursuant to Government Code section 11455.30(a):

> "[t]he *presiding officer may order a party, the party's attorney or other authorized representative, or both, to pay reasonable expenses, including attorney's fees, incurred by another party as a result of bad faith actions or tactics that are frivolous or solely intended to cause unnecessary delay.*"[44]

For all of the reasons set forth within this Response, as well as the facts identified in the independent report issued by Supervisor Veesart, the Request brought by the Petitioners clearly meets the definition of a bad faith action or tactic which is frivolous or solely intended to cause unnecessary delay. Therefore, State Parks respectfully request Petitioners withdraw their Request in order to avoid being assessed expenses and attorney's fees in connection with their Request.

CONCLUSION

Petitioners both lack standing and have failed to make the proper showing as required by the Commission's regulations. The Petitioners' Request fails to show how State Parks representatives intentionally misled the Commission. In addition, the Request is not plead with particularity as required, and is riddled with inaccuracies which bring into question the veracity of the Petitioners' claims. The Petitioners' Request is patently frivolous and without merit. It is clear from State Parks response, the administrative record, and Supervisor Veesart's report, that each and every one of Petitioners' claims are without merit. Project applicants, like State Parks, should be entitled to some certainty after CDPs are issued. Project applicants should not be required to incur the expense of proceeding through a revocation hearing when there is absolutely no basis for doing so. State Parks respectfully requests that the Request be rejected and that no revocation hearing be scheduled.

Thank you for your consideration of this request.

Sincerely,

Ruth Coleman

Ruth Coleman
Director

Attachment

[44] Government Code Division 3, Part 1, Chapter 4.5, Article 12, section 11455.30.

cc: Hope Schmeltzer, Chief Counsel, California Coastal Commission
Chris Pederson, Attorney, California Coastal Commission
Ann S. Malcolm, Chief Counsel, Legal Office,
Craig Sap, Superintendent, Angeles District
Suzanne Goode, Senior Environmental Scientist, Angeles District

From: Marcia Hanscom [mailto:wetlandact@earthlink.net]
Sent: Friday, July 13, 2012 6:09 PM
To: Ainsworth, John@Coastal; Hudson, Steve@Coastal; Lester, Charles@Coastal
Cc: Roy van de Hoek; Travis Longcore
Subject: SENDING AGAIN: Western Snowy Plover - IMMEDIATE and URGENT concern

I received notification that some of you might not have received this message in a readable form - so am sending again.

~~~~~~~~~~~~~~~

Hi Jack, Steve, Charles ~

Another concern arises that applies to BOTH the dewatering plan and the revocation request we've submitted.

See attached to review an update that Shelley Luce of the Santa Monica Bay Restoration Commission has circulated re: Malibu Lagoon. This footnote at the end seems critical.

~~~~~~~~~~~

- The USFWS recently issued a critical habitat designation for the endangered western snowy plover, including a small portion on the southeast corner of Malibu Lagoon State Park (see https://www.federalregister.gov/articles/2012/06/19/2012-13886/endangered-and-threatened-wildlife-and-plants-revised-designation-of-critical-habitat-for-the). The Army Corps of Engineers has initiated a new consultation with USFWS to determine whether these areas actually do provide the "constituent elements" of critical snowy plover habitat. Until then no work is occurring within these areas. We very much appreciate the Corps and USFWS working with us in a timely manner, to protect sensitive species while we continue to clean up and repair the damaged habitats at the Lagoon

~~~~~~~~~~~

Given this NEW CONSULTATION between ACOE and USFWS re: Western Snowy Plover - it seems to us that this is yet ANOTHER reason to stop the project and at LEAST to not allow discharge of waters from the lagoon on the area of sand where it has been proposed. As you might know, this bird species uses the sandy beach and it also uses the area of the shoreline between the ocean water and the sand - for food! And the pipe for the dewatering is scheduled to be going 24/7 - which will impact this species.

EXHIBIT 9
R-4-07-098 (Malibu Lagoon Revocation Request)
~~~~~~~~~~~

In addition, the current fenced area for the Western Snowy Plover has been moved (by State Parks or other project managers?) and is NOT in the area where it has been in past years. It seems to be being used more as a way to keep the public away from shooting photos of the lagoon construction project rather than to protect the Western Snowy Plover. Chuck Almdale from Santa Monica Audubon recently commented on this change in position for the fenced area in a blog.

Still, the most important fact is that this bird species is likely on its way back in migration soon, and usually there would be a really good fenced off area....and, since, of course, the fenced in area does NOT mean this bird species only stays in the fenced-in area, but is simply a way to keep the public away from some of these sensitive and imperiled birds, the dewatering discharge pipe is a problem for the time periods during which this species may be on the beach. All of this needs to be discussed with the various agencies charged with protecting this species, and since the Malibu Surfrider Beach has now been declared to be CRITICAL HABITAT, the law requires that adequate consultation occur, including possibility of jeopardy opinion - and, almost always that means no project can occur which would impact this critical habitat. Freshwater flowing out in the amounts and at the velocity planned would be a severe impact.

~ Marcia Hanscom
Wetlands Defense Fund

~ Marcia Hanscom
Executive Director

Wetlands Defense Fund
protecting wetlands ~ the cradle of life
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Playa del Rey, CA 90293
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SAVE MALIBU LAGOON ~ a campaign project of Wetlands Defense Fund
SaveMalibuLagoon.com

bay restoration commission

STEWARDS OF SANTA MONICA BAY

santa monica bay restoration commission 320 west 4th street, ste 200; los angeles, california 90013
213/576-6615 phone 213/576-6646 fax www.smbrc.ca.gov

Work on the Malibu Lagoon Restoration and Enhancement project continues smoothly!

It's been a couple of weeks since our last update and a lot of good things are happening at the Malibu Lagoon. Hundreds of small mammals and lizards were relocated to safe habitat on site, thanks to the diligent work of our biologists and equipment operators. The vegetation has been largely removed, except for plants around six duck nests that are being protected until the young have fledged and the mothers no longer use the nests. Five other nests that were also protected onsite, where young successfully fledged, have already been abandoned, with no impacts to the birds that were using them.

Photo: Building the earthen dike to block the western channels with fish biologists observing (SMBRF 6/15/2012).

The western channels of the Lagoon have been carefully cleared of fish – most fish swam out of the channels of their own accord with the outgoing tides while the berm at Surfrider Beach was open. Then a temporary dike was built to separate the western lagoon channels from the main estuary at the Malibu Creek mouth. This ensures that no fish will swim into the channels while we are working there. The pedestrian bridges that choked the flows to the lagoon channels have been removed – a big step in repairing the habitat! We have started to create the islands that will provide permanent, safe habitats for birds and other wildlife. The next step: assembling dewatering equipment to remove the groundwater that seeps into the western channels, treat it, and discharge it to the ocean. Then the channels can be re-shaped to provide better flow and vastly improved habitat for the fish, birds and other wildlife at the Lagoon.

Photo: The last of the wooden bridges being removed from the Lagoon (SMBRF 7/3/12).

We're on our way to a healthier Lagoon! Keep checking the project website at www.restoremalibulagoon.com for more updates.

Photo: An aerial view of the restoration work underway (6/27/12 by L.Protopapadakis and made possible by the generosity of LightHawk).

Some interesting notes from our project biologists…

- *Thousands of cubic yards of soils have been moved from the lagoon channels, and we have found virtually no life in them. There were very few clams, and no worms, insect larvae, or any of the aquatic invertebrates that we would normally expect to see living in a wetland. As expected, the channel sediments were nearly devoid of fauna due to poor conditions.*

- *Where soils have been removed we are starting to uncover the historic wetlands, i.e. previously buried wetlands habitat, identified by naturally deposited alluvial soils (sand and gravels). It's very exciting to unearth the real Malibu Lagoon and to know that it will be brought back to life and allowed to thrive once again. In the process, lots of trash has been removed: chunks of asphalt and concrete, discarded telephone poles, truck tires, lots of plastic debris, old pipe – all dumped over the last hundred years and burying the original wetlands.*

And some regulatory notes:

- ✓ *The USFWS recently issued a critical habitat designation for the endangered western snowy plover, including a small portion on the southeast corner of Malibu Lagoon State*

Park (see https://www.federalregister.gov/articles/2012/06/19/2012-13886/endangered-and-threatened-wildlife-and-plants-revised-designation-of-critical-habitat-for-the). The Army Corps of Engineers has initiated a new consultation with USFWS to determine whether these areas actually do provide the "constituent elements" of critical snowy plover habitat. Until then no work is occurring within these areas. We very much appreciate the Corps and USFWS working with us in a timely manner, to protect sensitive species while we continue to clean up and repair the damaged habitats at the Lagoon.

- ✓ *An Enforcement Supervisor from the California Coastal Commission visited the Lagoon on June 20, 2012 to perform an inspection. The Supervisor provided a detailed account of his inspection and found that State Parks is meeting all permit requirements and conditions. He also stated his opinion that the breach of the sand berm at Surfrider Beach was likely caused by natural conditions including high water levels coupled with tide/wave/wind action. You can read KPCC's account of the project so far and see the letter from the Coastal Commission here:* http://www.scpr.org/blogs/environment/2012/06/25/6779/coastal-commission-stands-behind-malibu-lagoon-res/

STATE OF CALIFORNIA

COASTAL COMMISSION

CERTIFIED COPY

CALIFORNIA DEPARTMENT OF PARKS & RECREATION CITY OF MALIBU COUNTY OF LOS ANGELES	Application No. 4-07-098

REPORTER'S TRANSCRIPT OF PROCEEDINGS

Wednesday
October 13, 2010
Agenda Item No. 6.a.

Oceanside City Council Chambers
300 North Coast Highway
Oceanside, California

EXHIBIT 10
R-4-07-098 (Malibu Lagoon Revocation Request)
October 13, 2010 Hearing Transcript

A P P E A R A N C E S

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I N D E X   T O   S P E A K E R S

STAFF — Page Nos.

Deputy Director Ainsworth..........1,3,17,128,130,146
Chief Counsel Schmeltzer..................... 2,132
Staff Ecologist Dr. Jonna Engel............. 5,128,170
Deputy Attorney General Patterson............. 141,151
Executive Director Douglas...........36,141,164,169

PUBLIC COMMENT

Susan Goode, California State Parks........... 36,47,135
Bob Stark, ICF International.................. 40,49
Clark Stevens, Resource Conservation District.. 44,48
Marcia Hanscom, Wetlands Defense Fund.......... 51,61
Wayne Ferren, Wetlands Defense Fund............ 54,62
James Birkelund, Wetlands Defense Fund......... 57
Richard Ambrose,California State Parks......... 63
Dr. Martha Sutula, State Parks................. 69
Don Schmitz, Malibu Colony Homeowners Assn..... 73,145,150
Mark Gold, Heal the Bay........................ 78
Mark Wiaya, Native Americans................... 80
Mary Small, Coastal Conservancy................ 83
Dr. Sneeland U.S. EPA.......................... 84
Dr. Shelley Luce, Santa Monica Bay Restoration Commission....... 86
Marshall Thompson, Malibu Township Council..... 88
Liz Gossen, Santa Monica Bay Keeper............ 90
Penny Elia, Santa Monica Mountains Task Force.. 91
Athena Shlein, Malibu Resident................. 92
Geoffrey Nathanson, Malibu Resident............ 94
Wendi Werner, Malibu Resident.................. 95
Ian Bryant, Malibu Resident.................... 96
Rick Margolis, Malibu Resident................. 98
Julio Bermejo, San Gabriel..................... 100
Linda Piera-Avila, Green Party Candidate....... 101
Andy Lyon, Malibu Resident..................... 103
Jack Neff, State Parks Foundation.............. 106
Kathy Knight, Save the Ballona Wetlands........ 108
Bruce Campbell, West Los Angeles............... 109
David Warren, San Fernando Valley Audubon...... 111
John Ulloth.................................... 113
Barbara Lonsdale, Native American.............. 113
Robert Van de Hoek, Wetlands Action Network.... 115,172
Joyce Parker-Bozylinski, City of Malibu........ 119
Jonathan Coffin, Pasadena Audubon.............. 120
Walter Shirk, Malibu Resident.................. 122
Ann Donneen, Malibu Resident................... 124
Pera Kumler, State Coastal Conservancy......... 126,154,158
Craig Sap,District Superintendent Angeles dist. 146,148

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Blank.................32,35,141,149
Bloom....................1
Burke....................29,162,172
Kram.....................29,160
Liberman...........30,133,137,159
Mirkarimi................33,161,168
Sanchez..................22,152,168
Shallenberger............25,148,163
Stone....................33,158
Wan......................28,153,166
Wright...................24

ACTIONS

Motion by Blank.......137
Vote.....174
Motion by Blank.......139
Vote.....164

CONCLUSION...............176

-o0o-

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California Coastal Commission
October 13, 2010
California Department of Parks and Recreation

* * * * *

9:50 a.m.

DEPUTY DIRECTOR AINSWORTH: That brings us to Item 6.a. and we have a Power Point on this item, and will you pull that up, please.

The applicant, in this case, is the California Department of Parks and Recreation. I will present a brief introduction to the project, and then turn it over to Dr. Jonna --

VICE CHAIR SHALLENBERGER: Excuse me, staff, Commissioner Bloom has something he would like to put on the record before this staff presentation.

COMMISSIONER BLOOM: Right, thank you, Vice Chair Shallenberger.

I wanted to address this with staff at the outset of this hearing, because although I have had some analysis of the possibility of a conflict of interest on this, prior to the meeting today, and it came to my attention this morning that the analysis is a little more detailed than I thought it was.

I am the chair, and sit on the board the Santa Monica Bay Restoration Commission, and I confirmed with staff that there would be no conflict of interest, based on the law, where I could participate in today's hearing, were the Commission to be the agent, but as it turned out -- and I apologize for not focusing on this -- it is the Santa Monica Bay Restoration Foundation that is actually in today's hearing.

While the foundation is an adjunct organization, I would describe as an adjunct organization to the Commission, apparently the conflict analysis is a little bit different, and I would like to ask counsel to describe that for us. I apologize for taking the time this morning to do this.

VICE CHAIR SHALLENBERGER: No, I appreciate you putting that on the record so clearly, thank you.

Back to staff.

CHIEF COUNSEL SCHMELTZER: Thank you, Commissioner, that is correct, and because the foundation is a 501(c)(3) non-profit, there is no FTPC conflicts involved here. The foundation does occupy a slightly different role under the *Coastal Act*. There is an exemption of any potential conflict of interest, or bias allegation with regard to the Commission, that you have under your statutes. That does not necessarily apply to the foundation, however, there is no financial impact on you because of the non-profit status of the foundation.

With regard to bias, we would have to -- we had to examine whether there is a demonstration of bias. We do not believe that there is, and we would ask that Commissioner Bloom discuss his viewpoint on this matter.

COMMISSIONER BLOOM: Well, nobody has raised this issue. I don't think that there is any demonstration of or facts supporting bias that I might have, and in fact, I would be approaching today's hearing with an open mind, open to hearing all viewpoints.

That said, and discussing this publicly, I don't want there to be any question whatsoever, any impression by anyone that I am biased, and based upon the possibility that there might be some perception of bias, I think that -- because I really don't have a lot of time to think this through, and I don't want to hold up the meeting. I think my decision today will be to recuse myself from participation, and allow the hearing to go forward.

VICE CHAIR SHALLENBERGER: Thank you, Commissioner. I, personally, regret that, but I do respect your decision to do that.

So, now let's go back to staff.

DEPUTY DIRECTOR AINSWORTH: All right, so Item 6.a. and again the applicant is the California Department of Parks and Recreation.

First up, I will present a brief introduction to the project, and then turn it over to Dr. Jonna Engel, your

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staff ecologist, who will describe the science behind the approved restoration plan, and then I will address the minor modifications to the project descriptions that were made based on concerns made by the public, neighboring residents, and other comments received by the public.

The permit application is for a wetland habitat and enhancement plan for a 12-acre portion of Malibu Lagoon located on the western side of the lagoon, to improve the function of the lagoon ecosystem, and as you can see in this slide, the area that we are talking about is this area, here.

The project involves the de-watering of the western portion of the lagoon, recontouring the lagoon slopes and channels to increase hydrologic flow through the area. This will require 88,700-cubic yards of grading, followed by revegetation with upland and wetland plant species, removal of non-native plant species, construction of a public access trail around the lagoon, interpretative signage and educational elements, and implementation of a long term monitoring program.

The project also includes the recontouring a portion of the channel adjacent to the Adamson House on the eastern side of the channel -- which is over here -- to recreate a mud flat and promote additional water circulation in the lagoon.

I will now turn it over to Dr. Engel, who will

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proceed with the presentation.

STAFF ECOLOGIST ENGEL: Thank you, Jack, and good morning Vice Chair Shallenberger and Commissioners.

California has lost, approximately, 91 percent of its wetlands, a greater percentage than any other state, and southern California tidal wetland loss is estimated at 75 percent. Wetlands provide important ecological services, including filtering and transforming pollutants from water-shed runoff, flood control, sediment delivery, ground water recharge, shoreline erosion protection, habitat for resident plants and animals, routine support and stopover ground for migrating birds.

Losses of coastal wetlands in southern California, as well as the degraded state of those remaining, have greatly reduced these natural functions in the landscape. Opportunities to restore and increase the aerial extent of tidal wetlands in southern California are extremely rare, and when they arise, such as here at Malibu Lagoon, we should pursue them.

Okay, this is not working -- let me see, okay, next slide, please, thank you.

The Malibu Creek watershed is the second largest watershed terminating in Santa Monica Bay. Malibu Creek flows into this seasonably open shallow 31-acre Malibu Lagoon, which also receives tidal waters through an inlet at

Surfrider Beach. The lagoon lies within the footprint of the Pacific Flyway, and is an important stopover location for migrating birds.

Next slide, please.

One part of a much larger coastal lagoon ecosystem, Malibu Lagoon has been significantly diminished and altered by urban development. The first significant impacts were construction of the Rindge railroad in 1908, and the Pacific Coast Highway in 1929. Construction of the PCH bridge in the late 1940s bisected the lagoon and reduced its surface area. Beginning in the 1940s and '50s, low-lying areas near the mouth of Malibu Creek were filled for commercial and residential development, and by the 1970s they were completed filled and covered by two baseball fields.

Urbanization of the Malibu Creek watershed has increased the volume of water transported into the lagoon, particularly in the dry season, and urban pollution has impaired the water quality to its inputs of nutrients, sediments and chemical pollutants. The City of Malibu is working to improve water quality in the Malibu Lagoon.

Next slide.

Over the past 30 years several restoration efforts have been undertaken on the site. In 1979, the Commission approved a restoration project for Malibu Lagoon, including the removal of the baseball fields, which was conducted by

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State Parks in 1983. The 1983 restoration effort included the excavation of three distinct channels -- labeled here as A., B., and C., in the western portion of the lagoon, revegetation of lagoon habitat and construction of public access boardwalks.

From 1986 to 2008, the Commission approved various other projects at the site, including a 1,000-foot long walkway, viewing decks, stairways, underground utilities, habitat restoration, breaching the sand berm at the mouth of the lagoon, and installing temporary symbolic fencing for the threatened snowy plover.

In 1990, the Commission approved the Caltrans restoration project as mitigation for impacts to Malibu Lagoon from construction during the PCH bridge replacement project. That restoration program implemented in 1996 included a tidewater goby habitat enhancement project, and a non-native plant removal program.

While these restoration efforts have improved ecological and recreational values, somewhat, the natural system is still significantly, physically, and biologically degraded due to past human activities. Physical degradation includes a dysfunctional channel configuration consisting of three dead-end channels perpendicular to the larger lagoon water body, which has resulted in poor circulation, and anoxic sediments, and impaired water quality. Biological degradation includes fragmented plant communities, highly invaded by non-natives, and low biodiversity.

Next slide.

The following environmental problems are associated with the current lagoon configuration, and past development and restoration activities, loss of ecosystem functioning due to poor circulation, sedimentation, low dissolved oxygen, and eutrophication, loss of salt marsh and lagoon habitat due to historic fill, urbanization of the surrounding areas, and inappropriate landscaping, proliferation of non-native and invasive plants and animals, impovished native benthic invertebrate communities, and reduced native fish population.

Next.

Currently, the bed elevations of the western channels are above mean sea levels and can only be inundated about 50 percent of the time. Their perpendicular orientation to tidal currents in the main lagoon, shallow depths, narrow channel widths, and pinch points associated with bridges and boardwalks all restrict tidal circulation and promote deposition of fine sediments in the channel bottoms. Sediment samples obtained in the western channels consist primarily of very fine particles and high organic content, reflecting poor circulation and limited to no tidal flushing. Releases of stored nutrients from fine sediments

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triggered growth of primary producers during dry weather periods, creating hypoxic surface water conditions, water that is high in nutrients and low in salinity, stagnates at the end of the three dead-end channels where sediments are deposited and anoxic dead zones develop and persist.

Several researchers have suggested that these conditions contribute to the low infarnal and epifernal invertebrate diversities found in Malibu Lagoon, partly because of their orientation -- because their orientation is perpendicular to the tidal trends in the main lagoon, the western channels are not fully inundated during normal tidal cycles.

Malibu Lagoon plant surveys reveal significantly impaired plant communities, with a paucity of native estuarine species, and large numbers of non-native species.

In addition, there are many native species, including Channel Island endemics that are out of place in Malibu Lagoon ecosystem, but were inappropriately prescribed in the 1983 State Park restoration plan. An extensive Malibu Lagoon ecosystem survey in 1989 by Manion and Dillingham, included a botanical inventory that found 133 species of vascular plants in Malibu Lagoon, of these, only 5.3 percent were native estuarine species, and 29.7 percent were native non-estuarine species, planted as part of a landscaping effort, and an astounding 65 percent were non-native and

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invasive introduced species. The 1989 study looked at native estuarine species richness across 8 southern California coastal wetlands, and found that Malibu Lagoon had the lowest species plant richness of any of the wetland samples.

Manion and Dillingham also found low-benthic, infarnal, and epifarnal invertebrate richness and diversity in Malibu, and stated that repeated sampling at 5 locations revealed an infauna limited to two species of invertebrates, A spionid polychaete, Polydora nuchalis and a tellinid clam, Tagelus californianus. Both species prefer muddy organic sediments, and disappear from more sandy areas. Epifaunal invertebrates species richness was also very low.

Manion and Dillingham found an abundance of the mud crab Himigapsus oregonenesis, but only a few other species of invertebrates that occurred in low numbers.

In 1995, Ambrose et al. conducted an extensive survey at Malibu Lagoon which found that the infaunal polycheate, Polydora nuchalis, shown on the screen, represented 72 percent of the total numbers of individuals of the 17 species of benthic invertebrates collected. They found that only two epifaunal invertebrates, and mud crab, and the introduced oriental shrimp were common. Ambrose et al. concluded that observations of macrobenthic organisms in this study suggest that Malibu Lagoon ranks poorly at this trophic level when compared to less disturbed southern

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California estuaries.

In 2000, Ambrose and Orme identified Polydora nuchalis as a negative indicator species for Malibu Lagoon because it is an opportunistic species known to rapidly colonize and dominate benthic communities during or following disturbances.

A review of fish studies at Malibu Lagoon show that a total of 33 fish species have been identified at one time or another, over a span of approximately 20 years. The 1989 and 1995 studies I just mentioned looked at fish species richness and diversity, and in both studies 13 species of fish were identified. The federally endangered tide water goby, the California killifish, topsmelts, and the introduced non-native mosquitofish, made up two-thirds of the total catch.

Malibu Lagoon fish species richness is low relative to some southern California wetland systems, particularly large estuaries with uninterrupted tidal flushings, but it is comparable to other southern California estuaries that are seasonally closed.

The lagoon's native fish populations have suffered from an invasion of non-native species, such as the mosquito fish. During a one-day fish survey in 2005, a total of 8 species of fish were captured in Malibu Lagoon, tidewater goby and smelt were the most numerous.

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A number of studies have examined the status of bird species at Malibu Lagoon. Ambrose et al. surveyed birds over a 10-month period, and reported 107 species. They partly attributed the high numbers and diversity of birds to the diversity of habitat at Malibu Lagoon. They also attributed bird abundance and diversity to the rarity of coastal wetlands in southern California, and to Malibu Lagoon being one of only two remaining estuaries in all of Los Angeles County.

Cooper conducted breeding and quarterly bird surveys in Malibu Lagoon during 2005 and 2006, and in 2005 he recorded a total of 54 species, 16 of which he believed had bred or attempted to do so. Combining all surveys over two years, Cooper detected 127 species, including terrestrial, shore, and water foul species. Malibu Lagoon clearly represents extremely important habitat for a wide array of bird species. Ambrose et al. states that with respect to plants and vertebrates and fish, Malibu Lagoon probably ranks in the middle or lower end of the range of wetland quality in southern California. It ranks much higher for birds being an important stop over on the Pacific flyway, as well as supporting a diversity of species year-round.

The Malibu Lagoon restoration protect is consistent with the City of Malibu LCP and several of the biological resource sections of the *Coastal Act*, including

Section 30231 biological productivity, *Section 30233* diking, filling or dredging of wetlands and other waters, and for a number of reasons, including restoration purposes, *Section 30240* environmentally sensitive habitat areas where restoration is permitted.

Opportunities for tidal wetland restoration are extremely limited in southern California, and the overall goal of the proposed restoration is to enhance and expand the lagoon's tidal wetlands and associated habitat -- that is, to restore Malibu Lagoon to a healthy and functional seasonally closed tidal lagoon ecosystem.

Specific restoration goals include increased tidal circulation and flushing to improve water quality under open and closed lagoon conditions, restore a diverse mosaic of coastal salt marsh and transitional upland habitat, increase and enhance aquatic habitat for benthic invertebrates and native fish, including the federally endangered tide water goby and the federally threatened steelhead, increase native foraging, nesting, and roosting habitat for resident and migratory shorebirds and water foul, and provide educational opportunities while minimizing disturbance to habitat and wildlife.

The proposed project will change the lagoon configuration, improve slope and drainages, restore and enhance native coastal salt marsh plant communities, remove

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non-native vegetation and enhance the visitor and recreational amenities.

This phase of the project will involve temporary dike installation, temporary dewatering and reconfiguring and recontouring activities using earth moving equipment. In order to accomplish the desired ecosystem restoration, it is necessary to dewater the lagoon and remove a significant amount of fill and sediment. The grading activities -- all of the grading activities will occur in the western portion of the lagoon complex. The proposed design for the western portion of the lagoon consists of a single main channel with a system of sinuous side channels.

The single channel is designed with the opening close to the beach, and angled to enhance water circulation, and to promote maximum tidal circulation during open conditions, and maximize wind-driven circulation during closed conditions.

The lagoon tidal prism will be increased with the proposed project design and elevation at the channel entrance is the deepest area and the back channels are the shallowest, so that water will be encouraged to run out as the tide drops, and fill in as the tide rises.

Now, I am going to try and use the -- it is not responding very well, but you can see that there is one open channel with some sinuous vendrytic side channels. The main

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channel of Malibu Creek will remain the same, except that the lagoon channel interface will be reconfigured to form a more natural slope. Additionally, the existing boat house channel located on the grounds of the Adamson House will be deepened and recontoured with hand tools to restore functional hydrology and native vegetation.

Several species protection measures are required during the dewatering process, and Special Condition No. 4 requires the applicant to prepare a final dewatering plan to assure the proper protection and relocation techniques for tidewater gobys, steelhead, and other important aquatic species during dewatering operations. Water from the dewatered lagoon area will be filtered, tested, and discharged to the Pacific Ocean in accordance with the Regional Water Quality Control Board permit requirements.

Further, several species protection measures are required prior to and during construction, including bird and sensitive species surveys. Long term biological monitoring is also required. Special Conditions 5, 6, and 7 require the applicant to conduct bi-annual monitoring and submit annual monitoring reports for at least 5 years, regarding hydrologies, plant communities, revegetation, aquatic vegetation, benthos, fish and avian species. If the monitoring reports do not indicate improvement of water circulation, water quality, or if the reports indicate

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impacts to sensitive species, the applicant is required to submit a revised, or supplemental plan, that specifies additional or supplemental measures to modify the portions of the original plan that had failed, or was not in compliance with the approved plan.

The project includes plans for restoring the lagoon's plant community to a healthier high functioning native coastal salt marsh ecosystem with low marsh, mid marsh, high marsh, and transitional coastal scrub habitat with appropriate native plant species in the respective habitats. Although the disturbed coastal scrub habitat around Malibu Lagoon provides important resource values, it is even more important to restore and increase tidal wetlands resources because of their rarity in southern California.

The areal extent of tidal and sub-tidal and inter-tidal habitat will be increased by about one acre, and tidal salt marsh plant communities will be increased by approximately four acres.

Now, this is an old, or dated, plan that you see on the screen, the earlier one I showed was more recent. Tidal wetlands have been so diminished in southern California, that we need to take every opportunity to maximize their extent and function. The Malibu Lagoon is the second largest wetland in the Santa Monica Bay watershed, and the southern California Wetlands Recovery Project has

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identified the Malibu Lagoon as an impaired coastal lagoon ecosystem that required restoration. The wetlands recovery project's board of governors vetted and approved the proposed restoration and listed it on their wetlands recovery project work plan.

Plans for restoring Malibu Lagoon have been in the works for over 20 years, and the proposed project has been thoroughly researched and designed. While implementation of the plan will result in significant short term impacts, I believe that restoration enhancement of Malibu Lagoon will ultimately result in substantially greater long term improvements to the natural functioning and biodiversity of this seasonally closed tidal lagoon ecosystem.

And, I am now going to turn it back over to Jack for some more comments.

DEPUTY DIRECTOR AINSWORTH: Thank you, Jonna, first up, the residents of Malibu Colony have expressed concerns about the proposed perimeter wall that could adversely impact drainage and runoff from the Colony, and there are several drainage pipes from the Colony out into the lagoon.

In response to these concerns, the applicant has revised the project to incorporate openings and drain holes in the base of the wall, and they have also proposed a drainage bioswale to capture this runoff, and filter it

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before it returns to the lagoon.

Some of the residents, whose properties back up to the lagoon have also requested that the perimeter wall include a private access gate. They assert that the existing fences and walls have access gates, and they believe that the new wall should include these private access points.

First of all -- and they also assert that these gates provide an alternative evacuation route out of the Colony in case of wild fires. First of all, there are several evacuation routes in and out of the Colony, and we don't believe that that is an issue. The proposed upland plant pallet that has been designed specifically to minimize fire hazards, and in addition, the access road that runs along the wall will also provide access for the fire department. Furthermore, there is a concrete block wall will serve as a fire wall, which will provide added protection for the residents. So, the proposed project, in the end, will result in reduced fire hazards for the residential community.

So, in staff's opinion, there is no *Coastal Act* basis to require private access gates through the perimeter wall.

In response to the comments from some members of the Malibu Colony regarding the inclusion of some high fuel load plant species in the upland plant pallet, the applicant has redesigned the plant pallet to exclude these high fire

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hazard plants within 100 feet of the residences.

Now, also some members have expressed concerns regarding the use of herbicides to remove some of the non-native plant species here, even though the use of some types of herbicides are an accepted method to remove the more problematic invasive plant species in the context of a restoration plan, if they are properly applied. The applicant has, in response to these concerns, has deleted the use of the herbicides from the project, and we have best reflected in Special Condition 9, we have eliminated Special Condition 9, which outlined some restrictions on the use of herbicides.

Now, the opponents to the project argue that recontouring and removal of the wetland habitat is not the least environmentally damaging alternative, and as Dr. Engel has pointed out, the existing wetland habitat is not a highly functioning wetland, and does not have the appropriate wetland and upland plant species, and she has explained in detail why recontouring is so critical to insure the success of the future wetland habitat here.

Now, as Dr. Engel had indicated, this wetland design has been extensively studied and reviewed by all appropriate agencies. In order to achieve these goals of the wetland restoration, the area, we believe, must be recontoured, and we believe this is the environmentally

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preferred alternative based on this sound wetland science.

Members of the public have also raised a concern for the removal of the pedestrian bridge.

Please pull up the Power Point, again.

There were concerns that the removal of the pedestrian bridge and pathway through the wetlands will adversely impact the access to the beach. The pedestrian pathway through the lagoon and the bridges over the wetlands were not included in the proposed design, because the bridges and pile supports would impede the circulation of water through the channels.

In addition, in order to minimize the human disturbances to the wetland, the habitat, and the proposed bird islands, the pathway was routed around the perimeter of the existing wetland, as you can see here on this slide.

Although, there is the direct path would provide a shorter distance to the beach, the proposed path really does not, in our view, significantly increase the distance to the beach, and we must weigh the benefits of the shorter pathway -- the longer pathway gives the impacts associated with a pathway through the middle of the wetlands.

Now, the Wetlands Defense fund, and CLEAN have submitted a letter arguing that there has not been adequate time to respond to the staff's report, and the changes to the project since the reports were made available to the public.

This item was originally scheduled for the August 2010 Commission meeting. The original staff report recommendations for this project was released to the public on July 29, prior to the August meeting, and since that time the applicant has made some minor modifications to the project in response -- specifically in response to comments made by the public. These are not substantial modifications in our view, and the majority changes were, again, in direct response to comments received from the public, including CLEAN and the Wetlands Defense Fund.

The City of Malibu has submitted a letter generally supporting the project, but requesting additional bacterial indicator monitoring during construction and post construction, and during construction dewatering of the lagoon will include a filtration, decontamination and testing, which includes biological testing, as required by the Regional Water Quality Control Board approvals.

In addition, as outlined in Special Condition 5 of the permit, the applicant has agreed to compile monitoring data for bacterial levels, and provide the results as part of the applicant's annual monitoring reports.

A number of government agencies, environmental organizations, have submitted letters of support of the project, including the United States Environmental Protection Agency, the Bay Restoration Commission, the Santa Monica

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Mountains Conservancy, Regional Water Quality Control Board, Resource Conservation District of Santa Monica Mountains, the National Park Service, Heal the Bay, Santa Monica Bay Keeper, Caltral, Los Angeles Audubon Society, the Santa Monica Bay Audubon Society, Malibu Surfers Association, Friends of Ballona, and two letters from Assemblymember Julie Brownley and State Senator Fran Pavley, supporting the project.

Your addendum also includes some other letters of support, as well as a number of letters opposing the proposed project, and the staff recommendations.

In conclusion, staff is recommending your approval of the permit, subject to the special conditions outlined in the staff report.

The motion for approval can be found on page 4 of your staff report, and that concludes our presentation.

VICE CHAIR SHALLENBERGER: Thank you, very much, staff.

I'll come back to the Commission for ex partes. Do I have any ex partes to declare, on my left?

Commissioner Sanchez.

COMMISSIONER SANCHEZ: Thank you, on October 7, I spoke directly with Dave Grubb here in Oceanside, in my office at 4:00 o'clock. He spoke on behalf of Heal the Bay and Los Angeles Audubon. He especially indicated that the Malibu Lagoon restoration project is an historic opportunity

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to restore critical wetland habitat in the Santa Monica Bay. It will also help to greatly improve water quality for chronically polluted Surfrider Beach. The proposed Malibu Lagoon Restoration Enhancement Plan is based on over a decade of comprehensive planning, and the primary objectives to the plan are to improve water quality through increased circulation, enhanced lagoon, habitat for birds, fish and invertebrates.

It is necessary to reconfigure the sediments to simulate tidal flow and circulation, current configuration not based on historic lagoon boundaries, so preservation of the historic wetlands is not of concern.

I also received three emails. I believe they are in addition to the items that are contained in the record. I received an email from a Linda P. Yang, professor emeritus Cal-State Dominguez Hills indicating that she had heard of plans that would destroy one of her favorite places, Malibu Lagoon, indicated that she goes there monthly and wishes to save this important wildlife refuge and source of so much of her personal pleasure -- and that was dated October 11.

I also received one October 10, that was from a Julie Monders, and is a 4-page letter indicating that she has a daughter for nearly 40 years, and a 40-year Malibu resident, indicating her concerns about the plants for phase 2 to the Malibu Lagoon Restoration Enhancement Plan,

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indicating the second phase included bulldozing and dewatering of the lagoon between the breeding and fledging seasons of many of the lagoon's most appreciated avian residents, who belies arguments that it contains intense or compassionate procedures for the protection of the lagoon, existing birds and their young.

She is concerned about her tax dollars being spent on this phase 2 plan, thought that this was constructed unnecessarily, and hoping that the money would be put to supporting a gentler plan that does not require bull dozers, thus increase the biodiversity.

And, lastly, an email from Terra Mulsky dated October, actually 2nd -- I missed this one until I saw this last night -- writing about her great concern regarding the changes proposed by the Malibu Lagoon Restoration Enhancement project, asking that the plan be rejected or tabled until a suitable alternative plan could be proposed and approved by voters, encouraging me to support the withdrawal of the current application, and also concerned about heavy construction equipment, and stating that it was not appropriate for this project.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you.

Commissioner Wright.

COMMISSIONER WRIGHT: I have two declarations, one

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is on October the 4th, I had a telephone conversation with DOn Schmitz, and my ex parte declaration is filed with the staff, on file.

And, then, on Monday October 11th I had a telephone conversation with Mark Abramson with the Santa Monica Bay Restoration Foundation, and we reviewed a presentation folder that is on file with staff.

VICE CHAIR SHALLENBERGER: Thank you.

I have one ex parte, which is on file, and then additionally last night I had a meeting here in Oceanside with Marcia Hanscom, director of the Wetlands Defense Fund, Robert Van de Hoek, who is science director of the Wetlands Defense Fund, Wayne Ferren, who is the project manager with Master Consulting, and with James Birkelund who is an attorney with the law offices of James Birkelund.

They begin with explaining that this is a river mouth estuary with brackish water, and that is what the flora and fauna are that are currently in it, and that the dabbling ducks is an indication of that. What is not -- he said the microphytic algae which is in the river, is actually a result of nutrients coming down the river. What is not discussed in the staff report, not mapped in any way, is submerged aquatic vegetation which is an indicator of a brackish lagoon.

Ms. Hanscom said that the Malibu Task Force always thought that restoration would be on the two acres that used to be a parking lot, and if water quality was actually the driver for this project, this project won't affect the algae at all in the river, and the water quality.

They have an alternative, which they showed me, which would use a hydro-dredge, and the proposal is to clean out one channel a year for three years, and they said that non-natives are largely along the road, and that the site is, despite what staff says, actually is dominated by natives, and the difference is whether you talk about the number of species, or the average coverage of natives versus non-natives.

We then moved on to talk about the tide water goby, which only lives for one year. It has been on the endangered list -- endangered species list, for a long time, but is actually doing better in this lagoon than it is in most other places.

They say that if the lagoon is changed so that the salt content is higher that 12 parts per thousand, that the goby will not be able to survive in it. It is currently -- they measured it, and they said that it is 3 to 7 parts per thousand of salt right now, which is typical of the tide water goby habitat.

They said that in -- then we moved to the trail, that in 1983 the trail through the lagoon was built and during that building, and since then, the birds have adapted

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to it, and are not affected by the use of that trail. They asserted that what the staff is doing is actually looking at who -- they call them players -- are in this project, and not what is actually being proposed. They asserted that the Commission would not let a private developer take away an access, or close down an access.

They said that Susan Goode, the State Parks Department, had told them not to worry because phase 2 probably would never happen, and so they were actually surprised that it was moving along like this. They don't think it is the best alternative, and it seems odd that -- can't read that.

They then have a chart, which unfortunately, they showed me that I couldn't, and it was the only one they had, showing the time windows for construction, and this chart showed -- it apparently was out of the Commission's files -- it showed that there really was no window for construction that didn't affect some species significantly, and the time that the staff is permitting construction would, in fact, have the most major impact on the tide water goby.

They think there should be a smaller project, and they said that an example was in Los Angeles the Grand Canal Lagoon was a much smaller project, but it was to improve water quality, that they had disagreed with what the Commission did on that, took the Commission to court, and the judge agreed with their alternative and not the Commission's. They said that the amount of cubic soil being dredged was tremendous, that the project in the staff report doesn't disclose the actual temporal impacts, in other words, not the short term impacts of construction, but rather the longer -- all of the impacts look at when the restoration is completely done, what would be there, rather than the impacts at the time of construction.

And, they were saying that they completely support State Parks doing a project, just not this project. They have an alternative which I am sure they will share with all of us today.

Thank you.

Commissioner Wan.

COMMISSIONER WAN: Most of my ex partes are on file.

I did, on the 11th at 2:30 in the afternoon, speak with Gary George. He had sent the letter which was sent to everyone, and it was a letter from Kimball -- and I don't remember his last name now -- who made some -- and I asked him about his suggestions relative to having shoals for the birds to rest on, and he said he didn't know enough on how they would work, but asked that I try to find out about the shoals that were in that letter.

And, he said that he was much more concerned that

004687

State Parks would enforced a leash law relative to dogs, and that dogs that are in there now are allowed to be off leash, and that State Parks really needs to have an active enforcement program requiring that any dogs in the lagoon and in the park area, be on leash, because they are very disruptive to the birds.

That's it.

VICE CHAIR SHALLENBERGER: Commissioner Burke.

COMMISSIONER BURKE: I really have two emails from Marcia Hanscom, asking for an ex parte, and I was supposed to meet her this morning at 7:30. I was there, and she didn't show so that is all I have to report.

VICE CHAIR SHALLENBERGER: Thank you for sharing.

Commissioner Kram.

COMMISSIONER KRAM: Thank you, I have two ex partes to report. The first was a conversation with Don Schmitz, which is on file, representing the agent for Malibu Colony Owners Association. That is on file, but I will give you the highlights.

He supports the plan, believes it is a big improvement. He has concerns about the drainage, which apparently has been addressed, draining towards the Colony, certain plants, and there were flammability issues, but also was concerned about the rear accesses for emergency and recreational vehicles, and that being closed.

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He pointed out very strongly that, yes, I guess some of the hazard is fire, but a lot of it is in a flood situation, or a tsunami, or something of that sort coming ashore, these people would have a way out of their homes, in addition to, obviously, their recreational uses of the area, and some concern about the bridge being eliminated.

I also had an ex parte with Penny Elia, by phone, at 8:30 on October 11, in which we talked about the project, and she supports the staff recommendation, talked about the ten-year planning process, the water quality enhancement, the environmental issues for the plants and their lives, and very supportive of the project.

I asked her a series of questions about some things that were proposed that she didn't have answers for, and one of which was this issue about the gates in the back. And, she sent me this long ex parte, which has information that we didn't talk about, that I don't need to go into, and that was it.

VICE CHAIR SHALLENBERGER: Commissioner Liberman.

COMMISSIONER LIBERMAN: Thank you, very much, I have several ex parte communications to disclose --

VICE CHAIR SHALLENBERGER: Excuse me, for Commissioners, it is counter interactive, the red on your right means the mike is on, green light, the mike is off.

COMMISSIONER LIBERMAN: Got it, and thank you very much.

On October 7 of this month, I had a telephone conversation with Donald Schmitz, Jr. representing Malibu Colony Homeowners Association, and essentially the same points as Commissioner Kram has raised, we discussed, as well.

On October 11, at approximately 1:30 I had a telephone conversation with Penny Elia, representing -- speaking for Heal the Bay, L.A. Audubon, Sierra Club, indicating support for the project, a very brief conversation.

On October 12, at approximately 10:00 in the evening, I had a meeting in person with Marcia Hanscom, Roy Van de Hoek, and James Birkelund, and the first two being with the Wetlands Defense Fund, speaking about virtually the same issues that our Chairwoman described. James Birkelund, an attorney representing the Wetlands Defense Fund, was also in that meeting.

But, in addition to those issues, we also discussed two other issues, that the Chairwoman didn't mention, and those were the adequacy of the underlying EIR documents and process, and number two, stakeholder participation in the process through committees that have been in place in the past, at some point were terminated.

And, I believe those are all of my ex partes on

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this issue.

VICE CHAIR SHALLENBERGER: Commissioner Blank.

COMMISSIONER BLANK: Thank you, Madam Chair.

On October 11th I received a email from Lenny Roberts and Mike Ferrera of San Mateo ORCA, asking -- observing that L.A. Audubon and Heal the Bay are in strong support of the staff recommendation for approval, and that restoration of the Malibu Lagoon will restore critical wetland habitat, and improve water quality which is badly degraded.

Last month in Eureka, I met with Marcia Hanscom, and others, and that ex parte is on file, and it was a very informative and valuable ex parte.

I also received an email from Marcia Hanscom about providing additional information. I didn't receive any, and also ran into her last night at the hotel, but nothing substantive other than "hello" was exchanged.

On October 8th, in Pescadero I met with Don Schmitz, and the content of the conversation was substantively identical to that of Commissioner Kram's ex parte. The focus was on the Malibu Colony residents concerned about the removal of additional boardwalks, and also lack of gates and access, in case of flooding or tsunami, and felt that a wall without any access was actually not only dangerous, but appeared a little punitive.

004691

Oh, and I also received a email summary from Gary George of California Audubon, and that email and letter was sent to the staff and all of the Commissioners.

And, that is the sum of my ex partes.

VICE CHAIR SHALLENBERGER: Thank you.

Commissioner Stone.

COMMISSIONER STONE: Thank you, I have several ex partes that are on file, that I noticed there, and I also had an ex parte when I met with Sara Damron, Grant Weisman and Margy Kay of ORCA, at 10/07 at 1:00 o'clock in my office. They were speaking on behalf of Heal the Bay, and the L.A. chapter of the Audubon Society, and the substance was essentially the same as Commissioner Sanchez reported in her conversation with Mr. Grubb.

VICE CHAIR SHALLENBERGER: Thank you.

Commissioner Mirkarimi.

COMMISSIONER MIRKARIMI: Just one, an email by phone tag with Ms. Marcia Hanscom, about a meeting that never materialized, that's it.

VICE CHAIR SHALLENBERGER: Thank you.

Commissioner Achadjian.

COMMISSIONER ACHADJIAN: Thank you, Madam Chair.

I had a meeting with Don Schmitz, and the focus of our conversation was based on the wall. And, last week I happened to be in Sacramento and I met with Sean Dorherty

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with the same conversation as reported by Mr. Blank and Mr. Liberman.

I had a phone call requesting yet another ex parte two days ago. In my busy schedule, I will ask all listeners that need to have ex partes to stick with me, and please give us at least 3 weeks to schedule a meeting time, even if it is a minor phone call, I apologize for not being able to respond to their needs, but I am very busy.

VICE CHAIR SHALLENBERGER: And, we certainly understand.

COMMISSIONER ACHADJIAN: I would be happy to have ex partes with all concerned members, but any project does need to be scheduled way ahead of time.

VICE CHAIR SHALLENBERGER: And, I forgot that I had an ex parte yesterday afternoon, when in the car driving to the airport, it was with Mark Gold of Heal the Bay, and it was his concern that there was quite a bit of misinformation out there about the water quality impacts of this project, and to be quite honest he gave me quite a few numbers about the specific water quality, the current lagoon and river, and I asked him to give me that in writing at the meeting, and I don't have it, so I can't share it with you, but it means that I also don't remember it, so I don't think it will influence my decision-making.

And, having said that, I think that is all of our ex partes, and we will open the public hearing. Let me just explain, we do have nearly 40 speaker slips for this, and so with permission of the Commission, if you will all agree, it is my intention to -- the project applicant has asked for -- they have a 20 minute presentation, and they would like 5 minutes for rebuttal, which I have granted them.

Then, there is a 15-minute organized opposition, a 15-minute organized support, and after that I am inclined to give 2 minutes per person. Now, there probably aren't really 40 different issues here, despite there are 40 people who want to speak on it, and so what I would like to do, if we can make it work, everybody after those organized presentations will get 2 minutes. If you come forward with other people who will stand with you when you speak, you may have one additional minute for each person that comes forward. It is my feeling that that is fair, but I want to be sure that all of the issues are aired here, but that way, perhaps, one speaker can get an additional minute from each person who actually comes forward with them, and we can then leave more time for the Commission to deliberate.

Yes, Commissioner Blank.

COMMISSIONER BLANK: Madam Chair, before we get into substantial discussion, I was just reminded that I also had another ex parte that I want to put on record, which was a conversation with Shelly Loose of the Santa Monica Bay

Restoration Commission, and she was supporting the project, basically just told me that she was supporting the staff recommendation, and asked if I had any questions, on October 8th, and I apologize for not mentioning that.

VICE CHAIR SHALLENBERGER: Thank you.

Is the Commission in agreement with the proposal on how to move forward?

[No Response]

EXECUTIVE DIRECTOR DOUGLAS: Madam Chair, I assume that if somebody brings somebody else up to get an extra minute, the person that is brought up does not then later have the opportunity to address the Commission?

VICE CHAIR SHALLENBERGER: That is correct, and they much already have a speaker slip in at this time, and we are not taking any more speaker slips.

EXECUTIVE DIRECTOR DOUGLAS: Okay, thank you.

VICE CHAIR SHALLENBERGER: Thank you.

So, I will begin with the project applicant, and I believe Dr. Richard Ambrose, or whoever is the applicant, come forward. I don't actually have anybody identified as that.

MS. GOODE: Good morning, Commissioners, my name is Susan Goode. I am a senior environmental scientist with California State Parks, Angeles District. Before I start, I would definitely like to commend the hard work of your staff.

They have been very, very diligent on this project, a very complicated project. We know how difficult it is in these times for state employees and for state agencies, and you are very under-staffed and we do appreciate your hard work that they have put into this project.

If I could have the first slide.

Very well, and this will be -- thanks for the excellent staff report, this will be something of a review.

Next slide, please.

Malibu Lagoon is much changed from its original configuration. The earlier slide that was shown, the lagoon extended much much further to the west. It has been impacted by increasing urbanization, and infill, and as was also said earlier, it is a major stop on the Pacific Flyway. It is the second largest coastal wetlands in Los Angeles County, and it is a very significant regional resource.

Next slide, please.

The project history, there has been decades of urban development filling in of the wetlands, the function of the lagoon has become severely stressed as a result of that, the introduction of imported water into the watershed in the 1960s has exacerbated the situation of the lagoon being smaller, and now having to process more water than it ever did in the past.

Next slide.

In 1983, as it was mentioned earlier, State Parks did an initial attempt at restoration and created three western channels and the boardwalks you see today; however, we have discovered that the improvements that we made, while they did increase habitat did not really go far enough, and some of the improvements are, actually, contributing to the problems that we have today.

Next slide, please.

There is a critical need for restoring this particular lagoon at this time. The poor circulation is caused by the channel configurations, and has very very low species richness and diversity compared to other wetlands in southern California. There is an impaired status of the benthic invertebrates, shell fish nutrients, eutrophications and there is not enough oxygen and too many nutrients, resulting in dead zones. The diox that we have of viv-valves (sic.), they are extremely significant, these viv-valves are the very basis of the food chain to support the fish and the birds, as well, and so when we lose these species, when the oxygen gets critically low, this reverberates all the way up through the food chain.

There are invasive and non-native vegetation species in the lagoon, and there is habitat fragmentation and disturbance.

We have a very long, long history of stakeholder involvement going back to even before 1994, but in 1994, in particular, the Malibu Creek mediation effort identified action items for improvements to the watershed. The 2000 UCLA study identified both short term and long term restoration options for the watershed and lagoon. In 2001, the Malibu Lagoon Task Force recommended reconfiguration of Malibu Lagoon as the highest short term priority for restoration.

In 2003, the Malibu Lagoon Restoration working group was formed to create the lagoon restoration and enhancement plan. In 2005, the Lagoon Restoration and Enhancement Plan was complete. In 2006, our environmental impact report was certified, and since that time we have obtained all necessary permits, save for the one at issue today.

The Lagoon Restoration working group consisted of large group of stakeholders, private, public, NGOs, many many public agencies, and many activist groups.

Our technical advisory committee consists of well-known and learned experts in the field of biology and wetlands, and they were crucial in helping to develop this particular plan that we present to you today.

And, now I will turn the microphone over to our consultant, Mr. Bob Stark of ICF International.

VICE CHAIR SHALLENBERGER: Susan, before you leave

004698

today, would you be sure -- you may have filled out a speaker slip, but I don't have it, just fill out another one, if you would, thank you.

MS. GOODE: I will.

MR. STARK: Good morning, so the first step in the restoration was actually the parking lot reconfiguration --

VICE CHAIR SHALLENBERGER: Please give us your name for the record.

MR. STARK: My name is Bob Stark, from ICF International, good morning.

Not only does the new parking lot reconfiguration treat storm water before letting it back out into the water body, and is complete with enhanced visitor amenities, such as new tables, chairs, and an educational note for all of the thousands of students that visit Malibu Lagoon each year. The actual footprint of the parking lot is two acres smaller, which is wonderful because those two acres are now available for increased habitat in phase 2 of this restoration.

Some of the key restoration elements were derived straight out of the identification of the problems that we have already mentioned, improving tidal connectivity, removing all of the historic fill that has happened over the past decades, eliminating the habitat fragmentation disturbance from the existing boardwalks and paths that bifurcate the lagoon, enhancing the visitor experience through educational outlook, and a comprehensive interpretive component to the project, and of course increasing habitat diversity.

This graphic is a really great indicator, I think. Above you see the habitat as it exists now, and below you see the habitat as it will be once the restoration is complete.

Two key things I'll point to your attention is the light green shaded areas above, that is the coastal salt marsh, a real good wetland habitat. You can see clearly below, we are doubling that in sizes, it is the doubling of habitat coastal salt marsh habitats, and that is really wonderful.

The other thing to point out are those orange areas you see on the top graphic. Those are all of the non-native and disturbed areas, and as you can clearly see, in the graphic below, or after in this, those are gone and that is a good thing.

What you are looking at here is a cross section, so under existing conditions, if you can imagine taking a slice out of one of those side channels, this is a representation of what that would look like. What you are seeing here is that under -- is my laser going to get there, nope -- under, on the top there, you see it is really dominated by upland vegetation. There is that narrow channel that goes on the western side of the lagoon, and there are very narrow

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bands of wetland habitats, and then it is dominated by all of that upland habitat.

If you now look at the slice that will be taken out of the channel after the restoration is complete, on the bottom there, you will see that we have a much broader and shallow channel, and much greater abundance and diversity of wetland habitat, from low marsh to mid-high marsh, and the high marsh habitat that just simply are lacking today.

Here you see, how under existing conditions, those channels are very narrow, and you can also see the bifurcation from the human element that has been constructed in the middle of the wetland.

We move to an after image now, and you can clearly see the single broad wide channel that has more connectivity, and than the additional stengretic (sic.) side channel that will spread off of that.

And, this is another look at it, with those channels and those western lagoons completely filled in at a nine-foot water level.

These are the trails that were spoken of earlier. You see the existing trail in yellow, the proposed trail in green. Again, you can clearly see here how the existing trail fragments the habitat and creates those pinch points where all of the side channels come in, those narrow channels pass under those bridges.

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The new trail will be pushed to the perimeter of the wetland area, which serves many benefits. First, it decreases the human impact in the wetland area, and also provides greater opportunities for viewing and for interpretive and educational input, which Clark will speak to in a minute.

It is also important to note, I think, that the trail is really not that much longer. We have, actually, calculated, and you can see it is about 1500-feet, under existing conditions, to a little over 1600-feet. It is about a minute longer to walk the path in the proposed condition as it is currently.

And, this is just another good representation of how those pinch points with the other existing conditions with the side channels that needs to meander back into those dead zones that are created.

Some additional design features that are very important in how the restoration was designed, compatibility with future expansion into the golf course property, a reduced wildfire load, the new habitat planting pallets will produce a much lower fire load than the habitat and plants that exist under the current conditions, increased flood protection because we are actually increasing the capacity, the holding capacity of the lagoon, and has also been designed with sea level rise taken into consideration.

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And, the other component that was taken into consideration is the interpretative and educational piece of this restoration, and I will hand it over to Clark Stevens to discuss that in more detail.

MR. STEVENS: Good morning, and thank you for the opportunity to present the interpretative and public access element. My name is --

VICE CHAIR SHALLENBERGER: I need your name for the record.

MR. STEVENS: Yes, and my name is Clark Stevens. I am --

VICE CHAIR SHALLENBERGER: Mr. Stevens, just for a second, both Clark and Bob I don't have speaker slips for you also, so you need to do that before you leave, thank you.

MR. STEVENS: Sure, executive officer of the Resource Conservation District of the Santa Monica Mountains, and also the interpretative architect for the project.

Malibu Lagoon State Park, with its thousands of annual visitors is a unique learning landscape that currently hosts numerous environmental education programs, as well as the dedicated group of wild life and birding enthusiasts.

Early in the public design process, these educators and naturalists recognized an exceptional opportunity to enhance the visitor experience of the lagoon. Our design proposes to move the existing access road near the

004703

current golf course area, further to the west to capture a new upland area for conversion to an interactive wetland zone, bringing visitors into direct contact with the dynamic systems of the lagoon, while protecting the expanded interior habitat area.

That pointer is not going to work for you.

That is the area in red on the left, and is the primary interpretative zone. Our interpretative experience begins at the recently constructed seating area where the lagoon docents requested that we provide shade for their teaching activities in the area. We have designed a shade canopy that is inspired by the kind of quality of life that ones gets in a kelp canopy zone.

Also, located near the entry to the park is the watershed zone, and this will be a 4-foot by 8-foot scale model cast in bronze of the entire Malibu Creek Watershed, and features a drip system that can be activated by docents and visitors to show how all of the water in the watershed is collected and ultimately ends up at the lagoon, where they are standing.

With the watershed fountain, we actually have three access opportunities, three different routes, the first of which we call -- sometimes called the surfer expressway, which is for those who just want to get to the beach and the break in a hurry. There is also a teacher's pathway that

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accesses all of the interpretative landscape elements, and finally, there are more remote birder stalks route which take you along narrow and quiet trails to more secluded viewing areas.

From the watershed fountain, as I said, you proceed into the main body of the interpretative area, the section at the bottom which says winter platform is at the end of a 200-foot long ramp that descends from the watershed fountain, and ends up 8 feet below the level of the height of the surrounding berm.

Adjacent to this ramp and teaching platform, which is shown here in cross-section at the bottom, will be planted native wetland plants in horizontal rows that will provide a visual reference for the rising tides. That tide, at its highest point, will actually allow visitors to literally walk on water and be fully engaged in the lagoon.

On the teacher's path, also we have an element of the design that highlights the lagoon's unique pattern of seasonal filling and breaching. Water will mark time in the summer, as it advances up this ramp. The summer clock here, which is shown in detailed plan and cross-section, will indicate with every quarter inch of rise of lagoon level during the summer as it fills a foot of advancement up that path, so it is something you will literally be able to see every day, if you are a regular visitor to the lagoon.

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During this time, there is an alternate teaching area provided which we call the summer amphitheater, and that is located at the very best spot to look across the greatest expanse of new wetland area, and particularly open water surface.

Moving on to other, the final elements of the lagoon interpretative plan, we have introduced in the southern area of the main interpretative area, an area for birders. We have it -- above that winter platform, we have a topiary structure that is there to provide framing of views, and also to provide cover for people there in the lagoon.

On the south, as was mentioned in the staff report, we have a wall that is reminiscence -- will actually be built exactly as the current Adamson wall is, except that it will provide for 8X8-inch openings continuously at the bottom to allow for passage of surface drainage, as well as small animals. And, that surface drainage will be also combined with the pipes that were mentioned, but aren't in the staff report. They are also being captured and infiltrated before returning to the lagoon.

Susan has a couple of things, else, to say about the wall.

MS. GOODE: Yes, we have become aware that our neighbors in the Malibu Colony are concerned -- Susan Goode, with State Parks, once again. We have become aware that our neighbors in the Malibu Colony have concerns about being able to escape the back of their property during extreme emergencies, and I just wanted to point out that the wall is 3-feet into the State Park property, and the residents' fences and gates that they currently have will be untouched, and so in the event of an emergency, they will be able to exit those gates, and have a 3-foot pathway where they can escape onto the beach, if the need should arise.

MR. STEVENS: In closing, I just want to mention two other secluded observation areas that were selected by the naturalists in our public process.

One is located at the extreme southeast portion of the lagoon, further east, in fact, into the heart of the wetland, and the current bridges allow -- and as the current bridges provide intimate contact with the water surface, it also is designed to be a very solid structure of concrete rather than the wood structure that is there, so that the issue of vibration for those viewing with scopes is not a problem. It also faces north, which does two things, one is it provides glare free viewing in photography for naturalists and birders, but it also completes the understanding of the watershed concept that was introduced at the beginning with the watershed fountain by providing the best possible view of the canyon of Malibu Creek into the Santa Monica Mountains.

Finally, I just don't want to miss the opportunity here to say thank you to the many dozens of individuals who in the last 7 years have invested a great deal of free time to develop these ideas that have become this restoration plan and interpretive plan.

Thank you.

MR. STARK: Bob Stark, ICF International, just to finish up there are very precious resources in the state park area and within the lagoon, and we are, of course, all very aware of that.

There are voluminous measures that will be put in place as required, during the construction process, and I just listed a few here to run through to give us the sense of what those are: pre-construction resource surveys, biologists and archaeologists surveying before the construction begins, isolating the work area from main lagoon, again, important to remember that we are only doing work in those western arms. There is no construction that would occur in the main lagoon channel. Relocating the fish, the tide water goby, and other fish species that are there, out of those western arms, and placing them into the main lagoon channel before work occurs.

All of the water that will be removed from the western lagoon area will be filtered and treated before being then dispersed onto the beach. Native seed collection and plant salvage, of course, we are going to want to gather all of the plants and seeds that we can, that are there right

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now, so that we can use them to replant them when the restoration begins, after the earth work is completed.

Biological, archaeological, and water quality monitors on site during construction. And, of course beach access is a very big issue that we heard about and we made sure in the design and in the measurements that we will maintain the beach access throughout construction.

Finally, post construction, once we are done with the earth work and the restoration process that we don't walk away from it, we make sure that it works, and an adaptive management plan will be put in, and there will be monitoring of water quality of all vegetation, aquatic, avian, and benthic species over many years to make sure that our success criteria, as laid out, is being met, and if it is not, and changes need to be made, that those are very well thought out and very well prepared we are continuing to move forward to insure the long term success of this restoration.

With that, on behalf of State Parks, and all of our project partners and team members, I would like to thank the Commission for a careful consideration of this very important project, and all of our team members, as listed here, are available to respond to any questions as they may arise.

Thank you, very much.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Now, we will go to an organized presentation in opposition, and start with Marcia Hanscom.

MS. HANSCOM: And, we have a Power Point present-ation, and could I ask the Chair if you could give us 5 minutes each, because the three of us are going to just split, 5 minutes each.

VICE CHAIR SHALLENBERGER: I'll just leave it to you to watch the time, however.

MS. HANSCOM: Okay, thanks, that's great.

Honorable Commissioners, Marcia Hanscom with the Wetlands Defense Fund, CLEAN, which is Coastal Law Enforcement Action Network, Save Malibu Lagoon, and also Access For All has asked me to speak on their behalf today. There is a letter in the file from Access For All, which I serve on the board of directors for.

Why are we here today? and I guess I need to know, okay, this is why we are here. In our view the process for this has been completely flawed. There are confusing different plans that were studied in the environmental impact report to the staff report you have here today, to the original report, they are all different, and that causes some problems in and of itself.

But, I was a member of the Malibu Lagoon Task Force, and the recommendations you have here today were never voted on by the Malibu Lagoon Task Force, were not consensus by the Malibu Lagoon Task Force, they were -- and in fact, was never even, really, discussed. There was an initial plan that is quite different than today's plan, that had been presented to us, and there were a lot of concerns about that plan, and at that point, we decided that -- and there was consensus that we would agree to Phase 1 of this project, which was to move the parking lot, and we also agreed that we needed to lose some non-native plants, but no one ever thought that that was going to be happening with bull dozers. We all envisioned that we would be out there with the California Native Plant Society, and others, removing the plants, and putting new plant in.

We are also here because there are endangered species here, ESHA, wetlands, and public access issues, and I am one of State Parks biggest fans, and it pains me to be here opposing them, but these things are so important that we feel that these issues must be addressed.

In terms of the endangered species, I want to point you to the chart that the Commission's Chair Shallenberger mentioned to you, attached to my letter that was given to you this morning. This chart talks about the tidewater goby, the California least tern, and the steelhead trout, and this chart was in the Commission's file, and you will see the yellow highlighting is where it was determined that the project would be done between June and October, and

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you will see that there are very serious concerns that were raised in the original biological opinion by the US Fish and Wildlife Service, as to whether or not this could be done at any time of year, and if you look at this chart you will see that there really is no time.

And, in fact, in one of the ex parte communications that we saw from Commissioner Wan was one of the project proponents, she asked that very good question, and said, "Well, what about the fact that least terns are still feeding during that time?" And, his answer was, "They don't feed in the western arms of the lagoon," which is absolutely not accurate. I have seen it many times, as has many other birders.

And, that post-breeding feeding of the adults who bring their young up from Venice afterwards, and that is very important, and we don't believe the biological opinion, even though it was changed by the Fish and Wildlife Service about 6 months to a year after, and we don't really know why, but it was changed, changed for the tide water goby, but not for the least tern, we saw no evidence of that.

We, also, would like to just say that there is more than just the endangered species, this is ESHA, environmentally sensitive habitat area, and we believe that the Bolsa Chica decision does not allow ESHA to be moved, destroyed, at all, and there is a reason this is ESHA and you

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are going to hear a little bit more about that from our expert, Wayne Ferren, who I am going to give my extra time to.

MR. FERREN: Thank you, Marcia.

Madam Vice Chair, Commissioners, and staff, thank you for this opportunity to speak. My name is Wayne Ferren, I work at the ecology department of a major consulting in Red Back, New Jersey, and I am here today as a consultant to the Wetland Defense Fund. A little background, I spent 26 years at UC Santa Barbara in the ecology evolution marine biology department, and with the natural reserve system, where I studied and managed various wetlands in coastal California. My experience is from both coasts, and I currently work in a conservation and restoration of wetlands in the mid-Atlantic states of New Jersey, California, and in Mexico.

Before I proceed, I would like to -- I am not sure what is happening there, and I will let the technicians work on that.

Before I proceed, I would like to acknowledge my colleagues and associates and proponents of this project, many of whom I have worked for many years. It is a somewhat awkward position to be here in the opposition, given that I have high respect for their contributions and their dedication over the years to California wetlands.

But, here we are, and the situation is that the

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project, as proposed, is based upon a number of faulty analyses and mis-information, and the project, as designed, then anticipates upon that.

And, I would like to proceed with some of the slides, although I think, at this point, we will have to go without them.

Malibu Lagoon is a river type estuary that is brackish in nature much of the year. It has characteristics different than other estuaries, and therefore you can't lump all of the estuaries together, and have their biological resources compared, and have it make sense, it doesn't happen that way. Different categories of estuaries should be compared together, and so as a brackish water estuary, this supports species different than when we originally have Malibu open all of the time, and which would be more marine oriented. It supports brackish water plants, brackish water animals, and it is a different biodiversity, and so to say it is appropriate based upon comparing it to estuaries that are totally different ecosystem is somewhat of a mischaracterization.

Examples of that would be, for example, that this area has been characterized as having low biodiversity, and somehow that is an indication that is, in fact, preposite, when in fact a great biomass covering native plants there is a preponderance of native, and the exotics really don't characterize the site, so to indicate as a biodiversity element that that would be one way of characterizing it as being degraded, simply isn't the case, it supports the hybrid preponderance of native species, and they have high function.

Examples are the bull rushes that are there, as characterized by some as fresh water marsh, it is not, as this is an esturane brackish marsh, these have important functions, and also submerged aquatic vegetation.

This is a very important component, that has been lost again -- on the screen -- submerged aquatic vegetation is nationally important, and it is something that has come to the attention of many researchers as a declining resource on all coasts. As a result, many resources are being lost, and in California we do not have protection directly for submerged aquatic vegetation, as does many other states. This vegetation is important, for example, for tide water goby, and it is -- I have found that 100 percent of the time when you find, for example, welfious arosa [sic.] as you see here, supporting this particular population of birds and fish. The plant welfious arosa [sic.] not welfious meridia [sic.] a plant you would find in a more marine oriented estuary.

This is highly important, a basis for the food chain, and 100 percent of the time, when you find this plant in California estuaries, you will find it also as a support

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for the tide water gobys. And, here is an example of spiral witching grass.

Now, regarding water quality, as you will notice in this photograph here, the channel is highly polluted, indicated by the amount of algae, as compared to the restoration site that occurred before.

As proposed, the project is not going to solve the problems with water quality issues. What we propose is a rejuvenation project taking the existing conditions, rejuvenating the channels, for example by either a hydrorake, beneficial bacteria, or other elements, also preserving the trails, reducing the amount of algae, and this approach, rejuvenation approach, is far superior to one which would be quite damaging. It also preserves the existing access.

So, I would like to pass this along now to our legal expert, and I suppose if there are any questions we could answer them at the end of the presentation.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you.

MR. BIRKELUND: Good morning, my name is James Birkelund. I am an environmental attorney for the Wetlands Defense Fund, and CLEAN, and I am here to discuss the legal violations of the *Coastal Act*.

Before I do, I would like to thank the Coastal Commission for your longstanding efforts to protect our

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coastal lands. I would also like to thank the California Department of Parks and Recreation, the Coastal Conservancy, and Heal the Bay for all of your environmental efforts. We are fortunate to be on the same side as you for most of those efforts.

But, the environmental community is diverse, and the part of the purpose of today's hearing is to hear all sides of the environmental community before impacting wetlands.

I am going to high light the three major violations of the *Coastal Act*, and before I do I would like to point out to the Commission that the decision before you is, in truth, quite simple. It is rather, the proposal here today, is about the approach, the least damaging approach to restoring existing wetlands, wetlands that may not be perfect, but have highly functioning habitats.

Of all of the areas under the *Coastal Act*, wetlands are afforded the most stringent protections. The *Coastal Act* absolutely prohibits the dredging and filling of wetlands, a lot can be demonstrated that unless there is no feasible less environmentally damaging alternative. This project proposes over 88,000-cubic yards of grading, and mostly in wetlands. There is no question, as you heard from our experts, that there are alternatives that haven't been fully examined, alternatives that are environmentally superior, and achieve project objectives, and best of all these alternatives would avoid significant impacts to existing habitat.

The failure of the environmental documents to fully examine adequate alternatives is fatal to granting a development permit for this project.

Next, I would like to discuss ESHA, Malibu Lagoon is designated as ESHA, the projects will involve over 50,000-cubic yards of dredging, and over 35,000-cubic yards of fill within that ESHA.

The staff report concludes that there despite all of these activities, and despite the removal of the existing vegetation, existing habitat in the western portion of the lagoon, and without proposing barely any mitigation measures at all, that this project will have absolutely no significant impacts on ESHA. The staff report, on numerous occasions, references that the lagoon is degraded, and it is implied that the Commission need not consider impacts to the existing habitat values. This analysis is flawed.

First, the courts have been absolutely clear that ESHA, no matter how degraded, is strictly protected. And, second, you heard from our experts conclusively that there is highly functioning habitat in the western lagoon, including habitat that supports the tide water goby, and impacts to this habitat have not been examined.

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Finally, public access to the coast is one of the treasured assets under the *Coastal Act*. This project proposes to remove one of two existing public trails to the beach, absolutely, this violates the public access provisions that you see up here. It doesn't take an expert to understand that in removing one of two trails will diminish in half, and not maximize public access.

In addition, the existing trail, with wooden bridges through the lagoon has been -- has been in existing public usage and been around for over 27 years.

Other violations are cited in the comments we submitted, but I would like to point out to the Commissioners that the final EIR is now over 4.5 years old, much of the documents referenced in that EIR are even older, and this project before you today requires additional analysis.

My client, the Wetland Defense Fund and CLEAN, clients, strongly believe that no matter who proposes a project, whether it is a developer, the Coastal Commission itself, public agencies or other public entities, and no matter what, how well intended the project, we cannot cut corners to get around the *Coastal Act*. There are better ways to restore our wetlands, and we ask the Commission to deny and reject this Coastal Development Permit.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

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Marcia and Wayne, I would like to check with you, as there were some technical difficulties during your presentation, do you -- it seemed to me that we saw all of the slides, but I will grant you another minute, if you need. I don't want -- you had an organized presentation, there were technical difficulties no fault of yours, or ours, so I wanted to be sure that you feel that you have adequately gotten your time.

MS. HANSCOM: Thank you, Commissioner Shallenberger, I would like to finally say something that was on tapes 552 of the Malibu Creek Watershed UCLA study by Rich Ambrose and Andy Orhm, the conclusion was that the acquisition of potentially restorable land should be the highest priority of restoration and the first step in restoring the Malibu Lagoon ecosystem. That was backed up later by the Southern California Wetlands Recovery Project scientific advisory panel, and somehow we just have moved away from that, so Legacy Park which was just opened, the City of Malibu, is the first step towards doing that, having water, storm water, entering the flood plain before it gets to Surfrider Beach, and having some water treatment there.

And, I just want to make sure that you -- I am not sure who to present this to, but we have several thousands petitions signatures from people who walk across that bridge on a regular basis, and who have signed saying that they are in support of our position today, so we would like to submit those several thousand petition signatures to you.

VICE CHAIR SHALLENBERGER: Wayne, did you have something? you were the one whose slides were really jumbled.

MR. FERREN: Thank you.

I would like to refer the Commission to the letter that I submitted, which has many more details in it, and will cover the subject. It is important to know that the submerged aquatic vegetation was not mapped by any part of the project, was not analyzed, is not associated with any proposed impacts or mitigation, so the process is flawed in that important element of the ESHA in the Malibu Lagoon, and should be investigated further.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Now, we will go to the organized support group. I am not sure what order you want to take that in, but they will also have 15 minutes, and then it is my intention to take a very short break after that, which will also allow the members of the audience who have signed up to speak, to see if you want to group together come forward as groups and have one spokesman for longer periods of time.

So, you will have to give me your name as you speak, and will have 15 minutes total for this organized presentation.

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MR. AMBROSE: Good morning, Commissioners, my name is Richard Ambrose. I am a professor in the Department of Environmental Health Sciences, and director of the Environmental Science and Engineering Program at UCLA, and I also chair the Commission's Science Advisory Panel overseeing the San Onofre Nuclear Generating Station Marine Mitigation Program, and that includes a wetlands restoration at San Dieguito Lagoon. I chair the Santa Monica Bay Restoration Commission's Technical Advisory Committee, am a member of the Ocean Protection Council science advisory team, the Southern California Wetland Recovery Project, science advisory panel, US Army Corps of Engineers Environmental Advisory Board, and as Susan Goode mentioned I was a member of the Lagoon Technical Advisory Committee, so I have 35 years of experience of looking at and doing research along the California coast, and that includes involvement with wetland restoration planning throughout California, including San Dieguito Lagoon, as I mentioned, Ballona Wetlands, Mugu Lagoon, Ormond Beach, and much of my research experience has focused on looking at the effectiveness of wetland restoration activities, and I have published more than 140 scientific papers, and reports, and many of those having to do with wetlands.

So, Dr. Engel, in her staff report, mentioned some of the results from the research I have done in Malibu. I

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have been a resident of the Malibu Creek watershed for the last 20 years, and I first started working in Malibu in 1993. And, I am not going to talk about the particular scientific details, Dr. Engel mentioned some of those, but what I wanted to do is just give a bit of background on my perspective, having been involved with this issue for so many years.

The first study that we did started in 1993, and as Dr. Engel mentioned it included looking at birds and fish and investigate vertebrates and plants and water quality in the lower Malibu Creek watershed, and also in the lagoon.

It was very obvious from the beginning there that the lagoon has significant problems, and really that is what started me on the trajectory of doing research in the lagoon, and also trying to understand what could be done to improve the natural resource values in that lagoon.

Then, in -- can I have the first slide, please, my first slide.

So, then in the late '90s Tony Orm and myself led a group of scientists, mostly from UCLA, to do a project for the California Coastal Conservancy -- I am waiting for the slides.

VICE CHAIR SHALLENBERGER: We will hold it for you.

[Pause in proceedings.]

MR. AMBROSE: So, that project was -- there, that

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is it -- so that is the title page to the report, but the goal of that was to do an evaluation of the resources in the lower watershed, and the lagoon, and to try to come up with management options that could try to solve some of -- first try to identify the problem, but come up with management options to try to solve these problems that we had identified, and that included a very intensive public participation, mostly with the Malibu Lagoon Task Force, where we were having, I think, monthly meetings to talk about our work, but also there was a public meeting at the very end, to talk about the outcome of the project.

You can see up here on the slide, our general overall restoration goals were to try to reestablish natural ecosystem functions, and processes, and we concluded that we could accomplish that by increasing the size and functioning of wetlands in the diversity of wetland types in the area.

So, during the previous studies and this study, we identified a definite need for restoration, and I am not going to spend much time talking about this, as the other people, both project proponents, and Dr. Engel have already talked about these things.

I will emphasize that a lot of our concerns have to do with the water aspects of this, and not so much what is above water, but the problems with water quality, and also Bob Stark, I think, had mentioned the potential for

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connecting the property to the west to expand the wetland area, but that was an important part of our thinking, was to make sure that we could have a restoration project that was designed for this part that was expandable into the future.

VICE CHAIR SHALLENBERGER: I am sorry to interrupt you, but I just want to point out to you that two-thirds of your time has gone, and I am not sure how many people you have in your presentation.

MR. AMBROSE: So, thanks.

So, we proposed a number of different options for the lagoon, including for this site, and the alternative that would improve water quality and increase wetland area by reconfiguring the channel from the site, was given a ranking of high priority, and this alternative that we proposed in our 2000 report conceptually is the same as the project you are considering now.

The concept was to try to enhance the natural functioning of the lagoon, and at the same time recognizing that it is a seasonally open lagoon, and not a fully tidal lagoon.

So, Tony Orm, who is a distinguished geomorpho-logist from UCLA wrote a final chapter, a perspective chapter, on this report, and in this chapter he contrasted three different approaches, three possible approaches, the do nothing option, the return to nature option, and the do something option, and what Tony stated was that the do nothing option would be contrary to informed common sense, which commands that responsible agencies, land owners, and informed citizenry should seek to enhance the system that has been peculiarly dysfunctional through human mismanagement.

So he rejected the do nothing option, and as this except from that report shows that he is recognizing that there is a real need for doing something, that a stagnant lagoon replete with human waste and pathogens is not an attractive resource, and that the existing wetlands immediately west of the present lagoon, which is the site we are talking about, restored in 1983 is simply not functioning as such, and should be redesigned to incorporate a more realistic ecosystem, with improved water circulation by dealing in conjunction with adjacent former wetlands farther west. Such a proposal is scientifically feasible.

So, this is, essentially, the project that you are considering today, and it is the conclusion from our study that this was an important action that could be taken to improve the functioning of the Malibu Lagoon area.

So, as I mentioned I work for the Coastal Conservancy, involved with a lot of public meetings, and discussions, and that report was submitted in 2000, the Malibu Lagoon Task Force decided to move forward on a number of the recommendations from the report, including this

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recommendation to enhance the functioning of the project site, and then that alternative involves the whole site, it wasn't just two acres for a parking lot, or anything like that.

I know you have heard a number of things about concerns about the project, just wanted to address a few of those. It is true, for sure, that the existing site has natural resource values. I think nobody disputes that, but a lot of what you can see, you can see above the water, but what you can't see if you go out there are the problems in the water with the water quality, and that is really what this project, fundamentally, is about is to improve the functioning from the water associated resources.

We considered many alternatives, and there just is no way to accomplish what we are trying to achieve in terms of improving that functioning without doing the type of restoration that is being proposed here.

There are many examples of restoration projects, basically, every restoration, coastal restoration project in California has to involve the use of bulldozers, or heavy equipment to try to reestablish the hydrologic connections, and that is what needs to be done at this site, here.

I will comment, too, though, that the restoration projects are not going to change the salinity of the lagoon. We are recognizing that this is a seasonally open lagoon, so that when the lagoon is open it is going to be close to the marine, close to salt water, and when it closes the salinity will go down and it is going to become a brackish water lagoon.

So, this project is about changing the hydrology and expanding the area of wetlands, and it is not really about changing sort of what is a natural lagoon for this site.

So, finally, I will just end by saying that the resource activities here really are necessary to improve the functions. It is a rare opportunity to increase the wetland values of a coastal zone. We already know about how much wetland loss we have had in southern California, and we need to take every opportunity to try and increase the area of coastal wetlands we have, increase their functions, and we can't create coastal wetland habitat like this anywhere else, we have to do it near the coast, so this is the right project for this site.

Thank you.

MS. SUTULA: Good morning, my name is Dr. Martha Sutula, and I work for the Southern California Coastal Waters Research Projects where the department has a biochemistry department. For those of you who are not familiar with SCCWRP it is a public research -- it is a public agency dedicated to providing research to improve the management of

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natural resources and water quality, and my personal expertise is with emissions of eutrophication, and one of my current projects is I am the technical lead for a project to support the State Water Board's efforts to develop nutrient water quality objectives for estuaries. I have also conducted studies in cities of Southern California estuaries over the last 10 years, and many of which includes seasonally tidal estuaries, river mouth estuaries, as Wayne Ferren sites.

I was asked to make comment on two questions, with respect to this proposed project, number 1 what is the health of the lagoon with respect to eutrophication and to put it into context for you, and then second what is my professional opinion about the likely effect of the proposed restoration project on these conditions.

Very quickly, I can tell you that among the estuaries in southern California, Malibu Lagoon is one of the worst for eutrophication, the consequence of nutrient over enrichment has one of the highest annual loads of nitrogen among these estuaries, and the consequences are many, many of which have already been cited this morning, so I am going to highlight a couple of what I think are important, particularly to address some of the comments made about the brackish water submerged aquatic vegetation, that there is an over abundance of primary producers, including brackish water

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subversive of aquatic vegetation. It is an important habitat component, when under too much, too many nutrients what happens is that you get a very high density, and it begins to actually stagnant the water columns with thick growth of andres erosa and we have documented that in our 2004 study. Wayne Ferren is right, that some of the symptoms that you see may be coming from the upper watersheds, but the truth is that the brackish water submergence vegetation grows on site, as well as the mackeral scene [sic.] which is direct consequence of the conditions within the lagoon.

Another element that is really important to consider is the elevated sediment organic metal contents which says there is an over abundance of finds in the western lagoon, and as a consequence of its natural die off of rubia and other aquatic plants when the lagoon is open. And, so this is true, this is a river mouth estuary, and the great thing about river mouth estuaries is that every year when you have the onset of the rainy season, you get good flushing of the lagoon, basically bring in strong currents to flush out the organic matter, and that is not happening in this lagoon, currently, because of the restricted channels.

So, one way -- we talked about many way of trying to improve or decrease the susceptibility of this lagoon to eutrophication, and we settled on the one that in retrospect best balances all of the other habitat objectives, was to

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improve the circulation and flushing of those western channels and the direct consequence is decreasing the fine organic matter deposition increasing sand, and what that does is, essentially, reduce the amount of available nitrogen in the sediments, and this nitrogen, what is important is that once it has settled in it actually gets recycled to the water column again, and basically is a gift that keeps on giving, a vicious circle that keeps on continuing to support the over growth of aquatic plants and algae.

So, I think that if you ask my professional opinion about will this design make a lagoon less accessible to eutrophication, then the existing conditions, the answer is yes, it reduces the density of dead-end channels, and by forcing -- by creating one main channel you are basically going to be harnessing energy of tides as well as fresh water flows during the rainy seasons to flush out the lagoon.

And, I think it is important to consider that the brackish water is an important part of the habitat, by developing this configuration that is not likely to eliminate it, but just going to decrease the density, and I think it is, overall, in my opinion a reasonable design to balance the water quality aspects, and the problems in this lagoon with the other habitat and usage considerations, as well.

With that I will stop and say thank you for the opportunity to present.

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VICE CHAIR SHALLENBERGER: Thank you, very much.

We are now going to take a short break, and I want to remind everybody in the audience that we are still in the middle of a public hearing, so please do not speak to any Commissioner about anything having to do with this project.

Additionally, I would urge those of you who have speaker slips in to consider grouping together so that you have one spokesperson who has a similar message, and will have a little longer to speak for each person who actually comes forward with the speaker, thus retiring a speaker slip, and the speaker will get an additional minute, but you will begin with 2 minutes per speaker.

We will reconvene shortly, thank you.

[Recess]

VICE CHAIR SHALLENBERGER: I will ask people to please be quiet, as we have come back into order.

Don, I believe you have some people to come up with you?

MR. SCHMITZ: Yes, Ma'am.

Please, Commissioners, before you start the time, I have Mr. Blake --

VICE CHAIR SHALLENBERGER: Could I have some quiet, please, in the room.

Yes.

MR. SCHMITZ: Excuse me, some trepidation seeing

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the Executive Director at lunch, and it is good to see you, by the way, Peter.

EXECUTIVE DIRECTOR DOUGLAS: Good to be seen, Don.

MR. SCHMITZ: I have Mr. Blake, and Ms. Ventrusca, are here -- Truska, and I just completely ruined her name. You have speaker slips so I believe that would give me a very brief four minutes.

VICE CHAIR SHALLENBERGER: I am sorry, I do not understand what you just said.

MR. SCHMITZ: I have Mr. Merritt Blake -- I will try to speak clearly -- and I have Ms. Ventrusca who have filled out speaker slips, they are standing here as you directed, that would give me a total of four minutes.

VICE CHAIR SHALLENBERGER: It will, thank you.

MR. SCHMITZ: Okay, thank you, so with that I want to thank the Commission. I am here on behalf of the Malibu Colony Homeowners Association, we are not here -- well, we are reluctantly in opposition, but we are drawing closer by the minute, becoming supporters for the project that is before you today.

You are familiar with the property, and the main concern of the Malibu Colony Homeowners Association was the elimination of the existing drainage from this neighborhood, which had been there since the 1940s, and the introduction of flammable plants and the restoration plan, both of these issues have been addressed and we thank the State Parks for working with us on those issues.

We also appreciate the clarification that the drainage pipe would be part of the mitigation for the drainage on the site.

That does still leave the elimination of the rear gate access, and the removal of the existing bridge. We understand from the testimony of Ms. Goode that we may be getting very close to a compromise with regards to the gates, as well, from a modification to the project.

Now, the elimination of the rear gate access is an huge issue for the Colony residents, this will be a 6-foot high 880-foot long masonry wall. It will, in fact, completely wall in the whole northeastern block of the Colony. This current plan will deprive the property owners of abutting Malibu Lagoon of their escape route in the historic access, which is up to 70 years old. They pre-date the park by decades. The rear emergency access has existed for a very protracted period of time.

This is a fire safety issue, and we recognize that this restoration plan will, in fact, improve in some way the issue of fire safety for our neighborhood by the elimination of a lot of existing flammable species, but it is a real life fire hazard, and this picture here that you see is from 1993, and it is from our local newspaper, a fire in the lagoon

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estuary area.

So, we think that this wall should include emergency access, and we believe this is a *Coastal Act* issue, under 30253, which specifies that any proposed development will minimize wherever possible risk to life and property from fire and flood.

And, it is not just about fire, it is also about just getting out in a tsunami event. We have, essentially, one intersection here, and if it gets blocked, people are not going to be able to get out of the Colony area, and if you put down this block wall here, then you have effectively walled them in. What if a tsunami comes in, in addition to the fires, as this is subject to tsunami inundation, and if you take a look at the maps from the City of Malibu that was done in cooperation with the State of California, you can see that a tsunami event would leave this entire neighborhood would under water. You don't want to block them in so that they can't get in and out.

Now, with these 14 properties on the northeastern block we have been proposing a number of different solutions, including camouflaged doors in the wall, and we will do these doors at our expense, by the way. We don't want to ruin the esthetics of what the State Park is proposing. We will cover it with the same stucco, the same faux stone that they are planning on putting on the wall.

Since there are other options regarding shielding the wall, being on the park property, which would allow us to have the gates, and there -- we could put walls on the inside of the Colony property, to also shield the gates, so you would not see them when you are walking along the trail.

The solution that may be in the offing here is similar to this wall which you see right there, which was built by the Perenchio's for their golf course. This is another part of the Colony, just to the west of us, and the wall was built with a 5-foot offset. And, if I am hearing the State Parks correctly, they are now offering to move the wall 3 feet. The problem with 3 feet is that is not consistent with fire department access standards for pedestrians, which is 5 feet. You know, imagine rushing to get out of there, and also pulling along a small child, or having a fire department with their equipment, 3 foot is not enough, and we would need 5 feet. We would need it to be open at both ends, both on the easterly end and on the westerly end, and pursuant to the Uniform Fire Code, we would need to have three additional gates and it would be every 150 foot.

And, so with that, if we can -- in conclusion, if we could get that --

VICE CHAIR SHALLENBERGER: Thank you, very much.

MR. SCHMITZ: -- done, we would appreciate it,

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thank you.

VICE CHAIR SHALLENBERGER: Mark Gold.

MR. GOLD: Hello, my name is Dr. Mark Gold. I am president of the environmental group Heal the Bay, and I am here with Sarah Sikich, as well, so I get the extra minute, I hope.

VICE CHAIR SHALLENBERGER: You have three minutes.

MR. GOLD: And, on behalf of Heal the Bay, I just want to say that we strongly support the restoration project of State Parks, the Coastal Conservancy, and the Bay Restoration Commission.

It has been an exciting time in Malibu, after many, many years, in that we are starting to see some real opportunity for improvement. On over a decade ago Tapia stopped discharging from April through October in Malibu Creek, and that was one big improvement.

Just recently you had the State Water Resources Control Board and Regional Board rule that the civic center area had to move forward with sewering the area because of water quality problems, within the creek lagoon and the Surfrider Beach area. Legacy Park, as I know many of you know, just had a major ribbon cutting here, and now here before you, you have the Malibu Lagoon restoration project, after so many years of discussion.

I remember being a student at San Mon High and

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back then the Malibu Lagoon was a Little League field, and then the restoration occurred and it was not a great restoration, there are some maps that had values there, but there are many, many problems here that this is going to address.

We would think that the CEQA process hasn't even occurred yet, of course it had, it was completed in 2006. You didn't see anybody sue over that, because of all of the other alternative analyses that were in that EIR, you would think that that had never happened in light of some of the things that have been said here today.

You had some great testimony on the science, and on the poor water quality, within that lagoon. In my limited amount of time I do want to add a couple of things that didn't get mentioned on the eutrophication side of things.

We have our student monitoring program, and we have been doing monitoring within the creek and the lagoon for many, many years, and recently in the last three plus years, or so, we have been dealing with continuous monitoring, where we just sample once every 20 minutes for dissolved oxygen, and the average -- I am talking about the average dissolved oxygen has been around 3.4 milligrams per liter, for the monthly g.o. so to put that into prospective, the amount in the water quality standards is 5 milligrams per liter and in a healthy lagoon you would expect to have 8

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milligrams per liter, so eutrophication is leaning towards these high toxic conditions which will lead to fish kills, and all of the other issues that you have seen.

In the last 6 months of 2009, we saw g.o's that average less than 2 milligrams per liter, and as low as one milligram per liter in some months, so it is not a healthy lagoon. It is a dysfunctional lagoon, and really what this is all about is improving water circulation, reducing nutrient loads that are accumulating within the area, so that we can finally restore it to a healthy lagoon, and protect Surfrider Beach, and improve water quality.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Mark T. Wiaya, and I apologize if I misspoke your name.

MR. WIAYA: I hope I can have the extra minute in having Lucia here.

First of all, I would like to thank the Coastal Commission, Madam Chair, for this moment to --

[<u>Ringer sounds</u>]

VICE CHAIR SHALLENBERGER: Whoops, sorry.

MR. WIAYA: Oh, that was fast -- I tell you the time varies, Ma'am.

VICE CHAIR SHALLENBERGER: Time flies.

MR. WIAYA: It was bad enough in dealing with yesterday's, so I wish I had some slides to show you, before the PCH was there, so that you could see the original village of Jumoniwu. Jumoniwu is where the name Malibu comes from. You know, we celebrated this weekend the first world surf preserve, part of the ceremony today, and we have been part of this Jumoniwu Lagoon forever, for 10,000 to 13,000 years.

We have concerns for the upper part of the Jumoniwu village where sediment has washed into the lagoon, and I am asking here, urging the Commission to amend part of this permit, so that we can be assured that we have Chumash Indian contractor monitors on the project. As much as we have worked with archaeologists, there are friendly archaeologist and then there are some that have just made a living off of our culture, and we need to protect and preserve our resource.

And, you know, that although we council with our elders, and they have spent many, many years addressing issues up and down PCH, which I thought was protecting Chumash history, but it is something else.

We are concerned about the canals, that they might hit some new soil, so we are requesting that augers, test augers, so that we can make sure that we are not hitting any potential coastal resources.

Just last June, at ground zero they discovered a boat from the 1750s, I mean, whoever would have expected that? We made potentially hit at the mold, we are the maritime people, and we were there when the water level was even 100 feet lower. It has risen in 10,000 years 100 feet, so we are asking you to please take that into consideration.

A lot of us have dealt with the issue at Ballona at Marina del Rey, where we approve a project, and then we face the outcome, and in that particular case, they uncovered 600 burials. If you were to walk under these tents and see these squares of children, men and women and all of their artifacts, and see and think about the prayers and tears that were offered so that they could be resting in peace, that we move cautiously. And, I urge, again, to please bring our board a Chumash consultant contractor, with Chumash monitors.

In the area, on the east side, where there is a proposed part of work on the Edison House, I urge you to not allow that at all, as there are burials on that site. This is about circulation, so keep it on the west side.

Concern about the footings that we need our monitor for any earth moving, any heavy equipment, that there be a monitor.

Thank you, so much.

VICE CHAIR SHALLENBERGER: Thank you, very much.

[Applause]

It is the practice here on the Coastal Commission that we do not express our pleasure of displeasure with any

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speaker, so I would ask that people not -- and if you feel a need to express yourself you can shake your hand in the air, but, we give equal respect to each person coming before the Commission, thank you.

Mary Small, and then Dr. Cindy Lin.

MS. SMALL: Good morning, I am Mary Small, Deputy Director of the Coastal Conservancy. We want to thank you for your consideration of this project.

As was mentioned, I just want to highlight, this is the last permit of a very long journey. This project has been approved and we have permits from the the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, Fish and Game, and the Regional Water Quality Control Board, and other people may clarify this, your staff report in the addendum also reiterated this issue of the construction schedule, in deed, because we are trying to be so protective. It is a limited construction schedule of June to October 15 and that is consistent with the biological opinion from the Fish and Wildlife Service.

The Coastal Conservancy is involved in wetland restoration project throughout the state and many in Southern California, because as you have heard repeatedly this morning coastal wetlands are such an important resource, and where it is possible to acquire lands that were formerly a wetland, and restore it, we seek out those opportunities.

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But, it is also important to take the opportunity to restore wetlands where it is possible, and restoration can be a form of protection of the ESHA, because if the system isn't functioning we need to try and restore it.

And, what we have seen, and what this Commission has approved numerous projects in southern California that involved much more earth moving than this, and we have seen those systems

response.

I will quickly say the Conservancy has been involved and has supported a public planning process for 20 years, and that process has included a lot of people involvement, and it has been, in this project before you today, is entirely consistent with the recommendations that were adopted by the task force, and with the EIR that was adopted. And, there are no significant effects in this project that weren't analyzed in that EIR document, so we hope that you will approve it today.

VICE CHAIR SHALLENBERGER: Thank you, very much.

That was Cindy Lin, right?

MS. SNEELAND: Yes.

VICE CHAIR SHALLENBERGER: Okay, thank you.

Dr. Luce.

MS. SNEELAND: Good afternoon, my name is Dr. Sneeland. I am a senior environmentalist scientist

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representing the U.S. Environmental Protection Agency, Region 9. I am also the program lead on TNW Development, and L.A. Region. I would also like to mention that I have completed my masters and doctorate research in the Malibu Creek watershed and lagoon, so I am familiar with the area.

EPA strongly supports approval of the California State Parks application for the permit, and this action really, really, begins the need of restoration of the Malibu Lagoon.

Malibu Lagoon is currently on the state's *Clean Water Act* 303D list of impaired water bodies for benthic mackerel, invertebrates, shell fish harvesting advisory, enutrophication, ph, and bacteria.

Currently, the lagoon does not meet the state's standard for nutrients, dissolved oxygen and does not support healthy benthic, mackerel invertebrate communities. The lagoon does not meet the beneficial uses for recreation, and nor does it meet the benthic uses for supporting healthy ecosystem for the bird population and aquatic wildlife there.

Malibu Lagoon suffers serious water quality problems, and in addition to hydro-modification, excessive nutrients, like the many speakers who have spoken before you today, EPA is currently establishing three TMDL's in the Malibu watershed -- sorry, I just mention that, this is total maximum daily loads, and this is really to address impaired water bodies in trying to understand how we can, basically, both address the problems and provide targets to remediate the problem, the pollution problems.

During our preliminary assessment, dated today, shows clearly the large scale of impacts to the lagoon. A simple bandaid solution will not solve the problem. Removing indices, significant restructuring of the ecosystem to restore it to its natural condition so it can support the beneficial uses established by California.

This restoration effort presented will not address upstream sources of the pollution. The TMDLs that I have just mentioned will address the sources of impacts, and in the lagoon there are natural sources of bacteria that the TMDL will not address, but the restoration effort will address those.

So, we support the plan.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Dr. Shelley Luce.

MS. LUCE: Thank you, Madam Commissioner, I am Dr. Shelley Luce and I am the executive director of the Santa Monica Bay Restoration Commission. Our mission is to restore and protect the natural resources and benefits of Santa Monica Bay, and we have a 35-member governing board, that includes the directors of state and local agencies responsible for natural resources, and water quality in our region, as well as environmental groups and business representatives.

This diverse group often disagrees with each other on different issues, and there is a lot of healthy debate among them, but when it came to supporting the Malibu Lagoon restoration project, they were unanimous, because full ecological restoration of Malibu Lagoon is a high priority for the Santa Monica Bay Restoration Commission.

To achieve this the restoration plan before you will increase the salt marsh habitat available for birds and fish and other wildlife. It will increase in quantity as well as quality, and this is very important, as you have heard already today.

In addition, the Santa Monica Bay Restoration Commission does support and fund acquisition of land in the surrounding area, including $4 million contribution, and two years of our staff's time, towards the Legacy Park project that Marcia correctly mentioned as part of the long term plan for restoring, for the greater restoration of Malibu Lagoon. So, we are clearly committed to that land acquisition effort.

There are no other opportunity parcels in the area right now. There are prospects for future parcels, and we continue to track those, and have insured that the restoration plan before you has been designed to incorporate and take advantage of surrounding parcels, when it becomes

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possible to do so.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Marshall Thompson.

MR. THOMPSON: Hi there, Marshall Thompson. I am speaking today on behalf of the Malibu Township Council regarding Application No. 4-07-098. Thank you for the opportunity to speak on behalf of the entire board of the Malibu Township Council.

VICE CHAIR SHALLENBERGER: Can I, just for clarity here, I see two people standing with you, do they have speaker slips in, and you are using their time?

MR. THOMPSON: I have, actually, two different visits, one as a member of the board of the Malibu Township Council, and then I will be coming as a regular citizen of Malibu --

VICE CHAIR SHALLENBERGER: No, you only get one shot at this.

MR. MARSHALL: Okay, in which case, I will, again, I will bring my other friends here, because I have another video that we would like to play, in lieu of speaking.

VICE CHAIR SHALLENBERGER: And, what would the name of your friends be?

MR. MARSHALL: It would be Kent Swort, Craig Kozlowski, Judith Israel, Mary Davis, Steve Littlejohn, and

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John Deloth.

VICE CHAIR SHALLENBERGER: Thank you.

MR. MARSHALL: And, thank you for your time.

And, there is audio.

VICE CHAIR SHALLENBERGER: Five minutes.

[Video Presentation]

VICE CHAIR SHALLENBERGER: All right, is that the extent of your time? Okay, and while we are waiting for that, is Mary Davis a part of your group? is that what you said?

MR. MARSHALL: Yes.

VICE CHAIR SHALLENBERGER: Okay, they get another minute, if anyone asks.

MR. MARSHALL: What remains to be seen here is a video, I believe from 2001, put together by Bob Purvey, where it has Ms. Goode's comments about acquiring -- doing an appropriate job on restoring the lagoon, and a lot of it had to do with acquiring additional adjacent properties to it. And, so I am happy to make that available to you, and my apologies for a lack of audio on the program.

Overall, I think that a lot of people feel that there are some very, very good points being made for this proposal that is in front of you today, but ultimately a mechanized approach is destructive to the land, and not necessary, and needlessly expensive in a time of extreme financial duress on the entire state.

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Thank you, very much, for your time.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Liz Gossen, and then Penny Elia, and then Athena Shlein.

MS. GOSSEN: My name is Liz Gossen, I am the executive director for Santa Monica Bay Keeper, and thank you for the opportunity to speak in front of you today.

I am here to express the Santa Monica Bay Keeper's strong support for the proposed plan, a project many years in the making, and Malibu Lagoon is one of the most important coastal wetland resources of the Santa Monica Bay and the Santa Monica Mountains, a sensitive habitat area that is characterized by poor water quality, and impaired habitat conditions, due to prior modifications, urban encroachment, and watershed influences.

Anthropandemic activities have significantly altered the physical configuration of the lagoon, and the existing lagoon is only a very small portion of this historic area.

Santa Monica Bay Keeper managed and provided oversight of the Malibu Lagoon restoration during the construction of the low impact development parking lot that was completed in April of 2008. The Rain Garden Parking Lot captures, treats and infiltrates a site on site of 3.2 inch storm over a 24-hour period. Almost 2 acres of wetland

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habitat was regained by relocating and reducing the total size of the parking lot, and the proposed restoration plan will benefit Malibu Lagoon by increasing salt marsh habitat by recapturing approximately 2 acres of area that where the previous outfall parking lot was located.

The existing lagoon configuration prohibits the lagoon from functioning properly. This is a very important project for water quality. The Santa Monica Bay Keeper has been involved in water quality issues in the Malibu Creek, Malibu Lagoon, and Surfrider Beach for many years, through strong advocacy efforts, through litigation, and as you have already heard there have been several advancements lately in the water quality, such as the septic prohibition in the civic center of Malibu. This is one more step to improving water quality, and I urge the Coastal Commission to approve the proposed restoration plan.

Thank you, very much.

VICE CHAIR SHALLENBERGER: Thank you.

Penny Elia, and then Athena Shlein, and Wendi Werner.

MS. ELIA: Good morning, Commissioners, Penny Elia, and today I am here representing the Santa Monica Mountains Task Force, a subcommittee of the conservation committee of the Angeles Chapter of the Sierra Club, with special responsibility for reviewing developments affecting the Santa Monica Mountains and their magnificent Malibu coastline. Our task force is very familiar with the Malibu Creek and Lagoon, and the project as described in the staff report, as well as the extensive public process afforded everyone here today.

I come to this Commission quite often. I have been coming here for many years. You all know that I am a real greenie, and I really don't like to see it when we have differences of opinion within the environmental community, but it does happen every now and then.

And, I would just like to say that, in no offense to the Audubon, but you know sometimes we need to break the eggs to make the omelette, and I think this might be one of those cases, and I would like the opponents to think about that side of it.

And, so that you have time to deliberate, just in closing, I would like to say that I would love to see this happen at Aliso Creek in Orange County.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you.

Athena Shlein, Wendi Werner, and Geoffrey Nathanson.

MS. SHLEIN: Hi, my name is Athena Shlein. I am a California native, avid surfer, and have lived in Malibu for 6 years now.

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First off, I would like to say that I am very pleased with the decision not to use Monsanto's herbicide Roundup, for the removal of the non-native plants; however, I am strongly opposed to the bulldozing of our precious lagoon area.

The lagoon provides shelter, food and water to endangered species, as well as a variety of other habitat. Let us approach the situation with the utmost delicacy.

One of the definitions of bulldoze is to bully, or to do away with by force. Well, this makes no sense to me. If restoring the lagoon, in part, is to benefit the habitat then why in the world would we destroy it first? I believe it is better to do nothing at all, than to cause harm.

The precautionary principle states that if consequences of an action are unknown, but judged by some scientists to have a high risk of being negative, then it is better not to carry out the action, rather than risk the uncertain.

I would like to pose a question to the environmental specialists who are here today, where will all of the endangered species go while their homes are being destroyed by bulldozers? this is an ecosystem.

I believe there is a better way to approach the restoration of our lagoon. I am more than happy to support an alternative plan, one that would require much more care,

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but would be well worth it in the long run. I really, really love our lagoons. Please, please help keep it a home, not only for the animals, for generations to come.

Thank you, very much.

VICE CHAIR SHALLENBERGER: Thank you.

Wendi Werner, Geoffrey Nathanson, and then Ian Briant, and I would appreciate it if you all could come forward and be ready to testify.

MR. NATHANSON: My name is Geoffrey Nathanson, I am a 49-year resident of Malibu, my family moved here in 1961, when we lost our home in a Los Angeles wildfire.

We love Malibu, we love the lagoon, and we love those bridges and we sure hate to see them go. If you wind up taking them out, consider replacing them at a later date. It is where Malibu's kids and the Los Angeles school kids have been able to be intimate with those beautiful creatures that live in the lagoon.

But, I am here today to represent the interests of my neighbors in Malibu Colony. We have serious problems associated with the proposed restoration plan. The diversion of 1.5 million visitors behind out homes on a seldom used life guard access road creates some serious safety and security problems. The erection of a 6-foot wall behind our homes does not solve those problems.

First, it blocks the ability of county residents to access and egress their homes through their backyards -- a convenience they have enjoyed for over 60 years. But, even more important, a wall behind their homes will restrict the ability of the fire department to be able to fight Malibu's famous wildfires. Having fought those fires, and having watched my neighbor's homes burn to the ground, I am particularly sensitive to that horror.

I want to express my serious concern about the proposed 3-foot escape path on the Colony side of the wall. Can you imagine a mother with two panicked children in hand running down an 800-feet of smoke filled 3-foot path? We need a 5-foot path. We need multiple openings in that wall for fire access and we hope that you will give it very serious consideration. We have got families living on the other side of that wall.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you.

Wendi Werner, Ian Bryant, and then Rick Margolis.

MS. WERNER: My name is Wendi Werner, thank you for your consideration.

The proposed plan states that there is no less damaging alternative to the environment, I disagree. I recently spoke with the public works director who designed and implemented the storm water treatment system in Malibu. His plan would allow a certain percentage of water to enter a portion of the wetland, creating recirculation in the stagnant area. His alternative approach was shared with Heal the Bay in 2004, but turned down per Mark Gold. This approach is far less damaging and currently being in use.

I do appreciate the addendum that states the use of herbicides will no longer a part of this habitat enhancement. This is the first step, and I ask the Commission to please reconsider, and find a less invasive approach to the rest of this current plan.

Thank you, very much.

VICE CHAIR SHALLENBERGER: Thank you.

Ian Bryant, and Rick Margolis. Rick, if you could come to the free mike.

MR. BRYANT: Good afternoon, Council, thank you for having me.

As much as the Malibu is home to the life that thrives in and out of the waters, this is a home to me. It is the place of my work, through countless surfing lessons, and through my time spent with the California State Parks at Malibu Lagoon.

COURT REPORTER: May I have your name, for the record.

MR. BRYANT: The name is Ian Bryant.

I spent an entire summer of 2008 working immediate -ly after the Phase One restoration, which I believe was a

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suitable and clean plan for park entry. Shea's Field, on the other hand, a complete mockery of this lagoon's beauty.

There is no sense to drain and bulldoze an endangered wetland for the sake of restoring precious environment. What needs to be restored is the collective state of mind, that can actually benefit this lagoon in return for water to a cleaner state. This means giving back, and not to take away, especially taking away homes for the mammals, fish, reptiles and birds that find homes here in her waters, and they have the right to never be disturbed in the first place.

The only problem I see with this lagoon is its pollution, that it has inherited over the years. Upstream lay thousands of sub-urbanized tract homes that house tens of thousands of people that have their own individual responsibility for the waters here at the lagoon. Upstream also lies large chemically fertilized grass lawns, such as football fields, baseball fields, parks and golf courses. Upstream lies man-made lakes, concreted dams and reservoirs, upstream lies perpetually oil slick asphalted roads, and when water falls from the skies to relinquish and replenish the land, it follows these well beaten paths down through the Triunfo, Logo, Media, Windero, Las Virgenes, Cold Creek and Piuma Canyons, along with other thousands of washes, all through this once pristine watershed, and they end up at the

Malibu Lagoon, my home.

So, please, let us all feel sympathy, not to destroy this land as much as it has already been destroyed.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Rick Margolis, and then Julio Bermejo, and if you would take the other mike.

MR. MARGOLIS: I am here with Carl Deutsch.

VICE CHAIR SHALLENBERGER: Okay, thank you, you will have 3 minutes.

MR. MARGOLIS: Hello, Commissioners, my name is Rick Margolis, and a couple of years ago I got a -- you granted me a coastal development permit to build home inside of the Malibu Colony, backing up to the lagoon, by a vote of 11 to 1.

A valuable reason why I choose the location that I did for my home was the historic and existing access that I had to the lagoon, and the added safety and peace of mind that it would give me when in the case of an emergency or a fire in the front of my house, I could get my elderly father, my wife, and my baby, out the back gate. I am now being told that access needs to be taken away, in the name of environmental protection.

When I got my permit, State Parks was present at the environmental review board hearing. They were present at two planning commission hearings, and they were present at two city council hearings, and they were present here. I have 15 to 20 conditions on my house to protect the environment and not one word was ever said about the fact that I needed to be walled in to protect the environment.

State Parks has a 450-page environmental impact report that has been referenced today, done in 2004 and 2005. They have over 100 pages in a final analysis study that was done. They have thousands of pages of documents, but not one sentence in any one of those documents says anything about the need to wall us in, in order to protect the environment.

State Parks is looking to taking away a bridge and rerouting 200,000 to 300,000 people behind our homes -- 200,000 to 300,000 people, yet somehow us 10 to 15 homeowners, we are going to pollute the lagoon? that doesn't make any sense. And, we ask you to reconsider that aspect of it. We have families, and that is all we are looking at, hinges and a lock.

The arguments is backwards. We are not asking for access. We have access. We are looking to keep it. State Parks is looking to take away our access, why? why do they want to wall us in? there is not a reason for it. That is all we are looking for, hinges and a lock can be replaced, and they can put the wall exactly where it is. The can put the wall exactly where it is, and we want walls instead of

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gates. We will pay for it, don't wall us in, let me get my family out in an emergency, it is just wrong.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you.

Leo, and then Linda Piera-Avila, if you could take the other mike, please.

MR. BERMEJO: Good afternoon, Madam Chair, Commissioners, thank you for this opportunity to speak to you today. My name is Julio Bermejo, from San Gabriel, California. I am a Sierra Club member -- I did want to mention that, also, first of all.

I don't know if anyone was struck with the irony, or has noticed the irony that the proponents of this project are promising this incredible $7 million, you know, success story, you know, you are talking about draining, dredging, sending in bulldozers to grade this wetland, right, this incredibly complicated technical process, and here today all of us, many of us, educated adults who have had difficult with Power Point, have had difficult with the microphones, have had difficulty with the timer, okay, but no, we don't need to worry about this project, it is going to go fine.

The second point I want make is that today we have heard again, project proponents, use words like impaired, dysfunctional, degraded. I was out there two weeks ago, and I saw hundreds of birds, I saw insects, reptiles, mammals, luscious greenery all around, so I assumed that the project proponents would say to me, ignore all of that, okay, just ignore all of that and you will realize just how degraded it actually is, okay. Ignore the birds, just -- if they only wouldn't be here everyone would understand, I am not convinced.

And, finally, kind of going back to my first point, I brought -- and I would like to give these to the Commission and you can share them with the various organizations and agencies that have some role in this project -- a pair of dice, because this project is simply a crap shoot, okay, a crap shoot, and the EIR shows that, with the various restrictions that are supposed to take care of the various threatened and endangered species, you know, right there it shows what is at risk, okay. All you have to do is to look at this tide water goby, also.

Thank you, very much.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Linda and Andy Lyon, if you would come forward to the spare mike.

MS. PIERA-AVILA: Good afternoon, Commissioners, my name is Linda Piera-Avila, and I am the Green Party candidate for the 41st Assembly District which includes Malibu Lagoon.

There is a disconnect between the staff report's

004760

own project purpose and the strategy proposed to achieve the stated goal of improved water quality. The staff report, itself, says, quote, the water quality of the lagoon is poor due to inflow of nutrient and pollutant risk water, resulting from urban runoff and storm drainage, urban encroachment, leaking septic systems, limited water circulation, and other factors, end quote.

Bulldozing, grading and dredging the lagoon doesn't address the first four reasons for poor water quality. The proposal omits any substance of plans for controlling upstream sewage and other chloroform pollution or adjacent septic tank leakage. If these site sources of pollution are not systematically addressed, pollution will continue to flow into the lagoon resulting in ongoing poor water quality.

The cost of all this is somewhere between $7 million and $12 million. Now the recently passed state budget cuts $7 million from the State Parks' expenditures resulting in ongoing service reductions like leash law enforcement -- which was mentioned earlier -- and maintenance delays.

How can we rationalize to the taxpayers such a huge expenditure for this proposal with an uncertain outcome that will take years to realize, in light of the austere budget cuts, when a more cost effective and less aggressive

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alternative exist? has the cost benefit analysis of the proposal versus alternatives been conducted? how will as yet undiscovered cultural Chumash site to be protected if bulldozers are used, which will, by definition, destroy artifacts simultaneously with their discovery?

Finally, what are the effects of employing such a destructive methodology in a recognized environmentally sensitive habitat area, which will result in the unnecessary death of wildlife on a less disruptive and truly restorative not to mention less expensive alternative exists?

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Andy Lyon, it looks like, maybe, you have some --

MR. LYON: Alan Sorlow, and Steve Dunn.

VICE CHAIR SHALLENBERGER: The other name was?

MR. LYON: Steve Dunn.

VICE CHAIR SHALLENBERGER: Thank you, you will have 4 minutes.

MR. LYON: Thank you, my name is Andy Lyon. I am a third generation Malibu resident. I am also now on the stewardship of the newly formed world surf reserve at Malibu.

I don't have any science, anything like that, but I would say that in my lifetime I have been on that beach thousands and thousands of days, and I consider myself an expert.

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And, I don't trust Power Point, so I brought my own pictures of what the lagoon used to look like. This is in 1923, and actually -- well, first I want to say one thing, that if all of a sudden a component, this herbicide component is being taken out at the last minute, maybe there are some other components that also need to be taken out, that we maybe would step back and look at that.

Here is 1924, there is not a big lagoon behind the Colony. Here is 1933, again, a big sand bar, and no lagoon.

When we get to the California coastal records, these are the same pictures you used, and the lagoon is going straight out to sea -- the Little League fields, and everything.

One of the things that is not mentioned, I don't believe, is the impact on surfing and that being such a low cost recreation sport for the masses, and is not a component of this, and how that effects us, and how that effects the point, the way it has gone out to sea, and the water quality, and this is in '72 and you can see the changes.

This is after, in 1986, all of a sudden we have a sideways flow of the water, and things have now started to change, and you know, we have got this area of water that is now sitting in the lagoon, and it is not flowing. Of course, it is not working, but it is not going out, and I don't know if you are going to be able to stop this sideways flow when

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it has slowed down into these big channels.

One other thing that I would like to say, if everybody was having this meeting in Malibu, right now, this morning, and we were down on the beach, I would find it really hard if anybody would want to destroy what is down there, it is beautiful. There are thousands of pelicans and birds and things, and it is just amazing to me to kill off all of this stuff, and use bulldozers.

It is not supposed to go that direction, the creek isn't supposed to flow that way. It is not supposed to go down into the Adamson House, and the reason it is, is it is flowing down the natural flow of the water.

These are 2002, and all of these fingers, I don't know if any steelhead is going to be able to find his way up there when the creek is going out sideways down towards the highway, unless they are coming up on PCH.

This is, again, what happens when it starts moving off, is that gross water that stands. It is -- you see how it is standing water anyway. It is going to -- the point is -- what is the point? the point is that you are going to use bulldozers to take out things. You are going to destroy the fish, it just doesn't make sense.

I have got a little 5-year old bulldozer at home, and she would love to bring all of her friends down there and pull plants that are not supposed to be there, along with all

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of her school mates.

The bridges are made of the same thing as the pier, yet that has water flowing through it, so I don't know how these bridges are stopping water. This, our access to the beach, is a direct access to the beach that I think --

[Timer Rings]

-- needs to be capped, and I just hope that you can reconsider, and hopefully step back a little --

[Timer Ringing]

VICE CHAIR SHALLENBERGER: Thank you, very much, and Jack Neff was with you? No, okay.

Jack Neff, and then Kathy Knight, if you would take the other microphone, please, and then Bruce Campbell.

MR. NEFF: Honorable ladies and gentlemen of the Coastal Commission it is a privilege to be before you today.

I will speak briefly, I think what is going on here is, possibly, a boondoggle --

VICE CHAIR SHALLENBERGER: I am sorry, your name for the record.

MR. NEFF: Jack Neff.

I believe this project is really ill defined and there isn't enough specifics as far as the money goes. There are calls for sea walls, for doors, for Chumash monitors, replacing bridges, a 5-foot path, all of these uncertainties are going add to the cost, and we can't know how much it is.

Yet, as a member of the State Parks Foundation we get requests every month to contribute money to offset losses in the State Parks budget. I love the State Parks. I am a member of the foundation. I rely on them as a resource, and then to stand here and oppose them, I believe is because they are in with some consultants, have got an agenda from the RCDC, they have got a lot of these organizations that are conservation, but they are not restoration.

I support the least invasive alternative regarding the proposed Malibu Lagoon dredging project, because the no development alternative doesn't exist for this agenda item.

Malibu Lagoon is entitled to the highest protections from the Coastal Commission, in this case, to be restored using hand tools only. Use of diesel powered hydraulic earth moving equipment will destroy the 31-year old, partially restored habitats in Malibu Lagoon.

Use of hand tools to reverse naturally occurring soil or sand erosion and to remove invasive non-native plant life is appropriate and adequate to maintain and improve the 31-acres we are discussing.

The invasive bulldozer-driven plans supported by consultants working for Coastal Commission approval, wrongly assert that water quality will be improved as the result of dredging. The city of Malibu is already --

[Timer Rings]

VICE CHAIR SHALLENBERGER: Thank you, very much.

MR. NEFF: Thank you.

VICE CHAIR SHALLENBERGER: Kathy Knight, and Bruce Campbell, if you would come forward, and David Warren will be next.

MS. KNIGHT: My name is Kathy Knight, I am a 17-year volunteer to save the Ballona Wetlands in Los Angeles. I am on the board of the Ballona education project, and I am with the Sierra Club at the airport marina group. I didn't get a chance to talk with the Sierra Club on the letter they submitted, but we are very concerned. This is setting a precedent for us at Ballona.

This major bulldozing, we are really, really against that, like many other people have said today, it is an industrial solution to a previous industrial mistake, and we want to see a slower restoration, maybe involving school kids coming out, and at Ballona we want to bring schools out and have them take a part in the Ballona Wetlands, separately, and connect to the wetlands. Kids are not connected to nature anymore, and we don't need to go into what bulldozer -- showing the kids the wrong thing.

Also, I am concerned, Wayne Ferren said -- I understand there was no sub-strate study, seems like something should be done. I have been told that salinity can kill goby, and there is a thing that you showed moving fish

004767

into the channel, well, how do we know that the fish are going to survive in the channel while the bulldozing is going on? is there a marine biologist weighing in on this?

And, also we just want to see it going slower, have somebody like Roy Van de Hoek that you saw on the presentation, monitoring it, and letting us know if there is harm going on.

For example, when the bulldozer at the Ballona Wetlands east of Lincoln Blvd. it was -- the public was told, and everybody was told, oh there is nothing over there, just some old air port place for the Howard Hughes people, but when they started bulldozing there were massive amounts of wildlife being killed, okay? so what you are told is not exactly always correct.

So, I urge you to please go slow, don't do the bulldozing, let's do what everybody is saying about that, go slow and respect the animal and wildlife out there.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Bruce Campbell, David Warren, and the John Ulloth.

MR. CAMPBELL: Good afternoon, Coastal Commissioners, I am Bruce Campbell from West L.A.

I attended what was likely the first major conference on earth restoration to restoring the earth conference at UC Berkeley in 1988. David Brower, the most famous conservationist since John Muir, who was a major player in the Sierra Club, and founded Friends of the Earth and Earth Island Institute, pointed out that it is very important to restore the earth, but it is most important to save genetically wild pieces to have a clue on how to appropriately restore an area.

I urge the Commission to choose the no project alternative, or else delay this vote and order additional alternatives, included in a supplemental EIR, including a lot, quote, lighter alternatives which do not involve much, if any, habitat destruction.

I am concerned about the major bulldozing plans which show no respect for current species at the Malibu Lagoon, no respect to the local food chain, and no respect for the Native American sacred sites, including near the Adamson House.

I am also concerned about the impact on the tide water goby, as well as species that like islands within the lagoon, and I was concerned about the inadequate study of submerged aquatic vegetation, or perhaps, no study, and of an inadequate study of habitat on the islands.

I circulated certain ballot measures as they occurred in some water and park bonds, called park barrel spending. I believe the CC should redirect this bond money to appropriate uses, rather than this boondoggle project.

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I sure didn't support the waste water bond. I do support Prop. 21, though I hope that the people spending this money could have respect for the food chain, and for funds provided by taxpayers and drivers who pay into that Prop. 21 fund for State Parks.

I studied Zapper [sic.] in regards to bureaucracy in college and attended a conference sponsored by Randall O'Toole about how bureaucracies love to enlarge themselves and back scratch, so please --

[Timer Rings]

VICE CHAIR SHALLENBERGER: Thank you.

MR. CAMPBELL: Thanks.

VICE CHAIR SHALLENBERGER: David Warren, then John Ulloth, then Barbara Lonsdale.

MR. WARREN: Good afternoon, Honorable Mary Shallenberger and Commissioners, I am David Warren, and I would like to read a letter from the San Fernando Valley Audubon Society's Mark Bollencamps' conservation chair.

"At our general board of directors on September 2010, San Fernando Valley Audubon Society made and passed a motion to oppose stage two of the Malibu Lagoon's restoration project.
Our primary concern is over what is certain to be at least one year, probably more, devastating impacts to the bird life with

004770

no assurance that the hoped for end would result and be any better than the current conditions.

"We are also concerned that even if the project resolves to higher results whether or not any benefits are realized, one single storm event could wipe out all of this work and require additional human disturbances and expenses to bring it back to the newly manufactured conditions.

"The Malibu Lagoon ecosystem is still recovering and adapting to the less major manmade hydrological fix, and is still attracting bird life every year. The natural systems are finally beginning to overshadow the impacts of the human engineers' attempts at creating a wetland habitat.

"Do not erase what nature has recently accomplished with another attempt to improve upon the faulty templates that we created with a new unproven template for nature to start all over with.

"We recommend the no project alternative to remove non-natives and additional revegetation with native plants is desirable and can continue without approval of this project.

"The removal of 13,700-cubic yards of material

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from the lagoon may, or may not, improve the
hydrology sufficiently to clean the water."

And, also to add, I am a member of the National Audubon Society, the Los Angeles Audubon Society, and have been an officer of the Whittier Audubon Society, and I am very active in the Angeles Chapter of the Sierra Club.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

John Ulloth.

MR. ULLOTH: I already gave up my speaker slip to Marshall Thompson.

VICE CHAIR SHALLENBERGER: Okay, thank you.

MS. LONSDALE: Hi, my name is Barbara Lonsdale, I am a Native American and an environmentalist, and deeply opposed to this project, and as an environmentalist I belong to a lot of different environmental organizations.

So, I just wanted to point out --

VICE CHAIR SHALLENBERGER: Is it Barbara?

MS. LONSDALE: Barbara Lonsdale.

VICE CHAIR SHALLENBERGER: Do you have a speaker slip in?

MS. LONSDALE: Yes, I do.

VICE CHAIR SHALLENBERGER: Okay, I don't seem to have it, so after you have testified if you would fill one out, I would appreciate it.

MS. LONSDALE: Okay.

VICE CHAIR SHALLENBERGER: Go ahead.

MS. LONSDALE: So, as an environmentalist, I belong to a lot of different organizations, and a bunch of them are actually for this project, one is the Sierra Club, and I am a Sierra Club member. Just because an organization is for this project, it does not mean that all of its members are for the project.

For instance, I was trained by the resource conservation district of the Santa Monica Mountains, and by the Audubon Society to lead hikes for children in nature. They are for this project, and I am not.

Also, I am a Topanga docent to lead hikes into Topanga State Park, State Parks is for this project, and I am not. Surfrider is for this project, and I am a member of their facebook group, and I am not for this project. Heal the Bay is for the project, I am not. I, actually, have your logo attached to -- with a dead fish bone on the back, which I can show you later, if you would like.

Also, as a Native American I am opposed to this project mainly because this is an ancient Chumash Village. There are a lot of archaeological sites there that have been documented. There have been archaeological sites all over southern California that have been ruined by bulldozing and human developments.

There are some in the Santa Monica Mountains, there are thousands, and in the Ballona wetlands they found burial grounds there. There is also a scroll of a woman that was 30,000 years old that was found there, and they had thought that man had a right even 12,000 years ago. This find has changed the time line of when they thought that man arrived here. Also, at Point Dume they just found one of the 23 clovis sites in the Americas, one of 23. And, in Bolsa Chica, they have the largest scottstone [sic.] in the Americas, and that is just in Orange County.

Over at Muni High, they have bulldozed, and have actually ruined some of the archaeological sites there, and under the wall that was built there by the Sepulvedas, which they reburied and --

[Timer Rings]

-- well, thank you, so much.

VICE CHAIR SHALLENBERGER: Thank you, and that was my mistake, of course I have your speaker slip.

Now, we seem to have three of the Van de Hoek family, and you coming up together?

MR. VAN DE HOEK: No.

VICE CHAIR SHALLENBERGER: Well, then --

MR. VAN DE HOEK: It is a family affair.

VICE CHAIR SHALLENBERGER: You will have 4 minutes.

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MR. VAN DE HOEK: Thank you, four minutes, that is good arithmetic, my father, John, and my mother, Betty and they do not have to stay standing with me?

VICE CHAIR SHALLENBERGER: No, thank you.

MR. VAN DE HOEK: You can sit down, and I take direction from them a lot of the time, willingly and lovingly.

Okay, first, I am a scientist, and a hydrologist. I work for the U.S. Forest Service for five years measuring streams and water quality for fish, especially trout, to make sure that the waters were cool enough, oxygenated enough, and that I am a well trained hydrologist. I have also been a conservation biologist and a wildlife biologist for 10 years in the United States Department of Interior, retired from that.

I have an academic background in geography, so I am a geographer, and that is how I got to be a hydrologist with that course work, and I also became an air photo interpreter with the Department of Agriculture for 5 years, and am well trained in photogeology and advanced map interpretation, of all types of maps and photos from the air, and from mapping exercises. And, I am a restoration ecologist and have been involved in restoration ecology in various places in Southern California.

I will simply start with this statement, as a

004775

scientist, the water is healthy in the Malibu Lagoon, despite what you have heard, just ask the tide water goby. The numbers of the tide water gobys in the State of California declined, and declined for the last century, but a successful effort 20 years ago to put the tide water gobys at Malibu Lagoon has worked, and the numbers have increased in the precise area where the dredging is planned.

I am going to read from the most renown ichthyologist and fishery biologist in our country today, Dr. Peter Moyle at UC Davis, and he put the tide water goby in this book, Inland Fishes of California, and he didn't put it in a book on sea fishes, it is not a salt water fish.

> "The tide water goby prefers salinities of less than 10 parts per thousand, and as a consequence are generally found even in upstream portions of larger lagoons; however, they can live in zero parts per thousands."

In other words, fresh water.

> "Well oxygenated water is also required, so they disappear from lagoon areas that stagnate and stratify."

There you have it, the tide water goby as the evidence is there, it is a fish close to extinction, but this is a success story at Malibu Lagoon. We have to evaluate the water as healthy, and it is well oxygenated.

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The plants that were mentioned by Wayne Ferren, a renowned scientist himself, who identified ruppia cirrhosa, often called the spiral wridgengrass, also a plant in decline in our state, because when you put it in salt water, that plant disappears. That plant is able to absorb nutrients, enriched nutrients, high in nitrogen, and it grows and thrives on that, and that rare and endangered tide water goby hides in that wridgengrass, and it also finds its food, think about that, if there is just a tide water goby, there has to be food for this fish, and that food eats small damsel flies, snails, other types of aquatic invertebrates, and it requires a diversity of food life, and that life is thriving, and these little animals that are there without their backbones have gills, and they breath water.

There is oxygen like crazy in there, you heard rhetoric about low dissolved oxygen, which is untrue, the water is not stagnant, and the water is actually very healthy. They try to -- they characterize it with a transportation, a road transportation word, deadend, and that is not appropriate for a scientist to say deadend, because they are not deadends, if you look at the aerial photos it is connected with links and cross channels, and they are very ecologically sound streams.

The Mannion and Dillingham report that they cite, are incorrect. The mud crabs and shrimp statements are

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incorrect. The presence of polydorus ucalos, a rare worm, is very important, and it is possible to bring back many endangered species as you saw in the video that was played.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Allen Srjo, then Joyce Parker-Bozylinski, and then Jonathan Coffin.

[No Response]

Is Allen Srjo here? Oh, you have already ceded your time, haven't you? thank you, very much.

Joyce Parker-Bozylinski, and then Jonathan Coffin.

MS. PARKER-BOZYLINSKI: Chair Shallenberger, members of the Commission, Joyce Parker-Bozylinski, planning manager for the City of Malibu.

We do support this project, and we thank the State Parks and the Coastal Conservancy for working with the City of Malibu to address our concerns related to water quality; however, we still have some strong concerns related to water quality, and hopefully the Commission has had an opportunity to review the letter that we submitted. We are suggesting the addition of some additional conditions of approval related to water quality and they deal with bacteria, monitoring of bacteria, both pre- and post-construction. And, then on the next page there are two related to bird surveys, but again related to pre- and post-construction, and again related to water quality, so that is our main concern.

There is water quality being done, but we would like more frequent and more rigorous water quality included as conditions of approval.

Thank you for your time and consideration of our request.

VICE CHAIR SHALLENBERGER: Thank you, very much.

Jonathan Coffin, and then Jace Sullivan.

MR. COFFIN: My name is Jonathan Coffin, and I am here to read in this letter from the Pasadena Audubon Society, as submitted by Laura Gera for you. Oh, by the way, Laura Van de Hoek was also the president of the Audubon for Wilionaeros [sic.].

"Regarding the Malibu Lagoon" -- oh --

"California Coastal Commission regarding the Malibu Lagoon Phase 2, the mission of the Pasadena Audubon Society is to bring the excitement of birds to our community through birding, education, and conservation of bird habitats. While we support the idea of restoring Malibu Lagoon we also have some concerns about the current plans to do so, because they seem to overlook some remarkable educational opportunities that the lagoon offers, and because they will devastate

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the lagoon with no guarantee that they will truly benefit the lagoon.

"Therefore, we ask that the Commission delay this plan so that all parties and stake-holders can work together to find a less destructive and more educational solution.

"Our first concern is education, the destruction of the bridges removes a wonderful and unique opportunity for the community to observe and experience nature close up. Rather than removing them, why not redesign them so that they do no impede the flow of water, and why not provide educational signage so that the public can learn more about the ecology of the Malibu Lagoon. Places like this, where people can get very close to nature without disturbing it are rare, and that should be protected and enhanced, and not removed.

"Our second concern is that the current plans will kill many of the fauna that live there, while some of the birds can fly away, one must wonder where they will go? The other areas that can support these birds are already full, and what about the rarer

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birds, like the soros?"

My son and I saw one from one of the bridges, a couple of weeks ago.

"Where can they go? Isn't it just possible there is a kinder --"

[Timer Rings]

VICE CHAIR SHALLENBERGER: Thank you, very much.

MR. COFFIN: I am also going to add this letter her.

VICE CHAIR SHALLENBERGER: All right, thank you, you can give it to staff.

Jace Sullivan, and Walter Shirk, if you could both come forward -- was that Jace? okay, sorry, I missed.

So, Walter, you want to bring us home here.

MR. SHIRK: Okay, hi there, my name is Walter Shirk. I am a 40-year Malibu resident, and also have been fortunate enough to be a 37-year employee of the Santa Monica Fire Department. Presently, I am a division chief for support services, and my previous assignments included division chief in charge of training and suppression, platoon commander. I was 10-years as the California incident command certified strike team leader with a master mutual aide pack, and with 10 years prior experience as a engine company responding to many brush fires.

Besides urban fire incidents, I have been deployed

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to multiple mutual aid brush responses from San Luis Obispo County to San Diego County, including numerous Malibu fires, from the Green Meadow fire of years ago, to the more recent canyon and corral fires. Most recently, I spent a very long day at the Jesusita fire in Santa Barbara, within a stone's throw from where other fire units and crews were burned over.

Today, I have a Power Point, please.

[Pause in proceedings.]

Sorry, I should have noticed that.

VICE CHAIR SHALLENBERGER: That is quite all right. We won't punish you for being at the bottom, the last, or the second from the last. It is all right.

MR. SHIRK: This was planned for three minutes, so I am going to talk fast.

VICE CHAIR SHALLENBERGER: Okay, good.

MR. SHIRK: I want to talk today and discuss the importance of all sorts of means of access and egress both for residents and emergency responders, and especially emergency responders.

Problematic accesses, this is an example of one, a very small driveway, and ends up with some pretty unfortunate consequences. The incident command formulation of tactics and strategies depend upon the ability to have contingency plans, and fires do happen on the beach. These are both Colony residences that have burned in the canyon fire.

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Again, there are devastating results from that, just as impeded.

These are not as clear as I had hoped they would be, but these are all areas that we would look for to travel in an emergency situation, and there are other ones, these gates, other roads, these happen to be all in back of the Colony, and these would all go away with a constructed wall back there. There are 18 residences, I guess there are 13 gates.

[Timer Rings]

Okay, two minutes is too fast, thank you for your time.

VICE CHAIR SHALLENBERGER: Thank you, very much, and we have one last speaker slip, Ann Donneen.

MS. DONNEEN: Hi, I am Ann Donneen, thank you for the opportunity to speak.

I was born in Malibu 63 years ago, and I still remain there along Malibu Road. I wanted to show you an example of government science that could not go wrong -- this recent spill in the gulf.

I wanted to say, also, to respond to a comment earlier by Bob Stark, who was talking about monitoring the effects of the restoration once it is under way, and he made the statement that, you know, the scientific tests will be taken of the water, and I appreciate that, and that is good,

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but the point is that this is an experiment, and he was saying we will make adjustments. In other words, we don't know exactly what is going to happen there, and it can't be tested in its entirety until it actually is finished.

Regardless of what case the forensic biologists may make for this, it is impossible to forecast precisely what is going to occur, at best.

I feel that this is over kill. You are doing with a sledgehammer what you should be doing more with just a shovel. I am concerned about this, and I also speak for a number of my friends along Malibu Road.

Regarding water quality, there is nothing in this plan to actually improve the water quality as it comes down from the canyon, and it said the water quality could even be worse because many of the plants that are in the lagoon now do cleanse the water, so what the surfers might find, might actually even be worse water quality.

The bridges are beautiful, keep them, they are not dikes, they are not levies. It will cost $7 million to $12 million in bond money, why spend it? don't fix something that is broken -- that is not broken.

VICE CHAIR SHALLENBERGER: Thank you, very much.

MS. DONNEEN: Thank you.

VICE CHAIR SHALLENBERGER: And, that brings us back to the department for any rebuttal that you like, and

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you have 5 minutes you reserved for rebuttal.

MS. KUMLER: Good afternoon, Chair and Commissioners, my name is Pera Kumler, and I am the project manager for the State Coastal Conservancy on this project. I have been working on it for 6 years, since the beginning of the EIR process.

And, I think that, as far as rebuttal, we feel that a lot of disputers have addressed the issues substantially, and I don't need to go into too much detail. I just want to make a few points.

The first one being, in response to Amadia Wires testimony that we will be using a state archaeologist, from the Parks Department, so there is no issue with an unfriendly consultant. And, also we are totally amenable to including Native American monitors, and I do believe that we expressed that during the comments of the EIR process, as well, and you know, we want to be most protective of the resources, including cultural resources, so I wanted to put that out there.

And, secondly, we have heard a lot about less environmentally damaging alternatives today, and you know, we had a long EIR process. We did a lot of notifications. We had a very long stakeholder participation process prior to that, and we believe we fully vetted the alternatives -- we had multiple alternatives, and this was the most preferable

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alternative, and I think the staff report also supports that.

And, in general, we believe that we are consistent with *Coastal Act* policies, and we believe we have reduced the fire risk to the adjacent residences by reducing the fuel load, putting in more appropriate plants. We don't have any undesirable plants listed by the fire department within 100 feet of any of the residences.

And, in addition, we also believe we are enhancing public access, and we have taken great care to include Audubon and the surfing associations, and we have their support and we have incorporated their concerns into the design, and as well as educational groups that use the area very frequently. And, so we think it results in an enhanced experience for all of the visitors.

And, my last point I wanted to make is that we do want to emphasize that there is a great need here, and you have been shown a lot of technical information today that maybe didn't hold your attention because it was really detailed, but the studies that we have done do show that there is a need for a more aggressive approach at the lagoon.

And, again we have analyzed the alternatives, and we do think this is the best one. We are including a lot of mitigation, as in the staff report, and in the EIR to address any potential impacts.

And, so we thank you for your consideration, and

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the whole team is here to answer any questions that you have, and that is really all that I have.

Thank you.

VICE CHAIR SHALLENBERGER: Thank you, very much, and would you please be sure to fill out a speaker slip.

MS. KUMLER: Absolutely.

VICE CHAIR SHALLENBERGER: So, now we will come back to staff for anything you would like to add.

DEPUTY DIRECTOR AINSWORTH: First off, Dr. Engel will have some comments, and then I will follow those up, and Chief Counsel Schmeltzer has something to add, as well.

STAFF ECOLOGIST ENGEL: Okay, regarding evaluating alterntives, over the years a large number of alternatives have been examined, and after years of research and studies, the proposed project is the one that was determined to be the best.

In terms of the listed species, currently the tide water gobys don't live in the upper ends of the dead-end channels of the Malibu Lagoon, none of the experiments that have been performed have ever found gobys in this area. The dead-end channels have low oxygen levels, and you heard the extremely low numbers that Mark Gold reported for recent '02 samplings. The channels are filled with fine sediments that contribute to eutrophication.

As Dr. Sutula said, a main goal of the restoration

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is to improve circulation and water quality, which in turn will reduce fine sediments and facilitate the use of the channels by tide water gobys.

Also, the arrangement of the channels, the slopes and grading design is going to facilitate larger sediments, grain size, which the goby also require, they need larger grain sizes. So, right now gobys don't use those three dead-end channels. The proposed restoration is not going to change the lagoon salinity, as you heard Dr. Ambrose report, so this should not impact the presence or absence of tide water gobys.

While steelhead trout do use a larger portion of the lagoon next to the channel, in the past few years there has been significant reports that no large steelhead have been in the lagoon.

The ongoing efforts of the City of Malibu to improve water quality, and recent regulatory requirements in combination with the proposed project should result in higher 02 levels and a reduction, if not elimination of eutrophication events.

The least terns, over winter at the lagoon, they do not yet breed in the area, they primarily forage in the open water adjacent to the channels, and therefore we believe that the construction timing, and the construction location will not impact the least terns.

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Regarding the submerged aquatic vegetation, specifically the rugia, Wayne Ferren is right, this resource was not surveyed. It is an important natural resource that currently is experiencing a population explosion because of the water quality, that contributes to the lagoons eutrophication problems, those explosions.

The proposed restoration will not permanently eliminate the rugia, in fact, the proposed design should promote conditions that prevent population explosions and it is true that the tidewater goby like living among that rugia, and so, all in all, it should be better for the tide water gobys and the rugia will remain there and it will be in better condition.

The benthic invertebrate population in Malibu Lagoon, there is no doubt about it, it is impaired. Several studies have shown that the infaunal and epifaunal invertebrate species richness in the Malibu Lagoon is very reduced, must lower than expected in a healthy river influenced, seasonally closed tidal estuary. In addition, the plant communities are all disrupted, and there is way too much non-native invasive plants, and the proposed lagoon will restore coastal tidal marsh plant communities such that they resemble a truly functioning healthy coastal lagoon.

DEPUTY DIRECTOR AINSWORTH: Just quickly, in response to Mr. Birkelund, the Wetlands Defense Fund

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attorney's assertion that this project is not consistent with *Coastal Act Section 30233 and 30240*, the wetland and national policies of the *Coastal Act* specifically authorize ESHA and wetlands restoration activities, so these are authorized uses in ESHA and wetlands. Mr. Birkelund failed to mention that in his presentation.

Now, again, the whole point behind this restoration project is to enhance and restore the lagoon and salt marsh to a higher value habitat, being in the exact same location as the lagoon is today.

With regard to the gates and the wall issue, now staff doesn't particularly have a problem if gates were included in the wall; however, we do not believe this is a *Coastal Act* issue. In our view, this is a private access issue that should be worked out with State Parks. We do not believe we have a *Coastal Act* basis to require gates through the wall.

In response to Mati Wiaya's comments requesting the permit be amended to include a Chumash monitor, Special Condition 15 does, in fact, include a provision for Native American monitors on site during grading and restoration activities. He also cited that on the eastern side of the creek there was an area of particular sensitivity from a coastal resource standpoint, and in that area only hand work will be done in recognition of that. There will be no heavy

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equipment in that area, and native monitors will also monitor that area.

So, now I will turn it over to Chief Counsel Schmeltzer.

CHIEF COUNSEL SCHMELTZER: Thank you, just to follow up on what Deputy Director Ainsworth said.

One of the points he made was that this restoration occurs in the exact same location as the existing lagoon, and that is an important point, because the Bolsa Chica case stated that if ESHA values may not be moved to another location; however, in this case the ESHA values will be retained in the exact same location and so that case is not on point with what you are seeing in this manner.

In addition, the Bolsa Chica case also stands for the proposition that *30233* trumps *30240,* so to speak, with regards to wetland areas. As Mr. Birkelund stated, wetlands do receive the highest protection, and *30233* governs here, and does allow for this and the Commission staff has stated in detail why the proposed restoration is consistent with *30233.*

And, just for additional reference, although it is not exactly the same analysis, the Commission approved a very, very similar project in the Batiquitos Lagoon case, in the -- I believe in the early '90s, and that case, also, went up on appeal, and the Commission's decision there was upheld.

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And, again, it was a very similar situation, where the lagoon was restored in a very similar manner to what is being proposed here. In that case, is discussed extensively in the Bolsa Chica case, and they both were found to be consistent under the *Coastal Act*.

VICE CHAIR SHALLENBERGER: Thank you, and it comes back to the Commission, and is the Commission, at this point, willing to continue on to try and finish our deliberation before lunch?

[No Response]

All right, seeing none, I have several Commissioners signed up, and I will begin with Commissioner Liberman.

COMMISSIONER LIBERMAN: Thank you, very much.

I have two questions, and the first question has to do with the environmental review under CEQA, and a question has been raised about the adequacy of the CEQA process, given that the EIR was completed a number of years ago, and I am wondering if you could comment on that, and whether a supplement to the EIR has been considered? or if there is any change in circumstances that would require that kind of a supplement?

CHIEF COUNSEL SCHMELTZER: Well, to begin with the EIR was never challenged in the original CEQA proceeding that the lead agency undertook, so that CEQA process is considered

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to be final and the Commission doesn't have any role in challenging that process once it has been completed.

We are also not aware of any significant changed circumstances that would require them to reopen their process, and they have not -- it is not the Commission's role to determine that, either. The Commission's role here is to look at all of the information in front of the Commission and make a determination about its own policies based on the information in front of it, and certainly there has been many subsequent studies, and recent studies, that are in the Commission's file and that the Commission is relying on, as well.

The CEQA process, with regards to the lead agency, however, is complete.

COMMISSIONER LIBERMAN: Thank you, thanks for clarifying that.

My other question has to do with the community consultation process, and again, I know this is not a strict requirement but I am just curious because of some questions that have been raised, if someone could help remind us on what, in fact, took place in that process, and perhaps this might be a question appropriate for State Parks.

I know that there was, originally, a Malibu Lagoon Task Force, that met for a number of years that provided stakeholder input on this, and at some point my understanding

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is that it stopped meeting, and that the shift in conversation went to Malibu Lagoon working group, that was a -- had less stakeholder involvement, and could you please tell me if I am correct in that notion? or just to clarify what, in fact, was -- did it characterize stakeholder involvement over the years on this process -- project?

MS. GOODE: Stakeholder involvement really began in about 1989 with the creation of the Malibu Creek Watershed Council.

VICE CHAIR SHALLENBERGER: We need your name for the record.

MS. GOODE: I'm sorry, Susan Goode, California State Parks.

In 1989, the Malibu Creek Watershed Council was created, and over the years, ensuing years, a number of different task forces and subcommittees were created. I can't give you the exact year when the Malibu Lagoon Task Force was created, but was sometime in the '90s, Malibu Lagoon sub -- or the Lagoon Task Force, excuse me, so many different names.

The Lagoon Task Force was specifically involved in questions of water level management of the lagoon, and all of the other various problems that the lagoon has experienced.

In 2000 -- I believe it was 19 -- the year escapes me, but it was prior to 2001, the Coastal Conservancy paid for a -- I need my glasses -- paid for a professional facilitation process, and all of the stakeholders of the Malibu Lagoon area, including Ms. Hanscom and other environmental activists, and property owners of the adjacent area, were brought together to consider the 2000 Ambrose and Orm report that was done by UCLA. In that report, many different alternatives were suggested for -- a whole matrix of alternatives that were suggested for lower Malibu Creek watershed and lagoon restoration.

The group met very frequently, and finally came out with a list of preferred actions that could be taken, because some of things that were highlighted by the UCLA study were not compatible with other things, so that you couldn't do all of them.

The 100 percent consensus agreement among the people on the Lagoon Task Force was that the first high priority, short-term project to be undertaken, was the restoration of lands already in public ownership, i.e. Malibu Lagoon, and across the lagoon at the Adamson House, and this was presented to the Malibu City Council, by myself, on September 10, 2001, and with a Power Point presentation filmed by Bob Purvy, and it showed the exact site that we are considering now, and in concept described this exact same process.

We then sought funding from the Coastal

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Conservancy, and we created the lagoon working group, which was actually a little bit larger, I believe, than the Lagoon Task Force, and that group coalesced around the general concept of what the lagoon restoration project would be. Then, we formed the scientific technical advisory committee which refined it even further.

After we came up with concept plans, then we had a couple of series of consultants who further developed this plan, and ending up with the plan that you see today, which was reviewed along with all other alternatives in our 2006 certified EIR. There was public comments and participation every step of the way.

COMMISSIONER LIBERMAN: Wow, thank you.

VICE CHAIR SHALLENBERGER: Commissioner Blank.

[**MOTION**]

COMMISSIONER BLANK: Yes, Madam Chair, I want to make a motion, and then an amending motion, can I do that? all right.

I move that the Commission approve Coastal Development Permit Amendment No. 5-82-192-A2 for the development proposed by the applicants, and I am asking for a "Yes" vote.

COMMISSIONER ACHADJIAN: Second.

VICE CHAIR SHALLENBERGER: It has been moved by Commissioner Blank, seconded by Commissioner Achadjian.

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Would you like to speak to your motion?

COMMISSIONER BLANK: Just briefly, Madam Chair.

I think, if I understood the opposition, it fell into two categories, one, the homeowners who were objecting to both the removal of the existing bridge, and the wall, and I want to address that with an amending motion.

And, then, the appellants who were objecting to the bulldozing and reconstruction in its current proposed form in the lagoon, and in listening to the applicants and the appellants, I guess I was persuaded by the scientific evidence of the applicants, not only our staff, but all of the other groups that normally I find on the other side of moving a single grain of sand on the beach, and while that doesn't make it right, it was just compelling enough for me, as a Commissioner, who has to act between the applicants, the appellants and the staff and the scientific evidence in front of us, that I think I believe proposed amendment meets the conditions of the *Coastal Act*.

So, how do I make my amending motion?

VICE CHAIR SHALLENBERGER: Well, let the seconder speak first.

Commissioner Achadjian.

COMMISSIONER ACHADJIAN: I will save my time for the amending motion.

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[**MOTION**]

COMMISSIONER BLANK: Okay, then I would like to move that we include some provision, which I would be happy to defer to the staff, to allow gates in the wall. I, honestly, don't understand the purpose of not --

VICE CHAIR SHALLENBERGER: If we could get a "second" on that amendment, first.

COMMISSIONER ACHADJIAN: Would you repeat, please, what you are proposing?

COMMISSIONER BLANK: I moved that we permit gates in the wall.

COMMISSIONER ACHADJIAN: Second that motion.

VICE CHAIR SHALLENBERGER: All right, and would you like to speak to your amendment?

COMMISSIONER BLANK: I think I was on it, but somehow I am missing some undercurrent of discussion that isn't in the staff report. I find that no gates in the wall kind of punitive. I would also like to have part of that amendment that no dogs are allowed by the owners, and there is some monitoring, and if dogs actually do appear in the lagoon, that we then put locks on those gates. But, I think starting off by just saying no access for the current residents who have access to the lagoon, I am not sure that I could support that, and I would love to hear from staff, but if the issue is having residents' dogs in the lagoon, I think

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we could address that without just shutting them off and leaving them in.

VICE CHAIR SHALLENBERGER: Before staff, I would like the seconder the opportunity to speak to the motion.

COMMISSIONER ACHADJIAN: Thank you, Madam Chair.

I share the concern that there needs to be an access when there the spokesperson told us at the very beginning that there is 3 feet access between the residential fencing and the wall, that didn't address the concerns that I have, even though I heard staff say it was not a coastal issue but to me it is a safety issue, especially after hearing from the gentleman representing the fire department.

Everybody who spoke in favor of the access brought in good reasons why we should have it, but I would like to talk that out by bringing in yet another concern, what would happen to a person in a wheelchair? where are the ADA requirements for allowing access in a case of an emergency, as we were told by the person, the fireman representing the fire department. For all of those reasons, especially when looking at the requests brought forward by the homeowners as to their willingness to architecturally make this fitting, color wise, and scheme wise, I think that is also a plus, and I do support the amending motion.

VICE CHAIR SHALLENBERGER: All right, thank you.

Our attorney general has a question, and then

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staff.

DEPUTY ATTORNEY GENERAL PATTERSON: Commissioners, are you allowing them to install gates? or requiring them to install gates?

COMMISSIONER BLANK: I am allowing them to install gates as per a staff --

EXECUTIVE DIRECTOR DOUGLAS: I wanted to clarify that, okay.

COMMISSIONER BLANK: Yes.

EXECUTIVE DIRECTOR DOUGLAS: The way I understand it is that your motion is to permit gates in the wall, and we have no problem with that, and so --

COMMISSIONER BLANK: Great.

EXECUTIVE DIRECTOR DOUGLAS: -- that is fine.

This is not our proposal, I mean this came from the design of State Parks, so as Jack said, it is not really a coastal issue, but I think you could probably make that one, in terms of --

COMMISSIONER BLANK: I would like to make it a coastal issue, based on safety.

EXECUTIVE DIRECTOR DOUGLAS: Okay, and then, the other clarification I would like to have is that you just talked about the gates, but you didn't talk about the width of the path outside of the gates, and if that is going to be part of what you are going to propose, then I would like us

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to hear from State Parks about whether that can work, because again, we don't have a problem with that, if that is okay with them.

COMMISSIONER BLANK: Then, let me ask Executive Director Douglas, if I can, there is no wall there now, is there?

EXECUTIVE DIRECTOR DOUGLAS: No, there is no wall.

COMMISSIONER BLANK: Okay, so anything I am about to hear is a new addition that State Parks is going to require.

EXECUTIVE DIRECTOR DOUGLAS: That's right.

COMMISSIONER BLANK: So, to be honest, I really don't care to hear from State Parks, as a Commissioner. Now, perhaps you do, as there is no wall now, and there is no constraints on access at all today.

EXECUTIVE DIRECTOR DOUGLAS: Right.

COMMISSIONER BLANK: Right, and so I am happy in my only request, as this Commissioner, is that staff and the homeowners spend, you know, some time figuring out what works for them. I am not making a State Parks request, I am making a Commission request, and while I appreciate State Parks' opinion, we are not degrading what exists today. There is no wall at all.

I understand State Parks' need, and desire, that they have no access, and I clearly could understand that from the avian wild life, and I want to be clear, we put in a condition about no pets, this is not a dog run, right.

EXECUTIVE DIRECTOR DOUGLAS: Well, that was going to be my next comment.

The reason that I mentioned the width of the path was because Commissioner Achadjian raised that, and that is an issue that has been raised, so I didn't hear you address that in your motion --

COMMISSIONER BLANK: I thought I did. I want to make it clear again.

EXECUTIVE DIRECTOR DOUGLAS: Okay.

COMMISSIONER BLANK: No pets on the other side of the wall.

EXECUTIVE DIRECTOR DOUGLAS: Well, that is the other thing, and I am -- we are not very excited about a condition that we can't enforce, and we don't see how to enforce that one.

COMMISSIONER BLANK: We have a lot of those, and so, I guess, that is my request, as an amendment. I think the other Commissioners can decide, and I hear you, and I understand that, I just want to be clear that I don't want to wall off the homeowners from access that they already have in the lagoon.

I also want to be clear that I don't want them thinking that they now have an extended dog run, because that

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is not the goal of the lagoon restoration. I do think that we could put a condition in, and we have a very competent enforcement group that if enough people report, and in a lagoon that has 200,000 to 300,000 people visiting a year, the dogs are running in the lagoon, I believe our enforcement people will hear about it pretty quickly, and Commissioner Wan will probably be the first one to let us know, given that it is in Malibu, and I mean that as a compliment.

But --

EXECUTIVE DIRECTOR DOUGLAS: They might be her own.

COMMISSIONER BLANK: Excuse me?

EXECUTIVE DIRECTOR DOUGLAS: They might be her own.

COMMISSIONER BLANK: They might be.

But, I guess I have an amendment on the table, and I hear your concerns. I just wanted to make sure that mine was clear. You could tell me whether it is legally unenforceable, that is the law, good and I am glad it is not.

And, then, I will leave it up to my fellow Commissioners if they now understand what I am asking for, about whether they want to vote "Yes" or "No".

EXECUTIVE DIRECTOR DOUGLAS: And, so that we are clear, your motion included a 5-foot wide path?

COMMISSIONER BLANK: Let me ask the applicants, or

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the -- Mr. Schmitz.

VICE CHAIR SHALLENBERGER: I believe he has asked a question of the applicant.

MR. SCHMITZ: He pointed to me.

COMMISSIONER BLANK: I am sorry, the homeowners' representative.

MR. SCHMITZ: Through the Chair, Don Schmitz, again on behalf of the Malibu Colony Homeowners Association, yes, we would urge the 5-foot width, as the uniform fire department code requires.

COMMISSIONER BLANK: Could you live with a 3-foot width?

MR. SCHMITZ: Well --

COMMISSIONER BLANK: That sounds wonderful.

MR. SCHMITZ: -- a 3-foot is better than nothing, Commissioner, but --

COMMISSIONER BLANK: Right, so let me just, Mr. Schmitz, if you could stay, through the Chair to Executive Director Douglas, would the staff prefer 3 or 5 feet?

EXECUTIVE DIRECTOR DOUGLAS: Well, the concern about the wheelchair is a significant concern. That is why I wanted to hear from State Parks, whether or not a 5-foot path there works, or whether there are going to be significant adverse impacts? But, from our perspective, we don't really care, I don't think, whether it is 3 or 5 feet.

DEPUTY DIRECTOR AINSWORTH: Yes, because what is happening here, tension here, because if you pull the wall out any further, there is that drainage swail that we are capturing the drain, with the filtration there, so we need to hear from State Parks with regards to whether or not they can accommodate that 5-foot walkway.

COMMISSIONER BLANK: Okay, all right, then I will request State Parks' representative.

Thank you, Mr. Schmitz.

MR. SAP: I'll fill out a speaker slip when I get a change, Craig Sap, acting district superintendent for the Angeles District.

With regards to the 5-foot, you know 3-foot is what we believe is fair, another additional 2 feet is basically giving state property, or state lands, a gift to the public, and we would like to avoid that possibility, if possible.

Then, insofar as the dogs, Gary George the concern about dogs within the Malibu Lagoon area, as it stands now they are not permitted. I wish I could have said that a bit earlier, but the back and forth is so quick. Dogs are not permitted, and it is vigorously enforced by the rangers, and that would go for any dog through interpretative enforcement, to allow them, telling them where dogs are permitted, to outright violations being cited.

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COMMISSIONER BLANK: I think, Director Douglas has something.

EXECUTIVE DIRECTOR DOUGLAS: Commissioners, that clarifies that point, and from our perspective then, we would recommend that it be limited to 3 feet, and that the motion include a requirement for the gates, because if it is just permissive, we don't think that that makes sure it happens, but if that is what you want to see happen, then I think that is the requirement.

COMMISSIONER BLANK: That is, at least, the motion that I would like to make --

EXECUTIVE DIRECTOR DOUGLAS: Okay.

COMMISSIONER BLANK: -- if my fellow Commissioner could support access for the existing homeowners who already have it.

EXECUTIVE DIRECTOR DOUGLAS: Fine.

VICE CHAIR SHALLENBERGER: Commissioner Achadjian.

COMMISSIONER ACHADJIAN: Madam Chair, I concur as the person making the "second" on this, but I think where I would be more agreeable if the access through the wall is ADA compliance, the gate itself.

VICE CHAIR SHALLENBERGER: They are each making their own access.

COMMISSIONER ACHADJIAN: I don't want them to be just narrow walled, so that if a person has to just rush in

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and make a way, we want to make sure that it meets all of the requirements of the ADA.

MR. SAP: With all due respect, that puts an undue burden on State Parks, to maintain that area. Additionally, you know, we can't -- if 3 feet is what we feel is --

COMMISSIONER ACHADJIAN: No, no, no, wait, I am okay with the 3 feet.

MR. SAP: Okay.

COMMISSIONER ACHADJIAN: But, when the residents, the homeowners are willing, out of their pocket, to put access gate for an emergency use, that to be sure that that gate is ADA compliance.

MR. SAP: Well, that puts an additional burden on us, to maintain that on their behalf, because we couldn't permit them to do the maintenance, the patrolling, as for that particular property, that easement, if you want to call it that.

COMMISSIONER ACHADJIAN: I don't know if we are communicating.

VICE CHAIR SHALLENBERGER: Maybe I could give it a try here.

I have two concerns, one is it is my understanding that the gates go in by the residents, so it is not State Parks --

COMMISSIONER ACHADJIAN: It is not a question for

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State Parks --

VICE CHAIR SHALLENBERGER: -- concern.

COMMISSIONER ACHADJIAN: -- I am just bringing in part of the motion that the residents who put up the gates that it is ADA.

COMMISSIONER BLANK: As the maker of the motion --

VICE CHAIR SHALLENBERGER: We need to have just one Commissioner speaking at a time.

COMMISSIONER BLANK: -- I agree, and I am just agreeing, as the maker of the motion, that I think all we are arguing about is the width of the hole in the wall, and I think it is irrelevant, all right.

What I think we just were deciding was the width of the path, and I think we are done with the State Parks part, at least I am.

VICE CHAIR SHALLENBERGER: All right.

I have one other question, and that is my concern is, I understood that Parks had agreed to move the wall further onto their property from the current property line between this private property and the state, in order to accommodate the residents to be able evacuate along the back of their property. We are now allowing gates to go in from the property to the lagoon, and it seems to me what you have effectively -- if we don't change the alignment of the wall, there is a gift of public to the private landowners by moving

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that wall away from the property line --

COMMISSIONER BLANK: That is right and so --

VICE CHAIR SHALLENBERGER: -- so I think that needs to be fixed, also.

COMMISSIONER BLANK: So, with the permission of the Chair, I would like to ask the homeowners representative their opinion, and then I will modify the motion.

I would certainly like to ask them before that.

VICE CHAIR SHALLENBERGER: An opinion of what? my statement?

COMMISSIONER BLANK: Yes, Mr. Schmitz.

MR. SCHMITZ: Through the Chair, again Don Schmitz on behalf of the homeowners association.

It seems that we are trying to do both things.

COMMISSIONER BLANK: No, we are trying to give you --

VICE CHAIR SHALLENBERGER: I think we just want an answer to what I said.

MR. SCHMITZ: I am sorry, Madam Chair.

VICE CHAIR SHALLENBERGER: All right.

MR. SCHMITZ: If we have an individual gate for each property owner, then that solves their problem --

COMMISSIONER BLANK: Right.

MR. SCHMITZ: -- as opposed to having the offset with the 3 foot or 5 foot --

COMMISSIONER BLANK: Right, so --
[Several Discussions]
MR. SCHMITZ: -- along the property --
VICE CHAIR SHALLENBERGER: We need a little order here, we have a list of Commissioners who would like to speak.
COMMISSIONER BLANK: Okay, so Madam Chair, based on the -- if I understood the homeowners representative, I think we just got 3 feet back, and I think --
Counsel?
DEPUTY ATTORNEY GENERAL PATTERSON: I would also like to clarify that I am sure you intend for the homeowners in their ability to pay for it, these gates --
COMMISSIONER BLANK: Yes.
DEPUTY ATTORNEY GENERAL PATTERSON: -- and all aspects of it --
COMMISSIONER BLANK: Yes.
DEPUTY ATTORNEY GENERAL PATTERSON: -- and to maintain the gates --
COMMISSIONER BLANK: Yes.
DEPUTY ATTORNEY GENERAL PATTERSON: -- and with the wall now being located at their property line, there is no need to give that 3 feet to them.
COMMISSIONER BLANK: I think that was a great modification, and that is now what my amendment says.

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VICE CHAIR SHALLENBERGER: Okay, I would like to hear -- we need to hear from some other Commissioners here.

Commissioner Sanchez.

COMMISSIONER SANCHEZ: Thank you, Madam Chair, first of all I want to thank everyone for their comments. I want to say that I am impressed by the process that has occurred. It has been over several years.

I, actually, have been involved in some of the local restoration processes in progress, and understand that there are times when you do need to include something like a bulldozer. We are using that in our very sensitive San Luis Rey River, that is both a retention of sensitive habitat, as well as insuring that it has the appropriate flood control.

And, so I am -- and I also am persuaded by the testimony, especially the expert testimony, supporting the findings and the staff report, and so I am -- I do plan on supporting the main motion. With respect to the proposed amendments, I do not believe I will be supporting those.

Something akin to that is private access along beaches, and having, you know, own stairways and things like that. I guess we could also discuss safety issues as well, but we talk about the policies and having public access, and not private access, and so I feel that we are going into private access issues that are not protected.

I am not persuaded by the issues having to do with

004811

safety. I think that pulling back, or, excuse me, the 3-foot addressed very sensitive issues, including drainage, and what I think has taken place up to, even up to today, has been a settlement of the issues, so to speak, two out of four have been settled, the pesticides -- I forget the others, I think it was the pulling back, and providing the 3 foot.

However, in terms of the bridge, as well as the private access, I am not persuaded. I believe that dogs are a real threat, and while you have -- and I am hearing that there is enforcement. You know, it is a taxpayer cost, and I think what we are talking about is insuring the protection of a very valuable resource, insuring that it will be available to as many people of the public as possible, i.e. the focus on the route that goes around and actually will be enjoyed by many more people.

And, as to the wall, I just see that as a private access issue, and I cannot support that, so will not be supporting the amendment.

Thank you.

VICE CHAIR SHALLENBERGER: Okay, and I would ask Commissioners at this point to just speak to the amendment before us, so that we can deal with that, and then we will go back to the main motion.

Commissioner Wan.

COMMISSIONER WAN: All right, I noticed that when

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we are doing all of this we are talking about state property, and we do need to hear from the representative from the State Parks, and I don't remember what your name is? no, the person who is sitting next to Mark Abramson, you seem to want to get up and -- no? you are from the foundation?

[Discussion off Microphone]

VICE CHAIR SHALLENBERGER: We need to have you --

COMMISSIONER WAN: All right, then I need -- you are the one I would like to have come up to the microphone, please, since you are the funder, are you not, of this?

MS. KEMLER: We are.

COMMISSIONER WAN: Okay, can I hear what your comments on what this Commission is, presumably, attempting to do?

MS. KEMLER: I was just trying to make the clarification --

VICE CHAIR SHALLENBERGER: We need you to state your name for the record.

MS. KEMLER: I am sorry, Pera Kemler, State Coastal Conservancy, and I was just trying to make the clarification, if you put these in the wall, we don't actually get that 3 feet back. It is 3 feet from the property line, because we need that 3 feet to excavate and put footings in for the wall.

So, just as we wouldn't be allowed to do work on

004813

their property, because it is their property, so we have to set it back 3 feet.

So, we would think it would be more appropriate for them to put their funds towards moving their fences back 2 feet than paying to put gates in our wall, so they would have 3 feet on State Parks property, 2 feet on their property, so they would have a full 5 feet width, and it is open down at the beach end. They also have a gate down at that end on the Colony Road.

And, just like on the Perenchio side, they don't have gates there, and also I would note that not every home has a gate, currently. There are just some, so obviously, the other people find their way out, I would assume, without accessing State Parks. So, that was my only clarification, was about that 3 feet.

VICE CHAIR SHALLENBERGER: Okay.

COMMISSIONER WAN: Then I have some comments to make about this.

To begin with, let me ask one question, the person who came up who is a fireman, in a fireman's uniform --

UNIDENTFIED SPEAKER: I believe he left.

VICE CHAIR SHALLENBERGER: Bob Stark.

COMMISSIONER WAN: -- I don't believe he was representing the fire department, he was representing himself as a fireman, and I want to make that very clear. I don't

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believe the fire department has taken a position that there is a need for this for fire access.

And, so I would like to have you pull up, staff's Slide 15, because I want to talk about the need for this for, quote, fire access.

[Pause in proceedings.]

Because I don't see how this could possibly be needed for fire access, frankly. If you were going to have a fire in the Colony, other than a structure fire, it is going to be coming from PCH, and, you know, if it is brush fire it is going to have to skip over the wetlands and the lagoon, and it will get into -- look at the row of homes we are talking about -- and that's fine, okay -- look at the row of homes that we are talking about, and look at where most of the vegetation is, it is in their own yards, okay, and these are the people who are talking about the need for -- some of that tall vegetation is along the back, but a lot of it is not, okay, look at that.

The fact is that if a fire comes through, the first thing you are going to do is to try to get in your car and get out of the Colony through the use of your car. You are not going to go out the back way, walk around the lagoon to get to PCH, because that is what you would have to do in escaping, okay.

Yes, you can go back to that one, too, 16, and look at how much vegetation there is in the back yards, and in the side yards of these houses, the embers are going to catch those, and you are not going out the back across the lagoon to escape the fire, you are going out the front street, or if you can't use your car, you are going to walk to the beach, because that is your escape from the fire.

[Audience Reaction]

So, you go out the front door to get to the beach, that is where the ocean is.

[Audience Reaction]

VICE CHAIR SHALLENBERGER: Anybody who is unhappy can leave the room, now. We have a bunch of armed uniformed men in the back who will be glad to escort you out, thank you.

COMMISSIONER WAN: Now, I am not asking the question, yet, okay.

But, the fact is I don't see this as a fire protection issue. I really don't see this. This is a private access issue, and that isn't -- and I agree with Commissioner Sanchez on this one, it is a private access issue, and for this Commission to be starting to approve private gates, and access into a State Park when the State Park doesn't want this, is not appropriate, as far as I am concerned.

And, again, fire is a very real issue in Malibu,

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as it is in a lot of places, but that doesn't justify private access to a public park.

VICE CHAIR SHALLENBERGER: All right, just to be clear to Commissioners, I am making a list now of those wanting to speak to the amendment, and next is Commissioner Stone.

COMMISSIONER WAN: Before I finish.

You seem to be wanting to make a comment on this, so I am going to allow you to comment.

VICE CHAIR SHALLENBERGER: Actually, I would prefer that you ask her a specific question since the public hearing is closed.

MS. KEMLER: [Inaudible]

COMMISSIONER WAN: Okay, let me ask you about the position of the fire marshall.

MS. KEMLER: We did request counsel from the fire marshall, and they did send an email to State Parks, stating that it was not a concern for them, and I don't have his name.

VICE CHAIR SHALLENBERGER: Commissioner Stone.

COMMISSIONER STONE: On the amendment, I appreciate Commissioner Blank's attempt to work out the deal there, but I am going to go back to what staff said, from my standpoint, I don't think this is a coastal issue, I am not convinced of the necessity for that access, from a safety

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standpoint, it just seems to be mostly access into the State Parks grounds.

So, because I don't think it is a coastal issue, I don't think we should be requiring it. If there was a way to -- if we were silent on it, and it is really more of an issue between State Parks and those residents, then I would prefer to leave it there, so I am not going to support the amendment for that reason. I don't think it is something properly that we should be weighing in on.

VICE CHAIR SHALLENBERGER: Thank you.

Commissioner Liberman.

COMMISSIONER LIBERMAN: Thank you, very much, Madam Chair.

I am also concerned about the precedent here, the slippery slope that we get on. There is so much concern about both access and privacy, and once you begin to open up a link for access to those homeowners into the park, you then have to ask well, what about people who may be on the street at the time of a fire, and do they now get access through those homes, or should they have access through those homes into the State Parks?

You now begin to move towards the homeowners across the street, should they be provided access through those homes into the State Parks? what about the people on the beach, themselves, do we now have to provide for some

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provision for them to move through the two sets of homes and into the State Park?

I understand a fire is of particular concern, but what about other health emergencies? do we now have to provide access to paramedics and life guards who may have an issue on the beach, should they now be allowed access through two sets of homes into the public park to have an escape route?

And, I am just concerned for the homeowners that this is a precedent that they really don't want, and it seems like don't need, and that to offer an escape access here just is going to create too many problems down the road all along, and so I won't be able to support the amendment.

VICE CHAIR SHALLENBERGER: Commissioner Kram.

COMMISSIONER KRAM: Thank you, and Commissioner Liberman I really appreciate your comments, and I have a concern, too.

I did ask Penny Elia when she called, about, you know, why is State Parks requiring there be no gates, and what is the issue? and it was interesting what she wrote to me about how in State there is no rule against gates, there is no rule against excluding private entry onto public lands.

As a matter of fact, she spoke to somebody from State Parks and they wrote her a note on that very issue, and they have done it before, but they have had some problems

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with, you know, people with unpermitted development in there, and I don't really see this as a situation where anybody who lives in a home is going to plant a garden outside, or other things like that, on the public land that will cause a problem.

And, so I would support the motion, and I have concerns not only with the fire side, but with the tidal uprush.

VICE CHAIR SHALLENBERGER: Commissioner Mirkarimi.

COMMISSIONER KRAM: I guess we --

VICE CHAIR SHALLENBERGER: Oh, I am sorry, I thought you were done.

COMMISSIONER KRAM: No, no, that's it.

VICE CHAIR SHALLENBERGER: Commissioner Mirkarimi.

COMMISSIONER MIRKARIMI: Thank you, Madam Vice Chair, I look forward to speaking to the motion, but based on the amendment, I appreciate, I think very much the intention in trying to help resolve the question on access, something that is as critical and dramatic as proper egress and ingress as it relates to public safety hazards.

The bottom line -- and I think it is a bright line -- is that any question as to a gift of public lands, whatsoever, is not a question to be clumsily, I think, processed, and the way that this has been, I think it reduced -- I don't think we are able to adjudicate this question, as well as I think we, and effectively, think we should do so.

I appreciate the response, I believe from the project manager from the Conservancy on this question, that may have been a more suitable response to this larger question, but as the amendment, motion for the amendment stands, then I would say that that is not something that we can support.

VICE CHAIR SHALLENBERGER: Thank you.

Commissioner Burke.

COMMISSIONER BURKE: From my understanding, currently, nothing that impedes the homeowners from going into the park now, is that true?

UNIDENTIFIED SPEAKER: That is correct.

COMMISSIONER BURKE: Yes.

UNIDENTIFIED SPEAKER: And, we do actually have a --

COMMISSIONER BURKE: So, what we are, in fact, doing is taking away access from them. If there is no ability for them to go through there, then what you are doing is you are denying them access.

Yes, or no?

UNIDENTIFIED SPEAKER: That is correct, but there is no legal obligation for allowance.

COMMISSIONER BURKE: There is also no rule that says --

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UNIDENTIFIED SPEAKER: We have no --

COMMISSIONER BURKE: Now, that bothers me. You know, I buy a home, and I have access to the State Parks, and then some guys who get appointed by some people come along and say you can't go that way through the State Park anymore because, and to not have a basis other than their personal opinion, because one person here says this is not a coastal issue.

Well, the Coastal Commission is impacting this community with a non-coastal issue, so I am going to support the main motion, but I think that denying these people access through the back of their houses, you know, I don't think that is appropriate.

VICE CHAIR SHALLENBERGER: Okay, I am going to weigh in, and then we will a vote.

I just want to say that in the many years that I lived in a city, I never had access to my back neighbor's land, unless they agreed that we would have a gate between my property and their property. And, in fact it did happen to me where there was a gate between my back yard and my neighbor's back yard, and the back yard neighbor changed, didn't care for dogs, and out went the gate, because the fence is common.

And, I just don't see the difference between that and what we have here. This is State Parks, but they are

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still the landowners, and so I think I will not be supporting the amendment.

And, with that I would like to ask Ms. Miller to call the role and this is on the amendment, the maker and seconder are asking for a "Yes" vote.

EXECUTIVE DIRECTOR DOUGLAS: Madam Chair, before Vanessa calls the role, just so that it is clear, you are not bifurcating the question, it is gates and the 3 feet, or has the 3 feet been deleted?

VICE CHAIR SHALLENBERGER: I believe we heard from the department that the 3 feet is essential for them, because of building the wall.

EXECUTIVE DIRECTOR DOUGLAS: That is right, but the 3 feet on other side, the east side, the Parks' side, that is not part of the motion now? okay, just want to make it clear that it is only the gates.

VICE CHAIR SHALLENBERGER: Yes.

EXECUTIVE DIRECTOR DOUGLAS: Okay.

SECRETARY MILLER: Commissioner Achadjian?

COMMISSIONER ACHADJIAN: Yes.

SECRETARY MILLER: Achadjian, yes.

Commissioner Blank?

COMMISSIONER BLANK: Yes.

SECRETARY MILLER: Commissioner Blank, yes.

Commissioner Burke?

004823

COMMISSIONER BURKE: Yes.

SECRETARY MILLER: Burke, yes.

Commissioner Kram?

[No Response]

Commissioner Liberman?

COMMISSIONER LIBERMAN: No.

SECRETARY MILLER: Liberman, no.

Commissioner Mirkarimi?

COMMISSIONER MIRKARIMI: No.

SECRETARY MILLER: Mirkarimi, no.

Commissioner Sanchez?

COMMISSIONER SANCHEZ: No.

SECRETARY MILLER: Sanchez, no.

Commissioner Stone?

COMMISSIONER STONE: No.

SECRETARY MILLER: Stone, no.

Commissioner Wan?

COMMISSIONER WAN: No.

SECRETARY MILLER: Wan, no.

Commissioner Wright?

COMMISSIONER WRIGHT: No.

SECRETARY MILLER: Wright, no.

Vice Chair?

VICE CHAIR SHALLENBERGER: No.

SECRETARY MILLER: No.

The vote is three, seven.

VICE CHAIR SHALLENBERGER: All right, thank you.

The main motion is now before us. I am going to go back through the list of the people who had signed up for the main motion, if you would like to pass, I don't think we would object.

Commissioner Wan.

COMMISSIONER WAN: Well, I think a lot has been said about this. I think this is, overall, a very good project.

Are you going to have some disruptions in the short term? of course you are. But, the long term benefits far outweigh that. You are going to have tremendous long term benefits. Is there habitat there, right now? yes, particularly for birds and certain species of fish, but overall the lagoon is degraded, and you can't hide your head about that and claim that it isn't. It is not functioning as it should, and this restoration, while it may not cure all of the problems is going to go a long ways toward curing many of them. This is including the inadequate circulation, the habitat function, and the water quality, and it is going to enhance the entire ecosystem of the lagoon, frankly.

And, you can't do that by simply pulling the plants, or using hand tools. You are going to have to change the nature of those channels, and that, unfortunately, does

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require some temporary disruption, and that is what you are going to have to deal with, and accept.

As for public access, yes the existing path is slightly more direct and shorter to get to the beach, but the new path will be no longer, will no longer block the tidal action, and frankly, it is going to have a lot more value from a public access perspective, with viewing areas, picnic tables and a bird blind that I am sure I am going to use.

Right now, when I go that that lagoon, I walk across that path, and I go directly to the beach. I don't stop to look at the lagoon. Part of it is because it is so stagnant, and sometimes it is really not what you want to look at. But, regardless, there is nothing more than just a path to get to the beach. The new public access path is going to be much more interesting, much more will have the ability for you to take a side walk to get to a viewing platform, or to use a picnic table, et cetera.

And, I do want to say that I am in full agreement with what our legal staff has said about this, the question of whether this is consistent with the policies of the *Coastal Act* protecting ESHA, and the Bolsa Chica decision.

The *Coastal Act* doesn't prohibit the restoration and enhancement of ESHA. If we did we could never restore anything, I mean, that is total nonsense. In fact, *Section 30233* specifically allows for the restoration as one of the

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allowable uses of the fill of wetlands.

As to the Bolsa Chica decision, it is totally different. There was not an issue of restoration. It was just the opposite. There wasn't any restoration of that ESHA over there, in that case, an area of ESHA was to be destroyed completely for development purposes, and then an area at least -- I don't know whether it was a mile away, or not, but it was on the other side of the Bolsa Chica area -- was to then have ESHA recreated in some way. That is not what this is all about. This is totally different.

So, this project, okay, is a good project overall. It is clearly the best and least damaging alternative, and it is the only way you are going to get this lagoon restored the way it ought to be.

VICE CHAIR SHALLENBERGER: Thank you.

Commissioner Sanchez.

COMMISSIONER SANCHEZ: Just briefly, I think that flushing is critical for the viability of this lagoon. We are having issues with the Buena Vista Lagoon, because it is not flushing at this time. It is, you know, literally being killed off, too many reeds. This is for the viability and for to really restore this lagoon you need that flushing, so, thank you.

VICE CHAIR SHALLENBERGER: Commissioner Mirkarimi.

COMMISSIONER MIRKARIMI: Madam Chair, I agree with

004827

much of what Commissioner Wan has said, but there is one question that I would just ask of staff, and it is more just for my own edification.

With regards to *Section 30233*, with regards to the project's intent on trying to improve the hydrology and tidal flow, as long as I have been on this Commission, and even before with the environmental work I have done, it is typically 9 out of 10, or 10 out of 10 methods used in a very heavy mechanized approach. And, I really would like to try to understand that in the reconstruction, or rehabilitation, is it that every time it is case-by-case there seems to be the one preferred method so that is seen as the more effective, and that requires a less passive approach -- I mean, not a less passive approach, but aggressive approach, and I am wondering that each time we are confronted and saved by these particular questions our answers are always the same, at least from the score card I have been able to sort of compare.

And, I would like to know, if this is just, you know, going to be, in essence, the consistent trend that I think we shall continue down this path.

EXECUTIVE DIRECTOR DOUGLAS: The answer really is that it depends. There are certain restoration projects that do require mechanized equipment because that is the only way to do it.

For example, there are some areas where dune grass removal, invasive dune grass, can only be done that way. There are other places where hand tools, or use of methods other than mechanized equipment, makes a lot of sense, like on the east side where you may have some cultural resources there at risk that hand operations make more sense, so it depends on the particular project, and the resources that might be at risk, and the experience that we have.

So, there is no across-the-board answer to that, other than that.

COMMISSIONER MIRKARIMI: And, I get that, but as it applies to this particular project, I look backwards into the EIR, and because there wasn't a challenge to the EIR, on the question of methodology, doesn't mean that the alternatives should not have been reviewed, I think, in a more thorough way, so, that is what I am trying to understand, because of the absence of challenge, and this does not necessarily mean, on a case-by-case, would there have been a more suitable alternative to achieve the same results, other than what is before us now?

EXECUTIVE DIRECTOR DOUGLAS: I'll let Jack answer that, or Jonna.

STAFF ECOLOGIST ENGEL: The fact that we weren't challenged does not mean that we didn't look into all of the other alternatives and determine that this was, in fact, the

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best alternative.

COMMISSIONER MIRKARIMI: So, what was runner up? I was looking for that in the EIR, if there was another alternative that may have seemed a less aggressive approach? I was curious because I could not find that in the EIR.

STAFF ECOLOGIST ENGEL: Well, there was no project --

COMMISSIONER MIRKARIMI: Right.

STAFF ECOLOGIST ENGEL: -- alternative, but all of the others that were considered to be of an adequate nature involved a lot of earth work, because that --

COMMISSIONER MIRKARIMI: I agree, because of the yardage of what is being dislocated --

STAFF ECOLOGIST ENGEL: Remember, this area was completely filled, and there were two baseball fields, and the consultant did show a nice diagram of the elevation, and in order to get to a functional tidal wetland system, you have to remove a lot of material.

So, and you know, so the design to get to a functional system, requires a lot of earth-moving equipment.

COMMISSIONER MIRKARIMI: Thank you, very much, and not that I am questioning the need for the project, itself, but if we are ever to sort of look backwards in a score card fashion when these kind of projects on lagoon restoration come before us, literally 10 out of 10, this is our approach

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for most of the permission in how we are advancing, I think, any particular program of rehabilitation.

For me, this is just a flag, and the flag is that if this is the preferred methodology, or the only methodology, so be it. If there are alternative to this, then sometimes I wish that would enter into the debate, and they don't.

Thank you.

VICE CHAIR SHALLENBERGER: Commissioner Burke.

[No Response]

Would you like to speak to the main motion?

COMMISSIONER BURKE: I would like to ask Mr. Van de Hoek to come back to the microphone.

VICE CHAIR SHALLENBERGER: Mr. Van de Hoek, is that who you are asking for?

COMMISSIONER BURKE: Yes.

VICE CHAIR SHALLENBERGER: And, we will need your name for the record, when you begin to answer.

MR. VAN DE HOEK: My name is Robert Van De Hoek, nick named Roy, and I am a biologist, and Pedro Nava made --

VICE CHAIR SHALLENBERGER: And, that is fine, let's see what the question --

COMMISSIONER BURKE: We remember Pedro, let me ask you a question. You know, I enjoyed your testimony today, I find it always very informing, and I remember that you testified also along with Ms. Hanscom representing CLEAN on the Perenchio project.

MR. VAN DE HOEK: Yes.

COMMISSIONER BURKE: And, there seems -- you know your approach to these two projects don't seem to me to be consistent. Can you explain that to me?

MR. VAN DE HOEK: Well, it may not appear consistent, but the goal is pragmatic, when we can try to get to, ultimately, saving enough open land to save nature and endangered species, and then the people can enjoy the public resource. And, with the Perenchio property, if I can understand you are talking about the mini golf course with the wall around it --

COMMISSIONER BURKE: Right, right.

MR. VAN DE HOEK: -- we were able to successfully, interestingly, to negotiate without having to go to a court trial, we had a settlement that resulted in a long term solution that Mrs. Perenchio will eventually, when she passes away, give the land to the California State Parks, and we will restore that, not necessarily into a marsh.

COMMISSIONER BURKE: Those solutions did not impact that lagoon, to the point where you felt it had been, even in a modicum, been rehabilitated?

MR. VAN DE HOEK: Well, that is complicated, what you just asked, and what I think is that we got a promise to

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not use any more pesticides on her golf course, and to keep it as open as --

COMMISSIONER BURKE: I remember what we did, but I am just saying that was confusing for me.

Also, I was confused as to what university is your degree from?

MR. VAN DE HOEK: My degrees are from California State University North Ridge in environmental biology and geography, and graduate, further graduate education at the University of Nevada, Reno, in range, wildlife and hydrology departments.

COMMISSIONER BURKE: Great, great, thank you so much.

MR. VAN DE HOEK: Thank you.

VICE CHAIR SHALLENBERGER: Is there any unwillingness to vote?

[No Response]

Seeing none, I will ask Ms. Miller to call the role, please.

COMMISSIONER BURKE: What are we asking?

VICE CHAIR SHALLENBERGER: Sorry? just to remind you, the maker and seconded are asking for a "Yes" vote.

SECRETARY MILLER: Commissioner Blank?

COMMISSIONER BLANK: Yes.

SECRETARY MILLER: Blank, yes.

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Commissioner Burke?
COMMISSIONER BURKE: Yes.
SECRETARY MILLER: Burke, yes.
Commissioner Liberman?
COMMISSIONER LIBERMAN: Yes.
SECRETARY MILLER: Liberman, yes.
Commissioner Mirkarimi?
COMMISSIONER MIRKARIMI: Yes.
SECRETARY MILLER: Mirkarimi, yes.
Commissioner Sanchez?
COMMISSIONER SANCHEZ: Yes.
SECRETARY MILLER: Sanchez, yes.
Commissioner Stone?
COMMISSIONER STONE: Yes.
SECRETARY MILLER: Stone, yes.
Commissioner Wan?
COMMISSIONER WAN: Yes.
SECRETARY MILLER: Wan, yes.
Commissioner Wright?
COMMISSIONER WRIGHT: Yes.
SECRETARY MILLER: Wright, yes.
Commissioner Achadjian?
COMMISSIONER ACHADJIAN: Aye.
SECRETARY MILLER: Achadjian, yes.
Vice Chair Shallenberger?

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VICE CHAIR SHALLENBERGER: Yes.
SECRETARY MILLER: The vote is unanimous.
VICE CHAIR SHALLENBERGER: Thank you.

*

*

[Whereupon the hearing concluded at 2:15 p.m.]

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