STATE OF CALIFORNIA – THE RESOURCES AGENCY GRAY DAVIS, *Governor*

CALIFORNIA COASTAL COMMISSION
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REGULAR CALENDAR
STAFF REPORT AND PRELIMINARY RECOMMENDATION

Application No.: 6-00-134

Applicant: City of Del Mar Agent: Linda Niles

Description: Excavation of approximately 15,000 cu.yds. of sediment from an approximately 1.5 acre area at the lagoon mouth to restore tidal action, discharge of the excavated materials over approximately .2 acres of supratidal beach, and regrading of the beach to re-establish natural contours; this is the follow-up to Emergency Permit #6-00-134-G and includes a request for additional mouth openings as needed for five years.

Site: Mouth of San Dieguito Lagoon, from the shoreline to the railroad bridge, Del Mar, San Diego County. APNs 299-030-08 & 09

STAFF NOTES:

Summary of Staff's Preliminary Recommendation: Staff recommends approval of a five-year permit to restore tidal action, as needed, at San Dieguito Lagoon. Issues raised by the proposal are potential impacts on wetlands, public access, water quality and beach erosion. The lagoon mouth closes periodically due to a buildup of sands and sediments washing in from the ocean with the tides and coming downstream from the significant amount of inland development that is occurring. When the mouth is closed, the lagoon ecosystem becomes distressed, which can lead to impacts on lagoon habitat (i.e., fish kills, etc.) Thus, it has been necessary to manually open the lagoon mouth from time to time to maintain the health of the ecosystem. The issues raised by this proposal are resolved with the attached special conditions which establish minimum biological criteria required to perform a mouth opening; provide seasonal restrictions on when openings may occur; and require monitoring and reporting of the effects of all openings on water quality and sediment transport in an annual report.

This item was originally scheduled for the March Commission meeting, but was postponed to address concerns raised in materials received shortly before the day of the hearing. Project opponents are concerned that inlet openings may have adverse effects on the beaches south of the inlet, resulting in a threat to their beachfront homes. They

submitted a technical report which has been reviewed by both the Commission's and City's technical staffs. The City's technical consultants have concluded that artificial inlet openings will not contribute to downshore beach erosion and have submitted a report supporting their position. Staff is in general agreement with the City's technical consultants. However, staff has included a shoreline monitoring condition to further examine beach erosion relating to the inlet breaching activities.

Substantive File Documents: Certified City of Del Mar LCP Land Use Plan and draft Implementing Ordinances; San Dieguito Lagoon Enhancement Plan; Review and Analysis of the Impacts of Maintaining the Mouth of the San Dieguito Lagoon Open on the Adjacent Beach, Sandy Lane, Del Mar, California, (Stone); Review of "The Stone Report" Regarding the Sandy Lane Homeowners Litigation Against the San Dieguito Lagoon Restoration Project (Jenkins/Elwany); Relationship between San Dieguito Lagoon and Del Mar Beach (Elwany/Hamilton); CCC Files: 6-83-148; 6-97-36; 6-99-12

I. PRELIMINARY STAFF RECOMMENDATION:

The staff recommends the Commission adopt the following resolution:

MOTION: ***I move that the Commission approve Coastal Development Permit No. 6-00-134 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 will not prejudice the ability of the local government having jurisdiction over the area to prepare a Local Coastal Program conforming to the provisions of Chapter 3. 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.

See attached page.

III. Special Conditions.

The permit is subject to the following conditions:

1. Term of Permit. This permit is valid for a period of five years from the date of Commission action. Future lagoon mouth openings beyond this date will require a coastal development permit from the California Coastal Commission or its successor in interest. Any modification of the project within the five year period, such as changes in channel size or location, timing of work, staging areas, or biological criteria used to determine the need for lagoon mouth openings, will require an amendment to this permit unless the Executive Director determines that no amendment is required.

2. Timing of Work. Lagoon openings shall only occur with the authorization of the California Department of Fish and Game that the dredging, on the date proposed, will not cause adverse impacts on sensitive, threatened, or endangered species or the biological productivity of the area, and shall adhere to the following criteria:

a. No dredging may occur within14 days before a holiday or scheduled beach event (ex. marathon; surfing contest., etc.).

b. No equipment shall be stored on the beach or in public parking areas overnight.

c. No work shall occur during the two-week period spanning Easter of any year.

d. Commission staff shall be notified prior to commencement of any dredging.

Openings during the summer months shall be avoided if possible; however, if openings are necessary during the summer, the following additional requirement will be met:

e. No work shall occur on Fridays, weekends or holidays between Memorial Day weekend and Labor Day .

3. Initiation of Work. The proposed channel excavation work shall be performed only:

a. when the dissolved oxygen levels in the lagoon are less than 5 parts per million (ppm), or

b. when the water salinity level in the lagoon is below 25 parts per thousand (ppt) and dissolved oxygen levels are determined by a qualified biologist to be likely to drop below 5 ppm within the next two-week sampling interval, or

c. when the water salinity level in the lagoon is above 33 ppt (hypersaline).

The sampling results or biologist's determination which results in a decision to open the lagoon mouth shall be reported in writing, if time permits, or verbally, with written follow-up, to the nearest Commission office within one business day of any proposed opening, and shall be submitted to the Coastal Commission as part of the annual report required in Special Condition #4.

4. Monitoring Report. On an annual basis by April 1 of each year, the applicant shall submit for the review and written approval of the Executive Director, a monitoring report for the project. The report shall summarize the impacts of the multiple openings, including the project's impacts on public access and recreation, and the biological productivity of the lagoon, any changes in the tidal prism caused by external factors (such as upstream development impacts, extreme storm conditions or unusual tides) which may have contributed to the need for the lagoon mouth openings, and shall include recommendations for any necessary changes or modifications to the project. In addition, the annual report shall include the following information for each of the openings that occur over the subsequent years:

a. The date of the opening(s) which occurred, along with the date of each subsequent closure.

b. The specific biological criteria (described in Special Condition #3) which authorized each opening, along with a site map indicating the location where the determining samples were taken.

c. Sand level measurements taken before and after each opening wherein 3,500 cu.yds. or more of excavation occurs. The surveys will occur at SI01, SI02, SI05 and SI06, from the back of the beach to a depth of -6 ft. NGVD. Beach profile surveys before the inlet opening shall be measured within 1 month of the opening; beach profile surveys after the inlet opening shall be measured within 1 month and within 3 to 4 months of the opening.

d. Any noted adverse impacts on lagoon resources or adjacent public beach or park and recreation areas resulting from each mouth opening, and recommendations to avoid or mitigate these impacts with future openings.

The report shall be submitted annually beginning the first year after Commission approval of the permit. The permittee shall undertake development in accordance with the approved plan. Any proposed changes to the approved plan shall be reported to the Executive Director. No changes to the approved plan shall occur without an amendment to this coastal development permit unless the Executive Director determines that no amendment is required.

5. Staging/Storage Area(s). PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the applicant shall submit a site plan and/or area map

delineating all areas, both on- and off-site, which are proposed to be used for staging and storing equipment. Staging/storage areas shall be subject to review and approval by the Executive Director, shall not involve the use of any environmentally sensitive lands, and shall minimize disturbance to public access and recreation to the maximum degree possible by avoiding the use of public parking areas and sandy beach.

The permittee shall undertake development in accordance with the approved staging/storage area plan. Any proposed changes to the approved plan shall be reported to the Executive Director. No changes to the approved plan shall occur without an amendment to this coastal development permit unless the Executive Director determines that no amendment is required.

6. Deposition of Dredge Material. Material removed from the inlet channel shall be placed on the beach adjacent to the inlet, above the mean high elevation or at the back beach. The preferred placement location is the area south of the inlet. If material cannot be placed on the beach south of the inlet, the dredge material can be placed on the beach area just north of the inlet.

IV. Findings and Declarations.

The Commission finds and declares as follows:

1. Detailed Project Description and History. The subject permit application has been submitted to achieve two goals. First, this represents the follow-up permit to Emergency Permit #6-00-134-G, issued on September 14, 2000. That activity involved the removal of approximately 15,000 cu.yds. of sediment from an area extending from the shoreline to the railroad bridge at the mouth of the San Dieguito River. The mouth had been closed almost continuously for about a year and a half, and biological conditions within the lagoon were rapidly deteriorating. The emergency mouth opening occurred shortly thereafter, with excavation beginning on September 18th and tidal action restored on September 23rd. In addition to the excavation activities, the project approved in the emergency action included the deposition of the excavated materials on the beaches immediately north and south of the river mouth and minor grading of those beaches to re-establish natural contours; the deposition of dredged materials on the beach is also proposed for any additional openings.

The second purpose of the application is to request authorization for future mouth openings, to be performed as needed over the next five years. These potential future openings are proposed to use the same location, equipment, design, etc. as were used in the emergency opening last year, and would be triggered by similar biological conditions as occurred with the emergency action. The Commission's ecologist has reviewed the biological criteria historically applied and has modified the salinity criteria (20 ppt to 25 ppt) to allow dredging to occur before the lagoon resources are imminently or actively distressed.

The Commission has a long history of permitting the artificial opening of lagoons in San Diego County, including Los Penasquitos, San Elijo and San Dieguito Lagoons. These openings were typically proposed based on certain criteria being met related to salinity, dissolved oxygen and other water chemistry conditions as indicators of impending fish kills, alga blooms or similar unhealthy occurrences. At Los Penasquitos and San Elijo Lagoons, the Commission has also approved a number of permits and amendments for opening the lagoon mouth as experiments to allow the lagoon mouth to remain open for a longer period of time; these involved the removal of a more substantial amount of material (sediments and cobble) than would occur with the intermittent emergency openings designed only to prevent serious biological degradation. Although older permits typically allowed a one-time opening only, more recently the Commission has been approving permits for a set period of time (ranging from one year to five years) wherein multiple openings could occur as needed based on certain biological criteria being met.

Unlike Los Penasquitos and San Elijo Lagoons, the openings at San Dieguito have generally been done pursuant to Coastal Development Permit #6-83-148. That permit was for implementation of portions of the 1979 San Dieguito Lagoon Enhancement Plan, and included a condition assigning the City of Del Mar the responsibility of opening the lagoon mouth once each year prior to the rainy season. The City now seeks permission to open the lagoon mouth more than once per year when specified biological or water quality criteria are triggered. The new permit, unlike CDP #6-83-148, would also impose monitoring requirements and restrictions to limit potential adverse impacts on public access and recreation and sand supply.

The City of Del Mar has a certified Land Use Plan, and the implementation plan was recently certified with suggested modifications; however, the City Council has not formally accepted the modifications as yet, and the City therefore has not assumed coastal development permit authority. As such, the Commission retains permit jurisdiction for the entire city at this time. Moreover, the lagoon, river mouth and beach areas that are the subject of this permit are all tidelands such that the Commission will retain permit jurisdiction over this particular site in perpetuity. Therefore, the Chapter 3 policies of the Coastal Act are, and will continue to be, the standard of review, with the City's certified LCP used as guidance.

2. Sensitive Habitats. The following Coastal Act policies are most applicable to this application, and state, in part:

Section 30231

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...

Section 30233

(a) The diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following:

[...]

(7) Restoration purposes.

(8) Nature study, aquaculture, or similar resource dependent activities.

(b) Dredging and spoils disposal shall be planned and carried out to avoid significant disruption to marine and wildlife habitats and water circulation. Dredge spoils suitable for beach replenishment should be transported for such purposes to appropriate beaches or into suitable long shore current systems.

(c) In addition to the other provisions of this section, diking, filling, or dredging in existing estuaries and wetlands shall maintain or enhance the functional capacity of the wetland or estuary. Any alteration of coastal wetlands identified by the Department of Fish and Game, including, but not limited to, the 19 coastal wetlands identified in its report entitled, "Acquisition Priorities for the Coastal Wetlands of California", shall be limited to very minor incidental public facilities, restorative measures, nature study, commercial fishing facilities in Bodega Bay, and development in already developed parts of south San Diego Bay, if otherwise in accordance with this division....

Section 30240 (b)

(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 such areas, and shall be compatible with the continuance of such habitat areas.

The subject site is located at the mouth of San Dieguito Lagoon, an environmentally sensitive habitat area that is one of the 19 priority wetlands listed by the State Department of Fish and Game for acquisition. At this time, the lagoon has multiple public and private ownerships; the actual project site is owned by the City of Del Mar. A Joint Powers Authority (JPA) was created several years ago to oversee the lagoon and its watershed, acquire private lands to form a linear park, and investigate restoration potentials throughout the lagoon. Concurrently, a major restoration effort is being planned by Southern California Edison and its partners to mitigate for impacts on sensitive plant and animal communities resulting from the operation of the San Onofre Nuclear Generating Station (SONGS). A significant feature of the SONGS restoration

plan will be maintaining the lagoon mouth in an open condition to maximize tidal flushing of the lagoon. In addition to these ongoing planning efforts, the Commission certified the San Dieguito Lagoon Enhancement Plan in the early 1980's, and Coastal Development Permit #6-83-148, which implemented portions of that plan. Both the enhancement plan and the subsequent permit stressed the importance of keeping the lagoon mouth open. The proposed development is not part of the SONGS restoration project and is not mitigation for impacts resulting from the operation of SONGS. It has been designed, however, to be compatible with the anticipated SONGS restoration project.

The proposed development involves the removal of sediments from the mouth of San Dieguito Lagoon. Under the Coastal Act, dredging of lagoons and/or open coastal waters is severely constrained. To be allowable under Section 30233, the proposed development must be one of the listed permitted uses. In this case, the proposal is for restoration purposes. In addition, the development must be found to be the least environmentally damaging feasible alternative, incorporate feasible mitigation measures for any associated adverse impacts and either maintain or enhance the functional capacity of the wetland system.

Information received from the various resource agencies (U.S. Department of Fish and Wildlife and State Department of Fish and Game) regarding past proposals to open this and other Southern California lagoon systems indicate that the biological resources of these lagoons have been significantly stressed due to the frequent closures of the lagoon mouths. Lack of tidal action has a number of adverse effects on a lagoon environment. The lagoon water becomes stagnant, reducing the oxygen levels in the water. Reduced oxygen can lead to eutrophication, the condition where a closed body of water can "turn over," where large amounts of methane and hydrogen sulfide gas are released at the bottom and absorbed into the water, leading to fish and benthic invertebrate kills. Another problem facing the lagoon environment is the salinity levels of the water. Together, lack of tidal influence and low levels of freshwater inflow increase the salinity and temperature of the water, creating a hypersaline situation which is stressful, if not deadly, to many forms of plant and animal life in the lagoon. Conversely, decreased salinity caused by the combination of high levels of freshwater inflow and lack of tidal action allows for the establishment and growth of freshwater vegetation such as willows, cattails and tules in areas formerly entirely covered by salt marsh vegetation.

Both the old Enhancement Plan and the plan currently being developed identify dredging to maintain a tidal flow into the lagoon as an important part of an overall management strategy to enhance the biological productivity of the lagoon. The proposed sediment removal will allow the mouth to remain open longer to flush out stagnant water, replace low-salinity water and allow for the reestablishment of estuarine and marine invertebrates, fish and plant species. As proposed, the project does not involve any alteration or impact to existing habitat. The subject development will restore and enhance the functional capacity of the lagoon, and thus, is a permitted use under Section 30233 of the Act.

Dredging the lagoon mouth is a relatively inexpensive means of increasing tidal flushing and improving the biological productivity of the lagoon in a manner that has the least impact on the lagoon and surrounding environment. The U.S. Department of Fish and Wildlife Service and the California Department of Fish and Game were actively involved last August/September when it was determined that an emergency mouth opening was warranted; these agencies have also indicated their support for maintaining the lagoon mouth in an open condition to the greatest degree possible.

The Commission's ecologist has also reviewed both the emergency action that occurred and the proposed request for future mouth openings and determined that the biological criteria required in Special Condition #3 are appropriate to assess the need to open the lagoon. Briefly, the criteria allow the mouth to be opened in three situations: 1) when dissolved oxygen levels are less than 5 ppm; 2) when the salinity level is below 25 ppt and oxygen levels are expected to drop below 5 ppm within two weeks; or 3) when the salinity level is above 33 ppt. The biological parameters addressing minimum salinity levels have been modified slightly such that an opening can occur under less stressful conditions than those dictated by the previously applied criteria. Thus, the proposed project would carry out the goals of the resource protection policies of the Coastal Act. However, to ensure the work continues to be reviewed by the appropriate resource agencies, Special Condition #2 requires that the proposed work be coordinated with the State Department of Fish and Game, and that the Commission be notified of the dredging operations.

In addition, Special Condition #4 requires an annual monitoring report to document all openings performed pursuant to this permit. The report must address the number and dates of each opening, the particular biological reason which prompted each opening, beach profiles before and after each opening, weather and tide conditions which may have contributed to the described criteria and any adverse impacts on the lagoon and the adjacent beach resulting from the opening(s). The report must document the openings over the year, summarizing what, if any, impacts on the lagoon resources occurred as a result of the project, and provide recommendations on how such impacts could be avoided or mitigated in the future should such a project be contemplated again.

In summary, and as conditioned, the project will have a positive impact on the natural resources of the lagoon. A closed lagoon mouth stresses the ecosystem beyond the point where it can recover on its own. The proposed development is an allowed use pursuant to Section 30233 of the Coastal Act, and the project is designed to minimize any potential adverse impacts on the environment. Therefore, the Commission finds that the proposed project, as conditioned, is consistent with Sections 30231, 30233 and 30240 of the Coastal Act.

3. Public Access/Recreation. The proposed project is located between the first public road and the sea. Sections 30210-30214 of the Coastal Act state that maximum access and recreation opportunities be provided, consistent with, among other things, public safety, the protection of coastal resources, and the need to prevent overcrowding. In particular, Section 30211 of the Act states:

> Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.

As discussed in the previous section, all the various resources agencies, lagoon managers, local coastal wetland experts, and the Commission's ecologist, have agreed that opening the lagoon mouth is beneficial to the lagoon environment. However, there are a number of concerns related to public access and recreation associated with the project.

The project site is the mouth of San Dieguito Lagoon, which empties into the Pacific Ocean at Del Mar. The river channel runs across the municipal beach at the northern end of the city, and can be traversed on foot during most tidal regimes. The public beach provides very popular day-use facilities for beach visitors and serves as an important recreational resource of region-wide importance. As the proposed development will occur on the beach and the far-western portions of the lagoon, the potential for adverse impacts on public access and recreational opportunities exists.

Based on the experience of previous lagoon mouth openings, for a short period after the lagoon mouth is opened, bacteria levels (fecal and total coliform counts) in the water exiting the lagoon are usually above health standards in the mouth and surfzone surrounding the mouth. As a result, County Public Health officials have had to post the surrounding beaches with signs prohibiting any body contact with the water because of potential health hazards caused by the high bacteria counts. Although this has always been a known concern, in permitting previous lagoon mouth openings, the Commission has not found this to be a significant impact on public recreational opportunities as the lagoon mouth openings generally occur in the non-summer months and the high bacteria levels only last a few days to a week.

Based on data collected from monitoring previous lagoon mouth openings (at several different regional lagoons), it can be anticipated that after an initial opening, bacterial counts will exceed water quality standards and body contact with the water in the general area of the lagoon mouth will be prohibited. However, these reports indicate that within a short period of time, "bacterial water quality in the surfzone should meet the recreational standard as seawater dilution of the Lagoon occurs and after contaminated water in the Lagoon has flowed out." In addition, because bacteria levels deteriorate quickly once tidal flow is established, the longer the lagoon stays open, the less often the area surrounding the mouth has to be closed. However, if the lagoon does close and is then reopened, resulting in high enough bacterial counts that the beach must be closed, the proposed development could significantly impact public recreational opportunities during high use periods such as weekends or holidays during the summer months.

The Commission finds that every effort should be made to avoid an opening on weekends, during holiday periods (especially spring break), and during the period between Memorial Day and Labor Day, when beach use is at its peak. Under the terms of the attached special conditions, no dredging can occur 14 days before a holiday or a

scheduled beach event, no operations would occur on weekends during the summer months, and on weekends in the winter only if necessary. Moreover, the conditions require that no equipment be stored on the beach or in public parking areas overnight. Although the conditions will not assure that the beach is never closed during weekends and holidays, it will help ensure that the highest levels of contaminants which are present immediately after the mouth is opened, have time to dissipate before the weekend and that no equipment will physically block the beach.

As discussed in greater detail in the section of this staff report regarding beach erosion, the dredged lagoon mouth should not adversely affect the public's ability to pass along the beach in front of the lagoon mouth. The dredged opening should result in a shallow flow of water that can easily be crossed by foot.

The Commission acknowledges that the project will also have a beneficial effect on public recreation. All sediments excavated from the lagoon are deposited on the beaches just north and/or south of the mouth, effectively augmenting the sandy area available for public use. The emergency opening in September, 2000 resulted in sands being deposited on the beach north of the inlet only. The beach remains open to the public during the excavation operations, except for the actual site of dredging. Following the September emergency action, the beach was posted as unsafe for water contact for a distance of 200 feet on either side of the inlet; this temporary condition lasted only a few days. Based on the monitoring reports of numerous lagoon/river mouth openings in San Diego County, the past openings do not appear to have imposed any significant hardships on the public. To ensure that this remains the case, Special Condition #3 requires the submittal of a monitoring report by the applicant which documents any noted adverse impacts on public access and recreation opportunities should the lagoon mouth require an opening in the summer. The report should also identify potential ways to mitigate any identified impacts should multiple openings of the lagoon be proposed again in the future.

The proposed project has been identified as being beneficial to the lagoon and its associated habitat. Some inconvenience to beach users could result if the lagoon must be opened in the summer months; however, it is the intention of the project to keep the lagoon mouth open as long as possible, which will reduce the impacts associated with individual openings. With the proposed conditions of approval, impacts to public access and recreation will be reduced to the maximum amount feasible. The applicant will be required to monitor and record any impacts and propose a means of mitigating any identified impacts for future similar projects. Thus, as conditioned, the Commission finds the proposed development can be found consistent with the public access and recreation policies of the Coastal Act.

4. Water Quality. The following Coastal Act policies are applicable to the proposed development and state:

Section 30230

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

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.

The issue of water quality has been discussed in the two previous findings, with regard to adverse impacts on the biological resources in the lagoon when the mouth is closed, and adverse impacts on public access and recreation immediately following a mouth opening. There is, however, a serious potential hazard to human health in situations where the lagoon mouth is closed for extended periods and the water quality therein is deteriorating. Many people, especially those with small children, recreate in the waters of the lagoon/river mouth instead of on the actual shoreline, since the waters of the lagoon/river mouth are much calmer than the open ocean, especially when the mouth is closed. Although health hazard warnings in the form of signs are generally in place during these situations, they are largely ignored, as evidenced by the large numbers of people playing in the lagoon mouth during closed situations. This further supports the argument for keeping lagoon mouths open as often as possible, since the health of human beings, as well as lagoon species, is endangered when the mouth is closed. The Commission finds the proposed development, which will maintain an open lagoon mouth for longer periods of time, is thus consistent with the cited sections of the Coastal Act.

5. Beach Erosion. San Dieguito Lagoon is a southern California lagoon that has had long periods of time that it is open and long periods of time that it is closed. In the past, the lagoon mouth has been mechanically breached and it has been opened by flood events. Opponents of this project maintain that opening the mouth of San Dieguito Lagoon adversely affects their properties, which are located immediately south of the inlet. They are attributing a current loss of sand in front of their homes, which was first noted shortly after the emergency mouth opening in September, to that action. In support of their contention, a report titled *Review and Analysis of the Impacts of Maintaining the Mouth of the San Dieguito Lagoon Open on the Adjacent Beach, Sandy Lane, Del Mar, California,* by Dr. Gregory Stone, was submitted to Commission and City staff for

consideration. As seen in the title of this report, the objections raised by opponents to the City's inlet opening are also directed at the larger San Dieguito Lagoon Restoration Project, which is currently in the planning stages. The larger project will provide for a permanently open lagoon inlet to maintain better tidal flushing to support the restoration effort over the long term. The City is requesting that the subject permit be valid for five years, on the assumption that by then the larger project will have been implemented and this permit will no longer be necessary.

The report concludes that the inlet opening causes downshore beach erosion and that a closed inlet results in sand accretion on the beach south of the inlet. These conclusions are drawn from the author's review of existing data, field observations, discussions with the Sandy Lane homeowners and beach profiles taken just north and south of the inlet in December, 2000 and January, 2001.

The Stone Report provides a number of findings and several recommendations. It finds that: (1) while the Del Mar beaches are among the last of the slightly more stable in San Diego, any action that would potentially interfere with a longer-term equilibrium should be avoided where possible; (2) there has been a net deficiency of sand on the beach that can be attributed to the opening of the lagoon; (3) some sand is lost offshore due to flows out of the inlet; (4) although the applicant's expert, Jenkins, suggested that downcoast by-passing of sand will occur through an ebb tidal bar, there is no evidence that the ebb shoal actually exists; (5) sand by-passing to the south does not occur when the lagoon mouth is open; and (6) the two beach surveys (December 19, 2000 and January 16, 2001) indicate higher erosion rates south of the channel that could conceivably be related to maintaining the channel open throughout the survey duration. Dr Stone further finds that this is a complex system. He recommends: "Observe the system after it is modified by way of restoration, and make changes to the design/management if and when it becomes necessary to do so;" use the dredge material to renourish the downdrift beaches immediately south of the channel; and develop and implement a detailed sand management plan to protect the downdrift properties. In addition, he concludes that "a departure from the conventional, widely used riprap structures [to vertical walls] may actually lead to higher erosion near the toe of the structures due to increased reflection."

Julie Hamilton added to Dr. Stone's recommendations in a March 7, 2001 letter to Peter Douglas. In this she requests that the Commission consider conditions on inlet breaching that:

> 1. The inlet cannot be opened unless the beach volume in front of the Sandy Lane properties is equal to 150 cubic meters per meter of beach.
> OR
> Prior to opening the inlet, the applicant shall place enough sand of appropriate quality and grain size on the beach in front of the Sandy Lane properties to assure that a beach volume of 150 cubic meters per meter of beach will be maintained while the inlet is open.

2. Prior to issuance of the coastal development permit, the applicant shall submit revised plans for the review and approval of the Executive Director showing that the northerly bank of the opening shall coincide with the northerly abutment of the Camino Del Mar Bridge as it crosses the San Dieguito River. The opening shall then extend to the ocean at a 45° angle to the north.

3. All beach quality material excavated from the opening of the inlet shall be placed and spread on the beach in front of the Sandy Lane properties.

The City's consultants have prepared a response titled *Review of "The Stone Report" Regarding the Sandy Lane Homeowners Litigation Against the San Dieguito Lagoon Restoration Project* by Scott A. Jenkins, Ph. D. and M. Hany S. Elwany, Ph. D. The consultants also prepared *Relationship between San Dieguito Lagoon and Del Mar Beach* by Hany Elwany, Ph. D. and Magan Hamilton.

The City's response reaffirms some of the findings regarding dynamics of San Dieguito Lagoon from previous studies undertaken either for the City or for Southern California Edison Co. Major conclusions of these studies are that: (1) the effects to the adjacent beaches from lagoon flooding are different from the effects from sustained tidal action into the lagoon; (2) that Dr. Stone's analysis relating beach erosion to inlet openings disregards the history of inlet opening that has been reconstructed by scientists from both the Edison Company and the Commission; (3) that ebb tidal bars or shoals can be clearly identified on many of the aerial photographs of San Dieguito Lagoon and that a bar could be identified on some of the exhibits provided by Dr. Stone; and (4) that the beach changes that Dr. Stone identified between his December survey and his January survey could be part of a larger regional, seasonal trend, that could not be detected since Dr. Stone did not provide any surveys of control points that were outside the area influenced by the inlet. The City also provided historic surveys of the beach area north and south of the lagoon, showing that the beaches near the lagoon have large seasonal variability in beach width; beach widths, except for the areas immediately adjacent to the lagoon, are not significantly affected by the lagoon mouth; and that dredging and opening the lagoon mouth is returning material to the sand budget. Further, the City proposes to survey SIO5, SIO1 and SIO2 from the back of the beach to –6 ft NGVD, prior to excavation and after the opening of the inlet is complete. A report on these surveys will be prepared and submitted to the executive director.

Staff has reviewed each of these reports and believes that all the researchers have provided valid observations and information on the site. San Dieguito Lagoon has been opening on its own as a result of high flood events. These events quickly open the lagoon mouth and scour a fairly deep flood channel. These events can rapidly alter the adjacent beach area and cause localized beach erosion. The homes at Sandy Lane are built on the lagoon spit and the lagoon is restricted from migrating further to the south by the revetment and armoring that the property owners at Sandy Lane have erected to prevent flooding. The homes immediately adjacent to the lagoon at Sandy Lane can experience significant beach erosion from both the lagoon and from ocean waves. The armoring that has been installed was placed in response to this erosion.

There is a difference between a flood channel and a sustainable channel open for tidal flushing. Flood openings occur when upstream water flows are high enough to break through the lagoon spit. Flood channels are established by the upstream water flows and not by the presence or absence of a tidal exchange channel through the lagoon mouth. The flood channel inlet will be narrow and deep, with fast flowing water. Following a flood event, the inlet channel will quickly fill in with sediment and establish a rather wide, shallow channel. Non-flood water flows tend to be slower and normally people can walk or wade through these flows without risk. As noted by the City's consultants, it is the flood events that had the greatest erosion potential; however the lagoon breaching for tidal exchange is a separate event. Floods will continue regardless of the lagoon breaching for tidal exchange.

Regular longshore transport of sand will continue while the inlet is open for tidal exchange. During the initial mechanical breach, there could be high flows if the lagoon level is higher than the ocean level. There could be a small diversion of sand offshore, into the nearshore littoral transport zone and some beach quality material could be diverted past the beach areas immediately adjacent to the inlet. To account for this possible, but small impact, Special Condition #6 requires that the beach quality material dredged from the inlet will be placed on the dry beach area to the south of the inlet. If this area is not available for disposal of the dredge material, the area to the north of the inlet can be used; however, the area to the south is preferred. This material will expand the protective beach that fronts Sandy Lane and offset any possible erosion from the higher flows that could occur immediately after the opening.

Dr. Stone provided profiles and beach surveys for the area immediately adjacent to Sandy Lane in December 2000 and January 2001. These surveys do not provide a vertical datum, but seem to go only to wading depth. The surveys were not taken to closure depth and no control sites were surveyed. Dr. Stone's profile information could show some small beach changes effected by the lagoon mouth opening, however, the data provided were not adequate to separate these possible effects from the recognized seasonal changes, reshaping of the dry beach, development of offshore bars, and longshore transport. This beach does exhibit seasonal changes and there is often a seasonal change in longshore transport from north to south, reflecting changes in storm tracks. The City's consultants provided plots of historic profiles for these locations and the two profiles surveyed by Dr. Stone fit within the historic range of shoreline change. When Dr. Stone's survey data are compared with historic shoreline change and put into context with on-going regional and seasonal shoreline change, it does not appear reasonable to attribute all these changes to the inlet opening. However, there could be some small localized changes that might be attributable to the inlet opening. Therefore, Special Condition #4 requires that the applicant undertake wading depth surveys before and after each mechanical opening. These surveys will be provided to the executive director in a report, and examination of the data may provide some indication that the inlet is affecting the local beach adjacent to the inlet. Since all material dredged from the inlet will be used as beach nourishment, this will provide a benefit to the beach that is expected to exceed any impact from the inlet opening itself.

Ms. Hamilton has provided a condition that established a beach volume of 150 cubic meters per meter as being adequate to protect Sandy Lane from the added impacts that could occur due to opening the inlet to tidal action. She provides no support for this value; neither that this amount of sand would be adequate to protect the back beach, nor that the inlet would cause anything comparable to 150 cubic meters per meter of beach loss. The calculation of total sediment volume prior to each inlet opening would require detailed and expensive surveys to closure. While some survey information would be required prior to opening the inlet, these surveys would not go to closure and it would not be possible to determine whether there were 150 cubic meters per meter of beach, or if additional sand would be needed. For a fully nourished profile, 150 cubic meters per meter of beach would compare with a dry beach width between 60 and 75 feet. This would be a more readily measurable "trigger" for concern about erosion of the downcoast properties. Nevertheless, the erosion impacts from the inlet opening are expected to be insignificant and so no additional nourishment would be necessary. The property owners at Sandy Lane may wish to develop a sand management plan and may wish to use the 60 or 75 feet dry beach width as a trigger for concern. However, there is no reason to tie this sand management plan to the inlet opening program.

Dr. Stone's findings concerning the benefits of riprap over vertical seawalls has no bearing on this project and will not be covered in detail here. However, Dr. Stone's brief coverage of this issue does not provide data to support his conclusions. His conclusions do not provide any time period for the supposed erosion difference, and his analysis does not consider any of the other differences between riprap revetments and vertical seawalls which have been of concern to the Commission. While this shoreline armoring analysis by Dr. Stone has no bearing on the current project, its inclusion in a report addressing the impacts of the inlet must be considered as a pre-emptive effort to establish support for maintaining the current seawall system at this property.

Therefore, the Commission finds that the conclusions in the Stone report are not supported by the facts, and concludes that mechanical opening of the San Dieguito Lagoon inlet should not result in increased erosion to the beach in front of the Sandy Lane properties. However, since both reports accurately state that information on shoreline processes in general is incomplete, Special Condition #4 (monitoring) also requires that sand levels be measured north and south of the inlet, and offshore, both before and after each opening to help determine whether inlet opening affects the movement and distribution of sand along the shoreline. Special Condition #6 will put the dredged material on the beach south of the inlet and will more than address any possible losses that could result from the inlet opening. Therefore, as conditioned, the Commission finds the proposed development consistent with Coastal Act policies addressing erosion.

6. Local Coastal Planning. Section 30604(a) also requires that a coastal development permit shall be issued only if the Commission finds that the permitted development will not prejudice the ability of the local government to prepare a Local

Coastal Program (LCP) in conformity with the provisions of Chapter 3 of the Coastal Act. In this case, as conditioned, such a finding can be made.

As stated, the subject site is located in the City of Del Mar, at the mouth of San Dieguito Lagoon, west of Highway 101 at the city's municipal beach. The proposed development has been reviewed and approved by the City, and is consistent with the certified LUP, which the Commission uses as guidance in the review of coastal development permit applications. As conditioned, the Commission finds the proposed development consistent with all applicable Chapter 3 policies of the Coastal Act, which will continue to be the standard of review in this area of original jurisdiction. Therefore, the Commission finds the proposed development, as conditioned, should not prejudice the ability of the City of Del Mar to complete and implement a certifiable local coastal program for the remainder of the City.

7. Consistency with the California Environmental Quality Act (CEQA). Section 13096 of the Commission's Code of Regulations requires Commission approval of Coastal Development Permits to be supported by a finding showing the permit, as conditioned, to be consistent with any applicable requirements of the California Environmental Quality Act (CEQA). Section 21080.5(d)(2)(A) of CEQA 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 proposed project has been conditioned in order to be found consistent with Chapter 3 policies of the Coastal Act. Mitigation measures, including measuring biological criteria to determine when an opening is warranted, measuring sand levels before and after an opening to determine if there are any changes in erosion rates, restrictions on timing of the work and submittal of monitoring reports, have been incorporated as conditions of approval which will minimize all adverse environmental impacts. As conditioned, there are no feasible alternatives or feasible mitigation measures available which would substantially lessen any significant adverse impact which the activity may have on the environment. Therefore, the Commission finds that the proposed project, as conditioned to mitigate identified impacts, is the least environmentally damaging feasible alternative and can be found consistent with the requirements of the Coastal Act to conform to CEQA.

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.

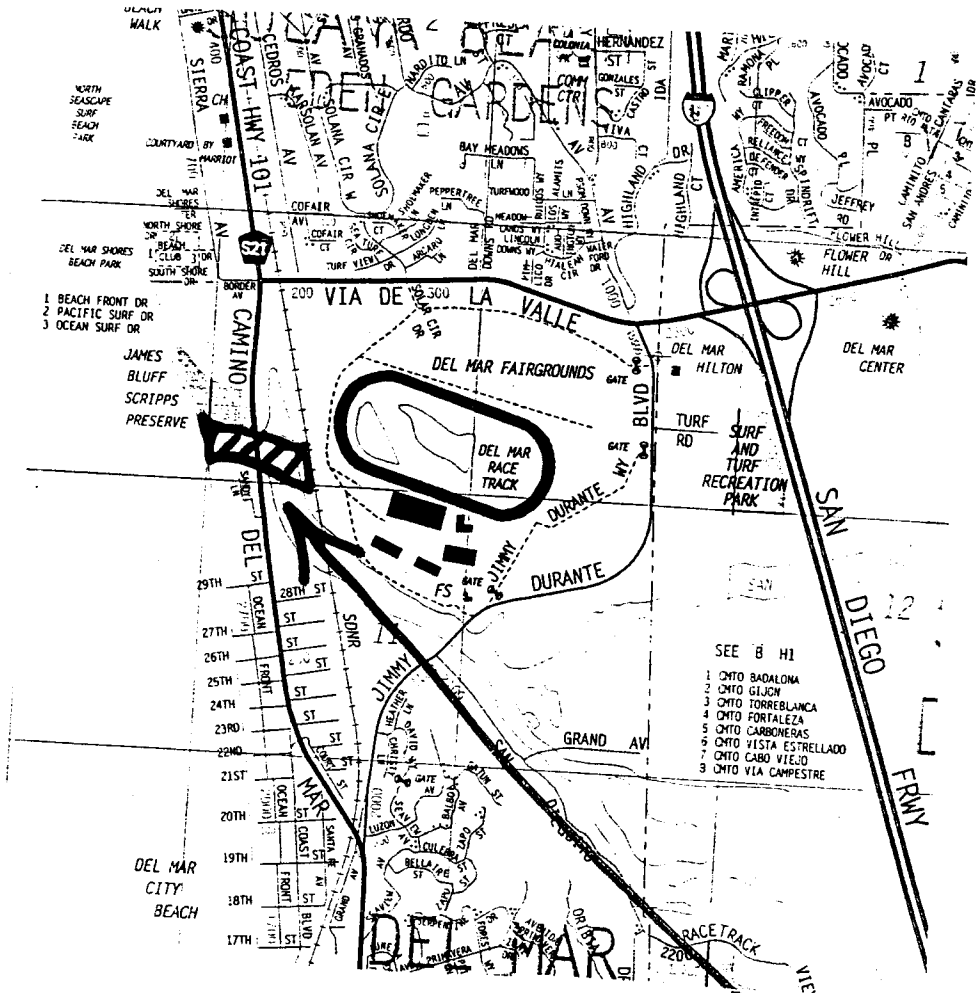
3. Interpretation. Any questions of intent or interpretation of any condition will be resolved by the Executive Director or the Commission.

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.

(G:\San Diego\Reports\2000\6-00-134 Del Mar stfrpt .doc)

6-00-134



Site

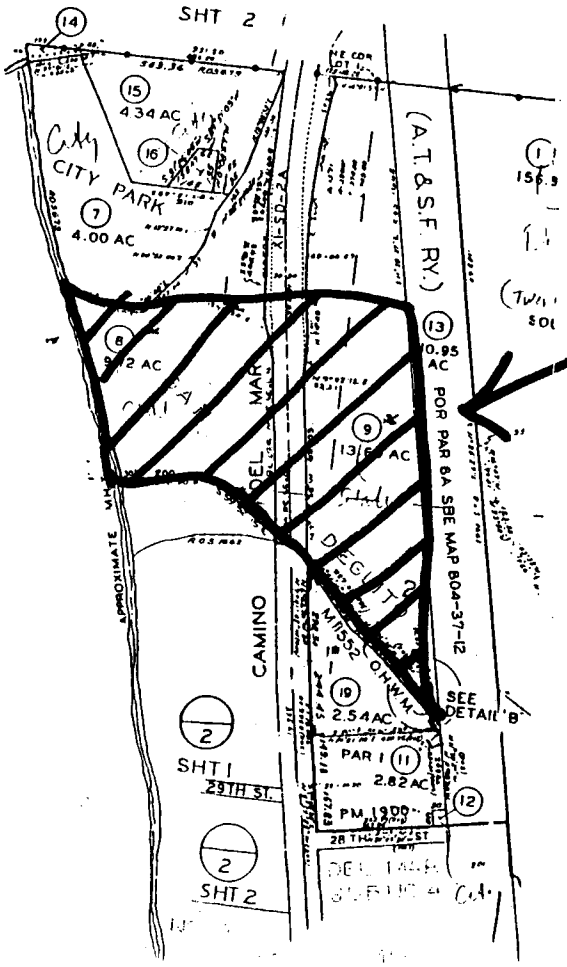


EXHIBIT NO. 1
APPLICATION NO.
6-00-134
Location Maps

California Coastal Commission

6-00-134

EXHIBIT NO. 2
APPLICATION NO. 6-00-134
Site Plan
California Coastal Commission

GENERAL NOTES

1. THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY OR STRUCTURES SHOWN ON THESE PLANS WAS OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. THE CONTRACTOR SHALL TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN ON THESE PLANS AND ANY OTHER LINES WHICH MAY NOT BE OF RECORD NOR SHOWN ON THESE PLANS. AS REQUIRED BY THE SPECIFICATIONS, THE CONTRACTOR SHALL PERFORM ALL EXPLORATORY EXCAVATIONS NECESSARY TO DETERMINE THE EXACT LOCATIONS AND DEPTHS OF ALL EXISTING UNDERGROUND FACILITIES INCLUDING CONNECTION POINTS AHEAD OF CONSTRUCTION. UNLESS OTHERWISE NOTED, ALL EXISTING UTILITIES SHOWN ON DRAWING ARE OF UNKNOWN DEPTH.
2. THE CONTRACTOR IS HEREBY NOTIFIED THAT ESSENTIAL AND PERTINENT INFORMATION REGARDING THE CONSTRUCTION AND COMPLETION OF WORK FOR THIS PROJECT IS CONTAINED IN THE CONTRACT DOCUMENTS AND SPECIFICATIONS; AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO READ AND REVIEW THIS INFORMATION TO THEIR OWN SATISFACTION PRIOR TO PERFORMING ANY WORK; AND THAT ANY DEFICIENT, INCOMPLETE OR INCORRECT WORK SHALL BE THEIR RESPONSIBILITY AND THAT SUCH DEFICIENT WORK SHALL BE REDONE TO MEET SAID REQUIREMENTS AT SOLEY THE CONTRACTOR'S EXPENSE.
3. NEITHER THE OWNER NOR THE ENGINEER OF WORK WILL ENFORCE SAFETY MEASURES OR REGULATIONS. THE CONTRACTOR SHALL DESIGN, CONSTRUCT AND MAINTAIN ALL SAFETY DEVICES, INCLUDING SHORING, AND SHALL BE SOLEY RESPONSIBLE FOR CONFORMING TO ALL LOCAL, STATE AND FEDERAL SAFETY AND HEALTH STANDARDS, LAWS AND REGULATIONS.
4. CONTRACTOR AGREES TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOBSITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, AND THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER AND ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.
5. THE CONTRACTOR SHALL CALL U.S.A. AT 1-800-422-4133 (FOR LOCATION OF EXISTING UTILITIES) A MINIMUM OF 48 HOURS PRIOR TO ANY WORK OR EXCAVATION.
6. CONTRACTOR TO REMAIN WITHIN THE PROJECT LIMITS.
7. CONTRACTOR TO PROVIDE PEDESTRIAN CONTROL AND FLAGGING.
8. SEE SHEET C-1 FOR CROSS SECTIONS.

SPECIFICATIONS

ALL WORK SHALL BE DONE ACCORDING TO THESE PLANS, SPECIFICATIONS AND STANDARD DRAWINGS. THE CONTRACT SPECIFICATIONS SHALL TAKE PRECEDENCE OVER STANDARD SPECIFICATIONS AND DRAWINGS.

CONTRACT SPECIFICATIONS

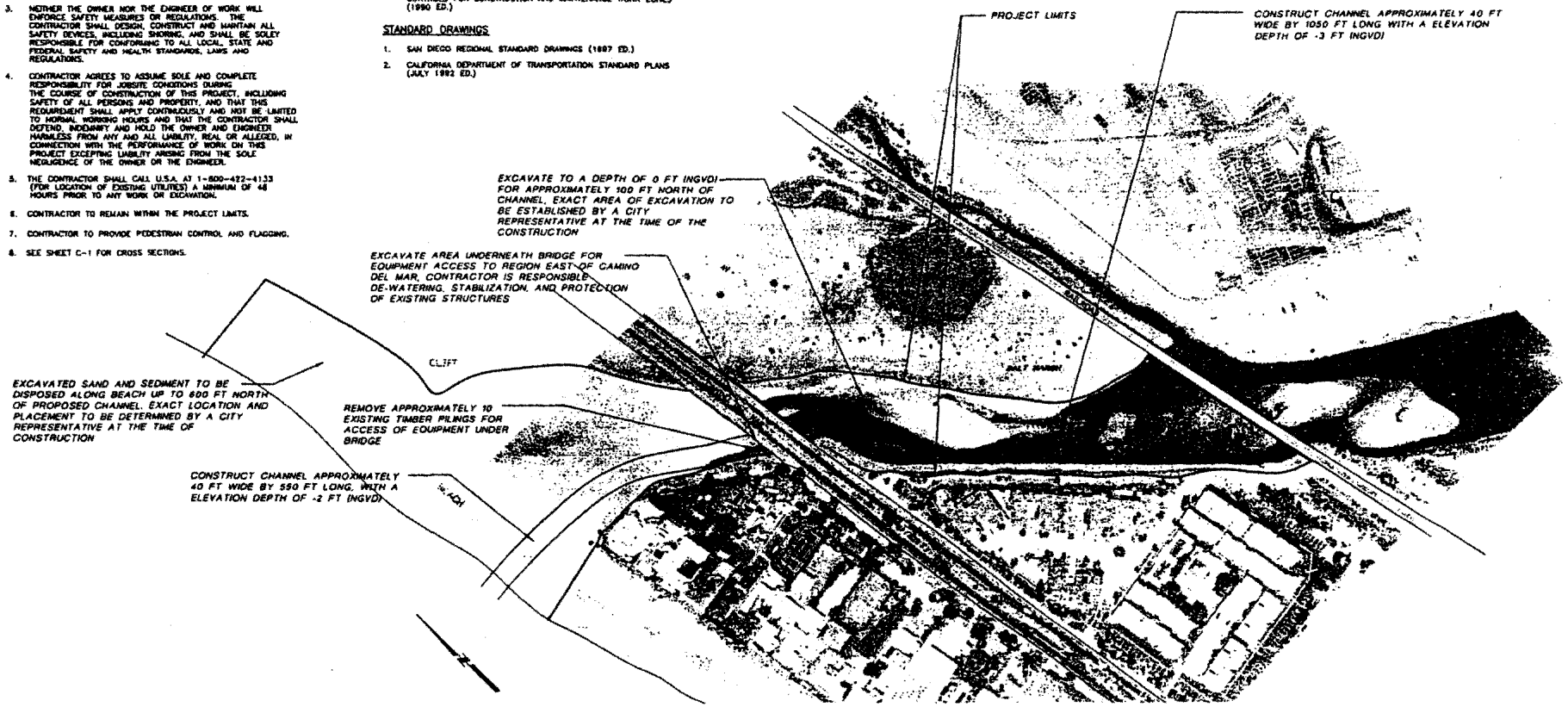
1. SPECIFICATION ENTITLED "CONTRACT DOCUMENTS, SPECIFICATIONS, AND REDUCED DRAWINGS FOR THE CONSTRUCTION OF SAN DIEGUITO LAGOON OPENING", DATED SEPTEMBER 2000

STANDARD SPECIFICATIONS

1. STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, (1997 ED.), PARTS 2, 3, AND 4 INCLUDING THE REGIONAL SUPPLEMENTAL AMENDMENTS.
2. CALIFORNIA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS (JULY 1992 ED.)
3. CALIFORNIA DEPARTMENT OF TRANSPORTATION, "MANUAL OF TRAFFIC CONTROLS FOR CONSTRUCTION AND MAINTENANCE WORK ZONES" (1990 ED.)

STANDARD DRAWINGS

1. SAN DIEGO REGIONAL STANDARD DRAWINGS (1997 ED.)
2. CALIFORNIA DEPARTMENT OF TRANSPORTATION STANDARD PLANS (JULY 1992 ED.)



REVISION	DESCRIPTION	APPROVED	DATE	SCALE: AS SHOWN	DESIGNED: HE	DRAWN: MD	CHECKED: EA
				ACAD FILE NO.			
				PROJECT NO. 2.015 SP			

PLAN
1" = 200'

CITY OF DEL MAR
SAN DIEGUITO LAGOON OPENING

SHEET G-1 of 3 sheets

March 7, 2001

Julie M. Hamilton
Attorney at Law

Mr. Peter Douglas
Executive Director
California Coastal Commission
45 Fremont, Suite 2000
San Francisco, CA 94105-2219

RE: COASTAL DEVELOPMENT PERMIT APPLICATION NO. 6-00-134

Dear Mr. Douglas:

I represent the Del Mar Sandy Lane Association ("Sandy Lane".) Del Mar Sandy Lane Association is the Homeowner's Association for the 12 properties located on the West side of Camino Del Mar adjacent to the south bank of the San Dieguito River. Sandy Lane is opposed to issuance of a coastal development permit for the opening of the inlet to the San Dieguito Lagoon. This project will not be consistent with the Coastal Act unless additional mitigation measures are required.

The City of Del Mar is requesting a coastal development permit to open the inlet to the San Dieguito Lagoon on a regular basis for the next five years. Staff has recommended conditions that require certain criteria be met prior to opening the inlet. These criteria relate to biological resources and public access with no consideration given to impacts on Sandy Lane caused by the opening.

Artificial Opening of the Inlet to the San Dieguito Lagoon Will Cause a Significant Loss of Sand South of the Opening.

Sandy Lane initiated a series of surveys to monitor sand loss because of its concern regarding the impacts of inlet opening on the beach sand supply. Sandy Lane also commissioned an expert in the field of coastal processes to perform an analysis of impacts on Sandy Lane caused by artificial inlet opening. This analysis was performed by Gregory Stone, Ph.D., the Exxon Mobil Professor of Marine Geology at the Coastal Studies Institute of Louisiana State University.

Dr. Stone prepared "A Review and Analysis of the Impacts of Maintaining the Mouth of the San Dieguito Lagoon Open on the Adjacent Beach, Sandy Lane, Del Mar, California."[1] Dr. Stone's report points out the errors in coastal process studies prepared by Jenkins and others for the San Dieguito Wetland Restoration Project. Dr. Stone also came to a number of conclusions that differ from past studies: Significant findings in his report include, but are not limited to the following:

[1] Dated February 18, 2001, submitted to Commission staff under separate cover.

Letters of Opposition

5958 Rancho Mission Rd. Ste 207 ▪ San Diego, CA. 92108 ▪

1. Using data provided by Dr. Howard Chang for the period of October 1, 1926 through September 30, 1995 (Table 1), it is apparent that the entrance to the lagoon remained closed 72% of the time. Using the same data set but for the shorter period of time January 1, 1980 through December 31, 1989 (Table 2), it is observed that in contrast to the findings of Jenkins, the inlet was open for a period of 48.7 months (40% of the record) and closed for 71.3 months (60% of the record). This clearly contradicts the findings of Jenkins in that the inlet was open nearly 75% of this period. Thus, there is no evidence to support the conclusion of Jenkins that the shoreline accretion measured at DM 560, 580 and 590 is primarily due to the high incidence of inlet opening. In fact to the contrary, it can be argued that the higher percentage of inlet closure enhanced stability along the downdrift beach because the degree of interruption of longshore transport of sediment to the south was minimized. As shown in Table 3, high rates of accretion were also noted further south along Torrey Pines during this interval indicating a period when the entire region was undergoing infusion of sediment, not simply at Del Mar. The source of the material is not known. (Stone Report, p. 5.)

2. From 1974 to a period before the winter of 1982 and 1983, the beach width and volume immediately south of the entrance to the San Dieguito Lagoon showed a marked downward trend indicating erosion. This is an important observation in that it is precisely this location that will likely be most sensitive to the effects of channel opening and consequent sand deprivation. It is observed that for the period between 1974 and pre-storms in the winter of 1982-83, the inlet remained open some 50.2 months and closed 31.5 months. Therefore the net deficiency of sand on the beach can be attributed to the opening of the lagoon. (Stone Report, p. 12.)

3. After marked beach erosion attributed to the storms of winter 1982 and 1983, post-storm recovery of the beach at Del Mar was virtually accomplished three years after the storms at all sites with the exception of the profile immediately south of the entrance to the lagoon. The site was more than 60% deficient in sand in 1985 when compared to what it was prior to the storms. It is likely that the beach did not recover because the channel remained open for a period of 13.6 months between February 1983 and March 1984. It is important to note that beach recovery was apparent between the early part of 1984 and winter 1985 when the inlet was primarily closed for more than 18 months. (Stone Report, p. 12.)

Dr. Stone's report contains extensive evidence refuting previous findings by Jenkins, Elwany and others. Jenkins refuted previous evidence presented by Rick Engineering on behalf of Sandy Lane based on the presence and function of an ebb tide bar. Jenkins found that the ebb tide bar acts as a sand bypass and prevents the beaches south of the opening from eroding. Jenkins' assumptions were not based on field

evidence but were based on sand transport mechanics which assume the presence of an ebb shoal feature. In fact, field evidence does not indicate the presence of an ebb shoal/bar offshore. There is strong evidence indicating that the channel is serving as a sediment sink to southward longshore transport, thus causing a loss of sand downdrift.

In plain English, the evidence does not support Jenkins' conclusions and leads more strongly to a conclusion that the open inlet contributes significantly to the loss of sand south of the opening. To further document this conclusion, Sandy Lane had field surveys conducted after the inlet was opened. These surveys reveal trends that are typical of an inlet causing higher levels of erosion downdrift (south of the opening). All of this evidence supports anecdotal evidence that has been observed by the residents of Sandy Lane for nearly 50 years, opening the mouth of the lagoon causes sand loss south of the opening, directly seaward of the Sandy Lane properties.

The Inlet Opening is Not Consistent With The Shoreline Erosion Policies of The Coastal Act.

Section 30233 of the Coastal Act allows for the "diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes...where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects..." The Stone report clearly demonstrates opening of the inlet will cause adverse environmental effects on shoreline erosion. The recommended conditions and findings supporting approval of this project do not address or mitigate the adverse effects on shoreline erosion. Therefore approval of this project is not consistent with Section 30233 of the Coastal Act.

Section 30253 of the Coastal Act requires that new development minimize risks to life and property in areas of high flood hazard and neither create nor contribute significantly to erosion or destruction of the site or surrounding area. Dr. Stone's report also shows that artificial opening of the inlet will increase the risk to property along Sandy Lane by causing increased erosion of beach sand. This project is not consistent with Section 30253 of the Coastal Act unless the risk to Sandy Lane can be minimized.

The Inlet Opening Will Have a Significant Impact on Public Access and Recreation, and Is Not Consistent With the Public Access and Recreation Policies of the Coastal Act.

The public access policies of the Coastal Act require that new development shall not interfere with the public's right of access to the sea, including the use of sandy beach. (Coastal Act Section 30211.) The Coastal Act also requires that oceanfront land suitable for recreational use shall be protected for recreational use. (Coastal Act Section 30221.) Contrary to the analysis in the staff report, this project will have a significant impact on public access and recreational use of the beach.

As discussed above, opening of the inlet will result in increased shoreline erosion south of the opening. This will result in a subsequent loss of sandy beach available for use by the public for passive and active recreation uses. The staff report acknowledges the loss of sandy area for the opening itself, but fails to recognize the additional loss of sandy beach due to erosion.

The Environmental Impact Report for the San Dieguito Wetland Restoration Project finds that permanent opening of the inlet will make the river impassable at the mouth 80% of the time, compared to 49% of the time without the project. It is reasonable to assume that artificial opening of the inlet on an intermittent basis will make the river impassable somewhere between 49% and 80% of the time. Yet, staff finds that "the river channel runs across the municipal beach of the city, and can be traversed on foot during most tidal regimes." (Staff Report p.9.) The only public access condition recommended by staff requires monitoring of impacts if the mouth is opened during the summer. This condition fails to address impacts on public access for any other time of the year.[2]

The staff report fails to consider impacts on public access caused by the loss of sandy beach from shoreline erosion. The staff report also fails to accurately analyze the publics' ability to cross the river. Additional mitigation will be required to minimize impacts on public access and recreation that were not considered in developing the recommended conditions.

Staff Reliance on Other Lagoon Openings as Justification or Precedence for This Opening is Misplaced.

Staff makes reference to other situations in San Diego County where the Commission has approved permits for artificial opening of lagoon inlets. These openings involve a very different set of circumstances and should not be viewed as precedence for this project. Staff specifically referenced permits to open Los Penasquitos and San Elijo Lagoon in addition to San Dieguito lagoon. It is important to note, San Dieguito Lagoon is the only lagoon in San Diego County with existing residential structures located on the beach immediately adjacent to the opening.

A third party reviewer of the coastal processes effects of the Wetland Restoration Project stated: "When I saw the San Dieguito lagoonal system, I wondered why it was chosen as a mitigation measure, given its highly urban locale and associated modifications...A less anthropologically stressed lagoon system would have been a better choice from a fiscal point of view."[3]

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[2] Keeping in mind, the LCP Implementing Ordinances recommended for approval by staff would prohibit opening from November 15 - March 15 each year. This would leave from March 15 to Memorial Day and from Labor Day to November 15 available for inlet opening.

[3] Letter from Ashish Mehta to Frank Melone dated April 21, 1998.

The differences between the San Dieguito Lagoon and other lagoons in San Diego County must be noted when considering permission to artificially open the inlet. Opening the inlet to San Dieguito lagoon has a direct and immediate effect on the ability of the residents of Sandy Lane to protect their homes. There is no other situation like this in San Diego County.

Additional Mitigation Measures are Necessary for This Project to be Found Consistent With the Coastal Act.

The Coastal Commission cannot find this project consistent with Coastal Act policies if approved as recommended. Additional mitigation measures are required to address impacts on shoreline erosion and public access. Based on the information contained in the report prepared by Dr. Stone, Sandy Lane believes the following conditions will adequately mitigate the impacts noted above:

1. The inlet cannot be opened unless the beach volume in front of the Sandy Lane properties is equal to 150 cubic meters per meter of beach.

   - OR -

   Prior to opening the inlet, the applicant shall place enough sand of appropriate quality and grain size on the beach in front of the Sandy Lane properties to assure that a beach volume of 150 cubic meters per meter of beach will be maintained while the inlet is open.

2. Prior to issuance of the coastal development permit, the applicant shall submit revised plans for the review and approval of the Executive Director showing that the northerly bank of the opening shall be coincident with the northerly abutment of the Camino Del Mar Bridge as it crosses the San Dieguito River. The opening shall then extend to the ocean at a 45° angle to the north.

3. All beach quality material excavated from the opening of the inlet shall be placed and spread on the beach in front of the Sandy Lane properties.

These mitigation measures will assure that sand loss south of the opening will be minimal or will be mitigated by the provision of additional sand. Impacts to Sandy Lane are further reduced by placing the inlet opening as far north as physically possible given the constraints of the Camino Del Mar Bridge. This puts distance between the opening and Sandy Lane and provides an additional supply of sand before the sand at Sandy Lane is lost. Utilizing excavated materials on the beach in front of Sandy Lane provides further mitigation of the impacts on shoreline erosion.

These additional conditions are necessary to mitigate the loss of sand to shoreline erosion caused by opening the inlet. These conditions must be required for the

Commission to find the project consistent with Sections 30233, 30253, 30211 and 30221 the Coastal Act.

Thank you for your time and consideration. I look forward to continuing a working relationship with the Commission and its staff in the future.

Very truly yours,

Julie M. Hamilton

Julie M. Hamilton

CC: Ellen Lirley, San Diego District
Linda Niles, City of Del Mar
Del Mar Sandy Lane Association

THE ZUMBRUN LAW FIRM

A Professional Corporation

March 8, 2001

RECEIVED
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CALIFORNIA
COASTAL COMMISSION
SAN DIEGO COAST DISTRICT

Agenda Item No. 12F
Coastal Permit Application
No. 6-00-134
Opposition of Citizens United
to Save the Beach

Ms. Ellen Lirley
Coastal Program Analyst
California Coastal Commission
San Diego Coast Area
7575 Metropolitan Drive, Suite 103
San Diego, CA 92108-4402

Dear Ms. Lirley:

Re: Objections to the Granting of Coastal Development
Permit Application No. 6-00-134, Agenda Item No. 12F

Enclosed please find objections to the granting of the above-referenced permit application submitted on behalf of Citizens United to Save the Beach. Please be advised that a copy of the objections enclosed herewith has been mailed directly to commissioners, alternates for commissioners, and the four nonvoting members on the commission.

If you have any questions, please do not hesitate to contact me.

Sincerely,

JEFFERY B. YAZEL
Attorney

Enclosure

3800 Watt Avenue
Suite 101
Sacramento, CA 95821

Tel 916-486-5900
Fax 916-486-5959

8

THE ZUMBRUN LAW FIRM

A Professional Corporation

March 8, 2001

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CALIFORNIA
COASTAL COMMISSION
SAN DIEGO COAST DISTRICT

Agenda Item No. 12F
Coastal Permit Application
No. 6-00-134
Opposition of Citizens United
to Save the Beach

California Coastal Commission
San Diego Coast Area
7575 Metropolitan rive, Suite 103
San Diego, CA 92108-4402

Dear Chair and Members of the Commission:

OBJECTIONS TO THE GRANTING OF COASTAL DEVELOPMENT
PERMIT APPLICATION NO. 6-00-134, AGENDA ITEM NO. 12F

These objections are submitted on behalf of Citizens United to Save the Beach (CUSB). In doing so, CUSB incorporates all other comments opposing the granting of the Coastal Development Permit Application No. 6-00-134 (CDPA) and especially the February 12, 2001, letter by Ms. Julie Hamilton on behalf of Del Mar Sandy Lane Association.

I

MISSTATEMENTS SUBMITTED IN CDPA
REQUIRE DENIAL OF A COASTAL DEVELOPMENT PERMIT

The CDPA certified and signed by Ms. Linda S. Niles on behalf of the City of Del Mar (Del Mar) at Page 8, Section 7, Subsection 2, states: "I understand that the failure to provide any requested information or any misstatements submitted in support of the application shall be grounds for either refusing to accept this application, for denying the permit, for suspending or revoking a permit issued on the basis of such misrepresentations, or for seeking of such further relief as may seem proper to the Commission." The CDPA signed and submitted on November 13, 2000, contains misrepresentations that the proposed development is not in or near areas of state or federally listed rare, threatened or endangered species (see CDPA, page 6, question 9b), that the lagoon mouth opening is an "emergency," and that this project is minor excavation. These representations are false.

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Fax 916-486-5959

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A. Endangered Species

Though Ms. Niles certifies in the CDPA on November 21, 2000, that the proposed development is not in or near areas of state or federally listed rare, threatened or endangered species, on September 19, 2000, Del Mar made extraordinary efforts in the case of ***Citizens United to Save the Beach v. City of Del Mar***, San Diego County Superior Court, North County Branch, Case No. GIN010018 to prove that endangered species do exist in this same project area. In fact, Del Mar submitted three expert's declarations for the very purpose of proving there are endangered species in or near the proposed development. ***See*** attached copies of declarations. The Supplemental Declaration of Steve Schroeter (Schroeter Declaration) attached hereto as Exhibit 1 at 3:24-26 states: "Cord grass is important habitat for a number of wetland species and is of critical importance to the endangered clapper rail (Rallus sp.)." The Schroeter Declaration at 4:4-6 further states: "The loss of critical habitat in the lagoon may have a potentially significant impact on the least tern, Belding's sparrow, and clapper rail, all endangered species."

The Declaration of Andrew Lissner, Ph.D., in Opposition to Petitioners' Request for Temporary Restraining Order (Lissner Declaration) attached hereto as Exhibit 2 at 2:8-10 states: "Threatened and endangered species in San Dieguito Lagoon that can be impacted by degraded water and/or habitat quality include the least tern and Belding's savannah sparrow, potentially among others." The Lissner Declaration at 2:18-19 also states: "Therefore, it is our opinion that interim opening of the lagoon is appropriately protective of the lagoon ecosystem, including threatened and endangered species and their habitat." ("Our opinion" refers to Dr. Lissner's representation that Mike Dungan and Keith Merkel, other project biologists, share this consensus opinion.)

To drive home the point that endangered species exist in the project area, Del Mar submitted Supplemental Declaration of Hany Elwany, attached hereto as Exhibit 3 at 3:14-16, which mimicked the words of the other experts in stating: "Cord grass is important habitat for a number of wetland species and is of critical importance to the endangered clapper rail (Rallus sp.)." ***See*** attached declaration.

In addition, the environmental impact report for the San Dieguito Wetlands Restoration Project, prepared September, 2000, repeatedly acknowledges the existence of endangered species in the proposed development area. Among those listed are light footed clapper rail, California least tern, Canadian goose, Belding's savannah sparrow and the brown pelican as well as others.

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Del Mar cannot have it both ways. Either endangered species exist in or near the proposed development project or they do not. Is the truth regarding endangered species in the opinions of Mike Dungan, Keith Merkel, Dr. Andrew Lissner, Hany Elwany and Steve Schroeter sworn under oath and submitted to the Court under penalty of perjury or in the representations made by Ms. Niles in the CDPA?

B. The Opening of the Lagoon Mouth Is Not an Emergency Situation

The CDPA is improperly labeled as an emergency project. The natural build-up of a sand berm creating the San Dieguito lagoon does not constitute an "emergency" as defined under CEQA.

Section 21060.3 states:

> "'Emergency' means a sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services. 'Emergency' includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage."

The build-up of sand at the mouth of the San Dieguito River has been recurring for decades. Tractors have been used many times in the past to dredge a channel from the San Dieguito lagoon into the Pacific Ocean. This time the sand berm had been building since April, 1999. The San Dieguito lagoon situation was and is neither sudden nor unexpected and thus does not qualify as an emergency under Section 21060.3.

Furthermore, in its September 21, 2000, ruling, the Court noted in ***Citizens United to Save the Beach v. City of Del Mar*** that "it is not persuaded on the current record that the project qualifies as an emergency as defined by Public Resources Code section 21060.3. Under the reasoning of Western Municipal Water (supra), Castaic Lake Water Agency v. Santa Clarity (1995) 41 Cal.App.4th 1256 and Los Osos Valley Associates v. San Luis Obispo (1994) 30 Cal.App.4th 1670, the court is compelled to construe narrowly the emergency exemption. Here, there is not substantial evidence of a sudden unexpected occurrence, involving clear and imminent danger that would qualify the project for the exemption provided by section 21080 (a) (4)."

Since the Court did not deem the September, 2000, opening of the lagoon mouth an emergency, then surely asking for an emergency permit looking five years into the future is far less likely to be deemed an unexpected sudden occurrence and thus it is improper to label this project an emergency.

C. The Lagoon Mouth Opening Project Is
Not Minor Excavation But Massive Dredging

The CDPA is improperly labeled as a minor excavation effort. Labeling the excavation of 15,000 cubic yards of sediment a minor excavation is a misrepresentation. To illustrate this deception, please note the August 16, 2000, memorandum from Linda S. Niles to the Honorable Mayor and City Council attached hereto as Exhibit 4 suggesting possible solutions to the closed river mouth at Page 3, Option 2: "Conduct a ***massive*** dredging effort to remove sand all the way from the river mouth to railroad bridge." (Emphasis added.) Clearly, when the same individual describes the same project to one body as a "massive dredging effort" and to another body as a "minor dredging effort" there has been a misrepresentation and thus credibility and the representations made in the CDPA are in serious question. The repeated misstatements submitted in support of the CDPA are grounds for both denying the permit and suspending or revoking the permit issued on the basis of these misrepresentations and for seeking further relief as may seem proper to CCC.

II

OBJECTIONS TO THE GRANTING
OF COASTAL PERMIT NO. 6-00-134

A. CEQA Requirement

The 15,000-yard Del Mar beach excavation is a new project to which the California Environmental Quality Act (CEQA) applies and the required CEQA process has not been followed. Previous permits and previous CEQA processes relative to the lagoons in the San Dieguito River basin concerned altogether different projects in different locations, and none of those permits or CEQA processes of the past provide valid support for an excavation project of the size planned by Del Mar in 2001 at the river mouth of the San Dieguito River.

B. CCC's Lack of Authority Over Tidelands

The lands at the river mouth, where most of Del Mar's beach excavation is expected to take place, are tidelands. Tidelands at this river mouth and the submerged lands around the area are sovereign lands of the State and may not be used except in accordance with the Public

Trust Doctrine announced by the California Supreme Court and in accordance with the dictates of the Coastal Initiative of 1972, enacted by the people of the State. CCC has no jurisdiction and no authority over any tidelands of the State, and no permit it issues would have any validity with respect to tidelands. Most of the lands surrounding these river mouth tidelands are in private ownership with titles issued as patents from the federal government. The water boundary of most of these lands is the line of mean high tide. There are few uplands in the river mouth area to which a Coastal permit to excavate sand could apply that are neither tidelands nor private property, making the issuance of a Coastal permit to Del Mar invalid.

C. Del Mar Application Part of Wetlands Restoration Project

Creating a permanent open mouth for the San Dieguito River is part of a mitigation measure required of Southern California Edison (SCE) by CCC to compensate for ecological damage done by the enlargement of a nuclear power plant, a profit-making venture. Del Mar's effort to create an open river mouth is a premature effort to further SCE's project which already faces challenges in court. CCC has required and coerced SCE, a private company, to take over if not expropriate the use of an existing public beach in order to perform SCE's private mitigation measures. CCC is not authorized or empowered by the Coastal Act to take away from the public an existing public beach and turn it over to a private company to be used to mitigate environmental damage by a profit-making venture. The cities of Del Mar or San Diego or the Joint Powers Authority do not have the power to give away public lands, especially public beaches, to private companies for such private purposes.

D. The Private Use of Public Wetlands

A part of the area surrounding the lagoons to the east of the San Dieguito river mouth area is already wetlands in public ownership. As part of the SCE mitigation project these existing wetlands are also being turned over to that private company to perform its private mitigation measures. This is also a gift of public lands for private purposes, which the law does not allow. Furthermore, these wetlands are already serving a public purpose in purifying the waters flowing through the San Dieguito watershed to the ocean via the "kidney effect" of wetlands on drainage water. To appropriate the wetlands to another use would be a violation of the federal Clean Water Act and several state laws regulating water quality.

E. Repeating Failure as a Crime Against Nature

In September, 2000, Del Mar, in violation of both state and federal law, had 15,000 yards of beach sand moved in an effort to create a permanently open river mouth for the San Dieguito River. The ocean closed it in ten weeks, making the excavation an expensive failure where

an inexpensive failure would have accomplished just as much. Now the perpetrators of the first failure are requesting permission to repeat that illegal and expensive project once again with the results being entirely predictable: the open mouth will not last long. Now CCC is being asked to share the blame and the public humiliation that the Del Mar Council has already earned. Misery loves company. If natural forces close the river's mouth, it is a crime against nature for public officials to keep it open in violation of the law and against all odds and physical reality. These officials should be required to reimburse the public treasury for the cost of their repeated follies.

F. Sand Replenishment Project Makes
Open River Mouth More Difficult

Next month the Regional Sand Replenishment Project will be adding more sand to Del Mar's beach, a project welcomed by most beach users. This project will add much more sand that is now there onto all the beaches of San Diego County, including the Del Mar beach. This extra sand will, besides increasing the width and depth of the sandy beaches, most likely improve the ability of the ocean to close the San Dieguito River mouth in an even shorter time period. This is government action at its worst--one government agency trying to keep the river mouth open and another agency making it more difficult to do so. Both these activities have public support and both are expensive. Conflicting issues should be resolved BEFORE public moneys and public confidence in government are squandered.

G. Conflicting Environmental Uses of the Wetlands

The specified purposes of SCE's San Dieguito Wetlands Restoration Project, as required by CCC, are in conflict with each other, in conflict with other legal requirements, and in conflict with nature. Wetlands cannot simultaneously be a habitat for endangered species, a habitat for saltwater fish, a habitat for freshwater fish, and act as a kidney system for a watershed. Birds, different fish species and wildlife will determine which fish survive in the lagoon no matter what humans plan. It is a matter of which species in the lagoon is higher up on the food chain. Storms and dry spells will determine how much of the time the river mouth will remain open, and therefore whether the lagoon is a saltwater pond or a freshwater pond. Contrary to expectations, SCE is in no position to "guarantee in perpetuity" that the river mouth will be kept open to perpetuate a saltwater-dominated tidal lagoon. SCE cannot even guarantee its own existence for the rest of this year. A serious public debate is now developing about whether wetlands that are part of a river system can be put aside as habitat if they are already useful for water cleansing. In cases where it is impossible for the wetlands to serve both purposes which purpose has the higher ecological rank with the public and the government: clean water or wildlife habitat?

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H. A Preferable Project

A freshwater or a saltwater lagoon should be developed using water pipes carrying the preferred type of water to where it is wanted within the lagoon area. This pipe system would be coupled with a drain that will pump excess, but clean, water away from the lagoon. This combination of faucet and drain will create a water flow that will maintain a desirable water quality for a healthy lagoon. The public beach should play no part in creating or maintaining such a lagoon project and the sandy beach should be left to the forces of nature. Existing wetlands should also remain as they are and be left completely alone. New wetlands should be developed where they do not already exist to serve any purpose desired by those that develop and pay for them.

CONCLUSION

The opening of the San Dieguito Lagoon is riddled with conflicts. Sand excavation versus sand replenishment, polluted lagoon versus polluted beach and ocean, fresh water versus salt water, wetlands and endangered species versus nuclear power, truth versus fiction. To further the lagoon opening, Del Mar has submitted evidence to the court that is completely the opposite of the CDPA it submitted to CCC. These misrepresentations and conflicts require that CCC deny CDPA No. 6-00-134, suspend or revoke any permits issued on the basis of these misrepresentations and seek such further relief as the Commission deems proper.

Sincerely,

JEFFERY B. YAZEL
Attorney at Law

Enclosures

cc: California Coastal Commission Chair and Members

EXHIBIT 1

TAMARA A. SMITH (SB #113819)
DEL MAR CITY ATTORNEY
McDOUGAL, LOVE, ECKIS, SMITH & BOEHMER
460 North Magnolia, Drawer 1466
El Cajon, California, 92022-1466
(619) 440-4444

Attorney for Respondent, CITY OF DEL MAR

ENDORSED
SEP 19 2000
By L. Mena-Sanchez, Deputy

SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF SACRAMENTO

CITIZENS UNITED TO SAVE THE BEACH, an unincorporated association; and JOHN FLETCHER JAEGER, an individual, Petitioner, vs CALIFORNIA STATE LANDS COMMISSION; a state agency; CITY OF DEL MAR; 22nd DISTRICT AGRICULTURAL ASSOCIATION, and DOES 1 through 50, inclusive, Respondents.	Case No. AS-05062 **SUPPLEMENTAL DECLARATION OF STEVE SCHROETER** Date: 9-21-00 Time: 9:00 a.m. Dept: 54 Judge: Joe S. Gray

I, STEVE SCHROETER, declare and state as follows:

1. I am a Research Biologist in the Marine Science Institute of the University of California at Santa Barbara and a principal contract scientist for the California Coastal Commission's program to monitor mitigation impacts of Southern California Edison's ("SCE") San Onofre Nuclear Generating Stations Units 2 and 3. One of my responsibilities is to monitor the impending wetland restoration in the San Dieguito Lagoon The restoration is required of SCE as a condition of those mitigation impacts. The project will cost in excess of $55 million. The head agency for the project is the San Dieguito River Valley Joint Powers Authority, comprised of the County of San Diego and the Cities of San Diego, Solana Beach, Del Mar Poway, and Escondido. I have held these positions throughout the time-frame involved in the above-referenced matter. The

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1 facts set forth below are known to me by my own personal knowledge and, if called to testify, I
2 would be competent as a witness at trial. The views expressed in the declaration are mine in my
3 capacity of a professional scientist and should not be construed as representing the official view of
4 the Coastal Commission.

5 2. This declaration is to support the emergency inlet maintenance of San Dieguito
6 Lagoon and to urge its immediate implementation. It is my understanding the Court has requested
7 additional information to support the fact that the conditions in the San Dieguito Lagoon constitute
8 an emergency that requires an inlet opening as soon as possible. To supplement my declaration of
9 September 15, 2000, I believe the facts support that conditions in the San Dieguito Lagoon have
10 declined during the present lagoon closure and have now reached a critical level, and that failure to
11 implement immediate inlet opening will result in significant degradation which will require costly
12 remediation over the long term.

13 3. The "natural" quality of the lagoon has been altered in the past 100 years due to
14 construction of roads, bridges, highways, and houses, which have constricted the lagoon channels
15 and reduced tidal flushing. Fresh water flow into the lagoon has been decreased by agriculture
16 usage of the San Dieguito River water. Despite the increasing impact of development, the lagoon
17 mouth has remained open about 60%-70% of the time over the last several decades. However, the
18 current lagoon closure has persisted since early April of 1999. Opening of the river mouth in
19 June 1999, lasted only a few days. Previous studies of this lagoon have shown that given the
20 present narrowed lagoon channels, it is a near certainty that, in the absence of a major flood, the San
21 Dieguito Lagoon will remain closed to tidal action over the next year without inlet maintenance.
22 The present extreme conditions are very far from those under which the plants and animals in the
23 lagoon evolved, and with which they are adapted to cope.

24 4. Due to lagoon closure, water quality throughout the lagoon has steadily worsened
25 over the last eighteen (18) months.

26 5. The lack of tidal flushing has resulted in progressively lower salinities, higher
27 temperatures, and lower levels of dissolved oxygen over the course of the summer months of 2000.
28 Dissolved oxygen values have decreased to approximately 5 parts per million ("ppm") in much of

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the lagoon, in some locations dissolved oxygen is near zero. This represents a significant stress to animals (and even plants) living in the lagoon The lower salinity has promoted the growth of large quantities of duckweed throughout the lagoon. The lack of flushing has allowed large quantities of green algae which is normally swept out of the system, to build up to extremely high levels, so that it now covers between 50%-100% of the water surface in much of the lagoon. Due to the increasing degradation of water quality in the lagoon, these large quantities of algae and vascular plants have begun to die. The dead and rotting algae and plants further reduce dissolved oxygen levels and produce excess nutrients, resulting in a vicious cycle of eutrophication in the lagoon. The high temperatures experienced in recent weeks have brought this process to a critical condition, which can accurately be described as an emergency.

6. The worsening water quality in the lagoon has had severe adverse effects on lagoon biota. There is clear evidence for this in recent fish kills in the channels east of the now-closed inlet The pace of fish kills has increased alarmingly, and includes large numbers of all sizes and classes of California halibut and diamond turbots. This is particularly disturbing, since these species (California halibut in particular) require coastal lagoons as nursery areas Failure to open the lagoon in the near future will result in the loss of significant numbers of recruits to the open ocean populations. Based on observations of the sizes of the dead flat fishes, several different year classes will be lost if the closed condition is allowed to remain in effect Hundreds if not thousands of fish have already died and thousands or tens of thousands more may die unless the river mouth is opened.

7. Another important biological loss is that of cord grass (*Spartina maritima*) Cord grass was transplanted to the lagoon during the restoration efforts of the California Department of Fish and Game ("CDF&G") in 1983. Due to the generally open condition of the lagoon inlet in the ensuing decades, cord grass populations flourished in the CDF&G restoration. Cord grass is important habitat for a number of wetland species and is of critical importance to the endangered clapper rail (*Rallus sp.*). The recent extended closure of the lagoon has resulted in an 80%-90% decline in cord grass and continued closed conditions will reduce it even further, completely eliminating past restoration efforts and their value to the future restoration efforts in the lagoon

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While difficult to quantify precisely, it seems safe to argue that most of the value of the cord grass restoration will be lost unless the inlet is opened quickly.

8. The present unusual lagoon closure has resulted in clearly documented degradation of water quality and biota in the San Dieguito Lagoon. The loss of critical habitat in the lagoon may have a potentially significant impact on the least tern, Belding's sparrow, and clapper rail, all endangered species. The closure represents an "unnatural" event to which the natural healing and recovery mechanisms of the biota are not adapted, and which requires human intervention to remedy. Finally, the closure is putting past restoration efforts of the CDF&G at grave risk and will require significant efforts in addition to the $55 million impending restoration by Southern California Edison.

9. The Los Penasquitos Lagoon is located immediately to the south of the San Dieguito Lagoon. The Los Penasquitos Lagoon undergoes a similar excavation to open the river mouth up to four times a year to protect and preserve the ecological balance of the lagoon. Based upon my experience with the opening of the Los Penasquitos Lagoon I can affirmatively assert that the opening of the San Deiguito Lagoon will not pose an adverse effect upon the environment. The opening of the San Deiguito Lagoon will have a positive effect on ocean flora and fauna in providing nutrients to the ocean dwellers. The only negative effect will be a temporary closure of the ocean immediately adjacent to the river mouth for approximately 2 days after the river mouth is opening. Based upon my experience with the San Dieguito Lagoon and other similar lagoons the opening of the river mouth does not pose a significant health risks and the positive effects on the environmental far outweigh the temporary closure of a short stretch of the ocean to swimming. The closure of the area surrounding the inlet is not unusual in that it frequently occurs at many river mouths due to nutrient-laden water entering the ocean.

10. The potential health risks are greater if the lagoon is not opened due to the lagoon being a breeding ground for mosquitos, etc.

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I declare under penalty of perjury under the laws of the State of California that the forgoing is true and correct and executed on this 18th day of September 2000, at Del Mar, California.

Stephen Schroeter, Ph.D

STEVE SCHROETER

EXHIBIT 2

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ENDORSED
SEP 19 2000
By L. Mena-Sanchez, Deputy

TAMARA A. SMITH (SB #113819)
DEL MAR CITY ATTORNEY
McDOUGAL, LOVE, ECKIS, SMITH & BOEHMER
460 North Magnolia, Drawer 1466
El Cajon, California, 92022-1466
(619) 440-4444

Attorney for Respondent, CITY OF DEL MAR

SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF SACRAMENTO

CITIZENS UNITED TO SAVE THE BEACH, an unincorporated association, and JOHN FLETCHER JAEGER, an individual, Petitioner, vs. CALIFORNIA STATE LANDS COMMISSION; a state agency; CITY OF DEL MAR; 22nd DISTRICT AGRICULTURAL ASSOCIATION; and DOES 1 through 50, inclusive, Respondents	Case No. AS-05062 **DECLARATION OF ANDREW LISSNER, Ph.D., IN OPPOSITION TO PETITIONERS' REQUEST FOR TEMPORARY RESTRAINING ORDER** Date: 9-21-00 Time: 9:00 a.m. Dept: 54 Judge: Joe S. Gray

I, ANDREW LISSNER, declare and state as follows:

1. I am employed by Science Applications International Corporation and one of the leading biologists on the San Dieguito Wetland Restoration project. The facts set forth below are known to me by my own personal knowledge and, if called to testify, I would be competent as a witness at trial.

2. This declaration represents a consensus among project biologists (Drs. Andrew Lissner and Mike Dungan, and Mr. Keith Merkel) regarding the tradeoff between interim, human-directed opening of the San Dieguito Lagoon inlet vs. no direct action.

3. The conservative and environmentally protective approach is to open the inlet to avoid potentially significant impacts to existing habitats and communities, including threatened and

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endangered species, that would result if the inlet remains closed and does not open naturally during the ensuing fall and winter. Under the scenario of the inlet remaining closed, continued degradation of water quality and/or broader inundation of saltwater marsh areas by freshwater from runoff and the river would likely result in interim losses of habitat value and longer recovery times for this ecosystem once the restoration project is initiated. This is because the restoration project will minimize impacts to the existing wetland habitat, so the remaining habitat and species will represent important colonizers of the post-construction environment.

4. Threatened and endangered species in San Dieguito Lagoon that can be impacted by degraded water and/or habitat quality include the least tern and Belding's savannah sparrow, potentially among others. The extent of specific impacts will be influenced by the duration and intensity of the degraded conditions. Variability in rainfall and river flows, including the past several years, make it difficult to predict whether the inlet will open naturally (or not) during the next few months. However, continuing impacts to water and habitat quality in the lagoon system are a present and continuing problem and certainty. Impacts to the environment could be significant.

5. Finally, impact to near shore ocean water quality from the interim, directed opening of the inlet would be short term (e.g., days to a week), as compared to the much longer term impacts (e.g., months to years) to the lagoon habitats and species that could result from failing to open the inlet. Therefore, it is our opinion that interim opening of the lagoon is appropriately protective of the lagoon ecosystem, including threatened and endangered species and their habitat.

I declare under penalty of perjury under the laws of the State of California that the forgoing is true and correct and executed on this 18th day of September 2000, at Del Mar, California.

ANDREW LISSNER, Ph.D.

EXHIBIT 3

TAMARA A. SMITH (SB #113819)
DEL MAR CITY ATTORNEY
McDOUGAL, LOVE, ECKIS, SMITH & BOEHMER
460 North Magnolia, Drawer 1466
El Cajon, California, 92022-1466
(619) 440-4444

Attorney for Respondent, CITY OF DEL MAR

ENDORSED
SEP 19 2000
By L. Mena-Sanchez, Deputy

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SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF SACRAMENTO

CITIZENS UNITED TO SAVE THE BEACH, an unincorporated association; and JOHN FLETCHER JAEGER, an individual, Petitioner, vs. CALIFORNIA STATE LANDS COMMISSION; a state agency; CITY OF DEL MAR; 22nd DISTRICT AGRICULTURAL ASSOCIATION; and DOES 1 through 50, inclusive, Respondents.	Case No. AS-05062 **SUPPLEMENTAL DECLARATION OF HANY ELWANY** Date: 9-21-00 Time: 9:00 a.m. Dept: 54 Judge: Joe S. Gray

I, HANY ELWANY, declare and state as follows:

1. I am the president and owner of Coastal Environments which provides environmental and biological consulting services to the City of Del Mar. I have held this position throughout the time-frame involved in the above-referenced matter. The facts set forth below are known to me by my own personal knowledge and, if called to testify, I would be competent as a witness at trial.

2. This declaration is to support the emergency inlet maintenance of San Dieguito Lagoon and to urge its immediate implementation. It is my understanding the Court has requested additional information to support the fact that the conditions in the San Dieguito Lagoon constitute an emergency that requires an inlet opening as soon as possible. To supplement my declaration of September 15, 2000, I believe the facts support that conditions in the San Dieguito Lagoon have

declined during the present lagoon closure and have now reached a critical level, and that failure to implement immediate inlet opening will result in significant degradation which will require costly remediation over the long term.

3. The "natural" quality of the lagoon has been altered in the past 100 years due to construction of roads, bridges, highways, and houses, which have constricted the lagoon channels and reduced tidal flushing. Fresh water flow into the lagoon has been decreased by agriculture usage of the San Dieguito River water. Despite the increasing impact of development, the lagoon mouth has remained open about 60%-70% of the time over the last several decades. However, the current lagoon closure has persisted since early April of 1999. Opening of the river mouth in June 1999, lasted only a few days. Previous studies of this lagoon have shown that given the present narrowed lagoon channels, it is a near certainty that, in the absence of a major flood, the San Dieguito Lagoon will remain closed to tidal action over the next year without inlet maintenance. The present extreme conditions are very far from those under which the plants and animals in the lagoon evolved, and with which they are adapted to cope.

4. Due to lagoon closure, water quality throughout the lagoon has steadily worsened over the last eighteen (18) months, as depicted in Inlet Channel, South Channel, and North Channel oxygen level graphs attached hereto as Exhibit "A."

5. The lack of tidal flushing has resulted in progressively lower salinities, higher temperatures, and lower levels of dissolved oxygen over the course of the summer months of 2000. Dissolved oxygen values have decreased to approximately 3 parts per million ("ppm") in much of the lagoon; in some locations dissolved oxygen is near zero. This represents a significant stress to animals (and even plants) living in the lagoon. The lower salinity has promoted the growth of large quantities of duckweed throughout the lagoon. The lack of flushing has allowed large quantities of green algae which is normally swept out of the system, to build up to extremely high levels, so that it now covers between 50%-100% of the water surface in much of the lagoon. Due to the increasing degradation of water quality in the lagoon, these large quantities of algae and vascular plants have begun to die. The dead and rotting algae and plants further reduce dissolved oxygen levels and produce excess nutrients, resulting in a vicious cycle of eutrophication in the lagoon. The

high temperatures experienced in recent weeks have brought this process to a critical condition, which can accurately be described as an emergency.

6. The worsening water quality in the lagoon has had severe adverse effects on lagoon biota. There is clear evidence for this in recent fish kills in the channels east of the now-closed inlet. The pace of fish kills has increased alarmingly, and includes large numbers of all sizes and classes of California halibut and diamond turbots. This is particularly disturbing, since these species (California halibut in particular) require coastal lagoons as nursery areas. Failure to open the lagoon in the near future will result in the loss of significant numbers of recruits to the open ocean populations. Based on observations of the sizes of the dead flat fishes, several different year classes will be lost if the closed condition is allowed to remain in effect.

7. Another important biological loss is that of cord grass (*Spartina maritima*). Cord grass was transplanted to the lagoon during the restoration efforts of the California Department of Fish and Game ("CDF&G") in 1983. Due to the generally open condition of the lagoon inlet in the ensuing decades, cord grass populations flourished in the CDF&G restoration. Cord grass is important habitat for a number of wetland species and is of critical importance to the endangered clapper rail (*Rallus sp.*). The recent extended closure of the lagoon has resulted in an 80%-90% decline in cord grass and continued closed conditions will reduce it even further, completely eliminating past restoration efforts and their value to the future restoration efforts in the lagoon. While difficult to quantify precisely, it seems safe to argue that most of the value of the cord grass restoration will be lost unless the inlet is opened quickly.

8. The present unusual lagoon closure has resulted in clearly documented degradation of water quality and biota in the San Dieguito lagoon. The closure represents an "unnatural" event to which the natural healing and recovery mechanisms of the biota are not adapted, and which requires human intervention to remedy. Finally, the closure is putting past restoration efforts of the CDF&G at grave risk and will require significant efforts in addition to the $55 million impending restoration by Southern California Edison.

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9. The 22nd Agricultural District Association has periodically opened the river mouth due to flooding caused on its property when the river water backs up behind the blocked river mouth.

10. Also during the past five (5) months, the water in the lagoon has gradually evaporated and seeped through the channel bed such that the water in most parts of the lagoon is 1 - 2 feet deep With seasonal (summer) temperature increases, the lagoon water temperature has risen above a level in which the habitat can survive. For these reasons, emergency action is required to be taken immediately to open the lagoon to tidal flushing in order to avoid severe damage to the system. There is need to open the lagoon this week for two important reasons: (1) to release habitat stress and reduce environmental losses, and (2) take advantage of the coming spring high tides (greater than 6 feet) by Saturday, September 23, 2000. The high tides will improve flushing of the lagoon system and help; to clear the lagoon channels.

11. Attached as Exhibit "B-1" are true and correct photographs taken on April 13, 1996, looking south showing San Dieguito Lagoon inlet opening and West Channel. Notice the Blue Water.

12. Attached as Exhibit "B-2" is a true and correct photograph taken on June 6, 1996, while the lagoon open locking west from the railroad bridge toward Highway 101. Notice the blue water color.

13. Attached as Exhibit "B-3" is a true and correct photograph taken on September 18, 2000 from Highway 101 looking east at the West Channel's present condition. Notice the yellow color of fresh water vegetation in a 1- to 2- foot water level.

14. Attached as Exhibit "B-4" is a true and correct photograph taken on September 18, 2000 from Interstate 5 looking west showing the present condition.

15. Attached as Exhibit "B-5" is a true and correct photograph taken on September 18, 2000, showing fish kills in the West Channel between Pacific Coast Highway and the railroad bridge.

16. Attached as Exhibit "B-6" is a true and correct photograph taken on September 18, 2000, showing fish kills in the West Channel.

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I declare under penalty of perjury under the laws of the State of California that the forgoing is true and correct and executed on this 18th day of September 2000, at Del Mar, California.

HANY ELWANY

SUPPLEMENTAL DECLARATION OF HANY ELWANY

EXHIBIT "A"

The San Dieguito Lagoon is approximately 160 acres and consists of three channels, an inlet (West Channel), the South Channel and the North Channel (Figure 1). Water quality measurements are taken all over the lagoon at fifteen (15) different stations encompassing the three channels. Figure 1 shows where the measurements are taken. Figures 2, 3, and 4 show dissolved oxygen in parts per million ("ppm") for stations representing the Inlet Channel, the South Channel, and the North Channel, respectively. Measurements at all stations show a consistent decline in dissolved oxygen content since January 2000. By August 2000, the level of dissolved oxygen is at or below 3 ppm, which is considerably less than an acceptable level of 8 ppm when the lagoon is healthy. Figures 2, 3, and 4 show gradual degradation in the lagoon over the past five (5) months until the conditions reach critical levels (i.e., dissolved oxygen values less than 3 ppm). The degradation was all over the lagoon. At that time, massive fish kill started everywhere in the lagoon (Inlet Channel, North Channel, and South Channel).

Low dissolved oxygen content is directly responsible for:

1.) Fish kill all over the lagoon in all channels;
2.) Degradation of the salt marsh;
3.) Health endangerment of rare and endangered species that frequent the lagoon and feed on the fish.

EXHIBIT "A"

EXHIBIT 4

City of Del Mar
Memorandum

TO: Honorable Mayor and City Council

FROM: Linda S. Niles, Planning and Community Development Director
Via Lauraine Brekke-Esparza, City Manager
Prepared by Amanda Johnson, Assistant Planner

DATE: August 16, 2000

SUBJECT: Update-- Existing Conditions of the San Dieguito Lagoon and Possible Solutions

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ISSUE:

The San Dieguito Lagoon river mouth is currently closed off from its natural tidal exchange due to an extensive sand berm between the Lagoon and the ocean. Tidal mixing is vital to maintain the health of the Lagoon in that it serves to stimulate the oxygen level necessary to support life within the Lagoon. In the absence of tidal mixing, vegetation and other organic matter begin to decay thereby contributing to an accelerated decline of water oxygen levels within the stagnant water.

Currently the Lagoon is experiencing a major fish kill, a loss of invertebrates, an extensive algal mass, elevated nutrient loads, low water oxygen levels, and high water temperature levels due to the absence of tidal flushing. Based on this evidence, a manual opening of the San Dieguito Lagoon river mouth is an option that should be seriously considered to restore tidal flushing.

BACKGROUND:

The San Dieguito Lagoon is a part of the San Dieguito River Valley coastal wetlands system. The Lagoon was once one of the largest coastal wetlands in the County; however, it has been badly degraded due to surrounding development. In 1935, a portion of the San Dieguito Lagoon was filled in order to construct the Del Mar Fairgrounds. In addition, flow of the San Dieguito River and its tributaries has also been restricted due to construction of the Lake Hodges Dam and the Interstate 5 freeway. These permanent impacts in addition to other factors including dry weather, nonpoint source (urban runoff) and point source (animal wastes and storm water drains) pollution, and an increasing sand berm have contributed to the deterioration of the San Dieguito Lagoon by decreasing the lagoon water oxygen levels.

- Invertebrates are gone
- Extensive algal mass covers approximately 60-70% of the surface
- Numerous fish in the lagoon are dying
- Brackish Water
- Low Oxygen levels (Dissolved O_2 is less than 3 parts per million measured at 5 am)

As mentioned previously, the deteriorated condition of the Lagoon is due to an absenc of tidal flushing. The degradation of the Lagoon has been occurring over the course o a year due to the gradual development of a sand berm that blocks tidal exchange. Th lack of a storm event has prevented the ocean tides from breaking through the berm v natural forces and as a result it is unlikely that the river mouth can open itself through natural forces without some kind of excavation.

Within the stagnant water, fish die offs have been occurring in the Lagoon at night whe there is a lower oxygen level due to a lack of photosynthesis. In early August 2000, a major fish kill (150-200 fish) was discovered in the San Dieguito Lagoon. The City of Del Mar received numerous calls from concerned residents regarding the condition of the Lagoon. As a result, a meeting was convened by the Del Mar staff in order to discuss the existing state of the Lagoon and to discuss possible solutions to address those issues associated with the closure of the river mouth.

The meeting was held on August 8, 2000 in the City Hall Annex. The City extended invitations to scientists familiar with the San Dieguito Lagoon and those agencies with jurisdictional authority over the Lagoon. Meeting participants are listed in attachment A of this report.

Six possible solutions were evaluated by the meeting participants who ultimately arrive at a final consensus that selection of the deep dredge option to open the river mouth would be the best alternative for restoring the state of the San Dieguito Lagoon back t a thriving ecosystem. They are described below with a quick summary of the pros an cons for each discussed solution.

POSSIBLE SOLUTIONS:

Option 1 *Fill in lagoon with water in the isolated section and construct a berm to keep water from escaping*
(-) Would not improve the overall condition of the Lagoon
(-) Would be a temporary solution

Option 2 *Conduct a massive dredging effort to remove sand all the way from rive mouth to RR Bridge*
(+) Good quality beach sand would be the product of the dredge
(+) Tidal flushing would occur as a result
(-) Sand berm is approx. 10 feet so dredge may not have a lasting imp but probably would last until winter

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The no action alternative would leave the situation to chance. More specifically, the outcome would depend on what type of weather occurs and its interplay with other factors. A dry winter season would not improve the situation caused by the existing sand berm, while a wet winter season may open the river mouth through natural forces if there is a strong enough tidal velocity. However, this could have other associated negative impacts such as flooding of surrounding properties.

If the existing sand berm is not excavated to reopen the channel, the Fairgrounds may be in jeopardy of flooding when and if any rain occurs. When the river mouth is closed, the water level of the river rises during storm events. The rising level of the river in turn covers the storm water drain outlets located on the Fairgrounds property and may cause significant flooding on the 22nd DAA property. In addition, the Sandy Lane residential properties located to the south of the river mouth may be in jeopardy of flooding.

PREFERRED ALTERNATIVE:

At the August 8 meeting, the alternative selected by the entire working group was to conduct a deep excavation of the river mouth (option 2). This option would require an approximate 30-foot wide, 10-foot deep dredge from the west channel back to Railway Bridge. A berm would be necessary at the south bank to act as a buffer.

Dr. Hany Elwany mentioned that it might be necessary to remove old pilasters from the old Highway 101 Bridge during the proposed dredge, which increases the estimated cost of this option. The pilaster removal will be done eventually as a part of the Southern California Edison Restoration project, but it would benefit the Lagoon most if they were removed at this time.

Timing of Dredge Option

- It would take about seven days to open the river mouth.
- Dredging of the river mouth would need to be scheduled around optimal tides. The optimum time would be just before a high tide. The next high tides are anticipated in late August and late September (6'9" tide).
- September is the soonest possible to allow time to secure funding, bids, and permits.

It should be noted that the river mouth may close up again in 4-6 months after the deep dredging operation. However, by that time, sufficient tidal flushing will have occurred to allow the Lagoon ecosystem to restore itself. In addition, the temperatures will have dropped and even minimal rainfall will not allow the conditions experienced today to reoccur. The participating agencies felt that the deep excavation alternative is an investment in the Lagoon's health that will have a far reaching effect, even if closure occurs again later in the year.

Water Quality

Following any excavation of the pilot channel, the resulting tidal exchange would cause for the poor quality lagoon water to mix with the ocean water. It is anticipated that the

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Based on this evidence, a manual opening of the San Dieguito Lagoon river mouth is an option that should be considered to restore tidal flushing. As directed by Council, staff will continue to contact other agencies to solicit contributions to fund the excavation of the river mouth and will also pursue any available emergency funding sources.

Attachment A- Participants of 8-8-00 Meeting
Attachment B- Results of Water Quality 8-1-00

Meeting to discuss the state of the San Dieguito Lagoon

Meeting Date: Tuesday, August 8, 2000

Location: City Hall Annex

Participants:

Dr. Hany Elwany, Coastal Engineer Southern California Edison
Steve Schroeder, California Coastal Commission/UCSB research
Ellen Lirley, California Coastal Commission
Tim Dillingham, California Fish and Game
Clay Clifton, County Dept of Environmental Health
Richard Andrews, Public Works Director, City of Del Mar
Linda Niles, Planning and Community Development Director, City of Del Mar
Amanda Johnson, Assistant Planner, City of Del Mar

The 22nd District Agricultural Association, California Regional Water Quality Control Board, and San Dieguito River Park Joint Powers Authority were informed of the meeting, but were unable to attend.

Tue 7b

3 Technical Reports Addressing Erosion 6-00-134

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Tue 7b

Review and Analysis of the Impacts of Maintaining the Mouth of the San Dieguito Lagoon Open on the Adjacent Beach, Sandy Lane, Del Mar, California

By

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February 18, 2001

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Review and Analysis of the Impacts of Maintaining the Mouth of the San Dieguito Lagoon Open on the Adjacent Beach, Sandy Lane, Del Mar, California

Introduction

The importance of quantitatively determining the impacts of inlets on adjacent beaches is perhaps realized when one considers the following; In Florida, 80-85% of coastal erosion is attributable to inlets and associated modification of littoral drift (cross shore and longshore) and ebb tide deltas (Marino and Mehta, 1988; Dean, 1991). Not withstanding, and as stated by an internationally recognized expert on inlet dynamics, "... ... our predictive capability for impacts on the surrounding environment remains considerably short of what is essential for assessing the long-term changes due to designing or modifying inlets." (Dr. Ashish Mehta, University of Florida; quoted from Mehta, 1996).

A considerable effort has been undertaken by scientists and engineers to address the potential impacts of restoring the San Dieguito Lagoon on hydrodynamics, coastal processes and sedimentation in the adjacent environmnets (Figure 1). A requisite of the tidal wetland restoration project in the lagoon is that in order to restore and maintain the aquatic functions of the system, the tidal basin would be increased and the mouth of the lagoon maintained open via maintenance dredging since it is subject to closure (Figure 2). It is the latter undertaking that concerns among others, residents south of the inlet along Sandy Lane. The primary concern is that interruption of the southward directed net littoral drift sand transport system would cause beach draw down and exacerbate a chronic problem of storm wave inundation and damage to adjacent homes.

This report will address these concerns and review the work that has been accomplished to date that deals directly with the impacts of maintaining the inlet open on coastal processes, and subsequent downdrift effects. It will draw on existing literature, field reconnaissance, observations and recently conducted field measurements. A brief overview of the current geological conditions of adjacent regional beaches is provided by way of background and to provide a contextual framework. A considerable amount of information already exists in other reports of which the most comprehensive is the "Sate of the Coastal Report" for the San Diego region prepared by the U.S. Army Corps of Engineers (USACE, 1991).

Current Status of Beaches in the Area

It is estimated that approximately 86% of California's ocean fronting coast is actively eroding (Griggs, 1992; 1995). Based on long term shoreline chang data (USACE, 1991), it can be argued that the beaches of Del Mar are among the last of the slightly more stable in San Diego County. Therefore, any action that would potentially interfere with a longer term equilibrium should be avoided. There is an abundant literature that demonstrates the unequivocal reduction in sediment supply to this section of coast over time. The Hodges Dam on the San Dieguito River has prevented fluvial

Figure 1. Oblique aerial view of the SanDieguito Lagoon, mouth and Sandy Lane properties.

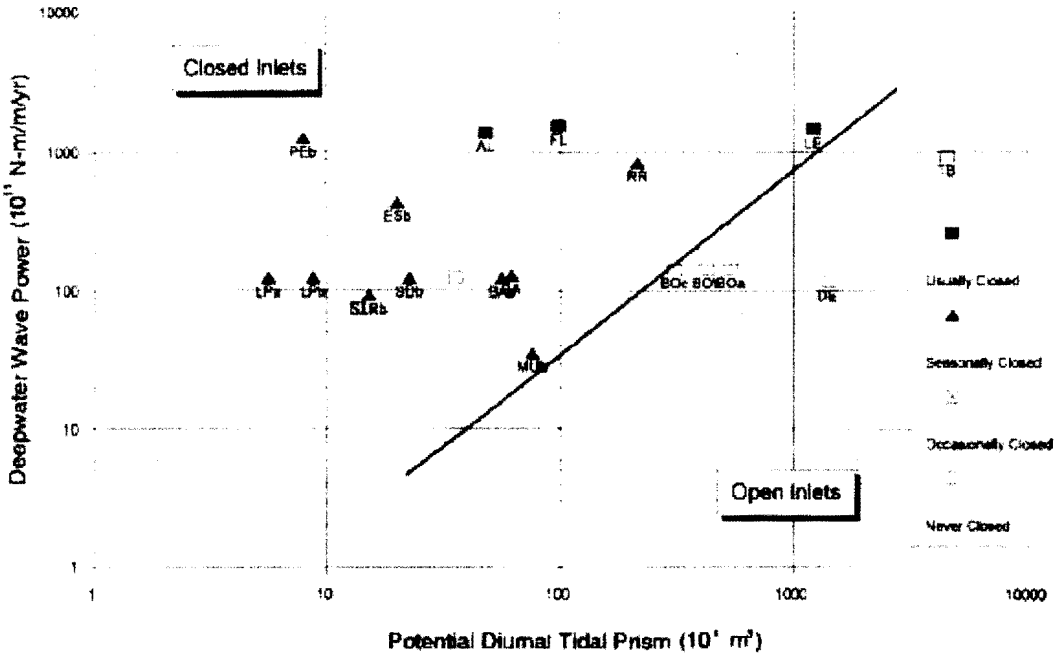


Figure 2. Johnson's criteria for closure of California inlets showing San Dieguito inlet (SDb) as seasonally closed (from Goodwin, 1996).

inputs of sediment to the coast during periods of increased discharge. The construction of Oceanside Harbor north of Del Mar has disrupted the supply of littoral sediments for transport south towards Del Mar (USACE, 1991). There is no expectation that the net deficit of sediment being experienced along this coastal reach will become one of a surplus for a variety of reasons: First, scientists have concluded that sea level is continuing to rise and that we may have entered a period in which the rate of rise will accelerate (Peltier, 1998); a potential increase in storminess and clustering resulting in higher wave energy along the coast (Inman and Masters, 1991; Seymour, 1998; Allan and Komar, 2000); maintenance of large structures that effectively impede littoral transport (e.g., Oceanside Harbor); maintenance of seawalls and revetments along sandy cliffs thereby reducing the infusion of sand into the littoral system due to cliff erosion; and maintenance of dams (e.g. Hodges Dam) on rivers for human and agricultural purposes which invariably reduces the sediment load and supply to the coast (Komar, 1999); and finally, a declining trend in beach nourishment along the beaches of Southern California (Flick, 1993; Komar, 1999). Within this context and as suggested earlier the implication is that this coast has reached a critical physical condition. It would be prudent for managers to re-evaluate any modification to the environment that will potentially de-stabilize this coast.

Issues Pertaining to Maintaining the Mouth Open

Downdrift Erosion

In light of the voluminous literature that concludes inlets often create erosion along downdrift beaches, a justifiable concern of several residents is the impact of maintaining the mouth of the lagoon open with a considerably larger cross-section than existsat present by maintenance dredging. In a report prepared by Rick Engineering in 2000 (Review of EIR/EIS for the San Dieguito Wetland Restoration Project), observations were presented suggesting that beaches south of the opening to the lagoon were eroded when the inlet was open. This was refuted in a follow on report by Jenkins (Response to Comments on the DEIR/EIS for the San Dieguito Wetlands Restoration). Using data presented by the U.S. Army Corps (USACE, 1991) obtained at monitored profile lines south of the inlet at Del Mar (DM-0560, DM-0580 and DM-0590), Jenkins (2000) reports the following:

> "Inspection of Enclosure B shows that the beach widths from the mouth of San Dieguito River south to La Jolla remained virtually unchanged between 1940-60 and 1960-80, and actually increased between 1980-89. Enclosure C from Jenkins and Waysl, 1996 summarized the historic openings and closures of the mouth of the San Dieguito lagoon. Inspection of Enclosure C reveals that the lagoon mouth was open 74.7% of the time during the decade of the 1980's, the highest percentage occurrence of an open inlet configuration found anywhere in the period of record. Thus, the observational data show that the south-lying beaches have actually widened, not receded, when the inlet is open. Jenkins and Waysl, 1998, pp. 135-136 extensively modeled the shoreline evolution of the Del Mar

beaches in response to the open inlet configuration of the restoration project, and found no change relative to existing conditions."

There are several points that need to be stated regarding Jenkins (2000) and his statements presented above:

1. Using data provided by Dr. Howard Chang for the period October 1, 1926 through September 30, 1995 (Table 1), it is apparent that the entrance to the lagoon remained closed 72% of this period of time. Using the same data set but for the shorter period of time January 1, 1980 through December 31, 1989 (Table 2), it is observed that in contrast to the findings of Jenkins, the inlet was open for a period of 48.7 months (40% of the record) and closed for 71.3 months (60% of the record). This clearly contradicts the findings of Jenkins that the inlet was open nearly 75% of this period. Thus, there is no evidence to support the conclusion of Jenkins that the shoreline accretion measured at DM 560, 580 and 590 is primarily due to the high incidence of inlet opening. In fact to the contrary, it can be argued that the higher percentage of inlet closure enhanced stability along the downdrift beach because the degree of interruption of the longshore transport of sediment to the south was minimized. As shown in Table 3, high rates of accretion were also noted further south along Torrey Pines during this interval indicating a period when the entire region was undergoing an infusion of sediment, not simply at Del Mar. The source of the material is not known.

2. Comparing two surveys to calculate a rate of change increases the potential survey error to +/- 4 ft over the 9-year period which equals +/- 0.44 ft/yr. Thus the significance of a rate of change of 0.56 ft/yr. seaward of the Mean High High Water shoreline as an indication of evidence that the inlet being open actually supplies sand to the south-lying beaches, is highly questionable. It should also be noted that data sets derived prior to the 1980-89 data set are prone to higher potential error values because of the use of maps and photographs.

In a report prepared by Flick et al. (1986), the authors present the findings of a beach profiling program conducted along the San Diego coast. Several profiles are of interest here, and presented in Figures 3 through 7. The survey lines extend from immediately south of the opening to the lagoon, and occupy sites at 15 th., 20 th., and 25 th. Streets. Both beach width and the volume of sand on the beach relative to a specified datum are presented for a 12-year period (1974-1985). Seasonal fluctuations in beach width and volume are clearly apparent throughout the time series at each profile. The effects of storm waves during the winter of 1982 and 1983 are clearly apparent at all locations where the volume of beach sand is reduced considerably. The profile immediately south of the lagoon entrance is particularly intriguing in that in the years prior to the winter of 1982 and 1983, the beach width and volume show a marked downward trend indicating erosion. This is an important observation in that it is

Table 1

Summary of Inlet Channel Opening and Closure between October 1, 1926 and September 30, 1995 (Data initially compiled by Chang, 1995)

Date	Inlet Channel Change	Duration, months	
		Opening	Closed
October 1, 1926	Closed		
February 15, 1927	Opened		4.5
February 15, 1929	Closed	24.0	
February 13, 1931	Opened		24.0
February 28, 1931	Closed	0.5	
February 1, 1932	Opened		11.3
April 24, 1932	Closed	2.8	
December 12, 1932	Opened		7.6
January 12, 1933	Closed	1.0	
February 7, 1935	Opened		24.8
April 22, 1935	Closed	2.5	
February 16, 1936	Opened		10.7
March 15, 1936	Closed	1.0	
February 8, 1937	Opened		10.8
May 8, 1939	Closed	27.0	
February 4, 1940	Opened		8.9
June 15, 1940	Closed	4.3	
February 10, 1941	Opened		7.8
July 1, 1942	Closed	16.7	
January 23, 1943	Opened		6.7
August 5, 1943	Closed	6.4	
March 15, 1944	Opened		7.3
August 15, 1944	Closed	5.0	
November 12, 1944	Opened		2.9
January 1, 1945	Closed	1.6	
April 10, 1945	Opened		3.3

Date	Inlet Channel Change	Duration, months	
		Opening	Closed
July 10, 1945	Closed	3.0	
December 22, 1945	Opened		5.4
February 8, 1946	Closed	1.5	
November 13, 1946	Opened		9.2
November 28, 1946	Closed	0.5	
January 13, 1949	Opened		25.5
January 31, 1949	Closed	0.6	
January 18, 1952	Opened		35.6
March 18, 1952	Closed	2.0	
April 10, 1952	Opened		0.7
August 10, 1952	Closed	4.0	
March 9, 1954	Opened		19.0
April 25, 1954	Closed	1.5	
January 19, 1955	Opened		8.8
March 4, 1955	Closed	1.5	
January 29, 1956	Opened		10.8
April 1, 1956	Closed	2.0	
January 29, 1957	Opened		9.9
March 30, 1957	Closed	2.0	
February 5, 1958	Opened		10.2
May 5, 1958	Closed	3.0	
February 12, 1959	Opened		9.2
February 27, 1959	Closed	0.5	
February 20, 1962	Opened		35.8
March 5, 1962	Closed	0.5	
April 1, 1965	Opened		36.9
May 16, 1965	Closed	1.8	

Date	Inlet Channel Change	Duration, months	
		Opening	Closed
November 19, 1965	Opened		6.1
February 28, 1966	Closed	3.3	
December 6, 1966	Opened		9.2
January 12, 1967	Closed	1.2	24.0
December 18, 1967	Opened		11.2
January 31, 1968	Closed	1.5	
January 23, 1969	Opened		11.8
May 8, 1969	Closed	3.5	
March 4, 1970	Opened		9.9
May 10, 1970	Closed	2.2	
January 8, 1974	Opened		43.9
February 23, 1974	Closed	1.5	
March 9, 1975	Opened		12.5
May 10, 1975	Closed	2.0	
February 9, 1976	Opened		9.0
March 30, 1976	Closed	1.7	
March 1, 1978	Opened		23.0
September 15, 1978	Closed	6.5	
January 10, 1979	Opened		3.8
October 25, 1979	Closed	9.5	
February 1, 1980	Opened		3.2
July 1, 1982	Closed	29.0	
February 1, 1983	Opened		7.0
March 21, 1984	Closed	13.6	
December 25, 1984	Opened		9.1
February 25, 1985	Closed	2.0	
November 26, 1985	Opened		9.0

Date	Inlet Channel Change	Duration, months	
		Opening	Closed
December 9, 1985	Closed	0.4	
March 15, 1986	Opened		3.2
July 1, 1986	Closed	3.5	
April 21, 1988	Opened		21.9
April 28, 1988	Closed	0.2	
March 1, 1991	Opened		33.9
May 20, 1991	Closed	2.7	
February 15, 1992	Opened		8.8
April 10, 1992	Closed	1.8	
January 10, 1993	Opened		9.0
November 10, 1994	Closed	22.0	
January 4, 1995	Opened		1.8
September 30, 1995	Period ending	8.9	
Total		234.2 months 19.52 years (28 %)	594.9 months 49.58 years (72 %)

Table 2

Inlet Condition and Duration from January 1, 1980December 31, 1989 at Entrance to Sand Dieguito Lagoon (modified from Chang, 1995)

Date	Inlet Condition	Duration Open	Duration Closed
1/1/80	closed		(inlet closed 11/25/79)
2/1/80	open		1.0
7/1/82	closed	29.0	
2/1/83	open		7.0
3/21/84	closed	13.6	
12/25/84	open		9.1
2/25/85	closed	2.0	
11/26/85	open		9.0
12/9/85	closed	0.4	
3/15/86	open		3.2
7/1/86	closed	3.5	
4/21/88	open		21.9
4/28/88	closed	0.2	
12/31/89	closed		20.1 (inlet not open until 3/1/99)
		48.7 (40%)	71.3 (60%)

Table 3

MHHW Shoreline Change Rate (ft/yr.) Between La Jolla and Del Mar (Data obtained from USACE, 1991)

Location	Pre 1940's	1940-1960	1960-1980	1980-1989	Max. Seasonal MHHW Movement	
					Summer	Winter
LJ 443	1.00	-1.00	1.20	5.50	12.7	-13.00
LJ 445	-1.50	1.40	-1.50	-4.10	41.4	-63.5
LJ 450	0.50	0.80	-2.00	7.80	73.2	-21.8
LJ 460	1.00	-0.10	-1.60	8.10	74.0	-80.8
TP 470	3.00	2.60	-0.30	13.80	77.9	-147.5
TP 520	0.50	0.80	-0.80	4.70	47.4	-36.7
TP 530	1.00	1.60	-4.30	5.10	79.1	-80.0
TP 540	2.00	0.70	0.00	5.90	43.0	-14.00
DM 560	1.50	-0.60	0.70	0.90	41.6	-49.5
DM 580	2.50	0.00	-0.40	3.50	93.4	-91.8
DM 590	4.00	-2.20	8.50	28.00	23.1	-90.8

LJ=la Jolla; TP=Torrey Pines; DM=Del Mar

precisely this location that will likely be most sensitive to the initial effects of channel opening and consequent sand deprivation. The data prepared by Dr. Howard Chang in August 1995, as summarized in Table 1, show the duration in months when the inlet "opened" or "closed". It is observed that for the period between 1974 and pre -storms in the winter of 1982-1983, the inlet remained open some 50.2 months and closed 31.5 months. It is also noteworthy from these data sets that post-storm recovery of the beach at Del Mar was virtually accomplished at all sites with the exception of the profile immediately south of the entrance to the lagoon. Comparing pre-and post-storm beach widths, the beach width remained more than 60% less three years after the storm season than what it was prior to that period in time. It is reasonable to conclude that recovery of the beach was not apparent because the channel remained open for a period of 13.6 months between February 1983 and March 1984. Recovery was accomplished between the early part of 1984 and the winter of 1985 when the inlet was intermittently closed for more than 18 months.

This analysis supports two important conclusions that pertain to the stretch of coast between the entrance to San Dieguito Lagoon, south towards 25 th Street:

1. From 1974 to a period before the winter of 1982 and 1983, the beach width and volume immediately south of the entrance to San Dieguito Lagoon showed a marked downward trend indicating erosion. This is an important observation in that it is precisely this location that will likely be most sensitive to the effects of channel opening and consequent sand deprivation. It is observed that for the period between 1974 and pre-storms in the winter of 1982-1983, the inlet remained open some 50.2 months and closed 31.5 months. Therefore, the net deficiency of sand on the beach can be attributed to the opening of the lagoon.

2. After marked beach erosion attributed to the storms of winter 1982 and 1983, post-storm recovery of the beach at Del Mar was virtually accomplished three years after the storms at all sites with the exception of the profile immediately south of the entrance to the lagoon. The site was more than 60% deficient in sand in 1985 when compared to what it was prior to the storms. It is likely that the beach did not recover because the channel remained open for a period of 13.6 months between February 1983 and March 1984. It is important to note that beach recovery was apparent between the early part of 1984 and the winter of 1985 when the inlet was primarily closed for more than 18 months.

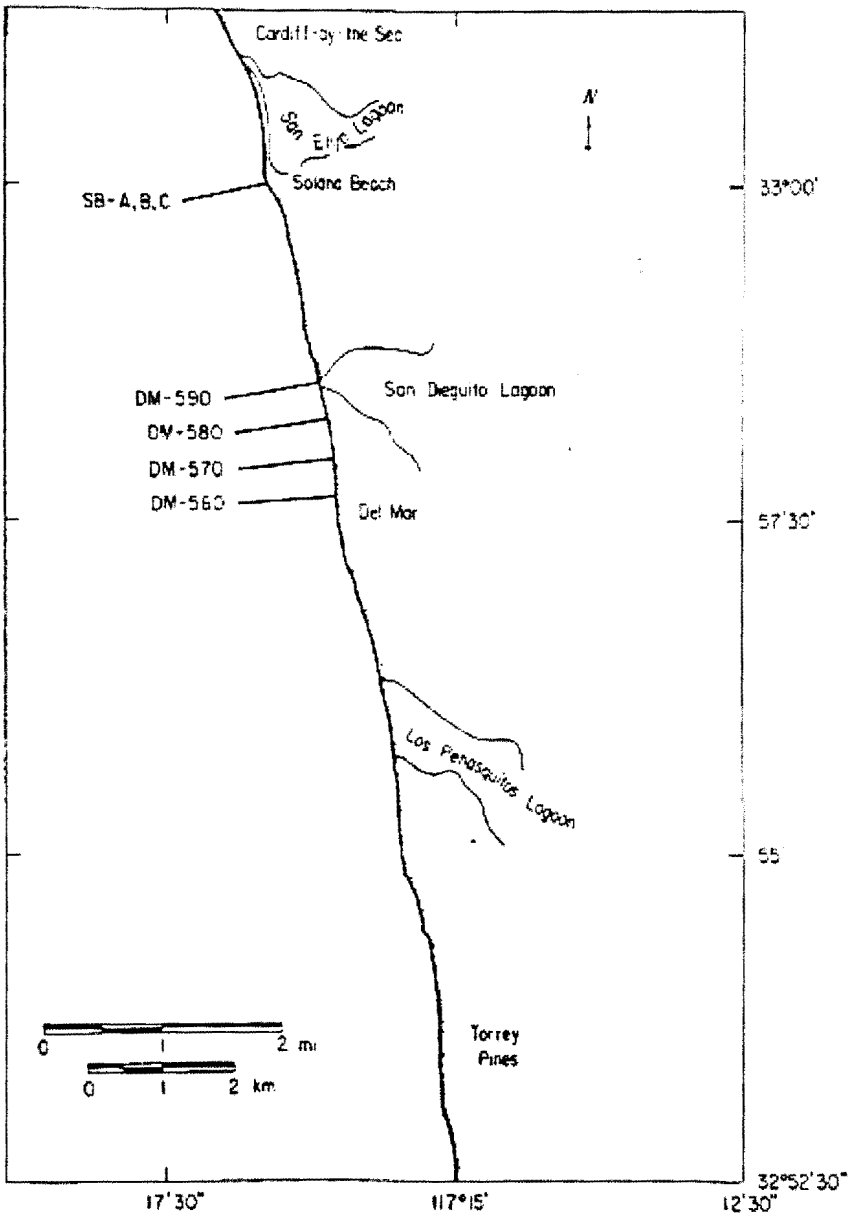


Figure 3. Map showing the location of the Corps' survey lines (from Flick et al., 1986).

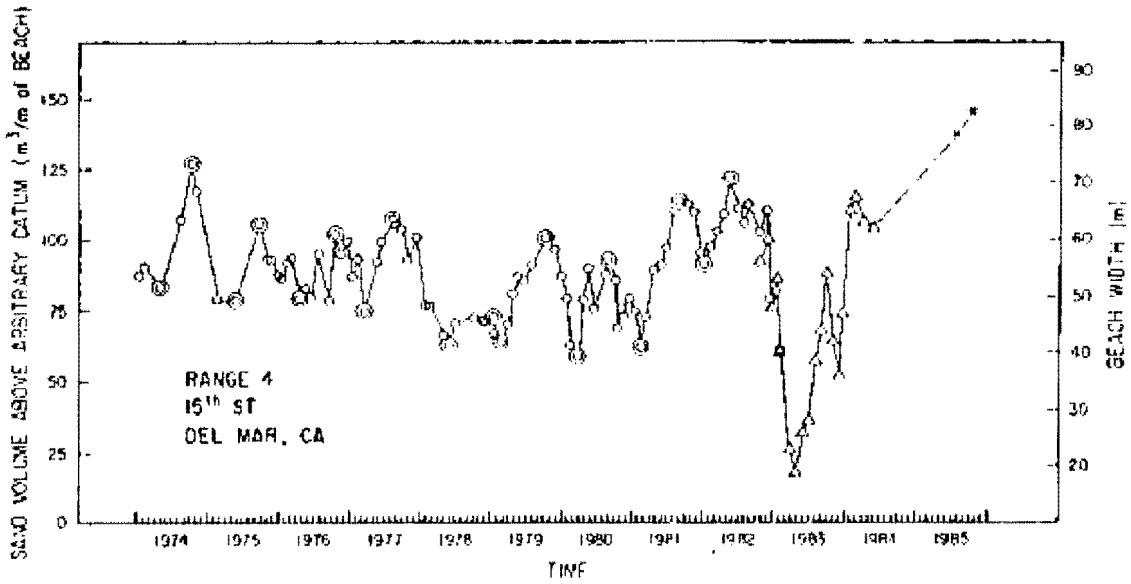


Figure 4. Range 4 at Del Mar showing beach volume and width change from 1974 through 1985 (From Flick, 1986).

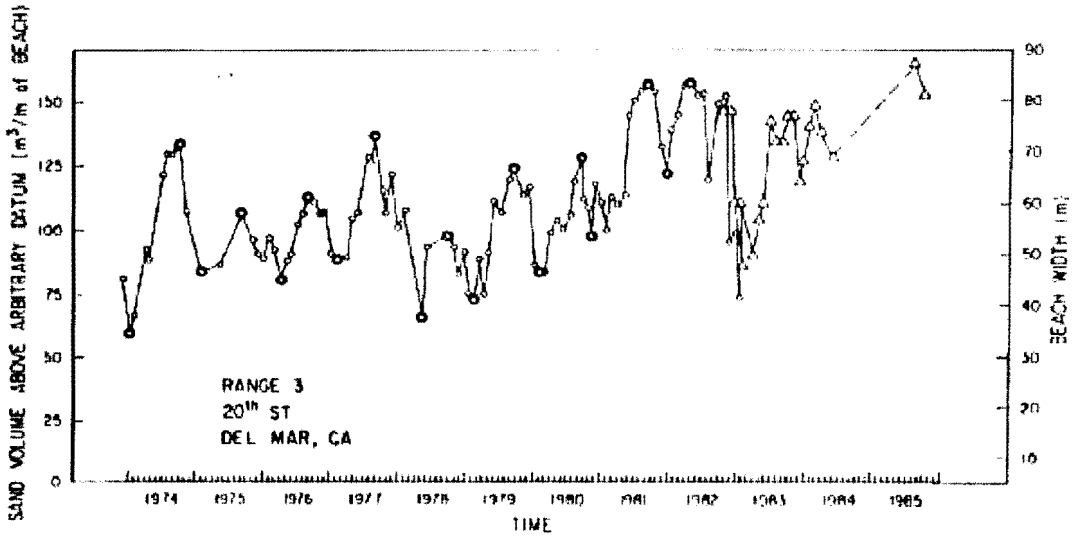


Figure 5. Range 3 at 20 th. St. showing beach volume and width changes from 1974 through 1985 (From Flick et al., 1986).

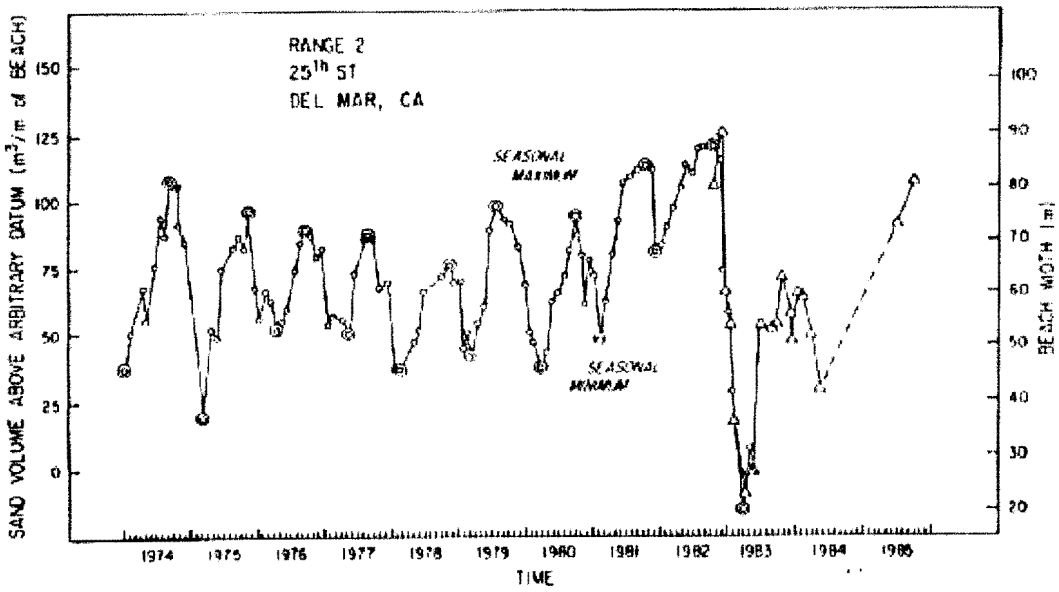


Figure 6 Beach volume and widths at Range 2 at 25 th. St. over the period 1974 through 1985 (From Flick et al., 1986).

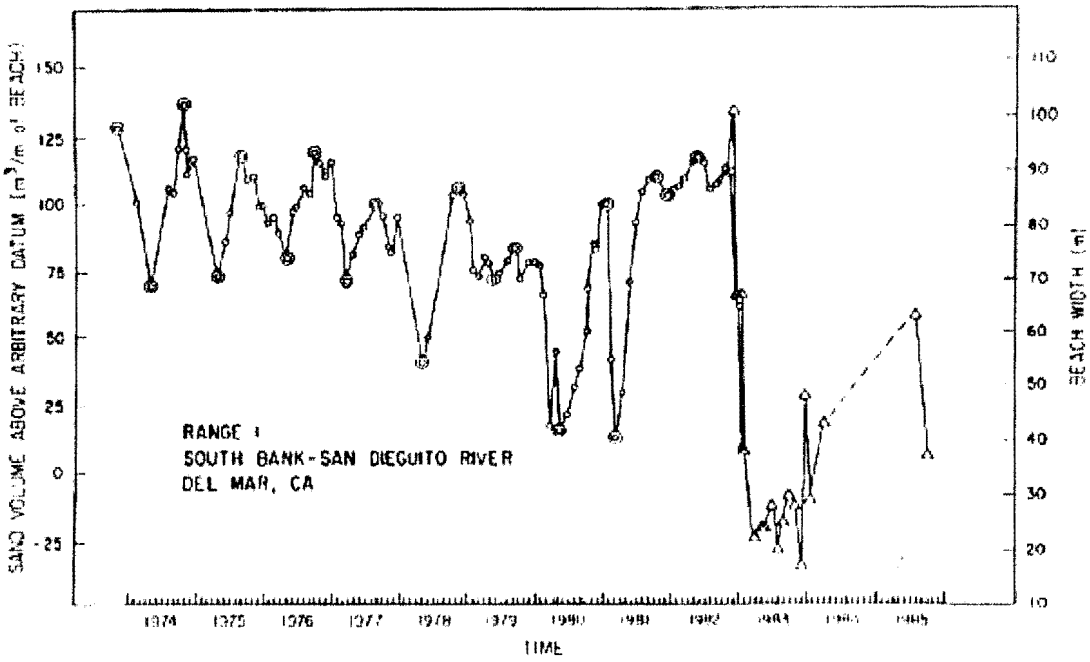


Figure 7. Beach volume and width on the south bank of the San Dieguito River at Range 1 (From Flick et al., 1986).

Mechanism for Bypassing the Inlet

In the previously mentioned report prepared by Rick Engineering in 2000 (Review of EIR/EIS for the San Dieguito Wetland Restoration Project), statements were made that an open inlet directs sand seaward and then is lost from the system. This was refuted in a follow on report by Jenkins (Response to Comments on the DEIR/EIS for the San Dieguito Wetlands Restoration) as follows:

> "The Rick Engineering assertion that an open inlet directs sand seaward is technically flawed from the standpoint of transport mechanics because they have failed to recognize the presence and function of ebb tidal bars at the mouth of any tidal lagoon. Enclosure D from Inman and Dolan, 1989 gives a schematic diagram of transport pathways around a tidal inlet. A small fraction of the total littoral drift is influxed on flood tide along Pathyway-1, while a portion of that is subsequently flushed from the inlet during flood tide along Pathyway-2. However, because the preponderance of littoral drift is found near the break point in the outer portion of the surf zone, most of the littoral drift by-passes naturally around the inlet following a pathway over the ebb tide bar, as indicated by Pathway-3. Hence tidal exchanges thru (Jenkins' misspelling) an open inlet do not cause beaches to erode." (page 4, Jenkins, 2000).

Enclosure D referred to by Jenkins (2000) is presented here in the upper section of Figure 8. Jenkins (2000) uses the term "tidal inlet". The mouth of the San Dieguito River does not function as the more typical tidal inlet. As well documented in the literature (see reviews in Mehta, 1996) and as stated in the paper which Jenkins cites, "For tidal inlets, there appears to be a balance between the scouring action of the tidal currents that keep the channels open, and the longshore transport of beach sand that tends to close them." (Inman and Dolan, 1989, p 213). The data presented in Table 1 confirm the fact that the mouth at San Dieguito remained closed 72% of the time between 1926 and 1995. This is the classic scenario for what is referred to as a wave dominated system, and one in which the longshore (and cross-shore) transport of sand plays an important role in the dynamics of the system. Thus, waves and flood tide currents dominate ebb currents with the exception of periods when storms occur and the beach is breached. Mehta (1996) classifies inlets less than 150 m in cross-sectional width and shallow channels as "Small Inlets" and states "Their hydraulic regime is often distinct from that of larger inlets in terms of the relationship between the tidal velocity and the throat area, and the sea and bay tidal ranges." Mehta (1996) also states that "Small Inlets" are not well understood. If we momentarily assume that Jenkins' use of the Inman and Dolan (1989) discussion is indicative of the San Dieguito case then certain clarifcations need to be made:

1. Net longshore transport at the San Dieguito entrance is north to south (Jenkins and Waysl, 1998). Entrance channels to inlets migrate in concert with the direction of longshore transport unless constrained by headlands, or jetties (Inman and Dolan, 1989) or antecedent geological controls. Elwany (2000) concluded the following after having monitored the inlet for a period extending from 1992 through 1996.

"Based on our observations, a pattern of northerly inlet channel migration is thus established for the time periods under study." This would imply that the inlet channel is migrating against the net longshore transport direction which is to the south. If this is indeed the case, the system is clearly more complicated than previously thought, and warrants more investigation beyond a simple analogy with considerably larger, tidal inlets as proposed by Jenkins (2000).

2. Rick's contention that sand may be reworked offshore through an open inlet is not as technically flawed as Jenkins (2000) suggests. Returning to the Inman and Dolan (1989) paper that Jenkins uses to refute Rick's comments, the following statement was made: "Unfortunately little is known about the rate at which sand is returned to the beach from the migrating ebb-tide bar. Undoubtedly some sand is lost offshore when extreme offshore flows are channeled through the inlets as a result of storm setup in the lagoons." (Inman and Dolan, 1989; pp. 218.).
3. Jenkins (2000) uses the upper diagram shown here in Figure 8 to suggest that downdrift (south) beaches will not feel the effects of maintaining the mouth of the lagoon open. He concludes that bypassing will occur across the tidal bar. A more comprehensive overview, however, would introduce the concept of "drift divergence" at the inlet. Again, the followin g description is based on discussion by Inman and Dolan (1989) and use is made of the lower figure in Figure 8 extracted from this paper. It is used to underscore the shortcoming associated with Jenkins' review.

   > "Divergence of the drift is an important aspect of inlet migration. The lens effect of the ebb-tide bar of the inlet produces wave convergence near the upcoast side of the inlet and divergence downcoast. This causes the longshore transport to vary across the inlet. The divergence relation requires that there be deposition on the upcoast side of the inlet and erosion on the downdrift side. Beach sand transported through the entrance and deposited in the lagoon as flood tide bars constitutes a local sediment sink that increases the erosion rate of the downcoast spit."

   In reference to the mouth of the San Dieguito Lagoon, upcoast would be to the north, and on considering that the net longshore transport at the site is to the south, then as presented here, the south beaches along Sandy Lane would constitute the erosional downcoast site. This is clearly evident on the lower diagram as presented in Figure 8 and is a highly plausible mechanism to explain the noted sand loss determined by beach profile comparisons discussed earlier.
4. The discussion above is not based on field evidence, rather it is based on sand transport mechanics which assumes the presence of an ebb shoal feature. The ebb shoal feature, or bar, would be significant enough in size to induce wave refraction and therefore, drift divergence. The wave refraction patterns would be noticeable if the ebb feature actually existed. Without the ebb feature, the mechanism for bypassing as presented by Jenkins would not be accomplished at the mouth of the Lagoon when open. The net result would be that the inlet channel would serve as a sediment sink, extracting sand from the longshore transport system and starving downdrift beaches. In order to investigate this further, all aerial photographs taken

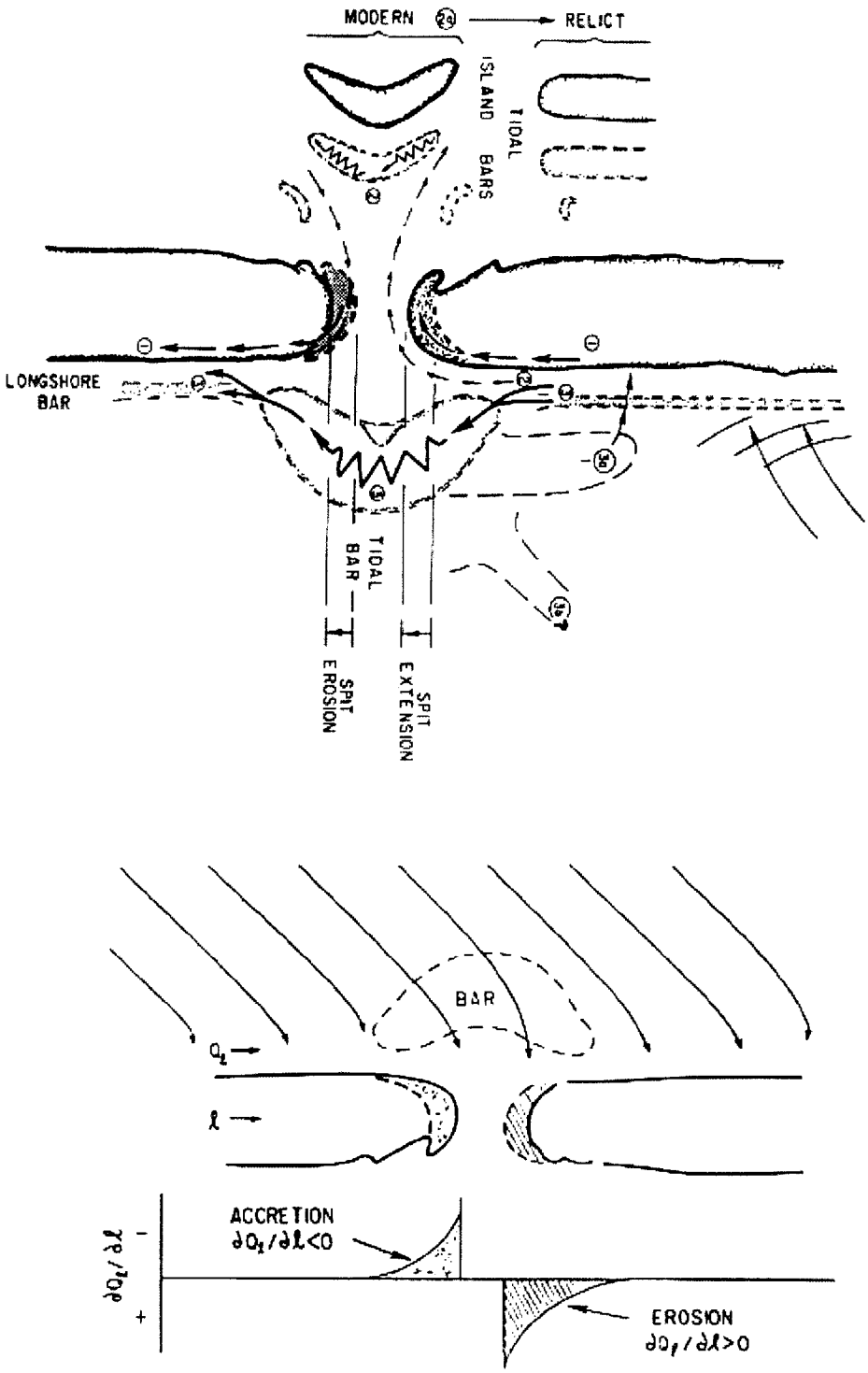


Figure 8. Upper: Pathways of sediment transport across a migratory inlet. Lower: Divergence of drift at an inlet caused by refraction ofwaves across an ebb tide delta and consequent areas of erosion and deposition (from Inman and Dolan, 1989).

while the inlet was open were inspected for the presence or absence of refraction patterns that could be attributed to the presence of a bathymetric feature resembling an ebb shoal/bar. An example of refraction patterns over an ebb tide bathymetric feature is shown in Figure 9. Sample photographs are provided in Figures 10 through 12 showing the inlet in various open states. In none of the photographs examined could an indication of significant refraction patterns be observed. Emphasis is first placed on Figure 12 since both photographs were taken four and eleven months respectively after a major event that occurred on November 13, 1997 which caused the largest possible tidal exchange between the lagoon and ocean and was used by Jenkins (2000) to "estimate the maximum loss of beach sand caused by tidal scour." According to Jenkins, this extreme high water event caused erosion of 7,500 cubic yards of sand from the beach . There is no indication that sand was deposited as an ebb tide shoal/bar in either of these photographs even four months after the event occurred. Figure 13 is an oblique aerial photograph taken February 22, 1980, twenty one days after the mouth had been opened during a storm. As shown on Table 4, this event was among the highest on record with a peak discharge of 22,000 cubic feet per second, sediment flushing of some 259,000 tons and a return period of 49 years (Chang, 1995). It is again evident from this image that there are no wave refraction patterns evident that would convey the presence of an ebb shoal/bar offshore. In fact, the refraction patterns that are noted on this photograph that occur at A and B located north and south of the inlet, indicate that sand is being reworked into the channel proper where subsequent infilling did occur. This is strong evidence indicating that sand bypassing to the south did not occur and that the channel was serving as a sediment sink to southward directed longshore transport. This again corroborates field data and trends presented earlier.

Table 4
Opening Duration in Relation to Return Period of Storms
(Prepared by Howard H. Chang, July, 1995)

Peak Discharge Cfs	Date	Return Period Years	Sediment Flushing 1,000 tons	Duration of Inlet Opening
0	Numerous	1.00	0	0
260	November 21, 1963	1.34	2.3	1 week
460	April 1, 1965	1.54	3.8	10 days
550	November 14, 1946	1.61	4.6	2 weeks
1,160	November 13, 1944	2.38	9.1	1.6 months
1,170	February 6, 1958	2.40	11.0	1.7 months
1,440	February 5, 1940	2.63	14.4	2.0 months
3,300	None	5.0	28.0	3.5 months
6,600	None	10	59.0	6.5 months
12,000	None	20	104	15 months
14,000	None	27	120	17 months
22,000	February 21, 1980	49	259	21 months
47,000	February 16, 1927	160	450	24 months

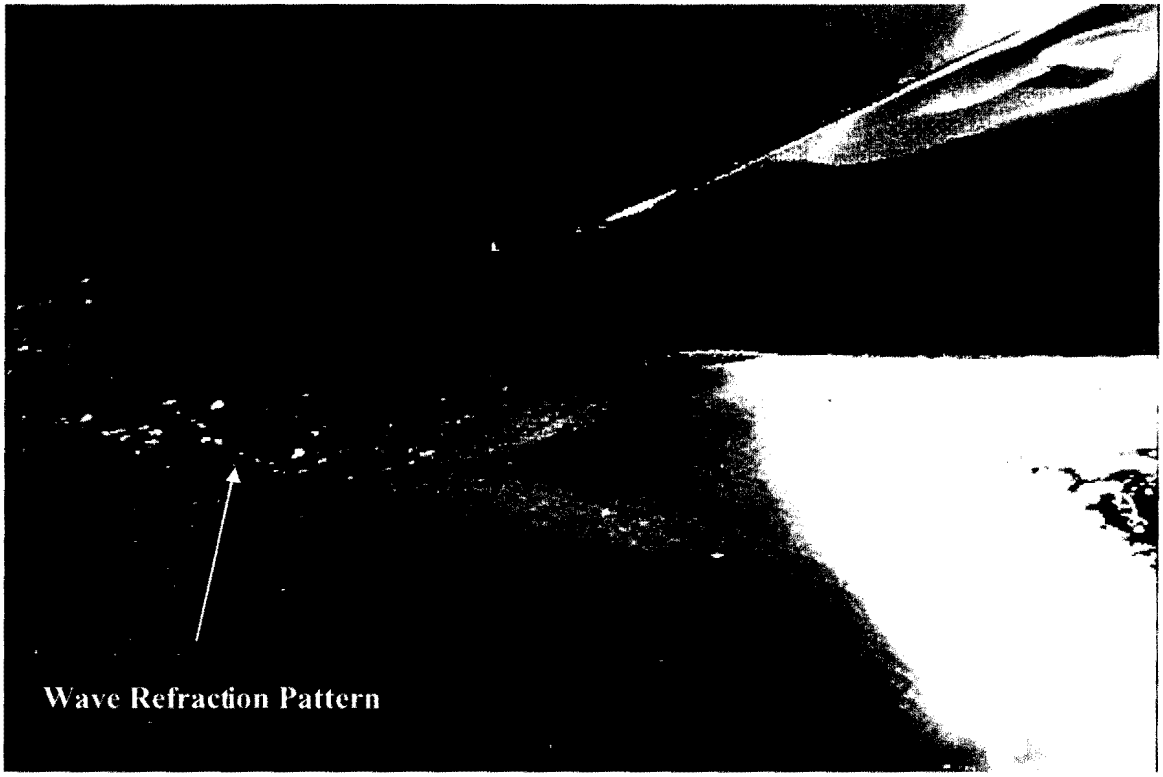


Figure 9 Classic refraction pattern established at a well defined ebb tide delta. This delta (Destin East Pass, Florida), plays an important role in allowing sand to be trasported to the downdrift shoreline. Such a feature was not detected at the mouth of the San Dieguito inlet at any time after opening.

Figure 10 Upper: Aerial photograph taken 6/22/78 of the lagoon when the mouth had been open since 3/1/1978. Lower: Aerial photograph taken on 7/20/83 showing mouth open with opening occurring in 2/1/1983. In neither example does wave refraction occur indicating absence of any ebb shoal/bar feature at the mouth of the channel.

Figure 11 Upper: Photograph taken 3/5/1984 showing the channel open which initially occurred in 2/1/1983. Lower: Mouth of the lagoon shown here open in 7/1/9195 after having been opened in 1/4/1995. Neither photograph shows refraction indicating no shoal. Note refraction does occur as expected in the channel proper, but not seaward of the opening where the ebb shoal/bar would typically occur.

Figure 12 Photographs taken in 1998, 4 and 11 months after a major event occurred in November 1997. Neither indicate the presence of an ebb shoal feature. Note also the conspicuous narow beach in front of the northern properties in Sandy Lane indicating beach erosion that is likely attributed to sand trapping by the inlet channel.

Figure 13. Oblique aerial image of lagoon mouth taken February 22, 1980, twenty one days after the mouth had been opened by a storm. The lack of wave refraction patterns on the seaward flank of the channel indicates the absence of an ebb tidal bar/delta and therefore, no means for signifiant bypassing. The refraction that does occur at A and B indicates that the inlet is serving as a sediment sink.

New Monitoring Effort and preliminary Results

It is quite apparent that much of the work carried out to evaluate the potential impacts associated with maintaining the mouth of the lagoon open on longshore transport, bypassing and downdrift beach evolution was largely accomplished via numerical modeling due to the absence of field data. Detailed evaluation of the existing field data and photography as presented here indicates disagreements with the conclusions reached by Jenkins (2000). With this in mind, a beach profiling program was initiated shortly after dredging re-opened the channel on September 26, 2000. The objective of this effort is to obtain a very high resolution data set of topographic and bathymetric changes north and south of the mouth of the lagoon to further evaluate channel influence on downdrift beaches.

Survey location points are presented on Figure 14 for two surveys, December 19, 2000 and January 16, 2001. Surveys were conducted by Rick Engineering and the data processed and presented by the author. Surveys were referenced to a local, common datum. Survey error in the vertical is within 0.1 ft. and the horizontal 0.2 ft. The precise locations of all survey lines is shown in Figure 15 along with the approximate location of the channel during the first survey. Three north-south lines are also shown at the lower foreshore, mid and back beach area (v1, v2 and v3 respectively). Measured profiles are presented in Figures 16 through 21 and the north-south lines in Figures 22 and 23. Topographic and bathymetric changes that occurred between surveys are presented in Figure 24 and volumetric changes in Figure25. Rates of change at each profile are presented in cubic yards/ft. in Figure 26.

Profile comparisons show a net loss of sand at each profile, north and south of the channel. Net loss north of the channel approximated >6,000 cubic yards; net loss south of the channel approximated >9,000 cubic yards. When normalized to linear feet, erosion rates were lowest at Profiles 11 and 12 (north of the channel) showing a marked increase to the south from profiles 5 to 1. These data translate to landward displacement of the beach profile of between 50 and 100 feet away from the location of the channel, and approximately 200 feet at profile 9 which intersects the channel. Erosion was generally limited to the mid and backshore regions of the beach.

It is not yet possible to extract from these data, the erosion signal that is attributable to inlet opening, the period of time is too short. Over time, this signal will be discernible relative to the background erosion trend. The preliminary data do, however, reveal trends that are typical of an inlet causing higher levels of erosion downdrift. The continuation of this data collection program will prove very useful as the time series increases and future monitoring will reveal the direct impacts of openingand closure of the inlet on downdrift beaches. The two surveys conducted thus far, and presented here, have provided a very important baseline and an excellent opportunity to accurately monitor the volume of sand on the beach.

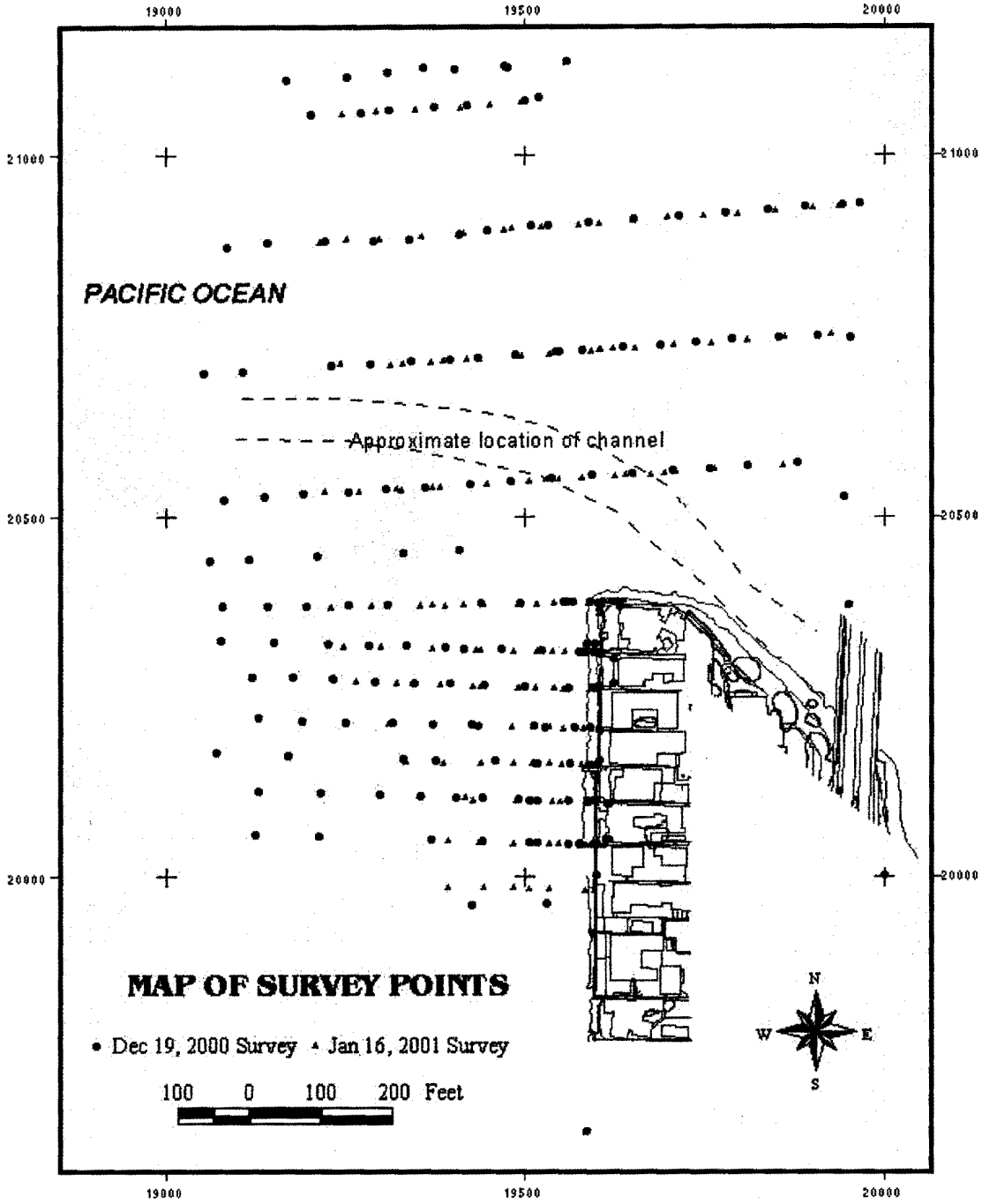


Figure 14 Map of survey points taken during two surveys, December 19, 2000 and January 16, 2001.

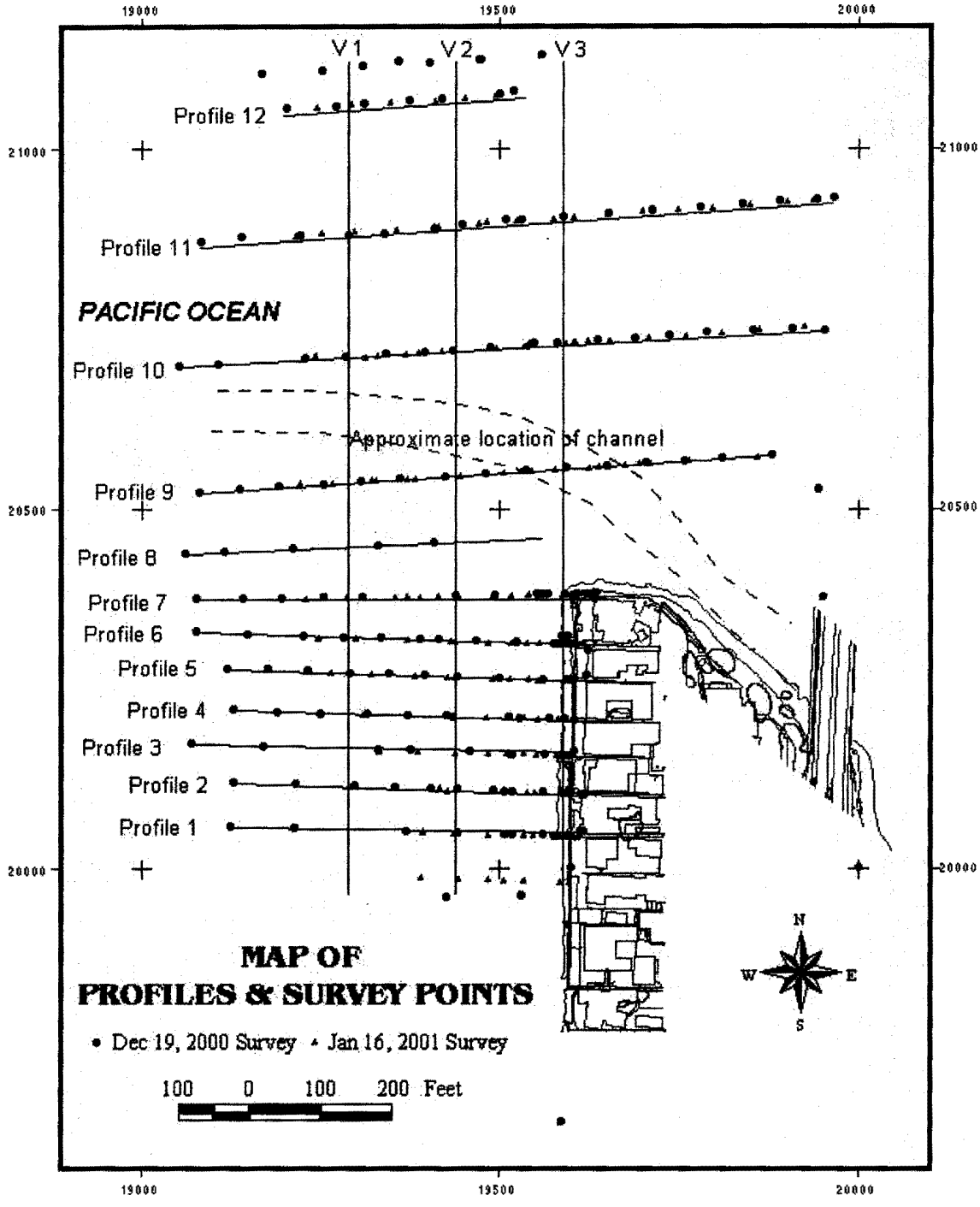
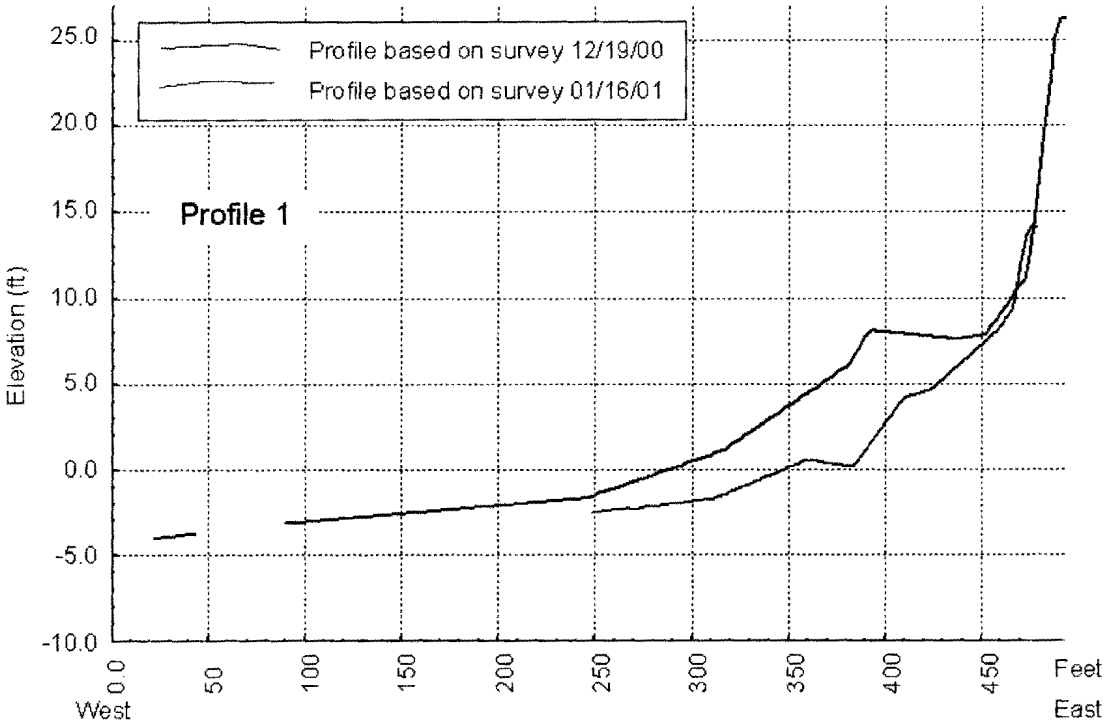


Figure 15 Map showing profile locations for two surveys. Note lines V1V3 were generated to show longitudinal profiles parallel to the coastline.



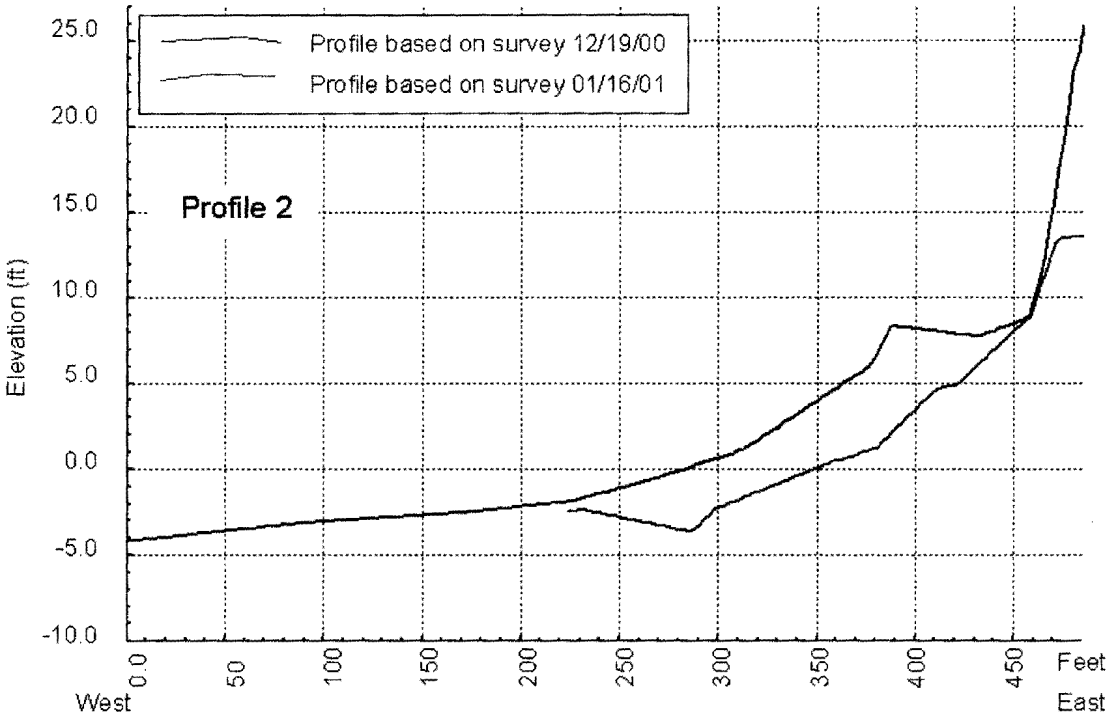
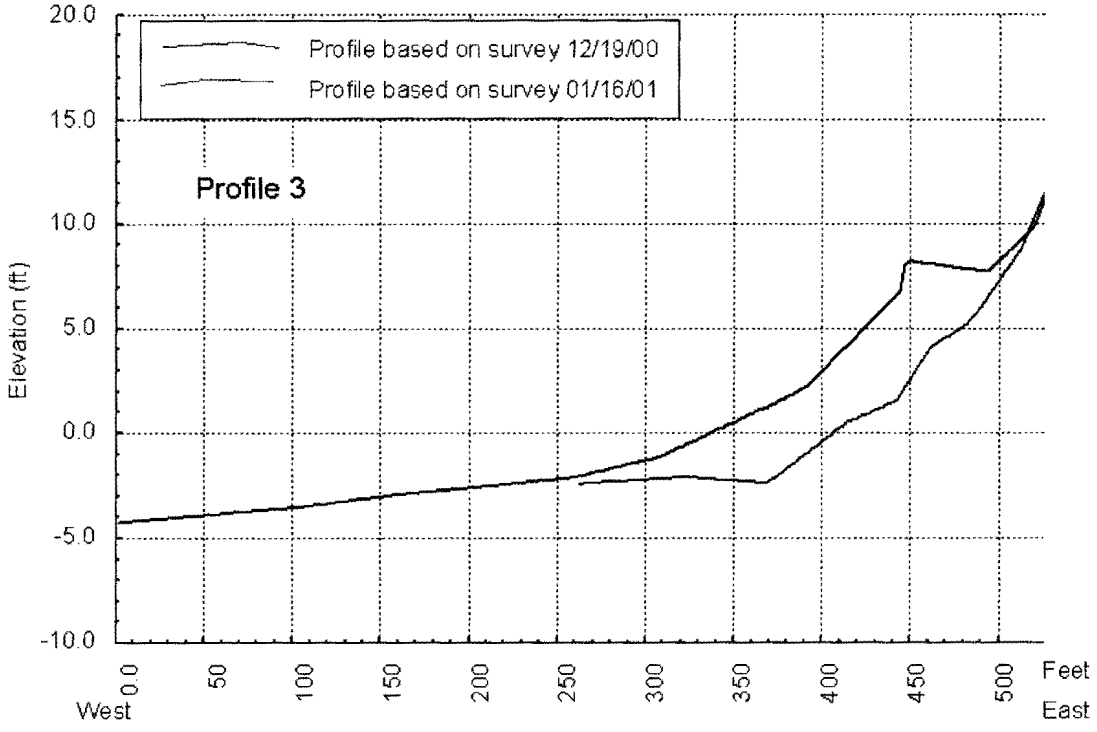


Figure 16 Profiles 1 and 2.



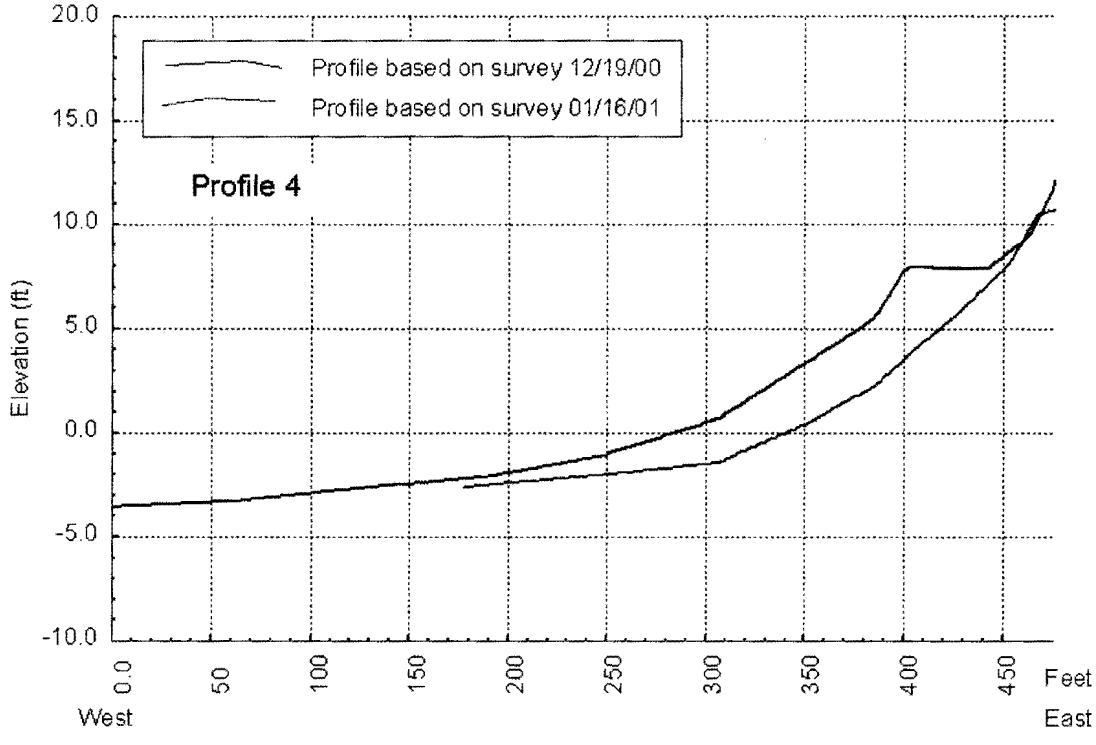
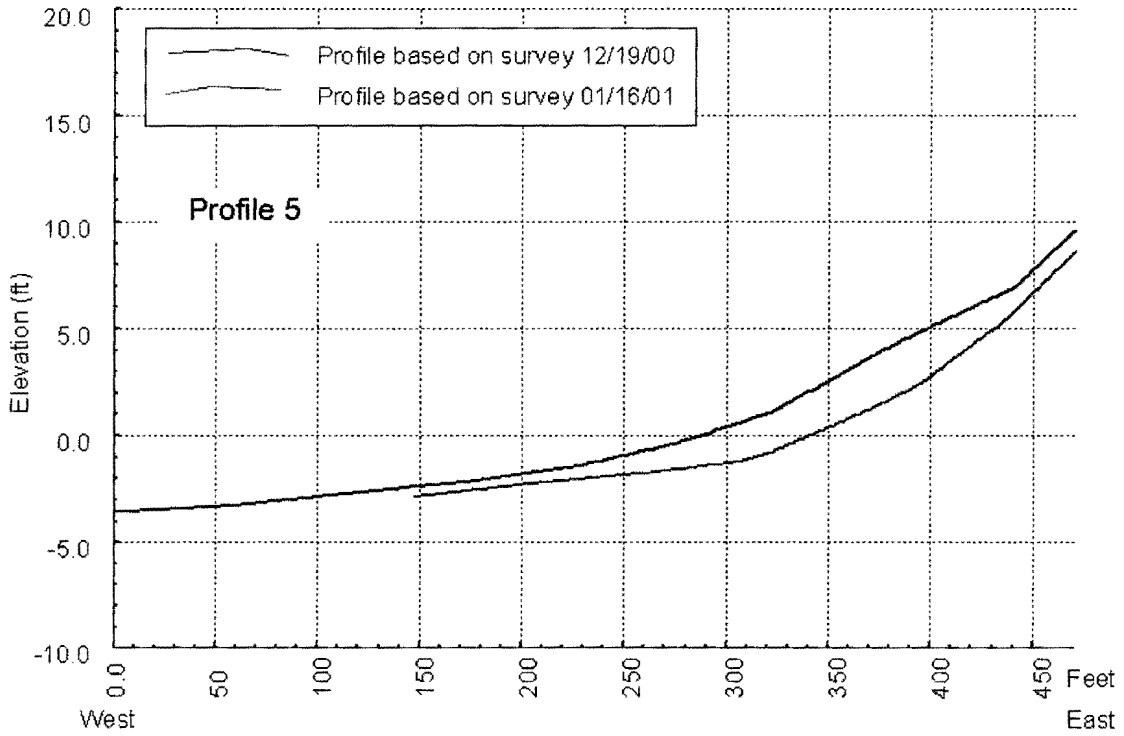


Figure 17 profiles 3 and 4.



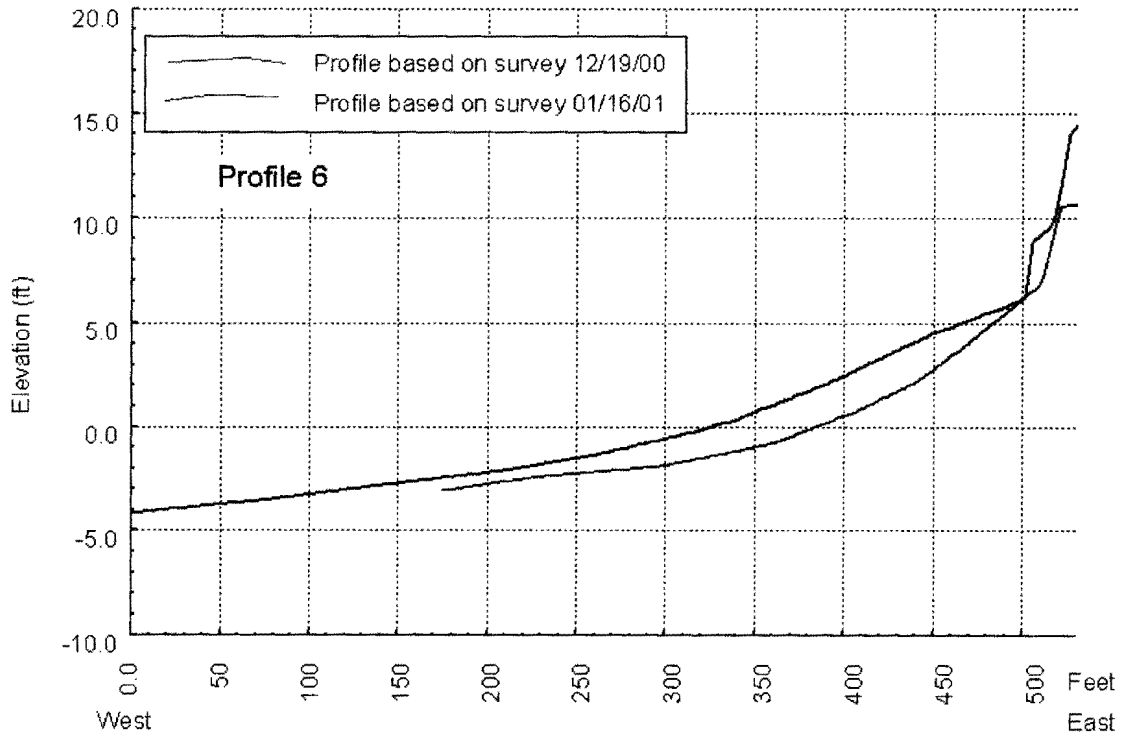
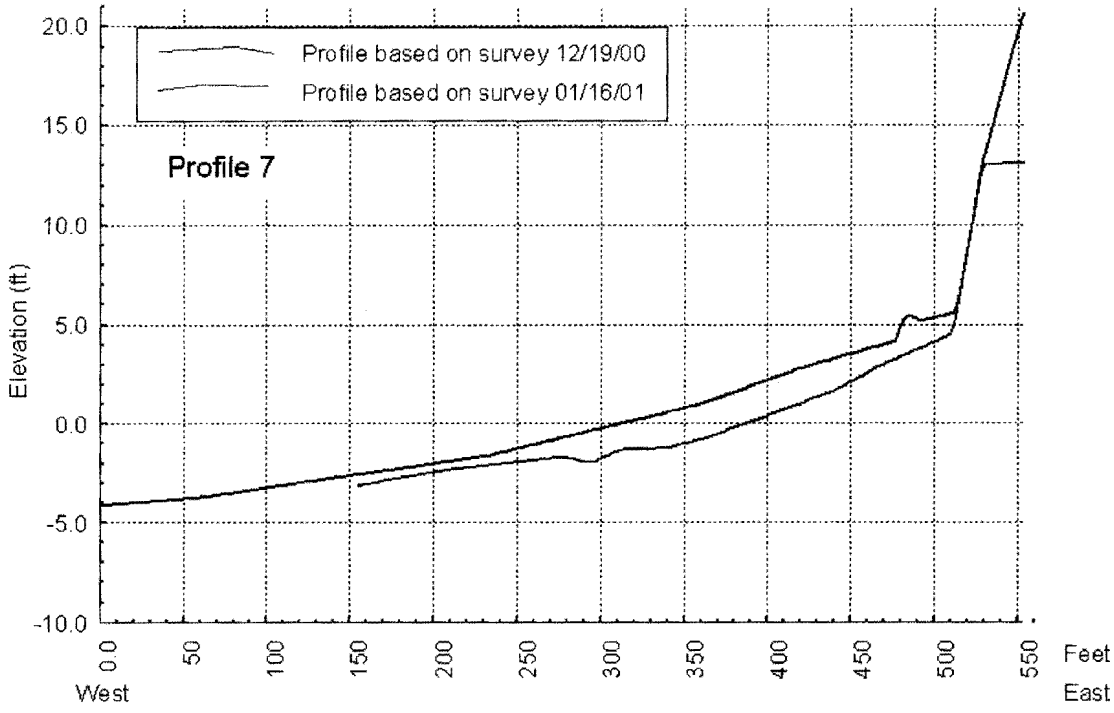


Figure 18 Profiles 5 and 6



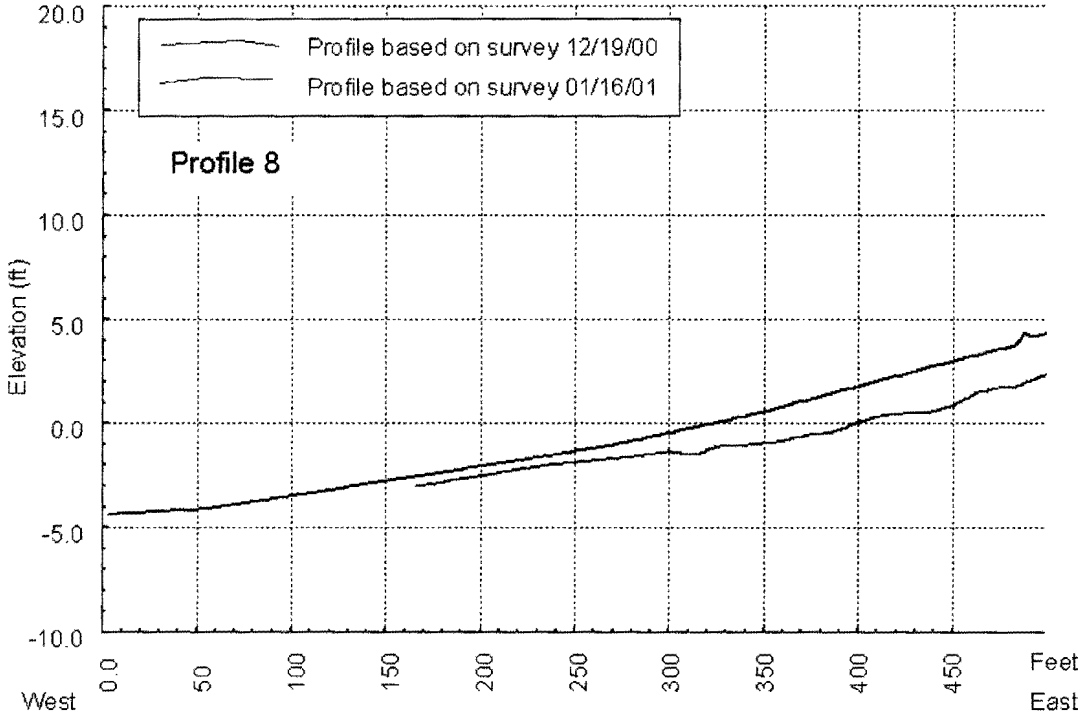
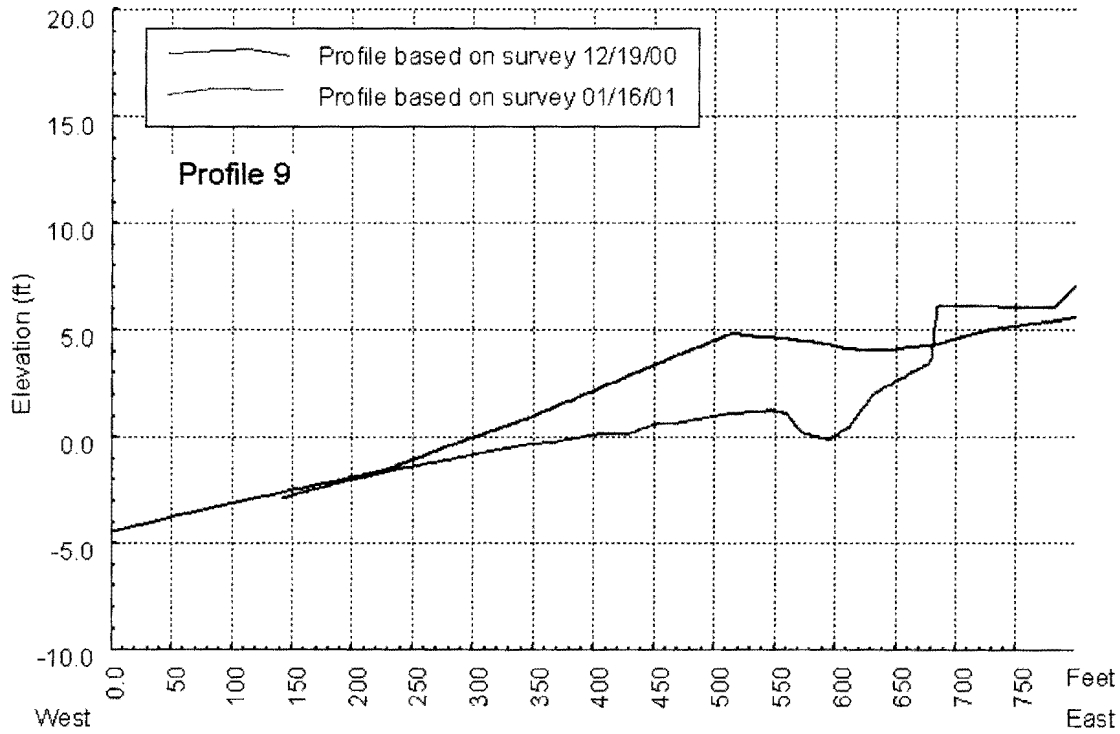


Figure 19 Profiles 7 and 8.



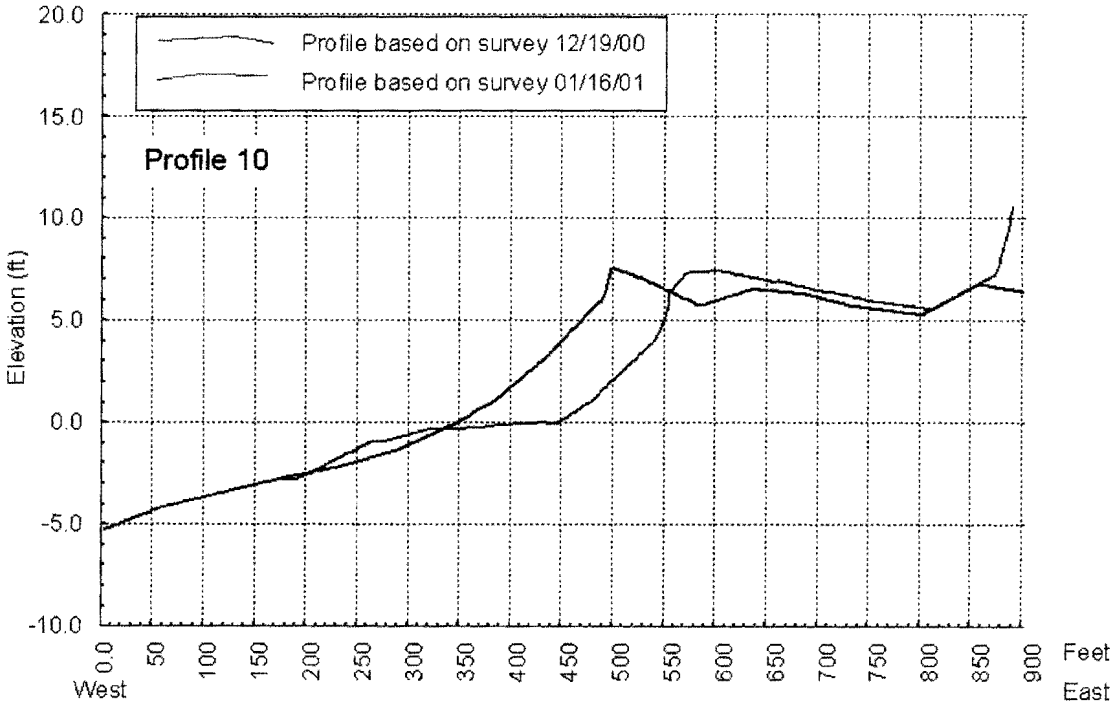
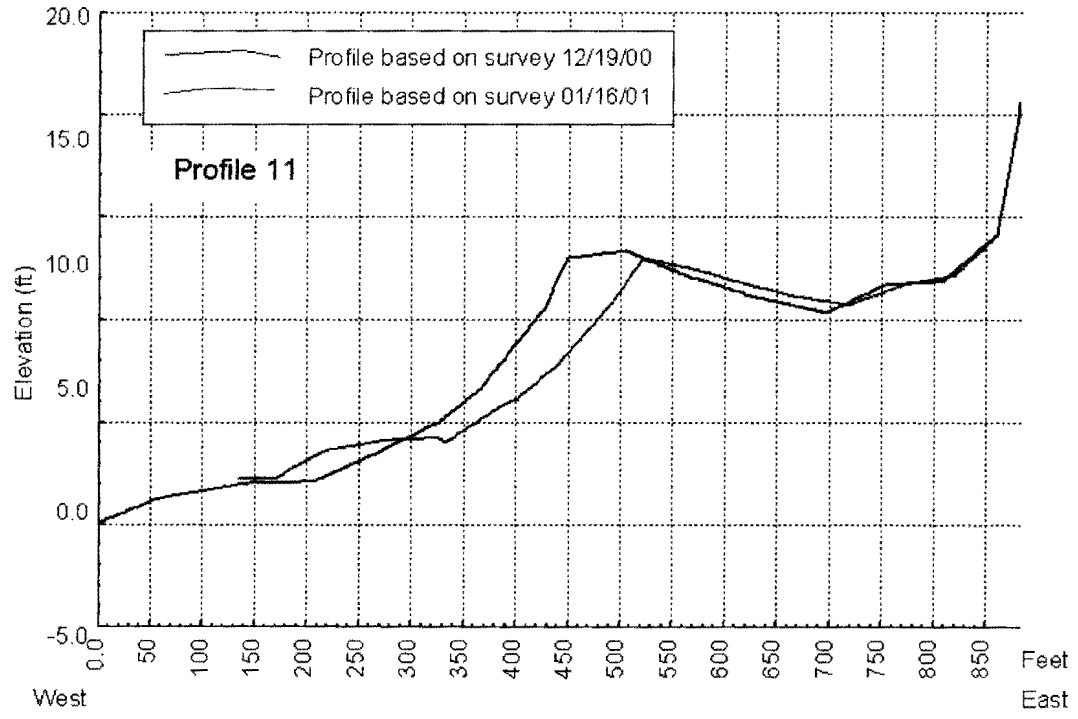


Figure 20 Profiles 9 and 10.



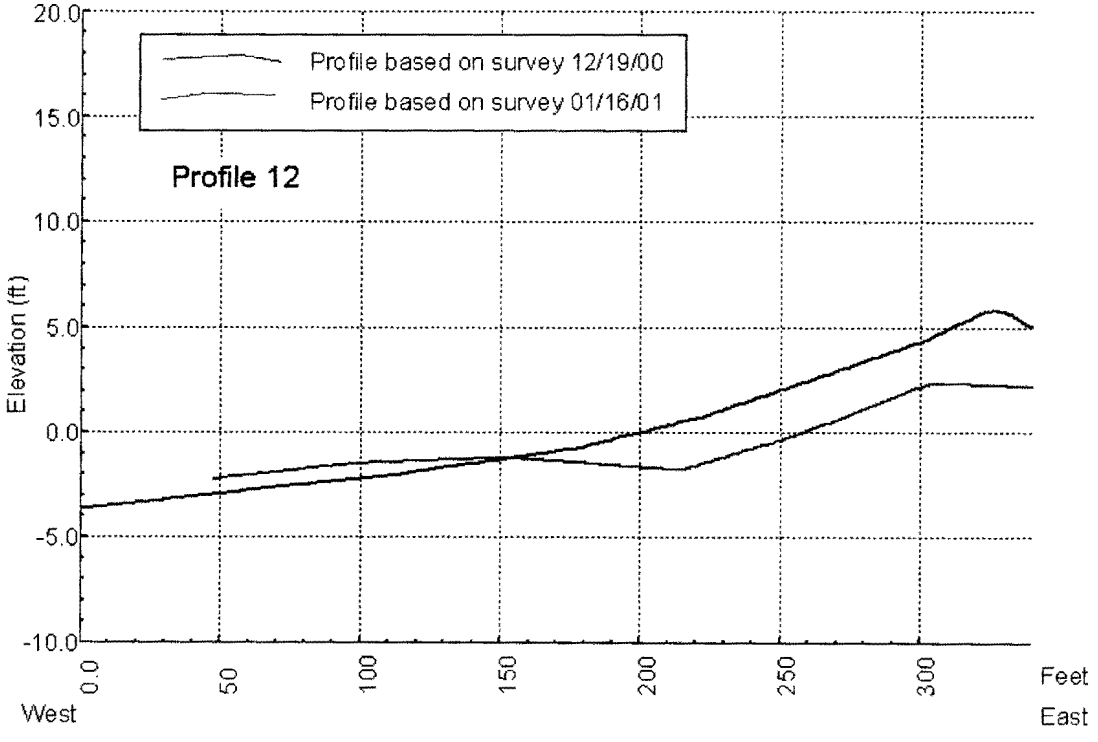


Figure 21 Profiles 11 and 12.

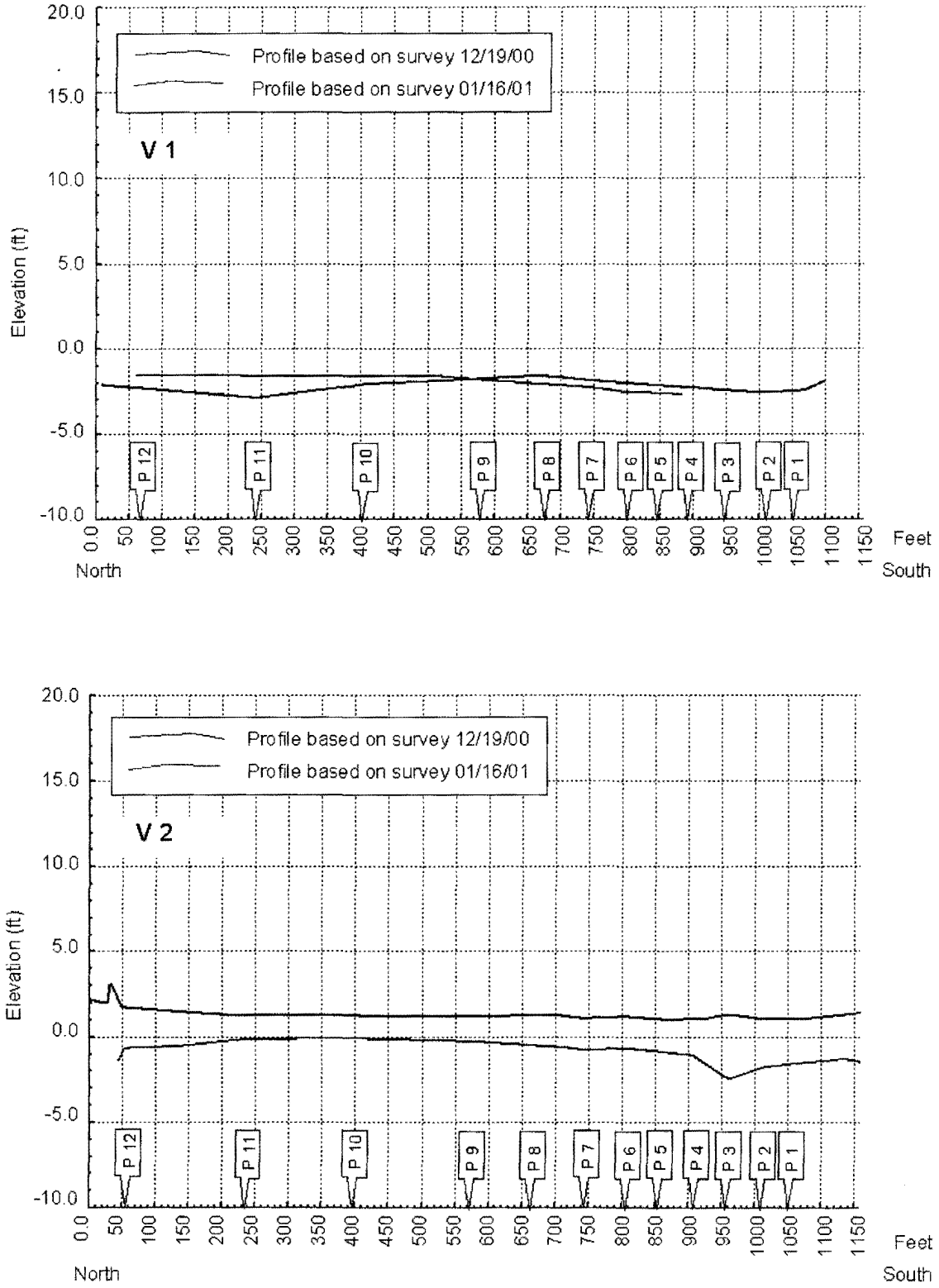


Figure 22 North-south profiles V1 and V2 along the lower foreshore and mid tide sectiomf the beach.

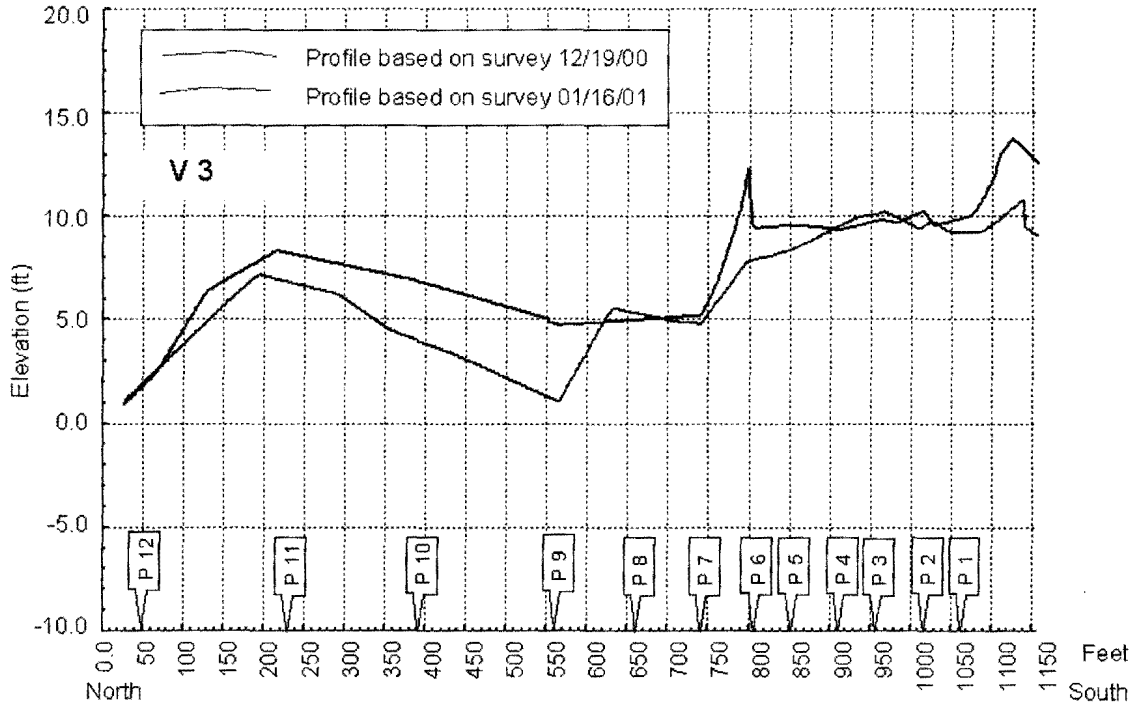


Figure 23 North-south profile located along the backshore.

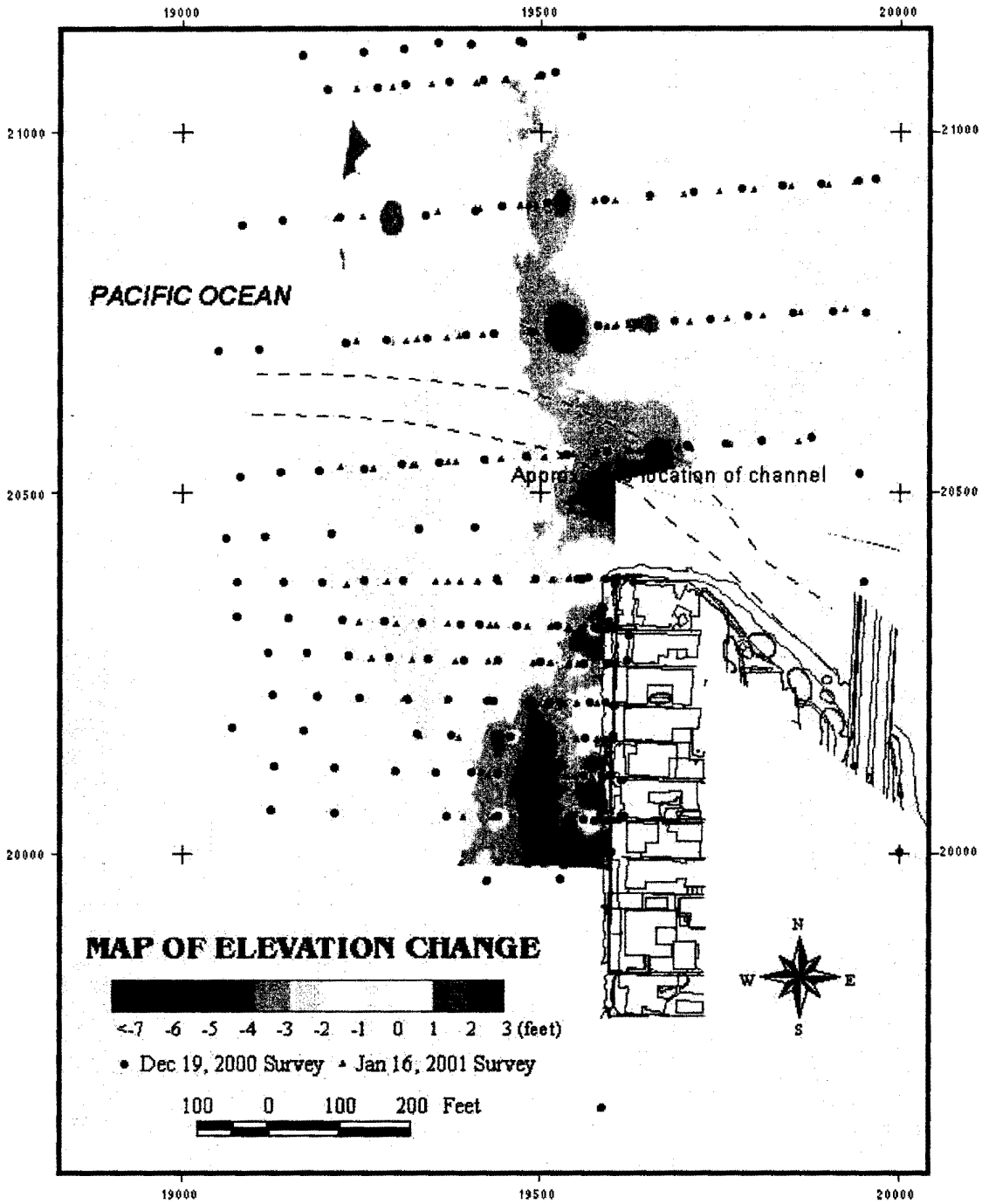


Figure 24 Topographic/bathymetric change map for the period December 19 2000 through January 16, 2001.

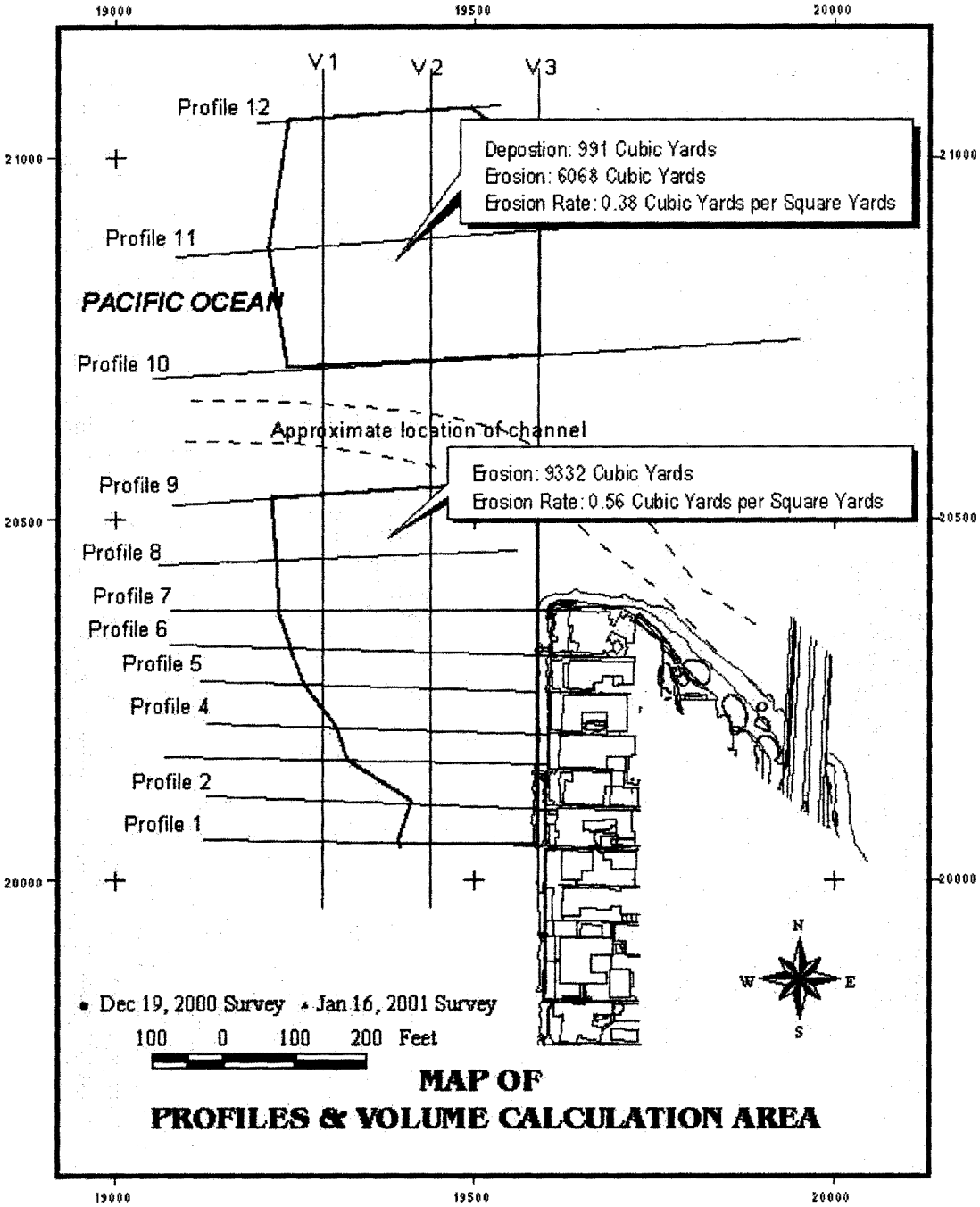


Figure 25 map showing areas for which volume change statistics were derived.

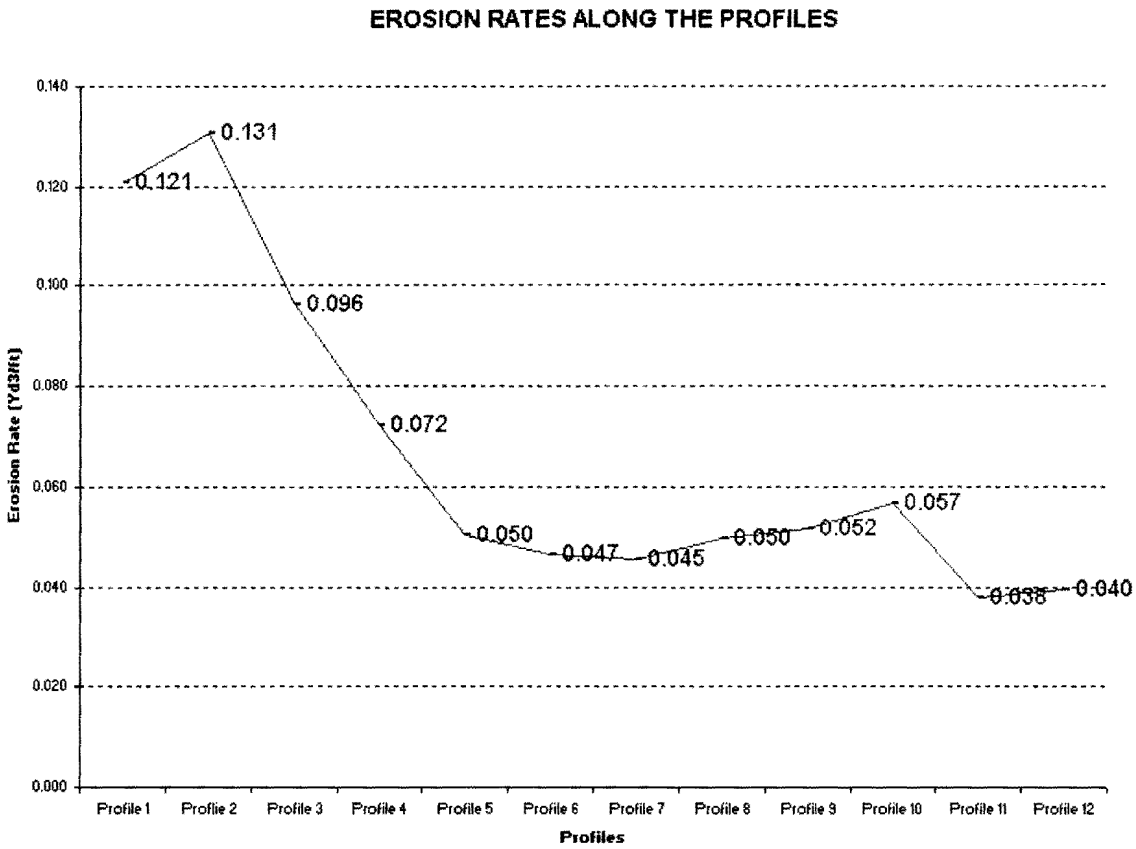


Figure 26 Erosion rates (yds/cubed/ft) for all profiles.

Seawall Influence on the Beach

A voluminous literature exists on the effects of seawalls on beaches (see reviews in Kraus, 1988; Kraus and McDougal, 1996). Rubblemound (or riprap) structures have proven to be very effective in minimizing wave damage during storms to upland property and infrastructure (Figure 27). One of the more pronounced concerns with seawalls is the potential for reflection of wave energy and subsequent scour at the toe of the structure (McDougal et al., 1996). As shown on Figure 23, the backbeach area fronting the seawalls within the survey area is considerable higher than along the beach north of the channel which is unprotected. The elevation is typically between 9 and 14 feet fronting the seawall, and less than 8 feet to the north. Although several winter storms occurred between the survey period, scour at the toe of these structures did not occur to any significant extent. Several beach elevations were measured in front of the rubblemound and vertical sheetpile seawalls at the site during the surveys. An impotant finding is that in some places the beach elevation in front of the rubblemound structures was near 1 foot higher than in front of the vertical sheetpile. To elucidate this further, it will be recommended that similar measurements be made in the future. This finding is understandable given the performance of vertical, impervious structures versus permeable, rubblemound structures. The vertical structure reflects incident energy offshore more efficiently than does the more porous, rubblemound structure. Thus, the potential for scour is greatly reduced with the more porous rubblemound structures. Additionally, sand is trapped between the spaces of the rock thereby helping further stabilize the structure.

In 1999, Rick Engineering prepared a report(Coastal Process and Seawall Comparison Study for Sandy Lane Seawall Del Mar, California) and have listed several advantages of the current riprap structures at Sandy Lane over vertical sheetpile structures. In support of their general conclusions, the data presented here indicate that a departure from the conventional, widely used riprap structures may actually lead to higher rates of erosion near the toe of the structures due to increased reflection.

SUMMARY AND RECOMMENDATIONS

There are numerous examples along the coastlines of the Unites States indicating that inlets maintained open, more often than not cause downdrift erosion. As presented earlier in this report, Florida is likely the best example in the country where 8085% of coastal erosion is attributed by experts to maintaining inlets open. When viewed within the context of increased storm wave susceptibility, consequent damage to property and infrastructure, and the fact that some 86% of California's coast is experiencing erosion, it is perfectly understandable that the residents south of the entrance to San Dieguito Lagoon are concerned with future restoration plans. Residents along Sandy Lane have observed that during times when the mouth of the lagoon is open, that the beach becomes narrower and the elevation decreases. Intuitively they attribute this to the interruption of littoral drift the net of which on an annual basis, is from north to south. Reports authored by personnel of Rick Engineering have also made similar assertions. Theobservations made by the residents of Sandy Lane have been either ignored or dispelled because there

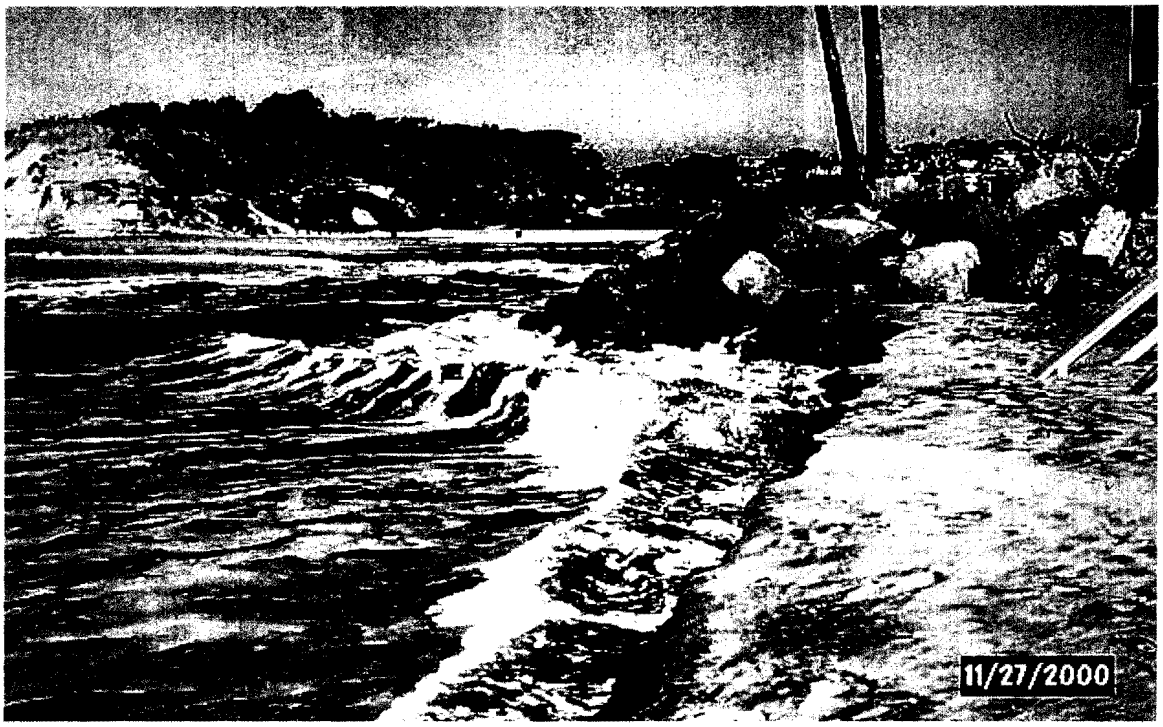


Figure 27 (Upper) Sandy Lane showing transition from riprap to vertical sheet pilseawall: (Lower) viewing north, apparent narrowing in beach southward of inlet (image taken 11/27/00).

is no evidence to support their contention. While observations are always a powerful tool when one wishes to arrive at accurate conclusions as to how coastal systems function, the lay person often has little success in having his/her arguments heard by the appropriate parties. In the present case, Rick Engineering responded to the Draft EIS with concerns regarding the negative impact that maintainingthe mouth open would likely have on the downdrift (Sandy Lane) beach. Rick's arguments were refuted primarily by Jenkins (2000) who has consistently maintains the following:

"The only effect that the project will have on the local beach will be due toan enlarged inlet channel cross-section. However, the loss of beach sand caused by this enlarged inlet channel is more than made up by the new sand dredged from the inlet channel during construction and subsequently placed on the beach."

It is understandable that the Sandy Lane residents remain dubious. Consider for example within the context of Jenkins' conclusions, recent dredging operations had dredged sand dumped on the north side of the newly created channel where it had no benefit to the downdrift beach along Sandy Lane. Evidence is presented in Figure 28 and 29. More fundamental, however, is that based on the following evidence, the present author refutes some of the more critical conclusions reached by Jenkins (2000).

Major Findings of this Study

Based on a synthesis of existing pertinent literature, re-evaluation of existing data sets, field reconnaissance, measurement and personal communications with residents and knowledgeable professionals, the major findings of this study are as follows:

California Context

1. It is estimated that approximately 86% of California's ocean fronting coast is actively eroding (Griggs, 1992; 1995). Based on longterm shoreline change data (USACE, 1991), it can be argued that the beaches of Del Mar are among the last of the slightly more stable in San Diego County. Therefore, any action that would potentially interfere with a longer-term equilibrium should be avoided where possible.

Shoreline Erosion and Channel Opening

2. There is no evidence to support the conclusion of Jenkins (2000) that the shoreline accretion measured at Del Mar is primarily due to the high incidence of inlet opening. Between January 1, 1980 through December 31, 1989, it is observed that in contrast to the findings of Jenkins (2000), the inlet was open for a period of 48.7 months (40% of the record) and closed for 71.3 months (60% of the record). This clearly contradicts the findings of Jenkins that the inlet was open nearly 75% of this period. It can be argued that the higher percentage of inlet closure enhanced stability along the downdrift beach because the degree of interruption of the longshore transport of sediment to the south was minimized.

Figure 28. Photograph of dredging operations late 2000 provided by resident of Sandy Lane. According to residents, sand was piled north of the channel. (View looking west).

Figure 29. Mouth of the inlet showing initial infusion of water from the Pacific and sand piled north of the channel during dredging operations late 2000.

Long-Term Channel Closure

3. Over the longer term, it is apparent that the inlet tends to be closed. For example, between October 1, 1926 and September 30, 1995, it is apparent that the entrance to the lagoon remained closed 72% of this period of time.

Sand Deficiency Coincident with Channel Opening

4. From 1974 to a period before the winter of 1982 and 1983, the beach width and volume immediately south of the entrance to San Dieguito Lagoon showed a marked erosional trend. This is an important observation in that it is precisely this location that will likely be most sensitive to the effects of channel opening and consequent sand deprivation. Between 1974 and pre-storms in the winter of 1982-1983, the inlet remained open some 50.2 months and closed 31.5 months. Therefore, the net deficiency of sand on the beach can be attributed to the opening of the lagoon.

5. After marked beach erosion attributed to the storms of winter 1982 and 1983, post-storm recovery of the beach at Del Mar was virtually accomplished three years after the storm at all sites with the exception of the profile immediately south of the entrance to the lagoon. The site was more than 60% deficient in sand in 1985 than it was prior to the storms. It is likely that the beach did not recover because the channel remained open for a period of 13.6 months between February 1983 and March 1984.

Beach Recovery Coincident with Channel Closure

6. It is important to note that beach recovery was apparent between the early part of 1984 and the winter of 1985 when the inlet was intermittently closed for more than 18 months.

Complex Processes not yet Understood

7. Net longshore transport at the San Dieguito entrance is north to south (Jenkins and Waysl, 1998). Entrance channels to inlets migrate in concert with the direction of longshore transport unless constrained by headlands, or jetties (Inman and Dolan, 1989) or antecedent geological controls. Elwany (2000) concluded the following after having monitored the inlet for a period extending from 1992 through 1996. "Based on our observations, a pattern of northerly inlet channel migration is thus established for the time periods under study." This would imply that the inlet channel is migrating against the net longshore transport direction which is to the south. If this is indeed the case, the system is clearly more complicated than previously thought, and warrants more investigation beyond a simple analogy with considerably larger, tidal inlets as proposed by Jenkins (2000).

Loss of Sand Offshore Through the Inlet

8. Rick's contention that sand may be reworked offshore through an open inlet is not as technically flawed as Jenkins (2000) suggests. In accord with Inman and Dolan, 1989; pp. 218, "Unfortunately little is known about the rate at which sand is returned to the beach from the migrating ebb-tide bar. Undoubtedly some sand is lost offshore when extreme offshore flows are channeled through the inlets as a result of storm setup in the lagoons."

Bypassing of the Inlet via the Ebb Shoal

9. Jenkins (2000) draws on previously published models to suggest that downdrift (south) beaches will not feel the effects of maintaining the mouth of the lagoon open. He concludes that bypassing will occur across the tidal bar or ebb shoal. A more comprehensive overview, however, would introduce the concept of "drift divergence" at the inlet. As quoted from Inman and Dolan (1989):

> "Divergence of the drift is an important aspect of inlet migration. The lens effect of the ebb-tide bar of the inlet produces wave convergence near the upcoast side of the inlet and divergence downcoast. This causes the longshore transport to vary across the inlet. The divergence relation requires that there be deposition on the upcoast side of the inlet <u>and erosion on the downdrift side. Beach sand transported through the entrance and deposited in the lagoon as flood tide bars constitutes a local sediment sink that increases the erosion rate of the downcoast spit."</u>

10. In reference to the mouth of the San Dieguito Lagoon, upcoast would be to the north, and on considering that the net longshore transport at the site is to the south, then as presented here, the south beaches along Sandy Lane would constitute the erosional downcoast site. This is a highly plausible mechanism to explain the noted sand loss determined by beach profile comparisons discussed earlier.

11. Jenkins'(2000) explanation of sand bypassing the inlet to maintain stability along Sandy Lane relies heavily on the presence of an ebb tide delta. Without the ebb feature, the mechanism for bypassing as presented by Jenkins would not be accomplished at the mouth of the Lagoon when open. The net result would be that the inlet channel would serve as a sediment sink, extracting sand from the longshore transport system and starving downdrift beaches. After careful analyses of numerous aerial photographs, there was no indication that sand was deposited as an ebb tide shoal/bar through the absence of well-established wave refraction patterns. This is strong evidence indicating that sand bypassing to the south does not occur when the mouth is open and that the channel serves as a sediment sink to southward directed longshore transport. This corroborates field data and trends presented and is a critical point of concern with the proposed project.

12. The findings presented here suggest that the residents of Sandy Lane are justified in their concerns of the proposed project that necessitates widening the mouth of the San Dieguito Lagoon. All indications are that these downdrift beaches will undergo accelerated erosion directly attributable to the impedance of longhsore transport from north to south. Since the ebb tide delta necessary to accomplish the sand bypassing process cannot be observed in historic photographs, there is no reason to assume that such a feature would develop in the future on completion of the proposed project.

New Topographic/Bathymetric Program

13. Topographic/bathymetric surveys conducted in December 2000 and January 2001 north and south of the inlet were completed to establish a high resolution baseline

data set to further evaluate the precise relationship between channel opening and downdrift beach response. While the period between surveys is short, the data do indicate higher erosion rates south of the channel which could conceivably be related to maintaining the channel open throughout the survey duration. It is important that this program be maintained.

Recommendations

It is concluded here that beaches south of the opening of the entrance to San Dieguito Lagoon have and will continue to be negatively impacted through erosion due to sand starvation and loss of sand to the channel. It is recommended that a monitoring program similar to the one presented here be continued on a monthly basis to evaluate this relationship further. This could be separate or included in that proposed by Elwany (1998) for the inlet proper. Given that the mouth isnow being maintained open, the costs associated with this program should not be borne by the residents of Sandy Lane. This project would not be expensive and would provide much needed, field data that could be used to accurately quantify the relationship between inlet opening, closure, sand bypassing and beach evolution north and south of the lagoon. While the application of predictive numerical models used in previous work at the site is useful, such models provide at best first approximations of the system's dynamics. There is simply too much at stake in terms of maintaining seawall protection and the structural integrity of expensive property along Sandy Lane, the site where erosion will likely accelerate, to rely on approximate predictions (see discussion in Mehta, 1996). This is not meant as a criticism of modeling*per se*, but a realistic statement of what is at stake.

If the proposed project does proceed, at a very minimum the recommendations of one of the reviewers of Jenkins and Waysl's 1998 report should be given highest priority:

"Observe the system after it is modified by way of restoration, and make changes to the design/management if and when it becomes necessary to do so."

Dr. Ashish Mehta, 1998

The current practice of dumping quality dredge material north of the inlet as reported by the residents of Sandy Lane, and as proposed by Elwany (1998) should be terminated. This material should be transported mechanically and used to renourish the downdrift beaches starting immediately south of the channel adjacent to the properties. It is recommended that the material be disposed off along the backshore (Mean Higher High Water) and not down to the low tide line as proposed by Elwany (1998). Placement on the lower foreshore reduces the "residence time" of the dredge disposal. The proposed beach and nearshore monitoring project will provide an ongoing accurate update on which sections of beach require sand to maintain an optimum volume. A detailed sand management plan should be developed and implemented that caters to the maintenance of the downdrift beach after successive dredging. A threshold beach volume level could be calculated and if reached a remedial dredge and fill plan should be implemented immediately to protect downdrift property.

The rip rap sea walls along northern Sandy Lane appear to function well in protecting property. The higher beach levels at the toe of theses structures indicates that they are performing better than vertical sheet pile in reducing sand losses offshore due to reflection of incident wave energy. It is recommended that these structures be retained and maintained as needed. This findings further supports the recommendations of Rick Engineering.

It is perhaps fitting to end this report with two quotations obtained from two of the reviewers of Jenkins and Waysl's 1998 report. These statements would appear to represent their respective philosophies, philosophies that have important meaning for human intervention through the proposed proje ct at San Dieguito Lagoon:

> "It comes as no surprise that beach erosion is now being experienced throughout Southern California, with the negative impacts of human activities outweighing their positive contributions from beach nourishment."
>
> Paul D. Komar (*in* Komar, 1999).

> "... ... our predictive capability for impacts on the surrounding environment remains considerably short of what is essential for assessing the long-term changes due to designing or modifying inlets."
>
> Ashish Mehta (*in* Mehta, 1996).

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APPENDIX 1

Photographs taken 12/01/00

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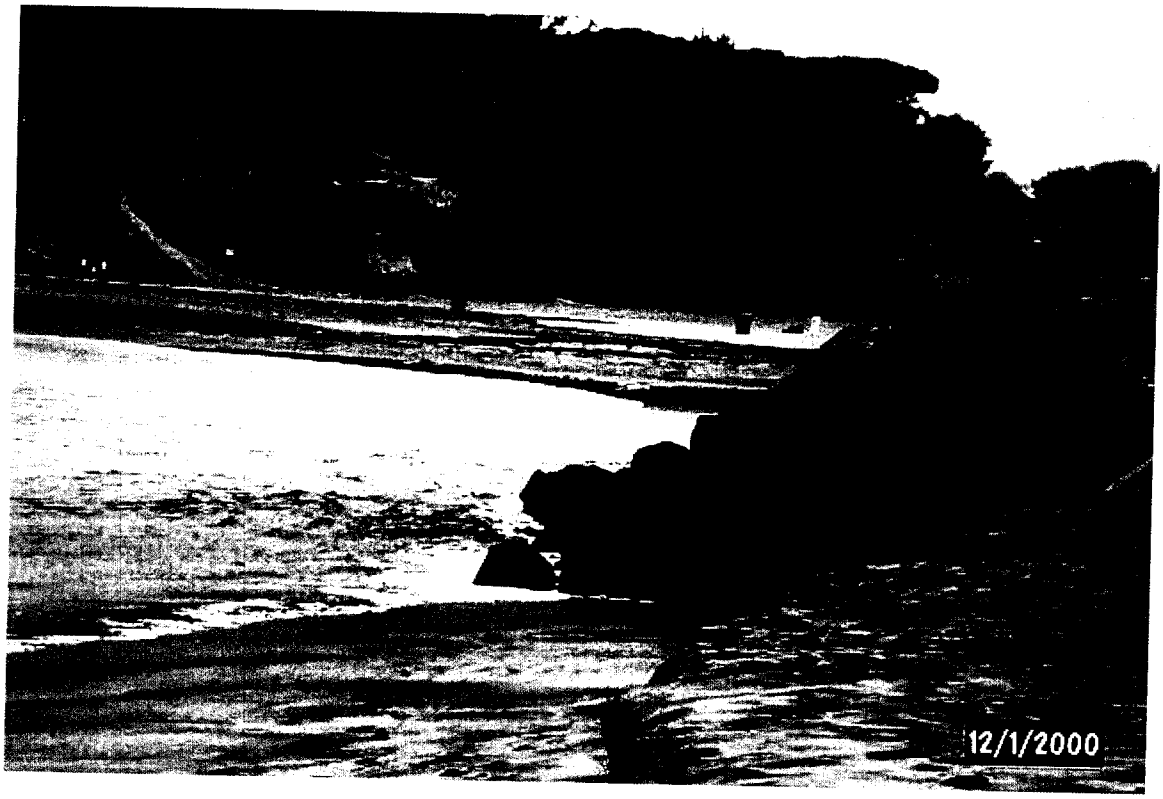
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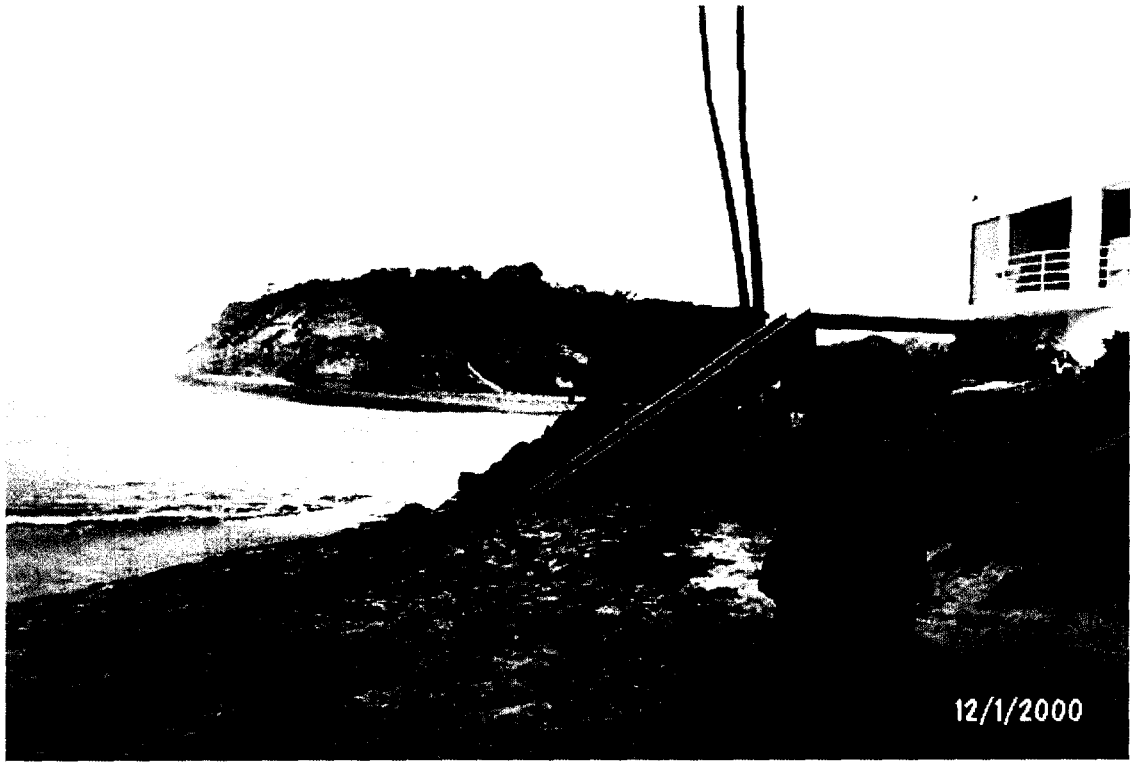
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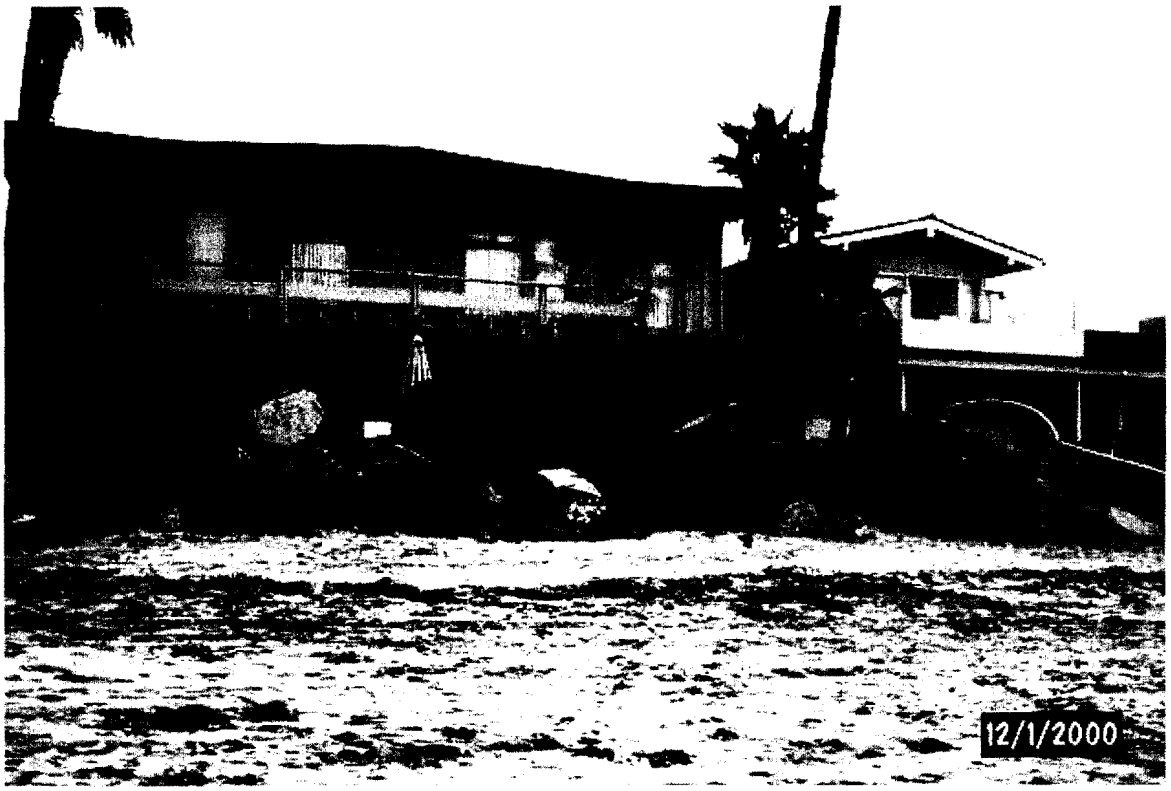
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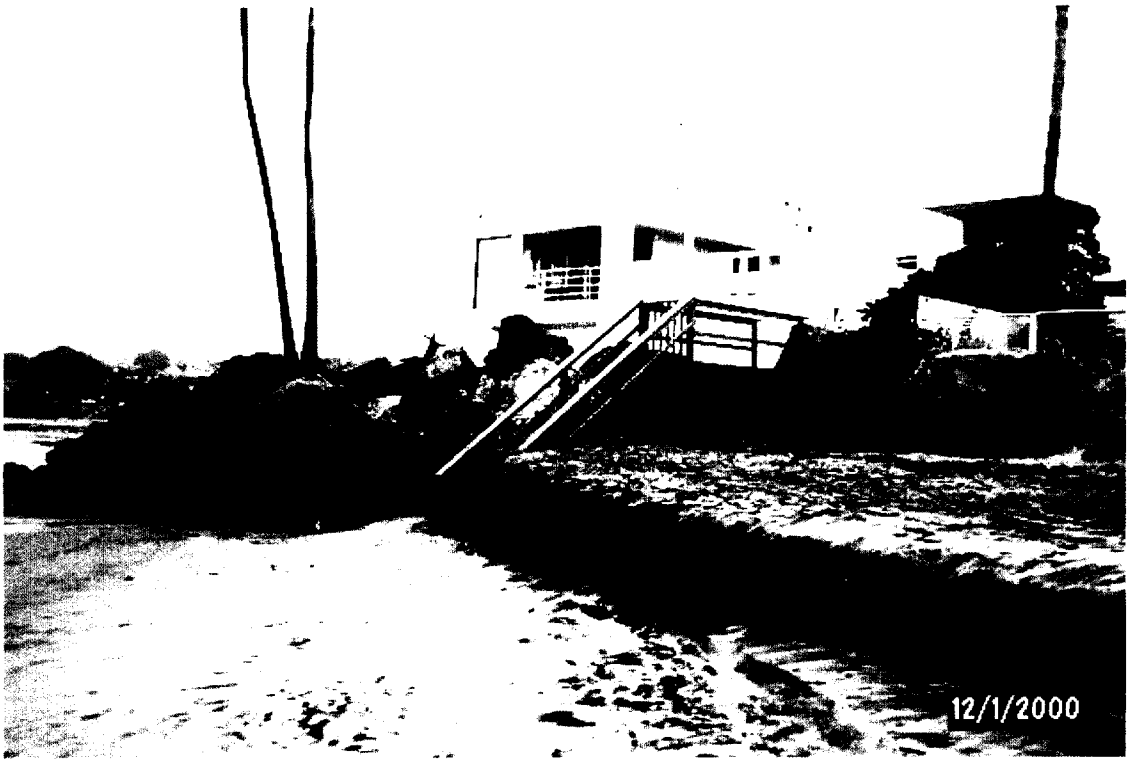
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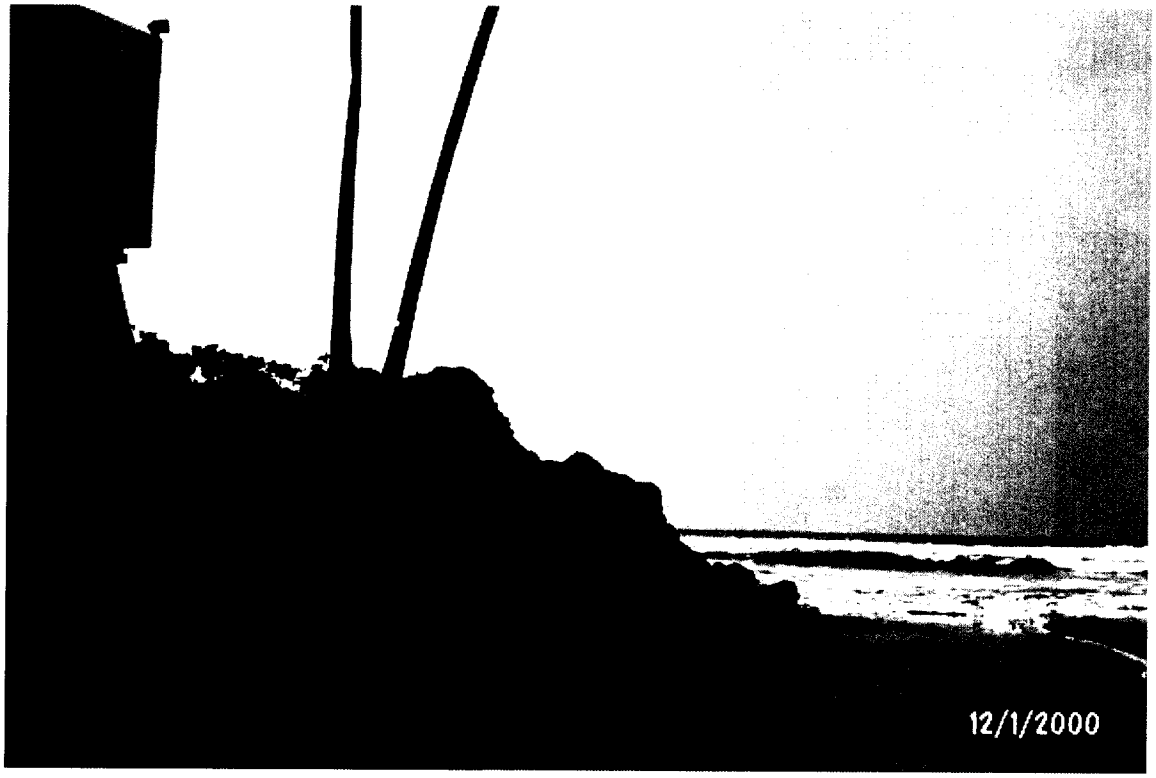
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APPENDIX 2

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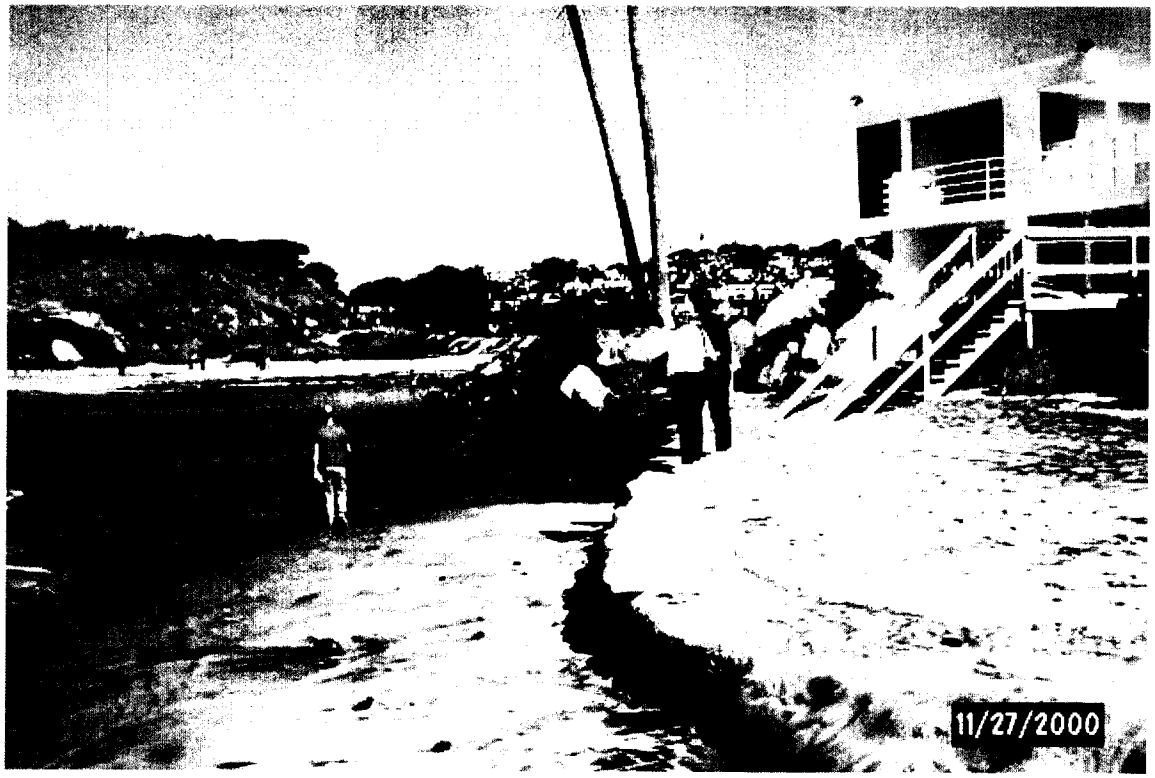
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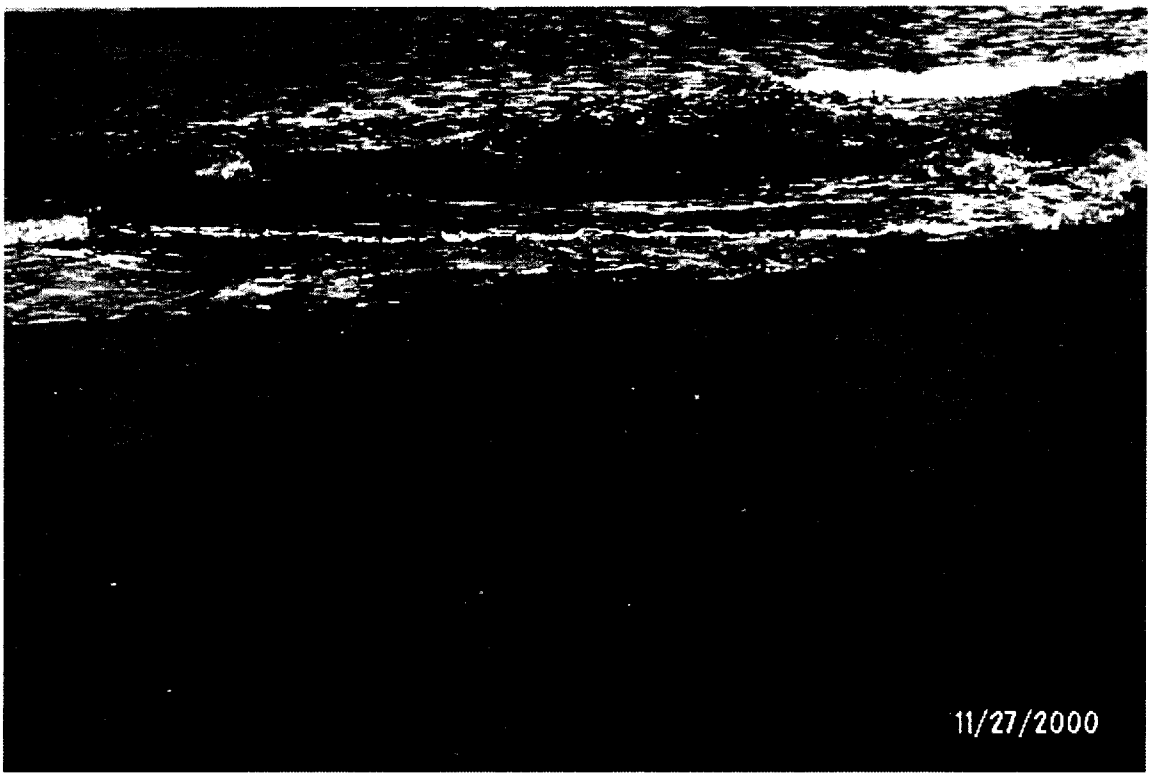
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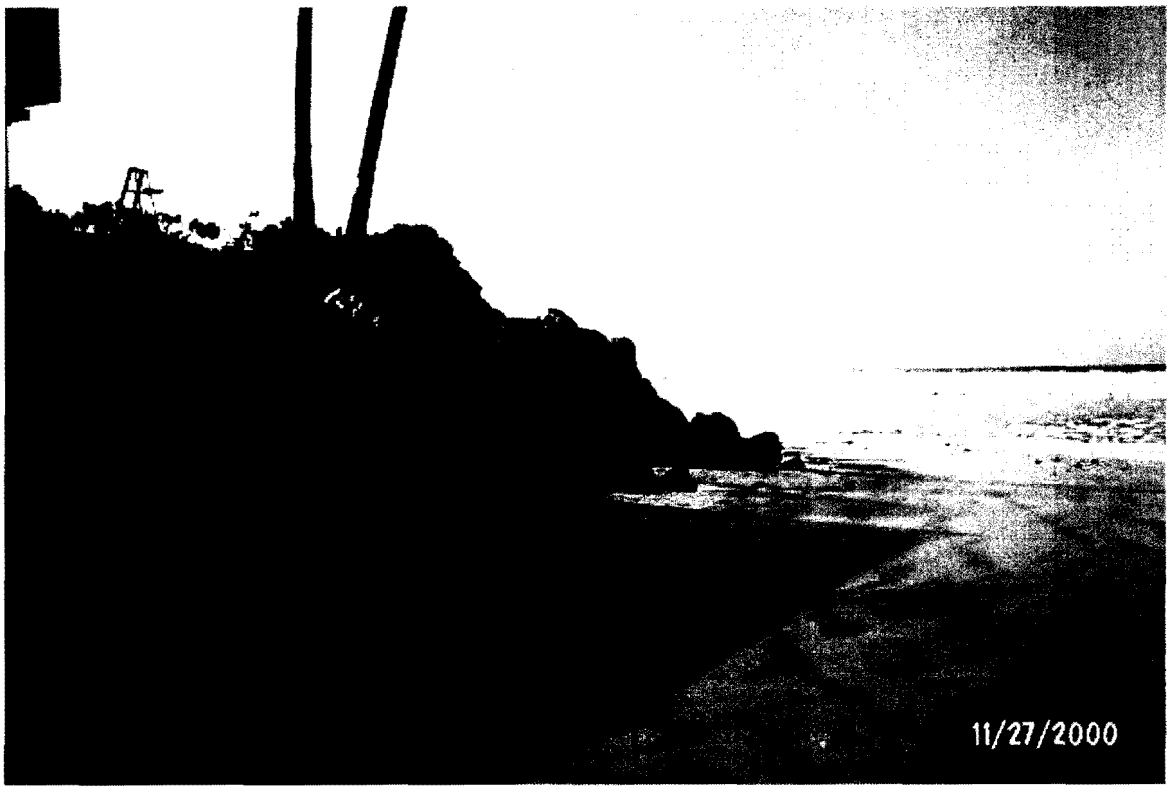
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APPENDIX 3

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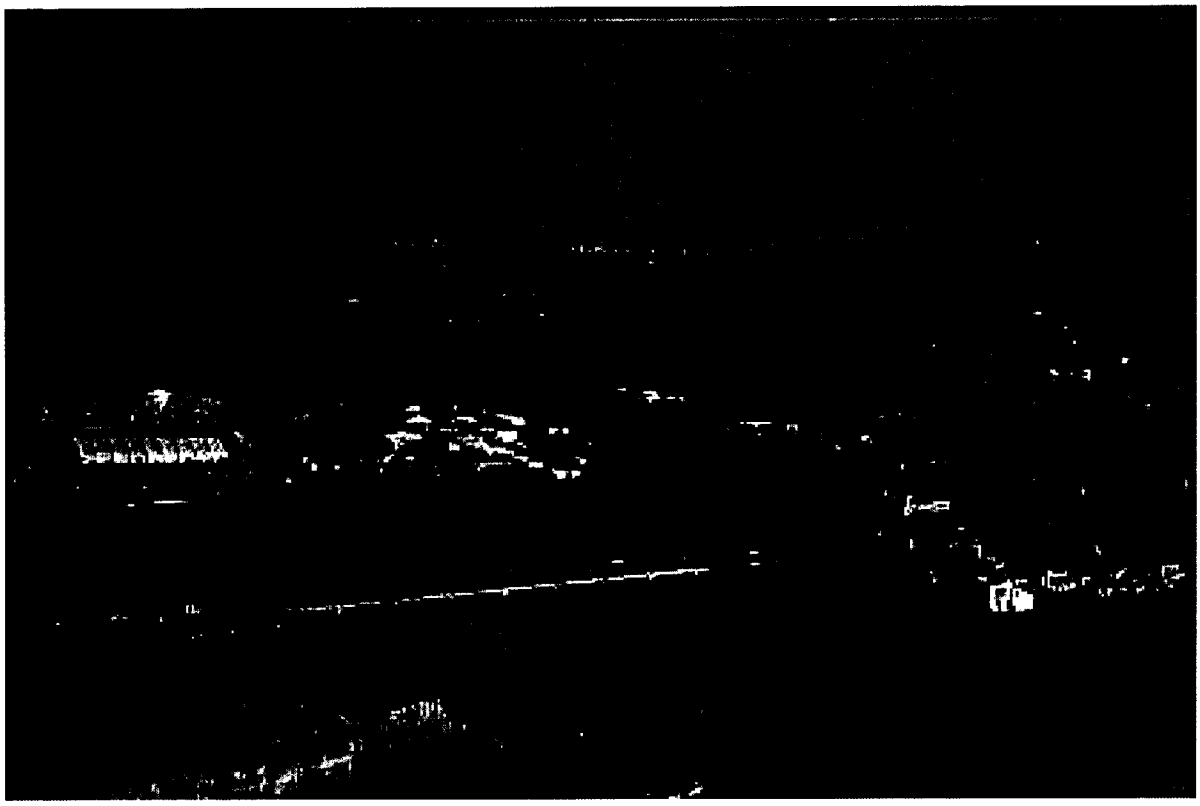

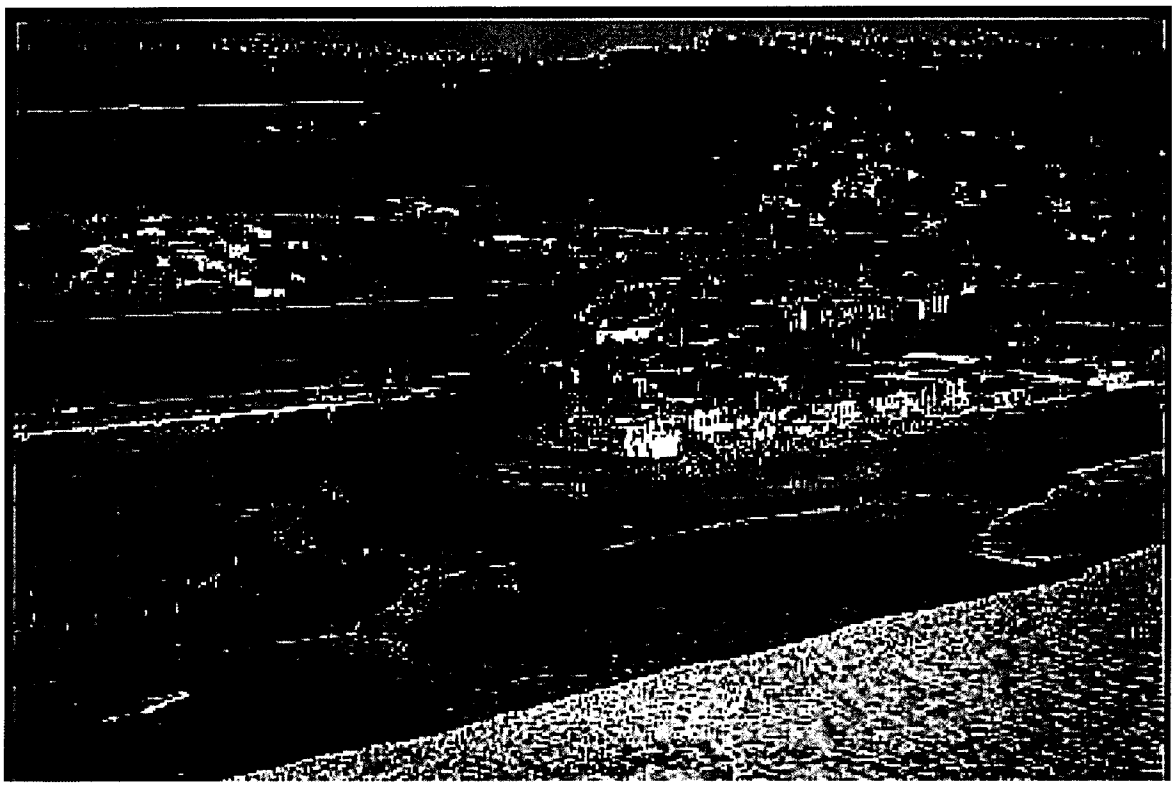

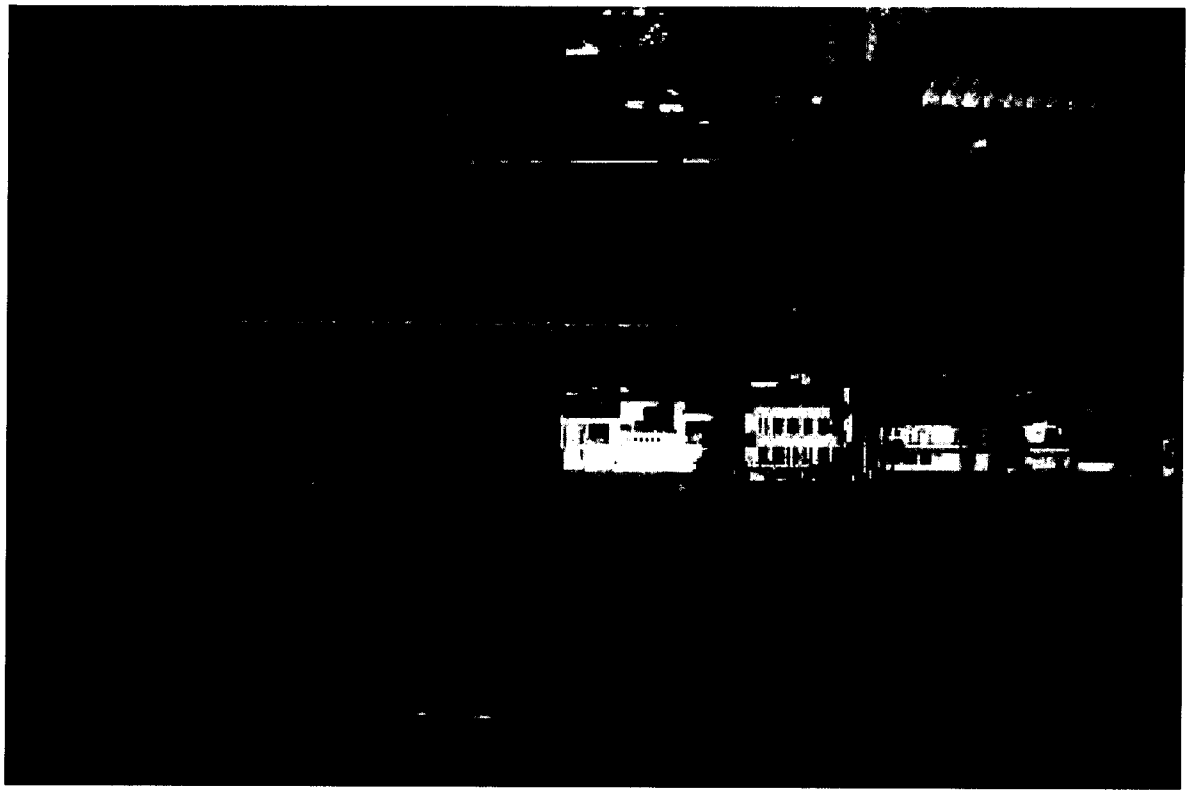

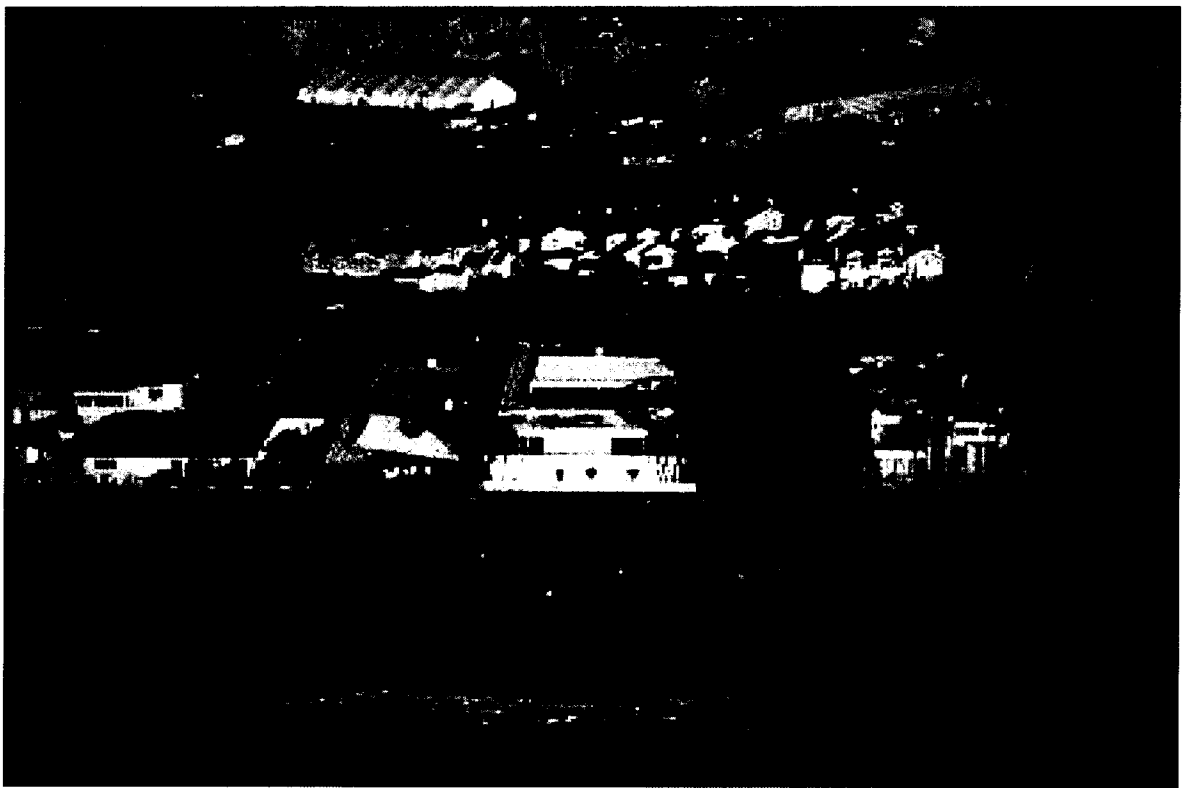

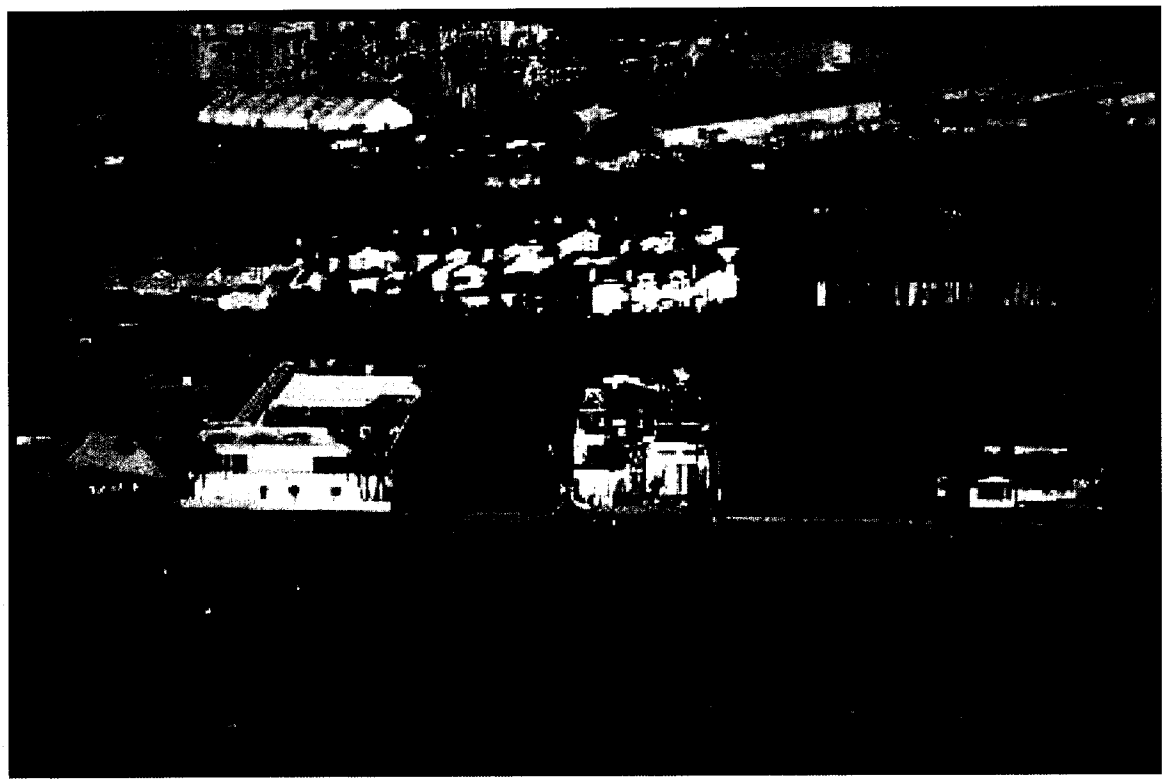

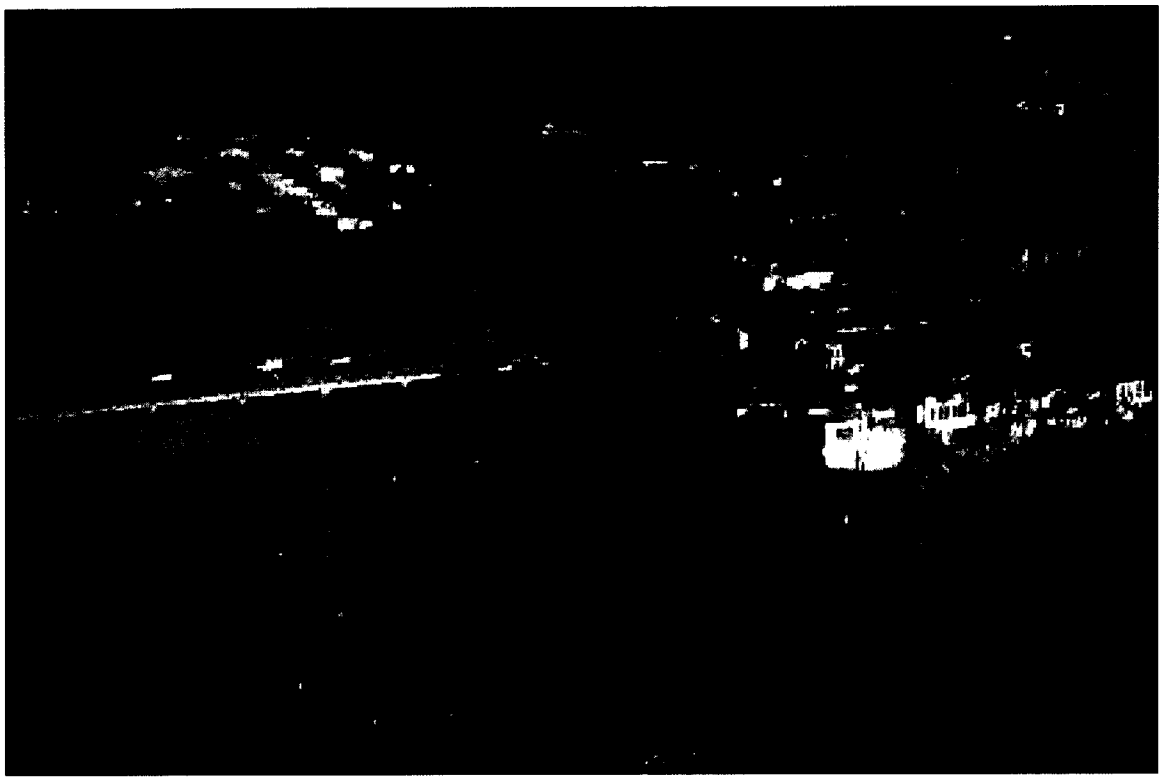

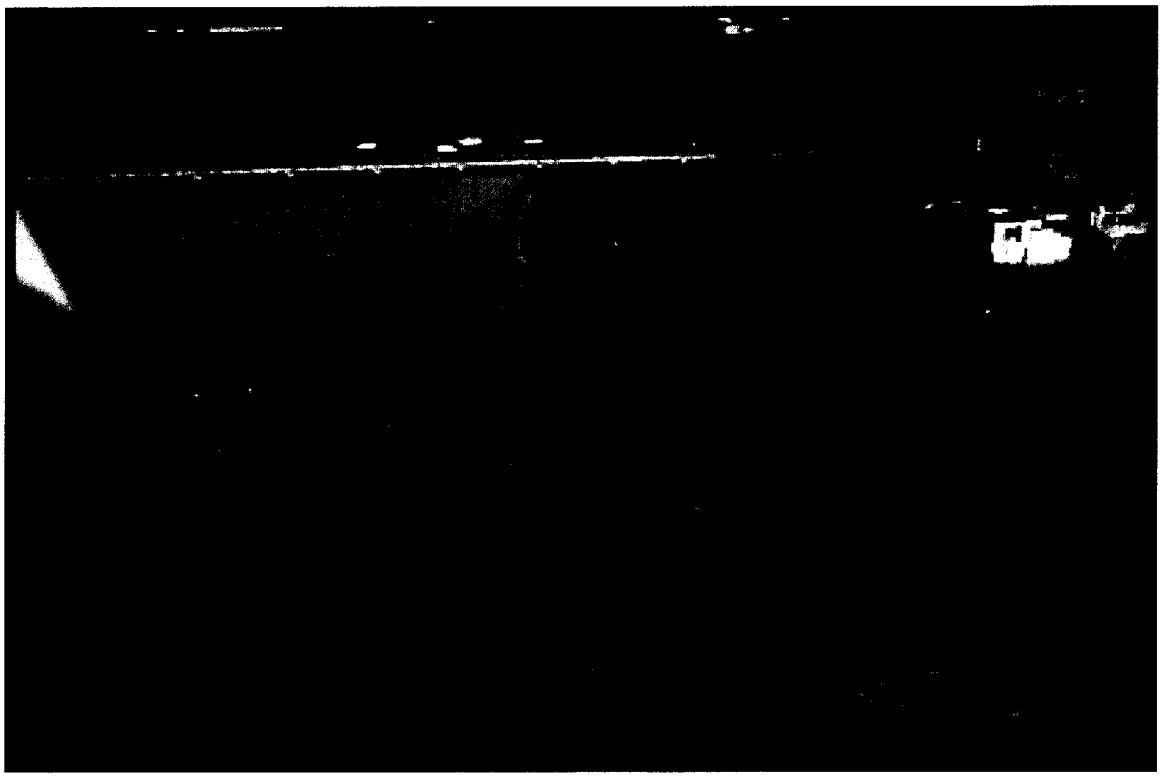

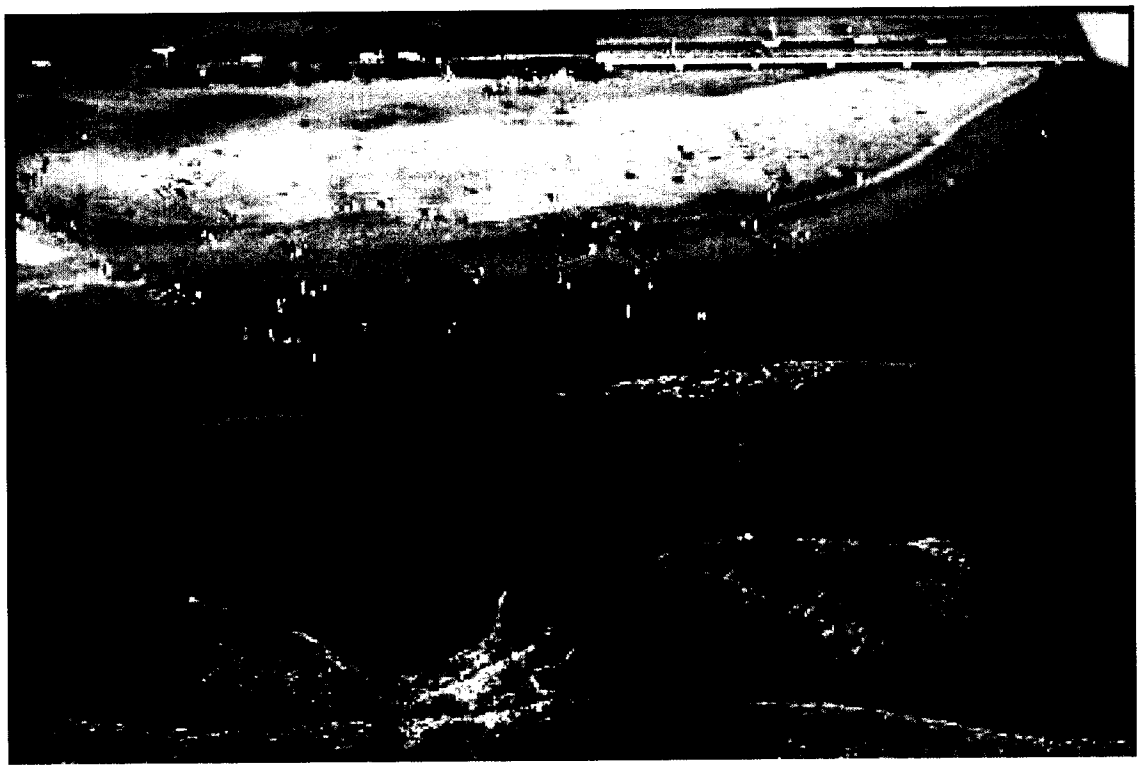

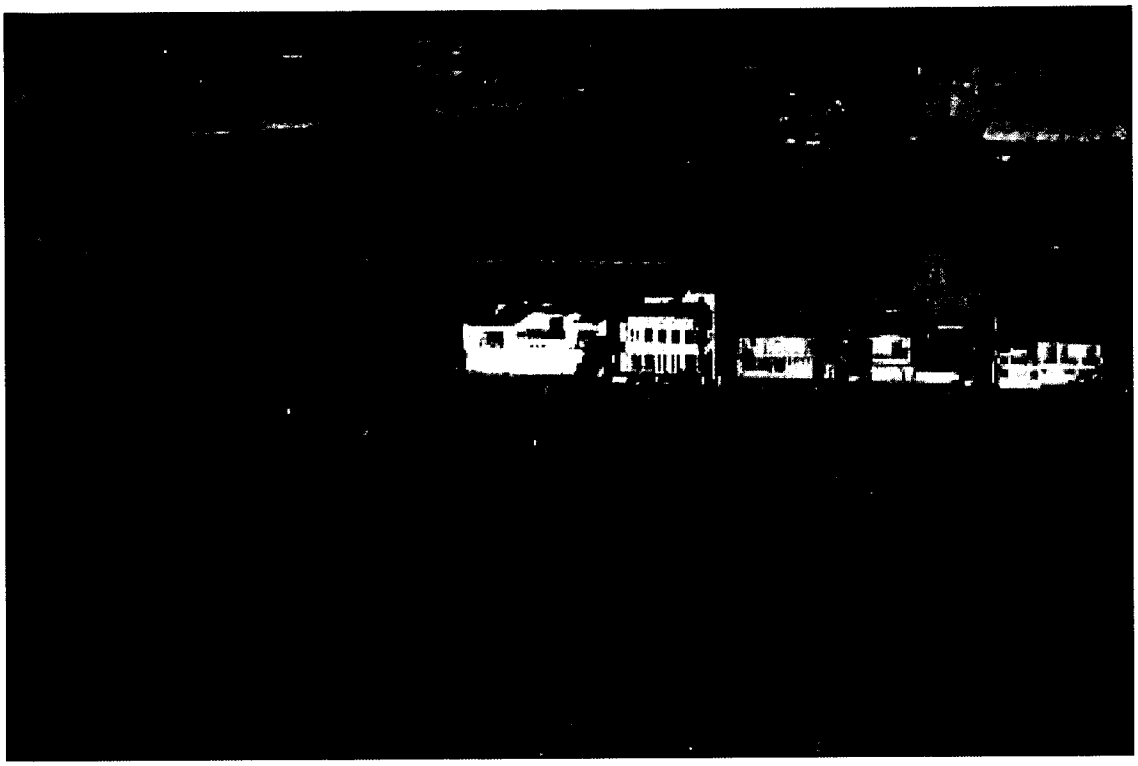

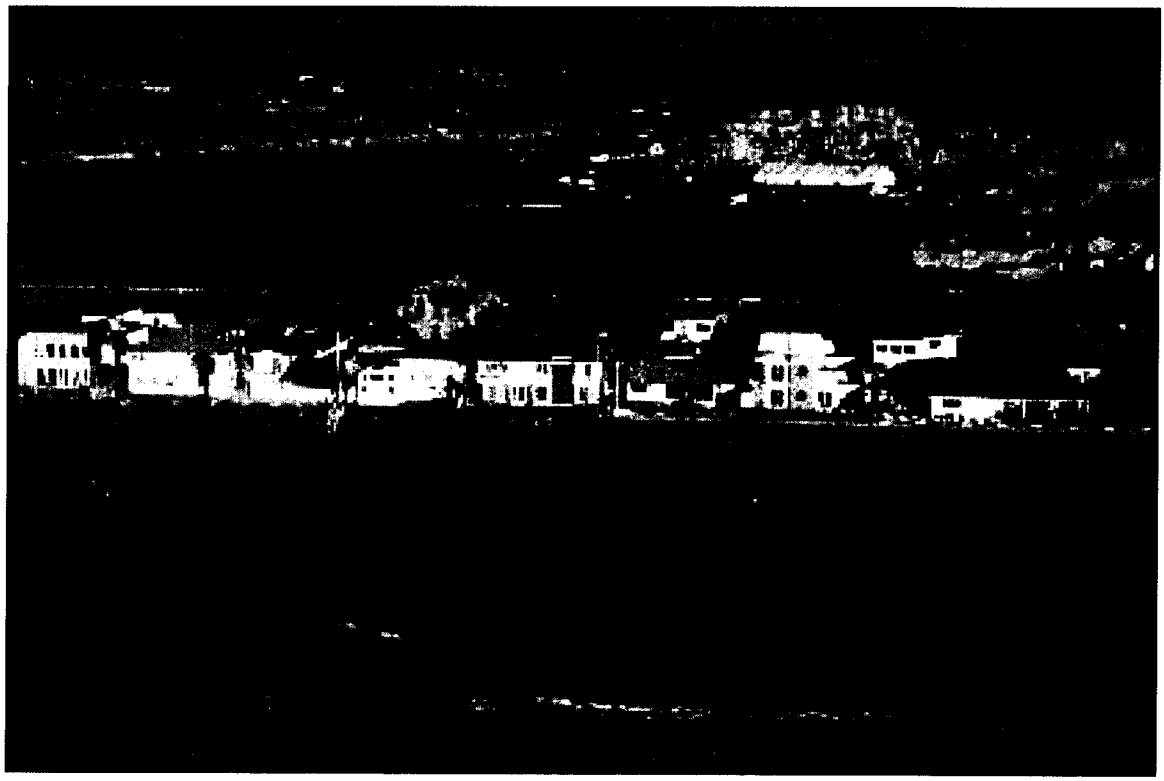

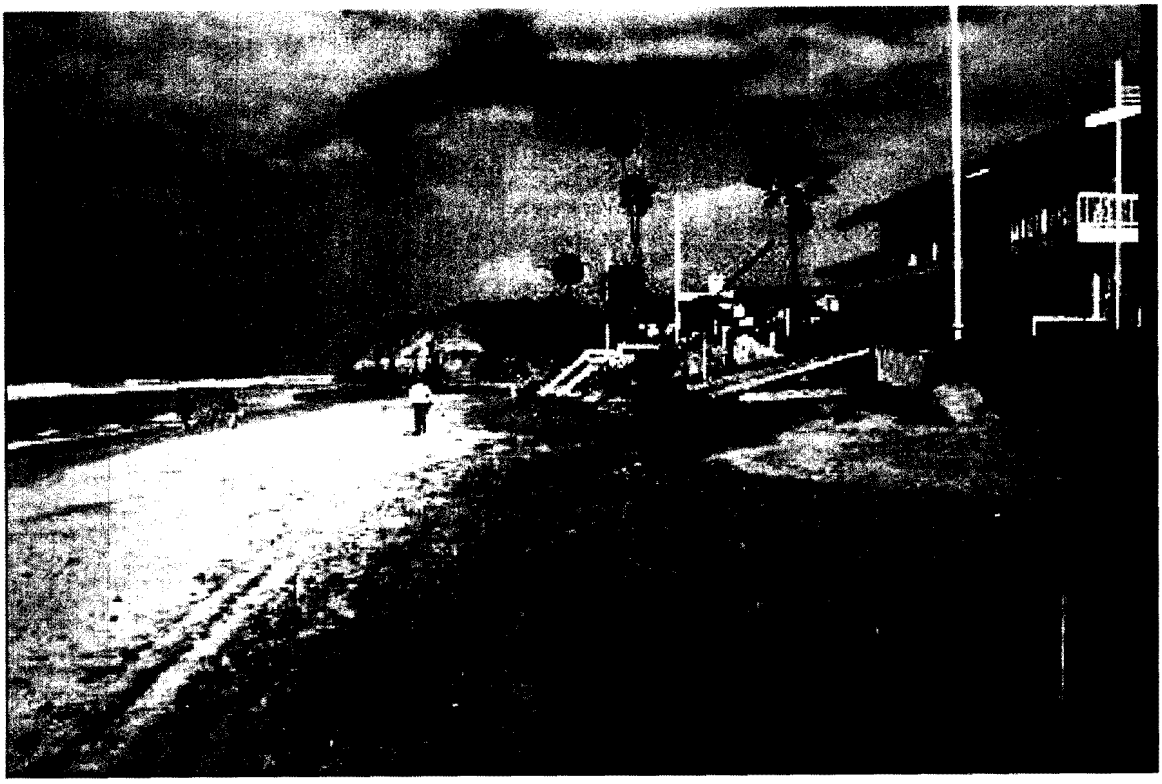

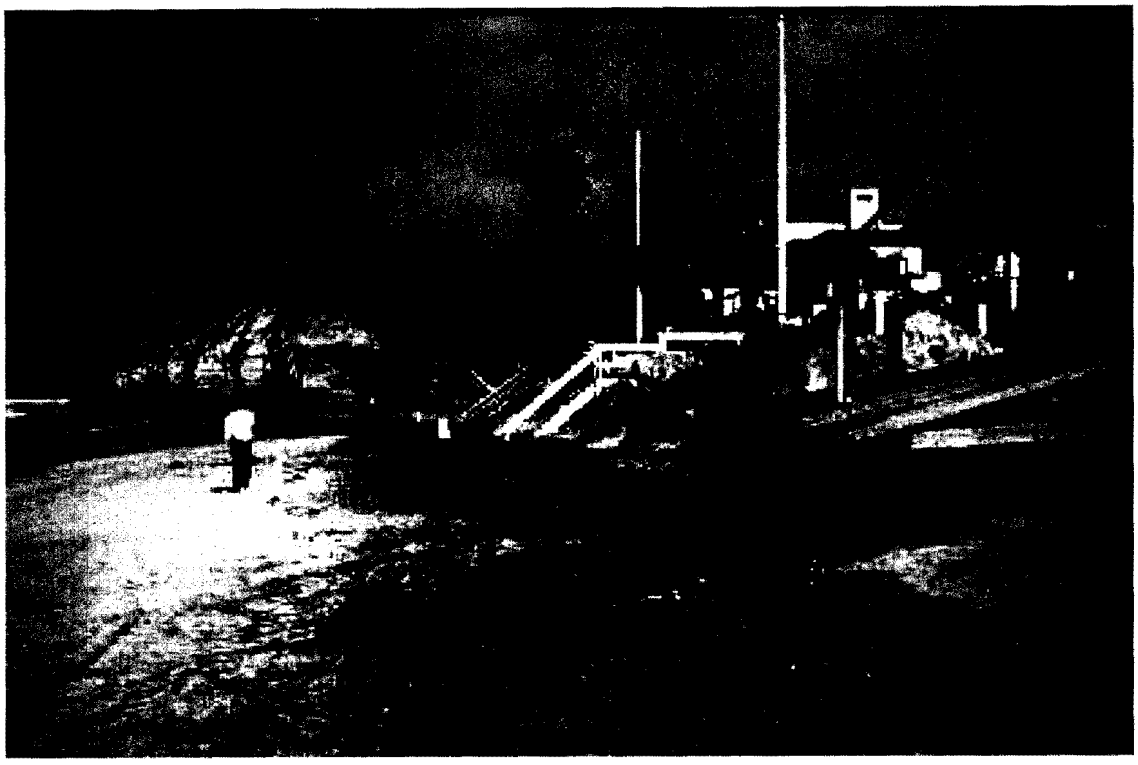

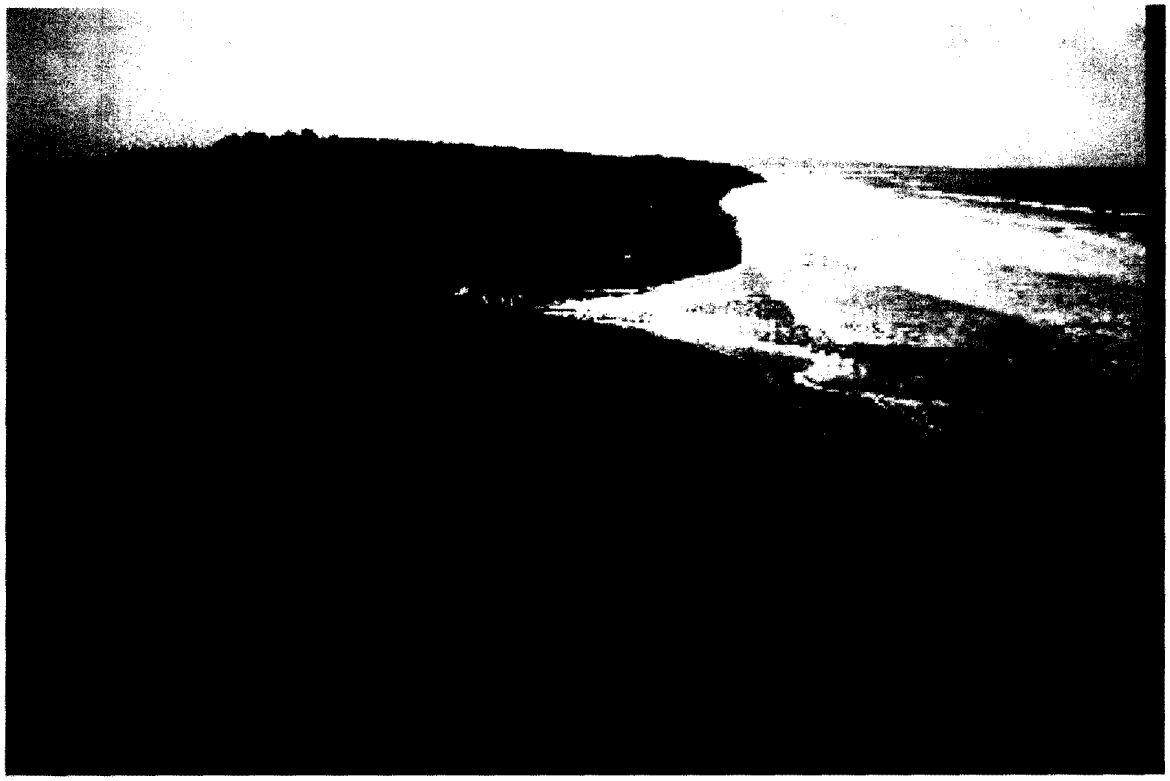

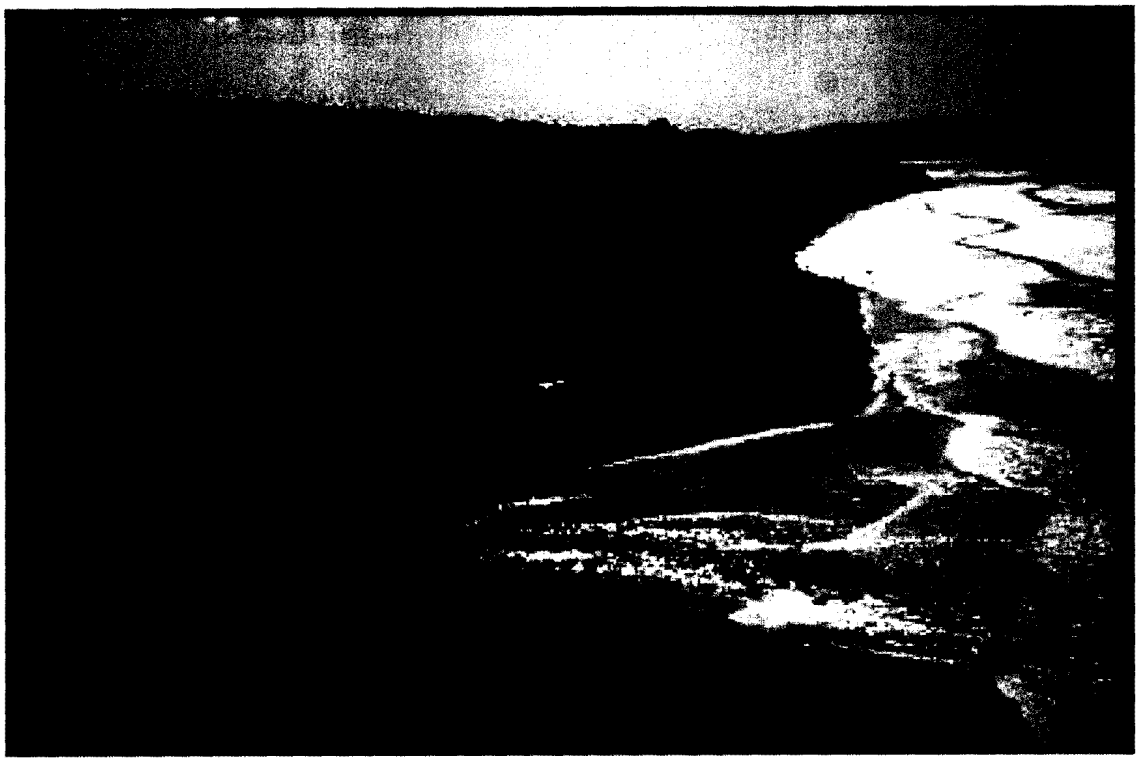

Tue 7b

City of Del Mar
1050 Camino Del Mar · Del Mar, California 92014-2698
Where the fun meets the surf

Leslie Ewing
California Coastal Commission
45 Fremont, Suite 2000
San Francisco, CA 94105-2219

RECEIVED
MAY 1 8 2001
CALIFORNIA
COASTAL COMMISSION
SAN DIEGO COAST DISTRICT

Re: Relationship Between San Dieguito Lagoon and Del Mar Beach

Dear Leslie,

To preserve the San Dieguito Lagoon in the most cost effective manner, we hope that a small beach monitoring effort will be sufficient to obtain a permit to open the lagoon under conditions, that if sustained, could cause extensive damage to the lagoon ecosystem.

We have shown in our report, submitted here, that:

1) There is a wealth of beach profile data that exists for Del Mar Beach collected under various conditions including times of flooding and drought and periods when the inlet is open and closed.

2) The effect of an inlet open to tidal flow on the adjacent beaches is not statistically significant.

3) The effect of an inlet opened due to a flood, on the adjacent beach, is significant and the beach does take time to recover to its pre-flood state.

4) Other factors cause beach erosion including winter storm waves. The seasonal variability at Del Mar Beach is large and greater than other area beaches.

5) Dredging and opening the lagoon does not add or detract from the total sand budget of the littoral cell. Sand that has accumulated in the lagoon is being returned to the sand budget.

For the beach monitoring effort, for those excavations greater than 5,000 cubic yards, we propose to include surveying SIO5 (north of the inlet) and SIO1 and SIO2 (south of the inlet) from the back of the beach to a depth of -6 ft NGVD (Figure 1). A survey of the beach would occur prior to excavation of the inlet and after opening of the inlet is complete. A report will be prepared and submitted to you.

Thank you for your assistance. Please contact me at 858-755-9313 ext. 13 if you have any questions or concerns.

Sincerely,

Linda S. Niles

Linda Niles
Planning Director

Cc: Ellen Lirely
Dr. Hany Elwany

Coastal Environments
Oceanographic and Coastal Services

May 14, 2001

Ms. Ellen Lirley
California Coastal Commission
7575 Metropolitan Drive, Suite 103
San Diego, CA 92105

RE: Relationship Between San Dieguito Lagoon and Del Mar Beach

Dear Ms. Lirley::

As we discussed this morning, I am pleased to send you a copy of our recent report "Relationship Between San Dieguito Lagoon and Del Mar Beach." I think you will find the data and conclusions most useful and interesting.

If you have any questions, or need further information, please do not hesitate to call me.

Sincerely,

COASTAL ENVIRONMENTS

Hany Elwany, PhD
President

RECEIVED
MAY 17 2001
CALIFORNIA
COASTAL COMMISSION
SAN DIEGO COAST DISTRICT

HE:ab

Encl.

D:\CoastEnv\Letters\Ellen Lirley - CCC - 05-14.01.wpd

2166 Avenida de la Playa, Suite E ■ La Jolla, California 92037 ■ Tel. 858.459.0008 Fax 858.459.0107

City of Del Mar
1050 Camino Del Mar · Del Mar, California 92014-2698
Where the fun meets the sea

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MAY 17 2001
CALIFORNIA
COASTAL COMMISSION
SAN DIEGO COAST DISTRICT

Leslie Ewing
California Coastal Commission
45 Fremont, Suite 2000
San Francisco, CA 94105-2219

Re: Relationship Between San Dieguito Lagoon and Del Mar Beach

Dear Leslie,

To preserve the San Dieguito Lagoon in the most cost effective manner, we hope that a small beach monitoring effort will be sufficient to obtain a permit to open the lagoon under conditions, that if sustained, could cause extensive damage to the lagoon ecosystem.

We have shown in our report, submitted here, that:

1) There is a wealth of beach profile data that exists for Del Mar Beach collected under various conditions including times of flooding and drought and periods when the inlet is open and closed.

2) The effect of an inlet open to tidal flow on the adjacent beaches is not statistically significant.

3) The effect of an inlet opened due to a flood, on the adjacent beach, is significant and the beach does take time to recover to its pre-flood state.

4) Other factors cause beach erosion including winter storm waves. The seasonal variability at Del Mar Beach is large and greater than other area beaches.

5) Dredging and opening the lagoon does not add or detract from the total sand budget of the littoral cell. Sand that has accumulated in the lagoon is being returned to the sand budget.

For the beach monitoring effort, for those excavations greater than 5,000 cubic yards, we propose to include surveying SIO5 (north of the inlet) and SIO1 and SIO2 (south of the inlet) from the back of the beach to a depth of -6 ft NGVD (Figure 1). A survey of the beach would occur prior to excavation of the inlet and after opening of the inlet is complete. A report will be prepared and submitted to you.

Thank you for your assistance. Please contact me at 858-755-9313 ext. 13 if you have any questions or concerns.

Sincerely,

Linda J. Niles

Linda Niles
Planning Director

Cc: Ellen Lirely
Dr. Hany Elwany

RELATIONSHIP BETWEEN SAN DIEGUITO LAGOON AND DEL MAR BEACH

RECEIVED
MAY 17 2001
CALIFORNIA
COASTAL COMMISSION
SAN DIEGO COAST DISTRICT

by

Hany Elwany, Ph.D.
Megan Hamilton

Submitted to

CITY OF DEL MAR
1050 Camino Del Mar
Del Mar, CA 92014

COASTAL ENVIRONMENTS
2166 Avenida de la Playa, Suite E
La Jolla, CA 92037

7 May 2001
CE Reference No. 01-04

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RELATIONSHIP BETWEEN SAN DIEGUITO LAGOON AND DEL MAR BEACH

1.0 INTRODUCTION

The purpose of this study is to investigate the relationship between San Dieguito Lagoon and the adjacent Del Mar Beach. It has been alleged that San Dieguito Lagoon, when open to tidal flow, causes beaches north and south of the inlet to erode.

Lagoons are separated from the ocean by barrier beaches. The natural dynamics of lagoons and barrier beaches have changed due to construction of roads, bridges, outfalls, houses, restaurants, and other structures. These changes add new constraints to lagoon inlet conditions by preventing the entrance from migrating and causing the lagoon inlet to be closed more frequently. This in turn affects lagoon habitat and water quality.

Coastal lagoons provide so many ecological, recreational, aesthetic, and economic values that they are important components of any coastal zone management plan. Only a small percentage of natural wetlands remain in southern California. For this reason, they must be preserved and enhanced whenever possible.

Southern California lagoons are in general small and shallow. These lagoons typically extend a few miles inland (2 to 5 miles) and usually have coastal fronts which vary from 1 to 3 miles. The water depth of these lagoons is about 3 ft below sea level. The outflows of these small lagoons lose momentum about 100-200 ft from the shoreline allowing the longshore transport of sand to continue naturally, away from the inlet, in the outer surf zone.

There are many factors involved in beach erosion/accretion, such as floods, storm waves, location of the beach with respect to the river inlet and sand supply. The effects of open tidal inlet of small lagoons on adjacent beaches are insignificant and small and are overwhelmed by other large effects such as floods and proximity of the site to a natural river entrance to the ocean

There are four major types of lagoon opening: 1) lagoon opening due to flood conditions; 2) quasi stable lagoon opening after flood subsides and the lagoon channels attain their equilibrium state; 3) artificial lagoon opening to maintain the tidal prism; and 4) emergency lagoon opening to relieve stress on habitat or drain the lagoon to prevent flooding of adjacent property.

In this report, we present existing beach profile data from a 23-year period (1978 to 2001). Our discussion of this data will show that: 1) a wealth of beach profile data exists for Del Mar Beach; 2) seasonal variability at Del Mar Beach is large compared to other San Diego County beaches; 3) the beach just north and south of the river inlet in the flood plain is eroded during floods to a greater degree than those at further distances; 4) the volume of sand transport in the longshore is far greater than the volume of sand that the lagoon can trap; and 5) the lagoon does not add or detract from the total sand budget of the littoral cell (when the lagoon is dredged, sand that has accumulated in the lagoon is returned to the littoral cell).

The study found that the dynamics of the San Dieguito Lagoon are controlled by floods. For example, a flood will cause the San Dieguito Lagoon to open. Unfortunately, floods also cause erosion on the beach located south of the lagoon inlet, such as SIO1, located immediately south of the river channel. Beaches take time to recover. Consequently, it can be perceived that the opening of the lagoon caused beach erosion, when in reality, it is the flood that opened the lagoon that caused the erosion. This study also found that the effect of artificial openings on beach erosion is small and statistically not significant.

2.0 DYNAMICS OF SOUTHERN CALIFORNIA LAGOONS

San Dieguito is a typical southern California lagoon. Southern California lagoons are estuarine lagoons located at the ends of rivers or creeks. Estuarine lagoons are usually perpendicular to the shoreline, and their dynamics are controlled by river floods, as will be explained below.

San Dieguito Lagoon is a 140-acre wetland located on the northern edge of the City of Del Mar in San Diego County, California. The lagoon forms the lower part of the San Dieguito River Valley (Mudie et al., 1976). The lagoon can be divided into four main sections: the inlet and the West, North, and South Channels. The North Channel is connected to San Dieguito River. The San Dieguito River drainage basin has an area of 325 mi^2 of which 45 mi^2 are below Lake Hodges Dam.

The dynamics of small, shallow lagoon inlets are highly complex (Bruun, 1978; Inman and Dolan, 1989; Kjerfve and Magill, 1989), and those in southern California are no exception. Lagoon hydrodynamic behavior depends on channel bottom topography, which changes rapidly in response to river floods, tides, and wave-driven sand transport.

The typical inlet opening and closing sequence observed at San Dieguito Lagoon begins when a major flood scours the lagoon and inlet channels. In most cases, this below-equilibrium depth can not be sustained by the maximum available tidal prism. Therefore, littoral sand washed into the inlet by tidal flow and wave surges rapidly fills the entrance and exterior portions of the channels. The interior channels slowly fill over a period of 2-5 yr, decreasing the tidal prism and eventually leading to a relatively sudden closure of the lagoon.

When there are no floods, and river flow is insufficient to fill Lake Hodges and spill over the dam, the lagoon remains closed. Exceptions may occur during unusually high tide events, or during periods of heavy rains, or when the lagoon has been artificially opened. How long the inlet stays open depends upon the condition of the interior lagoon channels. If the lagoon channels are shallow and narrow, the inlet will remain open for only a period of days or weeks, and will close rapidly. If the lagoon channels are still relatively free of sand, tidal flushing will re-establish the inlet and the lagoon will remain open. This suggests that as long as sufficiently strong river flow occurs every 3 yr to 5 yr (wet time periods), San Dieguito Lagoon will remain open most of the time. During dry time periods the lagoon will be closed most of the time (Elwany et al, 1998).

3.0 SUMMARY OF DATA

3.1 BEACH PROFILES

Several historical beach profiles (SIO1, SIO2, SIO3, SIO4, SIO5, and SIO6) have been surveyed in the vicinity of the San Dieguito Lagoon. The locations of these profiles are shown in Figure 1. This data was gathered from 1978 to 1982 and from 1992 to 2001. Figure 2 shows the time periods when these beach surveys were made. In this figure, each survey is represented by a dot. Del Mar Beach has been extensively surveyed, more so than any other beach in San Diego County (e.g., Flick et al., 1986; USACOE, 1991; Pisarew, 1998).

In this report, we will be primarily concerned with SIO1, SIO2, SIO5 and SIO6. SIO1 is located immediately south of the San Dieguito Lagoon inlet, and SIO2 is located approximately 1200 ft south of it. Profiles SIO5 and SIO6 are located north of the lagoon inlet. Profiles SIO1 and SIO5 are in the vicinity of the lagoon inlet, while profiles SIO2 and SIO6 are at some distance from it. Herein we will refer to profiles SIO1 and SIO5 as impact stations and profiles SIO2 and SIO6 as control stations.

The beach profiles made at SIO1, SIO2, SO5, and SIO6 are shown in Figures 3, 4, 5, and 6, respectively. These profiles extend from the back of the beach to -6 ft, NGVD. NGVD stands for National Geodetic Vertical Datum, which is about 0.19 ft below mean sea level (MSL). These profiles show the large variability of Del Mar Beach.

3.2 FLOODS

Flood data are available for San Dieguito Lagoon for the years 1922 to 2000 (Figure 7). The major floods that occurred during the study period were in 1980, 1983, 1993, 1995, and 1998. For the 1980, 1993, 1995 and 1998 floods, beach data exist which cover beach conditions before and after the floods. In 1993, floods occurred on 16 January (6939 ft^3/sec) and 20 February (4541 ft^3/sec). In 1995, a flood occurred in March and in 1998 a flood occurred on 25 February (2650 ft^3/sec) and 26 March (1360 ft^3/sec).

3.3 OPEN/CLOSED STATUS OF THE LAGOON

Table 1 presents data indicating when the San Dieguito Lagoon was open or closed during the time period between 1978 and 2000 (modified from Elwany et al, 1998).

4.0 SEASONAL VARIABILITY OF BEACH CHARACTERISTICS

Figures A-1 through A-4 (Appendix A) show the histories of beach widths at SIO1, SIO2, SIO5 and SIO6. The profiles located adjacent to the inlet (SIO1 and SIO5) show the largest seasonal fluctuations in beach widths. The profiles located north and south of the inlet show smaller seasonal fluctuations. Table 2 (Statistics on Beach Widths) shows the maximum, minimum, mean, and

standard deviations in beach width for each of the four stations for the year as a whole and for the summer and winter seasons.

Comparing Del Mar Beach to other beaches in the Oceanside Littoral Cell, we find that its seasonal cycle is large. For example, Encinitas and South Carlsbad Beaches have seasonal cycles of about 50 feet in beach width, whereas at Del Mar Beach, the width can vary seasonally by 140 feet, almost three times as much (Table 3).

5.0 EFFECTS OF FLOODS ON SIO1 AND SIO5

SIO1 is located on the south edge of the San Dieguito River inlet. Therefore, one could anticipate that large floods would cause beach erosion at this location greater than at locations further from the river. Figures 8 to 11 show the changes on beach volume above 0 NGVD for profiles SIO1, SIO2, SIO5 and SIO6 versus time. On these figures we indicated the major floods (Section 3.2) by a dotted line . There is noticeable beach erosion during flood time periods; the beach erosion is more pronounced at SIO1.

Beach erosion is caused by flood outflow velocities (about 12 ft/sec) and large storm waves usually associated with weather systems causing the flood. Beach erosion can also be caused by those storm waves that normally occur during the winter season. Therefore, beach erosion is related to flood and storm events, not to inlet open status.

Floods cause scour of the river channel and open the inlet. When floods open the inlet naturally, the lagoon may stay open for periods varying from 1 to 3 years. Beaches take time to recover and return to their pre-storm states. The time period for beach recovery varies from 6 to 18 months.

This report compares the beach profile data from before and after the major floods that occurred at SIO1 in 1980, 1993, 1995 and 1998. From the large beach profile database that exists, we have selected those profiles which bracket the time period, along with summer profiles before and after the flood, to address beach recovery. Beach profiles for the 1993 floods at stations SIO1 (impact) and SIO2 (control) are shown in Figures 12 and 13, respectively.

In October 1992, the lagoon inlet was closed and the beach had a typical end-of-summer profile with a berm 6 ft high. By December 1992, the front portion of the berm had eroded due to storm waves. Floods occurred on 18 January and 21 February 1993. The February and March 1993 profiles show a substantial scouring of the beach so that beach width was reduced almost 300 ft from the previous October. The beach was slow to recover, as the October 1993 profile does not show the beach returned to its pre-storm state (Figure 12).

The changes at the control profile SIO2 are not as dramatic, as shown in Figure 13. There was a berm present in October 1992. The amount of scouring that occurred after the floods was less, reducing the width of the beach to 150 ft. The beach managed to recover to its pre-storm state by October 1993.

In order to estimate the effect of the flood on beach volume above 0 NGVD at SIO1, we assume that the flood effect at SIO2 is small (about zero). We subtract sand volume above 0 NGVD for SIO2 from sand volume above 0 NGVD at SIO1. This subtraction eliminates the winter storm wave effect on the beach. The difference between these two volumes (before and after the flood) is the effect of the floods on sand volume at SIO1 above 0 NGVD. A similar approach can be applied to the profile for SIO5, located north of the inlet. Table 4 presents data for 1980, 1993, 1995, and 1998 flood effects on beach volume at SIO1 and SIO5. The average change in sand volume above 0 NGVD due to flood at SIO1 is -401 ft^3/ft and 3 ft^3/ft at SIO5 (See Table 5). It should be noted that the effect of the flood on the beach at SIO1 may extend further offshore than 0 NGVD, resulting in an additional loss of a large volume of sand for the site. This may be the reason for the observed delay of beach recovery at SIO1 as compared to SIO2, as discussed above. SIO5 does not appear to be affected by floods, as it is far enough north of the inlet.

A comparison of inlet cross-sections for the natural 1993 flood and an inlet emergency/maintenance opening is shown in Figure 14. Section TR1 is at the west end of the inlet and section TR2 is east of it. Notice the erosion caused by the 1993 flood at TR1 and TR2 which shows the significant volume of sand that can be scoured by the large flood velocities. The outflow velocities from a tidally influenced lagoon are small (~3 ft/sec, much smaller than the flood velocities). The outflow discharge loses it is momentum rapidly and therefore lagoon outflow does not interrupt the natural longshore transport significantly.

6.0 EFFECT OF ARTIFICIAL OPENING ON BEACHES

Sometimes it is necessary to open the lagoons to relieve stress on lagoon habitat, to prevent flooding of property located on the lagoon banks, or to improve circulation between the lagoon and the ocean. In the first and second cases it is an emergency opening and in the last case it is a maintenance opening. All are artificial openings. The artificial lagoon openings are designed to minimize the sand trapped in the lagoon by ensuring sand that entered the lagoon during high tide is flushed out during the low tide (Elwany et al., 1994 and 1998). In emergency opening it is only necessary to open a small inlet channel just to drain the lagoon to a lower water level. In these cases, the volume of sand dredged is less than 5000 yd^3. In a maintenance opening about 15,000 yd^3 may be dredged from the lagoon. Sand dredged from the lagoon is usually placed on the predominant longshore current direction to minimize impact on the inlet.

Artificial openings occur infrequently. During the time period between January 1978 to April 2001, only 17 artificial openings were made (See Table 1). Sixteen (16) of these openings were made by the 22nd Agricultural District to drain the lagoon and prevent flooding of their properties. On 23 September, 2000, the City of Del Mar opened the lagoon to relieve stress on the marine habitat. 15,000 yd^3 were removed from the lagoon inlet and west channel. This opening was an emergency opening but was designed similar to a maintenance opening. Figure 15 shows two beach profiles surveyed at SIO1 immediately after the excavation (27 Sep 00) and 37 days after the excavation (03 Nov 00). The figure shows clearly that no erosion occurred at the SIO1.

Further we have studied the change in the beach width for the 17 artificial openings. The study looked for the beach width immediately before the opening and one month after the reopening. We calculated the mean beach width difference, 'before' minus 'after' artificial opening, and conducted a t-test to see whether the mean difference is different from zero. No statistically significant differences were found at SIO1 ($p=0.1928$, $N=6$, where p is the p-value and N is the number of pairs out of 18). There were insufficient data to test SIO5.

7.0 LONGSHORE TRANSPORT

Longshore transport is movement of sand along the coast and within the surf zone as the result of incomplete refraction of incoming breaking waves. A number of studies that reviewed the sediment budget and longshore transport rates within Oceanside Littoral Cell are presented in the Coast of California Storm and Tidal Waves Study (CCSTWS) prepared by USACOE (1991). Since these studies use various data sources, their estimates of longshore transport vary. These studies are conducted by Marine Advisors (1960), Nordstrom and Inman (1975), Hales (1978), and Inman and Jenkins (1983). On average, they estimate the gross longshore transport to be over 1,200,000 yd^3/year.

Since the late 1980's, the wave climate in the Southern California Bight has changed. The prevailing northwesterly winter waves changed to waves approaching from the west, and the southern hemisphere swell waves of summer have been replaced by tropical storm waves from the waters off Central America. The net result appears to be a decrease of the southerly component of the net longshore transport of sand that prevailed during the preceding 30 years, as summarized above.

Recently, Elwany et al (1999) and Coastal Environments (2001) estimated longshore sand transport volume for Oceanside, Carlsbad, and Cardiff from wave data . Figure 16 shows a comparison of longshore transport between Oceanside and Cardiff. Table 6 summarizes the data for Oceanside and Cardiff. The gross total longshore transport at Oceanside and Cardiff are 692,195 yd^3 and 529,252 yd^3 respectively. On average, 40% of the transport volume is to the north, and 60% is to the south.

Figure 17 shows the monthly mean longshore transport volume and direction at Cardiff, California. During the winter season, swells are predominantly generated in the northern hemisphere as a result of extra-tropical storms. The longshore transport is predominantly to the south from November through May and to the north in the summer season (June through October).

8.0 SEDIMENT TRAPPED IN THE LAGOON

Approximately 12,000 to 20,000 yd^3/yr of sediment accumulates in San Dieguito Lagoon. This volume was estimated by monitoring San Dieguito Lagoon from 1992 until the present. Further monitoring of other lagoons in the area, such as San Elijo Lagoon and Los Peñasquitos Lagoon, led to similar estimates (Elwany et al, 1998). This volume is small in comparison to the volume of

longshore sediment transport. It is about 1- 2% of the volume of the yearly longshore transport (Section 7.0). In addition, when the lagoon is dredged, sand that has accumulated in the lagoon is returned to the littoral cell.

Therefore, in the long term, there is no net change to the sediment budget. Rivers, such as the San Dieguito River, are sources of sand for beaches.

9.0 CONCLUSIONS

1. Southern California coastal lagoons are small and shallow, and their dynamics depend on many factors, such as flood, rainfall, inlet substrate type (sand or cobble), and wave climate.

2. Floods play a major role in keeping southern California coastal lagoons open. When a flood occurs, the outflow scours the lagoon channels, may erode the adjacent beaches and opens the inlet.

3. Since these lagoons are small, their inflow velocities are higher than their outflow velocities. Therefore, they tend to trap beach sand until they close. Studies show that they accumulate from 12,000 to 20,000 yd3 of sand prior to inlet closure.

4. The amount of sand trapped in coastal lagoons (< 20,000 yd^3/yr) is small compared to the volume of the longshore transport (~600,000 yd^3/yr).

5. An abundance of beach profile data is available for the years 1978 to 2001. These data were collected by an academic institution (Scripps Institution of Oceanography), a governmental agencies (United States Army Corps Of Engineers and San Diego Associations of Governments), and a private firm (Coastal Environments).

6. Beaches just north or south of the lagoon inlet are subject to erosion during large flood time periods. This erosion is largely due to the high outflow velocities of floods. At Del Mar Beach the effect of the flood outflow is much greater at the SIO1 profile to the south of the lagoon entrance as compared to the SIO5 profile to the north. This is due to the closer proximity of the natural lagoon opening to SIO1.

7. The study looked at the beach width immediately before an artificial opening and one month after the artificial reopening. We calculated the mean beach width before and after an artificial opening, and conducted a t-test to see whether the mean difference is different from zero. No statistically significant differences were found at SIO1. Further, on 23 September, 2000, the City of Del Mar excavated 15,000 yd^3 of sand from the lagoon. Profiles made immediately after the dredging and some time later (37 days) show no erosion for the beach at SIO1 (Figure 17).

8. There is a difference in the effect on beaches between the lagoon opened by flood or the lagoon artificially opened for emergency or maintenance. Natural flood openings cause severe erosion for beaches located south of the lagoon. Artificial openings are designed as equilibrium lagoon channels. In this case the lagoon takes a long time period to trap enough sand to close (15,000 yd^3). Therefore, their effect on beaches is insignificant.

In summary, the dynamics of San Dieguito Lagoons are controlled by floods. For example, a flood will cause the San Dieguito Lagoon to open. Unfortunately, floods also have effects on the beaches located south of the lagoon inlet. Floods can cause severe erosion to the SIO1 site located immediately south of the river channel. Beaches take time to recover. Consequently, it can be perceived that the opening of the lagoon caused beach erosion, when in reality, it is the flood that opened the lagoon that caused the erosion. This study also found that the effect of artificial openings on beach erosion is small and statistically not significant.

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Table 1. Inlet status (open or closed) at San Dieguito Lagoon, 1978 - 2001.

MONTH	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01
January	O	O	O	c	c	O	O	O	O	O	I	O	c	C	O	O	O	c	C	O	O	O	C	I
February	O	O	O	O	c	O	O	O	O	O	O	O	c	C	O	O	O	O	c	O	O	I	C	O
March	O	O	O	O	O	O	O	O	O	c	O	C	I	c	I	O	O	O	c	O	O	I	C	O
April	O	O	O	O	O	O	C	O	O	I	I	C	c		I	O	O	O	O	O	O	I	C	O
May	O	O	O	C	O			O	O	c	O	C			C	O	O	O	I	O	O	C	C	
June	O	O	O	C	O	O	C	O	O	O	O	I	C	C	C	O	O	O	O	O	O	C	C	
July	O	O	O	C	O	O		O	O	O	O	C	C	C	C	O	O	O	O	O	O	C	C	
August	O		O	C	O	O	O	O	O	O	O	O	C		C	O	O	O	O	O	O	C	C	
September		O			O	O	O	O	O	O	O	c	C	C	C	O	O	O	I	O	O	C	c	
October		C	C	C	O	O		O	O	O	I	O	C	C	C	O	O	O	O	I	O	C	O	
November		I	C	C	O	I	c	O	O	I	I	C	C		C	O	O	O	O	I	I	C	O	
December	O	c	C	c	O	O	O	O	O	I	O	C	C	C	C	I	I	C	O	I	O	C	C	
Annual data from literature[a]																								

[a] General Statement

O = Open Inlet
C = Closed Inlet
c = Artificially opened inlet
I = Intermittent Inlet

Table 2. Statistics on Del Mar beach widths.

Station	Season	Maximum Width (ft)	Minimum Width (ft)	Mean Width (ft)	Standard Deviation (ft)	Number of Observations
SIO1	All	340.8	31.2	199.3	86.9	98
	Summer	334.2	71.3	232.2	83.3	45
	Winter	340.8	31.2	171.4	80.6	53
SIO2	All	293.1	115.0	203.9	44.7	110
	Summer	293.1	150.0	231.3	35.9	51
	Winter	285.6	115.0	180.2	37.5	59
SIO5	All	339.8	60.1	175.8	65.0	67
	Summer	339.8	61.4	204.4	64.4	34
	Winter	236.8	60.1	146.3	51.6	33
SIO6	All	226.9	82.7	144.2	33.0	60
	Summer	226.9	99.0	161.0	34.1	30
	Winter	178.5	82.7	127.5	21.7	30

Table 3. Characteristics of beach profiles from Camp Pendleton to Del Mar.

Profile Name	Location	Berm Height (ft, NGVD)	Mean Grain Size (μ)[a]	Beach Slope	Beach Width (ft)				Seasonal Cycle (ft)
					Max	Min	Ave	N[c]	
PN-1110	Camp Pendleton	10.2	.[b]	1:20	830.9	293.9	528.8	27	..[d]
OS-1030	Oceanside	9.4	230	1:15.2	461.6	208.5	289.0	29	40.4
OS-1000	Oceanside	8.4	.	..	307.6	142.4	209.7	17	66.1
OS-0930	Oceanside	..	.	1:19.9	286.8	142.7	212.5	26	38.6
CB-0880	North Carlsbad	7.0	.	1:12.5	189.1	90.3	144.4	18	43.1
CB-0850	North Beach	9.8	240	1:11.1	308.7	188.6	277.5	17	37.2
CB-0840	North Beach	..	240	1:14.3	150.3	68.4	108.6	18	34.6
CB-0830	North Beach	7.4	240	1:12.5	221.2	62.7	110.6	28	..
CB-0820	Middle Beach	6.8	260	1:14.9	254.2	111.8	177.6	18	..
CB-0800	South of South Beach	..	.	..	106.4	52.9	83.8	12	17.8
CB-0760	South Carlsbad	..	300	1:20.3	276.8	99.9	143.8	27	26.6
CB-0740	South Carlsbad	..	.	..	264.6	130.4	180.0	18	18.2
CB-0720	South Carlsbad	..	250	1:14.3	371.6	162.9	211.2	29	49.8
SD-0670	Encinitas	7.4	460	1:16	199.5	85.25	134.6	14	50.8
DM-580	Del Mar	7.5	200	1:18	215	30	150	80	140

a – μ is equal to one micron
b – missing value
c – number of surveys
d – no clearly defined value

Table 4. Volume Changes before and after flood.

Flood Year	Period	Survey Date	Volume Above 0 NGVD ft^3/ft		
			SIO1	SIO5	SIO2
1980	Before	27 Jan 80	944	--	763
	After	30 Mar 80	557	--	650
1993	Before	22 Dec 92	1131	1115	983
	After	20 Mar 93	226	920	851
1995	Before	04 Feb 95	679	517	889
	After	24 Mar 95	205	677	781
1998	Before	11 Oct 97	787	643	932
	After	14 May 98	190	392	556

Table 5. Effects of floods on SIO1 and SIO5 (ft^3/ft).

Flood Year	Flood Effect (ft^3/ft)		Wave Effect
	SIO1 (south of inlet)	SIO5 (north of inlet)	
1980	- 274	--	- 113
1993	- 773	- 63	- 132
1995	- 366	- 52	- 108
1998	- 221	125	- 376
Average	- 401	3	-182

Table 6. Longshore transport at Oceanside and Cardiff[a].

Variable	Oceanside		Cardiff	
	yd^3	m^3	yd^3	m^3
Mean north transport per day	1,757	1,343	971	742
Mean south transport per day	-2,036	-1,557	-983	-751
Transport to the north per year	320,625	245,150	198,901	152,065
Transport to the south per year	-371,570	-284,102	-255,076	-195,012
Gross transport per year	692,195	529,252	453,977	347,077
Net transport per year	50,945	38,953	56,175	42,947

[a] Calculated from historical wave data at Oceanside from 1978 to 1994.

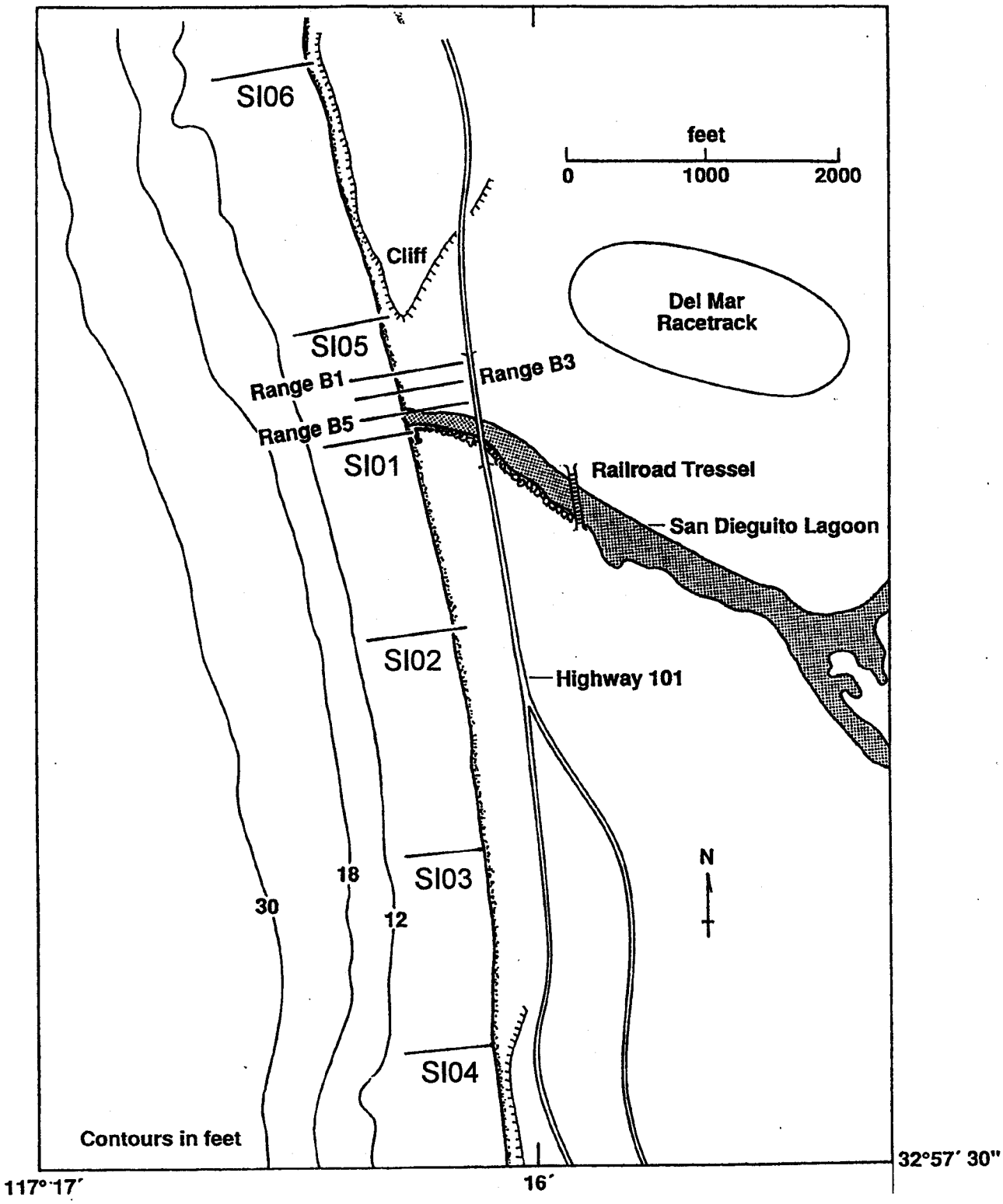


Figure 1. Location of historical beach ranges at Del Mar.

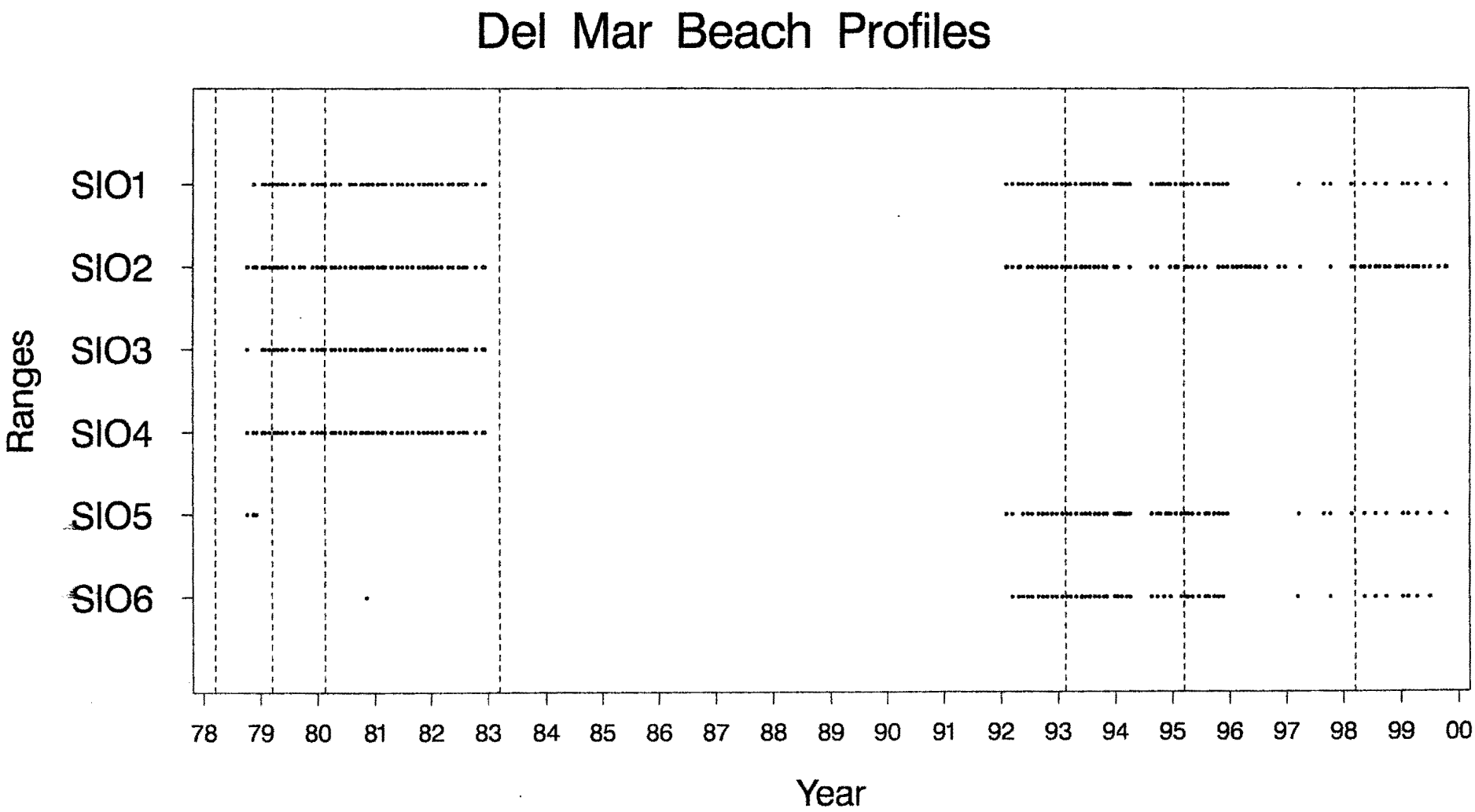


Figure 2. Surveys conducted between 1978 and 2000 at Del Mar. Each survey is presented by a dot.

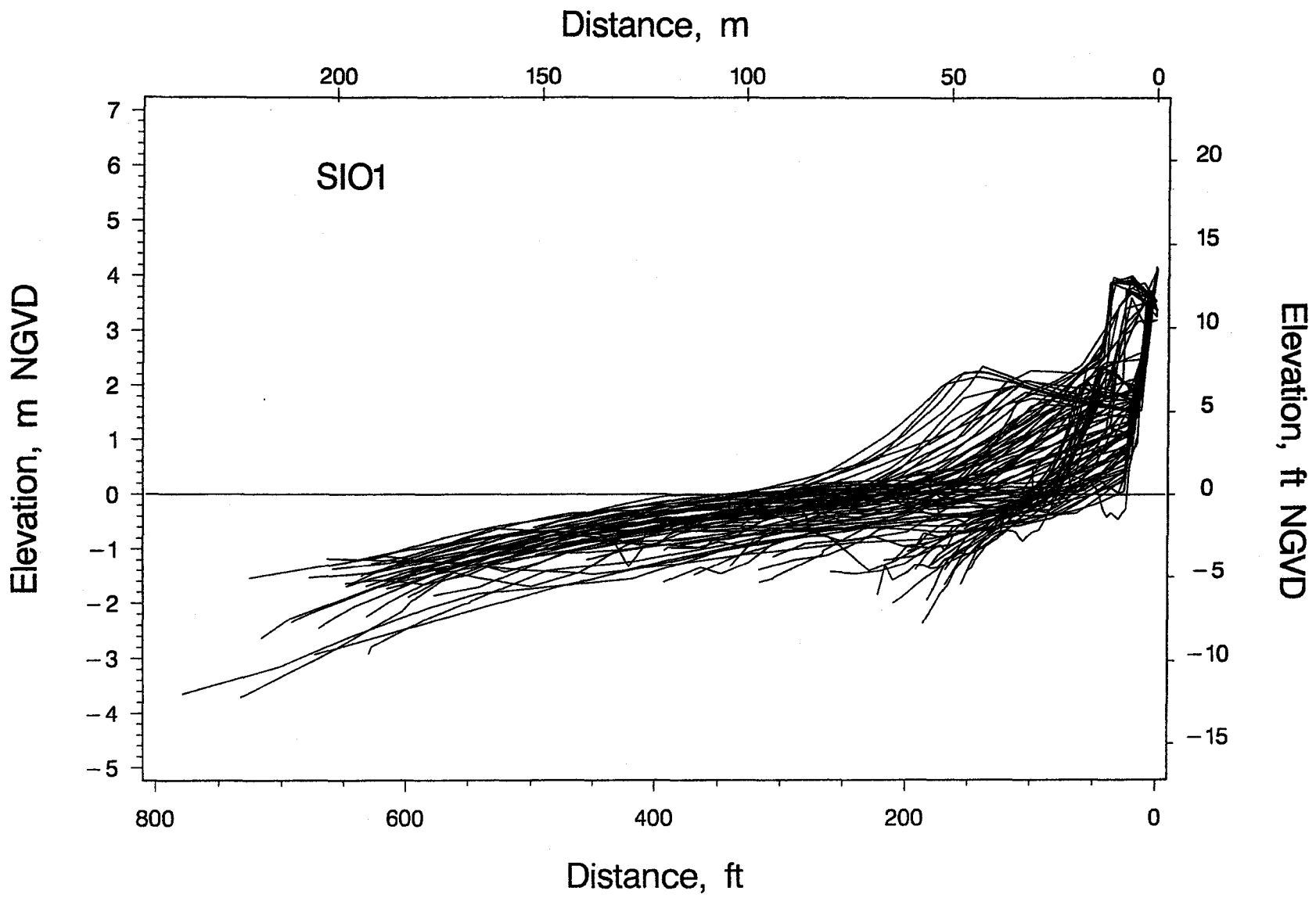


Figure 3. Beach profiles at SIO1 from 1978 to 2000.

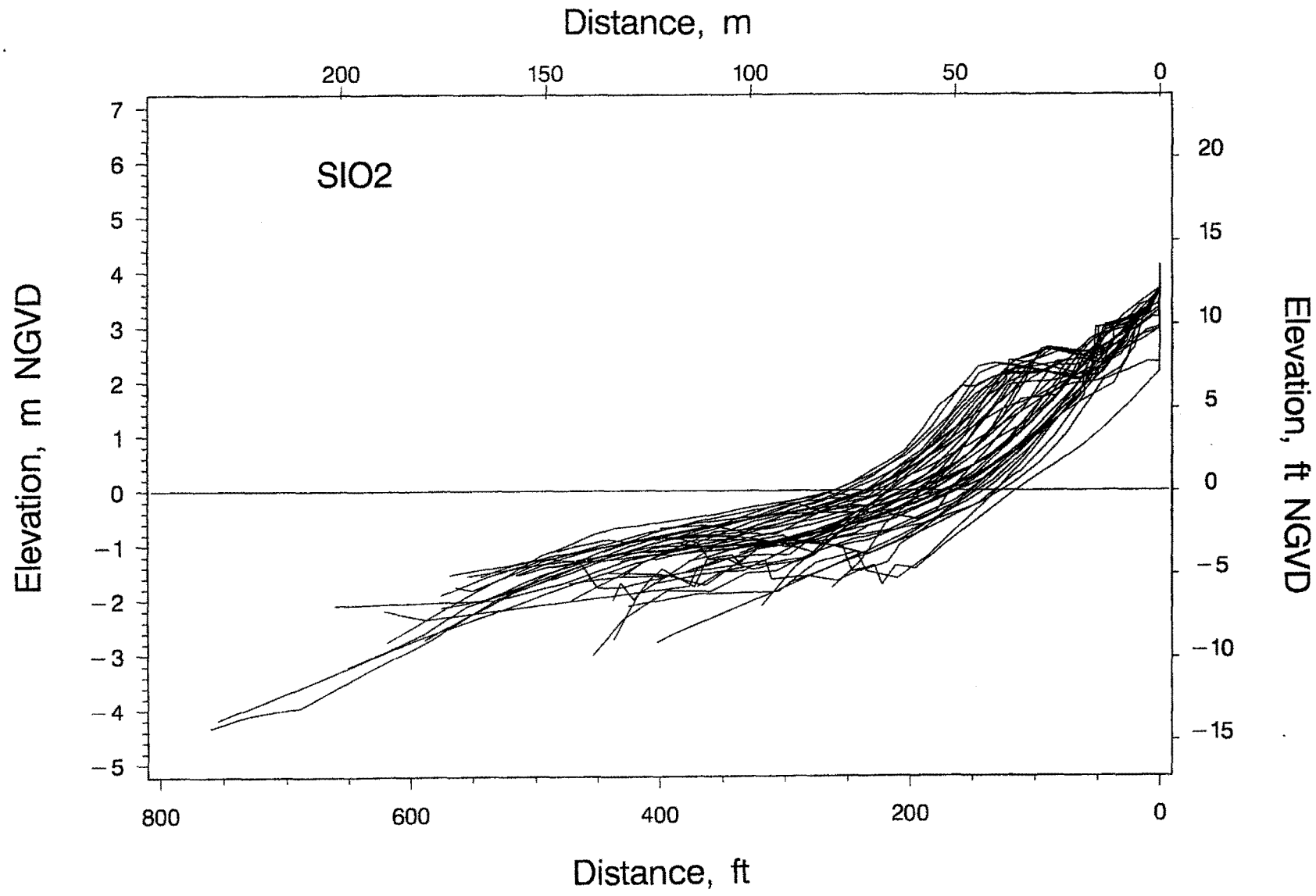


Figure 4. Beach profiles at SIO2 from 1978 to 2000.

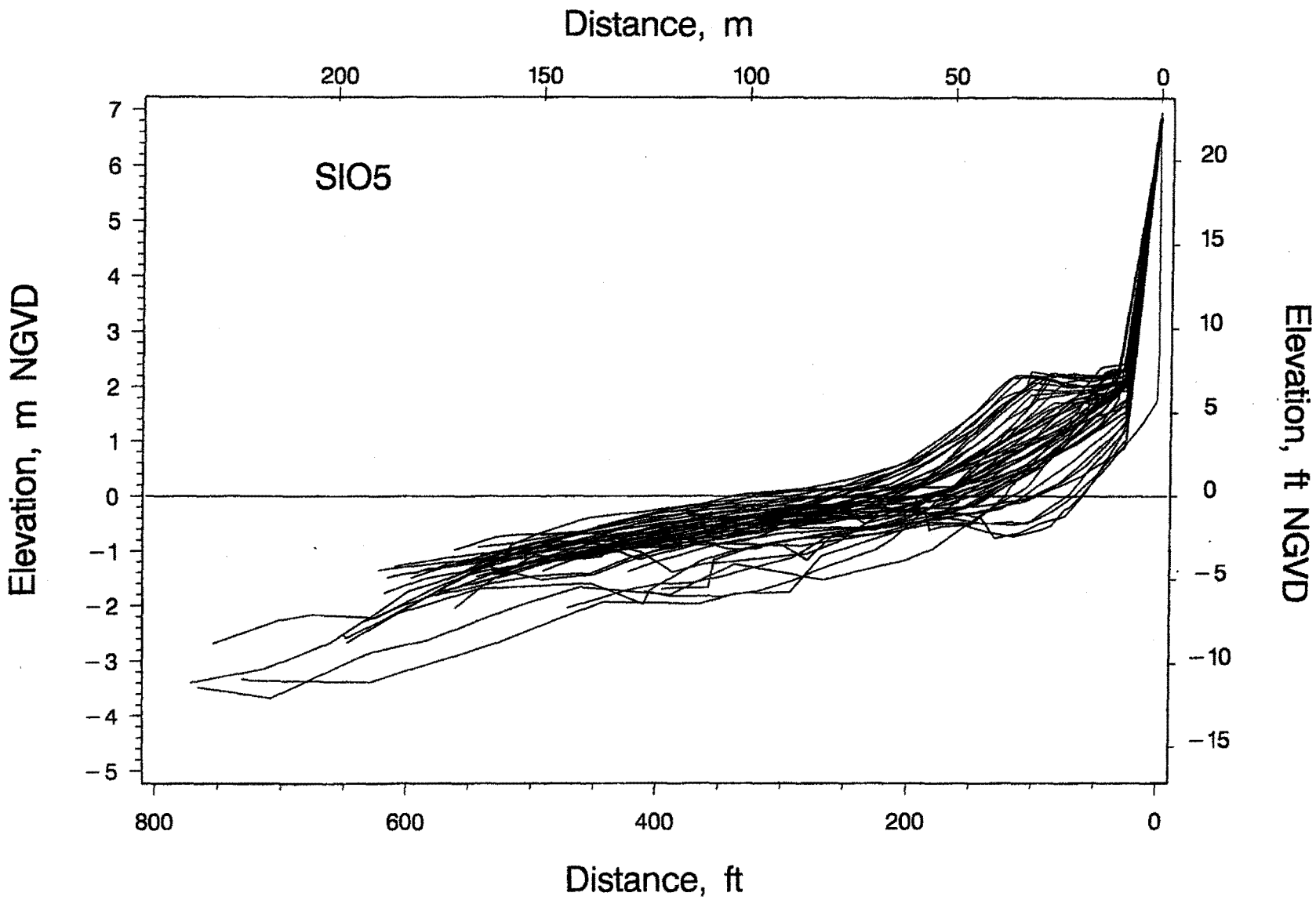


Figure 5. Beach profiles at SIO5 from 1978 to 2000.

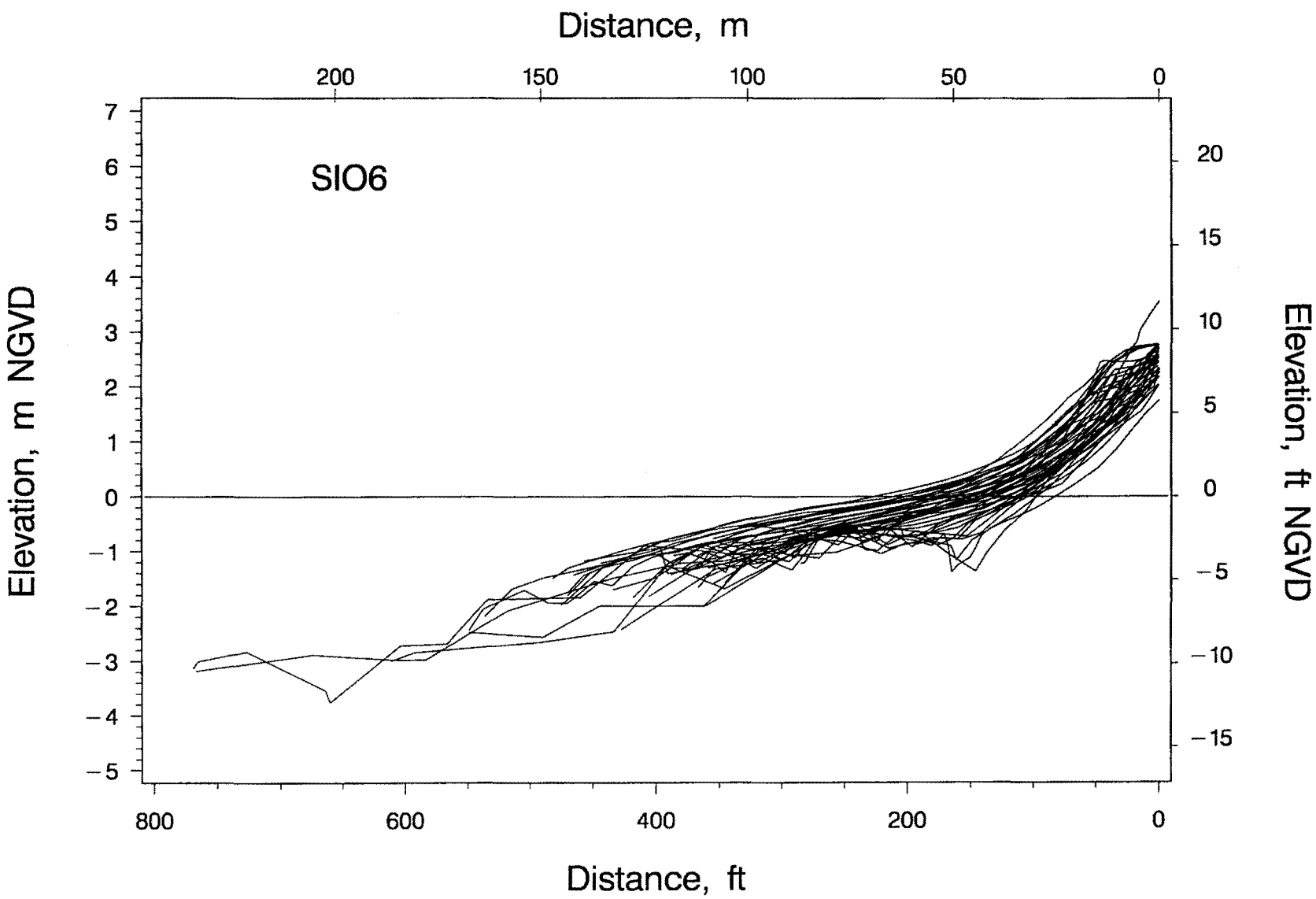


Figure 6. Beach profiles at SIO6 from 1978 to 2000.

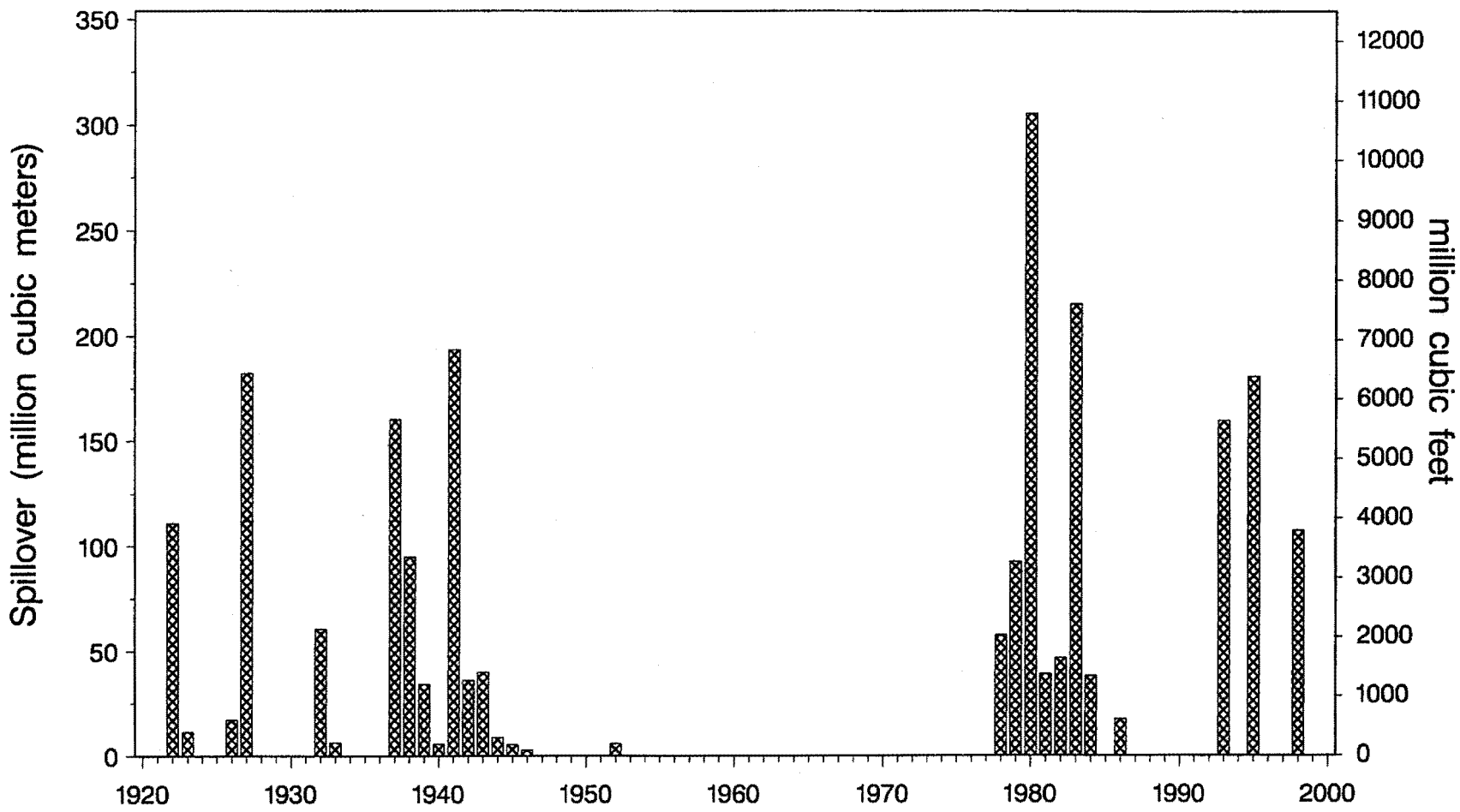


Figure 7. Lake Hodges spill-over from 1920 to 2000. Data represent flood at San Dieguito Lagoon.

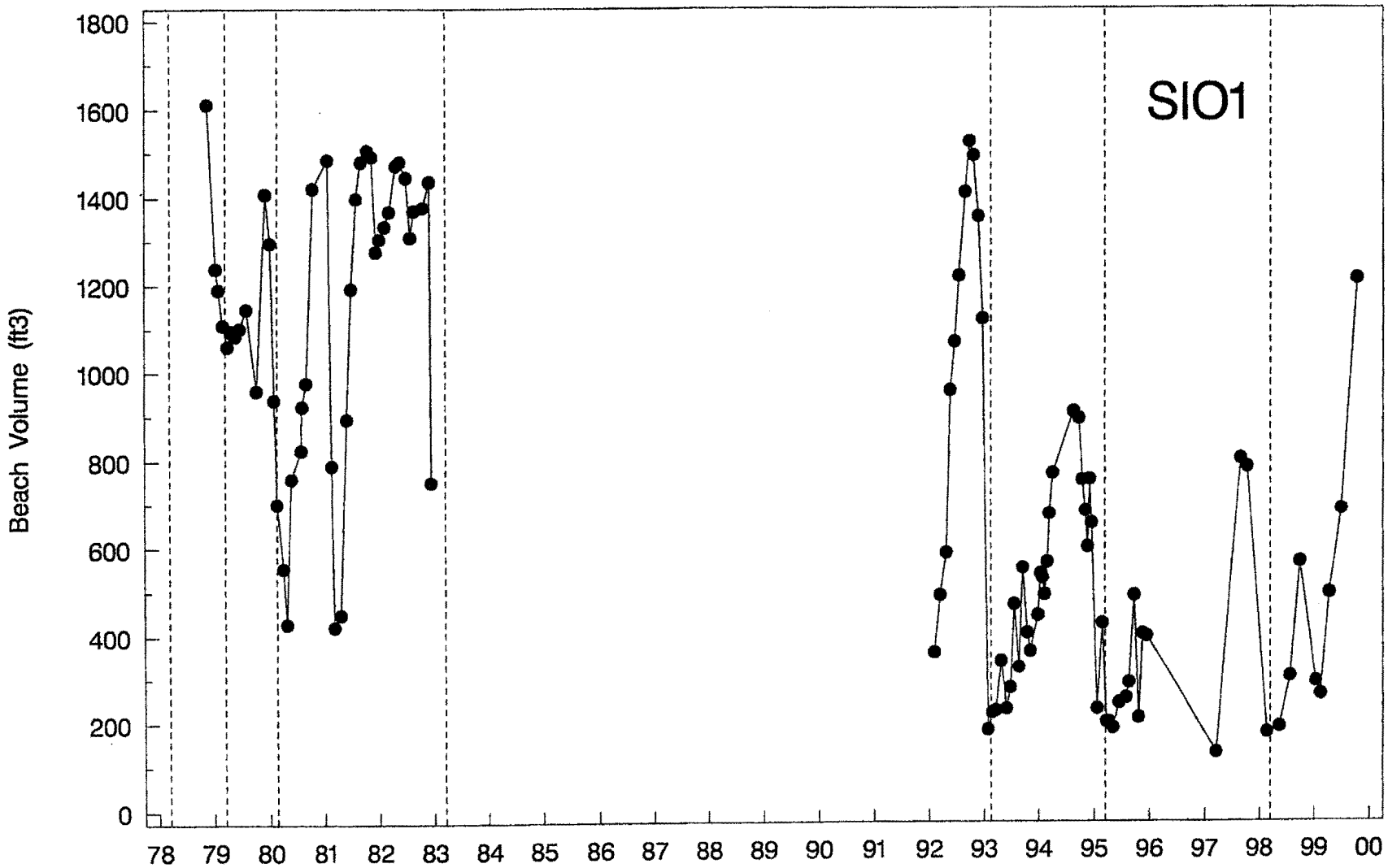


Figure 8. Beach volume changes above 0 NGVD from 1978 to 2000 for SIO1.

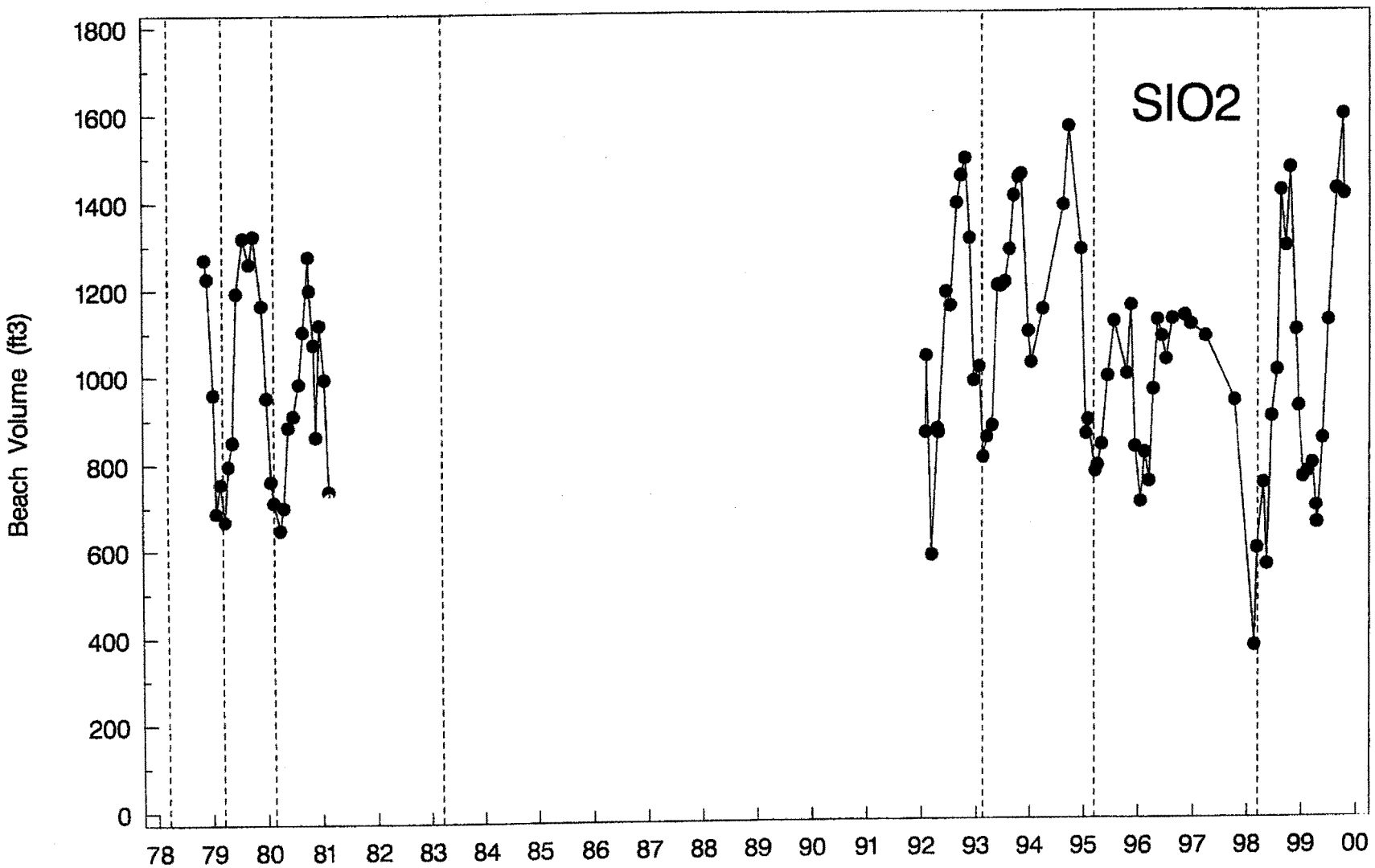


Figure 9. Beach volume changes above 0 NGVD from 1978 to 2000 for SIO2.

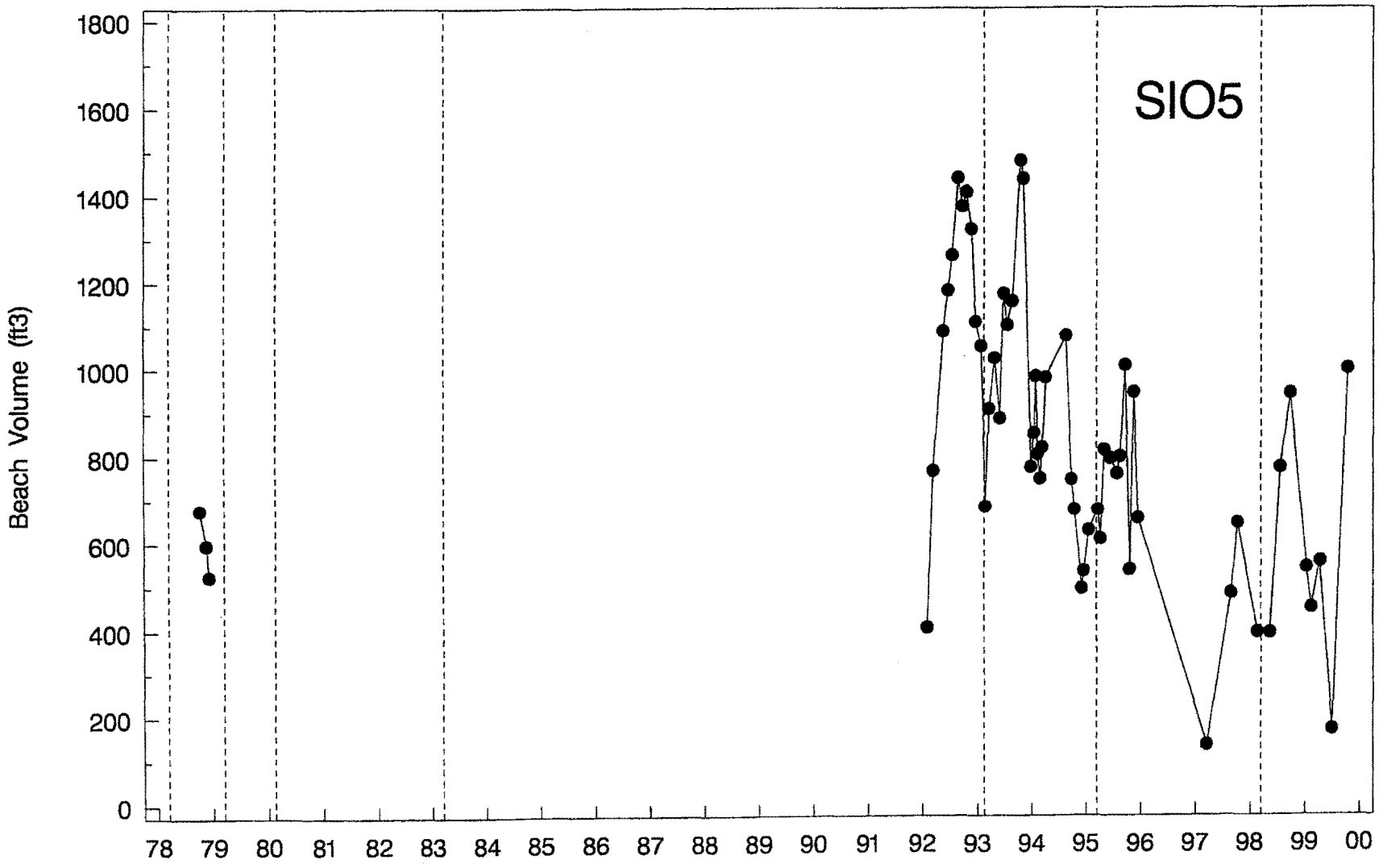


Figure 10. Beach volume changes above 0 NGVD from 1978 to 2000 for SIO5.

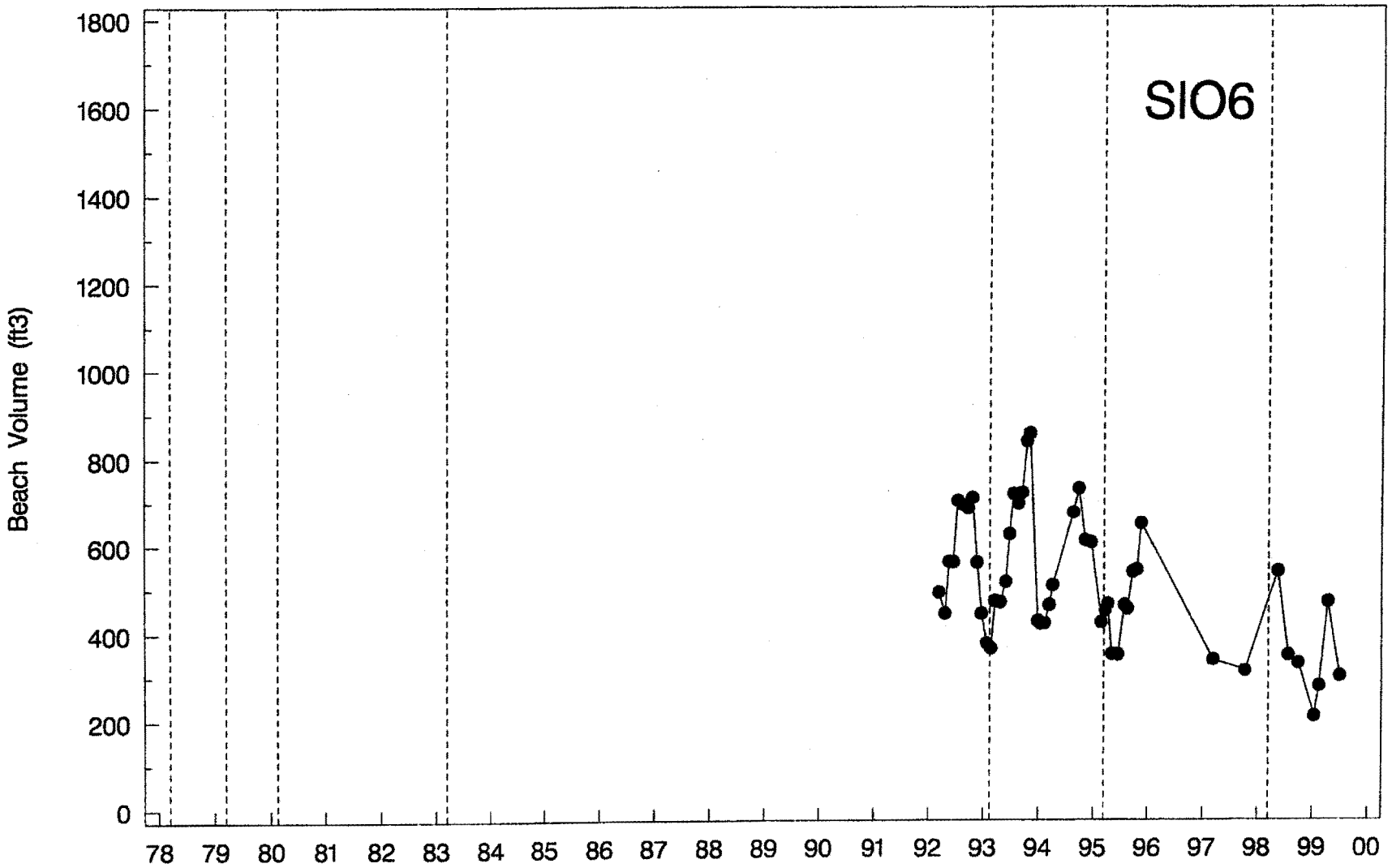


Figure 11. Beach volume changes above 0 NGVD from 1978 to 2000 for SIO6.

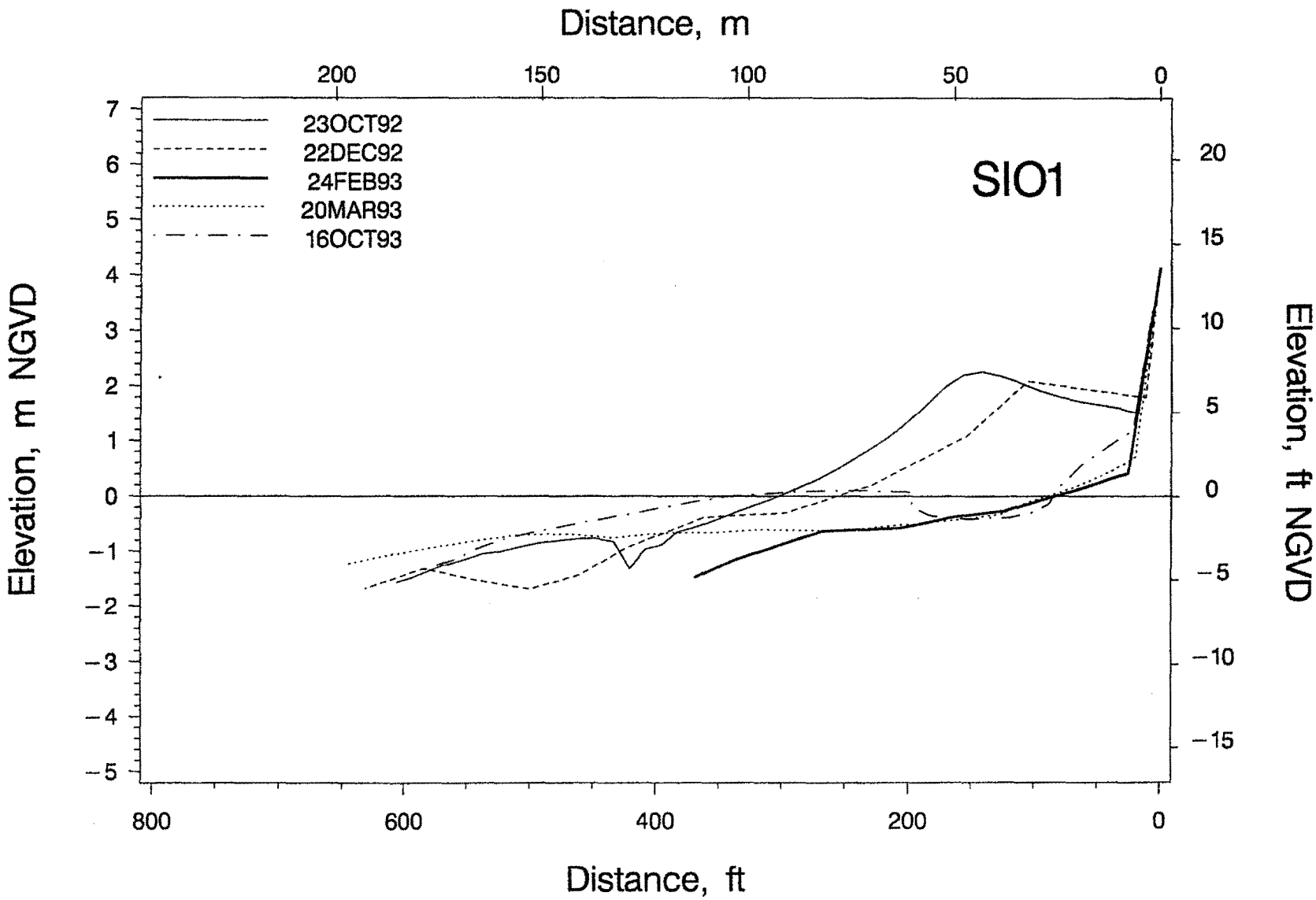


Figure 12. Response of beach profile SIO1 (impact) for the 1993 flood.

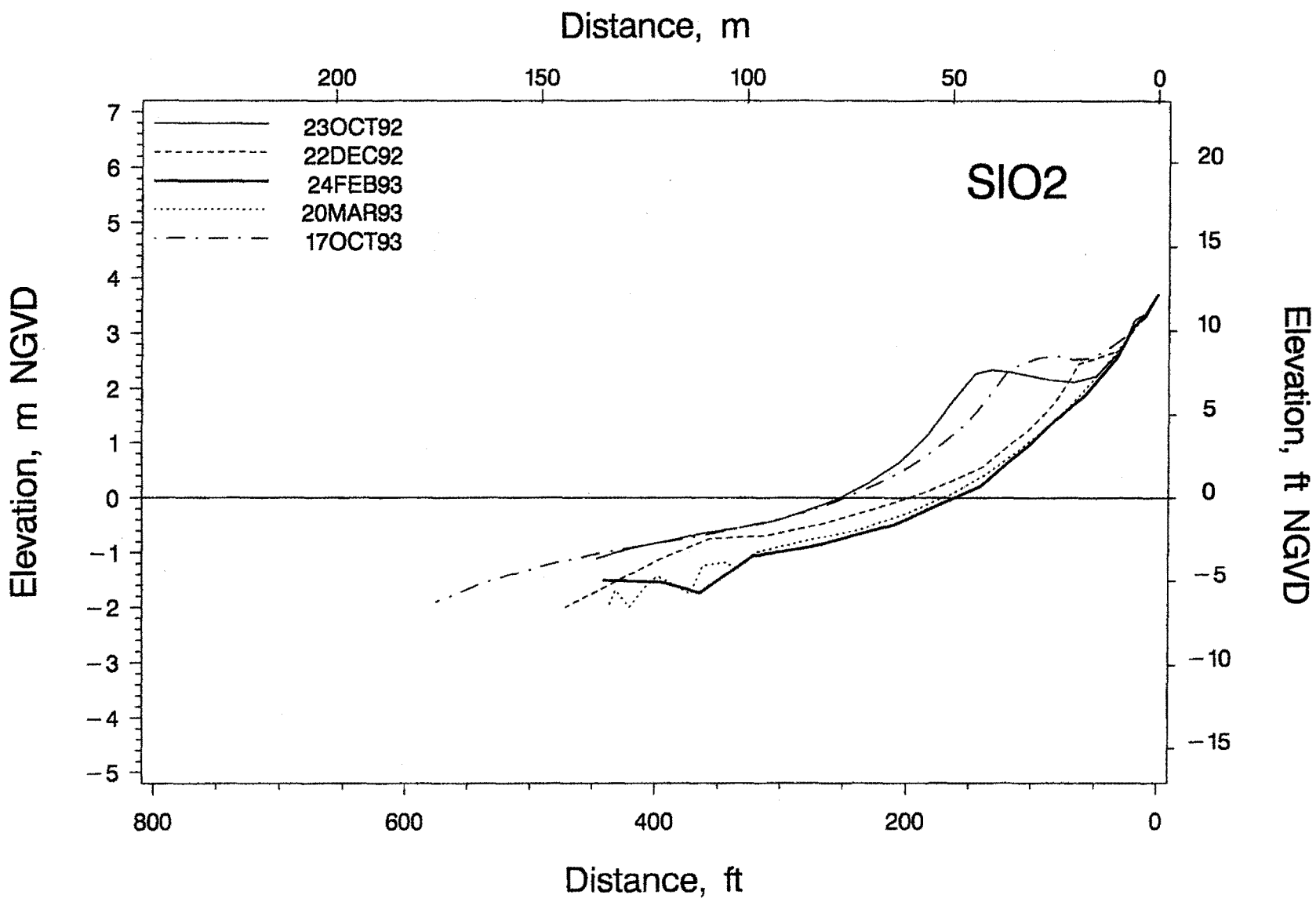


Figure 13. Response of beach profile SIO2 (control) for the 1993 flood.

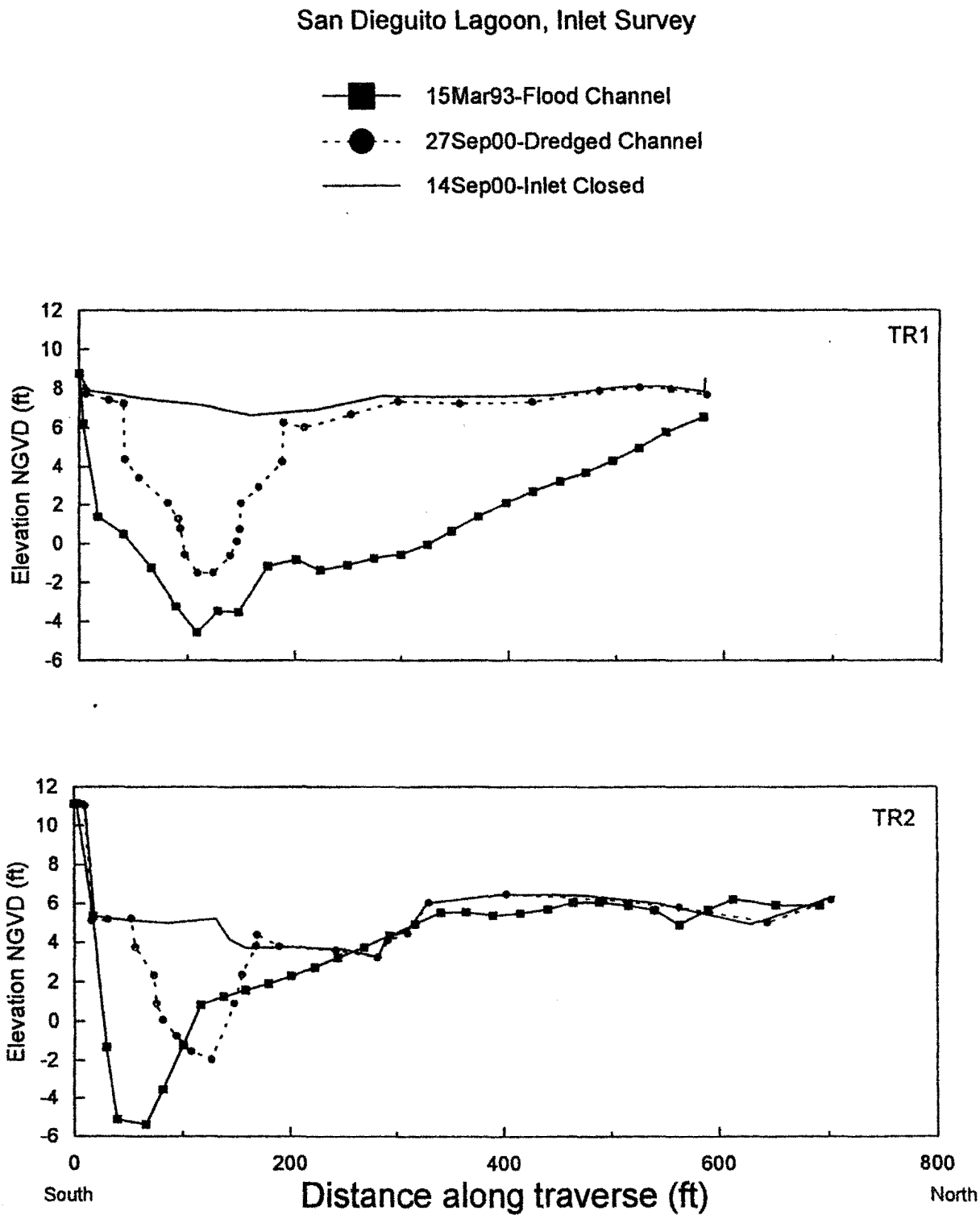


Figure 14. Lagoon cross-sections at TR1 and TR2 representing flood channel (15 Mar 93) and artificial excavated channel (27 Sep 00).

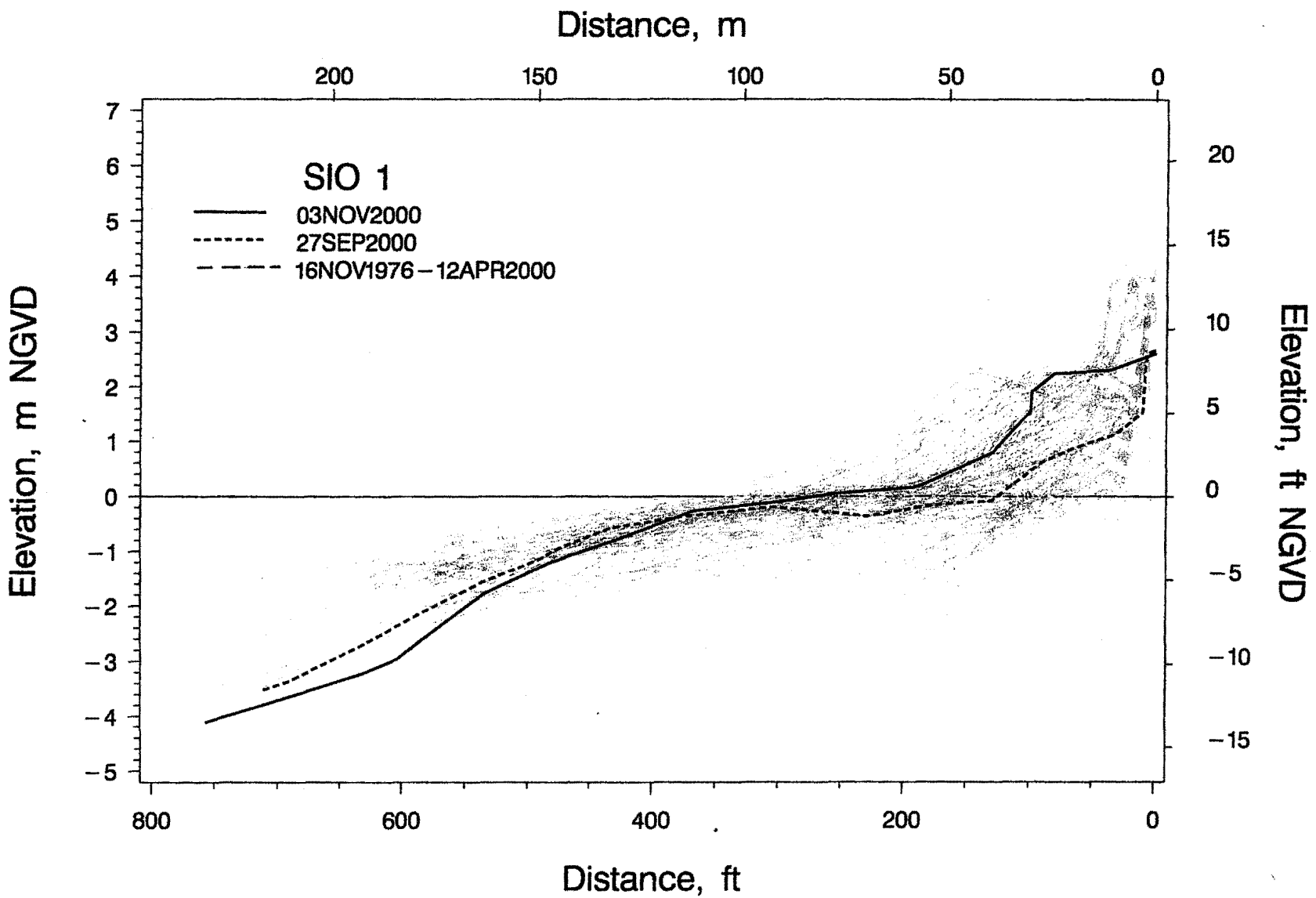


Figure 15. **SIO1 profiles submerged after excavation of inlet overlaid on all existing profiles.**

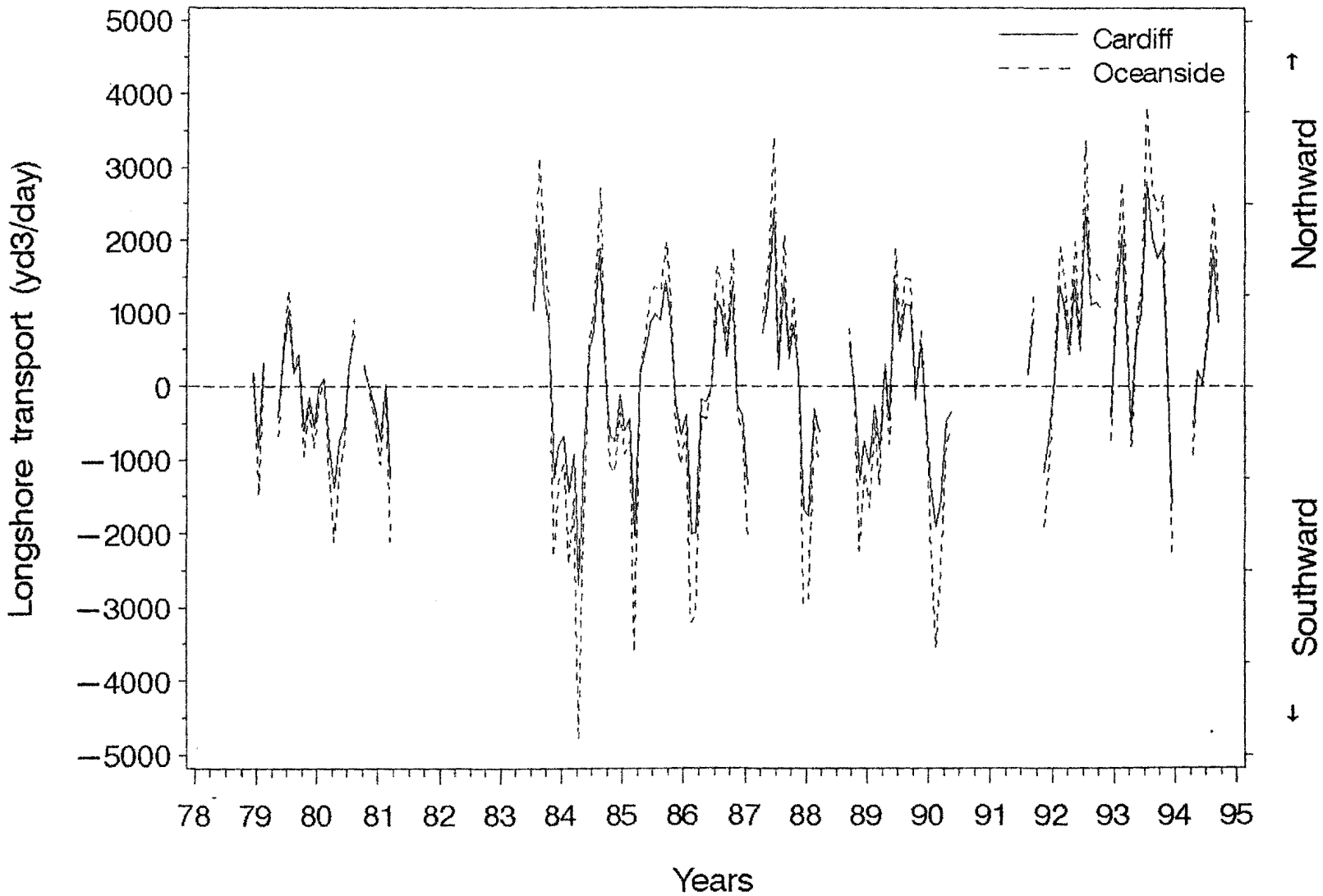


Figure 16. Longshore transport rates and direction at Oceanside and Cardiff.

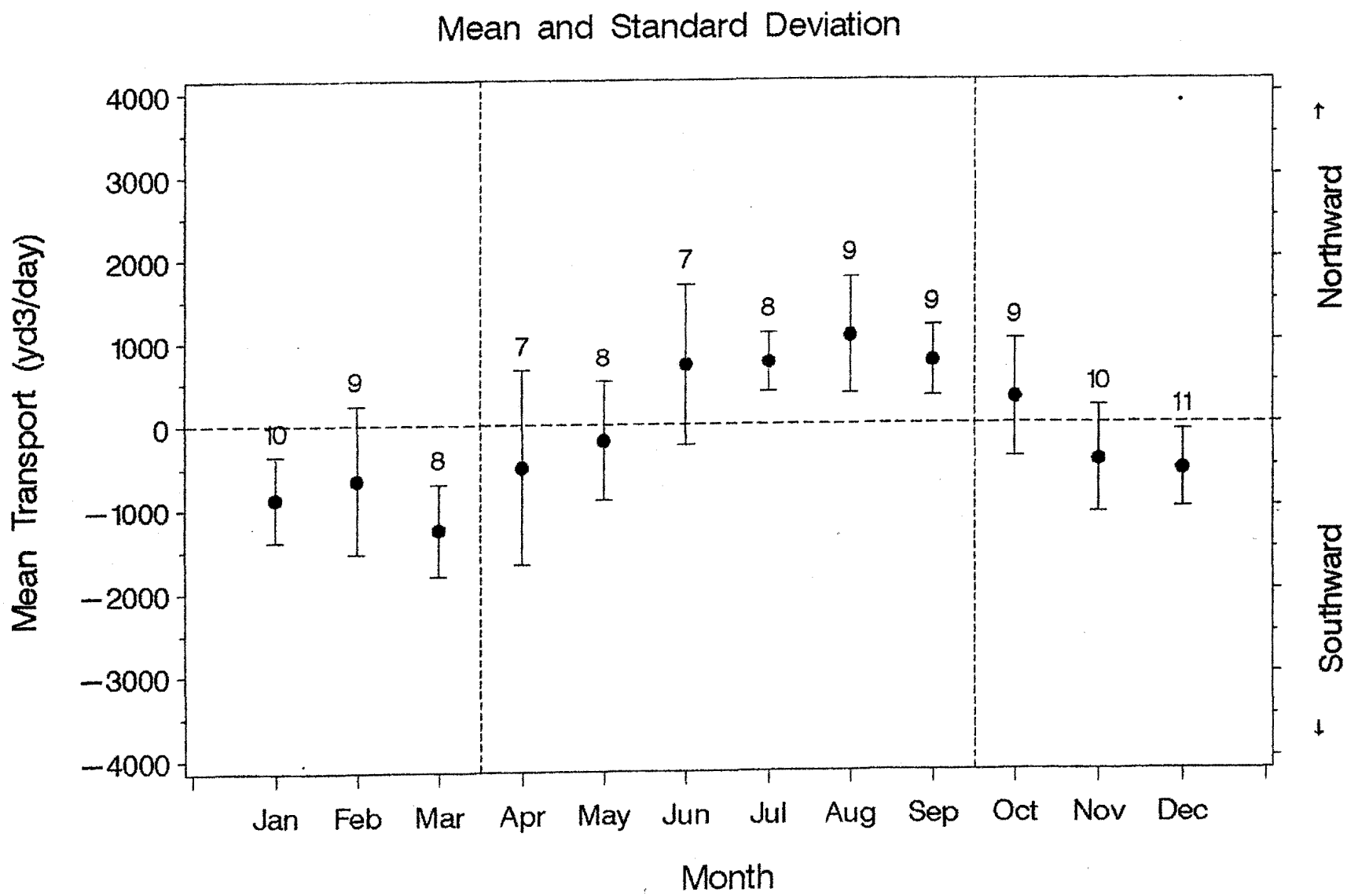
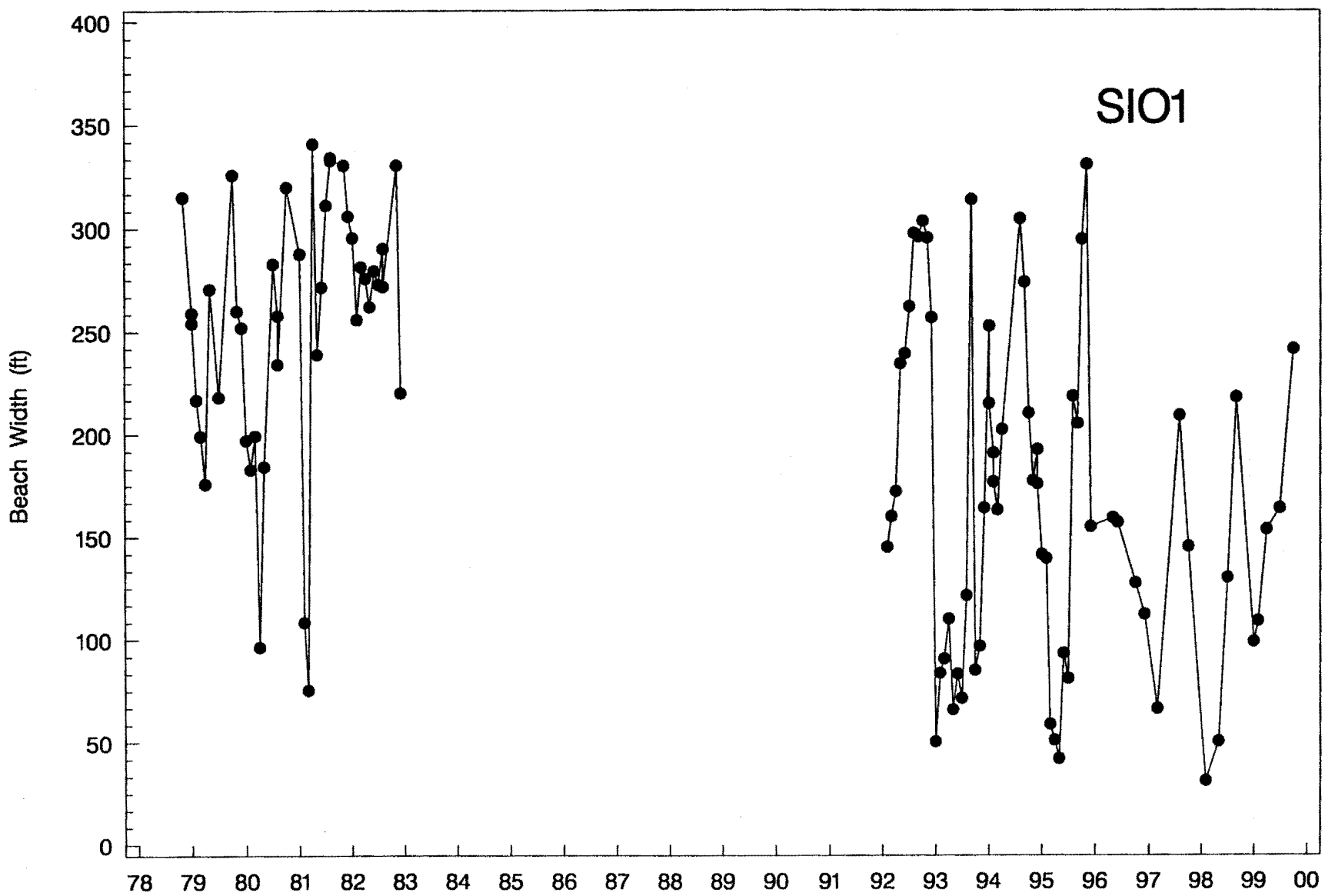
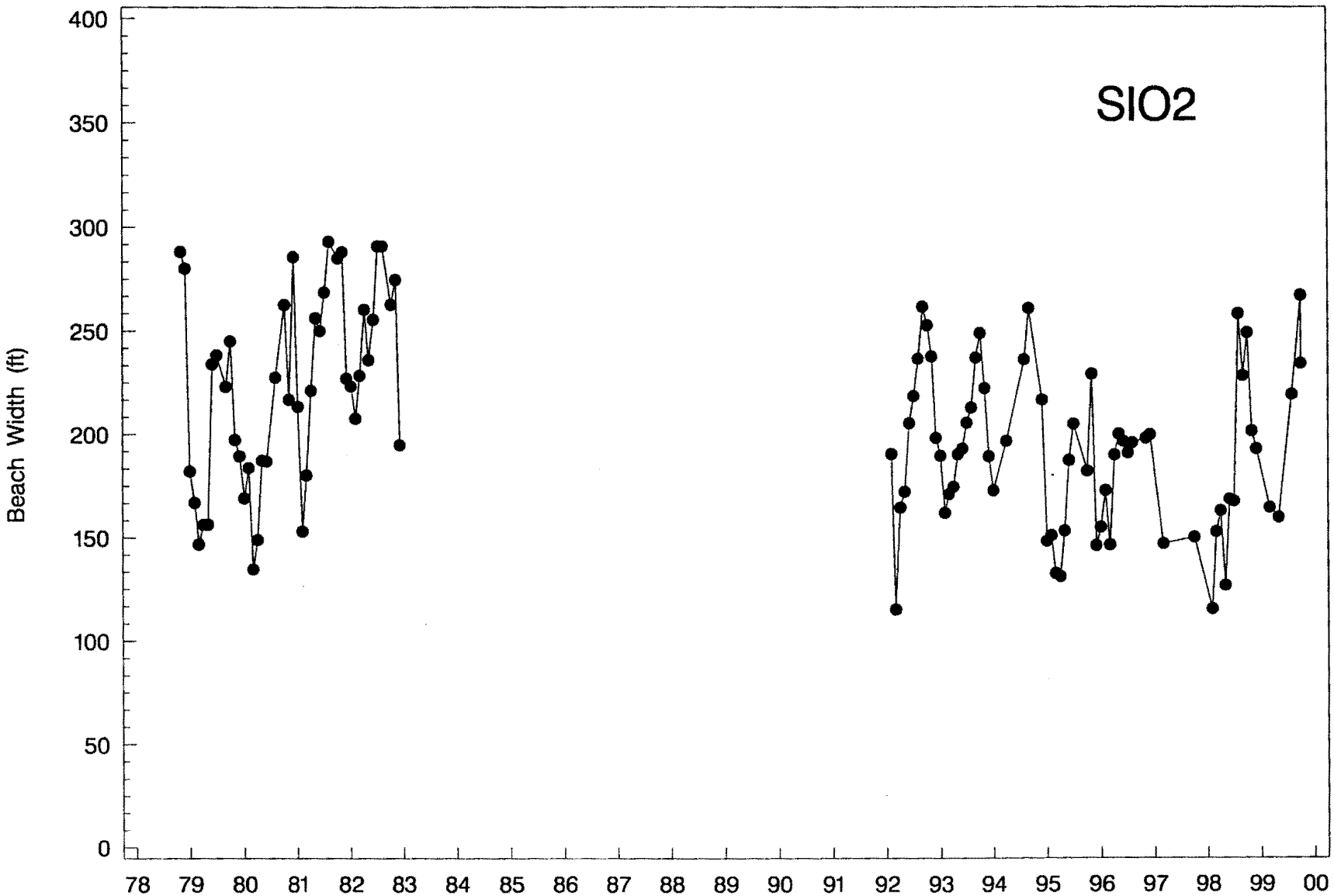


Figure 17. Monthly mean of sand longshore transport and standard deviation at Cardiff.

APPENDIX A

BEACH WIDTH CHANGES


SIO1
Beach Width (ft)
400
350
300
250
200
150
100
50
0
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
00


SIO2
Beach Width (ft)
400
350
300
250
200
150
100
50
0
78
79
80
81
82
83
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86
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88
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97
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99
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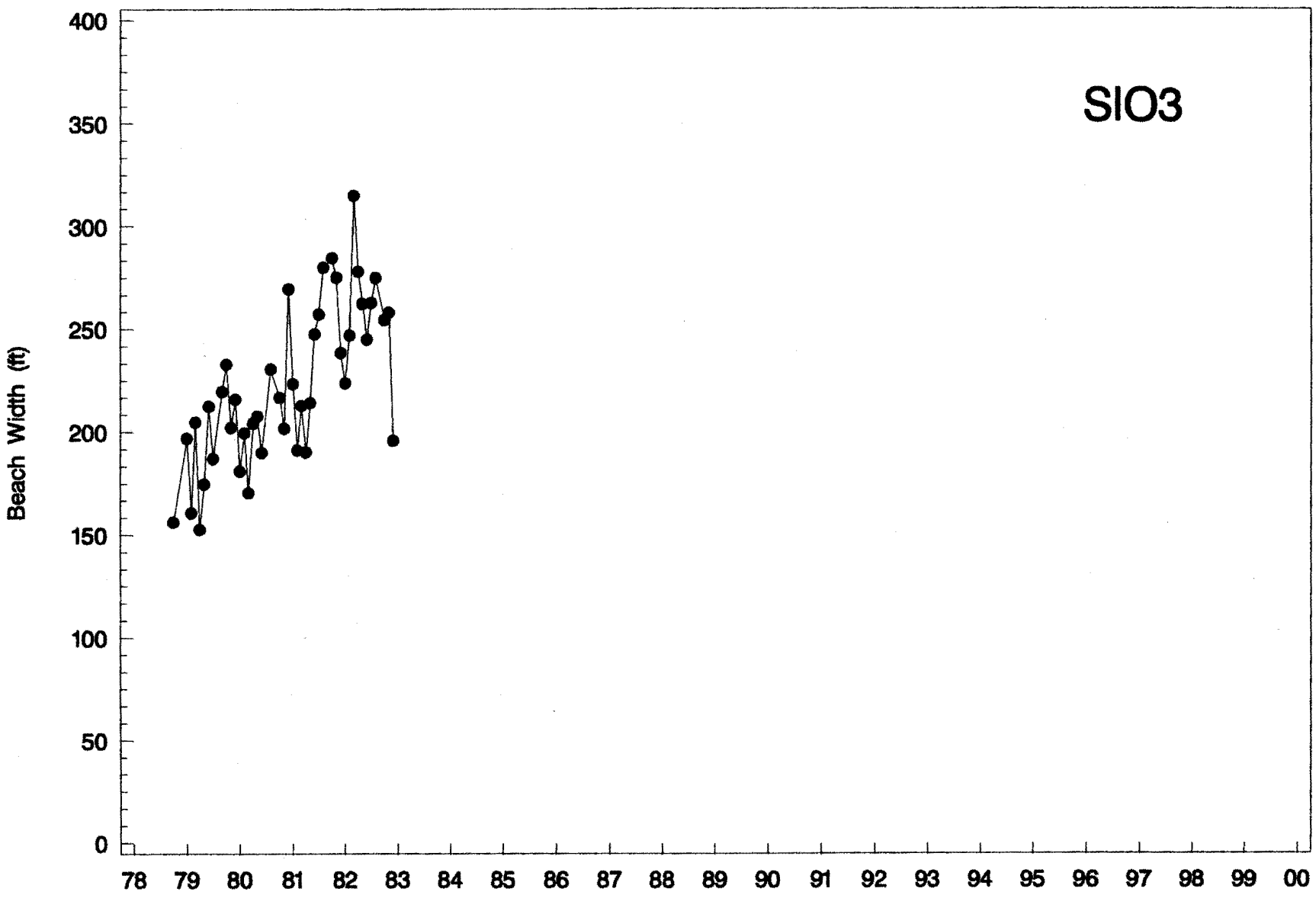
SIO3
Beach Width (ft)
400
350
300
250
200
150
100
50
0
78
79
80
81
82
83
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86
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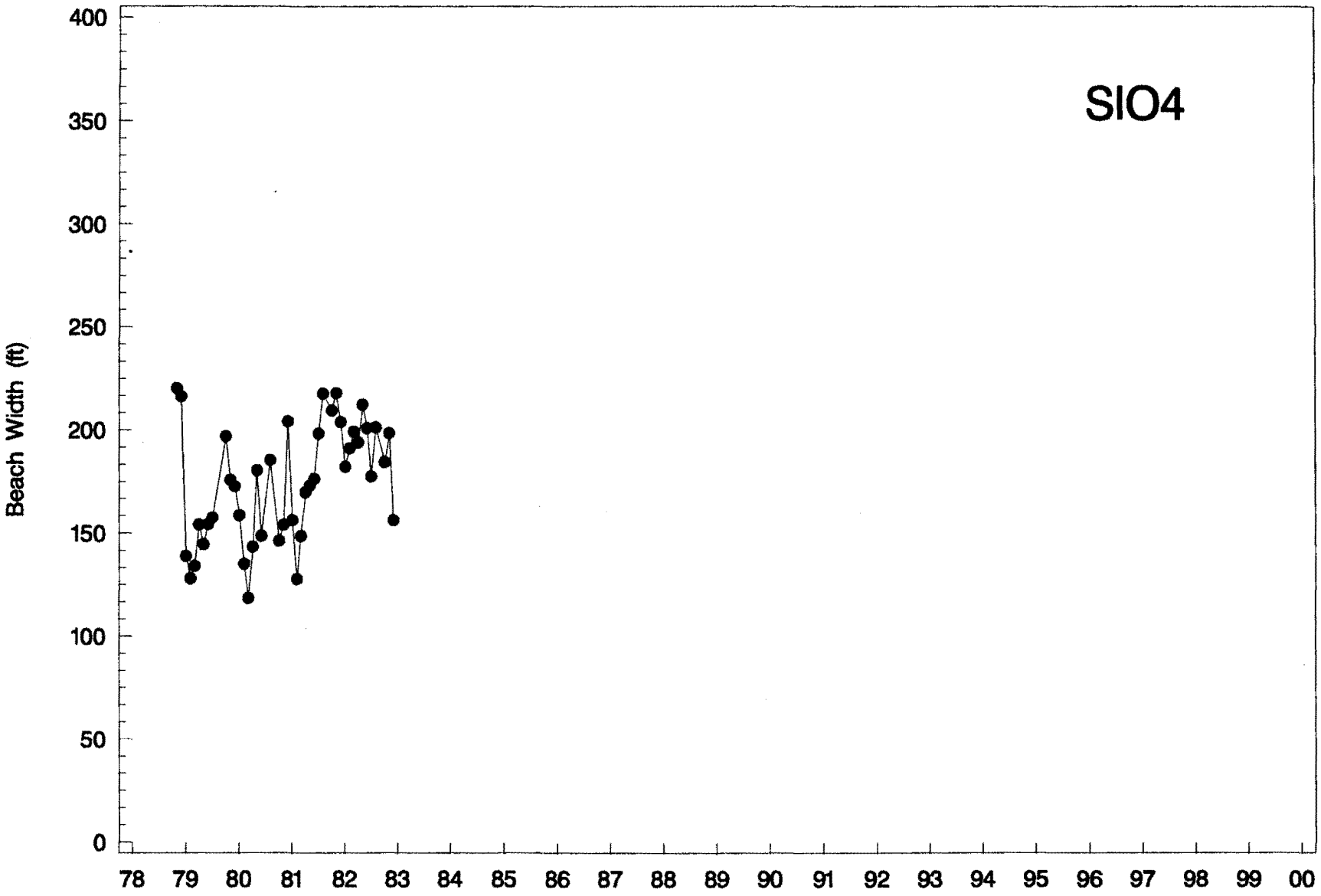
SIO4
Beach Width (ft)
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350
300
250
200
150
100
50
0
78
79
80
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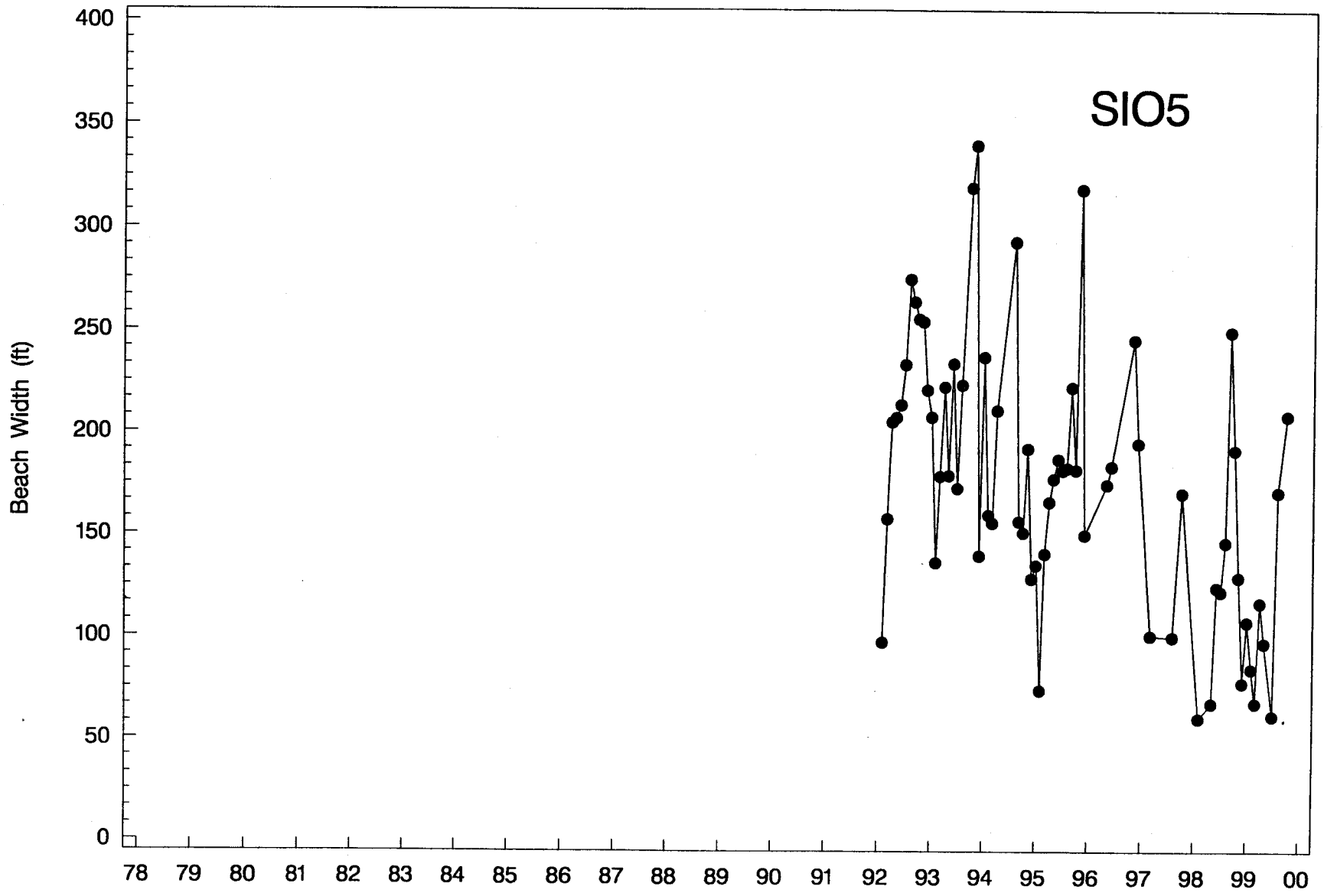
SIO5
Beach Width (ft)
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350
300
250
200
150
100
50
0
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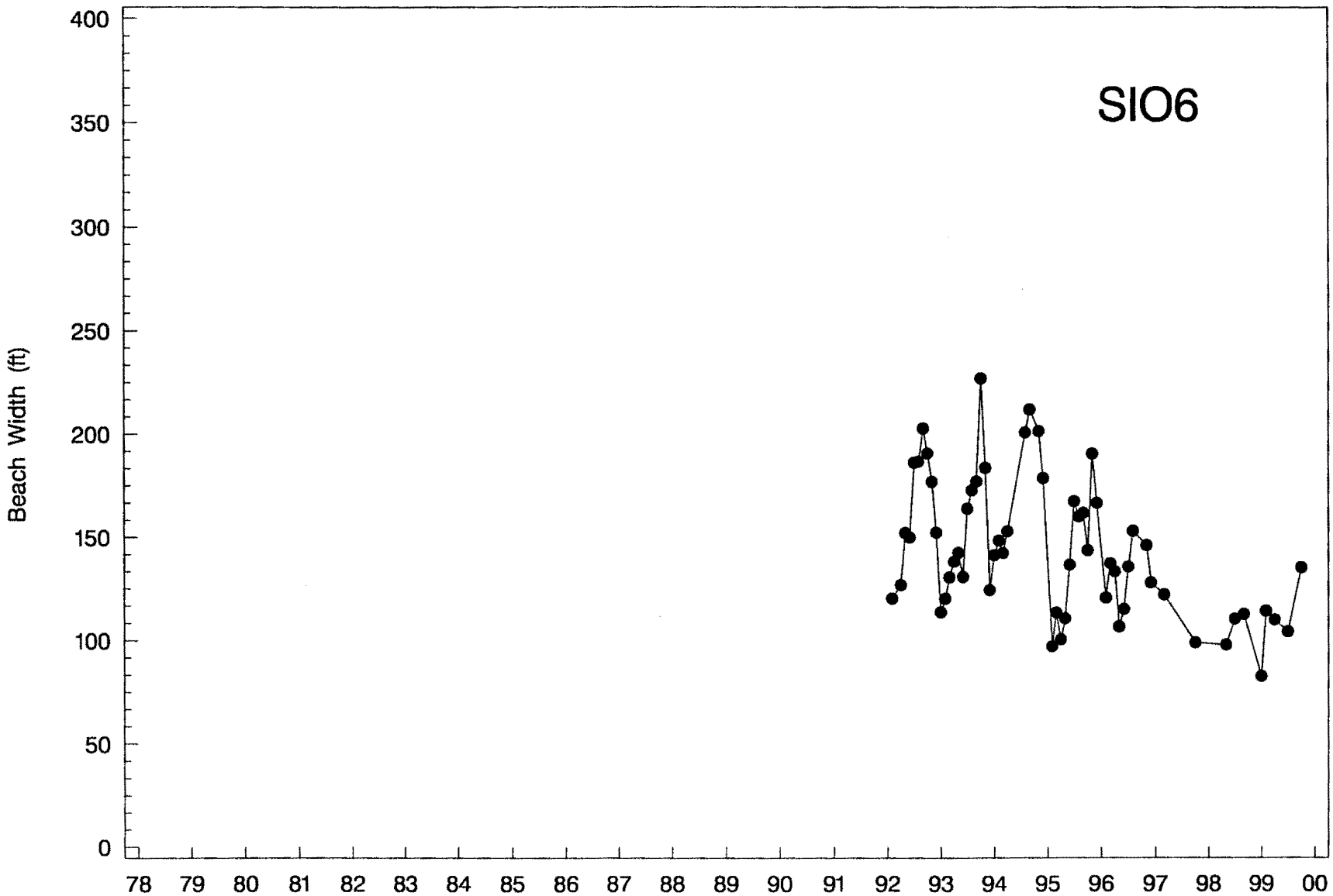
SIO6
Beach Width (ft)
400
350
300
250
200
150
100
50
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Tue 7b

City of Del Mar
Where the Turf meets the Surf
1050 Camino Del Mar · Del Mar, California 92014-2698

May 7, 2001

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COASTAL COMMISSION
SAN DIEGO COAST DISTRICT

Ms. Ellen Lirley
California Coastal Commission
7575 Metropolitan Drive, Suite 103
San Diego, CA 92105

Ms. Leslie Ewing
California Coastal Commission
45 Fremont, Suite 2000
San Francisco, CA 94105-2219

Enclosed: **Review of 'The Stone Report' Regarding the Sandy Lane Homeowners Litigation Against the San Dieguito Lagoon Restoration Project by Dr. Scott A. Jenkins and Dr. M. Hany S. Elwany.**

Ms. Lirley and Ms. Ewing;

Please find enclosed our first submittal concerning the report 'Review and Analysis of the Impacts of Maintaining the Mouth of the San Dieguito Lagoon Open on the Adjacent Beach, Sandy Lane, Del Mar, California' by Dr. Gregory W. Stone.

Jenkins and Elwany (2001) find that the report prepared by Dr. Gregory W. Stone, because of inadequate interpretation and analysis, fails to show that an open inlet causes beach erosion south of the inlet. The main points in the review are summarized below:

1) 'The Stone Report' does not make a distinction between an inlet open to tidal action and an inlet scoured open by major floods (e.g. 20 yr). In the case of floods, the beach in front of the Sandy Lane homes will experience greater erosion than a beach further from the inlet. However, an inlet open to tidal action should not cause down drift beach erosion. The outflow velocity from the lagoon is small and loses momentum as it enters the surf zone. Therefore, an open inlet will not significantly interfere with the long shore transport, which occurs in the outer portion of the surf zone (near wave break point). Additionally, there is a bypassing bar present in the near shore, which displaces the local wave break point seaward, allowing sand to migrate in the long shore direction around the inlet.

2) The monitoring effort undertaken by Dr. Stone aimed to show that an open inlet causes higher levels of down drift beach erosion. However, in the limited time period of the monitoring effort (less than one month) the inlet was closed and the changes observed in the beach profiles were due to winter wave action that usually occur during this time of the year.

3) Dr. Stone misinterprets the percentage of time the inlet has been open in the past 20 years and thereby forms conclusions that are not based on historic record.

Please accept this information as clarification that the "Stone Report" is inadequate and misleading. Please contact me if you have any questions.

Very truly yours,

Linda S. Niles
Planning and Community Development Director

Cc: City Manager; City Attorney

Tue 7b

REVIEW OF "THE STONE REPORT" REGARDING THE SANDY LANE HOMEOWNERS LITIGATION AGAINST THE SAN DIEGUITO LAGOON RESTORATION PROJECT

by

Scott A. Jenkins, Ph. D.*
and
M. Hany S. Elwany, Ph. D. **

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CALIFORNIA
COASTAL COMMISSION
SAN DIEGO COAST DISTRICT

Submitted by:
*SCOTT A. JENKINS CONSULTING
14765 Kalapana Street
Poway, CA 92064

and

** COASTAL ENVIRONMENTS
2166 Avenida de la Playa, Suite E
La Jolla, CA 92037

10 April 2001

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2) General Comments 1

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4) Divergence of Drift Pre- Versus Post-Project 12

5) By-Passing Bar 13

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7) Irrelevant Examples and Quotations 39

8) Conclusions 41

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APPENDICES-

A: Apparent Conflict of Interest with the Department of Oceanography and Coastal Sciences, Louisiana State University (LSU)

B: Letter to the Chairman of the Department of Oceanography and Coastal Sciences of LSU

C: Open and Closure Statistics for the San Dieguito Lagoon Inlet (1926 to 1995) From Jenkins and Wasyl (1996)

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APPENDICES-(continued)

D: Staff Report of the California Coastal Commission, 16 February 1996

E: Peer Review Comments on: Jenkins, S. A. and J. Wasyl, 1998

REVIEW OF "THE STONE REPORT" REGARDING THE SANDY LANE HOMEOWNERS LITIGATION AGAINST THE SAN DIEGUITO LAGOON RESTORATION PROJECT

by

Scott A. Jenkins, Ph. D. and M. Hany S. Elwany, Ph. D.

1) Overview

This is a technical review of the report entitled, "Review and Analysis of the Impacts of Maintaining the Mouth of the San Dieguito Lagoon Open on the Adjacent beach, Sandy Lane, Del Mar, California," by Gregory Stone (referred to herein as "Stone, 2001," or the "Stone report"). This report has been filed in the Superior Court of San Diego North County in support of a lawsuit on behalf of wealthy homeowners who are trying to stop the restoration efforts at the San Dieguito Lagoon in Del Mar, CA. Legal implications of attempts to associate this report with Louisiana State University (LSU) are discussed in Appendix-A and -B. The report contains numerous errors and omissions which render its conclusions invalid.

2) General Comments

Although Stone (2001) has a reference list which includes many of the significant studies conducted at the San Dieguito Lagoon, the text of this report neglects most of the significant data and findings of that prior work. This neglect is the primary cause of the errors and omissions contained in the Stone report.

The essence of the Stone report conclusions are the same as the original conjecture leveled by Rick Engineering against the EIR/EIS, namely that maintenance of an open tidal inlet at San Dieguito Lagoon as a part of the restoration effort will cause downdrift beaches (to the south of the inlet) to erode. These conclusions are set forth in the Stone report using four primary arguments:

A) When the inlet is open the beaches erode.

B) The restoration will cause a negative divergence of drift that will promote erosion of the downdrift beaches.

C) There is no ebb shoal (by-passing bar) at San Dieguito to facilitate the movement of littoral drift around the inlet.

D) "A New Monitoring Effort" indicates that maintaining an open inlet at San Dieguito causes increased erosion to the downdrift beaches.

We will show how Stone attempts to support these arguments by confusing tidal transport processes with river flood processes, and by making inappropriate analogies to U. S. east coast inlets that have nothing in common with San Dieguito either physically, hydrologically, or geomorphically.

3) Historic Inlet Closures and Beach Width Changes

Jenkins (2000) simply made the point that if the Del Mar beaches erode when the San Dieguito Lagoon inlet is open, then how can one account for what happened in the decade of the 1980's. During the 1980's the inlet at San Dieguito was open more often than at any other time in the period of record, and yet the beaches of Del Mar increased in width over this same period (Figure 1). Jenkins (2000) makes no simple cause and effect relationship between inlet openings and beach accretion, because beach widths are controlled by many factors other than the inlet status. The inlet status and beach widths of the 1980's are merely an observational fact.

During the 1980's observations of inlet openings and closures revealed that San Dieguito Lagoon was open 74.7% of the time (closed 25.3% of time) while the U. S. Army Corps of Engineers' beach surveys (USACE, 1991) showed that

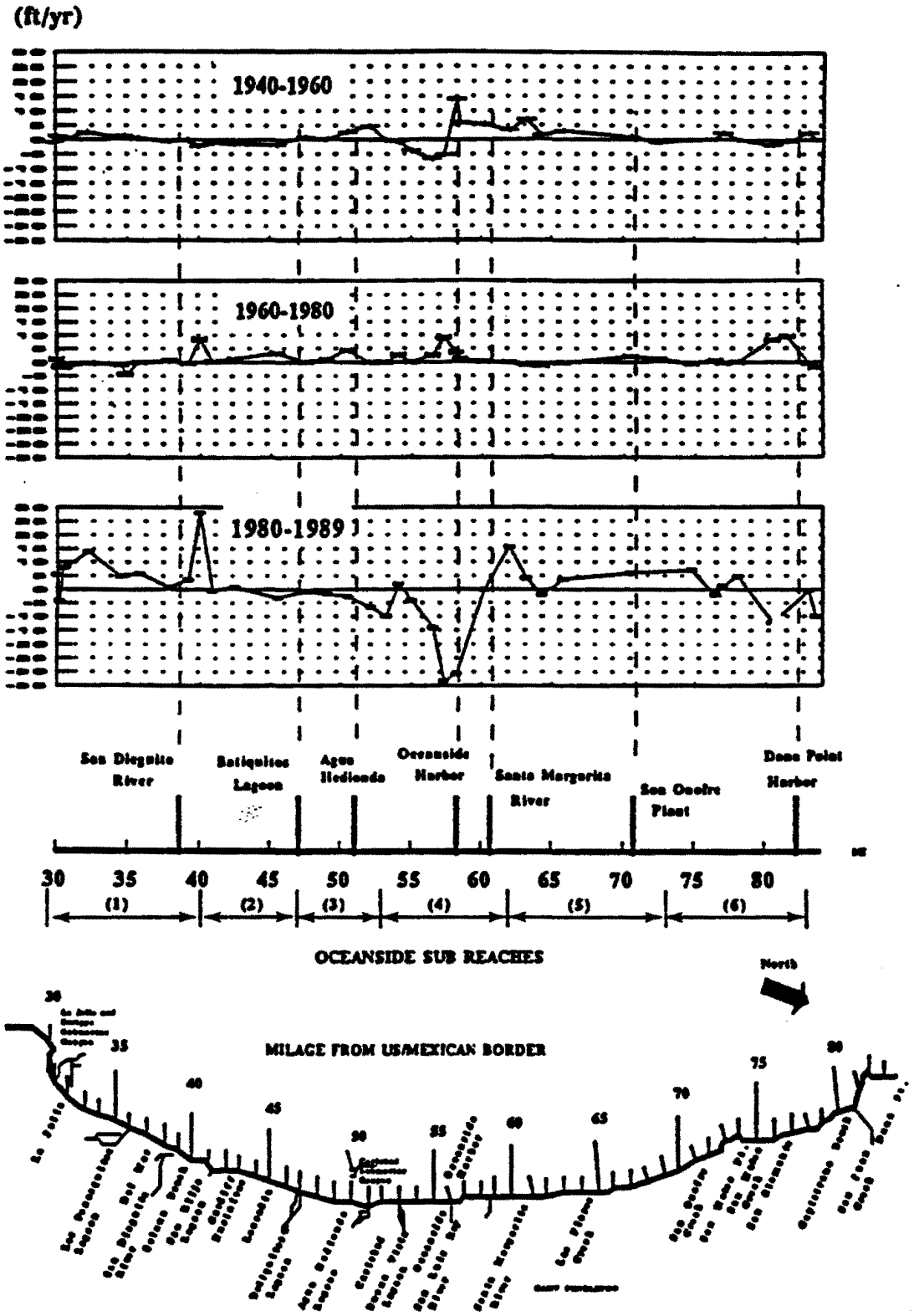


Figure 1. Historic rate of change of beach width for Oceanside to La Jolla beaches, 1940-89, from USACE, 1991.

the Del Mar beaches downdrift of the inlet increased in width at a rate of 0.56 ft./yr. (Figure 1). Stone (2001) on the other hand claims that this figure is wrong and that the lagoon was actually closed 60% of the time. Stone bases his estimate on the model results of Chang (1995) although he does not list Chang (1995) in the reference list of his report. What Stone fails to acknowledge is that Chang (1995) was a preliminary attempt to reconstruct the closure history of the lagoon, and was later abandoned by both the Southern California Edison (SCE) team and the California Coastal Commission (CCC) staff scientists in favor of historical observations of inlet status. The model of Chang (1995) is a river hydrology model, not an inlet model. It predicts river hydrographs and scour from which the time of inlet opening can be inferred as a consequence of the onset of river flow. The Chang (1995) model was not found to accurately predict inlet closure, because that process is a function of many other factors that are independent of river hydrology, including: wave climate, wave induced longshore and cross-shore transport, antecedent beach volume and equilibrium beach profile changes.

Determining the historic openings and closures of the San Dieguito Lagoon was a central issue in assigning the mitigation credits which SCE would receive for inlet maintenance. A great expenditure of effort was given to an historic reconstruction of the inlet openings and closures at San Dieguito. Observational data was collected from a number of sources, including photo archives, surveys by Scripps Institution of Oceanography, logs of the Del Mar Lifeguards, and field notes compiled by the Audubon Society. These data were compiled in Jenkins and Wasyl (1996) and are included in Appendix-C. These data were thoroughly reviewed by the staff scientists of the California Coastal Commission and the opening closure statistics quoted in Jenkins (2000) are taken directly from a

Coastal Commission staff report dated 16 February 1996 (Table 2; Appendix-D). The CCC staff report indicates the inlet was closed only 25% of the time in the 1980's and 37% of the time in the 1990's, (or an average of 31% closure for the last 20 years). These figures represent the consensus conclusions of the historic record by the scientists of the California Coastal Commission staff after careful review of Jenkins and Wasyl (1996) and the historic observational data. The Stone report has totally neglected these historic observations of inlet closures even though it had listed (without discussion) Jenkins and Wasyl (1996) in its reference list. By this neglect the Stone report is simply wrong about the historic inlet status.

Similar selective omissions of the data were made in Stone (2001) with respect to beach profile changes. Stone discounts the U. S. Army Corps surveys (Figure 1), which showed the Del Mar beaches were stable throughout the period of record and widened in the 1980's. Stone implies these surveys are inaccurate:

> "Comparing two surveys to calculate a rate of change increases the potential survey error to +/-4 ft. over the 9-year period which equals +/-0.44 ft./yr."

Whatever two surveys Stone is referring to is never stated. Stone did not produce details regarding his error estimate. Variability in beach width from place to place is often due to local variability in wave height and direction from wave refraction (Del Mar has complex offshore reef formations). In other words variability in beach width measurements is usually quite natural and does not necessarily imply "potential survey error." In addition, the magnitude of measurement error that Stone intimates would represent very sloppy surveying techniques which The Corps is not known to do.

The Stone report bases its conclusions on beach profile response to inlet status by way of a selective interpretation of surveys by Flick, et al. (1986) that were discontinued in 1986. The Del Mar beach response for the second half of the 1980's was neither measured by Flick nor explained by Stone. Proceeding from his already flawed inlet closure statistics, Stone repeatedly tries to establish a simple relation between an open inlet and beach erosion. His primary focus is the beach in front of the Sandy Lane homes immediately south of the river mouth. He bases his interpretation of the Flick, et al. (1986) profiles in terms of a binary climate characterized by a "pre-stormy" period before the 1982-83 winter and a "post-stormy" period thereafter. From these assumptions, Stone concludes from Flick's surveys that the Del Mar beaches only eroded during the "pre-stormy" period in front of the Sandy Lane homes because the inlet was open 61% of the time; and that the beaches recovered everywhere in the post-stormy period except in front of the Sandy Lane homes because the inlet remained open for 13.6 months. On this basis Stone concludes:

> "Therefore, the net deficiency of sand on the beach can be attributed to the opening of the lagoon."

Stone has neglected four important factors in making his simple cause and effect conclusions:

1) The Sandy Lane homes are built at the mouth of a river.
2) Historic record floods occurred on the San Dieguito River during his so-called "pre-stormy" period.
3) River floods scour the river mouth and the adjacent beach when they occur.

4) Recovery of flood scour occurs from redistribution of local sediment supplies.

During the so-called "pre-stormy" period, three very significant San Dieguito River floods occurred (Chang and Pearson, 1995):

1978.....10-yr. flood

1979.....7-yr. flood

1980.....49-yr. flood.

These floods caused flood scour damage to the beach in the neighborhood of the mouth which is clearly evident in the large reductions in beach sand volume 0(100 m^3/m) measured by Flick, et al. (1986) at survey Range #1 on the south bank of the San Dieguito River (Figure 2a). These floods also cause deep scour of the river channel at the mouth which become a trap for beach sand being transported by the waves. (The 1980 flood scoured the river mouth to -10 ft. NGVD, Chang, 1997). What the Flick, et al. (1986) surveys are probably showing in the "pre-stormy" period is a sand deficit in front of the Sandy Lane homes that was due to the latent effects of river flood scour and the subsequent infilling of that scour at the expense of local beach sand volume. These floods were the most conspicuous events of this period. The large losses in beach sand volume in front of the Sandy Lane homes were concurrent with the river floods but, at the same time are absent in the surveys taken further downdrift from the river mouth at 20th Street (Figure 2b).

The slow recovery of the beaches in front of the Sandy Lane homes in the "post-stormy" period was also probably due to additional river flood scour. The winter of 1982-83 was not just a stormy period from the standpoint of wave erosion, it was also a 20 yr. flood on the San Dieguito River, scouring another

a.

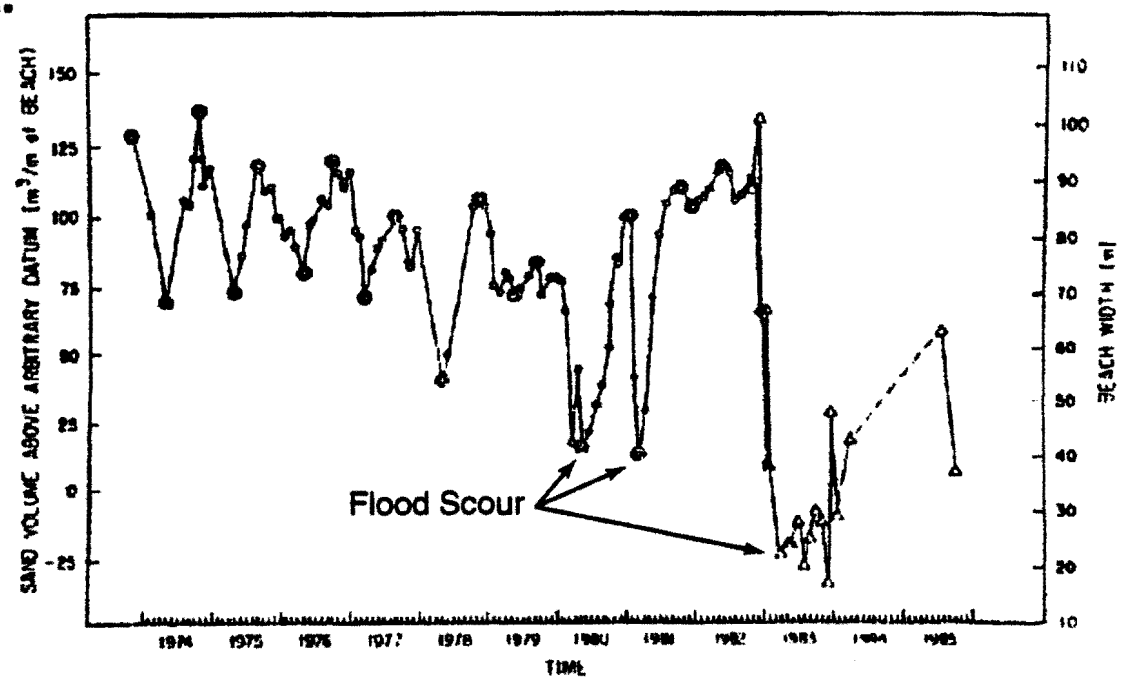


Figure 7. Beach volume and width on the south bank of the San Dieguito River at Range 1 (From Flick et al., 1986).

b.

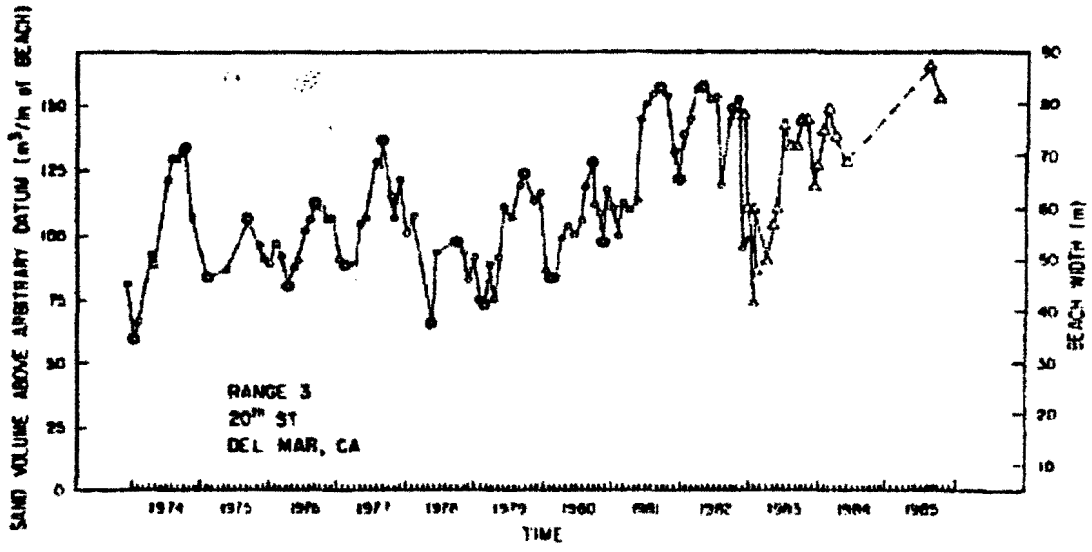


Figure 5. Range 3 at 20 th. St. showing beach volume and width changes from 1974 through 1985 (From Flick et al., 1986).

Figure 2. Del Mar beach sand volume changes from Flick et al (1986) showing: a) Flood scour damage to the beach at the river mouth, and b) no flood damage further to the south at 20th Street [Figures 7 & 5 from Stone 2001].

deep sand trap at the river mouth with bed elevation at -6.0 ft. NGVD. This scour at the river mouth required 14 months to infill (recharge) with beach sand (Chang, 1995, 1997). The recovery of the Sandy Lane beaches in the "post-stormy" period was retarded by the fact that much of the local beach volume was lost to infilling of the flood scour of the river mouth and adjacent beach.

These same concepts regarding river flood scour damage to the river mouth and beach were also presented in Jenkins (2000) in response to the photo collection compiled by Rick Engineering during EIR/EIS comment period. All the photos showing a reduction of beach area in the neighborhood of the river mouth were taken shortly after major floods on the San Dieguito River. These photos revealed fairly obvious beach morphology indicative of river flood scour that had not yet infilled by littoral transport during the relatively brief interval between the time of the floods and the times of the photos (Jenkins, 2000). It is insensible to point to beach surveys and photos that show an open inlet and loss of beach at the mouth concurrent with major floods of the San Dieguito River, and then claim that these features represent the same effects which the lagoon restoration will cause by maintenance of a comparatively low flow rate tidal inlet.

To illustrate the physical differences between a tidal channel and flood scour, Figure 3 gives a cross-section of the beach at the river mouth. The tidal inlet channel that will be maintained by the restoration is indicated in green and at the mouth it will have an inlet sill at -0.9 ft. NGVD and a sediment trap maintained at -2.0 ft. NGVD, (EIR/EIS, 2000; Jenkins, 2001). Only when the tidal elevation rises above -0.9 ft. NGVD can beach sand be transported into the channel, where it will be captured in the sediment trap and periodically dredged and returned to the beach. Maximum flow rates due to tidal exchange will be

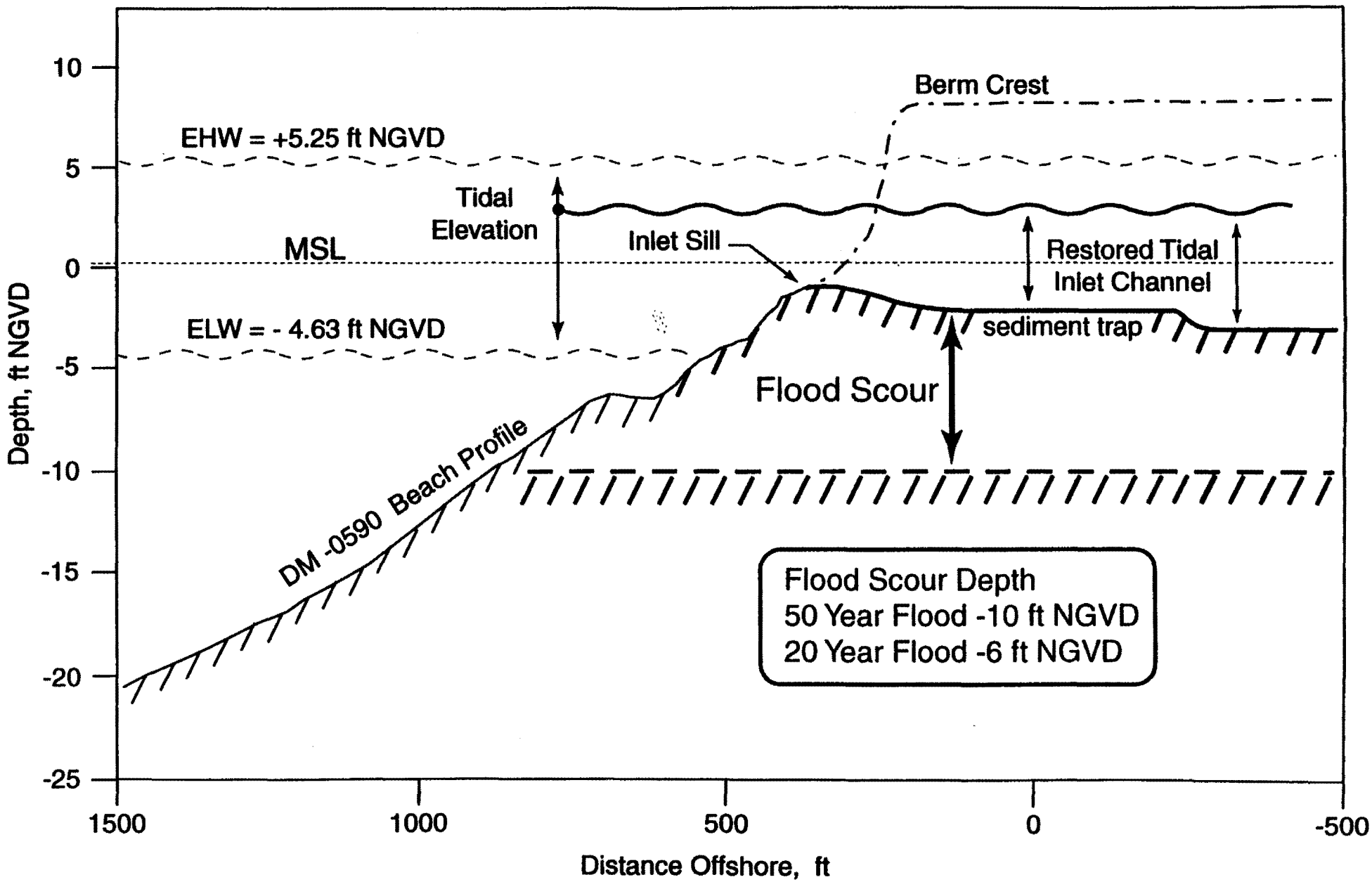


Figure 3. Along Channel Cross Section of Lagoon Inlet and Beach Profile for Final Plan without W6a & W6b.

800 cfs. When the tide is lower than -0.9 ft. NGVD, the tidal channel is landlocked and beach sand will not enter the inlet. This condition occurs 16.1% of the time for Edison's Final Plan (Jenkins and Wasyl, 2001). On the other hand, the high flow rate floods of the San Dieguito River will wash out the equilibrium tidal inlet sill and induce scour of the sediment trap and inlet channel. A 20-year flood as occurred in 1983 will scour the inlet channel to -6 ft. NGVD at the mouth and a 50-year flood like 1980 will scour the channel to -10 ft. NGVD. These scour depths are well below the historic extreme low water level of the ocean (-4.66 ft. NGVD), and will allow beach sand to be continuously pushed into the scour depression by wave action until the much shallower depths of a tidal channel are restored by the infilling (recharge) process. River flood scour creates depressions in the inlet channel and beach face which are enormously deep in comparison to the depths of the tidal channel which the restoration will maintain. Peak flow rates for a San Dieguito River flood range from 6,400 cfs for 1983 to 22,000 cfs for the 1980 flood (Chang, 1995, 1997). Because the sediment rating curve for the San Dieguito River varies as the 2.03 power of the flow rate, sediment transport due to river floods flowing over the beach is between 70 and 800 times greater than for tidal flows (Nordin, 1997; Jenkins and Wasyl, 1998). Therefore, there is no similarity in physical scale, between the flood scour damage to the beach that occurs when the inlet is open after river flooding, versus the sediment transport induced by the shallow tidal channel across the beach as proposed by the lagoon restoration.

Flood scour of the inlet channel and beach is a pre-project condition which the restoration will not exacerbate. The primary purpose of the levee system incorporated into The Final Plan of the restoration is to insure that the project does

not reduce sediment yield to the beach during floods, nor increase the already present danger of river flood scour to both natural and manmade features alike, (Chang, 1995, 1997; EIR/EIS, 2000).

4) Divergence of Drift Pre- Versus Post-Project

The Stone report correctly points out that a negative divergence of drift occurs across the inlet of San Dieguito due to sand influx into the lagoon. This provides a predisposition for the inlet to migrate southward in the presence of a southward directed net littoral drift. What Stone fails to acknowledge is that this negative divergence of drift is an already existing condition and that the inlet can't migrate because the Sandy Lane homeowners have built on the portion of the beach to where the inlet is trying to move. This state of affairs makes the beach on the downdrift side of the inlet (south side) pre-disposed to being narrow, because the negative divergence of drift depletes sand volume on the south bank when the inlet channel is prevented by structures from making compensating adjustments.

The negative divergence of drift is a pre-project condition because the inlet has been open 69% of the time during the last 20 years (CCC staff report, Appendix-D). The sand influx rates for the existing lagoon can be quite large (4,000 - 7000 cubic yards per month) during the post flood recovery periods when the flood scour depressions at the mouth are being infilled with beach sand. Surveys and channel current measurements by Elwany (1993) show that this infilling processes is controlled by tidal exchange and the infilling (recharge) zone extends from the river mouth up channel to the railroad bridge.

Numerical transport modeling by Jenkins and Wasyl (1998) and Jenkins and Inman (1999) show that the restoration will reduce the sand influx rates relative to

the pre-project conditions. These model results are shown in Figure 4, where the pre-project (existing) conditions are calibrated using the surveys of Elwany (1993). Figure 4 shows that sand influx rates (proportional to inlet induced divergence of drift) are reduced 61% by the restoration in an average tidal month during the post flood period of the 1993 flood. This is due to the increase in the ebb tide flushing of sand from the channel as a result of the increased tidal prism and improved hydraulic efficiency afforded by the restoration. A closer inspection of the individual tidal transport cycles in Figure 4 reveals that significantly more sand is flushed from the inlet channel by the restoration (orange line) than for the existing conditions (black line).

Therefore, the adverse effects of negative divergence of drift at the inlet are significantly reduced by the restoration relative to existing conditions. Furthermore the periodic dredging of sand from the inlet channel and its subsequent return to the beach under the restoration's inlet maintenance program will eliminate over time the residual negative divergence of drift effects on the local beach. In other words the long term average of the divergence of drift across the inlet will approach zero for the post-project condition due to maintenance activity. This conclusion is validated by the observed stability of downdrift beaches that have been nourished by inlet maintenance dredging at other local lagoons, such as Agua Hedionda and Batiquitos (Elwany, 1998; Flick, 1994 and CH2M Hill, 1989).

5) By-Passing Bar

This issue began with the Rick Engineering comment on the EIR/EIS that asserted the longshore transport would be deflected seaward by the ebb tidal flow

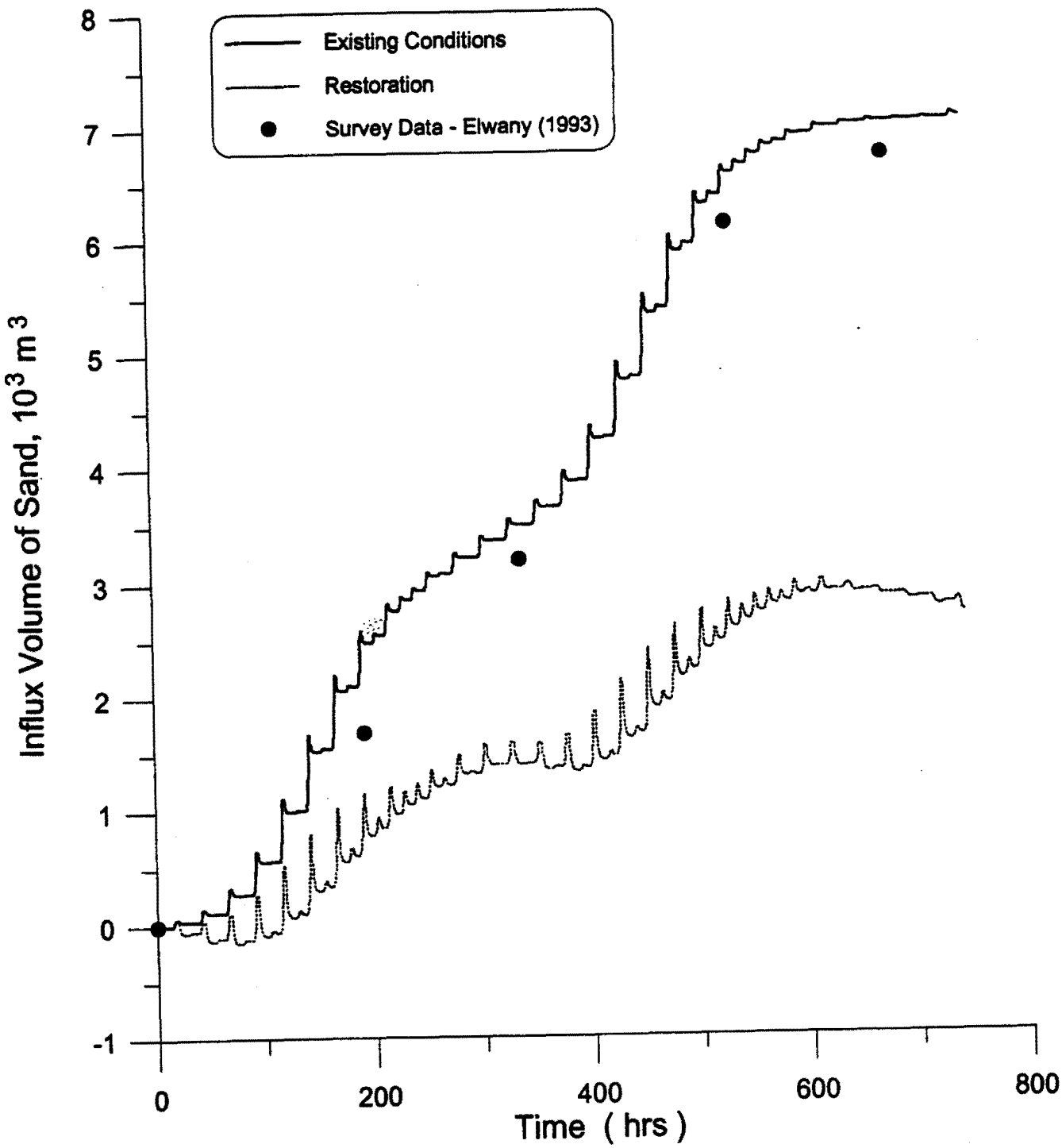


Figure 4. Sand influx volume pre vs post-project, San Dieguito Lagoon, CA, 1 Feb - 3 Mar 1993.

of the restoration and that would starve the downdrift beaches of sand. This notion was refuted by Jenkins (2000) based on the following:

A) Most of the longshore transport occurs in the outer portion of the surf zone near the break point (Longuet-Higgins, 1970).

B) The maximum ebbing tidal current over the inlet sill for the restoration is 3.5 ft./sec., decreasing to 0.02 to 0.5 ft./sec. at the break point (based on surf zone widths for historic ranges of breaker heights, Jenkins and Wasyl, 1998, 2001; EIR/EIS, 2000). These tidal velocities at the break point are between 1/4 and 1/10 the threshold velocity of Del Mar Beach sand, (Jenkins and Wasyl, 1998).

C) Tidal inlets typically have ebb shoals, sometimes referred to as "by-passing bars." By-passing bars displace the local break point seaward (over the bar) and provide a natural pathway around the inlet that is beyond the region of entrainment by the tidal stream through the inlet.

The Stone report refutes the third point (C) claiming that San Dieguito is not a typical inlet and does not have a by-passing bar. Stone comments on numerous irrelevant examples of inlets from the U. S. east coast that have little in common with San Dieguito either physically, hydrologically or geomorphically. He uses the large jettied inlet at Destin East Pass, Florida, (Figure 5), to provide an example of how to identify a by-passing bar from a photograph based on the "wave refraction pattern." Upon closure inspection of this photo, the features he refers to as "wave refraction" are actually short period wind waves that are breaking in the deeper water offshore, i.e., white caps. There is no apparent surf zone along the fillet beach. Therefore the offshore wave breaking could not be due to wave refraction and shoaling over a shallow bottom feature, otherwise the

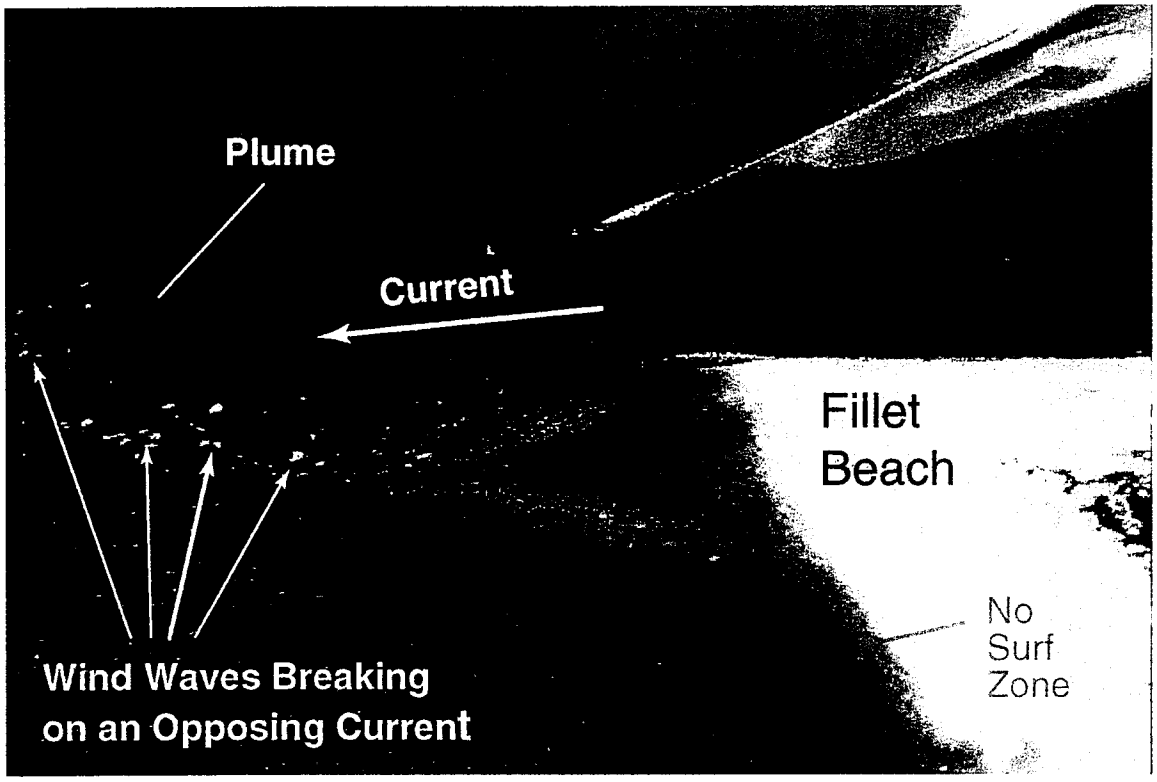
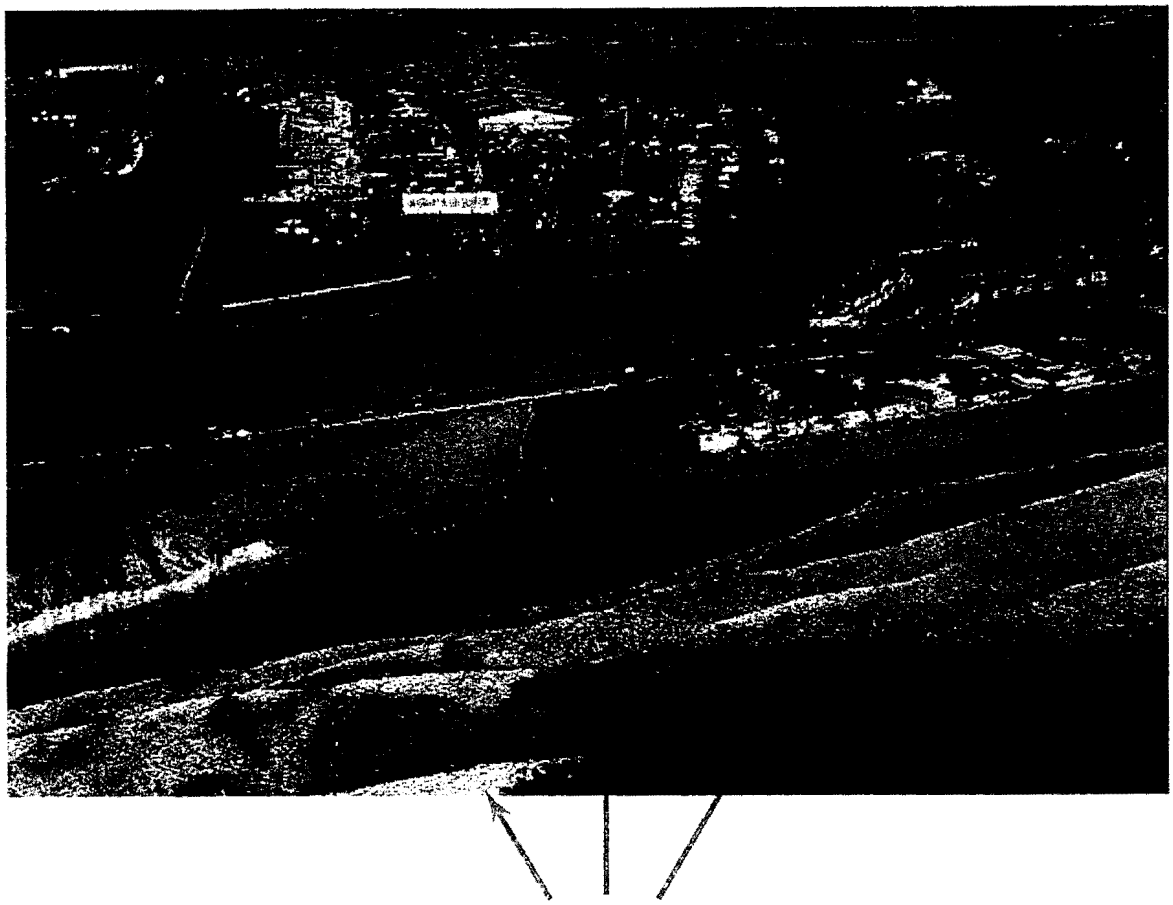


Figure 5. Jettied inlet at Destin East Pass, Florida. This figure has been re-annotated from Figure 9 of Stone, (2001).

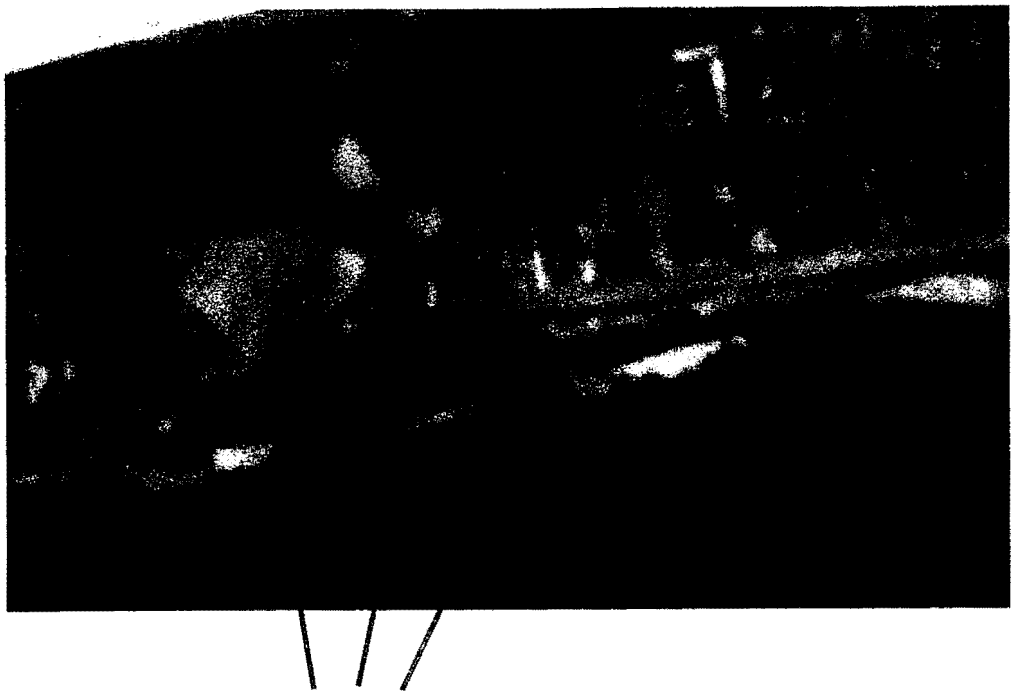
same type of wave breaking would be seen in the shallow water regions along the fillet beach; (note the absence of a surf zone along the fillet beach). The more likely phenomena portrayed in Figure 5 is short period wind waves propagating shoreward and breaking on an opposing current flowing out of the inlet. The seaward flowing current from the inlet is revealed by the plume of slightly turbid water emanating from the mouth of the inlet and spreading into the offshore over the region where the white caps are seen.

Given the inconsistencies between Stone's narrative and the photo evidence in Figure 5, his ability to interpret a photo for the presence of a by-passing bar seems questionable. Nonetheless, he proceeds in his report to comment on seven photos of the inlet to San Dieguito, claiming that none of them show the presence of an ebb shoal, ebb tidal bar, or by-passing bar. Five of these photos are shown in Figures 6-10. In studying these photos it should be kept in mind that waves will be breaking over the by-passing bar at the mouth of the inlet if one is present; otherwise, the waves will propagate unbroken toward the inlet and break further inshore in the shallower water near the inlet sill. In other words, the breaker line will bulge seaward at the mouth if a by-passing bar is present or bow shoreward if one is not. In Figures 6-10 we find that waves are shoaling and breaking further offshore in front of the inlet to San Dieguito, than they are to either side of the inlet. Also note that there is a well defined surf zone in all cases, unlike Stone's example in Figure 5. The only way waves could be shoaling and breaking further offshore in front of the inlet would be due to a shallow water feature in the offshore. There are no rocky reefs off the mouth of the San Dieguito River, and therefore that shallow water feature could only be a sand bar, i.e., a by-passing bar.



Offshore displacement
of shoaling and wave breaking
due to by-passing bar

Figure 6. Inlet of San Diguito Lagoon, re-annotated from Figure 1 of Stone, (2001).



Offshore displacement
of shoaling and wave breaking
due to by-passing bar

Figure 7. San Dieguito Lagoon inlet, 5 March 1984, re-annotated from Figure 11a of Stone, (2001).

Offshore displacement
of shoaling and wave breaking
due to by-passing bar

Figure 8. San Dieguito Lagoon inlet, 1 July 1995, re-annotated from Figure 11b of Stone, (2001).

Offshore displacement
of wave breaking
due to by-passing bar

Figure 9. San Dieguito Lagoon inlet, 1998, re-annotated from Figure 12 of Stone, (2001).

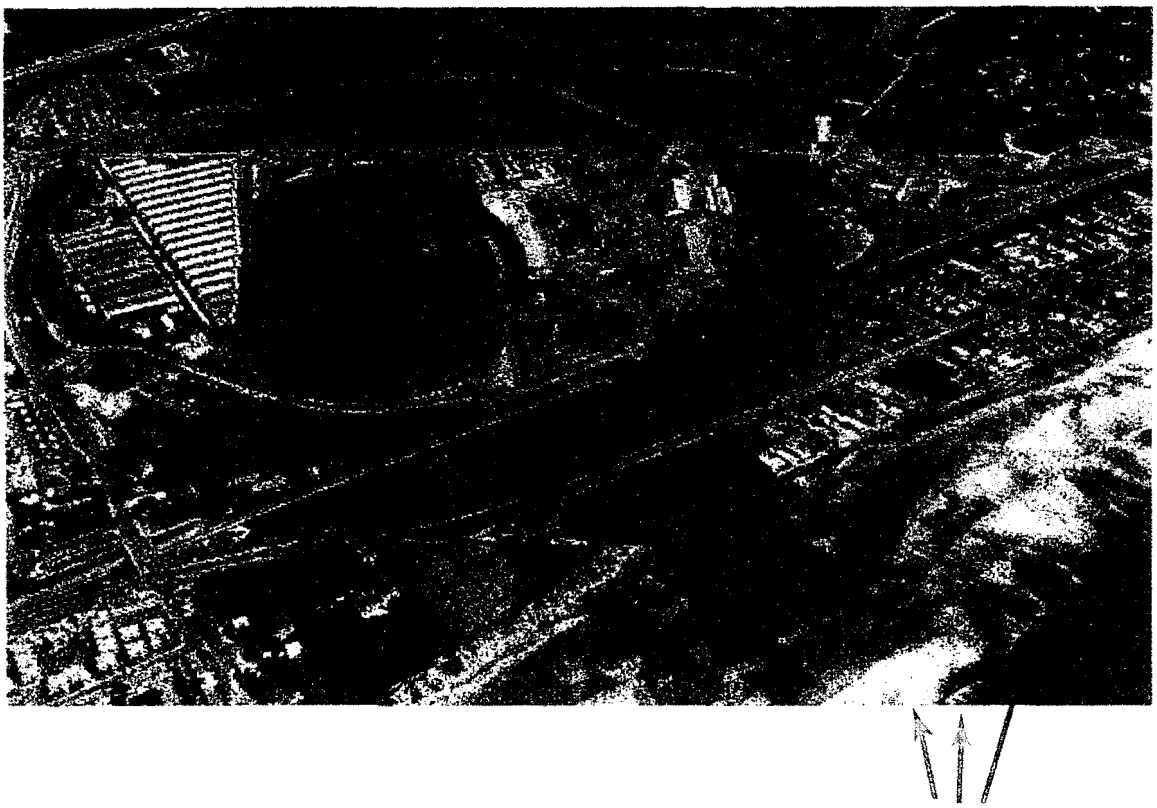


Figure 10. San Dieguito Lagoon inlet, 22 February 1980, re-annotated from Figure 13 of Stone, (2001).

Stone has actually provided fairly convincing photo evidence of the existence of by-passing bars at San Dieguito, and it is these bars which provide a pathway for longshore transport to detour around inlet of the lagoon seaward of the zone of tidal entrainment by the inlet. Because the restoration will increase the amount of sand flushed from the inlet channel during ebb tide, it will likely increase the sand volume of the by-passing bar and thereby improve its by-passing efficiency.

Figure 10 showing the February, 1980 flood condition is particularly noteworthy. The waves are shoaling and breaking extremely far offshore at the river mouth relative to the line of breakers along the beach further to the south. For this to occur requires a by-passing bar containing very large volumes of sand. In this case that sand volume was provided by the sediment yield of the river flood, estimated to be 259,000 tons (Chang, 1995). Over time much of that sand will be reworked by waves and a major portion redistributed from the by-passing bar to the beach. The sediment yield of San Dieguito River floods are the natural local nourishment source for the Del Mar beaches that has maintained the long term stability of these beaches, as evident in the U. S. Army Corps of Engineers surveys (Figure 1). There is no doubt that these floods result in short term scour damage to the beaches in the immediate neighborhood of the river. However this damage is self repairing by the new sediment which the floods deliver to the nearshore, deposited initially in an offshore bar as in Figure 10, and later redistributed by waves to promote recovery of the beach. The Sandy Lane homeowners have lived through these flood scour and beach recovery cycles in the past and will have to continue to deal with them for as long as they choose to live at the river mouth. However, these flood scour and beach recovery cycles must not

be confused with the low flow rate transport of the tidal inlet which the restoration will maintain.

6) "New Monitoring Effort"

After apparently rejecting the results of nearly 50 years of U. S. Army Corps of Engineers beach surveys based on alleged inaccuracies, the Stone report proceeds with an attempt to set the record straight with two new beach surveys over a period of less than one month, 19 December 2000-16 January 2001. The surveys covered only about 1000 ft. of shoreline and no monitoring of a control area outside the immediate neighborhood of the river mouth was conducted. Stone (2001), p. 25, draws the following inference from these two surveys:

> "The preliminary data do, however, reveal trends that are typical of an inlet causing higher levels of erosion downdrift."

The problem with this conclusion (however preliminary it may be) is that the inlet was closed 79-86% of the time during the period between his two surveys; and therefore an open inlet could not have been the cause of the observed beach erosion. Field observations and photographs show that the inlet was closed 16-21 December 2000 (Figures 11-13). Note in these photos that the barrier beach extends unbroken across the mouth of the inlet from the South Solana Beach sea bluff to the Sandy Lane riprap in the foreground. On 24 and 25 December 2000 the berm of the barrier beach was overtopped by the highest-high tides to occur during the month of December, when extreme spring tides reached +6.6 ft. MLLW, (Figures 14 and 15). Because the overtopping was short-lived, a well-defined inlet channel did not form, and tidal exchange was described in our field

Figure 11. 16 December, 2000. The San Dieguito Inlet is closed.

Figure 12. 19 December, 2000. The San Dieguito Inlet is closed.

Figure 13. 21 December, 2000. The San Dieguito Inlet is closed.

Figure 14. 24 December, 2000. The Inlet has been breached with the spring tide (6.6 ft MLLW), one of the highest high tides of the month of December 2000. Note the kelp pads that are grounded, not floating, on the shallow bottom of the inlet. Also, note the large waves.

Figure 15. 25 December, 2000. This photo was taken on Christmas Day. There was a high tide of 6.6 ft MLLW, at 8:30 AM. The inlet is essentially closed, but has been breached at high tide. Note the shallowness of the inlet.

notes as "a trickle." This is apparent in Figures 14 and 15 from the status of the kelp paddies which are found to be grounded on the inlet bottom. Therefore the flows that overtopped the barrier beach were no more than ankle deep. The failure of high tide overtopping to scour an inlet channel during the 24-25 December 2000 spring tides is confirmed by subsequent observations of the inlet on 31 December 2000 (Figure 16). Here no evidence of channel scour can be found anywhere between the South Solana Beach sea bluff and the Sandy Lane riprap. Also the berm remains high and unbroken with no signs of a channel breach. Subsequently high waves and high tides returned on 11-12 January 2001 when the highest high tide water levels reached +7.4 ft. MLLW. However these high water levels produced only minor overtopping of the berm and barrier beach that had built up across the inlet during the benign wave period of the preceding two weeks (Figures 16 and 17). Note again in Figure 17 that this overtopping produced no significant inlet channel scour or breaching of the barrier beach, but rather merely ubiquitous wetting of the entire barrier beach area. Such photo evidence indicates an absence of significant flow between the lagoon and ocean. Our field observations on 19 January 2001 found that the inlet had finally opened after heavy surf caused significant erosion of the Del Mar beaches. Apparently the inlet reopened sometime between 12 January 2001 and 19 January 2001. On the other hand the two beach surveys described in Stone 2001 were conducted on 19 December 2000 and 16 January 2001. Correlating these survey dates with the photo evidence from Figures 11-17 and field observations leads to the conclusion that the inlet was open at most 4 to 6 days of the 29 day monitoring period.

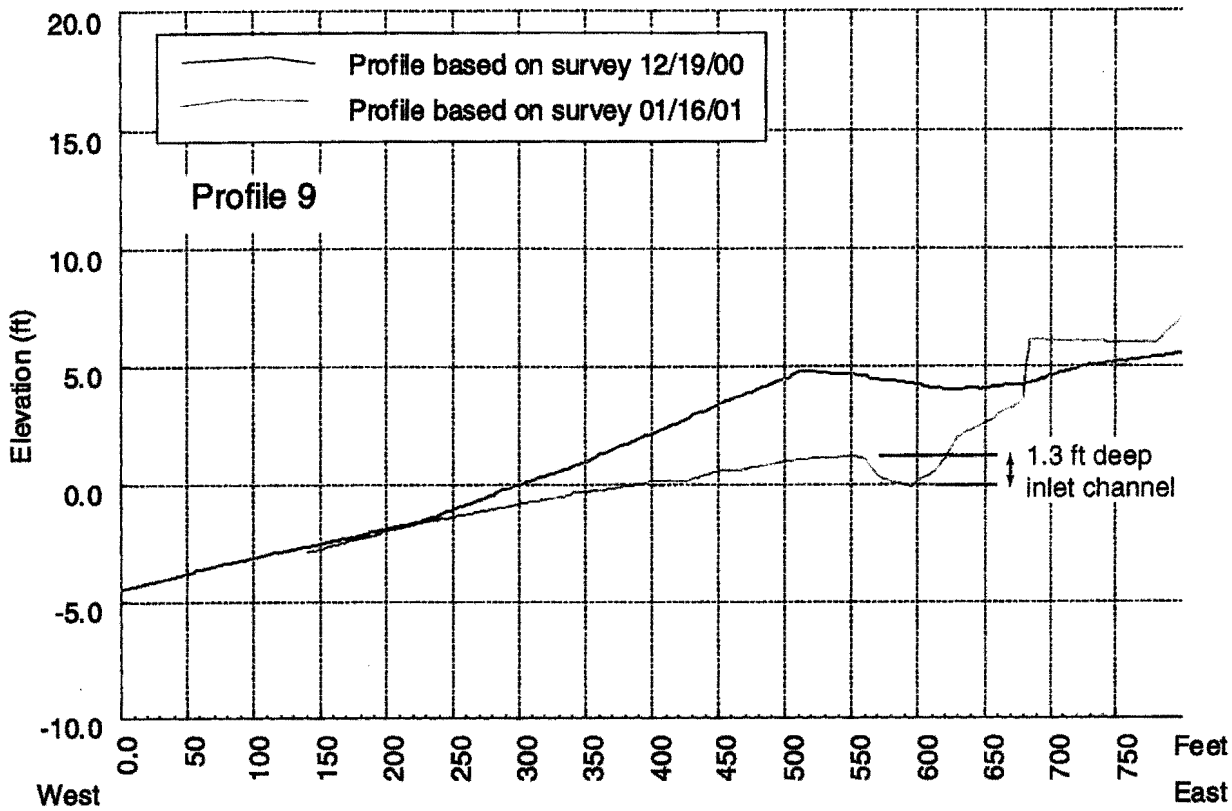
This conclusion is consistent with the features of the beach profiles measured in the Stone (2001) surveys. The only two range lines which could have

Figure 16. 31 December, 2000. The San Dieguito Inlet is closed.

Figure 17. 11 January, 2001. View looking south towards the inlet. The entire Del Mar beach area is overtopped by a combination of waves and high tides (7.4 ft MLLW), including the barrier beach across the inlet. Note that no well defined inlet channel or channel breach through the barrier berm is evident.

crossed the inlet channel were Profiles 9 and 10 in Figure 18. Profile 10 shows no evidence of an inlet channel depression in either the 19 December 00 or 16 January 01 surveys. Profile 9 in Figure 11 shows no inlet channel depression in the 19 December 00 survey. Only after the berm had eroded by the time of the 16 January 01 survey is there any sign of an inlet channel. Therefore the beach erosion seems to have caused the inlet channel to open rather than an open inlet channel causing the beach to erode. In addition the channel appears to have been very small, at most 70 ft. wide and 1.3 ft. deep. The channel width was probably even less because Profile 9 crosses the channel axis at about a 45° angle (according to Figure 14 of Stone, 2001), making the channel cross-sectional width about 50 ft. Given these small inlet channel dimensions and the fact that it was open at most 4 to 6 days, it is highly unlikely that the inlet channel conveyed sufficient flow volumes to account for 3,264 cubic yards of addition erosion observed on the downdrift beaches in front of the Sandy Lane homes.

There is additional survey data which indicates that the small inlet channel feature found in the last Stone (2001) survey was ephemeral and probably had no effect on local beach erosion. Cross-channel inlet surveys have been ongoing since 1992 at survey ranges TR1 and TR2 shown in Figure 19. In the immediate time frame of the Stone (2001) surveys, two cross-channel surveys were conducted prior to Stone's 19 December 2001 survey and one following his 16 January 2001 survey. Figure 20 shows a well-defined inlet channel at both TR1 and TR2 on 27 September 2000 shortly after dredging of the inlet channel and recharge zone had restored tidal exchange between the lagoon and the ocean. We note that the channel was about 4 to 6 ft. deep relative to surrounding elevations of the barrier beach. The channel persisted in this deepened state through the follow-on survey



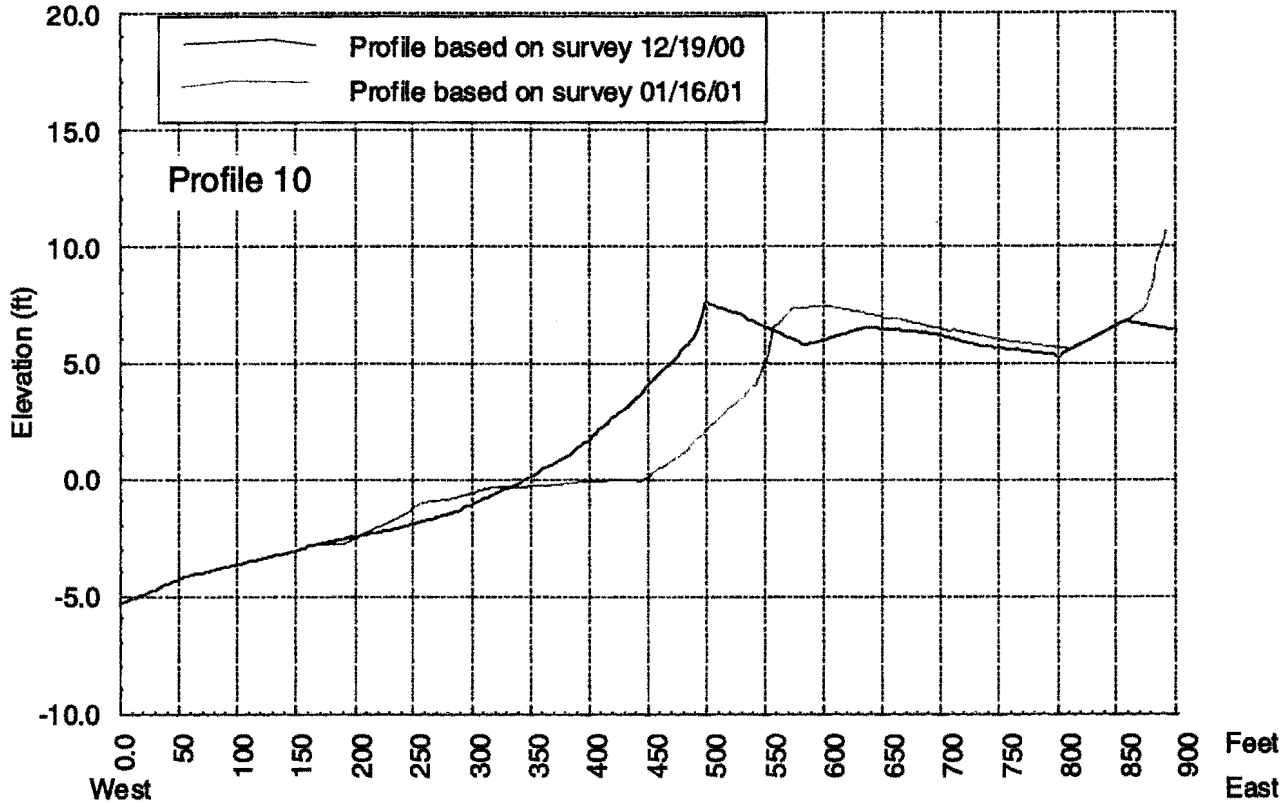


Figure 18. Beach profiles at the mouth of the San Dieguito River, 19 December 2000 to 16 January 2001, [from Stone 2001, Figure 20].

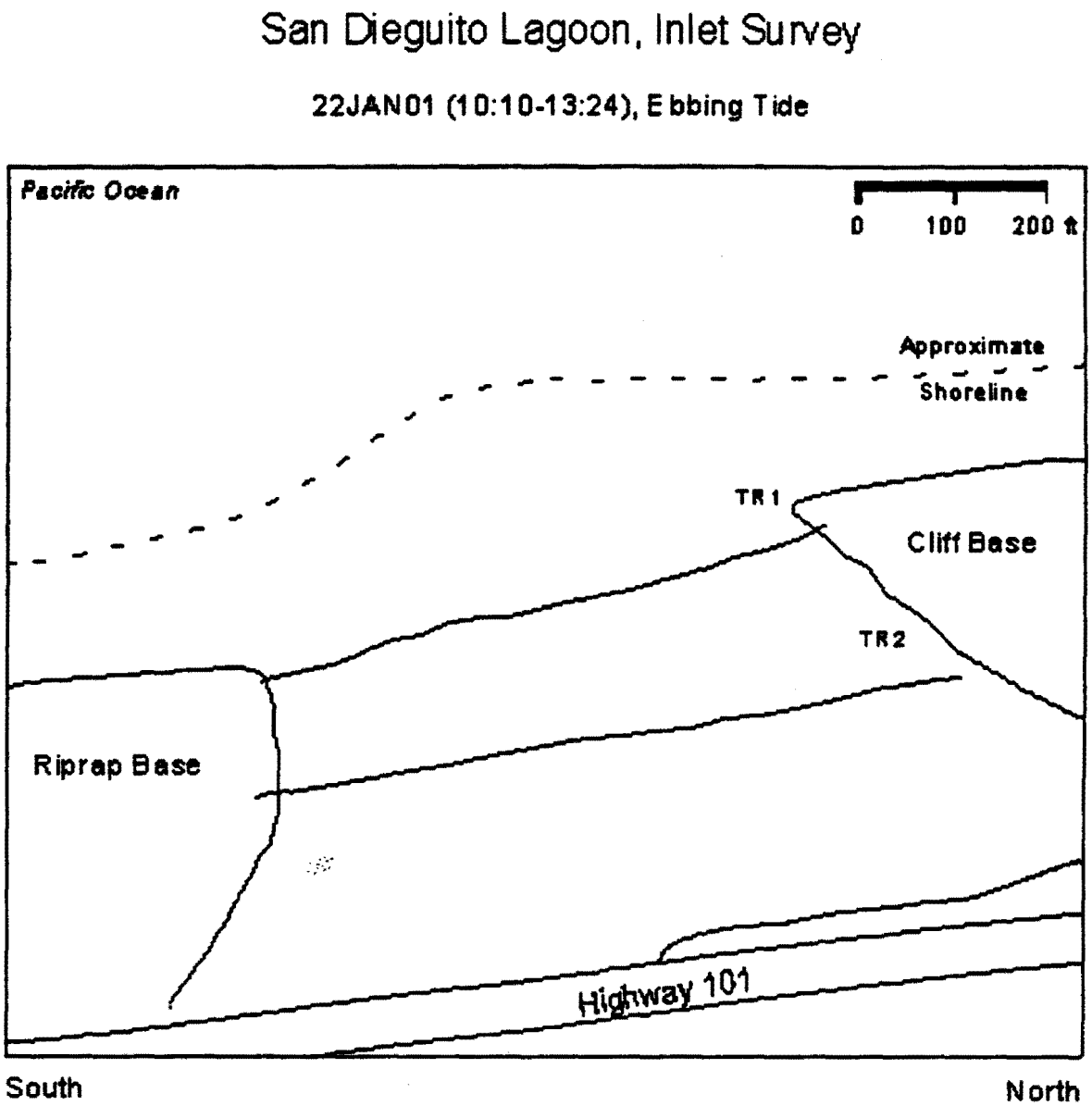


Figure 19. Location of two traverses crossing the San Dieguito Inlet.

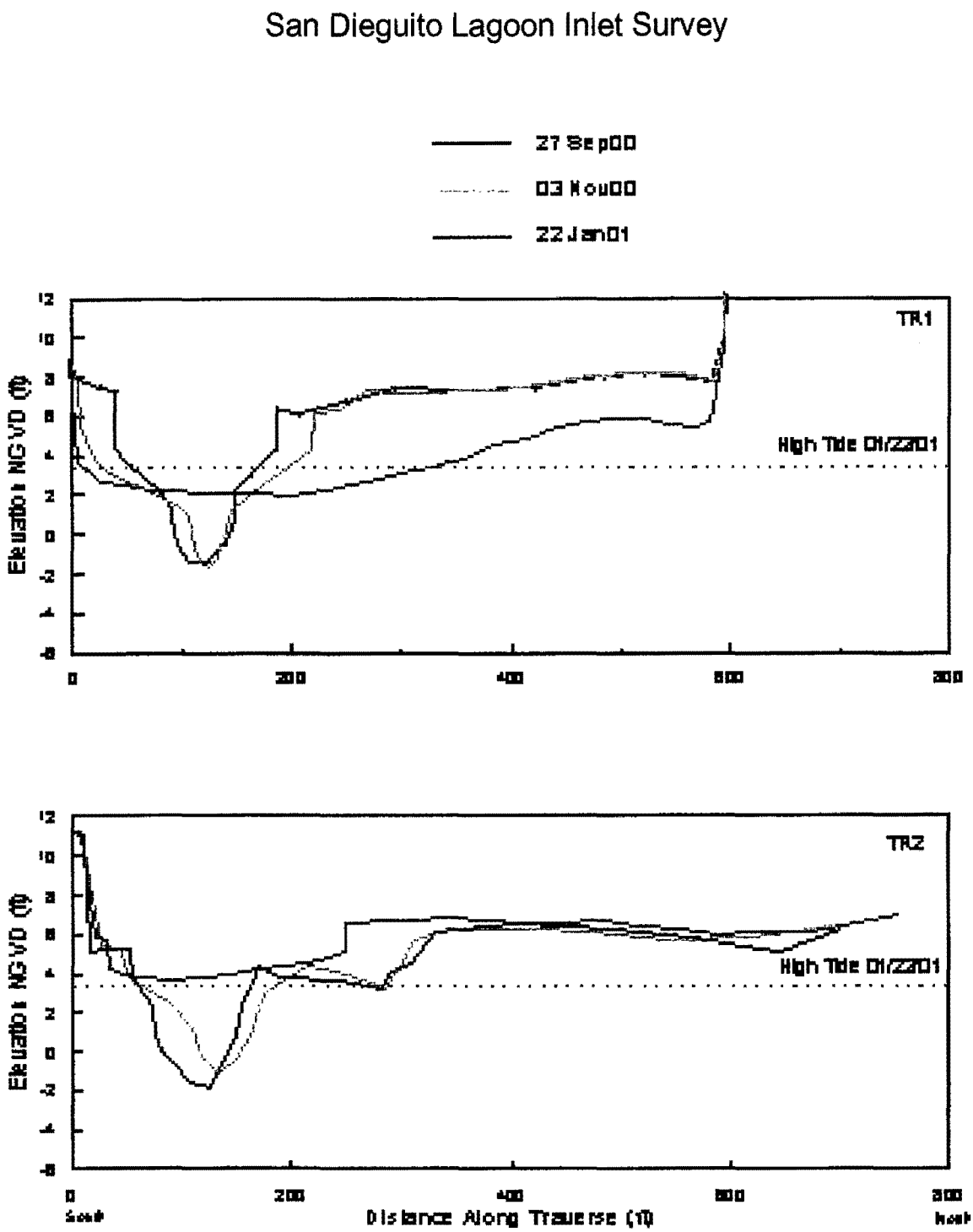


Figure 20. Survey results at TR1 and TR2 for September and November 2000 and January 2001.

of 3 November 2000, with very little evidence of infilling. These channel profiles are in sharp contrast to the shallow channel depression in the 16 January 2001 survey of Stone (2001), see Figure 18. Moreover the 22 January 2001 cross-channel surveys at TR1 and TR2 in Figure 20 show that Stone's small channel feature has vanished. In fact, the survey at TR2 on 22 January 2001 shows that the inlet had again completely closed, since the sand elevations are everywhere above the high tide elevation. Thus, the inlet channel feature identified in Stone's 16 January 2001 survey had a life span of at most 6 days. Indeed, it places a great strain on scientific imagination to believe Stone's hypothesis that such a small, short-lived inlet channel feature could cause erosion to increase by 50% in front of the Sandy Lane homes in a 29 day period.

There are other more plausible explanations for the higher beach erosion observed in front of the Sandy Lane homes. Among these are scour and erosion due to wave reflection from the shore structures protecting the Sandy Lane homes (CERC, 1977; Kraus and McDougal, 1996). Stone (2001) trivializes the drop in sand levels shown by many of the profiles that were measured in front of the Sandy Lane shore structures. Profile 6 is notable because it was measured at a location where a photograph was taken 3 weeks before the first survey, Figure 21a. This picture shows the remains of the summer beach being eroded as an incident wave is reflecting from the riprap of the Sandy Lane shore structure. Figure 21b shows the measured change in Profile #6. Inspections of the changes in Profile 6 shows that the sand levels of 16 January 2001 survey (red) are everywhere lower than those of the 19 December 2000 survey (blue). These are fairly significant drops in sand level over a 29 day period, that just happened to

a)

b)

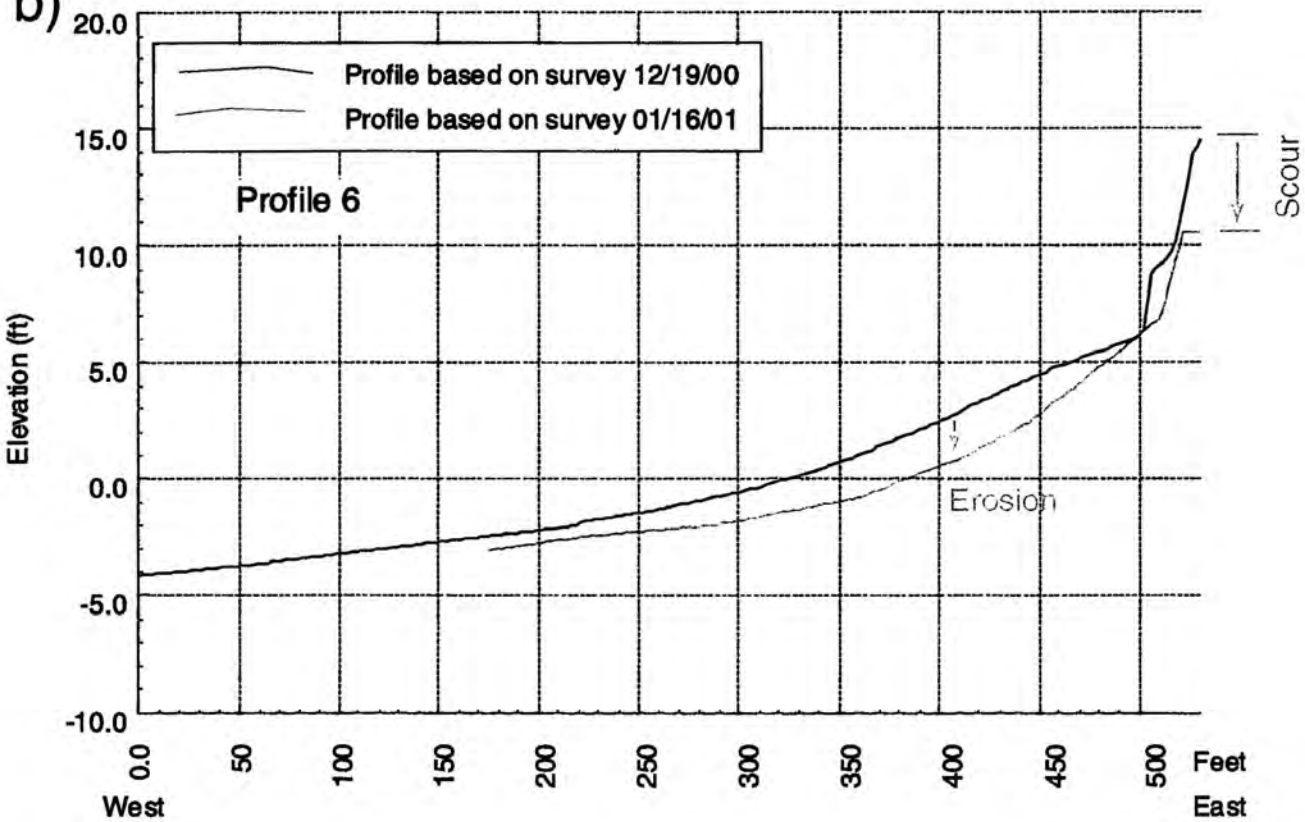


Figure 21. a) Remains of summer beach being eroded as an incident wave reflects from the Sandy Lane riprap seawall near profile 6. b) Sand level changes at profile 6, 19 December 2000 to 16 January 2001, [from Stone 2001, Figures 27 above & 18 below].

occur at the location where waves were known to be reflecting from a shore protection structure a few weeks earlier (Figure 21a).

Actually, the new "Monitoring Effort" described in the Stone report support no definite conclusions whatsoever. The monitoring effort provided for no observations of a control area and was totally inadequate in terms of sample space and record length; (loss of beach width occurred along the entire length of Del Mar beaches, Figure 17). There are certainly other explanations for the observed erosion pattern which seem more plausible than Stone's open inlet hypothesis, particularly since the inlet was closed throughout most (79-86%) of the survey period.

7) Irrelevant Examples and Quotations

Throughout the Stone report, examples and quotations regarding U. S. east coast inlets are repeatedly offered as proof that downdrift erosion will occur at San Dieguito if the inlet is maintained open to daily tidal exchange. Most of these east coast examples have inlet jetties (e.g., Destin East Pass, FL) whereas San Dieguito's inlet will not. The jetties of east coast inlets are probably responsible for much of the observed downdrift erosion. In addition the east coast tidal inlets have little in common with San Dieguito either physically, hydrologically, or geomorphically. These inlets are several orders of magnitude larger than San Dieguito in terms of both physical dimension and flow volume. East coast inlets have large continuous discharges of fresh water from drainage basins receiving almost daily rainfall. This continuous freshwater discharge produces a seaward directed mean flow (ebb dominance) to the daily tidal exchange. By contrast, the San Dieguito River is a semi-arid ephemeral stream which provides no fresh water

discharge through the inlet the majority of time each year, and only floods episodically. The tidal transport is flood tide dominated at San Dieguito inlet. The east coast inlets are situated on marginal sea and trailing edge coasts, with completely different beach morphology than the Del Mar beaches which are situated on a collision coast (Inman and Nordstrom, 1971). Because of these differences, it is insensible to argue that downdrift erosion will occur at San Dieguito just because it is observed to occur at open inlets on the U. S. east coast. Moreover the experience gained locally in restoring and maintaining tidal inlets at Agua Hedionda and Batiquitos is completely contrary to what has been alleged generically from the U. S. east coast examples. In spite of the fact that both these local lagoons have short inlet jetties, erosion to the beaches immediately downdrift has not been observed (Elwany, 1998; CH2M Hill, 1989; Flick, 1994). Therefore, the local experience indicates that inlet maintenance dredging with subsequent beach nourishment is a successful measure in avoiding the beach erosion effects otherwise found at inlets on the U. S. east coast.

Quotes of Professor Ashish Mehta are interjected throughout the Stone report in what appears to be an attempt to give an impression that Dr. Mehta is in disagreement with the analysis in Jenkins and Wasyl (1998), or the summary statements of that work contained in Jenkins (2000). Dr. Mehta was a reviewer of Jenkins and Wasyl (1998) and his unedited review is given in Appendix-E. In regards to the Jenkins and Wasyl (1998) analysis of potential beach impacts, Mehta writes

> "The sand budget investigation is extensive, and reflects Dr. Jenkins' long experience with this coastal region of California. The modeling methodology is robust, and is

> along the lines of a similar approach we have developed for the east and far-western coasts of Florida (e.g., Cheng, 1998)."

The senior staff scientist of the California Coastal Commission, Dr. John M. Boland, went on to summarize the peer review sentiment regarding the work of Jenkins and Wasyl (1998):

> "Scott, Congratulations on receiving such good comments from the reviewers. I wish my manuscript reviews had more words like 'particularly creative,' 'robust' and 'well done' in them! See ya, John Boland."

8) Conclusions

Stone (2001) was apparently written with a bias against the San Dieguito Lagoon Restoration and in sympathy with a challenge leveled by Rick Engineering on behalf of the Sandy Lane Homeowners Association. They contend that the maintenance of daily tidal exchange through the lagoon inlet will cause the downdrift beaches (to the south of the inlet) to erode. Stone attempts to prove this contention by trying to establish a simple cause and effect relation between an open inlet and beach erosion. Stone fails to provide such proof because he fails to examine the complete data base and public record available on the San Dieguito Lagoon Restoration Project. What little evidence he is able to provide that shows local beach erosion concurrent with an open inlet has nothing to do with tidal exchange through the inlet, but rather with floods on the San Dieguito River (a pre-project hazard). Local lagoons (Agua Hedionda, Batiquitos) where tidal exchange has been restored but where local drainage area is too small for flooding,

show no such downdrift beach erosion (Elwany, 1998; Flick, 1994; CH2M Hill, 1989).

Much of Stone's analysis breaks down when he attempts to relate beach changes to inlet status because he incorrectly calculates the periods of inlet openings and closures. He bases his calculation on preliminary model results of Chang (1995) that were later shown to be inaccurate when compared against historic observations. The reconstruction of the inlet closure history with observational data was a matter given the highest level of scientific scrutiny by the scientists of both the Edison team and the California Coastal Commission. The Stone report totally disregarded their findings, and thereby formed conclusions that are contradicted by the historic record.

The Stone report ventures into discussions of the mechanics of littoral transport around a tidal inlet. Stone correctly identifies adverse beach effects from negative divergence of drift across the inlet, but fails to recognize this as an existing (pre-project) condition that is most significant during post flood recovery from river scour of the inlet channel and beach. Stone also fails to acknowledge that the hydraulic improvements afforded by the restoration will diminish the negative divergence of drift by 60% relative to existing conditions, and will essentially eliminate these effects over the long term by periodic maintenance dredging of the inlet channel with subsequent return of the dredged sands to the beach. Stone also claims that San Dieguito is not a typical inlet and does not have a by-passing bar to help littoral drift detour around the inlet. He misinterprets numerous photos to support this claim when in fact many of the photos give clear indications of a by-passing bar at San Dieguito.

The final part of Stone (2001) presents results of a "New Monitoring Effort" of the beach in the immediate neighborhood of the inlet and Sandy Lane homes. Two surveys along about 1000 ft. of beach were performed 29 days apart with no monitoring of a control area. In spite of the fact that the inlet was open at most 4 to 6 days of the monitoring period, the Stone report suggests that these surveys... "reveal trends that are typical of an inlet causing higher levels of erosion down-drift." However erosion was ubiquitous throughout the survey region. When signs of an open inlet channel finally appeared at the end of the monitoring period, the channel was very small in cross-sectional dimension and closed again within 6 days. Therefore the data from the "New Monitoring Effort" provide an alternative interpretation, namely that the beach erosion caused the inlet channel to open, rather than an open inlet channel caused the beach to erode. There were also other physical factors that could have contributed to the survey results, including beach scour and erosion due to wave reflection from the Sandy Lane seawalls. The net result of the "New Monitoring Effort" is that the data was inadequate and proved nothing. It certainly did not warrant the emphasis given it in the Stone report.

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APPENDIX-A:

Apparent Conflict of Interest with the Department of Oceanography and Coastal Sciences, Louisiana State University (LSU)

A1) Apparent Conflict of Interest:

The title page of Stone (2001) seems to indicate that it is a technical report of Louisiana State University (LSU) written by a full professor at LSU. However, LSU lists Dr. Stone as an "Associate Faculty Member of Oceanography and Coastal Sciences," not as a professor. In addition, this report is being circulated on the Internet at LSU's web site:

http://erin.csi.lsu.edu/delmar_report.

In essence these two actions make Dr. Stone an agent of LSU in advocating the homeowner's position in their lawsuit against the City of Del Mar and the San Dieguito River Joint Powers Authority. On the other hand, it is highly unlikely that the administration of LSU was aware of these activities when they took place in February and March of 2001. Most universities have conflict of interest rules forbidding the use of the institution's name and facilities for the purpose of promoting or advocating private consulting activities by faculty or staff. Furthermore, most university scientists and engineers who do private consulting after hours do not feel a need to try and add credibility to their work by using the name of their host institution on their consulting reports. The chairman of the Department of Oceanography and Coastal Sciences at LSU has been informed of Dr. Stone's apparent conflict of interest in this matter, and has been asked to clarify the pedigree of Dr. Stone's report, (Appendix-B).

DOCS Faculty

List of Faculty Members

List of Adjunct Faculty Members

Faculty research interests are generally interdisciplinary, spanning 'blue water' oceanography to coastal wetlands. Principal interest groups of the faculty include both applied and basic topics in fisheries ecology, including the management and biology of important commercial species; physical and geological coastal sciences; coastal ecology of wetlands, estuaries, and continental shelves; pollutant fates and effects in coastal systems; physiological, population, and community ecology of marine and estuarine organisms (including marine biology); and the chemistry of wetland soils. Research projects within the last 10 years have taken the faculty to the Yellow River (People's Republic of China), Korea, the Java Straits, Mexico, Thailand, Alaska, the Caribbean, the Amazon River delta, the Persian Gulf, Central America, and to Europe. Much of the regional field work involves studies of the Mississippi River delta and continental shelf as well as nearby estuaries and wetlands.

The prominence of the Department of Oceanography and Coastal Sciences in the scientific community is based upon the quality and recognition of the faculty. In addition to contributing to the fields of oceanography and estuarine ecology, our faculty members routinely participate in national planning programs or reviews conducted by the National Academy of Sciences, National Academy of Engineering, the National Research Council, The National Science Foundation, the Congress of the United States, and various other international and national mission agencies. The faculty serve on the editorial boards of 17 peer-reviewed journals and Editors of 3 journals, and include 3 Distinguished Research Professors and 3 Chaired Professorships.

The Department of Oceanography and Coastal Sciences has 20 full professors (including 1 Emeritus and 2 Boyd Professors), 3 associate, and 4 adjunct professors from 20 universities. The average faculty member receives from $100,000-300,000 per annum in external funding for research.

DONALD M. BALTZ	Associate Professor of Oceanography and Coastal Sciences, Coastal Fisheries Institute. Ph.D., University of California, Davis, 1980. Research Interests: Fish ecology, life history, and habitat selection, ecology of marine vertebrates, life history strategies, fishery acoustics.
MARK BENFIELD	Assistant Professor of Oceanography and Coastal Sciences, Coastal Fisheries Institute. Ph.D.,Texas A&M University, 1991. Research Interests: zooplankton ecology, video/acoustic sampling systems, Penaeid shrimp ecology, and scientific visualization.
JAYE CABLE	Assistant Professor of Oceanography and Coastal Sciences, Coastal Ecology Institute. Ph.D., Florida State University, 1996. Research

Interests: Hydrology, submarine ground water research. radio isotope applications in the environment.

ROBERT S. CARNEY — Associate Professor of Oceanography and Coastal Sciences. Coastal Ecology Institute. Ph.D.. Oregon State University, 1977. Research Interests: Biological oceanography, research administration.

JAMES M. COLEMAN — Executive Vice Chancellor. Boyd Professor of Oceanography and Coastal Sciences, Coastal Studies Institute.Ph.D., Louisiana State University, 1966. Research Interests: Deltaic sedimentation, riverine processes, continental shelf sediments.

RICHARD CONDREY — Associate Professor of Oceanography and Coastal Sciences, Coastal Fisheries Institute. Ph.D., University of Washington, Seattle, 1981. Research Interests: Population dynamics, fishery management, coastal ecology.

JOHN W. DAY, Jr. — Professor of Oceanography and Coastal Sciences, Coastal Ecology Institute. Ph.D., University of North Carolina, Chapel Hill, 1971. Research Interests: Estuarine ecology, systems ecology, coastal management.

STEPHEN P. FAULKNER — Assistant Professor of Oceanography and Coastal Sciences. Wetland Biogeochemistry Institute. Ph.D., Duke University, 1994. Research Interests: Wetland biogeochemical processes, hydric soils, wetland delineation and functional assessment, constructed wetlands.

ROBERT P. GAMBRELL — Professor of Oceanography and Coastal Sciences, Wetland Biogeochemistry Institute. Ph.D., North Carolina State University, 1974. Research Interest: Environmental chemistry of metals, synthetic organics, and petroleum hydrocarbons in wetland soils and sediment/water systems, environmental analytical chemistry, wetland functions and restoration.

JAMES G. GOSSELINK — Professor Emeritus of Oceanography and Coastal Sciences, Coastal Ecology Institute. Ph.D., Rutgers University, 1959. Research Interests: Wetland vegetation processes, plant ecophysiology, systems ecology.

S. A. HSU — Professor of Oceanography and Coastal Sciences, Coastal Studies Institute. Ph.D., University of Texas, Austin, 1969. Research Interests: Coastal and marine meteorology, air-sea interaction, air pollution, air engineering and meteorology.

OSCAR K. HUH — Professor of Oceanography and Coastal Sciences, Coastal Studies Institute. Ph.D., Pennsylvania State University, 1968. Research Interests: Coastal and continental shelf oceanography/marine meteorology, satellite and aircraft remote sensing methods in oceanography, marine geology and coastal geomorphology.

MASAMICHI INOUE — Associate Professor of Oceanography and Coastal Sciences, Coastal

Studies Institute. Ph.D., Texas A&M University, 1982. Research Interests: Numerical modelling of ocean circulation, climate changes.

DUBRAVKO JUSTIC — Associate Faculty Member of Oceanography and Coastal Sciences, Coastal Ecology Institute. Ph.D., University of Zagreb, Croatia, 1989. Research Interests: Ecosystem modeling, biological oceanography, climate change.

PAUL A. LaROCK — Professor of Oceanography and Coastal Sciences, Ph.D., Rensselaer Polytechnic Institute, 1969. Research Interests: Estuarine Pollution, microbiology, geomicrobiology, oceanography.

KAREN MCKEE — Associate Faculty Member of Oceanography and Coastal Sciences, Wetland Biogeochemistry Institute, Ph.D., Louisiana State University, 1993. Research Interests: Mangrove ecophysiology, plant-herbivore interactions, plant-stress physiology, wetland degradation and restoration, and wetland seedbanks.

IRVING A. MENDELSSOHN — Professor of Oceanography and Coastal Sciences, Wetland Biogeochemistry Institute. Ph.D., North Carolina State University, 1978. Research Interests: Wetland and barrier island plant ecology, plant physiological ecology.

SAMUEL P. MEYERS — Professor Emeritus of Oceanography and Coastal Sciences, Professor of Food Science. Coastal Ecology Institute. Ph.D., Columbia, 1957. Research Interests: Marine microbial ecology, ocean food resources, aquaculture nutrition.

STEPHEN P. MURRAY — Professor of Oceanography and Coastal Sciences, Coastal Studies Institute. Ph.D., University of Chicago, 1966. Research Interests: Physical oceanography of coastal waters, dynamics of sea straits.

WILLIAM H. PATRICK, Jr. — Boyd Professor of Oceanography and Coastal Sciences, Director of Wetland Biogeochemistry Institute. Ph.D., Louisiana State University, 1954. Research Interests: Sediment chemistry, nutrient cycling in wetlands, environmental chemistry of soils.

HARRY H. ROBERTS — Professor of Oceanography and Coastal Sciences, Coastal Studies Institute. Ph.D., Louisiana State University, 1969. Research Interests: Marine geology, sedimentology.

LAWRENCE J. ROUSE, Jr. — Associate Professor and Graduate Advisor of Oceanography and Coastal Sciences, Coastal Studies Institute. Ph.D., Louisiana State University, 1972. Research Interests: Remote sensing, coastal, estuarine, and physical oceanography.

KENNETH A. ROSE — Associate Professor of Oceanography and Coastal Sciences, Coastal Fisheries Institute. Ph.D., University of Washington, 1985. Research Interests: Mathematical and computer modeling of aquatic populations, communities, food webs, and ecosystems, development

and application of individual-based modeling techniques, uncertainty analysis and risk assessment in ecological and fisheries models.

CHARLES SASSER — Associate Faculty Member of Oceanography and Coastal Sciences, Coastal Ecology Institute. Ph.D., University of Utrecht, Netherlands, 1994. Research Interests: Coastal ecology, plant ecology, and evolutionary biology.

RICHARD F. SHAW — Professor of Oceanography and Coastal Sciences, Director of Coastal Fisheries Institute. Ph.D., University of Maine, Orono, 1981. Research Interests: Ichthyoplankton ecology and dynamics, transport and recruitment mechanisms, biological oceanography.

GREGORY STONE — Associate Faculty Member of Oceanography and Coastal Sciences, Coastal Studies Institute. Ph.D., University of Maryland, 1991. Research Interests: Coastal morphodynamics and coastal zone management.

R. EUGENE TURNER — Professor of Oceanography and Coastal Sciences, Director of Coastal Ecology Institute. Ph.D., University of Georgia, 1974. Research Interests: Wetland ecology, biological oceanography.

NAN WALKER — Associate Faculty Member of Oceanography and Coastal Sciences, Coastal Studies Institute. Ph.D., University of Cape Town, South Africa, 1989. Research Interests: Satellite oceanography, ocean climatology, physical oceanography, air-sea interactions, and coral reef systems.

CHARLES A. WILSON — Department Chair, Professor of Oceanography and Coastal Sciences, Coastal Fisheries Institute. Ph.D., University of South Carolina, 1984. Research Interests: Fishery science, fisheries biology, artificial reef ecology, mariculture.

WILLIAM J. WISEMAN, Jr. — Professor of Oceanography and Coastal Sciences, Director of Coastal Studies Institute. Ph.D., Johns Hopkins University, 1969. Research Interests: Shelf and estuarine dynamics.

Adjunct Faculty

ARNOLD H. BOUMA — Professor, LSU Dept. of Geology and Geophysics. Ph.D., State University Utrecht, The Netherlands 1961. Research Interests: Marine depositional environmental settings, environmental geology, geochemical application to marine sediments.

RUSSELL CHAPMAN — Center for Coastal, Energy, and Environmental Resources. Ph.D., University of California, Davis, 1973. Research Interests: Algal ultrastructure and phylogeny, biology of the Trentepohliaceae (Chlorophyta), ribosomal gene sequencing and molecular evolution in algae and bryophytes.

MICHAEL J. DAGG	Adjunct Associate Professor, Louisiana Universities Marine Consortium. Ph.D., University of Washington, Seattle, 1975. Research Interests: Biological oceanography and zooplankton ecology.
QUAY DORTCH	Adjunct Associate Professor, Louisiana Universities Marine Consortium. Ph.D., University of Washington, Seattle, 1980. Research Interests: Phytoplankton ecology, nitrogen cycling, biochemical indictors.
JAMES GEAGHAN	Professor, LSU Dept. of Experimental Statistics. Ph.D., North Carolina State University.
BRENT A. MCKEE	Adjunct Assistant Professor, Louisiana Universities Marine Consortium. Ph.D., North Carolina State University, 1986. Research Interests: Biogeochemistry of coastal environments influenced by major rivers, deposition, remineralization, and burial of carbon and nutrients in coastal margins.
RALPH J. PORTIER	Professor, LSU Dept. of Environmental Studies. Ph.D., Louisiana State University, 1982. Research Interests: Fate and effect of carcinogens in fresh water and marine environments, bioremediation.
NANCY N. RABALAIS	Adjunct Associate Professor, Louisiana Universities Marine Consortium. Ph.D., University of Texas, 1983. Research Interests: Continental shelf ecosystems, benthic ecology, biological oceanography.
MARGARET REAMS	LSU Institute for Environmental Studies. Ph.D., University of Georgia, 1990. Research Interests: Public policy relating to environmental and water affairs, evaluation of environmental policies, policy analysis and implementation, comparative environmental policy, environmental equity, environmental risk analysis.
DENISE REED	Associate Professor, Louisiana Universities Marine Consortium. Ph.D., University of Cambridge, 1986. Research Interests: Sediment dynamics and coastal wetlands.
PAUL W. SAMMARCO	Adjunct Professor, Louisiana Universities Marine Consortium. Ph.D., State University of New York at Stony Brook, 1977. Research Interests: Interdisciplinary marine research, larval dispersal and recruitment process, chemical ecology, bioerosion, stable isotope geochemistry, science policy and administration.

APPENDIX-B:

Letter to the Chairman of the Department of Oceanography and Coastal Sciences of LSU

Dr. Scott A. Jenkins Consulting
14765 Kalapana St.
Poway, CA 92064

14 March 2001
FedEx: (225) 388-6308

Professor Charles A. Wilson
Chairman
Louisiana State University
Department of Oceanography and Coastal Sciences
153 Howe-Russell
Baton Rouge, LA 70803

Dear Professor Wilson:

I regret troubling you with the following matter, but I think you should examine the enclosed report written by a member of your department. The report is entitled, "Review and Analysis of the Impacts of Maintaining the Mouth of the San Dieguito Lagoon Open on the Adjacent beach, Sandy Lane, Del Mar, California," by Gregory W. Stone. This report is being circulated on the Internet at LSU's web site, http://erin.csi.lsu.edu/delmar_report/, and is being reviewed by the California Coastal Commission. In addition it has been filed in the Superior Court of San Diego North County in support of a lawsuit on behalf of wealthy homeowners who are trying to stop the restoration efforts at the San Dieguito Lagoon in Del Mar, CA.

The title page of this report seems to indicate that this is an LSU technical report written by a full professor at LSU. In essence this makes Dr. Stone an agent of LSU in advocating the homeowner's position against the City of Del Mar and the Joint Powers Authority, who are the lead agency for the San Dieguito Lagoon Restoration Project. In my day job, I am a coastal engineer at Scripps Institution of Oceanography and we are not permitted to use the Scripps name or our Scripps job titles on our consulting reports. I would assume that LSU has similar rules and if my assumption is incorrect I would appreciate you informing me accordingly.

In regards to the content of Dr. Stone's report, my colleagues and I find that it contains many errors and omissions which invalidate its conclusions. A written response is being prepared by me and several other scientists and engineers at Scripps and San Diego State University. It is my judgement that Dr. Stone's report will be much maligned and at the center of a great deal of regulatory and legal controversy. If you do not want the name of LSU and your department associated with such controversy, may I suggest that you contact Ellen Lierly at the California Coastal Commission and clarify the pedigree of Dr. Stone's report.

Ellen Lierly
Coastal Planning Analyst
California Coastal Commission, Suite 200
3111 Camino del Rio North
San Diego, CA 92108
Phone: (619) 521-8036

If you wish to discuss these issues further with me, I may be reached at (858) 534-6480 or by e-mail at saj@coast.ucsd.edu. Thank you for your attention in this matter.

Regards,

Scott A. Jenkins

Scott A. Jenkins, Ph. D.
Principal Scientist

SAJ:cjk

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APPENDIX-C:

Open and Closure Statistics for the San Dieguito Lagoon Inlet (1926 to 1995) From Jenkins and Wasyl (1996)

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)	Discrepancy Explanation
10/1/26 - 2/14/27	Closed								
2/15/27 - 2/14/29	Open								
	Open	Closed (1928)							
	Open	Closed (1928)							
	Open	Open (1928/1929)							
	Open					Closed (2/29)*			
2/15/29 - 2/12/31	Closed					Closed (2/29)*			
2/13/31 - 2/27/31	Open								
2/28/31 - 1/31/32	Closed								
2/1/32 - 4/23/32	Open	Open (2/26/32)							
4/24/32 - 12/11/32	Closed								
12/12/32 - 1/11/33	Open								
1/12/33 - 2/6/35	Closed								
2/7/35 - 4/21/35	Open								
4/22/35 - 2/15/36	Closed								
2/16/36 - 3/14/36	Open								
3/15/36 - 2/7/37	Closed					Closed (2/37)*			
2/8/37 - 5/7/39	Open					Closed (2/37)*			
	Open	Open (6/25/37)							
	Open	Open (4/16/39)							
5/8/39 - 2/3/40	Closed								
2/4/40 - 6/14/40	Open								
6/15/40 - 2/9/41	Closed	Closed (1/3/41)							
2/10/41 - 6/30/42	Open								
7/1/42 - 1/22/43	Closed								
1/23/43 - 8/4/43	Open								
8/5/43 - 3/14/44	Closed								
3/15/44 - 8/14/44	Open								
8/15/44 - 11/11/44	Closed								
11/12/44 - 12/31/44	Open								
1/1/45 - 4/9/45	Closed	Closed (1/3/45)							
	Closed	Closed (1/24/45)							
	Closed	Closed (3/45)							
4/10/45 - 7/9/45	Open								
7/10/45 - 12/21/45	Closed								
12/22/45 - 2/7/46	Open								
2/8/46 - 11/12/46	Closed	Closed (9/6/46)							
11/13/46 - 11/27/46	Open								
11/28/46 - 1/12/49	Closed								
1/13/49 - 1/30/49	Open								
1/31/49 - 1/17/52	Closed	Closed (10/9/51)							
1/18/52 - 3/17/52	Open								
3/18/52 - 4/9/52	Closed								
4/10/52 - 8/9/52	Open								

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)	Discrepancy Explanation
8/10/52 - 3/8/54	Closed	Closed (11/17/52)							
	Closed	Closed (4/11/53)							
	Closed	Closed (7/14/53)				Closed (7/53)			
	Closed	Closed (1953)							
	Closed	Closed (1953?)							
3/9/54 - 4/24/54	Open								
4/25/54 - 1/18/55	Closed	Closed (6/27/54)							
	Closed								
1/19/55 - 3/3/55	Open								
3/4/55 - 1/28/56	Closed								
	Closed								
1/29/56 - 3/31/56	Open								
4/1/56 - 1/28/57	Closed								
	Closed	Closed (7/1/56)							
	Closed								
1/29/57 - 3/29/57	Open								
3/30/57 - 2/4/58	Closed								
	Closed	Closed (6/30/57)							
	Closed					Closed (1/58)			
	Closed					Closed (2/58)*			
2/5/58 - 5/4/58	Open								
	Open	Closed (2/27/58)				Closed (2/58)*			
	Open					Closed (3/58)			
	Open					Closed (4/58)			
	Open					Closed (5/58)*			
5/5/58 - 2/11/59	Closed								
	Closed					Closed (5/58)*			
	Closed	Closed (6/29/58)				Closed (6/58)			
	Closed					Closed (7/58)			
	Closed					Closed (8/58)			
	Closed					Closed (9/58)			
	Closed					Closed (10/58)			
	Closed					Closed (11/58)			
	Closed					Closed (12/58)			
	Closed					Closed (1/59)			
	Closed					Closed (2/59)*			
2/12/59 - 2/26/59	Open					Closed (2/59)*			
2/27/59 - 2/19/62	Closed					Closed (2/59)*			
	Closed					Closed (3/59)			
	Closed					Closed (4/59)			
	Closed					Closed (5/59)			
	Closed					Closed (6/59)			
	Closed					Closed (7/59)			
	Closed					Closed (8/59)			
	Closed					Closed (9/59)			
	Closed					Closed (10/59)			
	Closed					Closed (11/59)			
	Closed					Closed (12/59)			
2/20/62 - 3/4/62	Open								

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)	Discrepancy Explanation
3/5/62 - 3/30/65	Closed	Closed (5/22/62)							
	Closed	Closed (6/19/63)							
	Closed	Closed (6/29/64)							
	Closed	Closed (7/1/64)							
	Closed	Closed (8/9/64)							
4/1/65 - 5/15/65	Open								
5/16/65 - 11/18/65	Closed	Closed (7/10/65)							
	Closed		Open (10/65)						
11/19/65 - 2/27/66	Open		Open (12/65)						
2/28/66 - 12/5/66	Closed	Closed (6/23/66)							
	Closed	Closed (6/30/66)							
	Closed	Closed (6/30/66)							
12/6/66 - 1/11/67	Open								
1/12/67 - 12/17/67	Closed	Closed (2/9/67)							
	Closed	Closed (8/28/67)							
	Closed	Closed (10/4/67)							
12/18/67 - 1/30/68	Open								
1/31/68 - 1/22/69	Closed	Closed (4/22/68)							
1/23/69 - 5/7/69	Open		Closed (2/69)						
	Open	Closed (3/24/69)							
	Open	Closed (4/3/69)							
	Open	Closed (4/27/69)							
5/8/69 - 3/3/70	Closed	Closed (6/26/69)							
	Closed	Closed (7/8/69)							
	Closed	Closed (11/12/69)							
	Closed	Closed (1/29/70)							
	Closed		Closed (3/70)*						
3/4/70 - 5/9/70	Open	Closed (3/6/70)	Closed (3/70)*						
	Open	Closed (3/19/70)							
	Open	Closed (4/23/70)	Closed (4/70)						
	Open		Closed (5/70)*						
5/10/70 - 1/7/74	Closed		Closed (5/70)*						
	Closed		Closed (12/70)						
	Closed	Closed (2/20/71)							
	Closed	Closed (9/27/71)							
	Closed		Open (4/72)						
	Closed	Closed (5/26/72)							
	Closed	Closed (8/31/72)							
	Closed		Closed (10/72)						
	Closed	Closed (11/9/72)	Open (11/72)						
	Closed		Intermittent (12/72)						
	Closed	Closed (1/1/73)	Closed (1/73)						
	Closed		Closed (2/73)						
	Closed		Closed (3/73)						
	Closed	Closed (5/73)	Open (5/73)						
	Closed	Closed (6/29/73)	Open (6/73)						
	Closed	Closed (8/9/73)							
	Closed	Closed (9/73)	Open (9/73)						
	Closed		Open (10/73)						
	Closed		Intermittent (11/73)						
	Closed		Open (12/73)						
	Closed		Open (1/74)*						

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)	Discrepancy Explanation
1/8/74 - 2/22/74	Open		Open (1/74)*						
2/23/74 - 3/8/75	Closed		Closed (3/74)						
	Closed		Closed (4/74)						
	Closed	Closed (7/17/74)							
	Closed	Closed (11/26/74)	Closed (11/74)						
	Closed	Closed (2/11/75)							
	Closed		Closed (3/75)*						
3/9/75 - 5/9/75	Open		Closed (3/75)*						
	Open		Open (4/75)						
5/10/75 - 2/8/76	Closed	Closed (7/15/75)							
	Closed	Closed (8/14/75)							
2/9/76 - 3/29/76	Open		Open (3/76)*						
3/30/76 - 2/28/78	Closed		Open (3/76)*						
	Closed	Closed (6/19/76)	Closed (6/76)						
	Closed	Closed (8/4/76)							
	Closed	Closed (10/28/76)							
	Closed	Closed (1/13/77)							
	Closed		Open (2/77)						
	Closed	Closed (3/10/77)							
	Closed		Closed (12/77)						
	Closed		Open (1/78)						
3/1/78 - 9/14/78	Open		Open (3/78)						
	Open		Open (4/78)						
	Open	Open (5/24/78)	Open (5/78)						
	Open	Open (5/30/78)	Open (5/78)						
	Open	Closed (6/22/78)	Open (6/78)						
	Open		Open (7/78)						
	Open		Open (8/78)						
9/15/78 - 1/9/79	Closed		Open (12/78)						
	Closed			Open (1/79)*					
1/10/79 - 10/24/79	Open			Open (1/79)*					
	Open			Open (2/79)					
	Open		Open (3/79)						
	Open	Open (4/24/79)	Open (4/79)			Open (4/79)			
	Open					Open (5/79)			
	Open	Open (6/19/74)	Open (6/79)	Open (6/79)		Intermittant (6/79)			
	Open			Open (7/79)		Open (7/79)			
	Open		Open (8/79)	Open (8/79)					
	Open			Open (9/79)		Open (9/79)			
	Open			Open (10/79)*		Closed (10/79)*			
10/25/79 - 1/31/80	Closed			Open (10/79)*		Closed (10/79)*			
	Closed	Closed (11/2/79)		Open (11/79)		Open (11/79)			
	Closed	Closed (12/27/79)	Closed (12/79)	Open (12/79)					
	Closed		Open (1/80)	Open (1/80)					

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)	Discrepancy Explanation
2/1/80 - 6/30/82	Open	Open (2/22/80)	Open (2/80)	Open (2/80)		Open (2/80)			
	Open	Open (2/80)	Open (2/80)	Open (2/80)		Open (2/80)			
	Open	Open (2/80)	Open (2/80)	Open (2/80)		Open (2/80)			
	Open		Open (3/80)	Open (3/80)					
	Open	Open (4/14/80)	Open (4/80)	Open (4/80)					
	Open			Open (5/80)					
	Open		Open (6/80)	Open (6/80)					
	Open		Open (7/80)	Open (7/80)					
	Open			Open (8/80)					
	Open	Closed (10/18/80)		Closed (10/80)					
	Open	Closed (10/29/80)		Closed (10/80)					
	Open			Closed (11/80)					
	Open	Closed (12/16/80)							
	Open		Open (1/81)	Open (1/81)					
	Open	Open (2/17/81)	Open (2/81)						
	Open		Open (3/81)	Open (3/81)					
	Open		Open (4/81)						
	Open		Open (5/81)	Closed (5/81)					
	Open		Open (6/81)	Closed (6/81)					
	Open			Closed (7/81)					
	Open			Closed (8/81)					
	Open			Closed (10/81)					
	Open			Closed (11/81)					
	Open		Open (12/81)	Closed (12/81)					
	Open	Open (1/30/82)	Closed (1/82)	Closed (1/82)					
	Open		Closed (2/82)	Closed (2/82)					
	Open	Open (3/6/82)	Open (3/82)	Closed (3/82)					
	Open	Open (3/20/82)	Open (3/82)	Closed (3/82)					
	Open		Open (4/82)	Open (4/82)					
	Open		Open (5/82)	Open (5/82)					
				Open (6/82)					
7/1/82 - 1/31/83	Closed		Open (7/82)	Open (7/82)					
	Closed	Open (8/6/82)	Open (8/82)	Open (8/82)					
	Closed	Open (8/14/82)	Open (8/82)	Open (8/82)					
	Closed	Open (8/19/82)	Open (8/82)	Open (8/82)					
	Closed	Open (9/2/82)	Open (9/82)						
	Closed	Open (9/29/82)	Open (9/82)						
	Closed	Closed (10/23/82)	Open (10/82)	Open (10/82)			Yes - 10/23/82		
	Closed	Open (10/27/82)	Open (10/82)	Open (10/82)					Artificial Opening
	Closed			Open (11/82)					Artificial Opening
	Closed	Open (12/18/82)	Closed (12/82)	Open (12/82)			Yes - 12/22/82		Artificial Opening
	Closed	Open (1/9/83)	Open (1/83)	Open (1/83)					Artificial Opening

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)	Discrepancy Explanation
2/1/83 - 3/20/84	Open	Open (2/1/83)	Open (2/83)						
	Open	Open (2/1/83)	Open (2/83)						
	Open		Open (3/83)	Open (3/83)					
	Open		Open (4/83)						
	Open			Closed (5/83)					
	Open	Open (6/13/83)	Open (6/83)						
	Open	Open (7/20/83)	Open (7/83)	Open (7/83)					
	Open	Open (8/7/83)	Open (8/83)						
	Open		Open (9/83)	Open (9/83)					
	Open		Open (10/83)	Open (10/83)					
	Open		Intermittent (11/83)						
	Open		Open (12/83)	Open (12/83)					
	Open	Open (1/3/84)	Open (1/84)	Open (1/84)				Moderate	
	Open	Open (1/22/84)	Open (1/84)	Open (1/84)				Moderate	
	Open		Open (2/84)	Open (2/84)				Moderate	
	Open	Open (3/5/84)	Open (3/84)*	Open (3/84)*				Moderate	
3/21/84 - 12/24/84	Closed		Open (3/84)*	Open (3/84)*				Moderate	
	Closed		Closed (4/84)					Moderate	
	Closed					Intermittant (5/84)		Moderate	
	Closed	Closed (6/84)						Moderate	
	Closed	Open (8/11/84)						Moderate	
	Closed		Open (9/84)					Moderate	
	Closed		Closed (11/84)				Yes - 11/21/84	Moderate	
	Closed		Open (12/84)*					Moderate	Artificial Opening
12/25/84 - 2/24/85	Open		Open (12/84)*					Moderate	
	Open	Open (1/1/85)	Open (1/85)		Open (1/85)	Open (1/85)		Low	
	Open		Open (2/85)*		Open (2/85)*	Open (2/85)*		Low	
2/25/85 - 11/25/85	Closed		Open (2/85)*		Open (2/85)*	Open (2/85)*		Low	
	Closed		Open (3/85)		Open (3/85)	Open (3/85)		Low	
	Closed		Open (4/85)		Open (4/85)	Open (4/85)		Low	
	Closed		Open (5/85)		Open (5/85)	Open (5/85)		Low	
	Closed	Open (6/30/85)	Open (6/85)		Open (6/85)	Open (6/85)		Low	
	Closed	Open (7/4/85)	Open (7/85)		Open (7/85)	Open (7/85)		Low	
	Closed	Open (7/7/85)	Open (7/85)		Open (7/85)	Open (7/85)		Low	
	Closed		Open (8/85)		Open (8/85)	Open (8/85)		Low	
	Closed		Open (9/85)		Open (9/85)	Open (9/85)		Low	
	Closed	Open (10/3/85)	Open (10/85)		Open (10/85)	Open (10/85)		Low	
	Closed		Open(11/85)*		Open(11/85)*	Open(11/85)*		Low	
11/26/85-12/8/85	Open		Open (11/85)*		Open (11/85)*	Open (11/85)*		Low	
	Open				Open(12/85)*	Open(12/85)*		Low	
12/9/85-3/14/86	Closed				Open (12/85)*	Open (12/85)*		Low	
	Closed		Open (1/86)		Open (1/86)	Open (1/86)		High	
	Closed		Open (2/86)		Open (2/86)	Open (2/86)		High	
	Closed		Open (3/86)*		Open (3/86)*	Open (3/86)*		High	
3/15/86 - 6/30/86	Open		Open (3/86)*		Open (3/86)*	Open (3/86)*		High	
	Open	Open (4/3/86)	Open (4/86)		Open (4/86)	Open (4/86)		High	
	Open		Open (5/86)		Open (5/86)	Open (5/86)		High	
	Open	Open (6/28/86)	Open (6/86)		Open (6/86)	Open (6/86)		High	
	Open	Open (6/28/86)	Open (6/86)		Open (6/86)	Open (6/86)		High	
	Open	Open (6/29/86)	Open (6/86)		Open (6/86)	Open (6/86)		High	

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)	Discrepancy Explanation
7/1/86 - 2/28/91	Closed	Open (7/7/86)	Open (7/86)		Open (7/86)	Open (7/86)		High	
	Closed	Open (7/18/86)	Open (7/86)		Open (7/86)	Open (7/86)		High	
	Closed		Open (8/86)		Open (8/86)	Open (8/86)		High	
	Closed		Open (9/86)		Open (9/86)	Open (9/86)		High	
	Closed		Open (10/86)		Open (10/86)	Open (10/86)	Yes - 10/28/86	High	
	Closed	Open (11/12/86)			Open (11/86)	Open (11/86)		High	Artificial Opening
	Closed		Open (12/86)		Open (12/86)	Open (12/86)		High	Artificial Opening
	Closed		Open (1/87)		Open (1/87)			Moderate	Artificial Opening
	Closed		Open (2/87)		Open (2/87)			Moderate	Artificial Opening
	Closed		Closed (3/87)		Open (3/87)	Closed (3/87)		Moderate	Artificial Opening
	Closed		Open (4/87)		Open (4/87)	Open (4/87)		Moderate	Artificial Opening
	Closed		Closed (5/87)		Closed (5/87)	Intermittant (5/87)	Yes - 5/11/87	Moderate	
	Closed	Open (6/19/87)	Open (6/87)		Open (6/87)	Open (6/87)		Moderate	Artificial Opening
	Closed	Open (6/19/87)	Open (6/87)		Open (6/87)	Open (6/87)		Moderate	Artificial Opening
	Closed	Open (7/4/87)	Open (7/87)		Open (7/87)	Open (7/87)		Moderate	Artificial Opening
	Closed	Open (7/30/87)	Open (7/87)		Open (7/87)	Open (7/87)		Moderate	Artificial Opening
	Closed		Open (8/87)		Open (8/87)	Open (8/87)		Moderate	Artificial Opening
	Closed		Open (9/87)		Open (9/87)	Open (9/87)		Moderate	Artificial Opening
	Closed	Open (10/24/87)	Open (10/87)		Open (10/87)	Open (10/87)		Moderate	
	Closed	Open (11/10/87)	Open (11/87)		Closed (11/87)	Intermittant (11/87)		Moderate	
	Closed		Open (12/87)		Closed (12/87)	Intermittant (12/87)		Moderate	
	Closed	Open (1987)						Moderate	
	Closed	Open (1/27/88)	Open (1/88)		Open (1/88)	Intermittant (1/88)		Moderate	
	Closed	Open (2/3/88)			Open (2/88)			Moderate	
	Closed	Open (3/26/88)	Open (3/88)					Moderate	
	Closed		Open (4/88)		Closed (4/88)			Moderate	4/21/88 Rain Event
	Closed		Open (5/88)		Open (5/88)			Moderate	
	Closed		Open (6/88)					Moderate	
	Closed	Open (7/3/88)	Open (7/88)		Open (7/88)			Moderate	
	Closed	Open (7/24/88)	Open (7/88)		Open (7/88)			Moderate	
	Closed	Open (8/16/88)	Open (8/88)		Open (8/88)			Moderate	
	Closed	Open (9/6/88)	Open (9/88)		Open (9/88)			Moderate	
	Closed		Open (10/88)					Moderate	
	Closed		Open (11/88)		Closed (11/88)			Moderate	
	Closed				Open (12/88)			Moderate	
	Closed				Open (1/89)				
	Closed	Open (2/14/89)	Open (2/89)		Open (2/89)				
	Closed				Closed (3/89)				
	Closed				Closed (4/89)				
	Closed				Closed (5/89)				
	Closed	Open (6/25/89)			Closed (6/89)		Yes - 6/25/89		Artificial Opening
	Closed	Closed (7/23/89)	Open (7/89)		Closed (7/89)				
	Closed		Open (8/89)		Open (8/89)				
	Closed		Closed (9/89)				Yes - 9/18/89		
	Closed		Open (10/89)		Open (10/89)				
	Closed				Closed (11/89)				
	Closed				Closed (12/89)				
	Closed		Closed (1/90)				Yes - 1/18/90		
	Closed		Closed (2/90)				Yes - 2/8/90		
	Closed		Open (3/90)						Artificial Opening

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)
	Closed		Closed (4/90)				Yes - 4/16/90	
	Closed	Closed (6/3/90)	Open (6/90)					
	Closed	Closed (6/23/90)	Open (6/90)					
	Closed	Closed (6/24/90)	Open (6/90)					
	Closed	Closed (7/1/90)	Open (7/90)					
	Closed		Open (8/90)					
	Closed				Closed (9/90)			
	Closed		Open (10/90)					
	Closed				Closed (11/90)			
	Closed				Closed (12/90)			
	Closed	Closed (1/18/91)						
	Closed	Closed (2/12/91)						
3/1/91 - 5/19/91	Open		Closed (3/91)		Closed (3/91)		Yes - 3/2/91	
5/20/91 - 2/14/92	Closed	Closed (6/23/91)			Closed (6/91)			
	Closed	Closed (6/29/91)			Closed (6/91)			
	Closed	Closed (7/6/91)						
	Closed				Closed (9/91)			
	Closed				Closed (10/91)			
	Closed				Closed (12/91)			
	Closed				Open (1/92)		Yes - 1/6/92	
2/15/92 - 4/9/92	Open				Closed (3/92)			
	Open				Closed (4/92)*			
4/10/92 - 1/9/93	Closed				Closed (4/92)*			
	Closed				Closed (6/92)			
	Closed				Closed (7/92)			
	Closed				Closed (8/92)			
	Closed				Closed (9/92)			
	Closed				Closed (10/92)			
	Closed				Closed (11/92)			
	Closed				Closed (12/92)			
	Closed				Open (1/93)*			

OPEN/CLOSURE STATUS FOR THE SAN DIEGUITO LAGOON INLET

Period	Modeling Inlet Status	Photo Inlet Status	Lifeguard Inlet Status	SIO Survey Inlet Status	Audubon Inlet Status	Technical Lit. Inlet Status	Artificial Inlet Opening? (Yes/No)	Wave Climate (High, Low Moderate)	Discrepancy Explanation
1/10/93 - 11/9/94	Open				Open (1/93)*			High	
	Open				Open (2/93)			High	
	Open				Open (3/93)			High	
	Open				Open (4/93)			High	
	Open				Open (5/93)			High	
	Open				Open (6/93)			High	
	Open				Open (7/93)			High	
	Open				Open (8/93)			High	
	Open				Open (9/93)			High	
	Open				Open (10/93)			High	
	Open				Open (11/93)			High	
	Open				Open (12/93)			High	
	Open				Open (1/94)			Moderate	
	Open				Open (2/94)			Moderate	
	Open				Open (3/94)			Moderate	
	Open				Open (4/94)			Moderate	
	Open				Open (5/94)			Moderate	
	Open				Open (6/94)			Moderate	
	Open				Open (7/94)			Moderate	
	Open				Open (8/94)			Moderate	
	Open				Open (9/94)			Moderate	
	Open				Open (10/94)			Moderate	
	Open				Open (11/94)*			Moderate	
11/10/94 - 1/3/95	Closed				Open (11/94)*			Moderate	
	Closed				Open (12/94)		Yes - 12/27/94	Moderate	
1/4/95 - 9/29/95	Open						Yes - 1/4/95	High	

APPENDIX-D:

Staff Report of the California Coastal Commission, 16 February 1996

RF-9100

STATE OF CALIFORNIA — THE RESOURCES AGENCY

PETE WILSON, Governor

CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
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VOICE AND TDD (415) 904-5200
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February 16, 1996

Mr. Frank Melone
Southern California Edison
P. O. Box 800
Rosemead, CA 91770

Subject: CCC Staff Comments on SCE's Calculation of Credit for San Dieguito Lagoon Inlet Maintenance

Dear ~~Mr. Melone~~, FRANK

In December 1995 you sent us three documents for review "Description of current inlet model - flushing and recharge" by Howard Chang; "Wave transport corrections to the inlet closure problem of San Dieguito Lagoon, California" by Scott Jenkins and Joseph Wasyl; and "Review of valuation of credit for inlet maintenance at San Dieguito Lagoon" by MEC Analytical Systems, Inc. These documents provide the basis for SCE's conclusion that maintaining the inlet of San Dieguito Lagoon open should yield more credit than the CCC calculated originally. The Commission's scientific staff originally calculated that maintaining the inlet of San Dieguito open would improve the value of the lagoon by 18%. SCE estimates that the inlet maintenance would improve the value of the lagoon by 61%.

The Commission's scientific staff have thoroughly reviewed these documents (see attached report). We have revised our original estimate of enhancement credit based on this review. Our revised estimate, which includes those changes made by SCE that are acceptable to the staff, is 24.2%.

This is our preliminary estimate based on the staff's review of SCE's reports. As was suggested in your letter of November 29, 1995 and agreed to in our letter of December 29, 1995, the next steps are for SCE to review these attached, detailed comments, and we will hold a meeting of all interested parties within two weeks of SCE's receipt of our analysis, to discuss the issue further. We propose to you and members of the Interagency Wetland Advisory Panel that the meeting be on March 8, 1996, in San Diego (at a location to be determined). Peter Douglas will be available to attend the meeting if it is held then. We will be sending out a draft agenda within the next week to you and the members of the Interagency Wetland Advisory Panel.

Sincerely,

Susan M. Hansch

Susan M. Hansch
Deputy Director
for Energy, Ocean Resources, and Technical Services Division

Attachment

cc: Interagency Wetland Advisory Panel
Coastal Commissioners

CCC Staff Comments
on
SCE's Calculation of Credit for San Dieguito Lagoon Inlet Maintenance

February, 1996

The following report presents the Coastal Commission scientific staff's comments on the following three documents:

- "Description of current inlet model - flushing and recharge" by Howard Chang;
- "Wave transport corrections to the inlet closure problem of San Dieguito Lagoon, California" by Scott Jenkins and Joseph Wasyl;
- "Review of valuation of credit for inlet maintenance at San Dieguito Lagoon" by MEC Analytical Systems, Inc.

Our response follows the five categories that the MEC document uses to revise the CCC model. The categories are:

A. Computer model code;
B. Hydrology;
C. Degradation rates;
D. Recovery rates; and
E. Effects of timing and duration of inlet opening on fish species number.

Below we comment on the merit of SCE's arguments for changes in credit that fall into each of these categories.

A. Computer model code

MEC found several errors in the Coastal Commission staff's model code; however, by their own calculations, "fixing" the code changed the value from .817 (out of 1) to 0.816 (p. 3-8 in the MEC document). Accordingly, we did not spend a great deal of time assessing the changes except to note:

I) MEC is correct in its assertion that when an opening of more than one year in duration was followed by a year in which a two month opening was selected, the extra months were not carryed forward. MEC's correction to the code corrected that error.

i) MEC technical staff were correct in their assertion that calculations of fish abundance, infaunal abundance and infaunal species number are wrong after two (or more) consecutive years of closure. However, MEC's corrections did not entirely fix the error. We have corrected the code.

ii) Contrary to MEC's claim (pp. 2-3, and 3-8 MEC 1995), in no instance was the value of the wetland not set to zero after 24 months of closure.

iii) The model calculation of zero degradation in fish was not in error as claimed by MEC, but rather reflected the staff's belief that the decline in fish abundance during the period of closure was due almost entirely to natural mortality. This was stated clearly in the text that accompanied the model. CCC staff based this belief on information gathered from San Dieguito Lagoon and other wetlands.

The bulk of fish abundance was made up of only a few species (the most abundant being topsmelt) all of which are believed to be characterized by a Type III survivorship. Specific data on survivorship of most marine and estuarine species is lacking. The bay anchovy is one species, however, for which there are survivorship data and we feel that it is probably representative of

the common species at San Dieguito Lagoon. Houde (1987)[1] estimated 3.6% survival for the juvenile stage (33 days to 1 year = 11 months) of bay anchovy and listed predation as the major source of mortality. By comparison, juvenile topsmelt showed 1% survival at San Dieguito Lagoon during the eight month period of closure in 1992. Thus, MEC's modification of the rate of fish degradation to half the regression slope is not consistent with what is known about the biology of estuarine fishes. The staff has now changed the code such that the value of fish abundance in the model is calculated as the integration of the mortality function at San Dieguito Lagoon during closure (12 % monthly mortality based on 100% mortality during 8.3 months of closure) divided by the integration over the same amount of time for the mortality function expected in an open system (as estimated from Houde, based upon 96.4 % mortality/ 11 months = 8.76% monthly mortality).

Effect of changes on value of wetland

Corrections to the code decreased the value of San Dieguito wetland (if the tidal inlet is not kept open) from 81.7% to 79.9%. The modification to the calculation of fish abundance changed the calculation of wetland value from 79.9 % to 78.8%.

[1] Houde, E.D. 1987. Fish early life history dynamics and recruitment variability. American Fisheries Society Symposium 2: 17-29.

B. Hydrology

i) Differences between the CCC and SCE algorithms for calculating inlet opening duration

The basis for calculating the value of the wetland (without inlet maintenance) is the algorithm used to determine the patterns of closure of the inlet. Both the CCC and SCE algorithms are based on the idea that the duration of inlet opening is related to the amount of sediment removed from the inlet during riverine flow; the rate of replacement of the sand bar in the inlet determines the duration of closure. Because there are few measurements of sediment removal, Dr. Chang developed flow records for major rainfall events in the San Dieguito River Basin using the hydrology model HEC-1 and flow data from the weir monitoring spillage flow from the Lake Hodges dam. These flows are then used to estimate the volume of scour in the tidal inlet using the sediment transport model, FLUVIAL-12. The rate of replacement of the sand bar can then be estimated. For simplification, the amount of sediment removal can be associated with a return period for the storm event that caused the scour. For example, an estimate for sediment removal can be made for a 1 in 10 year storm, that can later be used for other 1 in 10 year storms. Since return periods are probabilistic and best approximated by random assortment, sequences of return periods can be predicted. Application of an inlet opening algorithm to the sequences will produce sequences of inlet opening.

The CCC algorithm was derived directly from the best fit of duration of inlet opening to return period. [The CCC simplified its approach by assuming that the storms in any year have a cumulative effect on sediment removal that can be characterized as a 1 in X year event-year]. Empirical measurements were limited so one point was estimated - the duration of opening resulting from a 1 in 1 year event-year (= any event that is less than a one in two year event). This estimated value was one month and was provided to the CCC by Dr. Chang based upon his understanding of the lagoon hydrology. After review of the CCC valuation model, SCE produced a different algorithm to use in the calculation of wetland value (using the CCC valuation model). The major differences between the algorithms are shown in the Table 1 below:

Table 1: Comparison of CCC and SCE Algorithms

Algorithm	Function Type	Asymptote	Duration of opening for a 1 in 1 year event-year
CCC	Logistic	1 in 23 year event-year	1 month (average)
SCE	Power	1 in 160 year event-year	0

ii) Accuracy of the CCC and SCE Algorithms.

Following receipt of the SCE modified valuation model the CCC set out to assess the accuracy of the two algorithms by: (1) comparing the proportion of time the inlet was open as predicted by the two algorithms to the historical record and, (2) comparing inlet opening sequences predicted by the two algorithms to historical sequences. Note, the quantification of accuracy is based on the best available data, but the data set is discontinuous and sparse (Table 2). These data should be interpreted with care (Jenkins, 1995, Section IIIA).

Table 2: Summary of historical data on inlet closure at San Dieguito Lagoon. Data show a greater duration and frequency of lagoon opening in more recent years. This is counter-intuitive since the tidal prism is thought to have diminished over time, which should have caused the lagoon to be open for longer periods of time in the early years of the record. The data also show a greater duration and frequency of lagoon opening as the number of observations increased.

	1929-39	1940's	1950's	1960's	1970's	1980's	1990's
Number of Data Points	10	5	40	22	96	342	72
Period (years)	10.88	10	10	10	10	10	6
Percent Closed	31	100	100	93	68	25	37
Number of Openings	2	0	0	1	9	19	12

Based upon the inlet opening data from 1927-1995, SCE (Jenkins and Waysl 1995) calculated the overall proportion of time that the inlet was closed was 61.3%. In the determination, the inlet was considered open for the period between two consecutive records indicating the inlet was open; it was considered closed for the period between two consecutive records indicating the inlet was closed (Jenkins pers. com.). If the status of the inlet changed between two consecutive records, the interval between the two records was considered to be a data gap (Jenkins pers. com.). As a first approximation this is a valid and reasonable approach. However, such a method will invariably over-represent the more common status. If the real proportion of time that the inlet was open is p and the proportion of time that it is closed is 1 - p then the set of probabilities for two consecutive records are shown in Table 3:

Table 3: Set of probabilities for two consecutive records

Case	Status 1	Status 2	Probability
1	Open	Open	p^2
2	Open	Closed	$p(1 - p)$
3	Closed	Open	$(1 - p)p$
4	Closed	Closed	$(1 - p)^2$

SCE's calculation of the proportion of time the inlet was closed was based upon cases 1 and 4. Case 1 was considered the estimate of the proportion of time the inlet was open and case 4 was considered the estimate of the proportion of time the inlet was closed open. Therefore the formula used was:

$$(1-p)^2 /(1-p)^2 +p^2$$

If for example, the real proportion of time the inlet was closed was 0.7 (and the proportion open therefore was 0.3), then the SCE estimate (assuming unbiased records) for the proportion of time closed (1 - p) would be:

$$(1-0.3)^2 /(1-0.3)^2+0.3^2 = 0.83$$

which is different from the true value of 0.7. The error is fixable. If $[(1 - p)^2/(1 - p)^2+p^2] = .613$ (as shown above) then the corrected estimate of proportion of time the inlet was closed from 1927 - 1995 (using the SCE method and database) is 0.558 or 55.8%. For comparison, Table 4 shows the prediction of opening based on the SCE algorithm and the SCE estimate from the historical record (corrected and uncorrected).

Table 4: Estimated Percent Lagoon Closure, 1927 - 1995

Source	Percent closed
SCE(Chang from Jenkins and Wasyl 1995)	69.4 %
Historical record (Jenkins and Wasyl 1995)	61.3%
Historical record (corrected) (Jenkins and Wasyl 1995)	55.8%

In our revised approach, we did not apply their algorithm to the period 1927-1977 because the resource agencies (CDFG, FWS, and NMFS) recommended that we only consider the records from 1978 - 1994 because they are the only complete records of observed data on lagoon openings at San Dieguito. During 1978 - 1994 the lagoon was closed 32% of the time. This period includes a period of extended drought (mid to late 1980's) and a relatively wet period during 1990 to 1995. For comparison, Table 5 shows the prediction of opening based on the SCE and CCC algorithms (representative run of algorithm - in the CCC approach 1 year events may open the inlet for either 0 or 2 months (randomly assorted) so each run of years may have slightly different outcomes for the 1 year event-years) and the CCC estimate from the historical record. [Two estimates are shown for SCE: (1) from Appendix A (Jenkins and Wasyl 1995), which was said to be based upon the SCE algorithm and, (2) direct calculation using the SCE algorithm.]

Both models estimated greater inlet closure than the record indicates, however the error for the SCE estimates are about 3 times that of the CCC estimate.

Table 5: Estimated time San Dieguito Lagoon was closed during 1978-1994. Error represents the difference between that predicted by the algorithm and the historical record.

Source	Percent closed	Error
SCE algorithm (from Jenkins and Wasyl, 1995)	54.5%	22.6%
SCE - algorithm	55.4%	23.5%
CCC (representative run of algorithm)	38.3%	6.4%
Historical record (derived from Jenkins and Wasyl 1995)	31.9%	

Another way to compare the CCC and SCE algorithms is to see how predictive they are for individual years. This approach will allow assessment of how well the algorithms predict patterns of inlet closure and opening. Again, only the data from 1978 - 1994 were used. Table 6 shows the actual periods of inlet opening by year, for that period and the yearly estimates using the different algorithms.

Table 6: Yearly comparison of predictions of inlet opening based on SCE and CCC algorithms (representative run of algorithm). Two estimates are shown for SCE (see above). Event-year is based upon either SCE estimates presented in previous reports (e.g. 1980, 1983, and 1993) or the SCE algorithm (MEC 1995) using model output from Jenkins and Waysl (1995). Regressions compared predicted openings with historical record.

		Months open			
Year	Event-Year	Historical record	SCE (Jenkins)	SCE (algorithm)	CCC (algorithm)
1978	9	11	6.5	7.6	12
1979	14	10	9.5	11	12
1980	49	9	11	12	12
1981	7	4	12	11.5	12
1982	8	10	6	6.8	12
1983	18	12	11	12	12
1984	6	8	4	5.3	12
1985	4	12	3.25	3.2	4
1986	5	12	3.5	4.2	5
1987	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1988	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1989	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1990	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1991	3	0	2.6	2.2	2.33
1992	2	1	2	1.14	1.53
1993	20	12	11.5	12	12
1994	1	12	10	2.1	11
Months open		139	92.85	91.04	125.86
Percent open		68.1	45.5	44.6	61.7
Regression p-value			0.116	0.147	***0.033***

5/10-1
4/7

Of the three estimates only the CCC prediction is significantly correlated with the historical record of inlet opening at San Dieguito Lagoon.

The final, and as it turns out most important comparison between the two approaches (SCE and CCC) is in the way one year event-years are treated. In the CCC approach the duration of inlet opening associated with a one-year event is **on average** one month. This value is based on the original estimate of Dr. Chang (since changed - see below). Because there was evidence that the inlet has remained closed for over 12 months in the past, the CCC built in a function that caused the inlet to either open for two months or not at all during a one year event-year. There were equal probabilities of each duration (0 or two months, thus conserving a one month average) and they were randomly assorted among one year event-years (there is no *a-priori* basis for another pattern of assortment, P. Goodwin pers. com.). In the SCE approach, one year event-years **do not** lead to inlet openings (see line 3.04, 3.041 and 3.11 in SCEMOD1.BAS - note that the revised estimate of SCE's technical consultants for such event-years is one week (MEC 1995). The implications of these differences for predictions of inlet opening and wetland value are dramatic, as detailed below. For comparative purposes two points are now made. First because of the frequency distribution of event-years, the SCE approach predicts that over long periods of time the inlet will open in slightly more than 50% of the years. By contrast, the CCC model predicts that over long periods the inlet will open in slightly more than 75% of the years. Over the period 1978-1994 the inlet was closed for an entire calendar year only once (1991). The SCE algorithms (both estimates) predict 4 years of total closure (1987-1990) and the CCC algorithm predicts one year of closure (1990).

iii) Duration of opening during one year event-years

As noted above, although one year event-years cause no inlet opening using the SCE algorithm (and approach), SCE scientists have in fact indicated that the inlet will actually open for about 7 days following a one year event. However, they argue that no significant exchange of marine water occurs during a one week opening and that for the purpose of estimating enhancement credit, a one week opening is equivalent to no opening at all. The CCC questions SCE's revised estimate of a one week inlet opening following a one year event and disagree with the contention that there is no value to such a period of opening. During the period 1978-1994 there were 5 years which were, by SCE's own calculation, 1 in 1 year event-years (1987-1990, 1994). Four of those years were were consecutive (1987-1990 - see shaded portion of Table 6) and occurred during drought conditions. The SCE prediction of yearly inlet opening was 0 days for those years (the exception 1994 followed a 1 in 20 year event-year and was predicted to remain open in 1994 due to the 1993 event). The actual time open for 1987-1990 was 9, 10, 5 and 2 months, respectively; a yearly average of 6.5 months open. Therefore, based on the best available data there is no justification for the contention that one year event-years open the mouth for only one week. Further, these data suggest that even the CCC assumption (based upon the initial estimate SCE) of one month as the average duration of opening for a one-year event may be too conservative.

iv) Effect of changes on value of wetland

Table 7 shows the long-term estimates for the proportion of time the inlet will be closed and the value of the San Dieguito wetland (without inlet maintenance) for the CCC and SCE models using 3 different values for the average duration of inlet opening during a one-year event. Several points are worth noting. First, all models estimate the percent of time the inlet was closed as much higher than the historical record, either 1927-95 or 1978-94. Second, there is little difference between the CCC and SCE estimates of the value of the wetland without inlet maintenance for a given duration of inlet opening following a one-year event. Finally, SCE's assumption that a 7-day opening was no better than no opening at all, and subsequent use of a 0-day opening for a 1 in 1 year event-year, resulted in by far the most dramatic reduction in wetland value. This one assumption, which the CCC believes is inaccurate and without support, results in a decline in wetland value of 17.6%.

Table 7: Predictions of inlet opening and wetland value for the CCC and SCE models for different values of average inlet opening for a 1-year event. For comparison, duration of inlet openings based on the historical record are also shown.

Model	Opening following a 1 in 1 year event-year	Percent time inlet closed	Percent value of the wetland (without inlet maintenance)
CCC	1 month	65.5	78.8
CCC	1 week	68.8	77.7
CCC	0	69.2	62.8
SCE	1 month	73.1	77.3
SCE	1 week	76.1	76.1
SCE	0	77.0	59.7
Historical	Record (1927-1995)	55.8	N/A
Historical	Record (1978-1994)	31.9	N/A

Based upon the data presented above, we find no reason to award additional credit for changes made in hydrology; the most reasonable estimate of wetland value is 78.8%, though for reasons also noted above, even this estimate may be too low.

C. Degradation Rate

Fish and invertebrate abundances declined when San Dieguito Lagoon was closed from May to December, 1992. The CCC believes that most of the losses were due to natural causes and were part of the regular seasonal summer-high, winter-low pattern observed in San Diego County estuaries. MEC believes that the deaths were due to poor water quality during closure. However, the water quality data do not support this contention nor does the absence of fish kills in the lagoon.

Both the CCC and MEC analyses look at the decline in resource value during closure and compare it to that expected had the inlet remained open. Both analyses assume complete degradation after two years of closure (an assumption which is known not to be true, but is nonetheless made to simplify the model). The two analyses differ in: (1) how they calculate the observed rate during closure and (2) how they calculate the expected rate had closure not occurred.

i) Observed degradation rate. CCC staff rely on a regression of all the data collected during the period of closure to calculate the rate of decline in the resource. By contrast MEC fit their Biological Paradigm to the data.

We believe the Biological Paradigm constructed by MEC to help interpret the biological patterns observed at San Dieguito Lagoon has several problems. First, the Biological Potential portion of it largely ignores seasonality; the summer-high, winter-low pattern is a fundamental aspect of invertebrate and fish communities in open (and closed) lagoons in southern California. Second, the paradigm ignores the fact that fish abundances are frequently observed to be highest in recently closed lagoons. The highest density of fish at San Dieguito Lagoon occurred in May 1992 after the lagoon had been closed for five weeks (Fig 2-6 in MEC report). Peak densities of fish occurred under similar closed conditions at Los Penasquitos Lagoon in June 1989 (Nordby 1990)[2] and at Kleinmond Estuary in May 1981 (Bennett 1989)[3]. Therefore, MEC's idea that an estuary maintains a constant biological potential that is frequently the highest value ever recorded (during open or closed conditions) is without merit. Third, application of the Biological Paradigm to the degradation rate is not justified. MEC starts the decline following closure at the presumed biological potential (or maximum value), rather than the actual value at closure. MEC also frequently continues the decline during closure into the period of opening. There are no data to support fitting the paradigm to the degradation rate. Instead the arguments appear to be ad hoc.

ii) Expected degradation rate. CCC staff examined seasonal patterns in open lagoons and found that they were similar to those observed at San Dieguito Lagoon during closure. By contrast, MEC presumed that the value would have been constant at the highest level of Biological Potential had the inlet been open. For the reasons noted above this is not a realistic assumption.

iii) Effect of changes on value of wetland

In sum, the staff does not believe that any additional credit is warranted for changes SCE made in the model with respect to degradation rates.

---

[2] Nordby, C. 1990. Physical-chemical and biological monitoring of Los Penasquitos Lagoon. Final Report to the Los Penasquitos Lagoon Foundation. 22p.

[3] Bennett, B.A. 1989. A comparison of the fish communities in nearby permanently open, seasonally open and normally closed estuaries in south-western Cape, South Africa. S.Afr.J.Mar.Sci. 8: 43-55.

D. Recovery Rate

i) Assumptions of recovery in resource value after a period of inlet closure

Both the CCC and MEC models look at the recovery in resource value after a period of inlet closure and compare it to that expected had the inlet remained open. The two sides made different assumptions which led to different conclusions. Below we describe the rationale for the CCC's assumption on recovery rate and the basis of MEC's arguments that contest this assumption.

CCC staff assumed that a period of inlet closure does not cause a delay in the recovery of biological values following inlet openings. We were convinced by MEC's assertion (and recovery rates for fish and inverts at other lagoons) that recovery of biological values following inlet opening is delayed primarily because of the physical effects of the flood that caused the inlet to open (e.g., scour, turbidity, sediment movement and wetland flushing). Because the effects of the flood would have occurred had the inlet been open at the time of the flood, we presumed the observed recovery rates at San Dieguito Lagoon during 1993-1994 were similar to those that would have occurred had the inlet been continuously open.

MEC apparently missed the point in our estimation of potential delays in recovery following opening. MEC claims we assume recovery is instantaneous when in fact the document we provided to SCE explicitly states that recovery is not instantaneous, but rather that recovery is not influenced by how long the lagoon inlet was closed prior to opening. MEC's calculation of enhancement credit is based upon the assumption that recovery rate after opening is influenced by the period of closure. MEC provides no evidence that the effect of closure itself causes additional delay.

ii) Effect of changes on value of wetland

The CCC staff recognizes that it is theoretically possible for extended closure to delay recovery of some organisms (e.g. long lived sessile species) following certain types of openings (e.g., low scour events). However, given the lack of empirical evidence we believe that this phenomenon is not very important. Nonetheless, we are willing to assume a short delay in recovery due to closure that would increase SCE's enhancement credit by approximately 3% (as opposed to the 10% suggested by MEC).

E. Effects of timing and duration of fish species number

i) Assumptions of MEC's model

MEC argues that the timing and duration that an inlet is open is important to the recovery rate of fish species number. To account for this phenomenon MEC developed a simple model that estimates the number of fish species in San Dieguito Lagoon for different durations of inlet openings that occur at different times of the year. MEC's simple model is flawed in several ways. First, the model assumes that a fixed biological potential of 30 species will occur continuously after the inlet has been open for eight to nine months. The reality is that a total of 30 species has never been recorded in the San Dieguito Lagoon at any one time even though the lagoon was open for approximately 23 months after January 1993. The maximum number of fish species observed during 1993-1994 was only 16. Second, the model uses peak spawning periods which appear to be too short. The staff tested the model by using the short opening during winter 1992 to predict which species would be present during the closed period of 1992 and found that it was not accurate. Three species that were predicted to be present were not present, and four species that should not have been present, according to the model, were present. [One of the species that should not have been present, the California halibut, was actually abundant.] Third, the model ignores the contribution of juvenile and adult immigration to fish species number.

ii) Effect of changes on value of wetland
Because of these flaws the staff does accept MEC's model for estimating degradation in fish species number. The staff will continue to estimate degradation in fish species number using the data that were collected during the closed period in 1992, which we believe has more scientific merit and greater predictive power.

CONCLUSION

The changes to the CCC calculation of enhancement credit that the staff believes are acceptable are summarized in column three of the table 8. We do not believe that the other modifications proposed by SCE are justified. The net result of SCE's changes that are acceptable to the staff is a revision of the existing value of the wetland from 81.7% to 75.8%.

Table 8: Summary of the calculations of existing value of San Dieguito Lagoon. Values are percentages; 100% is considered the value when the lagoon is continuously open, lesser values reflect the predicted level of degradation that will result from periodic closure in the absence of continued inlet maintenance.

	SCE		CCC	
Category	Changes (%)	Value %	Changes (%)	Value %
Original CCC estimate		81.7		81.7
1. Computer code				
misc. errors	-0.1	81.6	-1.8	79.9
degradation in fish #	-1.6	80.0	-1.1	78.8
2. Hydrology	-18.0	62.0	0	78.8
3. Degradation rates	-8.0	54.0	0	78.8
4. Recovery rates	-10.0	44.0	-3.0	75.8
5. timing and duration of inlet opening	-5.0	39.0	0	75.8

- 8.5% due to degradation of fish + macroin.
- 7.0% loss in recovery rate

APPENDIX-E:

Peer Review Comment on:

Jenkins, S. A. and J. Wasyl, 1998, Analysis of Coastal Processes Effects Due to the San Dieguito Lagoon Restoration Project: Final Report, submitted to *Southern California Edison Co.*, 333 pp.

Date: Mon, 20 Apr 1998 10:30:59 -0700 (PDT)
From: John M. Boland <jboland@well.com>
To: saj@coast.ucsd.edu
Subject: reviews of San Dieguito report

Scott, Congratulations on receiving such good comments from the reviewers. I wish my manuscript reviews had more words like "particularly creative," "robust" and "well done" in them! See ya, John Boland.

>> >———
>> >From: A.J. Mehta[SMTP:mehta@coastal.ufl.edu]
>> >Sent: Tuesday, March 31, 1998 9:11 AM
>> >To: Melone, Frank L

>> >Subject: My comments
>> >
>> ><<File: DIEGUITO.NT>>
>> >
>> >Hello Frank:
>> >
>> >My draft comments are attached as a WordPerfect 6.1 file.
>> >
>> >Ashish Mehta
>> >
>>
>
>

Date: Fri, 3 Apr 1998 11:28:24 -0800
From: "Melone, Frank L" <MELONEFL@sce.com>
To: "'Jenkins, Scott (619)534-6480'" <SAJ@coast.ucsd.edu>
Subject: FW: My comments

For your info. Thanks for your help. You and Joe are not only doing a great job for us, but it is enjoyable having you on our team. I really appreciate all of your efforts!

>———
>From: A.J. Mehta[SMTP:mehta@coastal.ufl.edu]
>Sent: Thursday, April 02, 1998 8:56 AM
>To: Melone, Frank L
>Subject: Re: My comments
>
>Hello Frank:
>
>Thank you for your reply. I am satisfied with Scott's responses and do not
>have to add anything further at this point. I do not need to see Carl
>Nordin's report. I plan to go ahead and send my draft comments to John Boland
>(by e-mail). I will also send him Scott's responses to my specific questions
>and let him know that I posed these questions to Scott, and that I am
>satisfied with the answers he has provided.
>
>Ashish Mehta
>
>———
>> Hi Ashish,
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>> Thank you for the opportunity to review and comment on your report prior
>> to finalizing it. I noted that you had several questions which I asked
>> Scott Jenkins to address. His responses to these questions are set
>> forth below. I have no specific comments on your report. In general, I
>> believe you did a very thorough job and offered some very good
>> suggestions. I appreciate your participation in the review process.
>> Thank you for forwarding your review in such a timely manner.
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>> Scott's response to your questions are as follows:
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>> Questions raised on page 2:
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>> 1) On p. 64 it is noted that according to Figure 25, 63% of the load was
>> sand-sized. Is this percentage correct?
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>> Response: This data is straight out of Dr. Carl Nordin's report in his
>> review of Howard Chang's work. The data was from a suspended sediment
>> sample collected during the 1983 flood, which was a 20 yr event. For low
>> flow rate years the sediment yield is essentially all washload (silt &
>> clay) as characterized by the grain size data given in Appendix B of my
>> report.
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>> Ashish, I do not believe we sent you a copy of Dr. Nordin's report. If
>> you would like to see it, I will forward it to you.

Review of "Analysis of Coastal Processes Effects due to the San Dieguito Lagoon Restoration Project Preliminary Draft: January 23, 1998", by Scott A. Jenkins and Joseph Wasyl

1. Preamble

Prior to reading the above report (Jenkins and Wasyl, 1998) I was unaware of this project, and had to refer to related material, which included the following reports: MEC Analytic Systems (1994), Jenkins and Wasyl (1996), Chang (1997) and Southern California Edison Company (1997). In what follows, I will divide my response into two categories: 1) Modeling effort, 2) General Comments. These are based the written material and my participation at the workshop, related to the report, in Del Mar on February 21, 1998.

2. Modeling Effort

2.1 General

There in fact are two modeling efforts, each of which includes subsidiary modeling works. The first is related to the establishment of a sediment budget for the coastal cell, in order to assess the impact of sand output from the San Dieguito River on the stability of adjacent beaches, both for the *Modified Plan-B* and the *Consensus Plan*. The second is a hydrodynamic modeling effort, meant to examine the impacts of the two plans, and also to examine if one or both plans would meet the physical criteria pre-set for restoration of San Dieguito Lagoon.

2.2 Coastal Sediment Budget

The sand budget investigation is extensive, and reflects Dr. Jenkins' long experience with this coastal region of California. The modeling methodology is robust, and is along the lines of a similar approach we have developed for the east and far-western coasts of Florida (e.g., Cheng, 1998). There are some minor differences in the approaches, e.g., in the use of a beach profile equation; the one used in the report is based on the work of Dr. Jenkins and others cited in the report, whereas in Florida the "2/3 power-law", also mentioned in the report, has been used. The cross-shore profile approach of Dr. Jenkins is covered well in the report, although some of the details, e.g., the thermodynamical basis of the profile, which is an academic contribution, need not have been reported. The Oceanside Littoral Cell receives river sediment, and loses some to canyons, e.g., the La Jolla Submarine Canyon. In Florida, river sediment input is minimal, and rather than loss to the offshore, biogenic production and possibly other factors seem to annually add substantial amounts of sediment to the littoral cell, especially on the east coast (Cheng, 1998).

On the qualitative side the work relies on previous geological studies of the region, including that of Dr. Inman and co-workers. These studies are well reported and are, in the end, quite informative of the present situation with regard to the tidal end of San Dieguito River. The El Niño/Southern Oscillation effect is covered well, although perhaps too extensively. This effect, along with other factors, especially the influence of dams on reducing sediment output from rivers and sand redistribution by Oceanside Harbor, have been clearly identified as reasons why any solutions which would induced further reductions in sediment supply to the beach, e.g., as would occur in the absence

of the proposed levees under *Modified Plan-B*, cannot form an acceptable approach for lagoon restoration.

Sediment transport is qualitatively easy to understand, yet it remains one of the most difficult subject areas in coastal and river hydraulics as far as prediction is concerned. Apart from the possibility that deterministic equations may never be able to predict what is likely to be chaotic, we are saddled with the problem of the essentially episodic nature of the problem. To the extent that this can be handled, the report presents a good analysis of episodic forcing due to waves and flooding, and the corresponding response of the beaches. Input parameters are used as available; this has led to some problems, e.g., sediment yield estimated by Simon and Li versus Chang (Figure 17). Despite this, I tend to believe the report arrives at correct conclusions concerning sediment deficits for the Del Mar shores.

Two minor points: 1) On p. 64 it is noted that according to Figure 25, 63% of the load was sand-sized. Is this percentage correct? 2) Have the depths of closure calculated by Eq. (51) been reported?

2.3 River Inlet

The report relies on the so-called potential prism criterion along with a model for stability and closure (Figure 38) for an assessment of the need for dredging. In Florida there are several small inlets along the Gulf of Mexico coast which also rely on riven drainage for their stability. At Phillips Inlet (Mehta, 1985), where the problem was qualitatively similar to the one at the mouth of the San Dieguito River, stability and closure were handled by using the analysis of Escoffier and Walton (1979), and also via a simple but dynamic model based on a previous work (Winton and Mehta, 1980). Such modeling efforts can yield a good insight into the stability/closure issue; however, prediction may still remain a problem, given the uncertainty in episodic forcing, both with respect to waves/littoral drift and river discharge. This being the case, the report wisely avoids making quantitative predictions about the expected frequency of dredging. Instead, and correctly so, it recognizes that dredging will be required.

The report does not go significantly into methods for keeping the inlet open. Numerous methods such as jet pumps, fluidizer systems etc. have been routinely evaluated elsewhere; however, none of these may prove to be viable, if the Florida experience holds. There, dredging continues to be the sole choice for maintaining channels (e.g., Dombrowski and Mehta, 1993). Jet pumps, a potential choice, are being used in some places, e.g. at Indian River Inlet in Delaware; however they are expensive to service. The more expensive the system, the more likely it is that it will be abandoned or improperly maintained in financially hard times. The best choice at San Diego River mouth may turn out to be the use of a bulldozer to scrape out sand from the beach channel on as-needed basis.

2.4 Concluding Comment - Beach Sediment Modeling

The beach sediment modeling effort is well done, and I do not see the need for any further field or modeling work of a major nature; it is unlikely to be fruitful, given the uncertainties in

forcing and response. The conclusions from this part of the work clearly support the need for the *Consensus Plan.*

2.5 Hydrodynamic Modeling

It is unfortunate that the RMA-2 code could not become available in a timely way for its application to the San Dieguito Lagoonal system. This model has been used extensively, and has been well received by the coastal engineering community, although other compatible models are indeed available. The scheme of Connor and Wang has been used in TIDE_FEM, which was used for tidal computations. I learnt about this model from the report, although the Connor and Wang model, and subsequent versions, have been used widely including, I believe, for modeling tides and currents in Biscayne Bay in Florida. It is therefore reasonable to assume that TIDE_FEM functions well -- the general nature of the results seem to attest to it. My only question concerns the development and application of the storage rating function for the ocean-end boundary. I recognize the sensitivity of model output to this important boundary condition. In an application of RMA-2 to a system somewhat similar nature but involving a complicated set of branched residential canals forced by tide in the Charlotte Harbor area of Florida, we had to spend considerable effort in dealing with the "ocean" boundary condition for properly accounting for mass balance within the system. In other applications of RMA-2, I have seen the grid extended out into the ocean, and tidal boundary condition along the resulting arcuate boundary "tweaked" until the flow and elevation at the river mouth, in this case lying *within* the model grid, match with measurements there. As I understand, this approach could not be taken for San Dieguito River. Since the rating curve is obtained *a priori*, does it "force" a solution on tidal propagation within the interior?

Notwithstanding the above question, I find the model results reasonable, at least to the extent that they appear to be sufficiently reasonable for the ensuing design considerations for the restoration project. My presumption is that tidal damping due to head losses at the bridges etc. has been accounted for appropriately. In an application of RMA-2 to the estuary at Morehead City in North Carolina, we observed that the wood-piles of an old trestle running across the river was the cause of considerable head loss, equal to what would have occurred in the absence of the structure over a distance of ½ mile. As to the precision of the answers in the report with respect to elevations and areas of inundation after restoration of the San Dieguito Lagoon, I am somewhat less certain; some recent modeling work, e.g., that of Prof. Ian King at U. C. Davis, lays considerable emphasis on accurately simulating "wetting/drying" of the banks. Where banks are vertical, e.g., in bulkheaded canals, wetting/drying is obviously not an issue. To the extent that it is an issue elsewhere, the results will be influenced. At the study site, although this may be an issue, I tend to think the existing model results to be adequate for purposes of design.

2.6 Fine Sediment Transport Modeling

The fine sediment transport component of the modeling effort in the report is a highly simplified version of more sophisticated models now available, such as the U.S. Army Corps of Engineer's code STUDH. The question naturally arises as to level of sophistication required at the study site. Here, fine sediment concentrations are believed to be comparatively low (although I did not find actual values in the report), and annual yield is low as well. In order to calculate the rate

of deposition, the modeling approach selected focusses on deposition alone, which I tend to consider adequate for the answers desired. A more sophisticated approach is unlikely to yield information of sufficient additional utility. Mud deposition may not cause a serious problem for two reasons. It may become mixed with sand, and secondly, as occurs in San Francisco Bay, it could actually catch contaminants and sequester them at bottom. This would really be an advantage of having minor amounts of mud deposition.

2.7 Concluding Comment - Modeling of Interior Flows and Fine Sedimentation

The modeling of tides/currents and fine sedimentation can be improved to some extent; however I consider the effort adequate, and recommend against further extensive studies along this lines, since no significant additional benefits to design are likely to ensue.

3. General Comments

Overall I find the work of Dr. Jenkins commendable, and adequate for the restoration project in a general sense. Wherever sediments are involved, predictive modeling is a difficult task at best, and determination of responses over meso-time scales questionable, especially because the feedback loops between sediment transport and hydrodynamics are only known imperfectly. A case in point is the on-going effects of the intense ongoing ENSO event, which is generating several unusual coastal processes. For example, in Florida, at some spots we are observing beach accretion where erosion has been the norm. Significant and wholly unforecasted damage to sea defenses have been reported along the famous beaches of Rio de Janeiro. While all of these events can be modeled if one were to go about doing it with fervor, the probability of a predicting a particular scenario remains very low, despite recent efforts at *life-cycle based* stochastic modeling of coastal phenomena such as beach erosion. In the present lagoonal system, there is really no way of knowing exactly how the mouth will behave with regard to blockage/opening by sand and water flow; the report goes as far as one can in this sense as far as prediction is concerned (Dr. Jenkins has well examined the closure problem in an earlier report on a "hindcast" basis in Jenkins and Wasyl, 1996). This being the case, any further "fine-tuning" of the modeling effort may not yield results that are significant from a management perspective.

When I saw the San Dieguito lagoonal system, I wondered why it was chosen as a restorative mitigation measure, given its highly urban locale and associated modifications, especially the bridges that span the river. Admittedly, the article, "How to Make a Lagoon" (Appendix-A), presents a good case for restoration; however cost considerations may overwhelm benefits in some cases. A less anthropogenically stressed lagoonal system would have been a better choice from the fiscal point of view. Wherever human intervention is required on a frequent basis, as will undoubtedly be the case at the study site with respect to dredging the channel there, unless a strong and long term financial commitment exists, e.g., for the federal navigation projects, the likelihood of failure of the ecological system due to problems in maintaining the physical system is potentially high due to cost or other reasons.

In Florida, the State has mandated that sand bypassing at inlets be modified, if necessary, to mitigate for the interruption of sand drift along the beach. This has resulted in numerous studies

generically called "inlet management studies". Under this rubric we developed a management plan for the Loxahatchee River where the management concerns relative to competing requirements arising from people living along the beaches adjacent to the river mouth (called Jupiter Inlet) and those living along the interior banks of the river were somewhat similar to those in the San Dieguito Lagoon area. We carried out extensive field studies, laboratory physical modeling studies and numerical modeling studies to arrive at optimal management solutions; however, in the final analysis the collective personal experience of the involved coastal engineers and ecological scientists with that and other systems turned out to be critical to development of the final plan. In the present case I am of the opinion that Dr. Jenkins has that type of significant experience, and on that basis would like to conclude by recommending the following:

1. *Do not spend further monies in additional physical data collection or modeling in any significant way.* For example, a suggestion was made at the workshop that because the hydrodynamic model used only limited sets of data for coefficient calibration, e.g., for the bottom resistance coefficient, that additional data be collected to for model validation. Although in general this procedure would be appropriate, it must be recognized that the time-scales over which the lagoonal system is likely to change noticeably may be years, even as long as a decade or more (assuming no restoration). This being the case, obtaining "new" data within months of "old" data for calibration/validation would not be an effort of significant scientific value, because both sets would essentially relate to *practically the same* system. A genuine validation can be carried out only if the system were to change noticeably over the total time-span of data collection effort.

2. *Answer questions posed by biologists.* Questions which may have only minor significance to coastal engineers may have great implications for the development of the lagoonal ecosystem. I had the impression at the workshop that although from a coastal engineering point of view Dr. Jenkins showed that the expectations for the *Consensus Plan* in terms of flows, tidal levels, inundation and sediment transport would be met, there were some biology related questions which seemingly needed more definite answers. To that end my suggestion is as follows: All such questions should be collected, and each should be answered by Dr. Jenkins either using the existing modeling results, or running the models strictly to generate results that would answer the question (in writing). The degree of confidence in each case, including uncertainties, should be noted. This entire exercise should not take more than, say, four weeks.

3. *Place emphasis on the post-project monitoring plan.* Observe the system after it is modified by way of restoration, and make changes in the design/management if and when it becomes necessary to do so. This is a better, and in the long run less expensive, choice than to place emphasis of high accuracy for prediction on a pre-project basis (and thereby spending additional monies for that purpose). On that score my opinion is that the report is well done and needs to be relied upon.

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