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W7b

CC-0005-21 (SANDAG)

June 8, 2022

Correspondence

NORTH COUNTY TRANSIT DISTRICT

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June 7, 2022

Mr. John Ainsworth
Executive Director
California Coastal Commission
455 Market Street, Suite 300
San Francisco, CA 94105
Sent Via Electronic Mail: John.Ainsworth@coastal.ca.gov

RE: California Coastal Commission Agenda Item No. 7B: Del Mar Bluffs 5 Project

Dear Mr. Ainsworth:

The North County Transit District (NCTD) has reviewed Agenda Item No. 7B of the California Coastal Commission's (CCC) meeting scheduled for June 8, 2022 establishing conditions for the consistency certification of Del Mar Bluffs 5 (DMB5) project (Project) for construction. As you are aware, NCTD filed a Petition for Declaratory Order at the Surface Transportation Board (STB) on August 28, 2020 (STB Finance Docket No. 36433), requesting clarification from the STB regarding whether Federal Consistency Review under the Coastal Zone Management Act was preempted under 49 U.S.C. § 10501(b) of the Interstate Commerce Commission Termination Act (ICCTA).

The conditions being proposed by CCC for the Project, especially as it relates to the "Coastal Access and Recreation" conditions, are completely preempted by the ICCTA. Moreover, the CCC's attempt to extract an unlimited funding commitment for coastal access improvements that currently do not exist can only be construed as a gift of public funding and outside of the authority vested to the CCC. Accordingly, NCTD shall not authorize the advancement of this Project into construction until such time that the STB has acted on NCTD's petition for declaratory order or unless the CCC removes the following proposed conditions for the Project or unless SANDAG expressly agrees to solely fund and implement any such conditions as concurrent non-project activity in accordance with Addendum 18 to the Master MOU between NCTD and SANDAG:

1. Authorization Term: The CCC proposed requirement that SANDAG remove the seawall and rip-rap or submit a complete coastal development permit or consistency certification review application to the CCC at the expiration of the permit term is not agreeable.

2. Coastal Access and Recreation: The proposed conditions require SANDAG to develop and implement a capital improvement project "to complete planning, design, environmental review, and construction of three projects to provide and improve safe public coastal access and recreation in the project area through: (1) enhancement of the north-south trail system east of the rail track on the top bluff between Seagrove Park and 4th Street; (2) construction of a CPUC-approved pedestrian rail crossing near 7th or 11th Street; and (3) construction of a beach accessway at or between 7th and 11th Streets that does not involve significant

grading or alteration of the bluff beyond the work that is being performed as part of the Del Mar Bluffs Stabilization Project 5".

NCTD, the CCC and SANDAG have agreed that the direct project impacts are limited to loss of recreational space and future beach sand, with no impacts to coastal access. The mitigation projects required by the CCC's conditional consistency determination do not address those agreed-upon impacts. The conditions being proposed for the Project by the CCC impose significant obligations and undetermined future project costs to the region far beyond the implementation of the stabilization Project. NCTD is unaware of any funding that has been authorized to meet the requests of the CCC to implement their requirements. Moreover, from a NCTD perspective, the CCC requests do not support state of good repair needs, improvements to mobility, climate change, or advance social equity outcomes.

NCTD remains committed to advancing this critical safety Project in a manner that preserves and utilizes public funds in a manner consistent with an equitable and legal application of regulatory requirements. As previously stated to you, NCTD is willing to work collaboratively with the SANDAG, CCC and the City of Del Mar, outside of the permitting process of DMB 5, to support the construction of safe and legal crossings as evidenced by its funding contribution towards the Coastal Connections Study. It is my hope that the CCC will reconsider its approach and remove the unacceptable conditions identified by NCTD.

Sincerely,

Matthew O. Tucker
Executive Director

cc: California Coastal Commission
SANDAG Board of Directors
NCTD Board of Directors

From:	Laura Walsh
To:	Padilla, Stephen@Coastal; Escalante, Linda@Coastal; Brownsey, Donne@Coastal; Rice, Katie@Coastal; Hart, Caryl@Coastal; Wilson, Mike@Coastal; Bochco, Dayna@Coastal; Groom, Carole@Coastal; Harmon, Meagan@Coastal; Turnbull-Sanders, Effie@Coastal; Uranga, Roberto@Coastal
Cc:	Ainsworth, John@Coastal; Teufel, Cassidy@Coastal; Horn, Wesley@Coastal; Mitch Silverstein
Subject:	Surfrider Comments on Del Mar Bluff Stabilization Phase 5 Item on June Agenda
Date:	Friday, June 3, 2022 1:22:58 PM
Attachments:	Surfrider DMB 5 Coastal Commission Letter.pdf

Dear Chair Brownsey and Commissioners,

Please accept the attached letter on behalf of the Surfrider Foundation regarding Item W7b, CC-0005-21 (San Diego Association of Governments, San Diego Co.) on next week's agenda.

Best,
Laura W.

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Laura Walsh | California Policy Manager | Surfrider Foundation | she/her/hers
702.521.8196 | lwalsh@surfrider.org

June 3, 2022

To: Donne Brownsey, Chair, California Coastal Commission
Cc: John Ainsworth, Executive Director, California Coastal Commission

Re: Item W7b, CC-0005-21 (San Diego Association of Governments, San Diego Co.)

Dear Chair Brownsey and Commissioners,

The Surfrider Foundation (Surfrider) is a nonprofit grassroots organization dedicated to the protection and enjoyment of the world's ocean, waves and beaches, for all people, through a powerful activist network. Our San Diego Chapter is deeply involved in railroad protection and relocation issues in Del Mar. We have also been engaged in state and local decisions related to previous phases of Del Mar Bluff Stabilization (DMB) work, as well as more recent local conversations related specifically to DMB Phase 5.

Surfrider San Diego County is a member of the Los Angeles – San Diego – San Luis Obispo (LOSSAN) Regional Rail Corridor Working Group and the San Diego Shoreline Preservation Committee. We were part of Del Mar's Sea Level Rise Technical Advisory Committee that led sea level rise discussions related to Del Mar's Local Coastal Program Update process beginning in 2015. Our comments on DMB5 are consistent with our goal to see Del Mar plan for sea level rise to protect coastal access, coastal recreation, and marine resources in the most effective way, given current conditions affecting the safety and operability of the railroad.

We support the staff recommendation to make a conditional consistency determination for this project, but propose a number of critical suggestions to meet the needs of this community given the proposed project's extreme impacts.

Surfrider recognizes the need to stabilize the Del Mar section of the LOSSAN corridor and appreciates that the San Diego Association of Governments (SANDAG) and Coastal Commission staff have worked hard to reduce project impacts.

However, we cannot overstate the impact of this project to Del Mar's beaches and bluffs. Anticipated impacts can be found inconsistent with Sections 30251, 30253, and the access policies of chapter 3 of the Coastal Act (at a minimum) unless proper conditions are accepted in the Consistency Determination.

Del Mar's special bluffs, beaches, and waves are cherished by locals and visitors from throughout San Diego County, the State of California, and the country. Certain aspects of DMB5 — like the upper bluff stabilization, which can never be undone — will degrade the natural coastline in one of Southern California's quintessential beach towns far beyond the lifetime of this permit. Any permit extensions will also perpetuate related impacts.

Executive Summary

- To meet the specifications of Coastal Act Section 30253 and ‘mitigate’ damage, the project must facilitate relocation of the railroad.

- We recommend a number of suggested amendments to support relocation that are aimed at clarifying intentions to remove the proposed ½ mile of seawall.

- We support the staff report in pursuing a project design based on low-risk sea level rise scenarios because this supports the commitment to relocate the tracks.

- SANDAG has not provided environmental documentation to support a thorough analysis of the project proposal. The Commission should maximize public access opportunities so that the mitigation proposal is consistent with the access and recreation policies of Chapter 3 of the Coastal Act.

- We support the Capital Improvement Projects (CIP) proposed and recommend safe crossings at both 7th and 11th street. These projects are critical for securing access in spite of construction, proposed fencing, and armoring and should not be scaled back under any circumstance.

- The vertical access trails should benefit from a long-term rail to trail program.

- We recommend interim public access projects on Torrey Pines State Beach to address the seven year or more gap during which the CIP projects are not completed.

- The wetland mitigation ratio should be 4:1. The .28 acres of wetland habitat affected by this project are some of the last remaining intact wetlands in California.

- We request clarity around where and when rolling construction takes place so the schedule can be clearly understood by the community.

This project is devastating to Del Mar's bluffs and beaches

Approval of this permit includes the authorization of half a mile of seawall (2,500 feet) for 30 years, the permanent grading and upper bluff stabilization of approximately three quarters of a mile of bluff, and the construction of at least five stormwater outfalls.

Related impacts include:

- Construction activities taking up beach space and blocking access on Del Mar and State Park beaches for as long as three years**.** This impact could be found to be inconsistent with Sections 30210, 30211, 30212, 30220, 30221 of the Coastal Act and Section 4 of Article X of the California Constitution.

- Loss of beach access at 7th and 11th Street for up to seven years — or longer if other agencies do not comply with permit terms. This impact could be found inconsistent with Sections 30210, 30211, 30212, 30220, 30221 of the Coastal Act and Section 4 of Article X of the California Constitution.

- Narrowing of large stretches of beach and disappearance of lateral access along the beach caused by the placement of seawall and rip rap backfill for up to 30 years, with permanent narrowing of the beach expected in the future due to accelerated erosion and sea level rise. This impact could be found inconsistent with Sections 30210, 30211, 30212, 30220, 30221 of the Coastal Act and Section 4 of Article X of the California Constitution.

- Permanent loss of habitat along natural bluffs and on beaches, with temporary loss guaranteed during three years of project construction. This impact could be found inconsistent with Section 30240 of the Coastal Act.

- Drastic visual change to the bluffs, particularly due to the seawall visible to all beachgoers including surfers and boaters in the water for up to 30 years.This impact could be found inconsistent with Sections 30251 and 30253 of the Coastal Act.

- Potentially increased erosion, water quality contamination, and rip currents caused by the construction of five stormwater outfalls. This impact could be found inconsistent with Section 30231 of the Coastal Act.

- Permanent loss of .28 acres of some of California's last remaining wetlands.
  This impact could be found inconsistent with Sections 30233, 30231 and 30255 of the Coastal Act.

In light of these major impacts, we suggest mitigation opportunities and make recommendations to ensure accountability and transparency throughout the process:

The benefit of this project is that it can facilitate improved coastal access and long-term managed retreat

Surfrider can live with basic aspects of this project because it memorializes and motivates relocation of the LOSSAN railroad, which should never have been located on Del Mar's fragile and eroding bluffs in the first place. Further explanation is in our letter to this Commission related to emergency bluff work in 2020[1]. As this staff report points out, SANDAG committed to relocating the Del Mar section of the LOSSAN corridor by 2035 (memorialized in its 2021 San Diego Forward Regional Transportation Plan) due to the fact that the rail faces increasing coastal hazards from sea level rise and erosion in the near and long-term.

Relocation of the railroad tracks provides an extremely rare and important opportunity to allow space for Del Mar's coastline to migrate landward as sea levels rise. It will also secure public recreation, viewing, and access opportunities along the former rail corridor in the future. If successfully managed, this project will be a nationally significant case study, where today's permit represents one step along an adaptation pathway towards managed retreat of critical infrastructure and restoration of an otherwise highly developed area onan eroding shoreline.The site is unique in San Diego County as one of the few areas along coastal bluffs where existing development would no longer be threatened once the rail is relocated.

This project can be found consistent with the Coastal Act, the Coastal Commission's Sea Level Rise Guidance, and the Coastal Commission's Guidance on Critical Infrastructure **only insofar as it facilitates relocation and provides mitigation for both short and long term access impacts**.

It is obvious that this project contravenes many Coastal Act policies, including 30253 and 30251, as well as access policies in Sections 30210, 30211, 30212, 30220, 30221 of the Coastal Act and Section 4 of Article X of the California Constitution.

The justification for the project rests on the provision of Coastal Act Section 30235, which allows the Coastal Commission to permit armoring "*when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply*."

However, Section 30253(2) of the Coastal Act requires that new development shall not contribute to erosion nor "*require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.*" While hard structures provide temporary protection against the threat of sea level rise, they disrupt natural shoreline processes, accelerate long-term erosion, cause loss of beach and other critical habitats and corresponding ecosystem benefits, as well as impair beach access and recreational uses. Therefore, armoring must be avoided or, in this instance, used for a minimized and time-certain duration.

[1] https://documents.coastal.ca.gov/reports/2020/8/W13b/W13b-8-2020-correspondence.pdf

Relocating the train is a practical way of meeting the requirement to mitigate adverse impacts of this project, and SANDAG has already committed to this intention in its Regional Transportation Plan.

In order to facilitate rail relocation, critical adjustments to the staff report need to be made in order to ensure accountability and feasibility — we make those suggestions in later sections of this letter. We note here however that the goal of managed retreat is both ambitious and imperative, and we generally support staff in their assumption that retreat will be achieved by 2035 with flexibility through 2053 (which captures the 30 year permit timeline.)

Because of this permit timeline, Surfrider concurs with staff that in this particular instance, SANDAG should not be held to design this critical infrastructure project to meet the standards of the H++ risk aversion sea level rise scenario. We take note that the Commission's Sea Level Rise Guidance recommends analyzing critical infrastructure under the medium high-risk aversion and extreme-risk aversion scenarios because of its typically long design life, low adaptive capacity, and the high consequences associated with its failure; all of which apply to this project. While we strongly agree with this concept generally, the added variable of SANDAG's commitment to relocate the train drastically shortens the otherwise long design life of this type of project. We agree that a 1 in 20 and low-risk aversion scenario is more appropriate when the design life of the project is the next 30 years, as this allows for a calibration of the project design that reduces impacts to coastal resources and coastal access while still managing risk.

We do also note that it is important to interpret the Commission's Sea Level Rise Guidance[2] in context. The Guidance provides that the Commission must consider critical infrastructure projects on a case-by-case basis, and that projects that facilitate relocation are preferred:

Chapter 7: Adaptation Strategies includes a goal regarding special considerations for protecting transportation infrastructure which states that applicants should:

> "Develop or update a long-term public works plan for critical facilities to address sea level rise: Develop a long-term management plan to address the complexities of planning for sea level rise that incorporates any potential maintenance, relocation, or retrofits and structural changes to critical facilities to accommodate changes in sea level, and obtain Coastal Commission certification." (page 140, California Coastal Commission Sea Level Rise Guidance)

The Guidance similarly supports incremental changes to transportation networks specifically to facilitate realignment:

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2 https://documents.coastal.ca.gov/assets/slr/guidance/2018/0_Full_2018AdoptedSLRGuidanceUpdate.pdf

> “Allow for phased implementation of realignment and relocation projects: In some cases it may be necessary to make incremental changes in transportation networks so that access to and along the coast can be maintained while also addressing coastal hazards over the long-term” (page 141, California Coastal Commission Sea Level Rise Guidance)

We strongly support the staff report in working towards its own adopted SLR Guidance and memorializing the legally binding aspects of SANDAG’s policy commitment to relocate the Del Mar section of the LOSSAN corridor by 2035.

Environmental documentation is missing

The Staff Report notes that DMB5 is categorically exempt from the NEPA and CEQA process. Additionally, SANDAG has made clear that there is a pressing need to embark on this project before the next rainy season, given the bluff failures that have resulted in emergency work in recent years.

While Surfrider notes the intense efforts and collaboration that have been pursued to achieve the proposal outlined in the staff report, we note the following as important environmental documentation that is noticeably not part of the report:

- Identification of an environmentally superior alternative - Including potentially an entirely different alternative; perhaps one that includes a ‘phased’ component to seawall installation

- Lack of Coastal Connections Study - SANDAG has failed to complete the Coastal Connections Study within the timeframe provided by its DMB Phase 4 permit. This staff report is therefore unable to include information about the public access projects being proposed in this project, which would otherwise help determine whether or not appropriate public access mitigation can be provided on a reasonable timeline.

- Risk assessment information justifying the location, extent, and needed timing of stabilization measures - Currently SANDAG appears to be justifying the accelerated timeline of the project on the fact that recent bluff failures have occurred in areas that were previously identified as ‘low risk.’ This broad swath approach to stabilizing the entire bluff is reactive and most likely over-assumes risk in certain areas, which will ultimately come at the consequence of coastal resources and coastal access.

Without these environmental documents, it is extremely difficult for Surfrider and the Commission to determine whether or not the current proposal represents the least environmentally damaging and feasible alternative. It is also difficult to determine whether the proposed mitigation, monitoring and reporting efforts are sufficient.

In light of these missing environmental documents and analysis, we submit that the most important step the Commission can take to finding Coastal Act consistency in this case is to secure maximum reasonable mitigation opportunities for this enormously consequential project. Below, we suggest mitigation opportunities and make recommendations to ensure accountability and transparency throughout the process.

Recommendation #1 - Make adjustments to support relocation

As has been discussed, this project can only meet Coastal Act requirements and the Commission's Sea Level Rise Guidance requirements by reaffirming SANDAG's already formal commitment to relocation of the Del Mar Section of the LOSSAN corridor by 2035. We suggest the following adjustments:

1a. Staff Report Language on Relocation and Automatic Extensions - We ask that staff make a minor adjustment to the report so as not to undermine SANDAG's commitment to relocate the track by 2035. It is possible to justify the 30-year permit timeline without undermining SANDAG's formal policy language in its RTP. For instance, the discussion on page 10 of the staff report states:

> "SANDAG is currently in the process of planning to relocate the tracks consistent with the regional transportation plan; however, given the magnitude and complexity of that effort and outstanding funding needs for final design, environmental review, and construction, implementation of the relocation would likely extend beyond the target date of 2035."

This should be amended to replace the phrase 'would likely' with 'may,' at a minimum. We suggest further amendments to acknowledge the difficulty of relocation, while adding language such as the below:

> "However, SANDAG has made a formal commitment in its Regional Transportation Plan that commits the agency to relocating this rail by 2035."

Surfrider also has concerns with the potential for undue delay given the automatic extensions currently granted in the conditional approval. Surfrider suggests the report implement a condition that addresses authorization term without allowing for automatic extensions upon application submission so that the project is not unduly delayed. We appreciate that Condition One otherwise memorializes the commitment to relocate the track by 2035.

1b. Removability of Seawalls - The removal of the seawalls permitted in this project is a critical step towards relocation, which allows for mitigation of lost public access and recreation. We make the following recommendations to strengthen the requirements for removable seawalls:

- Adjust conditions on authorization terms to remove rail abandonment aspects. Condition 1a states that the authorization of seawalls included in the consistency certification shall expire in 30 years or upon relocation and legal abandonment of the sections of railroad at issue in this action, whichever occurs first. We suggest amending this language to require the seawalls to be removed after 30 years or when the rail line is no longer in service. The North County Transit District (NCTD) may never formally abandon this section of rail — for instance NCTD still leases portions of its property to the City of Del Mar near the Del Mar Fairgrounds, though that area has not received rail service in decades. This condition should also clarify that the legally permitted purpose of the seawall may only pertain to bluff stabilization as long as rail service continues.

- Clarify whether the current seawalls will also be removed as part of the project. Surfrider assumes that the temporary and emergency seawalls that have been constructed by SANDAG through previous permits will also be removed when the rail is no longer in service. Removal of these seawalls will also be necessary to achieve the goals of a larger managed retreat effort. This should be clarified through Authorization Term conditions.

- The Commission should add a condition that the seawall is constructed only to protect the railroad and any other existing or future development cannot rely on the permitted seawall to establish geologic stability. Failure to include this type of special condition may result in SANDAG or other property owners claiming that continued authorization of the seawalls is necessary to accommodate existing or additional development.

- The Commission should add a requirement that SANDAG work with the City of Del Mar to develop a formal notification procedure to inform current and future blufftop property owners that the seawalls are temporary and will be removed by the end of the permit term. This will serve to negate any legal takings claims when the seawalls are scheduled for removal and prohibit any future claimed reliance on the seawalls to protect private property.

- The Commission should consider an opportunity to delay seawall construction as long as possible. Surfrider understands that the various components of the stabilization project (upper bluff stabilization, bluff toe stabilization, and other irrigation efforts) all work together, but bluff toe stabilization specifically manages wave overtopping caused by storm surge that is exacerbated by sea level rise. It is unclear whether or not the current seawall designs are necessary to meet today's erosion impacts to the bluff toe. If the seawalls are designed to mitigate risk that is forthcoming, then the seawalls can be permitted today with an agreement about a phased, trigger-based installation at a later date. This would reduce the impacts of the seawall on erosion, which will immediately extend the back of the beach seaward on some parts of the beach and compound erosion and access issues over time.

- The Commission should include a condition that SANDAG work with Scripps Institution of Oceanography to employ advanced geophysical instruments and utilize the data from their coastal LiDAR surveys to track bluff erosion and monitor slope stability at the site.

Recommendation #2 - Adjust public access mitigation proposals to be consistent with access and recreation policies of Chapter 3

Surfrider appreciates the capital improvement projects that have been suggested in the staff report. In particular, safe crossings at 7th Street and 11th Street as well as vertical access trails would be an improvement to the current situation of unsafe and insecure access to the walkable beach and enjoyable waves in the area.

We agree generally with staff that it is not possible to 'buy back a beach' in this area to provide in-kind mitigation for the dramatic impacts that this project will have on beach erosion and lateral beach access, as well as both vertical and lateral access throughout construction. If public access mitigation is the only available form of mitigation as in-kind mitigation is not possible, and if the project is missing necessary documents (as described above) that would be required to fully find Coastal Act Consistency, the Commission should seek to maximize public access as mitigation.

In the past, mitigation for seawall impacts over time was provided by payment of recreation fees to account for lost beach area.[3] Similar fee programs should be considered, perhaps for an endowment fund to manage the vertical trails (mentioned later). In contrast to previous fee programs that only mitigate for lateral access and placement loss, the DMB5 project must also mitigate for additional loss of vertical beach access from the blufftop to the beach and for lateral access along the beach. In order to address these impacts, additional mitigation is required to meet the nexus test of the impact. Simply rebuilding existing vertical access while access is lost for many years does not mitigate all impacts commensurately. Both vertical and horizontal access must be mitigated in the short and long term in order to meet the nexus tests of the Nollan and Dolan cases[4].

We note that even the current staff recommendation affords SANDAG up to seven years to complete the proposed capital improvement projects. Given that these projects may hinge on approvals from the North County Transit District and California Public Utilities Commission, it could take even longer. It is unreasonable that the City of Del Mar and the over 2 million annual Del Mar beach visitors should fail to benefit from public access mitigation for seven years or more. We suggest the following adjustments to help mitigate this scenario and provide further suggestions for mitigation opportunities:

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[3] See for example Land Use Plan (LUP) Amendment #LCP-6-SOL-16-0020-1 (Public Recreation Fee), CDP 6-05-072/Las Brisas Recreation Fee and CDP 3-02-024/Ocean Harbor House.

[4] See Nollan v. California Coastal Comm'n, 483 U.S. 825, 107 S. Ct. 3141, 97 L. Ed. 2d 677 (1987) and Dolan v. City of Tigard, 512 U.S. 374, 114 S. Ct. 2309, 129 L. Ed. 2d 304 (1994).

1 - Strengthen mitigation project opportunities. The capital improvement projects suggested in the report are critical for securing access in spite of construction, proposed fencing, and armoring. These projects should not be scaled back under any circumstance. To maximize the benefits of public access mitigation, we strongly urge the Commission to require vertical access and safe crossings at both 7th and 11th Street - not one or the other. Both of these are currently popular accessways that facilitate surfing, walking, and beach enjoyment over more than a mile of beach. There is a recognized surfing reef at 8th St. in Del Mar and 11th St. offers a unique peak as well.

2 - Include interim project opportunities in addition to the capital improvement projects. Much of the staging for this project occurs on Torrey Pines State Beach, and no public access mitigation has been suggested in this staff report. Surfrider suggests working with State Parks to make two public access improvements to Torrey Pines, which would provide some mitigation for State Parks access and possibly address the 7 year or more gap in which SANDAG could fail to provide access.

2a. Project #1 - We suggest working with State Parks on a project concept to create a living shoreline near the highbridge between Los Penasquitos Lagoon and Torrey Pines State Beach. The maintenance of the beach under the bridge is important for visitors coming from the North Torrey Pines parking lot, and is a valued access point for on duty lifeguards and for Junior Lifeguards practice. The beach in this area is vulnerable to high tides because of its location near the lagoon, the local geomorphology, and the fact that the substrate (which is fill from the historic rail construction) is very soft. In the past, State Parks has maintained the beach by inlet dredging but this area is a good opportunity for a more resilient living shorelines project with cobble toe. Funding is needed to haul the sand and cobble from the lagoon and would also assist with annual planned inlet maintenance. Such a project would make the area more resilient, provide critical public safety and public recreation access, provide an access point for Rail ROW maintenance and repair, and be designed to maximize habitat and resilience. It could also be completed in the near term and serve as a multi-benefit coastal resilience pilot project in the City of San Diego.

2b. Project #2 - State Parks has also identified three areas along Torrey Pines Road where a staircase would be useful for facilitating public access to the beach. This section of the beach is often physically separated from the southern part of the beach when the lagoon is breached. People who are trying to cross to the other section of beach, or who parked in the parking lot near the lagoon, would be able to access the beach considerably quicker than is currently possible. At least one option for a staircase in this area would not require armoring and would provide faster access to the beach for public safety and maintenance staff. This project could also potentially integrate with the City of San Diego's goals to construct an ADA beach access in the area.

3. Require SANDAG to report on CPUC and NCTD successes - The safe crossings at 7th and 11th Street will require California Public Utilities Commission (CPUC) and NCTD approval, where approval could fail to be provided or extend the timeline of this project. The Coastal

Commission should hold SANDAG to account in making a robust effort to secure these approvals. We recommend including a condition requiring SANDAG to show and report on robust efforts to secure approvals from both of these agencies.

4. Ensure that public access benefits remain after project is gone. The staff report is unclear on what will happen to the vertical accessways once the permit expires and the seawalls are removed. Surfrider supports maintaining these accessways even while a larger relocation effort is pursued. We recommend SANDAG be required to implement a formal rail to trail program, which would perhaps set up a process for transferring ownership such as through the establishment of an endowment fund that the City of Del Mar, State Parks, or some other entity could use to assume management of the trails in the future.

Recommendation #3 - Adjust wetland mitigation

The .28 acres of wetland habitat affected by this project are some of the last remaining intact wetlands in California. They are home to endangered species and habitat to native flora and fauna, and they provide carbon sequestration benefits. In a May 26th SANDAG presentation to the City of Del Mar Design Review Board, a statement was made by SANDAG that impacts to ospreys are not a concern and that they feed in the San Dieguito lagoon. This is inaccurate. Ospreys, peregrine falcons, crabs, and many other species use the tidal zone for feeding.

It is also unclear why staff has chosen a 1:1 mitigation ratio for wetlands when it is more common to use a ratio of 4:1. We suggest a minimum 4:1 ratio based on the Commission's own Procedural Guidance for the Review of Wetland Projects in the California Coastal Zone, which states that a "wetland mitigation ratio in excess of one to one" should be used and that a higher mitigation ratio helps to compensate for wetland acreage and functional capacity lost at the specific site. Given that the recommendation is fee-based, we recommend applying this funding to the suggested project at Torrey Pines, which affects the Los Peñasquitos Lagoon.

Recommendation #4 - Communications for transparency

We suggest making some adjustments to better communicate the impacts of this project to community members. In particular, we suggest clarifying:

The project construction timeline - We are under the impression, but it is not clear from the staff report, that construction will occur on a rolling basis to address areas marked in the staff report as high priority, then medium, then low. SANDAG should be required to clarify which sections of the bluffs are being worked over time, and this information should also be stated in the staff report.

Project endurance - It is not stated anywhere in the staff report that the upper bluff stabilization is, in fact, permanent. This is of significant consequence to those who care about the natural features of the bluff. This should be stated clearly in the report. The state of the soldier piles,

connecting grade beams at the surface and tie backs as they become exposed should also be further discussed.

Conclusion

Thank you for your consideration of these requests. We hope to see coastal resources and access recovered in Del Mar in the long-term upon inclusion and consideration of these permit adjustments for finding conditional concurrence for Coastal Act consistency.

Best,

Laura Walsh,
California Policy Manager
Surfrider Foundation

Mitch Silverstein
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Jim Jaffee
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From:	Smith, Darren@Parks
To:	Energy@Coastal
Cc:	Ahmad, Marya@Parks
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Friday, June 3, 2022 4:48:15 PM

Thank you for the opportunity to comment on the Consistency Certification of the Del Mar Bluffs Stabilization Project 5. A large portion of the Project is directly adjacent to California State Parks Property at Torrey Pines State Beach. We understand that the project to be certified includes approximately 1,360 feet of new or recently constructed or repaired sea wall and associated bluff stabilization adjacent to State Park property. Additionally, the Project will require access and potentially staging through California State Parks property along McGonigle Road and within the Torrey Pines State Beach (and Natural Reserve) Day Use Parking Lot for approximately 36 months.

The urgency of the Project and its importance to the region's transportation and commerce is clear. The impact of the Project to California State Park property, our operations, recreational opportunities and visitor experiences is similarly clear. The project will armor a large section of beach and alter bluff erosion that allows the beach to migrate and provides material to the beach and littoral cell. This will also cause changes to the aesthetics and visitor experience from a natural bluff beach interface into an essentially developed-appearing space. Additionally, construction noise, traffic, and staging will be disruptive to our operations and diminish the experiences of our visitors.

SANDAG has worked earnestly to reduce the effects of this Project and appears committed to the longer-term solution of removing the proposed seawall and realigning the rail so that it is not as vulnerable to coastal processes. This commitment would provide opportunities for greatly improved public access and improved visitor experience at Torrey Pines State Beach. We strongly support the commitment to re-aligning the rail corridor to a more inland location and restoring the beach and bluff to a more natural condition within the 30-year timeframe.

SANDAG has also provided provisions to reduce some of the coastal access impacts including three proposals in the City of Del Mar that would not improve access at Torrey Pines State Beach. SANDAG has been working with State Parks on their current access study and has asked for improved access concepts for Torrey Pines State Beach and Torrey Pines State Natural Reserve. California State Parks and SANDAG have maintained a good working relationship during recent projects (currently with Project 4 and related emergency work) and we generally support the measures they have implemented to reduce access and visitor experience impacts within our current Right-of-Entry negotiations. We are concerned that the scope and duration of Project 5 will be more disruptive than recent work. We would like to work with SANDAG to implement additional measures to mitigate these impacts.

Three concepts include:

1. Improving the North access underneath the high-bridge to accommodate Project 5 construction while maintaining visitor beach access, State Parks public safety vehicular access, and the junior lifeguard program . This could be accomplished by moving sand and cobble from the annual Inlet maintenance to in front of the Rail-Right-of Way below the high bridge. This area is currently vulnerable to coastal erosion and may threaten access to Project 5

during winter storms.
2. Constructing a short staircase north of the low bridge between the ADA switchback in the City of San Diego Right-of-way. This would greatly improve beach access for northbound pedestrians and reduce bluff erosion and public safety problems in this vicinity.
3. Adding a short beach access staircase north at a lower elevation portion of bluff, North of the low bridge would also allow improved beach access for southbound pedestrians along North Torrey Pines Road.

Thank You for considering our comments and suggestions. We look forward to working with SANDAG on this interim work and ultimately longer-term solutions to improving the quality and sustainability of Torrey Pines State Beach and Torrey Pines State Natural Reserve while supporting the region's transportation needs.

Darren Smith
Senior Environmental Scientist
California State Parks
San Diego Coast District
4477 Pacific Highway
San Diego, CA 92102
(619) 952-3895

From: Richard Cohen
To: Energy@Coastal
Subject: Please…
Date: Tuesday, June 7, 2022 7:55:50 PM

---

no long high seawall west of the mean high tide at south Del Mar. Do not destroy goat trail access at 7th and 11th and do not interfere with beach walkability. Thank you, Richard Cohen 313 7th St. Del Mar.

From: Laura DeMarco
To: Energy@Coastal
Subject: Updated Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date: Tuesday, June 7, 2022 6:08:36 PM

Dear Coastal Commissioners and Staff,

Thanks for meeting in Del Mar tomorrow so the public can share in-person insights on how SANDAG's Bluff Stabilization Project 5 (DMB-5) impacts the nearby beautiful bluffs, beach, and scenic trails. Hopefully, you can visit them while you are in Del Mar.

Thanks to the Commission's staff and public input, SANDAG's revised project no longer "shaves" the top of the bluff berm west of the RR tracks, grading is minimized, two existing beach access trails at 7th and 11th Streets are not blocked, and proposed mitigation improves public access.

Bluff stabilization is needed as there have been 8 large bluff slides in the last 3 years that could have derailed a train on the steep bluffs, killing or injuring its passengers and crew as well as beachgoers below. SANDAG's 30-year bluff retreat map and Del Mar's longer-term 2018 Coastal Hazards report shows that existing public access trails down the bluff face to the beach would erode away, followed by the rail line and lower bluff trail, the upper bluff trail, and then city infrastructure and properties near the bluff (see attached map).

Longer term, when the rail line moves from the bluffs, Del Mar will bear the costs for maintaining the bluff and its public access trails plus the liability for injuries and deaths from bluff slides onto the popular beach below. The small city of Del Mar cannot afford these costs so it is critical for any project on these fragile bluffs not to create long-term damage and restrict public access.

That's why NCTD cannot be allowed to add 1,000+ new points of stress from drilling 3-ft deep x 1-ft wide holes to install 6-ft tall wire fencing with heavy concrete footings into these crumbling bluffs. Nor should SANDAG's mitigation in DMB-5 include digging and excavating into the upper bluff to create a new trail and installing a 3-ft high, wood and cable fence. This creates more sources of damaging water intrusion into the unstable bluff.

Cutting away the bluff to create a new upper bluff trail may also not be feasible in many sections because of the steep topography, existing trees and plant material, geology, and poor drainage. It would also undermine adjacent private property and violate terms of ROW easements granted by private property owners to NCTD requiring use of the land solely for operation of the rail line.

It would be far better for the stability of the bluff and the enjoyment of the public to use the existing 1.6-mile lower bluff trail to connect Seagrove Park to Torrey Pines State Beach.

None of the DMB-5's proposed public access mitigation can proceed without the approval of NCTD as property owner. The San Diego Union-Tribune reports that NCTD is not on board according to a recent article excerpted below:

> NCTD Executive Director Matt Tucker said Tuesday he opposes the mitigation projects, which increase costs and construction time for work necessary to keep the train tracks safe.
>
> "Attempting to impose unrelated and unfunded conditions on a railroad maintenance and safety project that is critical to the stability of our region's infrastructure is an overreach of authority by the Coastal Commission," Tucker said in an email. "It underscores the reasons NCTD filed the petition with the Surface Transportation Board and the need for the STB to issue its decision."

If NCTD does not approve DMB-5's public access mitigation, please designate the project's $8.68M CIP mitigation budget to fund a Del Mar Bluff endowment for future public access improvements on the bluff.

SANDAG's prior DMB-4 project required a coastal access study due in February with NCTD's participation. Its continued delay along with NCTD's STB petition indicates that this public transit agency, created and funded by the state legislature, does not intend to abide by the Commission's agreements with SANDAG and state environmental laws that the Commission enforces, the Coastal Act and CEQA.

Unfortunately, if the Commission denies or delays approval of this bluff stabilization project, it may help NCTD's claim to the STB that preemption is needed for the operation of the rail line endangered by unstable bluffs.

We appreciate the opportunity to provide public input to SANDAG's bluff stabilization project and are grateful for your

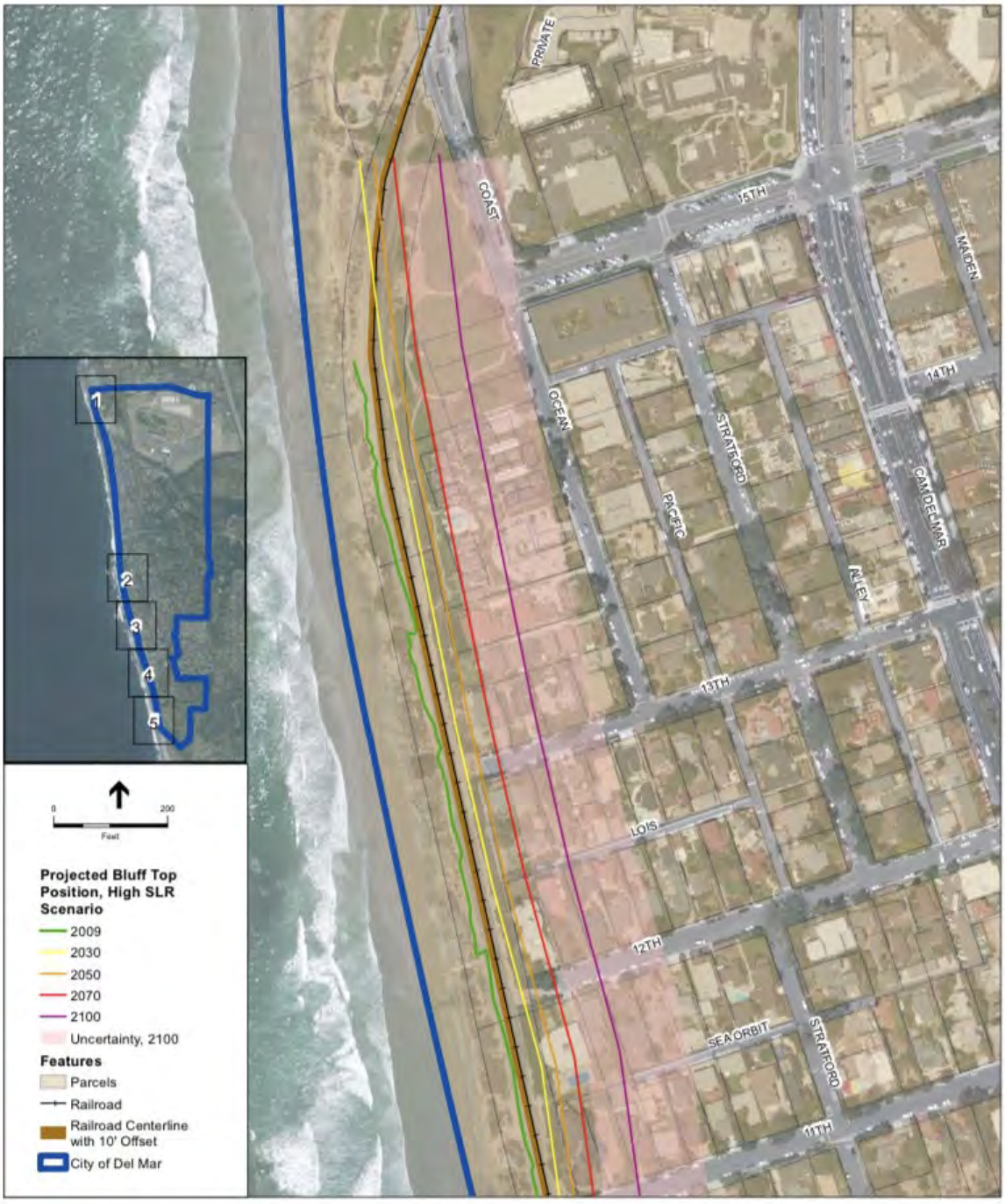
support of Del Mar’s scenic bluffs by opposing NCTD’s STB petition for preemption.

Thanks for your consideration,

Laura and Ralph DeMarco, Del Mar

P.S. 2018 SLR Del Mar Coastal Hazards Map

Estimated Impact of High Sea Level Rise



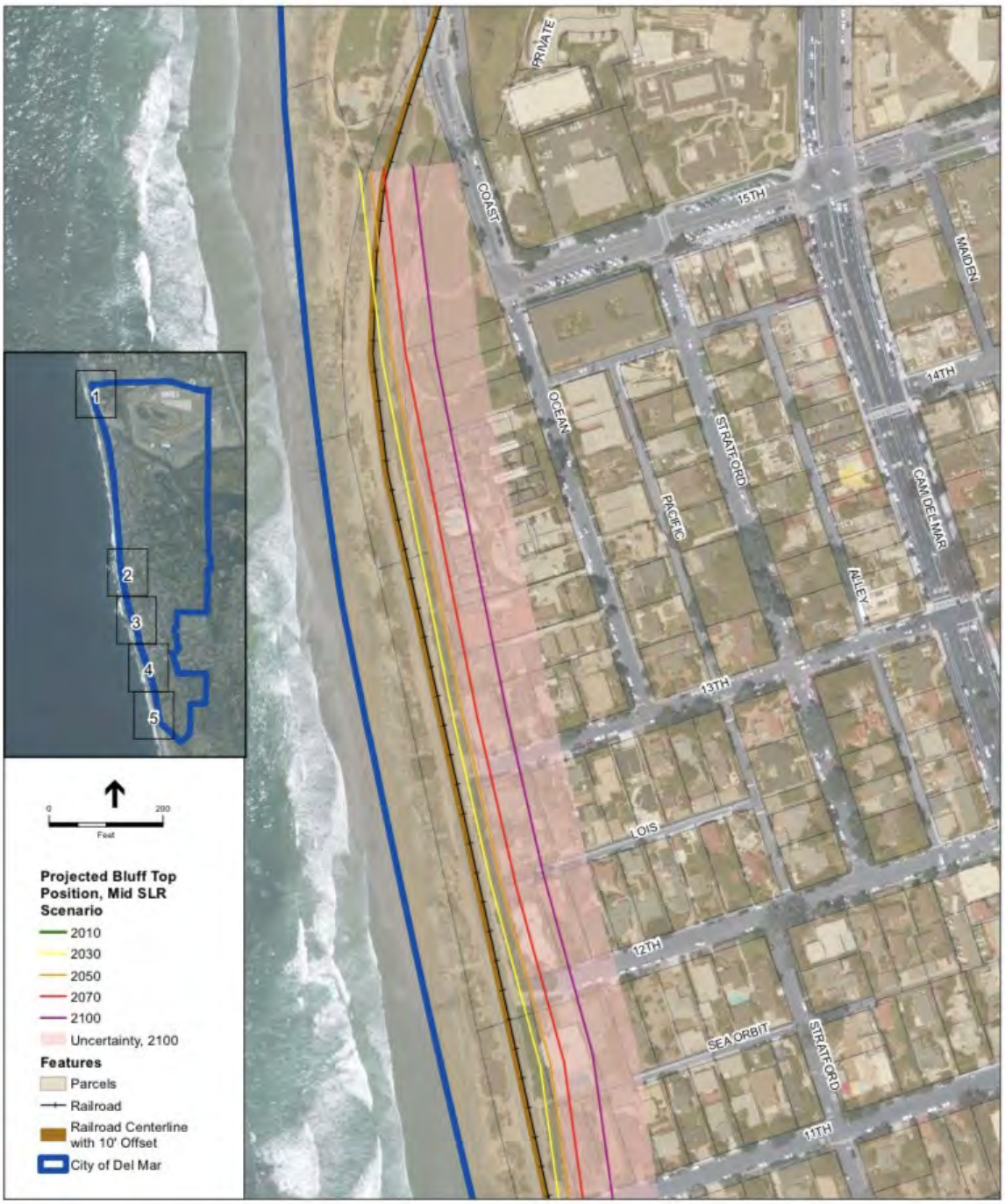
SOURCE: SanGIS 2016, USGS 2015

Note: Projected bluff top position for 2100 is interpolated from CoSMoS 3.0 results with 1.5 m SLR and 2.0 m SLR. Positions for 2030 – 2070 are interpolated based on CoSMoS 3.0 erosion rates. Positions in 2010 (north) and 2009 (south) are based on LiDAR elevation data.

Del Mar Vulnerability Assessment . D150347

Figure 30.2
High Sea Level Rise in Del Mar
Properties and Roads Vulnerability

Estimated Impact of Medium Sea Level Rise



SOURCE: SanGIS 2016, USGS 2015

Note: Projected bluff top positions are based on CoSMoS 3.0 results for 2100 with 1.0 meter SLR. Positions for 2030 – 2070 are interpolated based on CoSMoS 3.0 erosion rates. Positions in 2010 (north) and 2009 (south) are based on LiDAR elevation data.

Del Mar Vulnerability Assessment . D150347

Figure 29.2

Mid Sea Level Rise in Del Mar Properties and Roads Vulnerability

From:	Palato, Adriana@Coastal
To:	Energy@Coastal
Subject:	FW: Comment on Item 7b, Coastal Commission meeting April 8, 2022
Date:	Wednesday, June 1, 2022 2:46:57 PM

From: Camilla Rang <camillarang@yahoo.com>
Sent: Tuesday, May 31, 2022 9:41 PM
To: Padilla, Stephen@Coastal <Stephen.Padilla@coastal.ca.gov>; Brownsey, Donne@Coastal <donne.brownsey@coastal.ca.gov>; Bochco, Dayna@Coastal <dayna.bochco@coastal.ca.gov>; Turnbull-Sanders, Effie@Coastal <effie.turnbull-sanders@coastal.ca.gov>; Aminzadeh, Sara@Coastal <sara.aminzadeh@coastal.ca.gov>; Hart, Caryl@Coastal <caryl.hart@coastal.ca.gov>; Wilson, Mike@Coastal <mike.wilson@coastal.ca.gov>; Rice, Katie@Coastal <katie.rice@coastal.ca.gov>; Escalante, Linda@Coastal <linda.escalante@coastal.ca.gov>; Harmon, Meagan@Coastal <meagan.harmon@coastal.ca.gov>; Uranga, Roberto@Coastal <roberto.uranga@coastal.ca.gov>; Groom, Carole@Coastal <carole.groom@coastal.ca.gov>; Ainsworth, John@Coastal <John.Ainsworth@coastal.ca.gov>; Lilly, Diana@Coastal <Diana.Lilly@coastal.ca.gov>; Prahler, Erin@Coastal <Erin.Prahler@coastal.ca.gov>; Leach, Stephanie@Coastal <stephanie.leach@coastal.ca.gov>; ExecutiveStaff@Coastal <ExecutiveStaff@coastal.ca.gov>; SanDiegoCoast@Coastal <SanDiegoCoast@coastal.ca.gov>; Schwing, Karl@Coastal <Karl.Schwing@coastal.ca.gov>; EnvironmentalJustice@Coastal <EnvironmentalJustice@coastal.ca.gov>
Subject: Comment on Item 7b, Coastal Commission meeting April 8, 2022

Dear Coastal Commissioners and staff,

As I am grateful that SANDAG is putting in effort in making Del Mar bluff safe (for the train), I am also deeply saddened and shocked over the height and amount of seawalls/bluff toe constructions they want to install. They actually want to add a straight line of 10 foot seawalls all along our beach and fill it with rif raf behind so that they can artificially build up a "new" face of the bluff. That first means they are going to scrape the bluff of all its vegetation and animals, dump top soil over it to reshape it into something of their liking and then hold it up with seawalls. It sounds like the most insane and ecologically disastrous plan that has ever come up and been taken seriously.

How much destruction of nature are we going to allow so that NCTD can run more money-making freight trains (and empty passenger trains). How about they just run the volume of trains as presence and slow them down? Just one stop south of Del Mar, in Sorrento Valley, the train is going so slow due to an uphill that you think you´re on a sight seeing tour . Why not do the same along the 1.7 mile bluff stretch? Where there actually is something to see! **Please ask SANDAG how much stabilization they would need to just keep things as they are until the train is relocated**.

How much public access to nature are we going to allow to be cut off for the same reason as above?

With these suggested sea walls, two historical beach paths are being cut off (with a vague promise of putting one of them back some time in the far away future). Please, do NOT allow them to put up ANY seawalls that will cut off access to the two beach paths by 7th and 11th street. If seawall is going up, they need to put steps on the other side of the wall so that we can get down to the beach and back up. We cannot jump 10 feet straight up in the air, nor hop down 10 feet with surfboards, beach chairs and kids in hand. **NO SEAWALL WITHOUT SIMULTANEOUS BEACH ACCESS!** A vague promise to reinstate access some 5-10 years down the line simply is simply not good enough!

Study after study show how bad sea walls are for the environment. It is like an ecological disaster with a cascade effect of loss of biodiversity and species. The beach will first become narrower and disappear as a result of the way the water hits the sea wall. This in turn will lead to that scavenging invertebrates (amphipods, sand crabs, etc) vanish. Shore birds and migratory birds lose their food source and disappear. Grunions, who are dependent on wide beaches for their reproduction disappear. Shore fish disappear, which leads to that birds, such as osprey that we enjoy watching diving down from the bluff top to catch a shore fish, will no longer come there for their catch. Beach and bluff nesting birds will disappear. In fact, studies show that shore bird presence decreases 3-fold with seawalls.

Please, no more seawalls, SANDAG has already installed so much seawall along our otherwise stunning beach. The last one they put up is 14 feet tall! It looks hideous! Please, please, please, instead of seawalls, have them do pilings, the least of the two evil. I know that part of the reason to prefer seawalls is that they can b e removed, but that is some 30 years down the line. The damage that this 1.7 mile long continuous seawall will do to our beach and access far outweighs the benefit of a possible removal in 30 years. Don´t let SANDAG put them in, please, just don´t. But if you feel you have no other choice, at least mitigate it so that access is ensured at 7th and 11th at the same time as the seawalls go up.

Thank you for all that you do, and thank you for all that you are doing in regards to NCTD´s plans to fence our bluff. Please know that 10 foot seawalls down by the beach will have the same disastrous effect as the fence when it comes to public access. Both will cut off century long beach access paths.

Sincerely,

Camilla Rang
159 10th Street, Del Mar, CA 92014

From:	Laura Pierce
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 2:30:23 PM

Dear Commissioner -
I wanted to provide input on the proposed solution to bluff stabilization. I read that sea walls are being proposed and would ask that another solution be considered so that we don't lose walkable beach access south of 15th Street. I often walk from 15th St to Torrey Pines beach and I would hate for this access to be taken away. Sea walls would also block the natural beauty of the bluffs - this seems counter to maintaining the natural beauty of our coastline. Please consider less destructive engineering -

You must also continue to work to move the trains off the bluff ASAP - that is what is most destructive. Please strive to at least move the heavy freight trains — my house vibrates when they go by — I can't imagine what they are doing to our bluffs.

Thank you,
Laura Pierce
13th St, Del Mar

From: JOHN SPELICH
To: Energy@Coastal
Subject: Public Comment on June 2022 Agenda Item Wednesday 7b – CC-0005-21 (SANDAG, San Diego Co)
Date: Wednesday, June 1, 2022 2:13:30 PM

Dear Commissioners:

As a resident of Del Mar, I write in opposition to the proposed plan for Del Mar's beach and bluffs. Please please do NOT allow allow our South Beach and Bluff to be buried behind those hideous seawalls that will sit west of the mean high tide line. If you approve this, not only will you inflict a scar on the southern face of the city that will remain for decades to come, you will destroy the ability to enjoy the coast by walking between Torrey Pines Beach and Del Mar, as many of us like to do, because the beach will be blocked at high tide. As an alternative, please consider mandating buried soldier piles wherever possible. From what we've been given to understand, these will do the job of protecting the rail line without the concomitant damage to our beach front.

Sincerely,

John W Spelich
Del Mar
jspelford@aol.com

From:	Neuman, Tom
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b – CC-0005-21 (SANDAG, San Diego Co
Date:	Wednesday, June 1, 2022 1:59:18 PM

Dear Commissioners:

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Tom Neuman, MD, FACP, FACPM, FUHM
Emeritus Professor of Medicine
UCSD School of Medicine

From:	My Email
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 1:38:06 PM

This is absolutely atrocious. How could this possibly even be considered given to the fact that the entire point of living in Del Mar is for beach access. I will be moving out of Del Mar if this passes and I’m sure many others will also be relocating.

From:	Graham Howes
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 1:12:58 PM

Dear Commissioners:

• Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the
mean high tide line.

• The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach
is now).

• Please install Soldier Piles instead of Seawalls wherever possible.

Please do not destroy our precious coastline. It brings joy and happiness to so many people.

Thanks and Best Regards,

Graham Howes

Del Mar, CA

From:	Amy Snyder
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 1:12:35 PM

Dear Commissioners:

I'm a long-time Del Mar resident and I want to register my disappointment that the Commission is entertaining the most invasive, radical approach for stabilizing the Del Mar Bluffs. Namely, to bury them behind long, high seawalls west of the mean high tide line.

Please resist the temptation to adopt this approach – it's the lazy way out, and you will be met with strenuous community outrage because installing seawalls means there will be no walkable beach along the seawalls at high tide (like Solana Beach now), and these seawalls will block access down the 11th and and 7th Street "goat trails" which have been in continuous use for decades.

Don't destroy our bluff and beaches. Less destructive engineering is possible. Please install buried soldier piles instead of seawalls wherever possible.

Sincerely,

Amy Snyder
Del Mar, CA

From:	Jason Grindle
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 12:55:30 PM

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

-Jason Grindle

From:	Shannahoff, David
To:	Energy@Coastal
Cc:	Terry Gaasterland; Tracy Martinez; PAMELA SLATER-PRICE; Hershell Price
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 12:50:06 PM

Dear Commissioners:

First, let me state that I have been a resident in Del Mar for the last 53 years and I have enjoyed the beaches almost daily now for over a half century.

Here is a short list for your consideration to help protect the integrity of our beaches, Del Mar as a town, and the California coastline, one of the most unique treasures in our country.

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Thank you for your attention to this most serious and dangerous matter that will ruin Del Mar, impair the lives of its residents and the tens of thousands of San Diego county residents and tourists that visit our beaches yearly.

Sincerely,

David Shannahoff-Khalsa
507 1/2 Van Dyke Ave
Del Mar, CA 92014

From:	Steve Reich
To:	Energy@Coastal
Cc:	"Steven D. Reich"
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 12:28:46 PM

Commissioners-

I agree with the following points that have already been brought to your attention.

• Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the
mean high tide line.
• The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach
is now).
• Please install Soldier Piles instead of Seawalls wherever possible.

Thank you for your attention to this issue.

-Steve
Steve Reich
202 Stratford Park Circle
Del Mar, CA 92014
Mobile: (858) 204-6321
steve.reich@sbcglobal.net

From:	Deb Mills
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Wednesday, June 1, 2022 12:18:01 PM

Dear Commissioners:

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th Stand 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Constructing this so-called sea wall as proposed, will not keep people from trying to access the beaches by various means. This can entail vandalism, destruction and possible serious injuries.
This plan has the very likely potential of placing undue liability on the City and people of Del Mar.

Debra Mills
308 Ocean View Avenue
Del Mar

From:	Albert Hugo-Martinez
To:	Shannahoff, David; Energy@Coastal
Cc:	Terry Gaasterland; Tracy Martinez; PAMELA SLATER-PRICE; Hershell Price
Subject:	Re: Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 12:52:30 PM

BRAVO
WHAT NEXT?
WHO DOES WHAT?
WHEN ?

From: Shannahoff, David <dshannahoffkhalsa@ucsd.edu>
Sent: Wednesday, June 1, 2022 1:49 PM
To: EORFC@coastal.ca.gov
Cc: Terry Gaasterland; Tracy Martinez; PAMELA SLATER-PRICE; Hershell Price
Subject: Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)

Dear Commissioners:

First, let me state that I have been a resident in Del Mar for the last 53 years and I have enjoyed the beaches almost daily now for over a half century.

Here is a short list for your consideration to help protect the integrity of our beaches, Del Mar as a town, and the California coastline, one of the most unique treasures in our country.

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Thank you for your attention to this most serious and dangerous matter that

will ruin Del Mar, impair the lives of its residents and the tens of thousands of San Diego county residents and tourists that visit our beaches yearly.

Sincerely,

David Shannahoff-Khalsa
507 1/2 Van Dyke Ave
Del Mar, CA 92014

From:	River Cohen
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Friday, June 3, 2022 7:06:39 AM
Attachments:	image001.png

Dear Commission,
Please do not allow this project to be considered, I recently moved to Del Mar for the scenic beauty and the beaches.
No Sea Wall
Explore Alternatives
Do not destroy our beach way of life and ecosystem

Thank you

With Gratitude,

River Cohen
p 480.818.0353 | f 480.323.2944 | e river@datainsure.com

Datainsure

From: victoria bradshaw
To: Energy@Coastal
Subject: Public Comment on June 2022 Agenda item Wednesday 7b-CC-0005-21 (SANDAG, San Diego Co)
Date: Friday, June 3, 2022 12:41:44 AM

Coastal Commissioners:

I have just become aware of SANDAG'S request to erect a 10 foot tall continuous seawall from Torrey Pines Beach to 15th Street in Del Mar. As a life long Del Mar resident, I have witnessed the gradual disruption of our natural landscape throughout my lifetime. These changes have occurred both by natural erosion and man-made constructions. The natural bluffs and canyons are what define this area. What makes this area unique to us is the ability to be close with nature.
Erecting a mile long 10 foot high seawall will do just the opposite.

Don't destroy our beautiful **Bluff** and the **Beaches** with seawalls!!!

You must **not** allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line. It will be an ugly eye sore, prevent us, the public from accessing the beach and destroy the beach ecosystem.

Is this for the safety of the trains which run along the top of the beach cliff? What solution is this, since we have already been alerted to the plan to relocate the trains inland?

Is this for the sake of the houses at the top of the cliff?
The seawalls erected in North Del Mar beaches by homeowners to protect their homes from pounding winter waves were deemed a public "hazard" and homeowners told to tear them down by government agencies. Which they did.

A ten foot high and mile long seawall will not only result in the lack of pedestrian access to the beach as mandated by the California Coastal laws, but will actually deplete the amount of sand on the beach due to the effect of tidal and wave erosion.

Thus, undermining the very object you say you wish to save, ultimately causing the quickening of the bluff to collapse!

As the beach itself narrows,
a catastrophic cascading ecological disaster develops,
resulting in the loss of wildlife and biodiversity on our precious beach.

Less destructive engineering is possible. For example, install buried Soldier Piles instead of Seawalls wherever possible!

Victoria Bradshaw, PhD

858/401-2334

From:	Barbara
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Thursday, June 2, 2022 11:14:20 PM

Dear Commissioners,

Please do not destroy the walkable beach areas in Del Mar with a long and high sea wall. The beaches are a public treasure to our community and all beach goers and the sea wall will completely remove the access. There are better ways to solve this problem, such as using Soldier Piles. The sea wall will destroy the vegetation and animal life in these areas and that doesn't seem to be the right direction as we try to save our natural environment. We urge you to reconsider the idea of a sea wall that prohibits public access and causes more harm.

Thank you for listening and taking all information in consideration for this important decision.

Sincerely,
Barbara & Doug Myers.
Del Mar

Sent from my iPad

From:	Jennifer Terchek
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Thursday, June 2, 2022 11:03:03 PM

Dear SANDAG, Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
*The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now). *Historic access down 11th St and 7th St "goat trails" will be unusable. *Please install buried Soldier Piles instead of Seawalls wherever possible. *Don't destroy the Bluff and the Beaches. Less destructive engineering is possible
For
Sounds like this is a REALLY bad idea environmentally. Who comes up with these insane ideas? Would think we would want to conserve this beautiful stretch of beach for generations to come and the animals who live there.

Regards,
Jennifer Terchek
Del Mar, CA

Sent from my iPhone

From: Wendy Root Cate
To: Energy@Coastal
Subject: Public Comment on June 22 Agenda Item Wednesday 7b-CC-0005-21 (SANDAG, San Diego Co)
Date: Thursday, June 2, 2022 10:02:17 PM

Dear Coastal Commissioners:

Please oppose SANDAG's plan for 10 foot Seawalls on Del Mar's South Beach. These walls will block resident access for recreation as well as emergencies, and prevent use of established trails. The Seawalls will be west of the mean high tide line, which means that it will not be possible to walk on the beach at high tide. Many people now enjoy walking or running on the beach all year. Surfing and swimming would also be adversely affected. Seawalls will ruin the beach and damage the ecosystem of the bluff and beach. This would be difficult to replace.

If the bluff needs to be reinforced, perhaps soldier piles, strategic sand replenishment or big rocks would help, without harming the beach. Del Mar now has magnificent bluffs and beaches which we should try to preserve in their natural state, as much as possible. I want the train to be relocated to a tunnel soon, so that stress will be removed from the bluff and we can preserve it for future generations.

Thank you for your efforts to require NCTD to provide an environmental analysis of fencing on the Del Mar bluff and to obtain a Coastal Development Permit for that fencing. I really appreciate all you have done to help save the Del Mar Bluff. Please help us to save the beach, also.

Sincerely yours,

Wendy Cate
615 Stratford Court #8
Del Mar, CA 92014

From: Udo Wahn
To: Energy@Coastal
Subject: Public comment on agenda item W 7b-CC-0005-21 (SANDAG)
Date: Thursday, June 2, 2022 4:19:56 PM

Letter to the California Coastal Commission June 3,2022

RE: June 2022 Agenda Item W 7b-CC-0005-21 (SANDAG)

My Name Dr. Udo Wahn
Resident of Del Mar for 39 years

Public safety is a major concern as it relates to the trains running along the fragile bluffs in Del Mar.

These bluffs must be stabilized at least until the tracks are relocated, which I hope is ASAP.

DMB5 is a massive project that will forever marr the natural features of the Del Mar coastline and will result in the urbanization of the beach. For this reason I call for significant mitigation.

I support the 3 public access projects that are called for and I would hope that we can secure agreement with the CPUC and NCTD to use the right of way to complete those projects.
I would imagine that it must be determined who will accept liability for these projects going forward.

I also feel strongly that at grade crossings with access to the beach at 7th and 11th streets is critical.

Considering that upper bluff work including irrigation, soldier piles, grade beams and tie backs need to be done. I suggest that they be done first and seawall construction commence much later.

In addition it is my hope that the seawalls can be scaled back in

height and used sparingly as they will severely impact available beach access. This project should also clearly spell out and fund the removal of the sea walls as soon as the tracks are relocated.
I am also very concerned about the tidal zone habitat that will be severely disrupted. Many species including peregrine falcons, ospreys, crabs and many other smaller life forms will be severely impacted.

Mitigation for the many years of access loss during the project must be addressed in a fair and meaningful manner. There must be at least some public access points while this project is underway.

Thank you for your efforts and please take my comments and those of the public speakers in consideration and amend this staff report in keeping with the Coastal Act.

Respectfully,
Udo Wahn M.D
1227 Stratford Court
Del Mar, CA

From:	Rory Bennett
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b – CC-0005-21 (SANDAG, San Diego Co)
Date:	Thursday, June 2, 2022 4:18:25 PM

Dear Commissioners,

Please stop for a moment and take a good, hard look at what's proposed for our Del Mar Beach -- perhaps the most beautiful, peaceful and enjoyable stretch of coastline in all of Southern California.

Please do not move forward with the proposal by SANDAG to erect a gigantic seawall along this beach.
It's invasive, will severely impede public access, will destroy the sandy stretch we've worked so hard to maintain, and will essentially ruin our future environment.

Next to no one rides these passenger trains anymore, the tracks are planned to be moved inland very soon, and freight transport is a private enterprise -- certainly nothing our tax dollars should be supporting.

I implore you to ask this question: Why is it necessary to destroy our environment in order to "save" it?

Thank you, in advance, for doing the right thing.

Sincerely,

Rory Bennett
Del Mar

From:	Dora Csurgai
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Thursday, June 2, 2022 4:05:11 PM

Please see my comments about This is about 7b - CC-0005-21 (SANDAG, San Diego Co)

->Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
->The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
->Historic access down 11th St and 7th St "goat trails" will be unusable.
->Please install buried Soldier Piles instead of Seawalls wherever possible.
->Don't destroy the Bluff and the Beaches.

-> collapsing bluff of sandstone will eventually take down the wall

->sea walls eliminate sand retention in a beach.

Sincerely,

Dora Csurgai
Del Mar

From:	Reisner, Ralph
To:	Energy@Coastal
Subject:	Comment on June 2022 agenda item Wednesday 7b- CC-0005-21(SANDAG,San Diego Co)
Date:	Thursday, June 2, 2022 3:45:38 PM

Dear Staff and Coastal Commission, Commissioners:

We write to urge you to reject SANDAG's proposal to install a 10 foot seawall along significant stretches of Del Mar's beach front.

We understand the need to solidify portions of the bluff from further erosion. However the installation of soldier piles would be far less environmentally damaging and serve to protect the interests of entities associated with the safe operation of rail traffic.

We assume that enviromental protection is a *fundamental and essential element* if all Coastal Commission actions. The proposed sea wall would be at war with this purpose for three reasons:
(1) because of its height, a wall would in effect serve as a barrier to publics' *access to the beach* for long stenches of a unique beach setting long enjoyed by the public;
(2) a ten foot sea wall will serve to narrow the beach and lead to unforeseeable ecological damage;

(3) the erection of a ten foot high rusting steel barrier will degrade a spectacular **natural** artifact combining unique flora , fauna and sea vistas amidst irregular bluff fronts;

We respectfully urge that the Coastal Commission to instead authorize the installation of *soldier piles* adjacent to the rail bed as the the *least restrictive alternative* in addressing the safety needs of railroad interests.

Ralph and Danute Reisner
268 Surfiew Ct.
Del Mar, Ca. 92014

From:	Alfonso
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Thursday, June 2, 2022 3:15:43 PM

Hi

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable. Which I and many surfers use to access the surf.
- Please install buried Soldier Piles instead of Seawalls wherever possible.
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible

Thanks
Alfonso Saballett
10668 Arbor Heights Ln.
San Diego, CA 92121

From:	qin-hong
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Thursday, June 2, 2022 3:03:12 PM

Dear Coastal Commission

I am a resident of Del Mar. I am writing to ask you please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line. The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now). Historic access down 11th St and 7th St "goat trails" will be unusable. Please install buried Soldier Piles instead of Seawalls wherever possible. Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Thank you for your consideration.

Best,
Qin-Hong Anderson

From:	Kristi Stockton
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Thursday, June 2, 2022 1:52:40 PM
Attachments:	image001.png

Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line. The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now). Historic access down 11th St and 7th St "goat trails" will be unusable. Please install buried Soldier Piles instead of Seawalls wherever possible. Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Sincerely,

Kristi Stockton

NEXT LEVEL BUSINESS COACHING
Real. Simple. Next Level Results. With EOS
EOS IMPLEMENTER
KRISTI STOCKTON
Administrative Director
O. 760-720-9270
C. 619-886-3161
kristi@btigrowthadvisors.com
nlbcoach.com

From: SanDiegoCoast@Coastal
To: NCTD Fence Public Comment
Subject: FW: Shame On NCTD
Date: Thursday, June 2, 2022 1:37:04 PM

-----Original Message-----
From: Jason Estudillo <jasonestudillo@yahoo.com>
Sent: Thursday, June 2, 2022 12:19 PM
To: cblakespear@encinitasca.gov; MayorToddGloria@sandiego.gov; asotelosolis@nationalcityca.gov; hasan.ikhrata@sandag.org; priya.bhat-patel@carlsbadca.gov; keith.blackburn@carlsbadca.gov; spadilla@chulavistaca.gov; jmccann@chulavistaca.gov; bsandke@coronado.ca.us; nathan.fletcher@sdcounty.ca.gov; joel.anderson@sdcounty.ca.gov; Terra.Lawson-Remer@sdcounty.ca.gov; mdonovan@coronado.ca.us; ddruker@delmar.ca.us; dquirk@delmar.ca.us; jmosca@encinitasca.gov; khinze@encinitasca.gov; mmorasco@escondido.org; cmartinez@escondido.org; Edward.Spriggs@imperialbeachca.gov; Paloma.Aguirre@imperialbeachca.gov; marapostathis@cityoflamesa.us; jmendoza@lemongrove.ca.gov; ggastil@lemongrove.ca.gov; monarios@nationalcityca.gov; mbush@nationalcityca.gov; rkeim@oceansideca.org; jmullin@poway.org; cfrank@poway.org; vivianmoreno@sandiego.gov; MarnivonWilpert@sandiego.gov; RaulCampillo@sandiego.gov; JoeLaCava@sandiego.gov; sjenkins@san-marcos.net; EMusgrove@san-marcos.net; clerk@cityofsanteeca.gov; dzito@cosb.org; jedson@cosb.org; jfranklin@cityofvista.com; jgreen@cityofvista.com; nora.vargas@sdcounty.ca.gov; Dallarda, Gustavo R@DOT <gustavo.dallarda@dot.ca.gov>; Fox, Ann M@DOT <ann.fox@dot.ca.gov>; clerk@sandag.org; Ainsworth, John@Coastal <John.Ainsworth@coastal.ca.gov>; Padilla, Stephen@Coastal <Stephen.Padilla@coastal.ca.gov>; Brownsey, Donne@Coastal <donne.brownsey@coastal.ca.gov>; Bochco, Dayna@Coastal <dayna.bochco@coastal.ca.gov>; Turnbull-Sanders, Effie@Coastal <effie.turnbull-sanders@coastal.ca.gov>; Aminzadeh, Sara@Coastal <sara.aminzadeh@coastal.ca.gov>; Hart, Caryl@Coastal <caryl.hart@coastal.ca.gov>; Wilson, Mike@Coastal <mike.wilson@coastal.ca.gov>; Rice, Katie@Coastal <katie.rice@coastal.ca.gov>; Escalante, Linda@Coastal <linda.escalante@coastal.ca.gov>; Harmon, Meagan@Coastal <meagan.harmon@coastal.ca.gov>; Uranga, Roberto@Coastal <roberto.uranga@coastal.ca.gov>; Groom, Carole@Coastal <carole.groom@coastal.ca.gov>; ExecutiveStaff@Coastal <ExecutiveStaff@coastal.ca.gov>; SanDiegoCoast@Coastal <SanDiegoCoast@coastal.ca.gov>; Schwing, Karl@Coastal <Karl.Schwing@coastal.ca.gov>; EnvironmentalJustice@Coastal <EnvironmentalJustice@coastal.ca.gov>; mtucker@nctd.org; tkranz@encinitasca.gov; esanchez@oceansideca.org; pmcnamara@escondido.org; jim.desmond@sdcounty.ca.gov; ccontreras@cityofvista.com; tgaasterland@delmar.ca.us; aflores@nctd.org; Lilly, Diana@Coastal <Diana.Lilly@coastal.ca.gov>; Prahler, Erin@Coastal <Erin.Prahler@coastal.ca.gov>; Leach, Stephanie@Coastal <stephanie.leach@coastal.ca.gov>; matt.hall@carlsbadca.gov; lheebner@cosb.org; rbailey@coronado.ca.us; crodriguez@oceansideca.org; svaus@poway.org; jennifercampbell@sandiego.gov; rjones@san-marcos.net; JMinto@cityofsanteeca.gov; teresa.acosta@carlsbadca.gov; kharless@cosb.org; kmelendez@cityofvista.com; dworden@delmar.ca.us; tmartinez@delmar.ca.us; peder.norby@carlsbadca.gov; StephenWhitburn@sandiego.gov; MMontgomerySteppe@sandiego.gov; ChrisCate@sandiego.gov; SeanEloRivera@sandiego.gov; msalas@chulavistaca.gov; bwells@cityofelcajon.us; jshu@cityoflamesa.us; rvasquez@lemongrove.ca.gov; jritter@cityofvista.com
Subject: Shame On NCTD

On March 5th, NCTD brazenly defied two strongly worded letters from the California Coastal Commission plus a letter from the California Attorney General ordering NCTD to go through the correct channels and follow CEQA and the Coastal Act. In response, NCTD instead filed a motion for fast tracking their petition with the federal Surface Transportation Board to get the permission to completely ignore all of California´s environmental protection and public access laws. Shame on them! I am grateful to the California Coastal Commission who responded with filing a Cease and Desist order on NCTD. Don´t touch our bluffs without following coastal laws!
Thank you.

Jason Estudillo

From: Lynne Bernard
To: Energy@Coastal
Subject: Del Mar seawalls
Date: Thursday, June 2, 2022 1:07:07 PM

Dear Commissioners:

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Sincerely, Lynne Bernard
13th St.
Del Mar, CA 92014

From: OffshoreWind
To: Energy@Coastal
Subject: FW: Del Mar Bluff ...Staballization?
Date: Thursday, June 2, 2022 11:48:47 AM

-----Original Message-----
From: cathyinsd <tcmcarruthers@gmail.com>
Sent: Thursday, June 2, 2022 11:44 AM
To: OffshoreWind <osw@coastal.ca.gov>
Subject: Del Mar Bluff ...Staballization?

Dear Coastal Commission,

I am a concerned citizen that walks the Del Mar bluffs/beach a few days every week, so I have some idea about the bluffs.
I had a life long dream to live in this beautiful village by the sea. Years ago that dream came true. I fully appreciate the daily life and beauty of Del Mar wild life, Bluffs and beach. I can't imagine anyone destroying our bluffs with a mile or 2 of concrete stabilization/fences or more ugly things like they have already done. Our natural cliffs are thousands of years old and PERFECTLY BEAUTIFUL. I can't imagine destroying them for a train, that is going to have to be moved in the next 40 years! The wildlife including falcons, osprey and warblers are nervous with all the construction and I haven't seen "Lary", our favorite egret, since construction started on the bluffs.

**** Stabilization?? It's ridiculous how many times this current Del Mar/Torrey Pines construction site engineers have miscalculated. At least 3 times they have had bluff failures while working on the current project. One time, blowing out a HUGE chunk of the bluff, because they didn't even allow a place for water to flow from the major drainage pipe! (unbelievable) The other 2 times also had to do with water drainage problems. I saw all the work they had just completed, crumbled onto the beach below. …those are just problems I have seen while walking by. I can imagine there were more and I'm afraid how long it won't last.

All I know is, the more they keep drilling, pounding, cutting into our Bluff, the faster it will disappear …. forever! Many of us neighbors have enjoyed this bluff for 10, 30, 50 years and more.
I realize that there is normal wear and tear from the rising tides, but Please help us preserve this little slice of heaven on earth. Once it's gone it's gone forever. I can not attend the meeting but I hope my concerns and sentiments will be conveyed.

Sincerely,
Cathy Carruthers
concerned citizen

From:	Leonard Feder
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7a - CD-0004-22 (Bureau of Ocean Energy Management, San Luis Obispo County)
Date:	Thursday, June 2, 2022 11:13:10 AM

Dear Commission,

My family has had roots in Del Mar for four generations, and we currently live on Stratford Court, so we have immense history with the town and will be directly impacted by the proposed changes. I've read the materials and am disappointed with many aspects of the process and proposal.

1. I was surprised to learn that the plan is to move the tracks in less than a decade after the Wall would be built. It seems illogical that SANDAG would build large walls on our beaches that will become useless so soon after construction.

2. There is so little coastline given our large population that it is surprising that anyone (other than SANDAG) would prioritize railroad tracks over the benefit so many people get from coastal access.

3. I was also shocked that the "visualization" section of the presentation is anything but visible. The pictures are too small to see the actual impact of the walls on the beach. If I were the committee, I would be going out of my way to over-disclose how this will work instead of trying to hide it from the residents. In my opinion, before this topic can even be considered, SANDAG should be required to provide accurate, honest, and representative drawings. In addition, residents can't modify their houses without putting up story poles. I'd like to see SANDAG follow residents' rules so we can see the actual look of these proposed walls.

4. I understand that there are other options aside from building giant walls such as soldier poles, moving the train, etc. I feel this proposal should not go forward unless all options have been presented.

While I appreciate the concerns about the bluffs, it seems that there are other solutions that make more sense given the importance of our precious coastline.

Sincerely,
Lenny Feder
Stratford Ct, Del Mar

From:	Perla Wichner
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b – CC-0005-21 (SANDAG, San Diego Co)
Date:	Thursday, June 2, 2022 10:55:43 AM

Dear Commissioners,

Please do not allow Del Mar's Beach and Bluff to be buried behind long, high seawalls west of the high tide line. The current plan means there will be no walkable beach along the seawalls at high tide. Historic access will be unusable.

Please install buried Soldier Piles instead of Seawalls.

Please don't destroy the Bluff and the Beaches. There are other alternatives possible.

As a 25 year resident of Del Mar, the changes would be devastating.

Sincerely,

Perla Wichner
424 Stratford Ct. Unit B32
Del Mar, Ca 92014

From:	Li Zhang
To:	Energy@Coastal
Subject:	Object to the wall along the beach, regarding to Public Comment onJune 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Thursday, June 2, 2022 9:40:58 AM

Dear Sir or Madam,

*Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
*The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
*Historic access down 11th St and 7th St "goat trails" will be unusable.
*Please install buried Soldier Piles instead of Seawalls wherever possible.
*Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Thank you!

Li

From:	Mingzhu Zhang
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG)
Date:	Thursday, June 2, 2022 8:55:12 AM

Dear Sir/Madam:

I am a long time resident in Del Mar/Carmel Valley area. I heard that SANDAG wants to install a 10 foot high wall along the whole 1.7 mile beautiful beach in Del Mar which will cut off all bluff access to the beach, undermine the beach so it becomes narrow and slowly disappear, which leads to a cascade effect of bad things in regards to biodiversity.

*Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.

*The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).

*Historic access down 11th St and 7th St "goat trails" will be unusable.

*Please install buried Soldier Piles instead of Seawalls wherever possible.

*Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Best Regards,

Mingzhu Zhang, Ph. D.
858-504-1256 （C)

From: Fion Cheng
To: Energy@Coastal
Subject: Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date: Thursday, June 2, 2022 7:55:43 AM

Dear Sir/Madam,

As a long time north county coastal resident, i have been hiking along the coastal from Torrey Pines Beach to Del Mar to Solana Beach to the Cardiff . I am writing to you to let you know that I am strongly opposing SANDAG's recent proposal to install a 10 foot high wall along the whole 1.7 mile beach in Del Mar which will cut off all bluff access to the beach, undermine the beach so it becomes narrow and slowly disappear, which leads to a cascade effect of bad things in regards to biodiversity.

*Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.

*The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).

*Historic access down 11th St and 7th St "goat trails" will be unusable.

*Please install buried Soldier Piles instead of Seawalls wherever possible.

*Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.
Thank you in advance for considering my above deep concerns.

Sincerely yours,

Fion Lou

From: JOHN SPELICH
To: Energy@Coastal
Subject: Public Comment on June 2022 Agenda Item Wednesday 7b – CC-0005-21 (SANDAG, San Diego Co)
Date: Wednesday, June 1, 2022 10:12:18 PM

Dear Commissioners:

As a resident of Del Mar, I write in opposition to the proposed plan for Del Mar's beach and bluffs. Please please do NOT allow allow our South Beach and Bluff to be buried behind those hideous seawalls that will sit west of the mean high tide line. If you approve this, not only will you inflict a scar on the southern face of the city that will remain for decades to come, you will destroy the ability to enjoy the coast by walking between Torrey Pines Beach and Del Mar, as many of us like to do, because the beach will be blocked at high tide. As an alternative, please consider mandating buried soldier piles wherever possible. From what we've been given to understand, these will do the job of protecting the rail line without the concomitant damage to our beach front.

Sincerely,

John W Spelich
Del Mar
jspelford@aol.com

From: joan jones
To: Energy@Coastal
Subject: Del Mar bluffs
Date: Wednesday, June 1, 2022 10:00:12 PM

Sent from Mail for Windows
Please do not destroy our beautiful beaches and wildlife with unneeded fences and/or walls ,we will loose all the reasons we chose to live in Del Mar Please reconsider other options. Joan Jones

From:	Jonathan Polikoff
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 9:51:30 PM

As a resident of Del Mar who lives close to the bluffs - I am not in favor of a massive seawall.
I believe this approach has been shown to be a poor long term solution in preventing beach erosion. It's also unsightly and likely to decrease public use of that section of beach. Since the primary concern is bluff failure - I'd reconsider the buried soldier piles - an approach that has been used previously on this section of bluffs.
Thank you
Jonathan Polikoff
640 Nob Ave
Del Mar

From: Eric From
To: Energy@Coastal
Subject: Del Mar CC-0005-21
Date: Wednesday, June 1, 2022 8:28:55 PM

Dear Commissioners:
Please do not allow Del Mar’s South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
Historic access down 11th St and 7th St "goat trails" will be unusable.
Please install buried Soldier Piles instead of Seawalls wherever possible or come up with another idea. But in the end please do your job and don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

--
Eric From
Del Mar
hankfrom@fastmail.fm

From:	Olga Kravets
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 6:13:56 PM

Hello,
I agree with following

Dear Commissioners:

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Thank you for your consideration.

Sent from my iPhone

From:	Amy A Cheshire
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 5:44:33 PM

Dear Commissioners:

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Sincerely,

Amy A Cheshire

From:	Brett Gobar
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date:	Wednesday, June 1, 2022 5:27:13 PM

Aloha ! Brett Gobar, BS WATER QUALITY

64 yr old native californian, observed the DM Bluffs natural erosion for over 40 years; Family still lives here. Surfs, walks the entire Torrey Pines beach frequently.
we observed the Longard Tube fail and the "temporary seawalls" installed; we see the exponentially faster sand erosion as a result of seawalls and coastal armoring.
the beach disappears for half the year or more.
natural erosion of the sand dune and sand stone formation comprising the bluffs, supplies sand for the local beaches as well as downstream, via Littoral drift.

PLEASE BE SMART AND DENY ANY PROPOSED COASTAL ARMORING !

With hope !

Brett Gobar

From:	David Parkes
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Wednesday, June 1, 2022 4:32:44 PM

Dear Commissioners,

Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line. We have been accessing the beach for the past 33 years from our homes in Del Mar to surf, walk our dogs, and enjoy the beach, so it will destroy one of the main pleasures we all get from living in this amazing region. By the time the trains are moved inland and the bluffs/beaches are restored to their current state, we will all be dead and buried, so this will mean we will have little to no beach access for the remainder of our lives.
The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now), and a significant reduction in usable sand area for beach enjoyment.
Please understand that the enormous environmental loss from this planned construction will far outweigh any temporary gain for railway safety over the next 15-30 years.

Sincerely,
David Parkes, PhD and Barbara Roland, PhD.
156 9th St
Del Mar CA 92014

From: STE_EN SAKOFSK_
To: Energy@Coastal
Subject: NO SEAWALL
Date: Friday, June 3, 2022 8:32:49 AM

I have lived in this community since 1980

Do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line!!!
The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
Historic access down 11th St and 7th St "goat trails will be unusable.
Don't destroy the Bluff and the Beaches. Less destructive engineering is possible

Steven Sakofsky
Real Estate Broker
Mortgage Banker
619-246-5626
First California Funding
SunTrust Homes
12526 High Bluff Dr #300 SD CA 92130
www.SDhomeandloan.com
00945149-323995

From: Isla Cordelae
To: Energy@Coastal
Subject: Public Comment on June 2022 Agenda Item Wednesday 7b - CC-0005-21 (San Diego Association of Governments, San Diego Co.)
Date: Friday, June 3, 2022 9:15:37 AM

Please preserve coastal access and enjoyment of the beach in Del Mar by **saying NO to the massive seawall construction** along the Del Mar beach cliffs.

- Other less impactive measures are available such as Solider Piles.
- As a resident of Del Mar for over fifty years, I have seen the continual massive erosion of this bluff and the many engineering projects that have failed to stabilize the cliffs. The original railroad track was built a block away from the beach for good reasons. **The railroad has had fifty years to remedy this problem** by moving the track alignment, and yet it is proposing this kind of massive sea wall with major cliff removal and terracing.
- It is just another step to double tracking and the complete destruction of our beach and coastal bluffs along the water's edge and above.

These type of piecemeal "emergency" protection measures are ignoring the inevitable necessity to realign all of the railroad sections in Southern California that were built and maintained in such unstable areas at the water's edge.

Thank you for having the foresight to demand that the piece by piece loss of our coastal access and beautiful beaches be stopped in favor a comprehensive and long term solution as mandated by the Coastal Commission's original intent to maximize the natural preservation and use of this precious resource.

Isla Cordelae
106 11th St.
Del Mar, California

From:	Barb Davis
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Friday, June 3, 2022 9:31:52 AM

As a Del Mar resident I am urging you not to build this horrible dangerous fencing. You are preventing my family from having a safe way to evacuate from a fire during Santa Ana Winds. Also I would like to point out

*Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line. *The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now). *Historic access down 11th St and 7th St "goat trails" will be unusable. *Please install buried Soldier Piles instead of Seawalls wherever possible. *Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Barb Davis
755 Kalamath Dr
Del Mar, CA
92014

From:	Cathey Carter
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda Item Wednesday 7a - CD-0004-22 (Bureau of Ocean Energy Management, San Luis Obispo County)
Date:	Friday, June 3, 2022 9:45:05 AM

Dear Commissioners:

- Please do not allow Del Mar's South Beach and Bluff to be buried behind long, high seawalls west of the mean high tide line.
- The current plan means there will be no walkable beach along the seawalls at high tide (like Solana Beach is now).
- Historic access down 11th St and 7th St "goat trails" will be unusable.
- **Please install buried Soldier Piles instead of Seawalls wherever possible.**
- Don't destroy the Bluff and the Beaches. Less destructive engineering is possible.

Kind thanks and blessings,
Cathey Carter
159 6th St
Del Mar, CA 92014

Cathey Carter
Bible 7 and Bible 8
Maranatha Christian Schools
cathey.carter gomcs1.com

Transformed Lives Transforming the World

Now thanks be to God who always leads us in triumphal procession in Christ, and through us spreads everywhere the fragrance of the knowledge of Him. 2 Co 2:14

From:	ronw
To:	Energy@Coastal
Subject:	Objection to SANDAG Del Mar Bluffs Stabilization Project 5
Date:	Friday, June 3, 2022 10:26:38 AM

Dear Commissioners,

It saddens me to see how short-sighted we, as a society, have become with regard to the preservation of our country's natural beauty.

Yes, "preservation" does cost money and effort but we have a responsibility to untold millions of our current and future citizens to maintain the sense of awe and pride that the beauty of California offers.

And yes, there are some situations where the economic benefit outways the cost.

But this is not one of those situations, by far!

Please consider the effect your vote will have not only on current residents and visitors to our state but also upon future generations.

I implore you to vote **a ainst** certifying Del Mar Bluffs Stabilization Project 5.

Sincerely,
Ronald Wichner

From:	Susan Miller
To:	Energy@Coastal
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Friday, June 3, 2022 4:00:21 PM

Coastal Commissioners and Staff,

- In 2021, the SANDAG regional plan target for relocation of the tracks to the bluffs was 2035.

- Representatives of SANDAG are now estimating a completion date of 2052.

- SANDAG would rather install seawalls that will destroy the Del Mar coastline (and all its creatures) that exist today rather than prioritize and expedite the relocation of the tracks.

- The current plan means there will be no walkable beach along the seawalls at high tide.

- Less destructive engineering is possible if the tracks are relocated in 13 years.

- Please don't allow SANDAG to put the profits of freight trains above the protection of the natural beauty of our coastline.

- Trains should reduce their speed through Del Mar near the coastline just as they are slowed when going up grades and around curves.

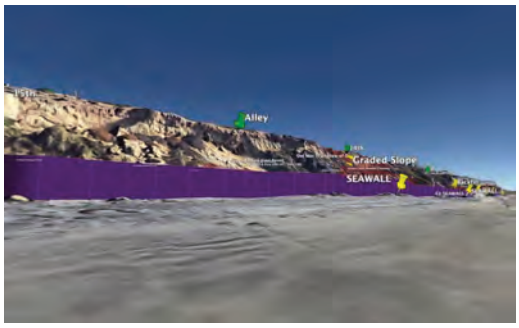
Thank you for your continued efforts to protect and preserve Del Mar's beaches and bluffs.

Susan Miller and Mike Maier
Del Mar

From:	Weare, John
To:	Energy@Coastal
Cc:	Camilla Rang; Terry Karl Gaasterland
Subject:	Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)
Date:	Friday, June 3, 2022 2:30:28 PM
Attachments:	Coastal comission Sea Wall.doc

To EORFC@coastal.ca.gov
Subject **Public Comment on June 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)**

This (present Del Mar beach) Beach	Or This (proposed sea wall)



YOU DECIDE: The California Coastal Commission Must Preserve the Remarkable Del Mar Bluff/Beach Environment for the Enjoyment of All!

The Most Important Environmental/Public Use Issue: If implemented this very poorly thought-out proposal will greatly reduce the public use of roughly half of the presently heavily used Del Mar Beach. The proposed project has a continuous 10 foot high fence (definitely not attractive) from roughly the South end of Sea Grove Park to the South end of Del Mar Beach. That means that to get to the middle of this stretch (Where the surfs is best) you must walk either to the South from Sea Grove Park or from the beach parking lot at the South end of the Del Mar beach. Either way is a long walk.

But that is not the worse news. The Proposed Sea Wall will be built WEST of mean high tide in some areas. Now suppose you are a great parent and you take your kids, your surf board, your wagon of stuff and etc. etc. You leave at low tide from one end or the other and drag all that stuff to the middle of the region. But the tide comes in and you can't get back with kids in tow and stuff. What happens now???

This means that a substantial part of Del Mar beach (presently heavily used by surfers and swimmers) will essentially become almost unusable.

It also means that more surfers will be in the water just West of Sea grove Park. This is the area where there are more children and swimmers in the surf. This is an additional danger and will require increased Lifeguard protection (costs to the city!). Other important concerns are discussed in the following.

Dear Coastal Commissioners and Staff:

My name is John Weare. I am a long-time resident of Del Mar and am writing to encourage you not to approve the SanDag proposed Sea Wall project along 2/3of the entire beach front in Del Mar. **This proposal is a major overreach and substantially reduces the access and enjoyment of the coastal region by all the residents of California**. **A better solution must be found that balances the rights of the residents of Californians versus the not very successful train operators. This is and MUST continue to be the goal of the California Coastal Commission.**

I became involved in the environmental protection of the lovely San Diego coastline more than 50 years ago (1970). I have worked (and accepted leadership roles) with many others on projects to protect unique and fragile environments such as Crest Canyon, Sea Grove Park, The San Dieguito Lagoon, Torrey Pines Park and Torrey Pines Extension among others.

When I started working on environmental issues (1970) the land use situation in this area was dire. There were proposed (and even approved) dense development projects in what is now called Crest Canyon, along the bluffs in Del Mar and Solana Beach and even on the beach at Sea Grove Park. The San Dieguito Lagoon was the place you tossed out your old refrigerator and old tires but was proposed for major development as a Northern Mission Valley Mega Shopping Center.

The intensity of these proposed developments and the disastrous effect they were already having (1970) on the California lifestyle up and down the coast stimulated the proposal of the 1972 Coastal Initiative. With its passage by a substantial majority in 1972 (which we all campaigned hard for) we hoped the era of inappropriate development was over. Of course, development pressures continued but we had a mechanism to try to find compromises that worked for all the residents.

In fact, the California Coastal Commission did make giant steps to control the growth in the Coastal region. Thanks for that! **But here we are we today with a proposed beach redesign that would make even the developers of 1970 blush. How can it be that the proposal that you are considering on this agenda so greatly disregards the objectives of the Coastal Initiative; diminishing the visual enjoyment of the many visitors to the beach and removes access to the beach that has existed for at least 100 years? All of this to support a marginal, at best, train operation. There must be a better solution. To find this is the job of the Coastal commission.**

I urge you to consider the following:

- The Del Mar Beach and Bluff environment provides a unique natural environment for many beach users and strollers of all ages. The proposed sea wall substantially diminishes this experience and restricts the use of this area
- If this plan is approved an active surfing region along the Del Mar beach (wonderful, relatively inexpensive entertainment for many California residents) would be totally cut off by the sea wall and only be accessible via long walk with surf gear from either end of the beach.
- There is very little evidence that a sea wall will be a successful (even intermediate) solution to bluff stabilization. The use of sea walls in Solana Beach has produced a situation where the sea wall needs constant maintenance and are becoming even uglier. This was predicted by shore process experts (UCSD Scripps) before sea walls were installed. How sure are you that you are right on this one!
- The passenger side of the train operation is presently operating at a very substantial deficit with very low ridership (not projected to increase!). Is it good environmental and energy policy to drive empty trains up and down the coast???
- So, the CA public is being asked to forgo their access and use of the beach and PAY for the not so useful train. How can this be???
- The protection of the rights of the very many beach users far outweigh the rather minimal use of the demonstrably unsuccessful passenger train.
- Finally: Del Mar is a very small community which serves the region by providing beach and lagoon open space for all to enjoy. Approximately ¼ of its General Fund comes from tourism. If you approve the sea wall the number of visitors to the city and the revenues they bring will diminish. It is not clear how the city will be able to deal financially with this problem.

The mission of the California Coastal Act is to “protect” and “enhance” California’s coastal region (California Coastal Act). The results of this act in 1974 were immediate and a tremendous success! It is discouraging see that we are back “in the day (1974)” threated by aggressive development that will substantially decrease the enjoyment and use of our coastal resources. In this case in favor of a financially unsuccessful and not supported by ridership passenger line that is projected to be removed. The scars on the beach environment that are proposed in this plan cannot be restored. There must be a better solution!!!

Sincerely,

John Weare

To EORFC@coastal.ca.gov

mike.wilson@coastal.ca.gov

Katie.Rice@coastal.ca.gov

Stephen.padilla@coastal.ca.gov

Meagan.Harmon@coastal.ca.gov

Carole.Groom@coastal.ca.gov

Roberto.Uranga@coastal.ca.gov

Donne.Brownsey@coastal.ca.gov

Caryl.Hart@coastal.ca.gov

Effie.Turnbull-Sanders@coastal.ca.gov

Sara.Aminzadeh@coastal.ca.gov

Linda.Escalante@coastal.ca.gov

From: Payson R. Stevens
Re: **Public Comment on June 8, 2022 Agenda item Wednesday 7b - CC-0005-21 (SANDAG, San Diego Co)**
Date: June 3, 2022

Respected California Coastal Commissioners & Staff:

I am a scientist, who studied at Scripps Institution of Oceanography, and consultant whose clients included NOAA, NASA and the US Geological Survey.

I am also the co-author (with Terry Gaasterland) of the Report: ***Impacts of Proposed NCTD and SANDAG Engineering on the Del Mar Bluffs & Beach -- Scientific Questions and Concerns: Request for Coastal Commission Action***, which was sent to the Commission on November 8, 2021.

I am attaching it again for your review along with the Report's ***Overview Summary*** **-- please scan this first as it has 3-D Google Earth visualizations showing the impacts of seawalls**. If you and Staff read our report again, you will see there are many unanswered scientific, coastal processes dynamics, and geology questions that remain unanswered or even considered as critical to the Commission's responsibility and mandate.

I am writing to all of you to express my concern at your **Report and Consistency Certification No. CC-0005-21**. That the Coastal Commission staff's recommendation would be to grant Conditional Concurrence to San Diego Association of Governments (SANDAG) is very troubling.

The bottom line of the beach impacts of your concurrence would be:

• Del Mar's south bluffs will have 1.5 miles of 10-foot seawalls at 15th south to 11th, 9th south to 6th Streets, and 4th south to Anderson canyon.

• The Commission's "condition" for approval is for the seawalls to be in place for 30 years.

So, the Commission is approving 1.5 miles of 10-foot high seawalls to be in place until 2053 (30 years from next year).

How is it possible for the Commission to consider the devastating impacts of SANDAGs proposal and concur with them? Your legal mandate is to protect the beaches and bluffs of California coastal region as stated in your Mission: (https://www.coastal.ca.gov/whoweare.html):

Protecting & Enhancing California's Coast

Studies by scientists at Scripps Institution of Oceanography (SIO) clearly understand basic coastal science and show that seawalls can change wave dynamics at the cliff base. If the cliff is not vertical, the waves can runup on to the cliff and dissipate wave energy. If a seawall is put in a location like this, the waves will reflect of the wall instead. This could cause what is termed as "active beach erosion". Reflective waves could also impact surfing conditions during high tides.

Without the necessary Environmental Impact Report (EIR), which is another mandate of the Commission, we don't know how significant these impacts could be.

Has the Commission even considered:
• The impacts of sea level rise/global warming/climate change, which is already underway?
• Ensuring that our sandy beaches will not be eroded or scoured away?
• Seawalls affecting/destroying many community benefits, not to mention sand-replenishment costs? Benefits that the beaches confer to Del Mar and the wider community of visitors?
• Other alternatives based on input from impartial engineering experts?

Are these not part of your responsibility along with the proper procedures for an EIR?

Are not the concerns of 3,300 citizens who have signed the Petition to the Coastal Commission, asking these important questions being addressed with their on-line appeal?

The Commission certainly must not support/approve the additional hardening of our coastline and preventing/removing public access. As your CC-0005-21 (SANDAG) Report states: ***the proposed project seawalls would occupy 49,566 square feet of beach area that would otherwise be available to the public for coastal access and recreation.***

There are other options. One is to put in pilings, at the proper depth, to help hold the cliff substratum. There are already many that have been placed at the Bluff top. More can be added, or the existing ones strengthened. And trains moving along the Bluff must be slowed down to minimize vibrations and further Bluff destabilization/collapse.

Yes, they would be permanent, but they would also hopefully confer bluff stability and not destroy the beaches, their access, and their natural beauty (with high, ugly seawalls).

Yes, these are complicated issues when important infrastructure is involved. We have all known for many decades that the train tracks and rail movement are unstainable, and they must be removed. But the funds are not immediately forthcoming. And until then, unfortunately, these issues will only become more common as sea level rises.

SIO and UCSD are at the forefront of studying Del Mar Bluff and beach coastal processes, especially with new monitoring technology such as LIDAR (see attached article, ***As California Cliffs Erode, UC San Diego Team Works to Track and Understand these Changes***). The Commission must include their expertise as part of the EIR along with other recognized California coastal scientist experts.

There is a much larger issue that the Commission is facing with approval of SANDAG's Conditional Concurrence:

You will be setting a dangerous legal precedent for the entire California Coastline that other interests will have the ability to challenge any legal or community concerns and opposition to projects that impact our coasts. Thus, you will be undermining the Coastal Commission's legal and environmental protection authority!

I sincerely hope and trust that you will fulfill your mandate for all Californians--and our coasts--with measured alternatives to the SANDAG proposed seawalls, based on sound scientific and all appropriately mandated and unbiased environmental assessments.

Commissioners, please understand and respect the science, listen to the community, and protect our beaches and their access. This will be your legacy.

Thank you.

Sincerely yours,
Payson R. Stevens
50-year Del Mar homeowner/resident

Please confirm receipt of this email and attachments.

Protect & Preserve Del Mar Bluffs & Beach

Proposed NCTD and SANDAG Engineering Impacts on the Del Mar Bluffs & Beach

Scientific Questions and Concerns

Request for Coastal Commission Action

Submitted by

Concerned Citizens of Del Mar

http://DelMarBluff.com

&

Coastal Bluff Conservancy

Del Mar, CA 92014

https://SaveTheDelMarNorthBluff.com

EXECUTIVE SUMMARY

THE PROBLEM

- The San Diego Association of Governments (**SANDAG**) and North County Transit District (**NCTD**) have sweeping engineering projects underway and in planning that will forever destroy **the entire 1.7 mile Del Mar Coastal Bluff and beaches below.**
- The SANDAG/NCTD plans are projected to reinforce railroad tracks on top of the Bluff for 20-30 years in the face of inevitable bluff collapse within this timeframe due to sea level rise.
- Without objective, independent review, the SANDAG/NCTD plans will impose environmentally destructive structures on the Bluff's top, face, and toe, and will bury the beaches below.
- For 20 years, local governments have postponed and ignored the necessary relocation of the railway off the fragile Bluff. This cannot continue.
- The railway must be relocated within 7 to 10 years to avoid further engineering expense and environmental destruction.

IMPACTS

(see page 5 and Appendix A)

- The natural Bluff will be destroyed and replaced by engineering.
- Beaches will be buried behind continuous seawalls.
- Public views and beach experience will be ruined.
- 100-years of public access to the Bluff and beaches will be denied.
- Over time, sea level rise will cause engineering structures to fail and fall onto the beaches.
- The Coastal Commission's legal authority will be undermined if a thorough and independent environment impact review, as required by law, does not happen.

UNANSWERED QUESTIONS

(see page 12 and Appendices B and C)

- Numerous science and engineering questions about the plans remain unaddressed.
- The engineering of the proposed structures is excessive and unproven.
- Objective analysis is lacking and needed, and requires SANDAG/NCTD public response.
- An Environmental Impact Report (EIR) must be done, as required by CEQA and the Coastal Act.

AN ALTERNATIVE

- Do a 10-year project, not 20 to 30-year. The railway relocation must be started now.
- **Don't destroy the Bluff and the beaches. Less destructive engineering is possible.**

To protect and preserve the Bluff, a 10-year timeline for railway relocation must be implemented now with far less destructive interim engineering. The beauty of this last remaining natural coastal Bluff in San Diego's North County demands conservation for future generations.

OVERVIEW

The Del Mar Bluffs are the last remaining stretch of 1.7 miles of natural terrain trails in San Diego North County. The Bluff and beaches have had continuous community access for over a century. The 20 to 30-year engineering plan proposed by the San Diego Association of Governments (**SANDAG**) and the North County Transit District (**NCTD**) will irrevocably damage the Bluff and beach and also deny access to the wide community of the public who have used them for 100 years.

This Report is addressed to the California Coastal Commission and concerned governmental, non-governmental, and citizen groups who have the means to question and challenge the engineering plans and ultimately to protect and preserve the natural Bluffs with the open beaches below for future generations.

The Report raises critical scientific and engineering questions related to the on-going and proposed engineering of the Del Mar Bluffs and beaches. Further, the Report will educate and inform stakeholders who question the engineering plans.

Our Objectives

Protect and Preserve the Del Mar Bluffs & Beach

- Visualize:
  - Simulations of what is planned
  - Engineering underway now
- Raise Unanswered Scientific & Engineering Questions
- Define Critical Issues Ensuring they are Objectively Addressed

We Call on the Coastal Commission to

- Ensure that SANDAG and NCTD Proposed Plans Are Subject to an Environmental Impact Report (EIR) by objective and expert engineers and scientists; and
- Ensure that the California Coastal Commission (CCC) legal mandate to protect the California Coastline is not hampered or superseded by legal maneuvers with the Surface Transportation Board.

Appendices provide expanded material on the questions and issues that need review by Coastal Commission staff and engineers, and by concerned public and private groups.

Urgent Action Required *WITHOUT* Excessive Measures

Del Mar, SANDAG and NCTD have a multi-faceted problem, 20 years in the making. Why should the lack of adequate progress relocating the railroad result in the destruction of the Del Mar Bluff and its beaches in San Diego's North County?

The Bluff is fragile and will continue to erode and collapse. It is understood and accepted that some degree of protection is needed to ensure the safety of the railway line that currently runs the 1.7 miles of the Bluff. Nevertheless, the Bluff offers multiple benefits to the community as one of the San Diego region's last remaining natural, accessible coastal bluff with trails above and beach below. Irreversible changes must be avoided.

The consequences of planned structures will deface the bluffs with armoring and grading, bury beaches and bluff toes behind seawalls, and deplete natural sand replenishment. This Report strongly questions the 20 to 30-year engineering plans as excessive and unproven.

Alternatively:

Relocate now. The railway line runs through Del Mar as a single track on top of the fragile bluff. The need for relocation has been recognized for over twenty years. Sea level rise and climate change have sped up the urgency. The tracks must be moved within the next 7 years without further delay.

Minimize interim engineering. In the interim, the extent of the proposed engineering requires thorough, objective scrutiny by independent engineers and coastal bluff and beach processes scientists to ensure minimal long-term impact on the Bluff with appropriate mitigation.

Requests to all responsible agencies and individuals:

- ☐ **Ensure** enforcement of Coastal Commission legal mandates
- ☐ **Require** an Environmental Impact Report from SANDAG and NCTD
- ☐ **Minimize** engineering to save the natural coastal Bluff, beaches, and access
- ☐ **Relocate** railroad tracks no later than 7+ years
- ☐ **Commit** funds to reverse the engineering impacts after relocation

WHAT IS PLANNED?

SANDAG leads a **project to impose environmentally destructive engineering structures along the entire 1.7-mile coastal Bluff top, face, and toe and the beach below that will:**

- **Armor** the entire Bluff with long continuous seawalls on the beach that will eliminate the natural chiseled contours of the Bluff toe and obscure flow of beach sand;
- **Bury** beaches behind the seawalls with in-fill dirt on top of beach sand and Bluff toes;
- **Destroy** bluff faces extensively with grading and compaction that will erase the existing natural bluff geologic features;
- **Construct** long retaining walls at the coastal bluff-top edge, west of tracks; and
- **Decapitate** completely the upper ~25% of the highest west-facing Bluff face.

NCTD leads a separate **project to install fencing on the Bluff tops for the full 1.7 miles.**

On October 15, 2021, Del Mar Council members and staff walked the entire length of the SANDAG bluff project together with SANDAG and NCTD engineering staff and one NCTD Board member. At that time, SANDAG staff indicated the engineering consultants had been directed to **plan for another 20 years of train operations atop the fragile, sensitive coastal Bluff** (Figure C-3, Appendix C).

COMMUNITY RESPONSE

A Citizens' Petition submitted to the California Coastal Commission, October 13, 2021, clearly states the community's concerns regarding the unique qualities of the Del Mar Bluffs and beaches that draw tens of thousands of visitors to walk, swim, surf, and enjoy **(Appendix D)**. The Petition was uploaded to change.org to collect signatures electronically.

Many environmental impact concerns and questions about the fencing project are addressed in the Petition. Further questions were raised by independent third-party engineering experts from Atlas Technical Consultants, LLC, contracted by the City of Del Mar **(Appendix B)**.

Residents of Del Mar, other San Diego communities, and from afar, have presented objections to the excessive engineering plans of SANDAG and NCTD in public meetings before the Del Mar City Council, the California Coastal Commission (CCC), North County Transit District (NCTD), and the San Diego Association of Governments (SANDAG) (See verbal and written Public Comments at meetings of these bodies during the week of Oct. 18, 2021).

This Report poses critical, unanswered questions to ensure they are objectively addressed now.

OVERSIGHT IS LACKING

The geotechnical stabilization plans offered by SANDAG and NCTD are unproven, excessive, and plan for 20 to 30 more years of bluff top railroad operation. The community demands a shorter timeline in which the railroad tracks go elsewhere, and the natural Bluff beauty remains.

The community realizes that some preventive engineering is required as soon as possible to protect the tracks and trains before they are relocated. However, the community demands that current engineering in process and planned engineering receive the full scrutiny required by the California Coastal Act. **Irreversible changes must be avoided.**

NCTD's approach to fencing the bluffs has disregarded the community and the importance of the natural coastal bluff and beach environment. Their reliance on a cursory geological opinion to justify massive drilling, imposition of concrete and fencing on the Bluff serves as a stark lesson that the Coastal Commission must not rely on the assurances of either NCTD nor SANDAG nor their consultants that their proposed sweeping redesign of the Bluff are **the least most destructive and necessary to accomplish legitimate goals.**

Dramatic, permanent changes are planned and underway without environmental review. They are a blow to the environment, armoring the Bluff with ugly concrete structures and seawalls creating a gauntlet to beach access: a direct violation of the Coastal Commission's legal authority and mandate.

THE BOTTOM LINE

Why do a 20 to 30-year project when the track relocation is expected within 10 years? Why destroy the Bluff and beaches when less destructive engineering is possible to bolster the Bluff until the railway is moved?

The Coastal Commission has the legal mandate and singular mission to protect our precious California coast

A Brief Visual Tour in Five Images

1. Proposed Engineering Ignores Coastal Protections

Visualization looking north along the Bluff from 11th St north to Coast Blvd.

IMPACTS:

- Grading and terracing will replace natural Bluff contours with industrial faces.
- All red shaded areas will turn into artificial graded slopes.
- High seawalls (purple) will obscure the base of the Bluff along the beach.

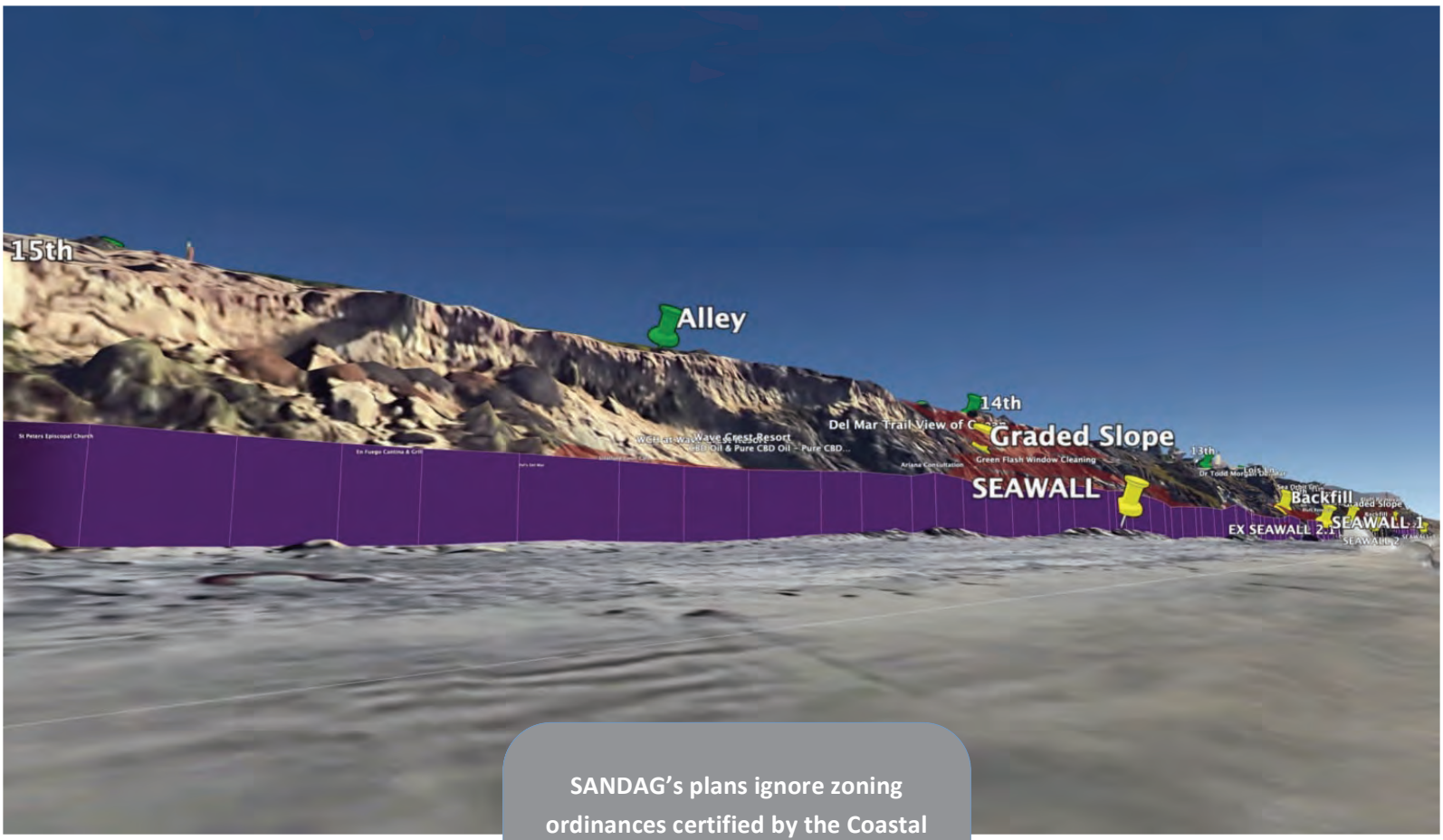
See Appendix A for more visualizations.

2. Continuous Seawalls Restrict Beach Access & Sand Renewal

Visualization looking south between 15th and 11th Streets.

IMPACTS:

- A long high seawall (purple) will block natural coves and bluff/beach features.
- Long seawalls 8 to 10 feet high will separate beachgoers from the Bluff's lively life.
- Bluff environments for small animals, wild plants, sea grasses, nesting birds, native frogs, and their ecosystem will be buried and obstructed.
- A walk along the beach will change completely - the Bluff will be caged behind a vertical wall.



SANDAG's plans ignore zoning ordinances certified by the Coastal Commission that limit protective structures west of the middle of the railroad track

See Appendix A for more visualizations.

3. Natural Beauty Will Be Irreversibly Destroyed

Natural Bluff from 11th to 8th St is slated to be decapitated. (photo, Terry Gaasterland)

IMPACTS:

- SANDAG plans will remove the top 20 to 25 feet of tall natural Bluff.
- Bluff crevices where birds nest and small animals live will be gone forever.
- Bluff material for sand replenishment will be eliminated.

4. Engineering Already Underway

SANDAG's Terracing At South End of Del Mar Woods. (photo, Terry Gaasterland)

With no environmenal review or public input whatsoever, SANDAG commenced with a small emergency repair that has grown into an outsized insult on the natural bluff face.

5. Armoring The Coast – Natural Beauty vs. Concrete Hardening

BEFORE: Coastal Bluff Top Trail below Del Mar Woods. *(*photo, Michael Keenan)

AFTER: Bluff Top Trail - Concrete drainage, natural flora/terrain scraped.
(Photo, Payson R. Stevens)

CRITICAL QUESTIONS

The Coastal Commission needs to require that these critical questions about impacts be answered by SANDAG and NCTD before moving forward. Without an EIR, the consequences of the engineering can never be fully understood and addressed.

1. What is the time horizon for the engineering before the railway is moved as that should determine the degree of armoring needed? What's the difference and impacts between a 20 to 30-year engineering plan versus a 10-year plan?
2. How will grading and in-fill be managed and minimized?
3. Can the project be reframed to place localized seawalls in high-risk locations? The risk of bluff slide and erosion is not the same along the entire Bluff. Collapses are punctuated, local events.
4. How will imminent sea level rise affect the beaches and proposed seawalls?
5. Are funds set aside to remove seawalls after railroad relocation.
6. Does SANDAG have jurisdiction to construct seawalls on the beach and bury coves behind them?
7. Have agencies with jurisdiction over the beach been included in the planning? For example, State Parks, the State Lands Commission, and the City of Del Mar. The southernmost planned seawall is on the Torrey Pines State Beach
8. Has SANDAG studied the impacts of the seawalls on wave energy dissipation patterns and erosion dynamics? How significant will the resulting *active beach erosion* be?
9. What serious and committed efforts are underway to relocate railroad in 7 to 10 years?
10. Will the proposed engineering plans be made consistent with the planned train relocation?

Appendix C provides expanded details for each Critical Question.

At this time no Environmental Impact Report (EIR) has been prepared for either agency's project.

SUMMARY OF SCIENTIFIC QUESTIONS AND ANALYSIS NEEDED

Geotechnical Impacts

Expert analysis of geotechnical impacts of the SANDAG's proposed engineered structures are clearly lacking and must be done. The City of Del Mar contracted an independent review of NCTD's geotechnical report by Leighton Consulting, Inc (2021) on their 1.7 miles of fencing plans. The independent review found multiple, serious deficiencies. Specifically, the critique of the Leighton report by third-party expert consultant Atlas Technical Consulting, LLC, noted analysis, tests, and measurements that were missing from the Leighton report.

The Atlas observations on needed geotechnical analysis pertain not only to the NCTD fencing but more generally to any engineering project on the fragile coastal Bluff. The following needs for analysis of geotechnical impacts apply equally to the SANDAG engineering. See **Appendix B** for these fundamental geotechnical questions that must be answered.

Urgent Analysis is Lacking in Key Scientific Areas:

- ☐ **Rain and irrigation subsurface Bluff penetration**
- ☐ **Latest technology for assessing Bluff geology**
- ☐ **Beach erosion effects from seawall construction along Bluff toe**
- ☐ **Sea level rise with wave energy against sea walls**
- ☐ **Identification of flora and fauna of Del Mar Bluff and beaches**
- ☐ **Vibration effects on coastal Bluff west of tracks**
- ☐ **Seismic risks and the Rose Canyon Fault**

Details for the above scientific concerns can be found in **Appendix C.**

Pressing questions and impacts must be addressed and require SANDAG's public response.

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California Department of Parks and Recreation
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Surfrider Foundation
San Diego Habitat Conservancy
Torrey Pines Conservancy

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REPORT ORGANIZATION

To define what is lacking to date and the elements of this Report, concerned citizens are in ongoing discussions with geologists and scientists who study coastal processes to examine the multiple engineered structures and changes proposed in the two projects.

This Report seeks to present a more accurate visual simulation of the proposed NCTD and SANDAG engineering and pose scientific questions and concerns about environmental impacts. Their details are presented in Appendices A through D.

Appendix A visualizes the issues and problems through simulations and photographs.

Appendix B provides the independent third-party expert (Atlas Technical Consultants, LLC) critique of NCTD's proposed fencing and relates it to SANDAG.

Appendix C expands on the scientific environmental impact questions not addressed publicly in the planning process to date.

Appendix D summarizes and links to the Citizens Petition to the California Coastal Commission.

APPENDIX A: VISUALIZING ISSUES, IMPACTS, AND PROBLEMS

Included here are our photo simulations that present realistic visualizations from multiple perspectives for the SANDAG-led project. Our visualizations were created using Google Earth and use the locations shown in SANDAG/NCTD engineering plans (as prepared by HNTB, July 2021, SANDAG contract no. 5007812).

These visualizations are general approximations and do not show any specific details of engineering structures planned by SANDAG. They offer bird's eye views showing the full extent of the bluff and beach areas, including closer views of locations with highest concern. Elevations ranged from sea level to 79 feet at the bluff face highest point.

Expected consequences of proposed engineering are listed as IMPACTS beneath each visualization, summarized as follows:

Impacts of Seawalls Along the Bluff Toe and Grading the Bluff Face

- Natural Bluff face will be erased by extensive grading, in-fill behind seawalls, terracing and compaction of bluff material.
- Natural Bluff/beach contours will be buried under in-fill dirt behind seawalls.
- Large swaths of natural beach areas will be buried by in-fill dirt.
- Existing large "cove" beaches will be buried and eliminated.
- Sand loss and beach erosion will be accelerated not slowed down.
- At high tide, beach users will have no space to escape "sneaker waves".
- Natural sand deposition on contoured bluff toes will be eliminated.

Impacts on Public Views and Beach Experience

- Natural public views will be demolished.
- Continuous manmade structures will eliminate beach access from historic bluff-top trails in continuous use for over 100-years.
- Retaining wall at top will diminish view of bluff from beach level.
- Retaining wall will eradicate the natural view of the bluff from the "upper bluff" to the east of the tracks.
- Natural views from Sea Grove Park and paths will be destroyed.
- Natural beach experience will be replaced by cavernous, continuous seawalls with no natural surfaces or contours along the beach.
- A walk along the beach will feel like walking along an industrial corridor with the bluffs caged in behind engineered structures

Impacts of Bluff Top Decapitation

- The current high bluff above the beach provides stunning beauty and geology to the Del Mar South Beach experience from the beach.
- Removal of the bluff top will erase this experience forever.
- Natural high bluff face will be gone entirely.
- Removal of the cliff will lower the bluff edge 10-15 feet.
- Approximately ~620,000 cubic feet of cliff material will be removed (23,000 dump truck loads).
- Removing overburdening will increase the risk of slide by removing buffer material. (Does this offset any decreased risk due to removal of weight?)
- Any removed material should be placed on the beach to prevent erosion.

Figure 1. Visualization of Del Mar Bluff Engineering from 15th to 8th St

Red shaded areas show slopes to be graded. Seawalls with back-fill on the beaches behind and graded slopes above stretch the entire length of the coastal bluff toe. New seawalls at bluff base, 8-foot height. Bluff top, 61-65 feet above sea level. (Note: Green pins mark consistent locations across simulations. Yellow pins mark specific engineered structures.)

Figure 2. Visualization of Del Mar Bluff Engineering, Sea Grove Park south to 7th St.
Continuous seawall (black) along the toe of the bluffs, approximately 8 feet high. Red shaded areas show graded slopes. Bluff top, 61-65 feet above sea level. (Note: Green pins mark consistent locations across simulations. Yellow pins mark specific engineered structures.)

Figure 3. Visualization of Del Mar Bluff Engineering, looking north from 7th St to Sea Grove Park (15th St)

Continuous seawall (black) along the toe of the bluffs, approximately 8 feet high. Red shaded areas show graded slopes. Bluff top, 61-65 feet above sea level. (Note: Green pins mark consistent locations across simulations. Yellow pins mark specific engineered structures.)

Figure 4. Engineering Plans for Del Mar Bluffs and Beaches, Google Earth overlay
Image overlaid with SANDAG Initial Engineering Plans (as prepared by HNTB, July 2021, SANDAG contract no. 5007812), basis for visualizations.

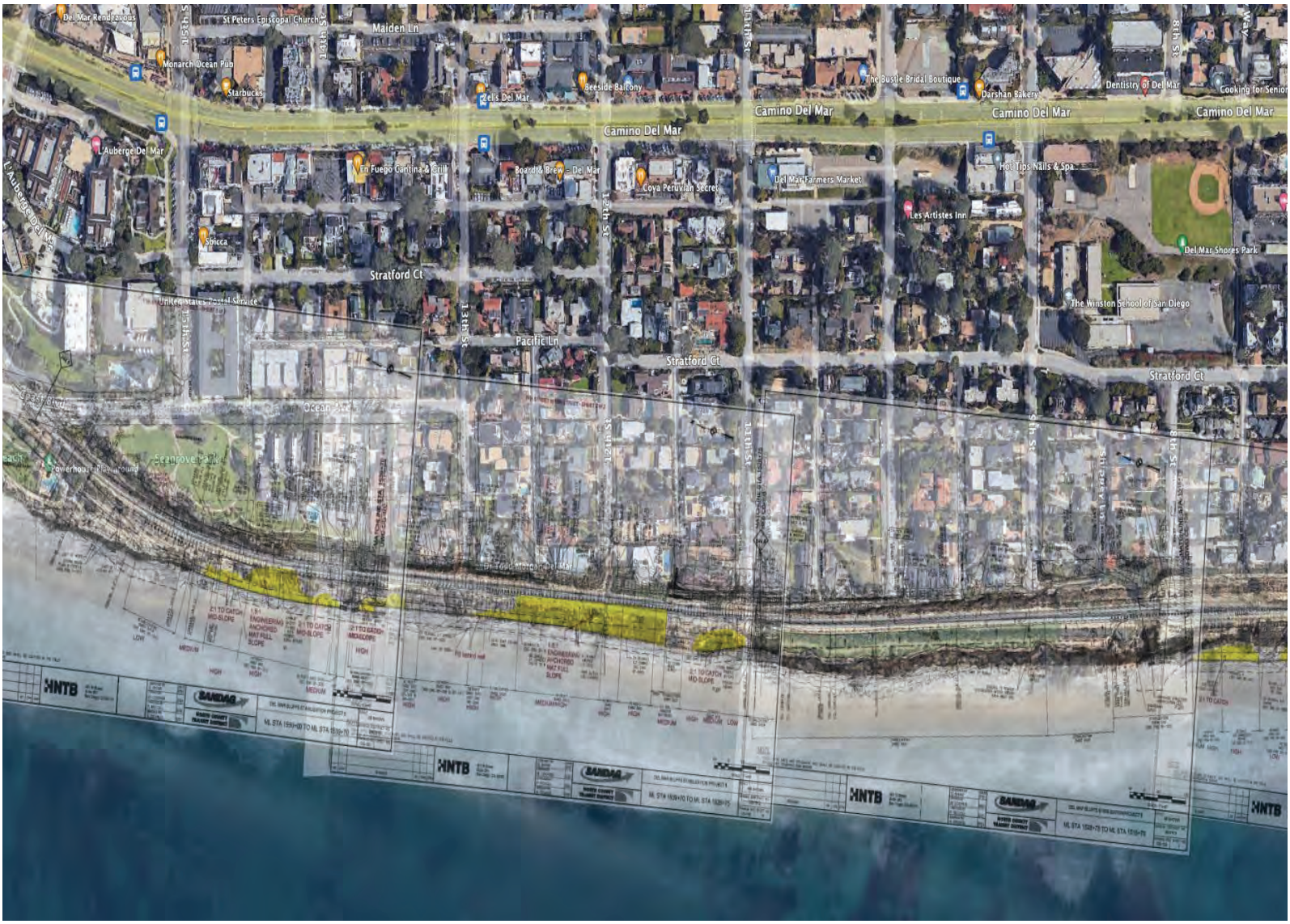


Figure 5. Del Mar Bluff Engineering, 15th St to 11th St

Continuous seawall (purple) along the toe of the bluffs, 8-foot height. Red shaded areas show graded slopes. Yellow pins mark each engineering region with its seawalls, back-fill, and graded slopes. Bluff top, 61-65 feet above sea level. **(Note:** Green pins mark consistent locations across simulations. Yellow pins mark specific engineered structures.)

IMPACTS:

- Natural beach contours will be destroyed by new in-fill dirt behind the seawalls.
- Natural bluff face will be erased by extensive grading and compaction.
- Natural public views will be demolished.
- Continuous manmade structures will eliminate beach access from historic bluff-top trails in continuous use for over 100-years.

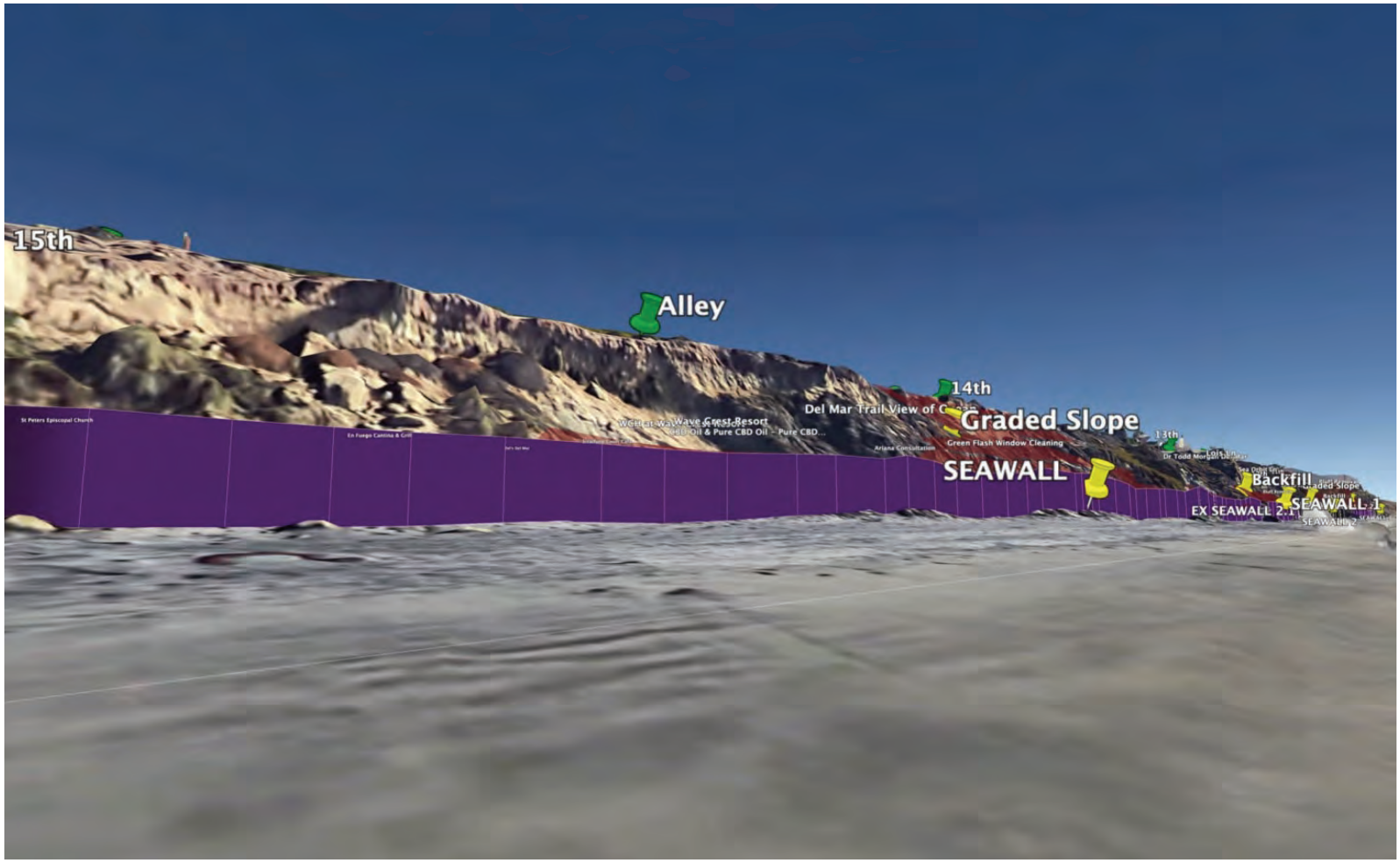
Figure 6. Del Mar Bluff Engineering, 15th St to 12th St

Continuous seawall (black) along the toe of the bluffs, 8 foot height. Red shaded areas show graded slopes. Yellow pins mark specific engineered structures, including seawalls, back-fill, and graded slopes. Bluff top, 61-65 feet above sea level.

IMPACTS:

- Note extensive grading and in-fill behind seawalls
- Natural views from Sea Grove Park and paths will be destroyed.
- Terracing on graded slopes will eliminate natural bluff face contours.
- Bluff/beach contours will be buried under in-fill.

Figure 7. Del Mar Bluff Engineering, Seawall at Beach Level below 15th St to 11th St
Continuous seawall (purple) along the toe of the bluffs, 8-foot height. Red shaded areas show graded slopes. Yellow pins mark specific engineered structures, including seawalls, back-fill, and graded slopes. Bluff top, 61-65 feet above sea level.



IMPACTS:

- Natural beach experience will be replaced by cavernous, continuous seawalls with no natural surfaces or contours along the beach.
- A walk along the beach will feel like walking along an industrial corridor with the bluffs caged in behind engineered structures.
- Natural sand deposition on contoured bluff toes will be eliminated.
- Large swaths of natural beach areas will be buried by in-fill dirt.

Figure 8: Removal of High Coastal Bluff Top, 11th St to 8th St

Red shaded area - to be removed. Current high bluff top, over 80-feet above sea level.

IMPACTS:

- The current high bluff above the beach provides stunning beauty and geology to the Del Mar South Beach experience from the beach.
- Removal of the bluff top will erase this experience forever.

NOTE: Trails along this stretch have already been blocked with demarcation fencing and extensive signage which should be maintained and expanded to protect the bluffs and citizens.

Figure 9: Removal of high coastal bluff top, 11th St to 8th St - Detailed View
Gray rectangles indicate bluff berm level after removal. Red shaded areas show bluff to be removed. Yellow pin marks northern boundary of engineering region. High bluff top, over 80-feet above sea level. Railroad tracks, 61-65 feet above sea level.

IMPACTS:

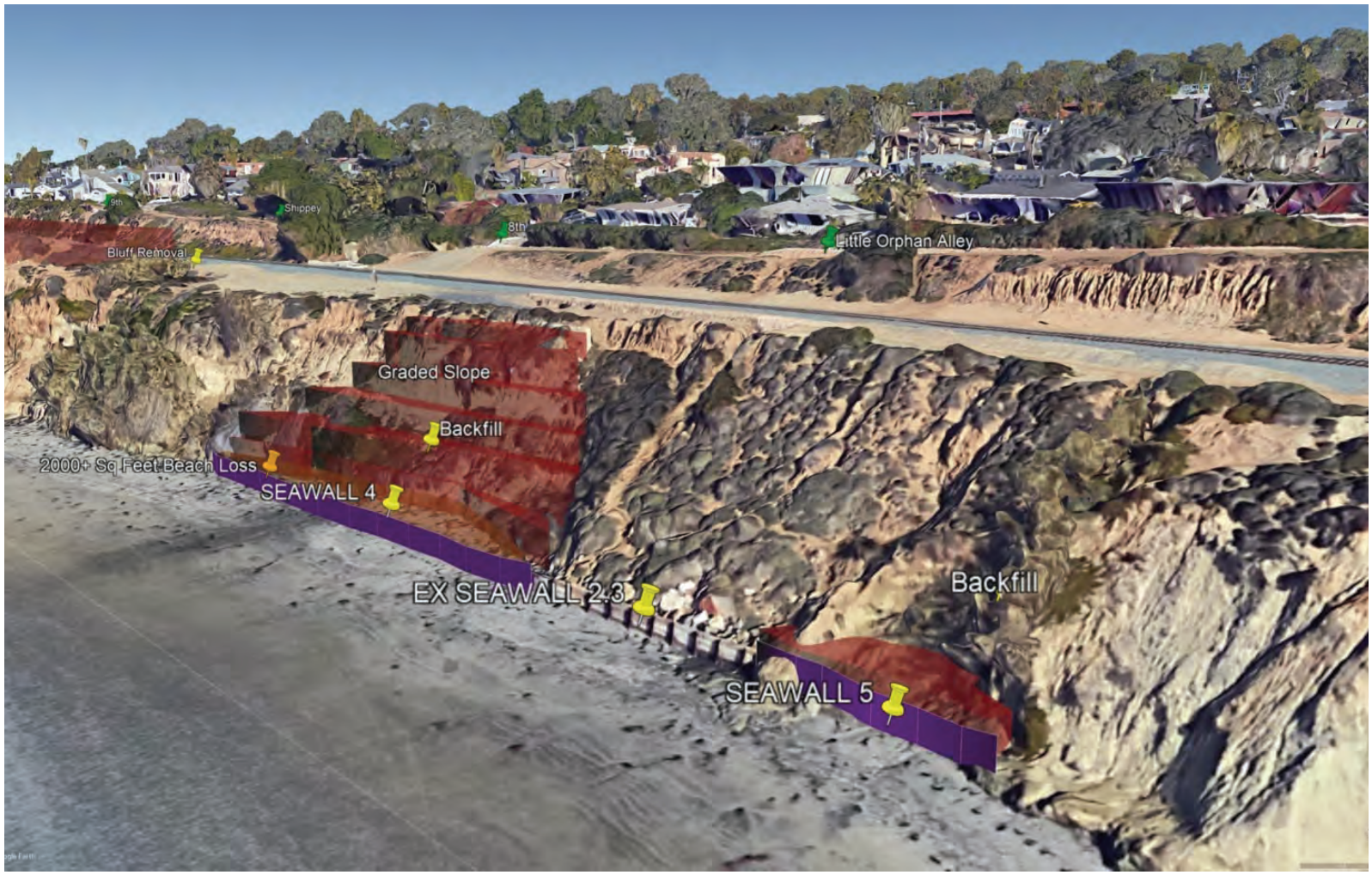
- Natural high bluff face will be gone entirely.
- Substantial amounts of bluff material will no longer be available to expand the width of the bluff after a slide and thus fight bluff erosion.
- Bluff material will no longer be available to replenish beach sand.
- Removing overburdening will increase the risk of slide by removing buffer material. More critically, it will undermine the cliff and tracks without any geology assessment/survey.

IMPACTS (Figure 9 continued)

- SANDAG reports risk of bluff slide will reduce by a mere predicted 10% based on models and projections. Have the models been critiqued or validated?
- Note the difference between the straight-line seawall (purple) and the natural bluff-toe contours.
- Removal of the cliff will lower the bluff edge 10-15 feet.
- Approximately ~620,000 cu ft of cliff material will be removed (enough to fill 23,000 dump trucks).
- Any removed material should be placed on the beach to prevent erosion.

Figure 10: Seawall from 8th St to 7th St with in-fill and grading - View A

Seawalls (purple) along the toe of the bluffs, 8-foot height. Red shaded areas show graded slopes. Yellow pins mark each engineering region with its seawalls, back-fill, and graded slopes. Bluff top, 61-65 feet above sea level. (Note: Green pins mark consistent locations across Views A-D)



Note: cliff slope back fill, and elimination of existing "cove" beach behind SEAWALL 4

IMPACTS:

- Existing 2000 sq ft large "cove" beach behind SEAWALL 4 will be buried and eliminated.
- Smaller "cove" beach behind SEAWALL 5 will also be buried and eliminated.
- Natural contours of bluff toe along beach will be eliminated.
- At high tide, beach users will have no space to escape "sneaker waves".

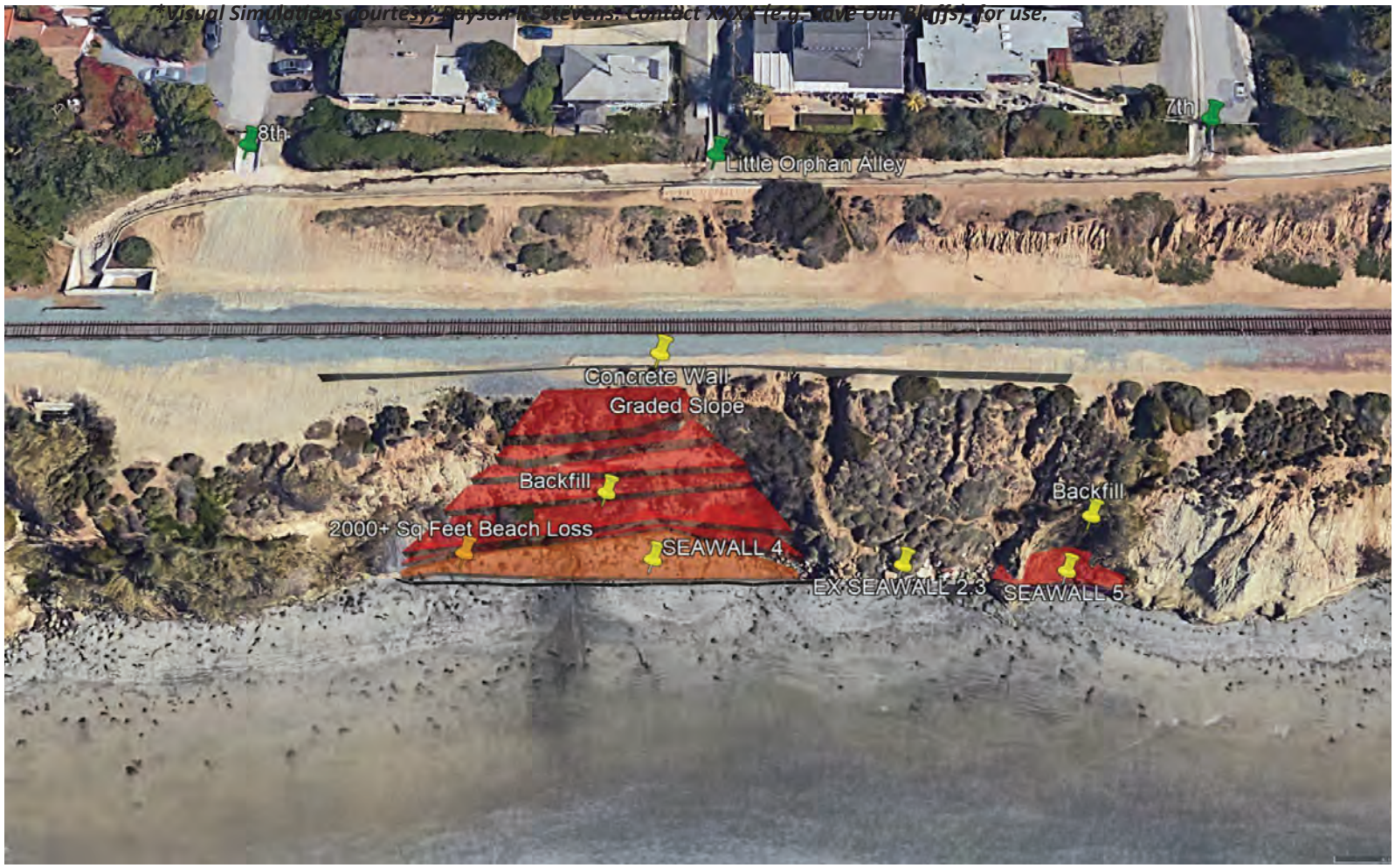
Figure 11: Seawall on Beach from 8th St to 7th St with in-fill and grading – View B

Seawalls (purple) along the toe of the bluffs, 8-foot height.Red shaded areas show graded slopes. Yellow pins mark each engineering region with its seawalls, back-fill, and graded slopes. Bluff top, 61-65 feet above sea level.

IMPACTS:

- See Figure 9 and 10 impacts.
- Retaining wall at top will diminish view of bluff from beach level.

Figure 12: Seawall from 8th St to 7th St with in-fill and grading - View C
Seawalls (white dashed line) along the toe of the bluffs, 8-foot height. Concrete retaining wall (black dashed line) along top of bluff. Red shaded areas show graded slopes. Yellow pins mark each engineering region with its seawalls, back-fill, and graded slopes. Bluff top, 61-65 feet above sea level.



IMPACTS:

- See Figure 9 impacts.
- Retaining wall will eradicate the natural view of the bluff from the "upper bluff" to the east of the tracks.
- Natural contours will be demolished at the top and bottom of the bluff.

Figure 13: Seawall at Beach Level from 8th to 7th St with in-fill and grading - View D

Seawalls (purple rectangles) along the toe of the bluffs, 8-foot height. Red shaded areas show graded slopes. Yellow pins mark each engineering region with its seawalls, back-fill, and graded slopes. Bluff top, 61-65 feet above sea level.

IMPACTS:

- See Figure 9 and Figure 12 impacts.
- Sand loss and beach erosion will be accelerated not slowed down.

Figure 14: SANDAG Rendering of Seawall at Anderson Canyon extending north to 4th St with in-fill and grading on bluff face.

Seawall along toe of the bluffs, 8-foot height. Bluff top, 61-65 feet above sea level.

**** SANDAG rendering presented to Del Mar City Council 9/20/21***

IMPACTS:

- Natural beach experience will be blocked by continuous seawalls.
- A walk along the beach will feel like walking along a cage.
- Natural sand deposition on contoured bluff toes will be eliminated.
- Natural beach areas will be buried by in-fill dirt.

PHOTOS: Engineering Impacts-underway or planned

This section presents photographs of existing bluff conditions, including emergency repair engineering underway **(Figures 15-18)** and shows current conditions where engineered structures are proposed **(Figures 19-24).**

The photos shown were shared by Del Mar's community of bluff and beach visitors. Many come from near and far to marvel at the vistas, absorb the every-changing sunrises and sunsets, walk the trails, descend the bluffs to swim, surf, jog, walk or just peacefully sit in the splendor of Nature on the Del Mar Bluffs where the edge of North America meets the Pacific. To deny them the potential loss of this century-old access is not only violation of their historical rights but those enshrined legally by the California Coastal Commission.

Figure 15: UNDERWAY: SANDAG's Terracing At South End of Del Mar Woods.

(Sept. 5, 2021; photo, T. Gaasterland)

Figure 16: SANDAG's Interim Drainage Engineering South of Del Mar Woods.

(Sept. 5, 2021; photo, T. Gaasterland)

Note water drainage of 5 gallons per minute pouring out of the bluff from yet unknown sources.

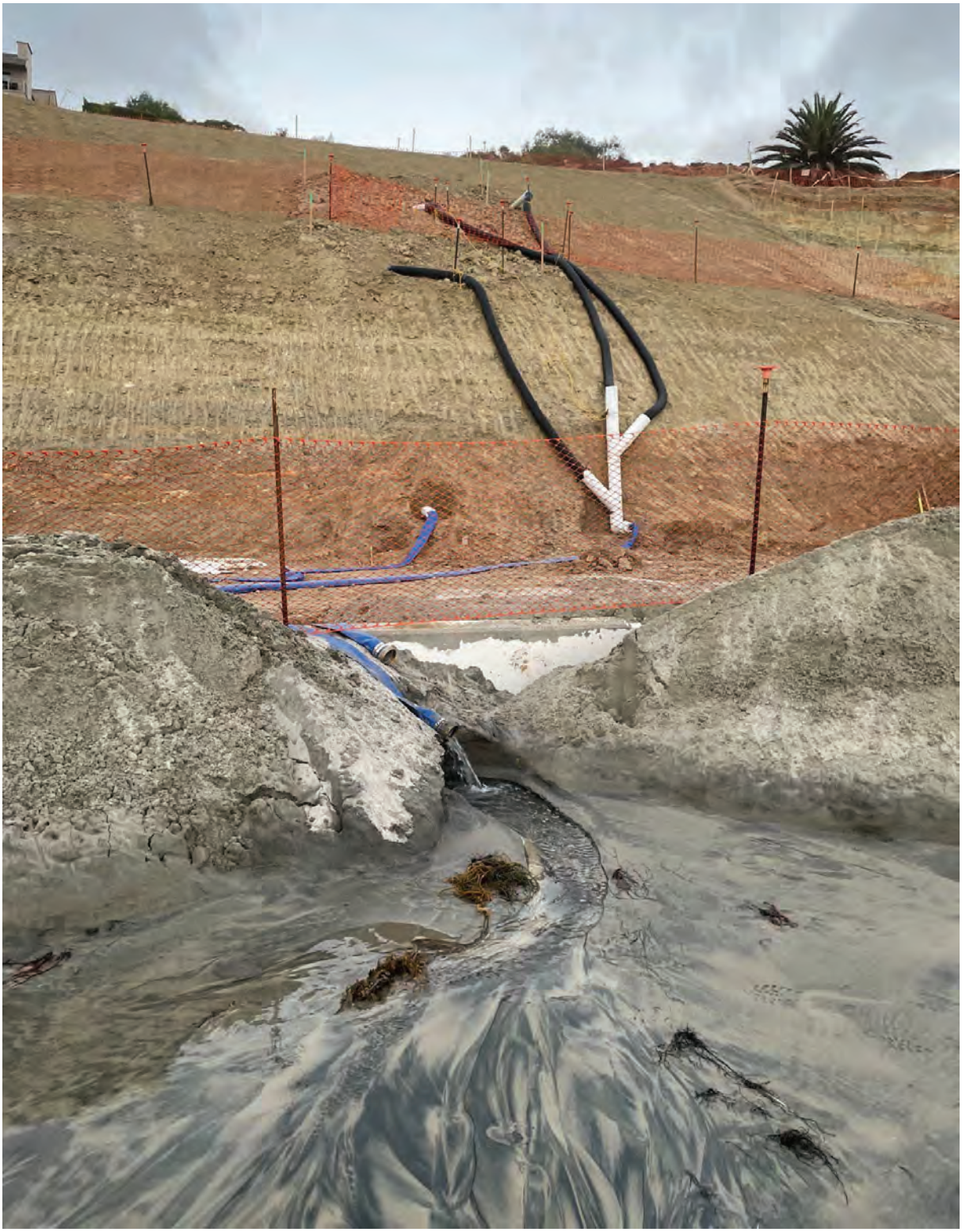


Figure 17. Seawall construction below Del Mar Woods south of 4th St.

(Photo, Udo Wahn)

Figure 18. Seawall construction below Del Mar Woods south of 4th St.

(Photo, Udo Wahn)

Figure 19. Natural Bluff Today Without Engineering, area to be decapitated

(September, 2021; photo, T. Gaasterland).

Figure 20. Natural Beach Today at 7th St to 8th St (known as Mango Reef), area to be buried behind extended seawall (October, 2021; photo, T. Gaasterland).

This beach shown at a high high-tide will be lost behind the seawall planned below 7th St to 8th St. No beach will remain at this location at high tide.

Figure 21. Bluff Avian Visitors

Blue Heron, 11th Street (Photo, Al Tarkington)

Peregrine Falcon (Photo, Udo Wahn)

Figure 22. Natural Beauty (Photos: Payson R. Stevens: top, bottom left; Karl Willet: bottom right)

Figure 23. Natural Erosion vs Concrete Armor (Photos: Payson R. Stevens)

Upper Bluff: Natural Chiseled Features

Upper Bluff: Concrete Terracing

Figure 24. Natural Beauty vs. Concrete Armor

BEFORE: Coastal Bluff Top Trail at South End of Del Mar Woods.
The trail has already been scraped by the emergency terracing.
(Photo, Spring, 2017, Michael Keenan)

AFTER: Upper Bluff: Concrete drainage, natural flora and terrain scraped.
(Photo, P.R. Stevens)

APPENDIX B: THIRD-PARTY GEOTECHNICAL ANALYSIS NEEDED

Expert analysis of geotechnical impacts of the SANDAG's proposed engineered structures are lacking and must be done. The City of Del Mar contracted an independent review of NCTD's brief geotechnical statement from Leighton Consulting, Inc (2021) on the impacts of fencing structures along 1.7 miles of fragile coastal bluff. **The independent review found multiple, serious deficiencies. Specifically, the critique of the Leighton report by third-party expert consultant Atlas Technical Consulting, LLC, noted analysis, tests, and measurements that were missing from the Leighton report.**

The Atlas observations on needed geotechnical analysis pertain generally to any engineering project on the fragile coastal bluff, not only to the NCTD fencing project. The following needs for analysis of geotechnical impacts apply equally to the SANDAG engineering:

- Needs discussion of geologic hazards, slope stability, and landslide potential. Drilling and other engineering proposed (piers, fencing, etc) in sensitive bluff segments could weaken bluffs.
- Needs discussion or anticipation of subsurface rock with distinct characteristics (e.g. geologic units) affecting bluff stability.
- Needs customary practice of descriptive survey and sampling of bluff geology (e.g. mapping, hand augers, geophysics, or other invasive or non-invasive exploratory geologic methods).
- Needs geologic descriptions and geologic cross-sections along the bluff top, geologic unit thickness, bedding, structure, groundwater, and other critical geologic conditions relevant to the site conditions.
- Needs description regarding lateral support, confinement and /or bearing support of the planned engineering.
    - Needs stated expert opinion regarding bluff-top stability and the potential for reducing the factor of safety for global and surficial stability of the bluffs where planned improvements will be located and may surcharge the bluffs.
    - Needs discussion of iron oxidation and impact of corrosion on engineering foundations.

These required analyses are needed not only for the NCTD fencing but also for the SANDAG Bluff Stabilization Structures.

Atlas provided the following two-page critique with unanswered questions:

ATLAS

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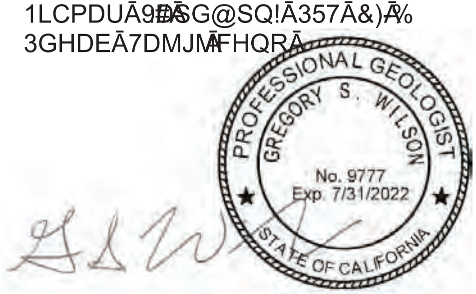

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Appendix C: Critical Scientific Questions & Impacts Not Addressed

Critical Science Questions of Concern Needing SANDAG Response

- **Rain and Irrigation Impacts (Figure C-1)**
  - What are the impacts of surface water penetrating to deeper groundwater?
  - Where is the imperious layer and how will it impact bluff slide?
  - What is the probability of increased risk of bluff slides?
  - Where is the data?
  - How are they being studied and addressed?
  - French drains on the east side at 11th St have helped to reduce risk. Can they go deeper?

Figure C-1. Bluff Erosion. Groundwater from multiple sources moves through pervious material, saturates cliff edge soil, and increases landslide risk.

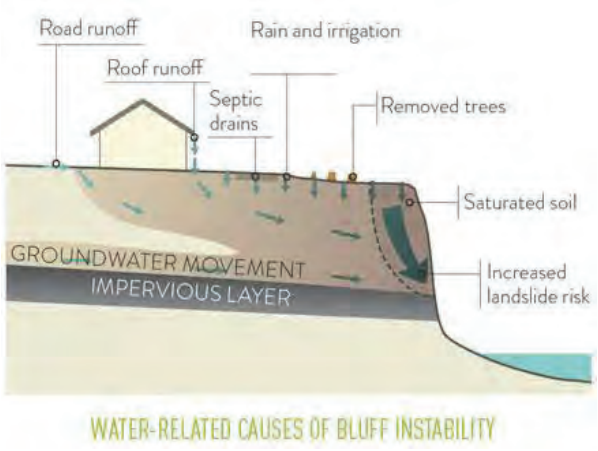


Figure Courtesy: Shore Friendly, **http://www.shorefriendly.org/your-erosion-risk/on-bluffs/**

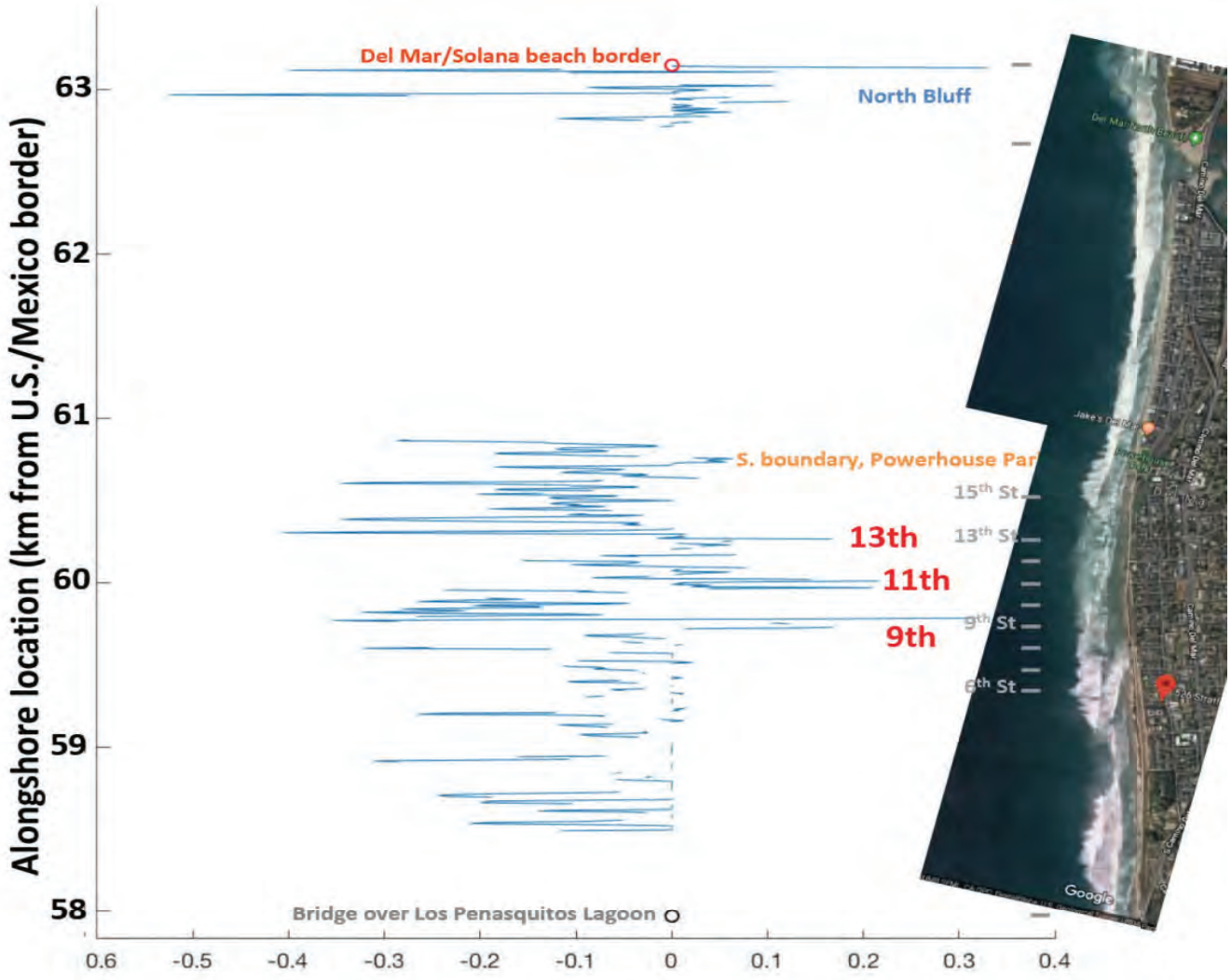
- **Use of Latest Technology to Assess Bluff Geology Impacts**
  - How is the latest coastal bluff geologic technology being used to assess the bluffs critically vulnerable regions?
  - SANDAG assessment can take advantage of LIDAR studies
  - SANDAG assessment can use strainmeters (optical-fiber equipment) at key locations along the cliffs, capable of measuring earth movements at the scale of microns.
  - SANDAG assessment can use tiltmeters, which measure minute changes in bluff masses potentially providing predictive capability to monitor slope stability.

    Reference: https://scripps.ucsd.edu/news/scripps-receives-25-million-lead-new-coastal-cliff-research

- **Excessive Seawall Engineering**
  - Research at Scripps Institution of Oceanography (SIO), using LIDAR, has shown there are bluff regions that are more vulnerable than others along the Del Mar beach.
  - SANDAG estimates of cliff erosion rates of six inches per year, are averages over the entire length of the bluff. They are not specific to those areas of the Del Mar Bluffs that are more or less susceptible to wave erosion.
  - **SIO research used LIDAR sensors to measure bluff surface distances to mean high tide line. The measurements yielded a bluff steepening index all along Del Mar's shoreline. The index showed with accuracy and precision that west of 13th, 11th and 9th Streets the coastal Del Mar bluff was most vulnerable to wave erosion based on measurements made during 1998 to 2009 (Figure C-2).**
  - The difference between average rate and punctuated erosion events must be explored before the wholesale construction of too many 8 to 10-foot seawalls that are not needed, will reduce sand deposition, and block beach access.
  - To protect the environment and preserve the natural bluff and beach coastline contours, any engineered structures need to use temporary/removable erosion protection methods. Further, increased monitoring to detect railway threats can enable a phased plan, and thus postpone and avoid irreversible measures.
  - These are complicated issues when important infrastructure is involved. Unfortunately these issues will only become more common as sea level rises.

Figure C-2. Localized Bluff Steepening Index Calculated from 1998-2009 Measurements Along Del Mar From North (top) to South (bottom).

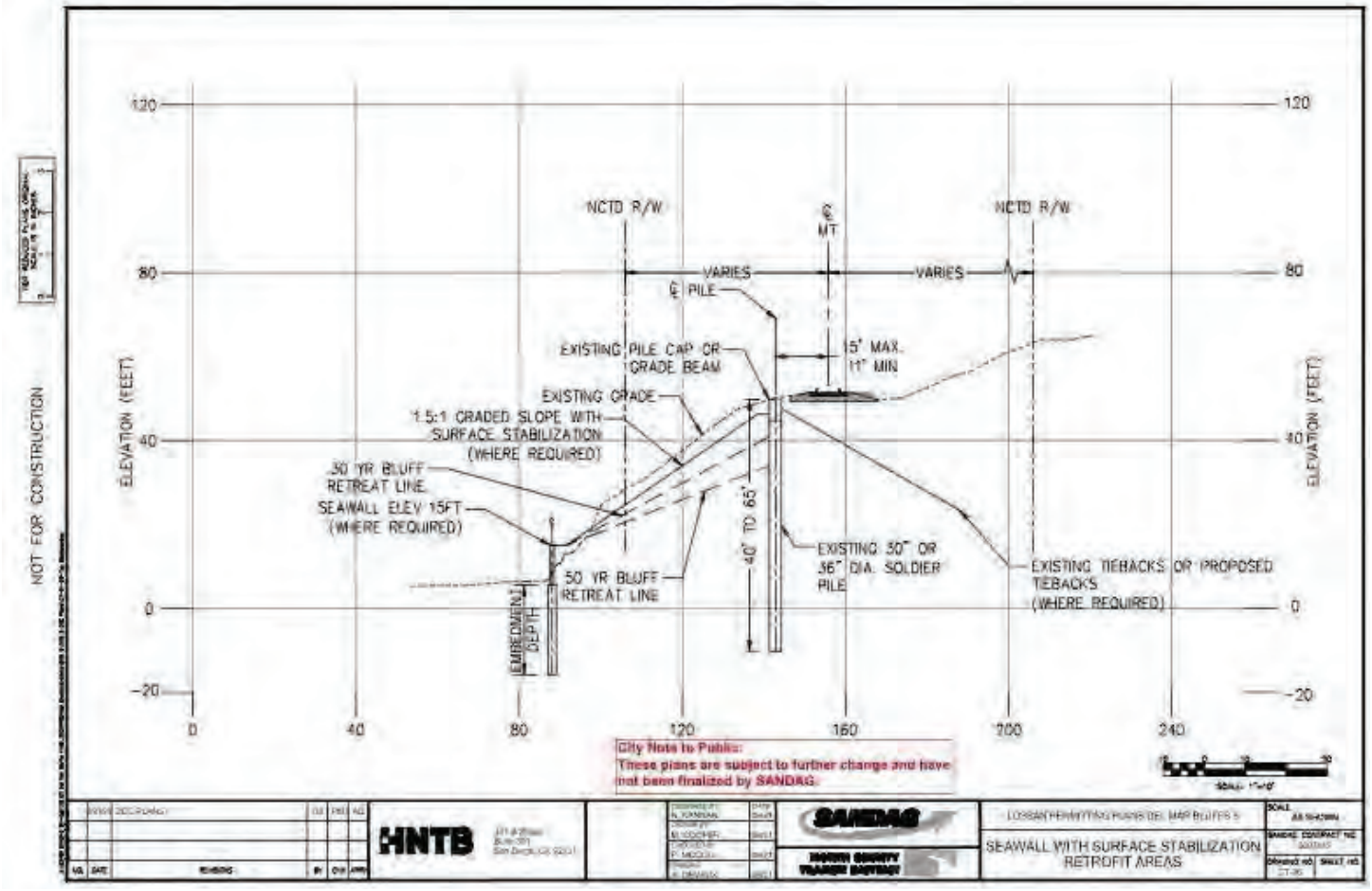
Graph of bluff steepening data as reported in A. Young (2020) side by side with satellite Google map of Del Mar coastline. South of 15th St, many of the punctuated high-risk zones at 13th St, 11th St, and 9th St have had slides. This index based on data through 2009 was predictive. The index could be used in the current planning. These data show bluff retreat is punctuated and specific, with measurable prior risk, not averaged across broad ranges.



Reference: Young et al: Three years of weekly observations of coastal cliff erosion by waves and rainfall , November 2020 Geomorphology 375(10):10754 10.1016/j.geomorph.2020.107545
https://www.researchgate.net/publication/347224570_Three_years_of_weekly_observations_of_coastal_cliff_erosion_by_waves_and_rainfall

Figure C-3: SANDAG Draft Design for Seawalls, Typical East-West Slice, with in-fill and grading specifications (2021 design).

Design notes indicate 30-year and 50-year bluff retreat lines; NCTD right of way (R/W) line is ~two-thirds down the bluff face (~30-50 east-west linear feet from middle of track [MT]); soldier piles up to 65' deep; 10 to 15-foot high seawalls with embedment to -17 feet below sea level (0 feet on y-axis Elevation); graded slope with 1.5:1 ratio (horizontal:vertical ratio).



- **Questions about Draft Design for Seawalls (Figure C-3)**
    - What are the following metrics based on?
        - 30 year bluff retreat line
        - NCTD R/W midway down bluff face, ~30-50 feet west of soldier piles
        - 40-65 foot depth for soldier piles
    - What will be the impact on the bluff to drive in soldier piles that are as deep as the bluff?
    - How many 3-foot diameter soldier piles are planned and at what distance apart?
    - Have they calculated separate local bluff retreat projections at each engineering location? Bluff retreat is punctuated, not averaged over the entire bluff face.
    - What is the source to establish mean-tide-line (x-axis)?
    - What review will happen to assess consistency with shoreline protections in the City of Del Mar? This design violates private easements between 10th and 11th Streets and also the Shoreline Protection Act (SPA) line in Del Mar's zoning, certified by the Coastal Commission, which prohibits protective structures west of the middle of the tracks (MT).

- **Sand Deposition Impacts**
  - Seawalls along natural coastal bluffs result in loss of sandy, recreational beaches. Armored bluffs in Solana Beach and Encinitas have shown beach loss over time.
  - **How much sand nourishment will be lost due to continuous bluff-toe seawalls?** Appendix B of the City of Del Mar's Sea Level Rise Adaptation Plan provides an analysis of coastal processes and sand movement along the Del Mar shoreline and presented the following observation that must be followed up to inform this question: *In Del Mar, approximately 75% of sediments in the sea cliffs are large enough grain size to contribute to the beaches.*
  - **Instead of seawalls, can soldier piles accomplish the goal of interim bluff stabilization with lesser environmental impact?** The Plan notes, [NCTD] *determined that installing soldier piles was the least environmentally damaging feasible alternative for an interim approach to track bed stabilization.*
  - **How much will soldier piles increase instability by driving 36-inch diameter piles 50-60 feet down into the cliff?** How close will they be to each other?
  - **Instead of seawalls or soldier piles, can other technologies be used?** Will they provide better protection? The Plan discusses Detached Breakwaters and Reefs, Groins, and Dunes as alternatives to protect against bluff erosion.
  - During 2014-2018, the City of Del Mar studied impacts of sea level rise on the Del Mar Coastal Bluffs (Chapter 7, **SLR Coastal Adaptation Plan**, adopted by Council into the Community (General) Plan, October 1, 2018).[1] The Plan's Chapter 7 assessed the Del Mar Bluffs, built upon a Vulnerability and Risk Assessment[2], and provided the following summary observations about vulnerability:

    Vulnerability assessment*:*
    With 1-foot of sea-level rise, the current localized vulnerability of the LOSSAN railroad to bluff erosion will increase and extend along almost the entire southern bluffs. The railroad would need to be moved inland or other adaptation measures, for example with underpinnings, caissons, or soldier piles, would be required to reduce the risk of the railroad collapsing.

    - If a seawall is constructed to protect the railroad, it will cause the beach to narrow and over time little to no beach will exist along the southern bluffs.

  - Del Mar's Sea Level Rise Adaptation Plan recommends the following Bluff adaptation options: Beach nourishment and retention; Railroad relocation; Public infrastructure relocation

    Sources:

    1. https://www.delmar.ca.us/DocumentCenter/View/3580/Revised-Adaptation-Plan-?bidId=
    2. https://www.sandiego.gov/sites/default/files/sea-level-rise-vulnerability-assessment.pdf

- **Biota: Flora and Fauna Impacts**
  - The Del Mar Bluff is a 1.7 mile narrow stretch of non-human colonized land between the two protected lagoons of Los Penasquitos and San Dieguito. Many protected fauna and flora inhabit both of those lagoons and it is very likely that the bluff serves an important function to prevent loss of genetic diversity, a so-called migration corridor. To remove the bluff corridor can lead to genetic isolation for many species, which will limit their ability to adapt to changing environments, such as global warming, as a result of loss of genetic variability[1,2].

  - **Endangered, threatened, of special concern, or to-watch** species of plants and animals that have been observed at or near the bluff include[3-5]:
    - **Plants**: Red Sand-Verbena, Short-Leaved Dudleya, Sea Dahlia, Coast Barrel Cactus, Western Dichondra
    - **Birds**: Coastal California gnatcatcher (non-migratory), Western snowy plover (migratory and non-migratory), Coastal cactus wren (non-migratory), Belding's savannah sparrow (non-migratory), Least Bell's vireo (neotropical migratory)
    - **Butterflies**: Wandering skipper
    - **Lizards**: Belding's orange-throated whiptail, California legless lizard, Coronado skink, Coast horned lizard
    - **Snakes**: Red diamond rattlesnake

  - **Vernal Pools:** The Del Mar Bluff also contains Vernal Pools that are crucial for the survival of its inhabitants. Vernal Pools are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. Plants and animals that thrive under these harsh conditions spend the dry season as seeds, eggs, or cysts, and then grow and reproduce when the ponds are again filled with water. More than 90% of California's vernal pools have already been lost[6]. It is important to protect the few remaining vernal pools as they provide habitat to some very rare plant and animal species. In addition, birds such as egrets, hawks and ospreys use vernal pools as a seasonal source of food and water. The vernal pools on the Del Mar Bluff are long and narrow along the eastern side of the bluff, commonly observed midway between 15th and Torrey Pines and have been observed to be used by frogs. To date, the frog species that depend on the vernal pools, for their survival and reproduction, have not been confirmed. They might be Tree Frogs, or also possibly be the endangered species Spade Foot Toad. Other endangered species that might use the vernal pools on Del Mar Bluff are Fairy Shrimp and California Tiger Salamanders since

they are native to Southern California and are dependent on vernal pools for their reproduction and survival. Frog species should be identified.

References, Sources:

1. Mark R Christie, and L Lacey Knowles (2015) Habitat corridors facilitate genetic resilience irrespective of species dispersal abilities or population sizes. Evol Appl., 8(5): 454–463, doi: 10.1111/eva.12255
2. Harrison, R. L. (1992). Toward a Theory of Inter-Refuge Corridor Design. Conservation Biology, 6(2), 293–295. http://www.jstor.org/stable/2386251
3. http://www.lospenasquitos.org/conservation/sensitive-species/
4. https://www.calflora.org/entry/observ.html
5. https://calscape.org/
6. https://www.epa.gov/wetlands/vernal-pools
7. http://www.californiaherps.com/frogs/pages/s.hammondii.html
8. https://databasin.org/maps/new/#datasets=443d192368f6409c949338014886c703
9. https://www.fws.gov/sacramento/es_species/Accounts/Amphibians-Reptiles/ca_tiger_salamander/

- **Biota: Bluff & Slopes**

  Have complete species lists for flora and fauna on the Del Mar coastal bluff been reviewed?

  a. Do they include any sensitive or endangered natives?
  b. Where else in San Diego do these native species still exist in natural state?
  c. What species depend on the Del Mar Bluff as a corridor from lagoon to lagoon?

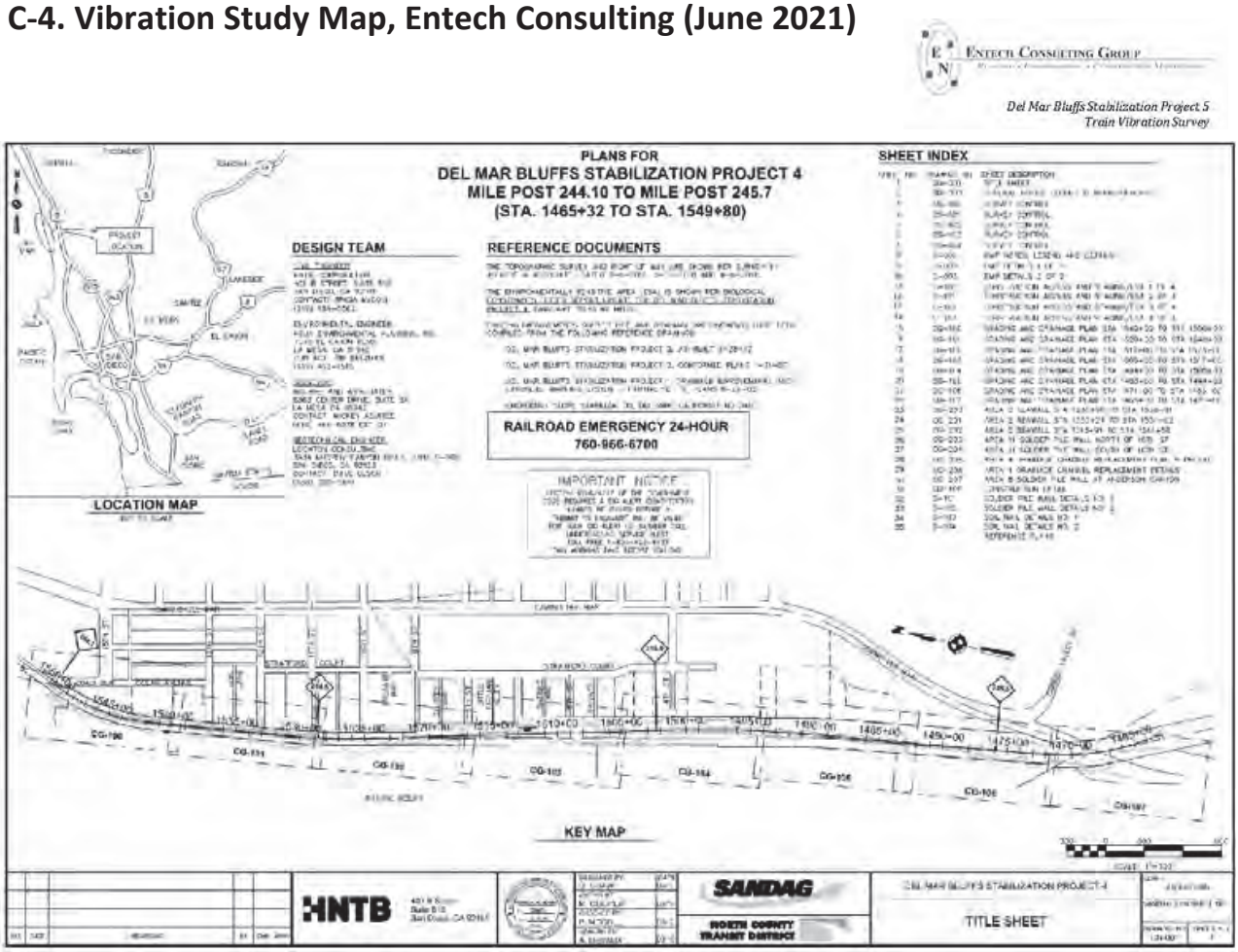
- **Biota: Beach & Intertidal**

  Have complete species lists for flora and fauna on the Del Mar beaches been reviewed?

  a. Do they include any sensitive or endangered natives?
  b. What will be the impacts on shorebirds due to loss of bluff face nesting areas?
  c. What will be the impacts on grunion runs at top of high tide along the bluffs? Grunion runs need a protected area without lights.
  d. What will be the impacts on nighttime fauna and flora? Because the main north beach in Del Mar has extensive lighting, the bluff beaches provide scant dark areas for species active at night.

Bottom Line: Without proper flora and fauna species identification, there is no clear picture of the bluff lifeforms, their surface and subsurface habitats, and their uniqueness.

Figure C-4. Vibration Study Map, Entech Consulting (June 2021)



- **Vibration Impacts**
  - SANDAG's consultant Entech Consulting Group measured vibration east of the tracks on the upper east bluff in 3 locations in June 2021.
  - The study measured vibration for only a 24-hour period in which two freight trains passed on the Bluff, and sampled in only 3 locations – an **insufficient sampling.**
  - Figure C-4 shows the Vibration Study map and measurement locations.
  - Measurements were at least 100 feet east of the tracks and at least 50 feet from the edge of the each upper bluff on top of surface streets.
  - Data from the study showed 15 second intervals between measurements, too long a period to sample multiple times during the passing of a train.
  - Data two of the three sampling points seemed to have duplicate values, indicating some sort of **measurement artifact or data processing error.**
  - Entech did not measure vibration in the limestone of the Bluff west of the tracks.
  - A person standing on the coastal Bluff or the upper east bluff when the train goes by will feel the Bluff vibrate.

VIBRATION QUESTIONS:

- **What are the effects of vibration from trains within the limestone Bluff over time?**
- **What will doubling the number of trains do to the effects of vibration?**
- **What will increasing the speed of the trains do to the effects of vibration?**
- **Should the trains run more slowly, not faster?**

- **Seismic Risk and Impacts**
  - **Rose Canyon Fault:** Experts estimate that this active fault, located less than 2 miles offshore from Del Mar's Bluffs, is the greatest seismic threat to the region as it is capable of earthquakes of magnitude 6.9. In the 1800s, the fault previously generated 6.5 and 6.0 earthquakes that caused widespread coastal bluff slope failures (Griggs and Scholar 1997). According to the Earthquake Engineering Research Institute's recent scenario of a 6.9 earthquake, "tracks in Del Mar are potentially subject to earthquake-induced bluff failures. Service can be expected to be disrupted for weeks to months while tracks are repaired" (EERI San Diego Scenario 2020, p. 48).

- **Stability Impacts**
  - **Assurances needed:** According to the Coastal Act's Section 30253, "new development shall assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs."
  - **Fencing:** NCTD's proposed fencing project will drill over 1,000 post holes into the fragile sandstone bluff to create over 1,000 new avenues for water intrusion and add almost 300 tons of weight from cement and fencing on the most vulnerable bluff edges. **How does this contribute to erosion and geologic instability?**
  - **Heavy Equipment:** SANDAG's project utilizes heavy construction equipment that can cause substantial ground borne vibration from pile drivers and large earthmoving equipment. **Given the many fissures on the bluff, how can SANDAG decapitate (or "shave") over 23,000 cubic feet from the top of the oceanfront bluffs between 8th and 11th St. without damaging them or causing more slides?**
  - **Risk/Reward:** SANDAG's engineer stated there is only an expected 10% reduction in bluff slide risk which is a very low risk/reward payoff given the high probability of failure and permanent damage to the long-term stability of the bluffs and train tracks.

- **Double-Tracking:** SANDAG acknowledges that vibrations from increased train traffic along rail ways from the "double-tracking of the LOSSAN railway corridor may also cause or exacerbate soil erosion along coastal bluffs." (current draft EIR for the 2021 Regional Plan). Will this create more stress on the fragile bluffs lining both sides of the train tracks? Is this what is contributing to the increasing frequency of large slides that now total 9 in the last 3 years, including the most recent on Oct. 29, 2021?

- **Permanent Alteration of Natural Land Forms**
  - **Scenic and Visual Resources:** According to the California Coastal Act Section 30251, "the scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinate to the character of its setting."

APPENDIX D: Summary of Citizens' Petition

The following text from the one-page summary of the Citizens Petition to the California Coastal Commission summarizes the overall situation:

> **For over 100 years, the public has used the trails on the iconic Del Mar bluffs ("Bluffs"). Despite decades of dangerous bluff collapses, SANDAG and NCTD have failed to take action to relocate the train tracks installed in 1910. SANDAG has finally commenced efforts to relocate the tracks by seeking alternative, inland train routes. In the meantime, NCTD and SANDAG propose to stabilize the Bluffs by grading the Blufftop, erecting concrete structures in the Bluff and making other changes, many irreversible.**
>
> **Even though the fragile sandstone bluffs are fast eroding, NCTD plans to further destabilize the Bluffs by erecting nearly two miles of six foot chain link fencing along the Bluffs.**
>
> **This fencing project will require extensive drilling of postholes, to be filled with cement to support the fence. The holes will create more than 1,500 new sources of water intrusion and add 317 tons of weight which accelerates erosion of the already stressed Bluff edges. While NCTD claims extensive two-mile fencing is required to avoid "trespassers," NCTD's data shows that all pedestrian and vehicle accidents occur at or within a third of a mile of the crossing at Coast Blvd and that extensive fencing is unnecessary in addition to destabilizing.**

The Petition urges the Coastal Commission to obtain a firm commitment from SANDAG and NCTD to relocate the tracks within a specific time frame--within 10 years--to ensure that alteration of the Bluffs be the minimum necessary to ensure safety until relocation; and to reject NCTD's proposed fencing plans and avoid further damage to and erosion of the Bluffs through limited, targeted fencing near the Coast Blvd crossing.

Ultimately, it is the Coastal Commission that has the statutory mandate and singular mission and to whom the citizens of California look, to protect our precious coast, in this case specifically the Del Mar Bluffs. SANDAG and NCTD have no similar mandate but rather are beholden to railroad and commerce interests. Certainly, a balance of interests is in order, but SANDAG's and NCTD's plans, which they insist are meant to address a "temporary" problem, will inflict permanent damage and place the interests of commerce far ahead of environmental interests and those of citizen's rights as mandated to the Coastal Commission. This paper asks that the Coastal Commission test SANDAG and NCTD assurances with just some of the scientific questions that need to be asked by the Coastal Commission's scientists.

Link to full Petition available via https://delmarbluff.com/one-page-summary-of-citizens-petition

Appendix E: EIR Regulatory Requirements

California Requirements:

- The California Environmental Quality Act – CEQA
  - CEQA requires public agencies to "look before they leap" and consider the environmental consequences of their discretionary actions. CEQA is intended to inform government decision makers and the public about the potential environmental effects of proposed activities and to prevent significant, avoidable environmental damage.

    Source: CEQA- The California Environmental Quality Act: **https://opr.ca.gov/ceqa/**

- The California Coastal Act
  - Elements of the bluff stabilization project do not meet the following requirements of the Coastal Act in PEIR 4.1:
    - Under the California Coastal Act of 1976 (Public Resources Code Sections 30000 et seq.), scenic and visual qualities of coastal areas are considered and protected as a visual resource. One of the primary objectives of the Coastal Act is the protection of scenic and visual resources, particularly as viewed from public places. Section 30251 requires that development be sited and designed to protect views to and along the ocean and other scenic coastal areas. New development must minimize the alteration of natural landforms. This policy also requires that development is sited and designed to be visually compatible with the character of surrounding areas. Where feasible, development must include measures to restore and enhance visual quality in visually degraded areas.

    - LOCAL LAWS, REGULATIONS, PLANS, AND PO

      https://sdforward.com/docs/default-source/2021-regional-plan-draft-eir/4-1-aesthetics-and-visual-resources.pdf?sfvrsn=210ffd65_2

    - County of San Diego EIR Requirements
      https://www.sandiegocounty.gov/content/dam/sdc/pds/docs/EIR-Format.pdf

Appendix F: Credits

Authors:	Payson R. Stevens & Terry Gaasterland
Text Research/ Content:	Biota: Camilla Rang; Seismic & Landforms: Laura DeMarco
Text Comments:	Drew Cady, John Stahl, Shirli Weiss
Visualization Simulations:	Mason Tripp
Satellite views:	Google Earth Pro
Design:	CorePR.com

Short Biographies

Payson R. Stevens

His multi-faceted career reflects two passions: earth science/environmental protection and art in multiple media (painting, experimental video, photography, writing). Payson did PhD studies at Scripps Institution of Oceanography mentored by the renowned scientist, Roger Revelle. He was instrumental in helping to stop oil development off the coast of San Diego and Orange County organizing and preparing the science assessment and critique of the EIR of Lease Sale 48 (1978). The two companies he founded, InterNetwork, Inc. and InterNetwork Media, Inc. consulted with NASA, NOAA, and the USGS on global change/climate issues (Earth System Science, Mission to Planet Earth/1980-2000). Both companies were pioneers at the beginning of the digital age and received many awards for cutting-edge work (Presidential Design Award for Excellence from Bill Clinton/1994, USGS John Wesley Powell Award/1992). Stevens is the co-author of the acclaimed, *Embracing Earth: New Views of Our Changing Planet* (1992) and contributing author to the best-selling college textbooks (*Biology Today* /1971), *Geology Today*/1973). His public speaking includes TED 2 & 3, CNN, Robert Redford's Greenhouse/Glasnost, Apple Developers Conference. He lives half the year with his wife, the writer Kamla K. Kapur (www.kamlakkapur.com), in a remote area of the Indian Himalayas where he is involved with nature conservation and rural community work. His India projects included: advisor to the Great Himalayan National Park/GHNP (2000-15); co-founder of Friends of GHNP (2000-present), successfully spearheading GHNP's Inscription as a UNESCO World Heritage Site (2014); co-founder of My Himachal (2006-12) which focused on rural healthcare and nutrition. His projects can be seen at www.paysonrstevens.com

Terry Gaasterland, PhD

Terry directs the Bioinformatics & Systems Biology Graduate Program at the University of California, San Diego, with tenure, and is a member of the faculty of the Scripps Institution of Oceangraphy. She earned her Bachelor Degree in Computer Science and Slavic Studies at Duke University, with study overseas at Oxford University's New College, and then completed a PhD in Computer Science. At the Department of Energy, then as faculty at the University of Chicago, The Rockefeller University, and now UCSD, she has sought to apply AI technologies to study and solve problems in biological systems and genomics, including genetic/genomics response to climate change stresses. In 2018, Terry was elected to the Del Mar City Council. In her active dual career as a scientist and as a local elected official, she strives to bring science and policy together to address problems at the local political level with particular emphasis on challenges facing California's coastal cities and jurisdictions. She chaired Del Mar's Sea Level Rise Technical Advisory Committee (2014-2018). Under her leadership, Del Mar's Sea Level Rise Adaptation Plan was developed to address vulnerabilities and protect against beach loss, and adopted into the Community (General) Plan. *TG's contributions to this Report reflect her own views and do not speak for the City.*

Camilla Rang, PhD

Camilla is a senior researcher at the department of Ecology, Behavior and Evolution (EBE) at the University of California, San Diego (UCSD). Her research focuses on the evolution and origin of aging in single cells organisms. She earned her PhD from Göteborg University, Sweden, studying the impact of microbiome on single cell bacteria in the intestine, and her post doc from the Center of Vaccine Development, University of Maryland, Baltimore. When joining UCSD 23 years ago, Camilla and her family settled in Del Mar, where she since has been an active and involved resident.

Laura DeMarco

Laura is a 34-year Del Mar resident and experienced fiduciary and investment management executive. As a senior partner, she contributed to the successful launch and development of two investment firms, including a global asset manager which grew to over $40B in assets under management. Laura uses her research and analytical skills to serve on investment committees and advise large public and corporate pension funds, insurance companies, financial institutions, endowments, foundations, Taft-Hartley plans and their investment consultants. She graduated from the University of San Diego and has over 30 years of institutional investment experience.

John Stanley, PE

John is a Del Mar Heights resident and licensed professional engineer with over 25 years of experience. A major area of his expertise is evaluating materials, stresses, and operational stability of machinery and aircraft in his role with the Department of Defense and as a design and engineering consultant. He is also a private pilot who has built experimental aircraft. Stanley earned his degree in mechanical engineering from San Diego State University.

Google Earth attribution:

Google Earth Pro 7.3.4.8248, (2021) Del Mar Bluffs at 7th St. 32°57'2.40"N, 117°15'56.31"W, elevation between 8'-79' above sea level. 3D Buildings, Terrain, Borders and Labels data layers. Data SIO, NOAA, U.S. Navy, GEBCO. [Online] Available at https://www.google.com/earth/versions/ [Accessed 27 October 2021]

Visualization Coordinates

Ex Seawall 2.3 32°57'2.40"N, 117°15'56.31"W

Ex Seawall 2.2 32°57'18.06"N 117°16'2.26"W

Ex Seawall 2.1 32°57'25.19"N 117°16'3.86"W

Seawall 32°57'29.65"N 117°16'4.91"W

Visualization Notes:

Fig 2: Depicted Seawalls are 3 Meters above ground (9.84') which does not take sand into consideration and should be considered a rough approximation. Due to limitations of software the altitude of the wall can only be adjusted in 1 Meter (3.28') increments. 2 Meters (6.56'), while technically the closet to 8'; seemed too low visually as the bottom portion of the wall does "sink" or "clip" into the ground in the 3D model.

Natural Coastal Bluff Top Trail For All To Enjoy

(photo, Karl Willert)

Protect, preserve, and respect the Del Mar Bluffs and Beaches now and forever.

Protect & Preserve Del Mar Bluffs & Beach

Proposed NCTD and SANDAG Engineering Impacts on the Del Mar Bluffs & Beach

Scientific Questions and Concerns

Request for Coastal Commission Action

Submitted by

Concerned Citizens of Del Mar

http://DelMarBluff.com

&

Coastal Bluff Conservancy

Del Mar, CA 92014

https://SaveTheDelMarNorthBluff.com

OVERVIEW

The Del Mar Bluffs are the last remaining stretch of 1.7 miles of natural terrain trails in San Diego North County. The Bluff and beaches have had continuous community access for over a century. The 20 to 30-year engineering plan proposed by the San Diego Association of Governments (**SANDAG**) and the North County Transit District (**NCTD**) will irrevocably damage the Bluff and beach and also deny access to the wide community of the public who have used them for 100 years.

This Report is addressed to the California Coastal Commission and concerned governmental, non-governmental, and citizen groups who have the means to question and challenge the engineering plans and ultimately to protect and preserve the natural Bluffs with the open beaches below for future generations.

The Report raises critical scientific and engineering questions related to the on-going and proposed engineering of the Del Mar Bluffs and beaches. Further, the Report will educate and inform stakeholders who question the engineering plans.

Our Objectives

Protect and Preserve the Del Mar Bluffs & Beach

- Visualize:
  - Simulations of what is planned
  - Engineering underway now
- Raise Unanswered Scientific & Engineering Questions
- Define Critical Issues Ensuring they are Objectively Addressed

We Call on the Coastal Commission to

- Ensure that SANDAG and NCTD Proposed Plans Are Subject to an Environmental Impact Report (EIR) by objective and expert engineers and scientists; and
- Ensure that the California Coastal Commission (CCC) legal mandate to protect the California Coastline is not hampered or superseded by legal maneuvers with the Surface Transportation Board.

Appendices provide expanded material on the questions and issues that need review by Coastal Commission staff and engineers, and by concerned public and private groups.

Urgent Action Required *WITHOUT* Excessive Measures

Del Mar, SANDAG and NCTD have a multi-faceted problem, 20 years in the making. Why should the lack of adequate progress relocating the railroad result in the destruction of the Del Mar Bluff and its beaches in San Diego's North County?

The Bluff is fragile and will continue to erode and collapse. It is understood and accepted that some degree of protection is needed to ensure the safety of the railway line that currently runs the 1.7 miles of the Bluff. Nevertheless, the Bluff offers multiple benefits to the community as one of the San Diego region's last remaining natural, accessible coastal bluff with trails above and beach below. Irreversible changes must be avoided.

The consequences of planned structures will deface the bluffs with armoring and grading, bury beaches and bluff toes behind seawalls, and deplete natural sand replenishment. This Report strongly questions the 20 to 30-year engineering plans as excessive and unproven.

Alternatively:

Relocate now. The railway line runs through Del Mar as a single track on top of the fragile bluff. The need for relocation has been recognized for over twenty years. Sea level rise and climate change have sped up the urgency. The tracks must be moved within the next 7 years without further delay.

Minimize interim engineering. In the interim, the extent of the proposed engineering requires thorough, objective scrutiny by independent engineers and coastal bluff and beach processes scientists to ensure minimal long-term impact on the Bluff with appropriate mitigation.

Requests to all responsible agencies and individuals:

- ☐ **Ensure** enforcement of Coastal Commission legal mandates
- ☐ **Require** an Environmental Impact Report from SANDAG and NCTD
- ☐ **Minimize** engineering to save the natural coastal Bluff, beaches, and access
- ☐ **Relocate** railroad tracks no later than 7+ years
- ☐ **Commit** funds to reverse the engineering impacts after relocation

WHAT IS PLANNED?

SANDAG leads a **project to impose environmentally destructive engineering structures along the entire 1.7-mile coastal Bluff top, face, and toe and the beach below that will:**

- **Armor** the entire Bluff with long continuous seawalls on the beach that will eliminate the natural chiseled contours of the Bluff toe and obscure flow of beach sand;
- **Bury** beaches behind the seawalls with in-fill dirt on top of beach sand and Bluff toes;
- **Destroy** bluff faces extensively with grading and compaction that will erase the existing natural bluff geologic features;
- **Construct** long retaining walls at the coastal bluff-top edge, west of tracks; and
- **Decapitate** completely the upper ~25% of the highest west-facing Bluff face.

NCTD leads a separate **project to install fencing on the Bluff tops for the full 1.7 miles.**

On October 15, 2021, Del Mar Council members and staff walked the entire length of the SANDAG bluff project together with SANDAG and NCTD engineering staff and one NCTD Board member. At that time, SANDAG staff indicated the engineering consultants had been directed to **plan for another 20 years of train operations atop the fragile, sensitive coastal Bluff** (Figure C-3, Appendix C).

COMMUNITY RESPONSE

A Citizens' Petition submitted to the California Coastal Commission, October 13, 2021, clearly states the community's concerns regarding the unique qualities of the Del Mar Bluffs and beaches that draw tens of thousands of visitors to walk, swim, surf, and enjoy **(Appendix D)**. The Petition was uploaded to change.org to collect signatures electronically.

Many environmental impact concerns and questions about the fencing project are addressed in the Petition. Further questions were raised by independent third-party engineering experts from Atlas Technical Consultants, LLC, contracted by the City of Del Mar **(Appendix B)**.

Residents of Del Mar, other San Diego communities, and from afar, have presented objections to the excessive engineering plans of SANDAG and NCTD in public meetings before the Del Mar City Council, the California Coastal Commission (CCC), North County Transit District (NCTD), and the San Diego Association of Governments (SANDAG) (See verbal and written Public Comments at meetings of these bodies during the week of Oct. 18, 2021).

This Report poses critical, unanswered questions to ensure they are objectively addressed now.

OVERSIGHT IS LACKING

The geotechnical stabilization plans offered by SANDAG and NCTD are unproven, excessive, and plan for 20 to 30 more years of bluff top railroad operation. The community demands a shorter timeline in which the railroad tracks go elsewhere, and the natural Bluff beauty remains.

The community realizes that some preventive engineering is required as soon as possible to protect the tracks and trains before they are relocated. However, the community demands that current engineering in process and planned engineering receive the full scrutiny required by the California Coastal Act. **Irreversible changes must be avoided.**

NCTD's approach to fencing the bluffs has disregarded the community and the importance of the natural coastal bluff and beach environment. Their reliance on a cursory geological opinion to justify massive drilling, imposition of concrete and fencing on the Bluff serves as a stark lesson that the Coastal Commission must not rely on the assurances of either NCTD nor SANDAG nor their consultants that their proposed sweeping redesign of the Bluff are **the least most destructive and necessary to accomplish legitimate goals.**

Dramatic, permanent changes are planned and underway without environmental review. They are a blow to the environment, armoring the Bluff with ugly concrete structures and seawalls creating a gauntlet to beach access: a direct violation of the Coastal Commission's legal authority and mandate.

THE BOTTOM LINE

Why do a 20 to 30-year project when the track relocation is expected within 10 years? Why destroy the Bluff and beaches when less destructive engineering is possible to bolster the Bluff until the railway is moved?

The Coastal Commission has the legal mandate and singular mission to protect our precious California coast

A Brief Visual Tour in Five Images

1. Proposed Engineering Ignores Coastal Protections

Visualization looking north along the Bluff from 11th St north to Coast Blvd.

IMPACTS:

- Grading and terracing will replace natural Bluff contours with industrial faces.
- All red shaded areas will turn into artificial graded slopes.
- High seawalls (purple) will obscure the base of the Bluff along the beach.

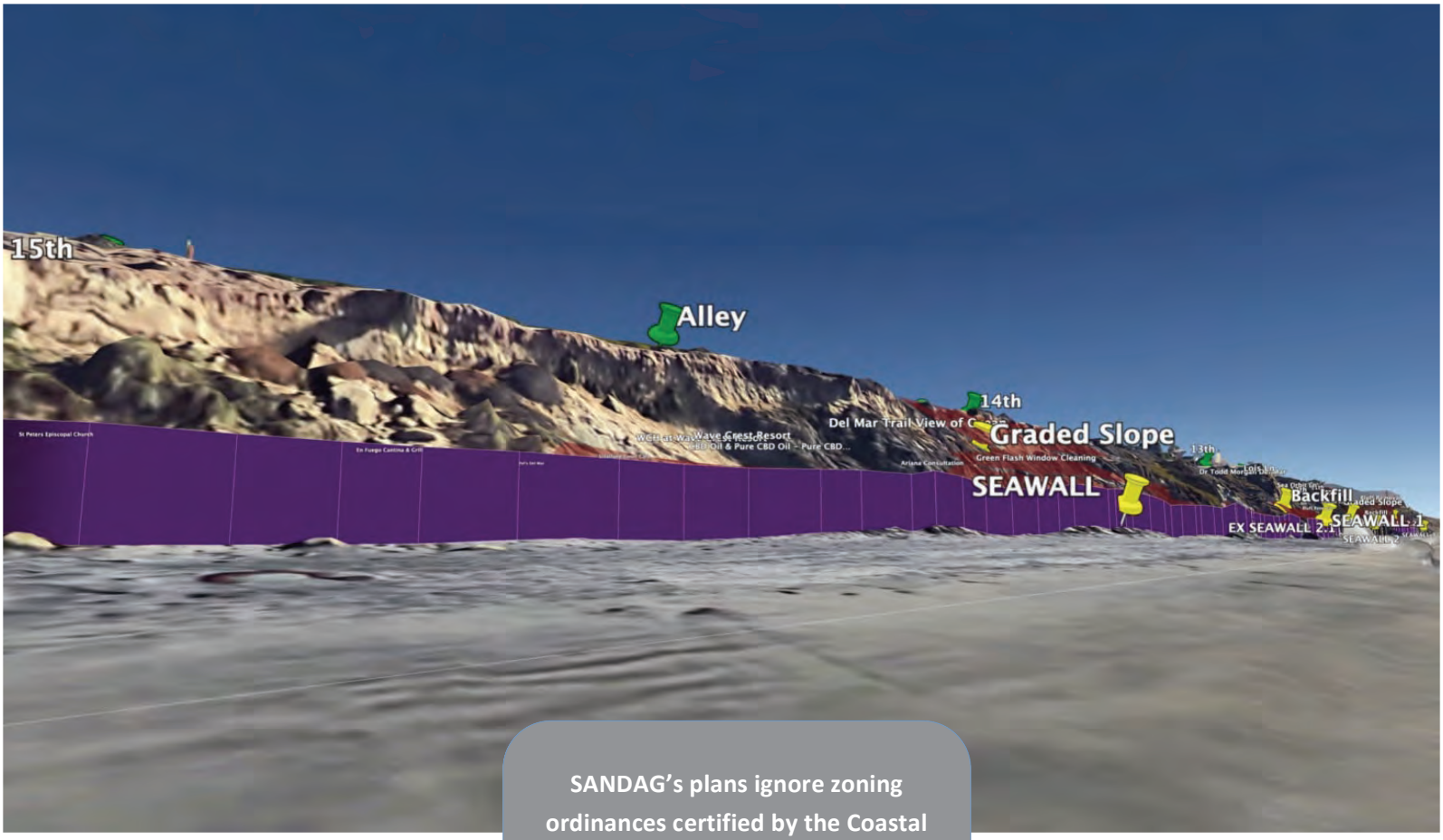
See Appendix A for more visualizations.

2. Continuous Seawalls Restrict Beach Access & Sand Renewal

Visualization looking south between 15th and 11th Streets.

IMPACTS:

- A long high seawall (purple) will block natural coves and bluff/beach features.
- Long seawalls 8 to 10 feet high will separate beachgoers from the Bluff's lively life.
- Bluff environments for small animals, wild plants, sea grasses, nesting birds, native frogs, and their ecosystem will be buried and obstructed.
- A walk along the beach will change completely - the Bluff will be caged behind a vertical wall.



SANDAG's plans ignore zoning ordinances certified by the Coastal Commission that limit protective structures west of the middle of the railroad track

See Appendix A for more visualizations.

3. Natural Beauty Will Be Irreversibly Destroyed

Natural Bluff from 11th to 8th St is slated to be decapitated. (photo, Terry Gaasterland)

IMPACTS:

- SANDAG plans will remove the top 20 to 25 feet of tall natural Bluff.
- Bluff crevices where birds nest and small animals live will be gone forever.
- Bluff material for sand replenishment will be eliminated.

4. Engineering Already Underway

SANDAG's Terracing At South End of Del Mar Woods. (photo, Terry Gaasterland)

With no environmenal review or public input whatsoever, SANDAG commenced with a small emergency repair that has grown into an outsized insult on the natural bluff face.

5. Armoring The Coast – Natural Beauty vs. Concrete Hardening

BEFORE: Coastal Bluff Top Trail below Del Mar Woods. *(*photo, Michael Keenan)

AFTER: Bluff Top Trail - Concrete drainage, natural flora/terrain scraped.
(Photo, Payson R. Stevens)

CRITICAL QUESTIONS

The Coastal Commission needs to require that these critical questions about impacts be answered by SANDAG and NCTD before moving forward. Without an EIR, the consequences of the engineering can never be fully understood and addressed.

1. What is the time horizon for the engineering before the railway is moved as that should determine the degree of armoring needed? What's the difference and impacts between a 20 to 30-year engineering plan versus a 10-year plan?
2. How will grading and in-fill be managed and minimized?
3. Can the project be reframed to place localized seawalls in high-risk locations? The risk of bluff slide and erosion is not the same along the entire Bluff. Collapses are punctuated, local events.
4. How will imminent sea level rise affect the beaches and proposed seawalls?
5. Are funds set aside to remove seawalls after railroad relocation.
6. Does SANDAG have jurisdiction to construct seawalls on the beach and bury coves behind them?
7. Have agencies with jurisdiction over the beach been included in the planning? For example, State Parks, the State Lands Commission, and the City of Del Mar. The southernmost planned seawall is on the Torrey Pines State Beach
8. Has SANDAG studied the impacts of the seawalls on wave energy dissipation patterns and erosion dynamics? How significant will the resulting *active beach erosion* be?
9. What serious and committed efforts are underway to relocate railroad in 7 to 10 years?
10. Will the proposed engineering plans be made consistent with the planned train relocation?

Appendix C provides expanded details for each Critical Question.

At this time no Environmental Impact Report (EIR) has been prepared for either agency's project.

SUMMARY OF SCIENTIFIC QUESTIONS AND ANALYSIS NEEDED

Geotechnical Impacts

Expert analysis of geotechnical impacts of the SANDAG's proposed engineered structures are clearly lacking and must be done. The City of Del Mar contracted an independent review of NCTD's geotechnical report by Leighton Consulting, Inc (2021) on their 1.7 miles of fencing plans. The independent review found multiple, serious deficiencies. Specifically, the critique of the Leighton report by third-party expert consultant Atlas Technical Consulting, LLC, noted analysis, tests, and measurements that were missing from the Leighton report.

The Atlas observations on needed geotechnical analysis pertain not only to the NCTD fencing but more generally to any engineering project on the fragile coastal Bluff. The following needs for analysis of geotechnical impacts apply equally to the SANDAG engineering. See **Appendix B** for these fundamental geotechnical questions that must be answered.

Urgent Analysis is Lacking in Key Scientific Areas:

- ☐ **Rain and irrigation subsurface Bluff penetration**
- ☐ **Latest technology for assessing Bluff geology**
- ☐ **Beach erosion effects from seawall construction along Bluff toe**
- ☐ **Sea level rise with wave energy against sea walls**
- ☐ **Identification of flora and fauna of Del Mar Bluff and beaches**
- ☐ **Vibration effects on coastal Bluff west of tracks**
- ☐ **Seismic risks and the Rose Canyon Fault**

Details for the above scientific concerns can be found in **Appendix C.**

Pressing questions and impacts must be addressed and require SANDAG's public response.

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San Diego Habitat Conservancy
Torrey Pines Conservancy

Journal of Coastal Research	26	3	580–585	West Palm Beach, Florida	May 2010

Coarse Sediment Yields from Seacliff Erosion in the Oceanside Littoral Cell

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ABSTRACT

YOUNG, A.P.; RAYMOND, J.H.; SORENSON, J.; JOHNSTONE, E.A.; DRISCOLL, N.W.; FLICK, R.E., and GUZA, R.T., 2010. Coarse sediment yields from seacliff erosion in the Oceanside Littoral Cell. *Journal of Coastal Research*, 26(3), 580–585. West Palm Beach (Florida), ISSN 0749-0208.

The coarse sediment fraction of geologic formations exposed in 42 km of southern California seacliffs in the Oceanside Littoral Cell was estimated using more than 400 samples. An impulse laser, oblique photographs, and coastal maps were used to define thickness and alongshore extent of the geologic units exposed in the seacliffs. The coarse sediment (defined as diameter > 0.06 mm) fraction in each geologic unit was estimated by sieving. About 80% of the exposed cliff face is coarse and can contribute to beach building. Finer cliff sediments are transported offshore by waves and currents. Although there are some differences, the observed 80% coarse fraction is generally consistent with previous estimates based on an order of magnitude fewer samples. Coastal development has largely eliminated about 40% of seacliffs in the Oceanside Littoral Cell as potential beach sand sources. For the remaining seacliffs, 1 cm of average cliff retreat yields 10,000 m^3 of potential beach-building material.

ADDITIONAL INDEX WORDS: *Coastal erosion, cliffs, southern California, sediment budget.*

INTRODUCTION

Southern California beaches are important economic, cultural, and recreational resources. Beaches also provide a natural buffer against coastal erosion that threatens coastal infrastructure throughout the region. An understanding of littoral budgets and processes is necessary for proper coastal management. Natural beach sediment inputs in California include rivers, seacliffs, gullies, and terrace surface erosion. In general, rivers contribute the majority of sand to California beaches (Best and Griggs, 1991; Bowen and Inman, 1966; Knur and Kim, 1999). River contributions of sand in southern California tend to be concentrated around relatively rare large-flow events associated with winters of especially high or concentrated rainfall. Recent research (Haas, 2005; Young and Ashford, 2006a) suggests seacliff erosion sometimes also supplies a significant amount of sediment to beaches in the Oceanside Littoral Cell.

The key variables in estimating the seacliff beach-sediment contribution include the rate of cliff erosion and the amount of coarse-grained sediment within the seacliffs that will potentially remain in the nearshore littoral system. While numerous studies have evaluated cliff erosion and retreat rates within the Oceanside Littoral Cell (Benumof and Griggs, 1999; Benumof *et al.,* 2000; Emery, 1941; Emery and Kuhn, 1980; Everts, 1990; Hapke and Reid, 2007; Kuhn and Shepard, 1980, 1984; Lee, 1980; Moore, Benumof, and Griggs, 1999; Robinson, 1988; Runyan and Griggs, 2003; Vaughan, 1932; Young and Ashford, 2006a, 2006b, 2007, 2008), little work has evaluated the cliff grain size composition. Here, extensive new cliff sampling and grain size analysis are used to better determine the coarse fraction of cliff sediments in the Oceanside Littoral Cell.

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STUDY AREA

The Oceanside Littoral Cell, located in northern San Diego and southern Orange Counties (Figure 1), spans 85 km of coastline from Dana Point to La Jolla (Inman and Frautschy, 1966). The cell is characterized by narrow sand and sometimes cobble beaches backed by seacliffs cut into uplifted marine terraces. Seacliffs comprise 80% of the littoral cell, with occasional alternating lowlands at coastal river mouths and lagoons. The majority of the Oceanside Littoral Cell contains residential, commercial, and recreational development on the cliff top, with the exceptions of the Camp Pendleton Military Reservation and San Onofre State Park. The cliffs are subject to both marine and subaerial erosion.

Urbanization and development of the region have altered the coastline (Flick, 1993; Griggs, Patsch, and Savoy, 2005; Inman, 1976), including a reduction in natural beach sediment supply caused by river damming (Willis and Griggs, 2003) and coastal armoring (Runyan and Griggs, 2003; Young and Ashford, 2006b). In the Oceanside Littoral Cell, damming has reduced

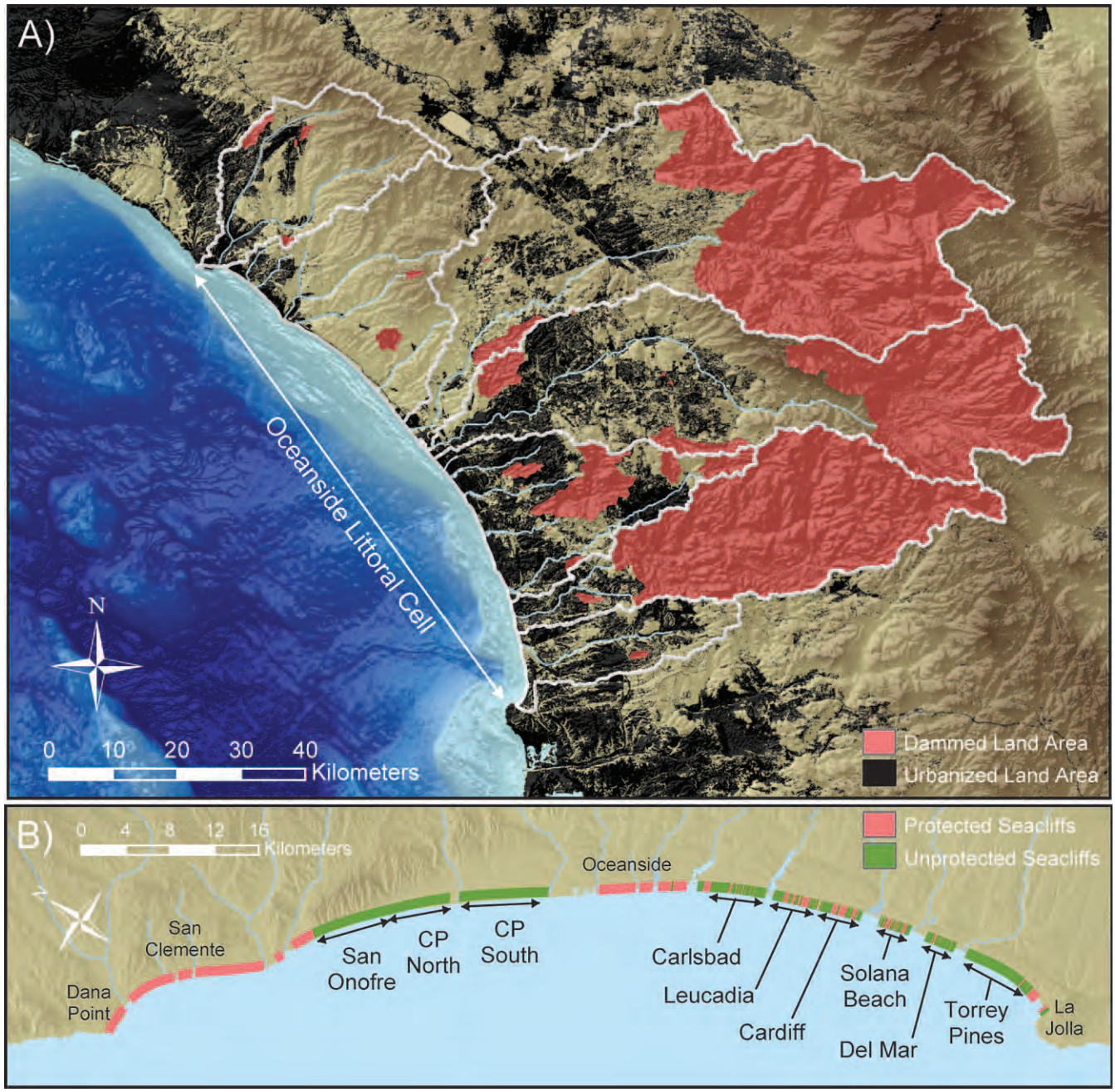


Figure 1. (A) Map of the Oceanside Littoral Cell and the adjacent watersheds that have been altered by dams (pink areas) and urbanization (black areas). In total, the damming and urbanization has resulted in a 60% reduction of the sediment-producing land area. (B) Map of the Oceanside Littoral Cell and the seacliff sections used in this study. Pink areas correspond to seacliffs that are significantly armored or separated from the littoral system by roads and railways, and green areas represent seacliffs without significant defenses. In total, 42% of the seacliffs are significantly protected and no longer contribute significant amounts of sediment to the littoral system.

the river sediment input by approximately 50% (Flick, 1993, 1994; Willis and Griggs, 2003), while coastal armoring and segregation have largely eliminated a significant portion of seacliffs as a potential sediment source. In addition to damming of the watershed, much of the adjacent watershed has been urbanized, and together these areas comprise 60% (40% dammed and 20% urbanized and not dammed; Figure 1) of the adjacent watershed. Warrick and Rubin (2007) suggest urbanization in southern California has significantly changed fluvial sediment loads and present-day loads may be substantially overestimated. The deficit in natural beach sediment supply in the Oceanside Littoral Cell has been counteracted by numerous beach replenishment projects since the 1940s with more than 15 million m^3 of sand (Flick, 2005). Despite these

beach replenishment projects, waves continue to erode the seacliffs, threatening cliff top infrastructure and public safety.

The seacliffs are usually between 25 and 33 m high but reach over 100 m in Torrey Pines. The cliffs are generally composed of two geologic units: (1) a lower unit of lithified Eocene, Miocene, or Pliocene mudstone, shale, sandstone, and siltstone, and (2) an upper unit of unlithified Pleistocene terrace deposits (Kennedy, 1975). The geologic conditions (*e.g.,* cliff resistance to erosion) vary alongshore at a range of scales, which contributes to the alongshore variation of cliff erosion rates and coarse sand content. Estimated long-term cliff retreat rates vary widely (between 2 and 170 cm/y) for different time periods and cliff sections in the Oceanside Littoral Cell (Benumof *et al.,* 2000; Everts, 1990; Hapke and Reid, 2007; Moore, Benumof, and Griggs, 1999).

The cliffs in northern Carlsbad, Oceanside, San Clemente, and Dana Point (a combined length of ~24 km) are either developed or removed from wave action by coastal roads or railways and were not evaluated in this study. The remaining 42 km of cliffs were divided into nine sections, based on general lithology and lagoon incisions (Figure 1). Approximately 2 km of scattered sections of unprotected cliffs (Figure 1) were not evaluated.

BACKGROUND

After a cliff failure, wave action disaggregates the talus and mobilizes the fine-grained sediments that are transported offshore. In contrast, coarse sediments are typically retained in the littoral zone and supply new beach-building material. The grain size threshold nominally separating these depositional environments is known as the littoral cutoff diameter (Best and Griggs, 1991; Hicks, 1985; Hicks and Inman, 1987; Limber, Patsch, and Griggs, 2008). Best and Griggs (1991, p. 38) define the littoral cutoff diameter as a grain size threshold below which sediment "will not remain within the active zone of littoral transport in any appreciable quantity"; however, there is currently no uniform method to sample and calculate this threshold (Limber, Patsch, and Griggs, 2008). For the Oceanside Littoral Cell, Everts (1990) used 81 samples (USACOE-LAD, 1984b) and found approximately 95% of the sediments in the littoral zone were larger than 0.063 mm, while Runyan and Griggs (2003) used 10 samples and found 99% of the sediments were larger than 0.088 mm. The transition from offshore transport to beach deposition is gradual, and further research could better define the effect of grain size on sediment retention in the Oceanside Littoral Cell. We used 0.063 mm as the littoral cutoff diameter, the value obtained with the larger sample size, to estimate the amount of beach-sized sand in the cliffs.

The percentages of coarse seacliff sediments were previously estimated (Table 1) for areas of the Oceanside Littoral Cell by the U.S. Army Corp of Engineers, Los Angeles District (USACOE-LAD, 1984a), Robinson (1988), Everts (1990), the California Department of Boating & Waterways and the State Coastal Conservancy (CDBW and SCC, 2002), and Runyan and Griggs (2003). Unfortunately, these estimates were based on a small number of samples at a few locations and in some cases were extrapolated over long distances over which the cliff composition changes. This study builds upon the previous research to provide a more detailed alongshore description of coarse sediments exposed along the cliffs, using extensive cliff sampling, sieve analysis, and detailed geologic mapping.

Table 1. *Summary of the percentage of coarse sediments within the seacliffs.*

	USACOE-LAD (1984a)	Robinson (1988)	Everts (1990)	CDBW and SCC (2002), Runyan and Griggs (2003)	This Study
Number of samples	*	26	‡	13	441
Number of sites	*	9	‡	9	295
San Onofre	80	72	60	52	62
Camp Pendleton north	80	54	60	52	72
Camp Pendleton south	80	†	60	52	67
Carlsbad	80	†	80	55	90
Leucadia	80	†	65	53	94
Cardiff	80	†	65	53	81
Solana Beach	75	†	65	53	93
Del Mar	75	†	65	53	61
Torrey Pines	75	42	65	52	78

* Information not given, values probably estimated without sampling.
† Sections not evaluated.
‡ No new samples evaluated, estimates based on USACOE-LAD (1984a) and Robinson (1988).

METHODS

Geolocated cliff samples were collected and analyzed for coarse-grain content (diameter > 0.063 mm) by sieving into two size classes (diameter ≥ 0.063 mm and diameter < 0.063 mm). The extent and thickness of the general geologic units were mapped. The average amount of coarse sediment (P_{Coarse}) for a given alongshore location was then estimated using a geologic layer thickness approach (Runyan and Griggs, 2003):

$$P_{\text{Coarse}} = P_1(T_1/H_c) + P_2(T_2/H_c)$$

The percentage of coarse material (lower unit = P_1, upper unit = P_2) is weighted by the relative vertical thickness of each geologic unit (lower unit = T_1/H_c, upper unit = T_2/H_c), where T_n and H_c are the unit thickness and the total cliff height, respectively (Figure 2). At a few locations in Solana Beach and Leucadia, where major seawalls completely cover the lower geologic unit (T_1), the first term in the equation was zero. A third term in the equation was added for locations where a gradual transition in the lower geologic units creates two overlapping lower geologic units.

The alongshore cliff height was measured using a digital elevation model derived from airborne light detection and ranging data. The extent and thickness of the geologic units were mapped in the field using an impulse laser (Laser Technology), oblique photographs (California Coastal Records Project, 2008; Terracosta Consulting Group, 2001), and coastal maps (Flick, 1994; Kennedy, 1975, 2001; Kennedy and Tan, 2007; Tan, 2001; Tan and Kennedy, 2006).

Previous geologic maps and studies (Berggreen, 1979; Ehlig, 1977; Flick, 1994; Kennedy, 2001; Kennedy and Tan, 2007; Tan, 2001) are inconsistent in their interpretation of the

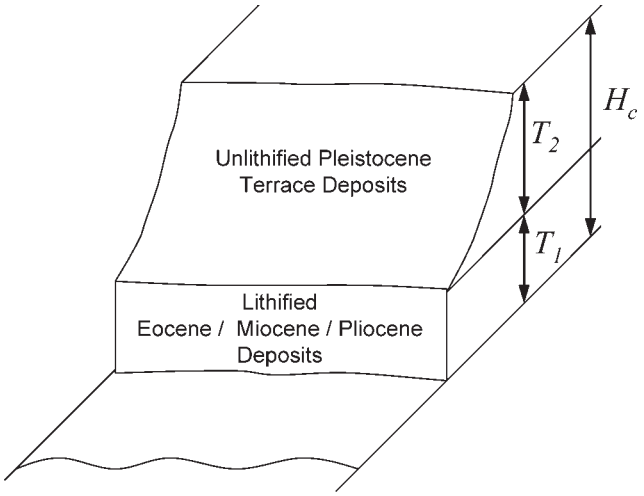


Figure 2. Typical seacliffs include a lower unit of lithified Eocene, Miocene, or Pliocene deposits and a thicker upper unit of unlithified Pleistocene terrace deposits (after Runyan and Griggs, 2003). The notation refers to variables used in the equation given in the main text.

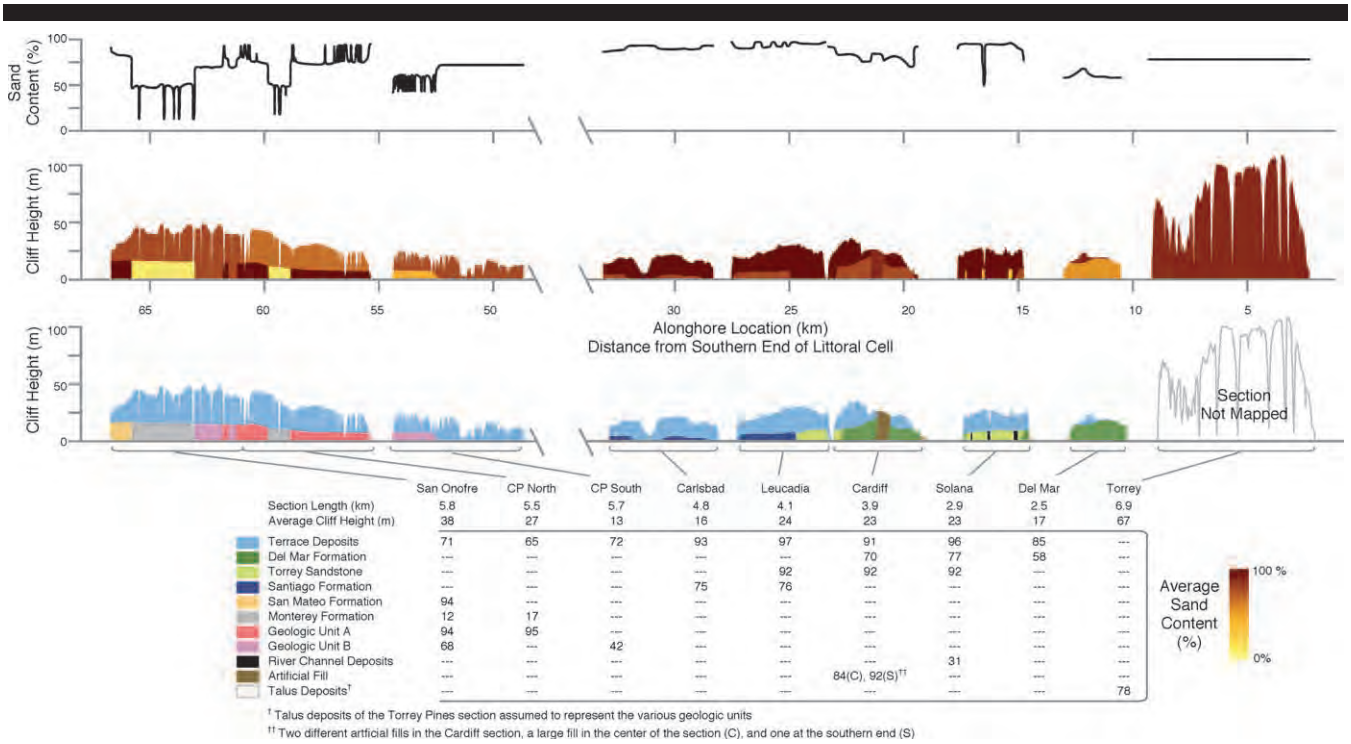
geology in southern San Onofre and northern Camp Pendleton, where the lower unit has been variously mapped either as the San Mateo or as sandy facies of the Monterey Formation. Here, the lower unit was delineated into regions based on the sample sand content and labeled as geologic units A and B (Figure 3).

Cliff sample locations were spaced (exceptions are noted later) approximately 100 to 200 m apart, and a 10- to 500-g (average an ~200-g) sample was acquired from each geologic unit, yielding 441 samples. Time limits imposed by access restrictions in Camp Pendleton prevented dense sampling, and the between-sample distance in this section averaged approximately 500 m. The high cliffs of Torrey Pines (>90 m) prevented sample collection from the upper geologic units. Therefore, samples of talus deposits taken at the Torrey Pines cliff base were assumed representative of the overall cliff.

Each sample was oven dried, weighed, disaggregated, and wet sieved (excluding Torrey Pines samples, which were dry sieved) with a 0.063-mm sieve to remove the fine material. The samples were then redried and reweighed to determine the percent weight of coarse material. Next, the samples were averaged by geologic unit and cliff section. This geologic unit average, and fine-scale maps of cliff height and unit thickness, were used in the previously given equation to determine P_{Coarse} at 3-m alongshore intervals.

RESULTS

The P_{Coarse} percentage ranged from 12 to 97%, with an overall average (weighted by section length) of 77%. Alongshore variation was partly caused by differences in the composition of the terrace deposits that make up the majority of the cliff in most areas. Because of differences in the original depositional environment, terrace deposits further south contain less-fine-grained sediments. These sediments ($P_{\text{Coarse}} > 90\%$) were deposited in a nearshore environment, and wave action had already winnowed fine sediments, resulting in



	San Onofre	CP North	CP South	Carlsbad	Leucadia	Cardiff	Solana	Del Mar	Torrey
Section Length (km)	5.8	5.5	5.7	4.8	4.1	3.9	2.9	2.5	6.9
Average Cliff Height (m)	38	27	13	16	24	23	23	17	67
Terrace Deposits	71	65	72	93	97	91	96	85	---
Del Mar Formation	---	---	---	---	---	70	77	58	---
Torrey Sandstone	---	---	---	---	92	92	92	---	---
Santiago Formation	---	---	---	75	76	---	---	---	---
San Mateo Formation	94	---	---	---	---	---	---	---	---
Monterey Formation	12	17	---	---	---	---	---	---	---
Geologic Unit A	94	95	---	---	---	---	---	---	---
Geologic Unit B	68	---	42	---	---	---	---	---	---
River Channel Deposits	---	---	---	---	---	---	31	---	---
Artificial Fill	---	---	---	---	---	84(C), 92(S)††	---	---	---
Talus Deposits†	---	---	---	---	---	---	---	---	78

† Talus deposits of the Torrey Pines section assumed to represent the various geologic units

†† Two different artficial fills in the Cardiff section, a large fill in the center of the section (C), and one at the southern end (S)

Figure 3. (Upper) Alongshore variation of percentage of seacliff sand content (sediment coarser than 0.063 mm). (Center) Percentage of seacliff sand content by geologic unit. (Bottom) General geologic units of the study area, and table of section and geologic unit statistics.

relatively high P_{Coarse} values in the southern half of the littoral cell, notably in Solana Beach, Cardiff, Leucadia, and Carlsbad (81–91%; Table 1). In contrast, farther north, the fine sediments are still present in the terrace deposits of nonmarine alluvial fans ($P_{Coarse} \approx 70\%$).

Many localized, abrupt changes of P_{Coarse} in San Onofre and Camp Pendleton, and at one location in Solana Beach, occur where the upper terrace deposits are absent mainly because of gullying. Gully erosion of the upper terrace deposits causes P_{Coarse} of the entire cliff to equal P_{Coarse} of the lower geologic unit. For example, in areas where the Monterey Formation outcrops in the lower cliff, the difference between the P_{Coarse} of the upper (65–71%) and that of the lower (12–17%) geologic units is large, resulting in abrupt alongshore changes in P_{Coarse}.

The average height of the 42 km of cliffs (31 m) and the average P_{Coarse} (77%) equate to a seacliff coarse sediment yield of 10,000 m^3 per centimeter of regionwide cliff retreat.

DISCUSSION AND SUMMARY

The present P_{Coarse} estimates are generally similar to those of previous studies (Table 1), with some significant differences in a few particular section comparisons. For example, P_{Coarse} for Torrey Pines is almost double the value in Robinson (1988) but similar to that in USACOE-LAD (1984a). Seacliff P_{Coarse} amounts found here for Carlsbad, Leucadia, Cardiff, Solana Beach, and Torrey Pines were slightly higher than those found in all previous studies. Differences among studies are likely caused by the location and the number of samples analyzed. The present results generally agree well with at least one of the previous studies and refine and synthesize earlier estimates.

Although the average overall P_{Coarse} of 77% varies only slightly compared to the 79% (USACOE-LAD, 1984a), 65% (Everts, 1990), and 53% (Runyan and Griggs, 2003) found in previous studies, the rates of cliff retreat and erosion can vary by an order of magnitude for the same locale (Everts, 1990), introducing uncertainty into estimates of the seacliff beach-sediment contributions. Even when retreat rates from previous studies (Benumof and Griggs, 1999; Benumof *et al.,* 2000; Everts, 1990; Hapke and Reid, 2007; Moore, Benumof, and Griggs, 1999; Runyan and Griggs, 2003) are averaged (weighted average by section length), the long-term retreat rates of the entire littoral cell range from 5 to 20 cm/y. (Note that Benumof and Griggs, 1999; Benumof *et al.,* 2000; and Moore, Benumof, and Griggs, 1999, do not provide retreat rates for cliffs north of Oceanside.) Large differences in the retreat rates are caused by episodic cliff retreat, along with endpoint retreat rate estimates, data sources used, time frame of study, retreat measurement method, and changing amounts of cliff protection. Therefore, although accurate estimates of coarse sediment yield require accurate P_{Coarse}, as provided here, the uncertainty in erosion and retreat rates remains relatively large and introduces more variation in seacliff beach-sediment contributions compared to P_{Coarse}.

Approximately 12% (5 km, all located south of Oceanside) of the cliffs evaluated for sand content are substantially protected with large revetments and seawalls. Additional small-scale protective devices exist throughout the study area. Although reducing the erosion rate, they do not eliminate all erosional processes (*e.g.,* subaerial erosion by rain; Young and Ashford, 2006b). In total, 42% (29 of 69 km) of the seacliffs in the Oceanside Littoral Cell are currently either substantially armored or isolated from the littoral system, removed from wave action, and probably no longer contributing significant amounts of sediment to the beach.

ACKNOWLEDGMENTS

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Comparison of short-term seacliff retreat measurement methods in Del Mar, California

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ABSTRACT

Seacliff retreat has been variously characterized as the recession rate of the cliff top, of the cliff base, and as the bulk recession rate based on volumetric changes of the entire cliff face. Here, these measures of retreat are compared using nine semi-annual airborne LiDAR (Light Detection And Ranging) surveys of southern California seacliffs. Changes in the cliff base location (where the steeply sloping cliff face intersects the beach) include cliff retreat owing to basal erosion, but also reflect changes in beach sand level and basal talus deposits. Averaged over the 2.5 km alongshore study span, the cliff base actually prograded seaward about 12 cm during the 4-year study. Cliff top change was dominated by few, relatively large (several meters) localized retreats. Cliff face changes, that include failures and deposits anywhere on the cliff profile, had a relatively small mean magnitude compared to cliff top changes and were more widely distributed alongshore. However, the similar alongshore averaged, cumulative cliff top and net bulk cliff face end-point retreat (14 and 19 cm, respectively) suggest that mean cumulative cliff top retreat can potentially be a viable surrogate for mean net cumulative cliff-wide erosion (and vice versa) over relatively short time periods. Cliff face erosion occurred repeatedly at some locations, confirming the presence of seacliff erosion hot-spots during the study period.

1. Introduction

Seacliff retreat, important to coastal management, is often estimated using the recession of the cliff top or cliff base obtained from aerial photographs, topographic maps, or in situ surveys (e.g. Jones and Williams, 1991; Wilcock et al., 1998; Benumof and Griggs, 1999; Moore et al., 1999; Budetta et al., 2000; Hapke and Richmond, 2002; Pierre and Lahousse, 2006; Dornbusch et al., 2008; Greenwood and Orford, 2008). Recently, three-dimensional high resolution maps derived from LiDAR have been used to estimate the cliff face bulk retreat, defined as the volumetric change (measured by differencing successive digital elevation models) divided by the cliff height and the alongshore width of a cliff section (Young and Ashford, 2006a,b).

Cliff top, base, and face change estimates can differ significantly over short time periods. For example, wave action can cause cliff base retreat, but no cliff top change (Fig. 1A). Mid-cliff face erosion can occur without changes to the cliff top or base (Fig. 1B). Alternatively, a cliff top failure may result in significant cliff top recession and no change at the cliff base if the talus is removed by wave action prior to subsequent data collection (Fig. 1C). When talus deposits are incompletely removed between surveys, the cliff base appears to accrete (Fig. 1D, E). Additionally, the cliff base location changes when the beach sand level at the cliff base changes (Fig. 1F, an increase in beach sand level causes retreat of the estimated cliff base location).

Although these estimates will converge over long time periods, short-term, seasonal estimates provide insight into cliff retreat processes (e.g. the relative importance of higher than usual rainfall or waves). Here, changes in the cliff top, cliff base, and cliff face, estimated using nine semi-annual airborne LiDAR surveys spanning four years are compared.

2. Study area

The studied 2.5 km reach of seacliffs in Del Mar, California (Fig. 2B), on average 18 m high with approximately 45° slope, are cut into uplifted marine terraces. The lower cliff consists of the Del Mar Formation, an Eocene sedimentary deposit composed of sandy claystone interbedded with coarse-grained sandstone (Kennedy, 1975). Near the middle of the study area, the Del Mar Formation is overlain by permeable sandy Pleistocene terrace deposits (Fig. 2C). The Del Mar Formation is relatively impermeable, resulting in perched groundwater and sapping at the interface with terrace deposits. The cliff face experiences weathering, desiccation, sheet erosion, and rilling, while the cliff base is subject to wave action. Typical beach width ranges from 30 to 70 m, and fluctuates seasonally with wider beaches in summer. During winter, the eroded beach permits direct wave attack at the cliff base when elevated tides coincide with large

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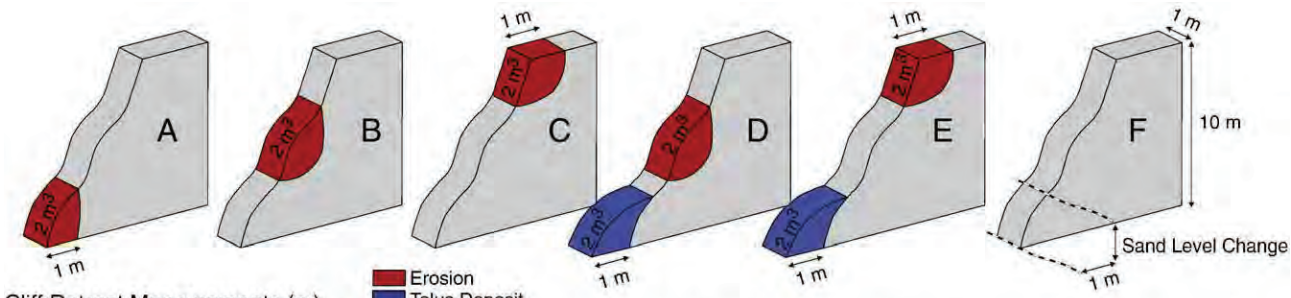

Cliff Retreat Measurements (m)

	A	B	C	D	E	F
Top =	0.0	0.0	-1.0	0.0	-1.0	0.0
Face (-) =	-0.2	-0.2	-0.2	-0.2	-0.2	0.0
Face (+) =	0.0	0.0	0.0	+0.2	+0.2	0.0
Face (Net) =	-0.2	-0.2	-0.2	0.0	0.0	0.0
Base =	-1.0	0.0	0.0	+1.0	+1.0	-1.0

Fig. 1. Interpretations of idealized cliff changes using the three different retreat estimates.

wave events. Subaerial and marine erosional processes result in long-term cliff top retreat rates estimated at 5–20 cm/yr (Benumof and Griggs, 1999; Moore et al., 1999; Young, 2006; Hapke and Reid, 2007). The North County Transit District railroad, currently situated on the cliff top within a few meters of the cliff edge, has been threatened by past cliff failures (Kuhn and Shepard, 1984). Portions of the cliff base stabilized with wooden and concrete seawalls (Fig. 2D) were identified with oblique photographs (California Coastal Records Project, 2008).

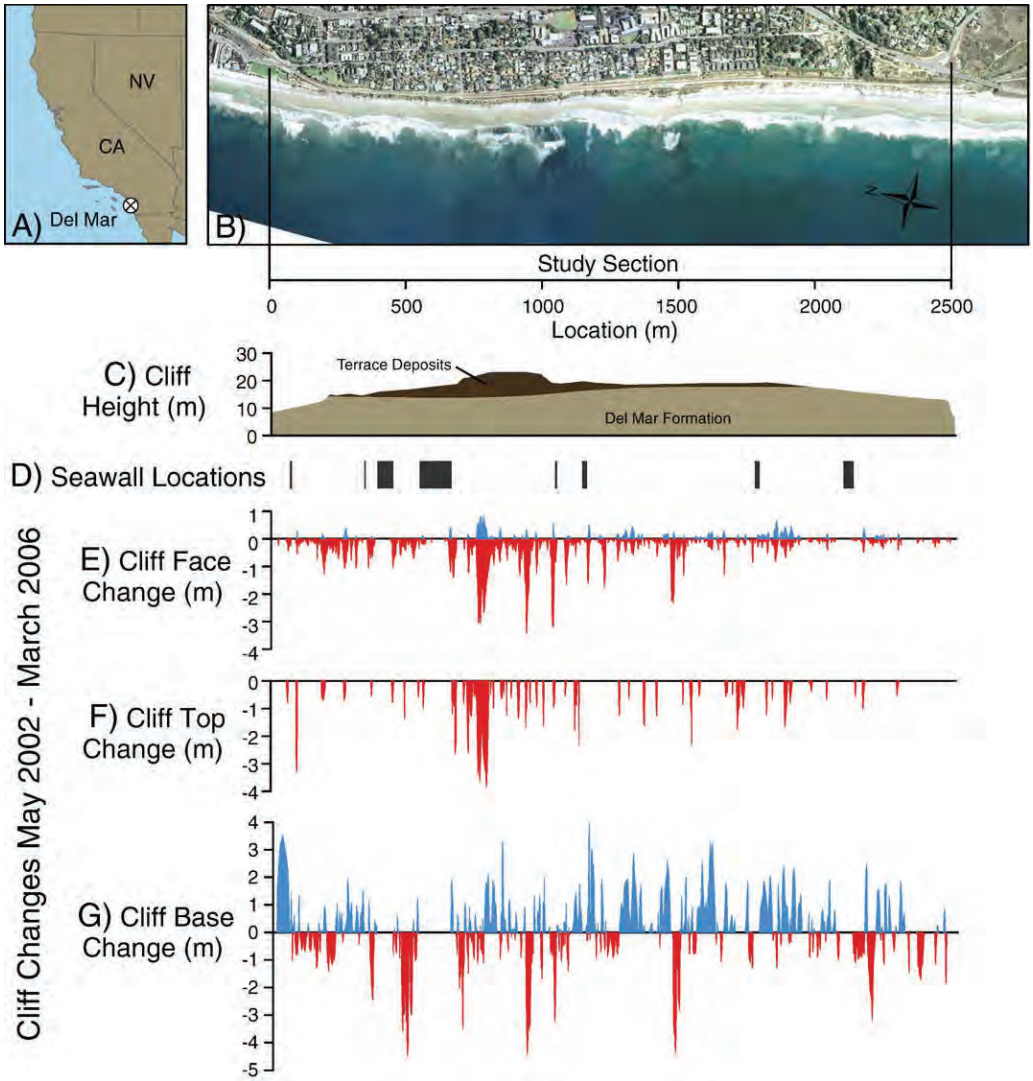

Fig. 2. A and B) Study location maps, C) cliff height and composition, D) major seawall locations, and cumulative (4 yr) changes of the cliff (E) face, (F) top, and (G) base versus alongshore location.

The seacliffs are exposed to waves generated by local winds and distant storms in both hemispheres. During winter, swell from the North Pacific and Gulf of Alaska are most energetic, whereas swell from the South Pacific dominates in summer. Waves reaching southern California cliffs undergo a complex transformation, and "shadows" of the Channel Islands create strong alongshore variations in wave height. The seasonal cycle in the Del Mar region has maximum wave energy in winter. Historical data indicates regional wave heights during the study period (May 2002–March 2006) were typical.

San Diego's semi-arid Mediterranean climate is characterized by dry summers and occasionally wet winters, with 85% of rainfall occurring from November through March. Annual precipitation amounts vary from about 10–60 cm, and average 25 cm. Rainfall in the region tends to be episodic and several centimeters of rain often fall over a few days. The study period was relatively dry, except for the wet winter of 2004–2005 when winter storms delivered about 56 cm of rain, resulting in significant coastal landsliding.

3. Methods

Airborne LiDAR data was collected each spring and fall from May 2002 through March 2006 with an Optech Inc. Airborne Laser Terrain Mapper 1225. The nine surveys yielded eight time intervals of cliff change. Four passes during each survey at an altitude of 300–1000 m provide a point density of approximately 3 points/m^2 on the cliff. LiDAR data were processed into 0.5 m^2 resolution digital elevation models (DEM) using the second of two LiDAR returns (the most representative of the ground surface) and a "natural neighbors" interpolation. Cliff height (Fig. 2C) and the beach sand elevation near the cliff base were obtained from the DEMs.

3.1. Cliff top and cliff base changes

Cliff base positions were identified manually from the DEM as the location of the slope break between the beach and cliff face. Similarly, cliff top location was defined as the slope break between the cliff face and the cliff top. For this particular cliff section, the break in slope is relatively easily identified and generally free of vegetation. However identifying cliff top and base positions may be difficult in other cliff sections lacking a clear break in slope or because of obstructions such as vegetation. For each survey, the digitized line (cliff top or base) from the previous survey was used as a baseline, and adjusted where new changes occurred. Changes were estimated on cross-shore transects spaced at 1 m intervals alongshore.

Automated cliff top and cliff base extraction methods (i.e. Liu et al., 2009) were not employed because these methods can induce significant errors when measuring relatively small changes in cliff top and base positions. For example, Liu et al. (2009) found average planimetric differences ranging from 2.5 to 4.2 m between manually digitized lines and automated extracted lines from airborne LiDAR data. Although errors of this magnitude may be negligible when cliff retreat is large, the potential error associated with automated algorithms exceeds the average retreat magnitude in this short-term study and therefore were not used.

3.2. Cliff face changes

Digital change grids (DCG), estimated by differencing successive DEMs, show both negative (erosion) and positive (accretion, talus deposits) changes. Sources of DCG error include the basic LiDAR observations, spatial interpolation, and vegetation. The vertical root mean square difference between two surveys (RMS_Z, Federal Geographic Data Committee, 1998), a measure of the total error, was estimated at 19 cm using fixed sloped surfaces.

The DCGs were filtered and edited to remove noise and erroneous data. First, all grid cells with vertical change less than 38 cm (twice the RMS_Z error) were neglected. Next, a minimum topographic footprint was imposed, requiring at least 10 connected cells of positive or negative change, thus enforcing a minimum change area of 2.5 m^2. This filtering identifies individual landslides and talus deposits with a minimum volume of about 1 m^3 (if all 10 cells had 38 cm of change). In practice, the minimum volume was approximately 2 m^3. Finally, the filtered DCG data were edited visually to remove spurious changes caused by vegetation. Manual editing was employed rather than automated algorithms designed to remove vegetation from LiDAR because these algorithms sometimes also remove valid cliff points where cliff geometry is complex.

Cliff face changes were separated into negative (cliff and talus erosion) and positive (talus deposits) volumetric changes and then evaluated in 1-m wide (in the alongshore direction) cliff compartments. Dividing the volumetric compartment changes by the cliff height and compartment width (1-m) yielded bulk negative and positive cliff face changes. The overall method is automated except for the manual removal of spurious changes caused by vegetation or other artifacts.

The calculated change volumes underestimate the actual erosion because only relatively large volume (>2 m^3) and large footprint (>2.5 m^2) slides are detected. The neglected small events may play an important role in short-term seacliff evolution (Rosser et al., 2005; Young and Ashford, 2007), and their volume contribution for the study period is unknown. However, previous studies in the area (Young and Ashford, 2007), suggest the volume contribution of these small events is less than 30% of the total eroded volume (Young et al., in press).

4. Results

4.1. Beach sand levels

Sand level changes measured at the cliff base ranged from 0 to 1.5 m, and were relatively small with an average absolute magnitude of 22 cm. Only 20% of the changes were greater than 35 cm. Over the entire beach face, normal seasonal change is observed (not shown), with elevated sand levels in summer (Aubrey et al., 1980). Interestingly, beach elevation changes at the cliff base were not seasonal. Average sand levels at the cliff base decreased in all time intervals except during the winters of 2003–2004 and 2005–2006. Cobble berms, which are ephemeral features in the region, occasionally build up at the cliff base during winter months and probably contributed to some of the measured beach elevation changes at the cliff base.

4.2. Cliff base changes

Cliff base change is strongly variable alongshore, and change of both signs was observed, both in a given time interval, and cumulatively (Fig. 2G). Alongshore-averaged cliff base changes were negative, except during the summer of 2002 and (especially) the winter of 2004–05 (Fig. 3A). The cumulative (over 4 years) cliff base change in 1-m sections ranged from −4.5 to +4.0 m, with an alongshore average of +12 cm. Cliff base changes were relatively widespread, comprising up to 37% of the study area during a single interval (Fig. 3D). The alongshore average of nonzero changes ranged from −0.5 to +0.7 m over the 8 time intervals (Fig. 3C). The largest change in a 1-m section during any time interval was +7.5 m (accretion), caused by a relatively large and clearly identifiable talus deposit (Fig. 4A).

4.3. Cliff top and cliff face changes

The cumulative cliff top retreat in 1-m sections ranged from 0.0 to −3.8 m (Fig. 2F), with an alongshore average of −14 cm. Changes occurred along less than 8% of the cliff top during any time interval

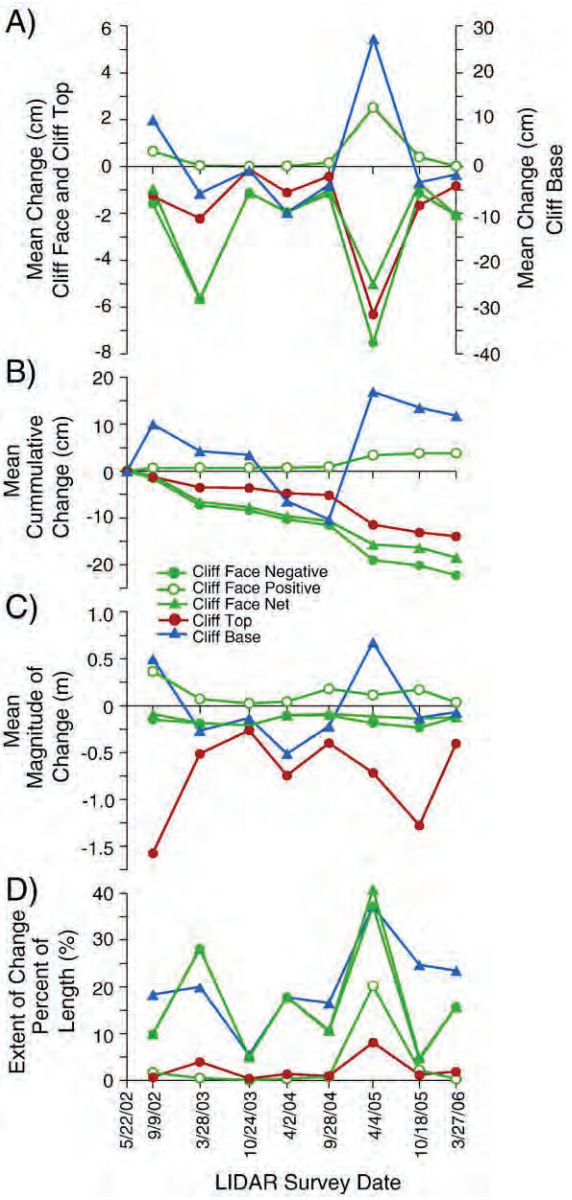

Fig. 3. Seacliff changes over the 2.5 km study area during each time interval, (A) mean change, note the change magnitude scale (*y*-axis) is different for the cliff base, (B) cumulative mean change, (C) mean change magnitude (zero changes neglected), and (D) percent of 1-m cells with nonzero change (number of 1-m cells with change / total number of 1-m cells).

(Fig. 3D). The alongshore averaged magnitude of nonzero changes ranged from −0.3 to −1.6 m over the 8 time intervals (Fig. 3C). The largest change in a 1-m section, during any time interval, was −3.8 m (Fig. 4C).

The cumulative cliff face change in 1-m sections ranged from −3.4 to +0.9 m, with an alongshore average of −22 cm, +4 cm, and −19 cm for the cliff face negative, positive, and net change, respectively. Positive changes (primarily talus accretion) occurred in less than 2% of the study length except during the winter of 2004–05 when positive change occurred in over 20% of the alongshore span (Fig. 3D). Negative changes were more spatially extensive and ranged from 5 to 37% of the study length during individual time intervals (Fig. 3D). The alongshore average magnitude of nonzero cliff face changes ranged from −10 to −23 cm, and +3 to +37 cm, for negative and positive change, respectively (Fig. 3C). The largest change in a 1-m section during any time interval was −2.2 m and 0.8 m for cliff face erosion and accretion, respectively.

Cliff face erosion (negative change) was spatially widespread, while cliff face positive and cliff top changes were relatively localized (Fig. 3D). Mean magnitudes of cliff top change (locations of zero change neglected) varied seasonally between −0.5 and −1.5 m, while the mean cliff face measurements were comparatively small (Fig. 3C). Cliff face changes occurred without cliff top or base change when the cliff material was eroded from the central portion of the cliff rather than cliff top or cliff base, and the associated talus was eroded before it could be measured. At all locations with nonzero cliff top retreat, cliff face retreat was also observed.

5. Discussion

5.1. Beach sand levels

The vertical elevation of beach sand at the cliff base limits the portion of the cliff base that can be surveyed, and thus contributes to changes in cliff base horizontal location. Measured horizontal cliff base locations are most effected by sand levels at locations with relatively low cliff base (or talus) slope angles. Although the average beach sand level change magnitude was relatively small and did not result in perceptible cliff base change at most locations, large sand level changes did cause spurious cliff base change measurements in some instances. For example, at one location (where no talus deposition occurred) the sand level was lowered by about 1.0 m, exposing more of the cliff and resulted in a +1.5 m (seaward) change of the cliff base. However, the majority of the observed large magnitude (>1.0 m) cliff base displacements coincided with locations of new talus deposition and talus erosion. The maximum horizontal change caused by sand level change is approximately 2 m, estimated as the maximum change in beach elevation (≈2 m) divided by tan α, where α is equal to the slope at the cliff base (≈45°).

Beach sand level changes can also affect cliff face measurements. For example, if the beach sand level increases prior to talus deposition, the talus volume estimate will include the accreted volume of sand under the talus. This affect is probably relatively small, because most new talus deposits were removed by wave action between surveys (cliff face positive changes ≪ cliff face negative changes, Fig. 4F), and if the talus was not removed only a small portion was generally located on the beach (talus is often deposited on the lower cliff face, Fig. 4A). Furthermore, the average magnitude of beach change was smaller (22 cm) than the vertical change threshold (38 cm). However, these small errors will increase with larger sand level fluctuations. The maximum volume error from fluctuations in sand levels equals approximately the area of talus on the beach multiplied by the maximum expected change in beach sand elevation.

5.2. Cliff base changes

Unlike the cliff top, cliff base location changes are not dominated by retreat (negative change). Cliff base location changes (identified here as the break in slope between the cliff and beach) are a combination of spurious changes resulting from beach sand level changes, talus deposition and removal (Fig. 4A, B), and real cliff base retreat. At much longer time scales (possibly several decades, based on historical erosion rates), cliff base retreat is larger than changes from either talus or beach sand levels, and this method will yield estimates of in situ cliff base erosion.

5.3. Cliff top and cliff face changes

Cliff top retreat was dominated by localized large events, and was the most episodic of the retreat estimates, with a mean magnitude of cumulative cliff top change (−82 cm, locations of zero change neglected) six times greater than mean cumulative change (−14 cm, including all locations). The cliff top and cliff face magnitude-

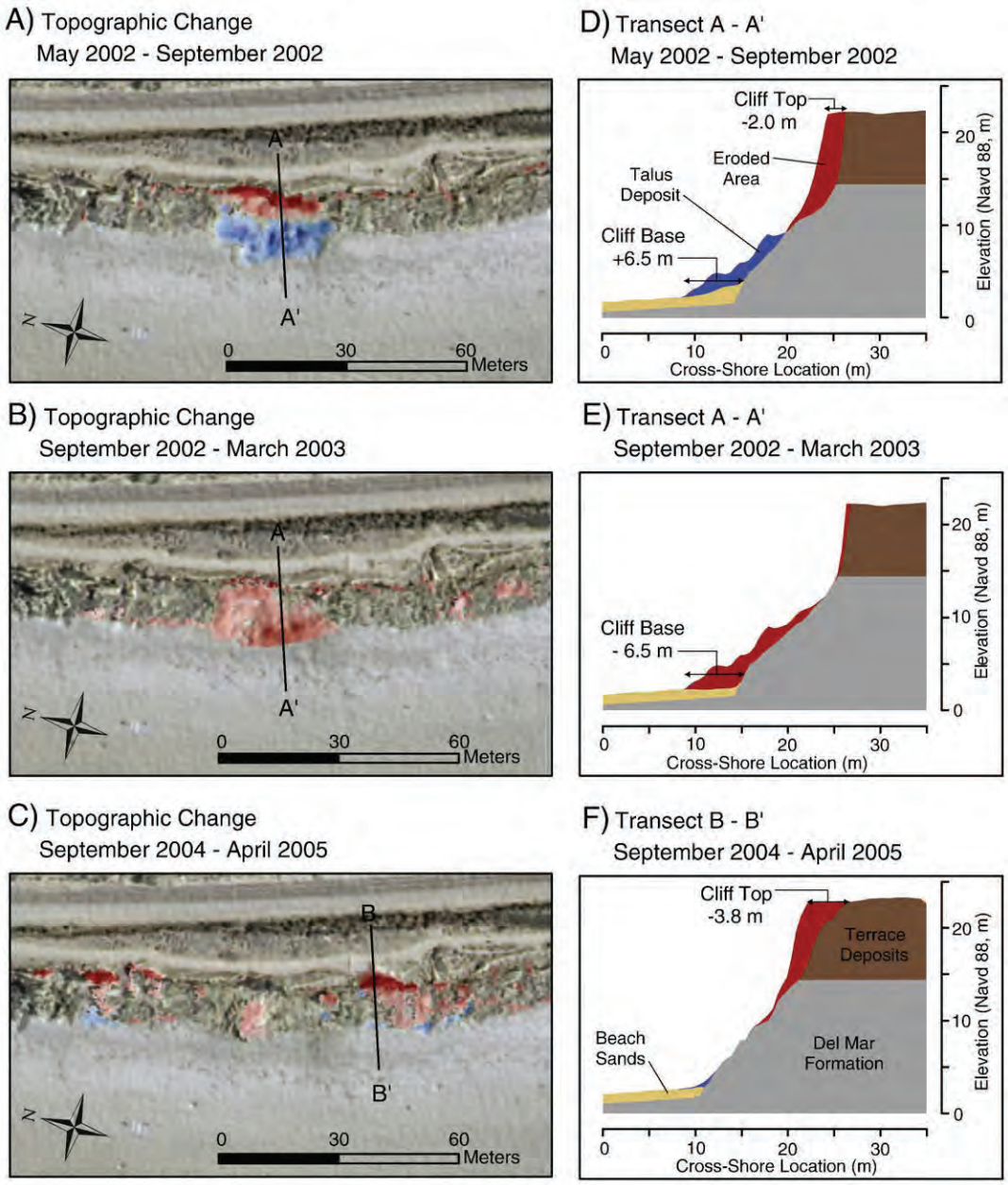

Fig. 4. Changes over a 120 m cliff section during 3 time intervals, where red and blue indicate erosion and accretion, respectively. A) Large upper cliff landslide and associated talus deposit. B) Next survey shows both continued cliff erosion, and erosion of the talus deposit in panel A. C) The upper cliff landslide associated with the largest cliff top retreat, −3.8 m. The talus was almost all eroded before the April 2005 survey. (D, E, F) Cliff profiles associated with panels A, B, C.

frequency distributions differ; 50% of cliff top changes were larger than −50 cm, compared with 6% for cliff face change. During most of the study period (an exception is the winter of 2004–2005), negative (erosional) cliff face changes were much more extensive than positive (depositional) changes, indicating that the available wave action was sufficient to erode talus deposits.

Although cliff top and face change differs significantly, there are similarities. For example, mean cumulative cliff face (negative and net) and top changes are correlated ($r^2 > 0.9$), whereas the cumulative cliff base changes are uncorrelated with the top and face (Fig. 3B). The cliff face and cliff top both show seasonality, with relatively more change during winter than summer (Fig. 3A), whereas cliff base changes are not seasonal. All methods recorded relatively extensive changes during the winter of 2004–05, and limited change during summers (Fig. 3D).

5.4. Geomorphic perspective

The seasonality of cliff top and cliff face changes reflects the seasonal variation of both wave energy and rainfall, which have greater potential for cliff erosion during the winter months. Our measurements of cliff base changes encompass a variety of processes, some of which can oppose each other during a given time interval. For example during winter months a large landslide deposit causes the cliff base to move seaward, while wave erosion of the cliff base produces landward movement. This type of opposition contributed to the lack of seasonality in observed cliff base changes.

The wet winter of 2004–2005 had a relatively profound affect on the Del Mar seacliffs, with the absolute maximum mean cliff face, cliff top, and cliff base changes all occurring during this winter (Fig. 3A). Rainfall triggered numerous coastal landslides and initiated erosion

through other subaerial processes ultimately eroding a total volume of about 3500 m^3. Available wave action was insufficient to remove the talus, and approximately 1/3 of the total eroded volume (1150 m^3) remained as talus at the end of the winter. The remaining talus during this time interval was more than double the volume in all other time intervals combined, and probably temporarily protected in situ cliff material from wave-induced erosion. As these talus deposits are reworked by future wave action, the erosion rates will probably be elevated, because talus is much more easily eroded than in situ cliff material.

Cliff top retreat reduces the overall cliff slope, while cliff base and cliff face erosion (not concentrated at the cliff top) cause overall slope steepening, thus reducing overall cliff stability. During the study period, 50% of both cliff top and cliff face failures were preceded by cliff face erosion at the same location during the previous year. This effect was cumulative over the study period and led to the development of localized erosional hot-spots. At some locations hot-spots persisted for the duration of the study period, with cliff face erosion occurring in 7 of the 8 time intervals. However, cliff face erosion did not necessarily lead to cliff top failure, and only 18% of cliff face erosion locations were followed by a cliff top failure, probably because of the relatively short study time period and the highly episodic nature of cliff top retreat. Over longer time periods, these concepts can be used to develop a seacliff erosion hazard index, defined as the difference between cliff top and cliff face erosion. For example, as the cliff face retreat exceeds cliff top retreat, the cliff becomes more unstable, and vice versa.

6. Summary

The three LiDAR-based estimates of cliff retreat, using observations of the cliff top, cliff face, and cliff base, are all limited by the accuracy and density of the observations. Cliff face change estimation is mostly automated, but requires manually deleting erroneous change caused by vegetation or other artifacts (if these areas cannot be removed through automated procedures). Manually digitizing the cliff top and base locations is labor intensive, with substantial errors when there is not a clear slope change between the beach and cliff face, and between the cliff face and cliff top. However, recent advances in automated extraction of cliff top and base positions (i.e. Liu et al., 2009) show promise, and may eliminate the labor intensive manual digitizing methods. Overall, cliff face change estimates were the most informative because all cliff changes, including changes at the cliff top and base, are captured. The cliff face method is also the most automated, and positive and negative changes are easily separated. The cliff top method captures real retreat, but provides only a limited view of cliff evolution. The cliff base method measures changes from basal erosion, but is complicated by a sensitivity to talus and sand levels at the cliff base.

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Decadal-scale coastal cliff retreat in southern and central California

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ABSTRACT

Airborne LiDAR data collected in 1998 and 2009–2010 were used to measure coastal cliff erosion and retreat between the Mexico/California border and Bodega Head, California. Cliff erosion was detected along 44% of the 595 km of shoreline evaluated, while the remaining cliffs were relatively stable. The mean cliff top retreat rate was 0.12 m/yr, while mean retreat averaged over the entire cliff face was 0.04 m/yr. The maximum cliff top and face retreat rates were 4.2 and 3.8 m/yr, respectively. Historical (~1930s to 1998) and recent retreat rates were significantly inversely correlated for areas with large historical or recent cliff retreat, such that locations with elevated historical retreat had low levels of recent retreat and locations with elevated recent retreat were preceded by low rates of historical retreat. The strength of this inverse correlation increased with cliff change magnitudes up to r^2 of 0.91 for cliff top retreat rates >2.9 m/yr. Mean recent retreat rates were 52-83% lower than mean historical retreat rates. Although beaches can protect cliffs against wave-driven erosion, cliffs fronted by beaches retreated 49% more than cliffs without beaches. On average, unarmored cliff faces retreated 0.05 m/yr between 1998 and 2009–2010, about three times faster than artificially armored cliffs. Alongshore metrics of wave-cliff impact, precipitation, and cliff hardness were generally not well correlated with recent cliff changes. A cliff hazard metric is used to detect cliff steepening and areas prone to future cliff top failures.

1. Introduction

Coastal cliffs comprise a high proportion of the world's coasts (Emery and Kuhn, 1982), where almost one quarter of the global population resides (Small and Nicholls, 2003). Retreating coastal cliffs currently cause numerous problems for coastal populations and managers. Sea-level rise is expected to cause increased coastal cliff erosion rates for many areas (Sunamura, 1988; Bray and Hooke, 1997; Dickson et al., 2007; Nicholls et al., 2007; Trenhaile, 2010, 2014). Studies of coastal cliff erosion and retreat have increased in recent years (Naylor et al., 2010), highlighting a growing interest and need to study rock coasts. Yet our understanding of coastal cliff processes and behavior is complicated by the wide array of erosional processes that occur (Trenhaile, 1987; Sunamura, 1992; Rosser et al., 2007; Kennedy et al., 2011), variable temporal changes and processes (Cambers, 1976; Dornbusch et al., 2008; Lee, 2008), geomorphic feedbacks (Sunamura, 1976; Kline et al., 2014; Young, 2015), and highly variable geologic, oceanographic, and climatic settings.

Actively eroding coastal cliffs comprise the majority of the California coast (Fig. 1) and threaten development throughout the State, including highways, railways, wastewater, oil, natural gas and nuclear facilities, universities, military bases, and numerous state beaches and parks in addition to homes and businesses. Episodic cliff failures have caused human injury and several deaths in recent years (*e.g.* Perry, 2000; Gross and Davis, 2008; Evans, 2015). Seawalls and rock armoring are increasingly used to prevent erosion, but eroding coarse-grained coastal cliffs can be an important source of sediment to beaches (Young and Ashford, 2006; Brooks and Spencer, 2010; Young et al., 2010a; Mushkin et al., 2016), which are important cultural and economic resources that generate billions of dollars annually in California. These problems will worsen as sea levels and coastal populations continue to increase, and effectively managing California's changing coast will become increasingly challenging.

Coastal cliff erosion is broadly attributed to marine and subaerial (including subsurface) erosion mechanisms (Trenhaile, 1987; Sunamura, 1992). Subaerial mechanisms (*e.g.* groundwater processes, rilling, slope wash) act over the entire cliff face, and beneath the surface. Rainfall has been empirically linked to inland landsliding (Caine, 1980), where marine processes are not active, and serves as an indicator of subaerial forcing. Young et al. (2009b) found a high correlation between the timing of rainfall and coastal cliff erosion in southern California. Brooks et al. (2012) discussed the importance of the sequence of rain events on sub-surface pore water pressures and cliff stability. Marine processes (*e.g.* wave-driven impact pressures and abrasion) act directly only at the cliff base, and only when tides and other water level fluctuations allow waves to reach the cliff (Sunamura, 1992; Rosser et al., 2013; Vann Jones et al., 2015; Young et al., 2016). While marine and subaerial processes drive cliff erosion, geologic conditions dictate cliff resistance and control the seacliff failure mode. The relative importance of marine and subaerial

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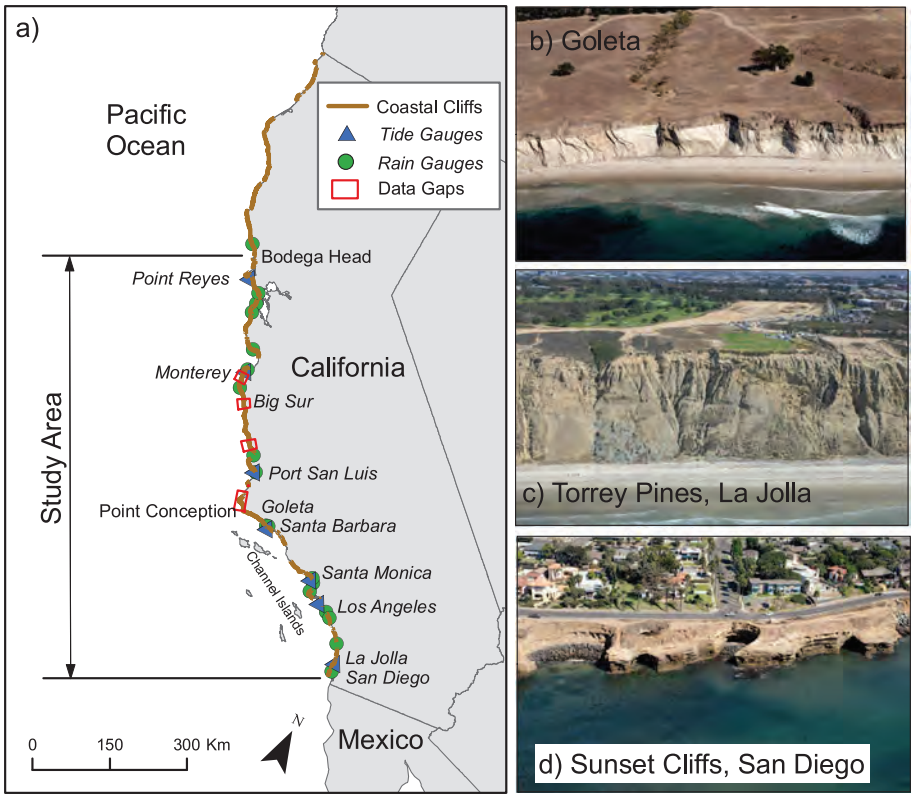


Fig. 1. a) Map of California's coastal cliffs/rocky shoreline and the LiDAR study area spanning 1100 km of shoreline. LiDAR data coverage was incomplete in some regions (boxes) resulting in 595 km of cliffed shoreline for analysis. Rain (circles) and tide (triangle) gauges used for this study were located alongshore in the study area. Example photos of representative California coastal cliff settings: b) low relief cliffs fronted by a beach in Goleta, c) high relief cliff at Torrey Pines, La Jolla and d) cliff top development, sea caves, and crenulated cliff line in Sunset Cliffs, San Diego. Photographs used with permission, ©2002–2017 Kenneth and Gabrielle Adelman, California Coastal Records Project www.Californiacoastline.org.

processes varies in space and time, and observations of cliff erosion and forcing (*e.g.* ocean waves and rain) are needed to establish these relationships. Brooks et al. (2012) established both marine and subaerial process thresholds associated with high magnitude cliff retreat events for soft cliffs on the Suffolk coast, U.K. and concluded the driving mechanisms vary through time.

Historical cliff retreat has been measured with historical maps and aerial photographs in a variety of locations worldwide, including Portugal (Marques, 2008), the United Kingdom (May and Heeps, 1985; Brooks and Spencer, 2010), Italy (Budetta et al., 2000), Australia (Bezore et al., 2016), Canada (Lantuit and Pollard, 2008), and India (Sajinkumar et al., 2017). LiDAR is increasingly used to measure more recent cliff retreat and erosion and has been applied in the United Kingdom (Adams and Chandler, 2002; Rosser et al., 2005; Earlie et al., 2015), Portugal (Nunes et al., 2011), the United States (e.g. Sallenger et al., 2002; Young and Ashford, 2006), Canada (Obu et al., 2016), Israel (Katz and Mushkin, 2013) and France (Letortu et al., 2015). Other methods to measure cliff retreat and erosion include using fixed markers in the United Kingdom (Williams and Davies, 1987), field surveys in Australia (Gill, 1973), micro-erosion meters (MEM) in New Zealand (Stephenson and Kirk, 1996) and measuring shore platform widths in New Zealand (de Lange and Moon, 2005).

Coastal cliff retreat studies in California date back at least to 1932 (Vaughan, 1932). Since then, numerous studies of California cliff retreat have been conducted using a variety of measurement techniques ranging from dated inscriptions (Emery and Kuhn, 1980) to terrestrial LiDAR (Collins and Sitar, 2008). These studies are often site-specific or local in scale, but Griggs et al. (2005) and Dare (2005) provide statewide compilations of many of these studies, and U.S. Army Corps of Engineers (1971) provides a qualitative statewide erosion assessment. Hapke et al. (2009) conducted the most recent systematic study and mapped retreat along 350 km of California cliffs using T-sheets from the 1920s and 1930s and airborne LiDAR data collected in 1998 and 2002. Using shore-normal transects spaced 20 m alongshore, Hapke et al. (2009) calculated mean and maximum cliff top retreat rates of 0.3 m/yr and 3.1 m/yr, respectively, with estimated errors of 0.2 m/yr. The highest retreat rates were in central and northern California, associated with large slumps and deep-seated coastal landslide activity, often triggered by elevated rainfall and associated increased pore water pressures (Thomas and Loague, 2014; Young, 2015).

Advances in cliff mapping with airborne LiDAR surveys (Matsumoto et al., 2017) provide unprecedented detail of volumetric and cliff top change over large areas, but existing studies in California have limited spatial extent (*i.e.* Young et al., 2009a, 2010b, 2011). This study provides the first large-scale assessment of coastal cliff erosion and retreat in California using high-resolution airborne LiDAR data collected in 1998 and 2009–2010. Both cliff top retreat and the average retreat of over the cliff face are quantified and used to explore changes on different parts of the cliff profile. The results are compared with historical retreat rates, alongshore metrics of erosion forcing mechanisms, and rock strength. A cliff hazard metric described by Young et al. (2009a) is used to locate areas prone to future cliff top failures.

2. Study site

2.1. Geologic setting

The study site extends 1100 km from the Mexico/California border to Bodega Head, California (Fig. 1). The California coast is tectonically active and contains numerous fault zones, most notably the San Andreas Fault dividing the North American and Pacific plates. Past tectonic processes produced several coastal mountain ranges and a series of uplifted marine terraces along much of the coastline. The majority of coastal

cliffs are low relief cliffs cut into the uplifted marine terraces while the rest are high relief cliffs and coastal mountains (Griggs et al., 2005).

Cliffs cut into the marine terraces are generally composite cliffs composed of two geologic units: a more resistant lithified Cenozoic mudstone, shale, sandstone and siltstone, and an upper unit of weakly lithified Quaternary terrace deposits (Griggs et al., 2005). Low-relief cliffs composed of alluvium or terrace deposits also exist where the lower unit is locally absent. The cliffs are generally 10–30 m in height, but exceed 100 m in some areas. Cliff heights remain generally constant as the cliff recedes because most cliff tops are relatively flat terrace features. The cliffs are typically fronted by a wave-cut platform usually covered by a veneer of beach sand and sometimes cobble. The beaches, which act as a buffer to direct wave-driven cliff erosion, are often narrow and occasionally stripped of sediment during large winter storms. Cliff profiles differ alongshore and their geometries are related to the relative importance of marine and subaerial processes, cliff composition, and phases of cliff profile evolution (Emery and Kuhn, 1982).

2.2. Oceanography

The California coast is exposed to waves generated by local winds and distant storms in both hemispheres (Flick, 1994). During winter, swell from the North Pacific and Gulf of Alaska is most energetic, whereas swell from the South Pacific dominates in summer. Waves reaching the southern California coast undergo a complex transformation, and shadows of the Channel Islands create strong alongshore variations in wave height (Pawka, 1983). Annual nearshore wave energies are generally larger in central (defined here as Point Conception to Bodega Head) and northern California compared to southern California (south of Point Conception). The tide range reaches up to 2.6 m during spring tides, so large swells arriving during relatively low tide may not reach the cliffs, whereas moderate swell arriving during high tide can have significant wave-cliff impact duration (Young et al., 2016).

2.3. Climate

The climate is characterized by dry summers and occasionally wet winters, with most rainfall occurring from November to March. Prolonged drought, very wet years, and multi-decadal scale precipitation cycles can cause high variation in annual rainfall (Michaelsen et al., 1987; Haston and Michaelsen, 1994). Annual coastal precipitation generally increases northward with mean annual precipitation ranging from 257 mm in San Diego to 1032 mm near Bodega Head (www.wrcc.dri.edu), but is locally higher along the Big Sur coast and lower in the San Francisco and Monterey areas. Strong El Niño events are usually associated with elevated winter precipitation, wave heights, and sea levels, causing increased coastal erosion, flooding and damage (Flick, 1998; Storlazzi and Griggs, 2000; Strolazzi et al., 2000; Barnard et al., 2017). Annual precipitation during the study was near average except during the winter of 2004–2005 when some regions received more than twice the annual mean precipitation.

3. Methods

3.1. LiDAR data

Airborne LiDAR datasets collected in 1998 and 2009–2010 (coast.noaa.gov/digitalcoast/; Table 1) provide regional coverage from the California-Mexico border to Bodega Head, with some gaps, notably along the Big Sur Coast (Fig. 1). A 2002 LiDAR dataset provides additional spatial coverage but was not used here because of low point density (probably from fewer aircraft flight passes) and data gaps. However, a cliff top line digitized by Hapke and Reid (2007) from the 2002 LiDAR was used in some localized areas. The overall coverage for this study includes 595 km of cliffs.

The LiDAR survey contractors estimated vertical root mean square error of the 1998 and 2009–2010 point data at 0.15 m, with horizontal accuracies of 0.5–0.80 m. LiDAR point data were processed into 1-m resolution digital elevation models using the last return (if multiple returns were available) and a natural neighbors technique. Typical point density of the 1998 and 2009–2010 datasets are 0.5 and 1.5 points/m^2, respectively.

3.2. Cliff erosion and cliff face retreat (1998 to 2009–2010)

Digital change grids, estimated by differencing successive digital elevation models created using these LiDAR datasets, show both negative (erosion) and positive (accretion, talus deposits) changes. Sources of digital change grid error include the basic LiDAR observations, spatial interpolation, and vegetation. The vertical root mean square difference (RMSZ) between surveys was estimated at 0.36 m using 14 control areas spread throughout the study area. Control areas representative of coastal cliff topography consisted of inland hillsides and slopes assumed to experience no change during the study period. RMSZ was calculated for each control area using the digital change grid raster values.

Elevation changes can indicate landslide motion, land erosion, talus deposition, topographic beach changes, and anthropogenic changes. The detected changes were programmatically filtered to remove noise and erroneous data. To do so, first all grid cells with a vertical change

Table 1
2009–2010 lidar coverage and survey dates (Fugro, 2011).

South End	North End	Survey date	Analysis time span (years, 1998 to 2009–2010)[a]
Border	La Jolla Shores	November 2009	11.6
La Jolla Shores	Dana Point Harbor	October 2009	11.5
Dana Point Harbor	Seal Beach	October 2009	11.5
Seal Beach	Point Dume	October 2009	11.6
Point Dume	Carpenteria	November 2009	11.6
Carpenteria	El Capitan	November 2009	11.6
El Capitan	Point Conception	November 2009	11.6
Point Conception	Oceano	November 2009	11.6
Oceano	Harmony	November 2009, May 2010	11.6
Harmony	Ragged Point	November 2009	11.6
Ragged Point	Point Sur	November 2009, May 2010	11.7
Point Sur	Moss Landing	May 2010, June 2010, October 2010	12.1
Moss Landing	Ano Neuevo	June 2010, September 2010, October 2010	12.2
Ano Neuevo	Pacfica	June 2010, September 2010, November 2010	12.2
Pacifica	Golden Gate	June 2010, October 2010, November 2010	12.2
Golden Gate	Tomales Bay	September 2010, November 2010	12.4
Tomales Bay	Sea Ranch	September 2010, November 2010	12.4

[a] Longest date range.

of <1 m (about 3 * RMSZ) were omitted. Next, a minimum topographic footprint was imposed, requiring >10 connected cells of positive or negative change. Finally, the filtered digital change data were checked visually and edited manually. Changes related to beaches, dunes, construction, and those areas inland of the coastal road were identified using aerial photographs and digital elevation model hillshades, and removed.

Changes were separated into negative (*i.e.* cliff erosion) and positive (*i.e.* talus deposits) volumetric changes and then evaluated in 5 m wide (in the alongshore direction) compartments. Dividing the volumetric compartment changes by the cliff height and compartment width (5 m) yielded bulk negative and positive cliff face changes, equivalent to average cliff retreat/advance over the cliff face (Fig. 2). Cliff/coastal slope heights were obtained from the digital elevation model.

The calculated volume changes under-estimate the actual changes because only relatively large volume and large footprint slides are detected. Thus, smaller topographic changes (such as a smaller individual rockfalls or localized surficial erosion) were not detected with the present methods. In a few locations such as Palos Verdes and Big Sur, the LiDAR swath did not fully cover the landward extent of coastal change, also causing an under-estimation of coastal change volumes.

3.3. Cliff top retreat (1998/2002 to 2009–2010).

Cliff top changes were measured using an existing 1998 (or 2002 in some locations) cliff top edge line from Hapke and Reid (2007) and a 2009–2010 cliff top edge line digitized manually for this study. The cliff top edge location was defined as the slope break between the cliff face and the cliff top. Areas were excluded where a definitive edge could not be identified. Cliff top retreat was measured at 5 m intervals alongshore using shore-normal transects. Negative cliff top retreat indicates landward cliff top movement (erosion). Measurements indicating seaward cliff top movement were assumed to result from data processing artifacts, and set to 'no change'. In some localized areas, cliff top retreat measurements were removed because of variation in the identified cliff top edge feature between this study and Hapke and Reid (2007). Cliff edge uncertainties of 1.3 and 1.1 m for the 1998 and 2009–2010 datasets, respectively, were estimated as the sum in quadrature of the horizontal LiDAR accuracy (0.5 and 0.8 m) and digitizing error estimated at 1 m. The annualized error for cliff top retreat rates was estimated as the sum in quadrature of the two cliff edge uncertainties divided by the time span (11.6–12.4 years) at 0.14–0.15 cm/yr.

3.4. Historical cliff top retreat (1929–1934 to 1998/2002)

Historical cliff edge lines from 1929 to 1934 and 1998/2002 (previously analyzed by Hapke and Reid, 2007) were reanalyzed at 5 m alongshore resolution for spatial consistency with the present analysis. Measurements indicating seaward cliff top movement were set to 'no change'. The error associated with these cliff retreat rates is estimated at 0.20 m/yr (Hapke and Reid, 2007).

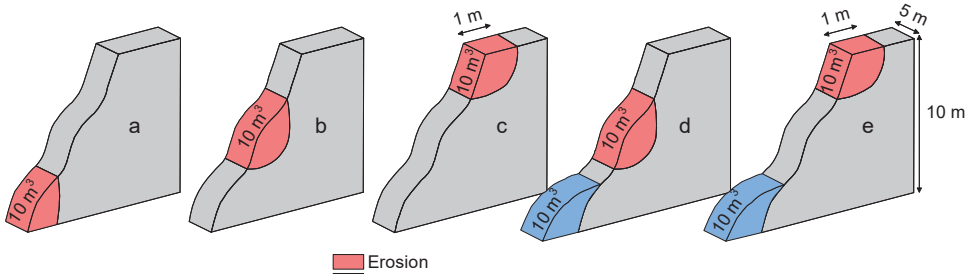
3.5. Waves and total water level

Hourly tide levels were obtained from the La Jolla, Los Angeles, Santa Monica, Santa Barbara, Port San Luis, Monterey, and Point Reyes tide gauges (tidesandcurrents.noaa.gov). A wave buoy network (CDIP, cdip.ucsd.edu) was used to estimate hourly wave conditions at 8707 virtual buoys located in 10 m water depth spaced at 100 m intervals alongshore. The effects of complex bathymetry, and of varying beach orientation and wave exposure, were simulated with a spectral refraction wave model initialized with offshore buoy data (O'Reilly and Guza, 1991, 1998). The model has been used throughout California and validated extensively (O'Reilly et al., 2016). Time periods without data at all virtual buoys were removed, resulting in 46,258 h between November 2003 and November 2009 for wave data analysis.

The total water level is the sum of tides and the vertical height of wave run-up (Shih et al., 1994; Kirk et al., 2000; Ruggiero et al., 2001). Time series of hourly total water level at the cliff base provide basic estimates of wave impact duration and a proxy for marine forcing. The vertical height of wave run-up (R2%) was approximated as the level exceeded by 2% of wave uprushes (Stockdon et al., 2006), using the formula:

$$R2\% = 0.043(H_o L_o)^{0.5}$$

where the deep water wave height (H_o) used in the run-up equation was calculated by backing out nearshore wave height to deep water by reverse shoaling using linear wave theory, while the deep water wavelength (L_o) was calculated using the linear dispersion relationship (Dean and Dalrymple, 1991). Hourly total water level at each cliff location was interpolated with R2% and tide gauge data and used to calculate wave-cliff impact metrics, defined as the number of hours total water levels exceeded 2.5 and 3 m in elevation (NAVD88).



Cliff Change Measurements

	a	b	c	d	e
Cliff Retreat (m)					
Top =	0.0	0.0	-1.0	0.0	-1.0
Face (-) =	-0.2	-0.2	-0.2	-0.2	-0.2
Face (+) =	0.0	0.0	0.0	+0.2	+0.2
Face (Net) =	-0.2	-0.2	-0.2	0.0	0.0
Cliff Erosion (m^3/m)					
Volume (-) =	-2.0	-2.0	-2.0	-2.0	-2.0
Volume (+) =	0.0	0.0	0.0	+2.0	+2.0
Volume (Net) =	-2.0	-2.0	-2.0	0.0	0.0

Fig. 2. Interpretations of idealized cliff changes using the different retreat and erosion estimates.

3.6. Coastal armoring and setting

Coastal armoring present in 2010 was mapped by updating and amending a 2004 database of coastal armoring (Dare, 2005) using 2010 oblique coastal photographs (California Coastal Records Project). The general coastal setting (rocky coast, sandy beach, cliff fronted by beach, *etc.*) was categorized and mapped alongshore using maps from Griggs et al. (2005) and 2010 oblique photographs (California Coastal Records Project). An accurate time series of beach width could not be established for the study area because of limited data availability and variable survey dates (Table 1) combined with large seasonal beach fluctuations, sometimes >50 m (Doria, 2016).

3.7. Rock strength

Nine hundred and thirty three *in situ* cliff rock strength measurements were made with Proceq Schmidt Hammers Type L and N at the cliff base using the ASTM method (ASTM, 2013). The ASTM method calculates the rebound value as the mean of 10 readings with outliers removed. Type L and N hammers were compared using 20 *in situ* measurements on a variety of rock types and combined with measurements from Kennedy and Dickson (2006) for calibration. Type L and N measurements were highly correlated ($r^2 = 0.98$), and Type N hammer measurements were converted to Type L for consistency. Schmidt hammer measurements were typically spaced 50–100 m alongshore in the sections evaluated. For each cliff compartment rebound measurements located within 100 m were used to evaluate rock rebound statistics including the minimum, maximum, mean, and non-zero mean. Similar rock rebound metrics were also evaluated using rebound measurements within 500 and 1000 m of each cliff compartment. Site access logistics limited most rock strength measurements to cliffs fronted by beaches.

3.8. Precipitation

Total precipitation during the study period was estimated by interpolating daily precipitation records from 18 coastal sites distributed over the study area to each 5 m alongshore compartment (Fig. 1; www.wrcc.dri.edu/).

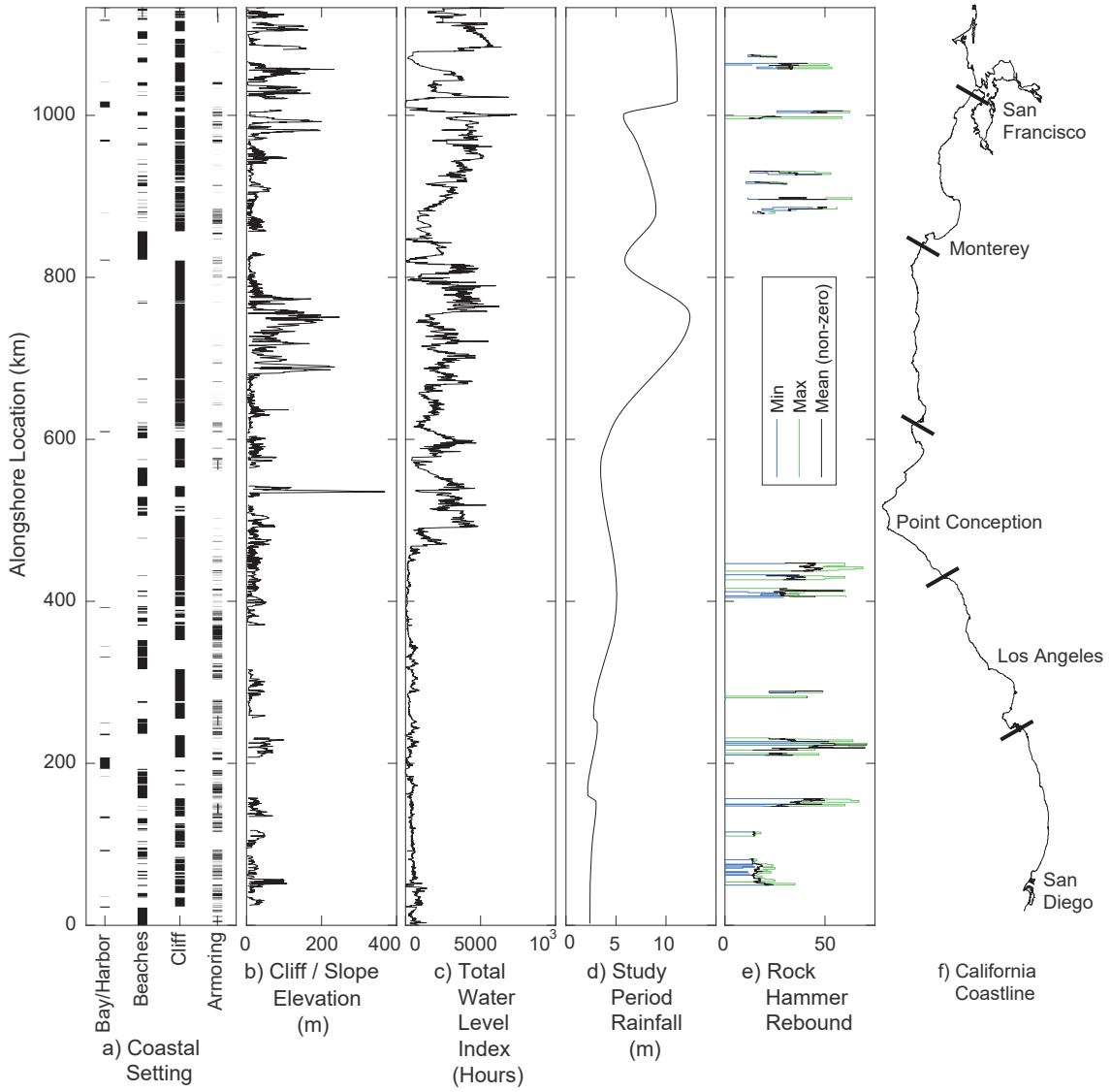


Fig. 3. Alongshore comparison of (a) coastal setting and classification, (b) cliff or coastal slope height, (c) total water level index (hours above 2.5 m NAVD88), (d) interpolated study period total precipitation, (e) Schmidt hammer rebound metrics (within 1 km of compartment location) and (f) coastline reference map with hashes at 200 km intervals. Lower rebound metrics correspond to weaker rocks.

Table 2
Coastal setting, cliff change, and cliff top hazard statistics by county.

County	Length in study area (km)	Classification (%)					Mean wave impact index[a]	Mean rock rebound value[a]	Mean recent cliff top retreat (m/yr)	Mean recent cliff face retreat (m/yr)	Length of cliff top evaluated (km)	Length of cliff face evaluated (km)	Cliff top hazard index		
		Armored	Beach	Cliff & beach	Cliff/Rocky	Bay/Harbor							Mean	Mean of positive values	Percent positive values (%)
Sonoma	7	2	42	25	26	7	2538	NaN	−0.32	−0.01	1	6	−0.31	0.005	10
Marin	111	3	21	42	33	3	2872	28	−0.21	−0.07	21	75	−0.06	0.11	54
San Francisco	19	23	26	23	23	28	2375	32	−1.08	−0.16	0	9	−0.82	0.12	11
San Mateo	82	10	13	52	32	3	3951	27	−0.16	−0.09	23	74	−0.05	0.09	34
Santa Cruz	62	24	18	49	33	0	1854	34	−0.09	−0.04	21	57	−0.05	0.04	28
Monterey	167	4	20	13	66	1	2547	NaN	−0.13	−0.01	15	63	−0.17	0.04	23
San Luis Obispo	140	8	24	21	53	1	1963	NaN	−0.04	−0.04	24	41	0.01	0.05	62
Santa Barbara	176	12	22	70	8	0	1317	37	−0.11	−0.05	66	102	−0.05	0.06	42
Ventura	67	55	52	31	15	2	399	NaN	NaN	0.00	0	13	NaN	NaN	NaN
Los Angeles	117	27	21	51	13	14	325	38	−0.09	−0.02	18	59	−0.07	0.02	22
Orange	67	42	54	35	8	4	380	37	−0.09	−0.01	6	22	−0.07	0.01	25
San Diego	120	31	40	45	12	3	558	16	−0.14	−0.02	40	74	−0.12	0.03	15
All	1133	18	27	40	30	3	1683	18	−0.12	−0.04	236	595	−0.07	0.05	33

[a] Compartment means for wave and rock metrics shown in Fig. 2.

3.9. Cliff top hazard index

Over long periods, cliff face and cliff top retreat measurements will converge. However over shorter time periods, these measures can differ substantially and provide information on geomorphic change and cliff stability. Cliff top retreat reduces the overall cliff slope, while cliff base and cliff face erosion (not concentrated at the cliff top) cause slope steepening, thus reducing overall cliff stability. Young et al. (2009a) suggested the difference between cliff top and cliff face erosion could be used as a cliff top retreat hazard index. For example, as the cliff face retreat exceeds cliff top retreat, the cliff becomes more unstable, and *vice versa*. A cliff top hazard index, defined here as the recent cliff top retreat rate (positive values set to zero) minus the recent cliff face net retreat, increases with overall cliff steepening. Positive hazard values indicate the cliff face retreat rates exceed the cliff top retreat rates, suggesting a higher potential for future cliff top failure.

4. Results

4.1. Coastal setting

Seventy percent of the studied shoreline contains coastal cliffs, with 57% fronted by beaches (Fig. 3a, Table 2). Beaches without cliffs occupy 27% of the shoreline, with the remaining 3% of the coastline consisting of harbors and waterways. Total water level index metrics were consistently higher north of Point Conception (Fig. 3c). Eighteen percent of alongshore compartments contained some level of coastal armoring (Fig. 3a). Armoring is more prevalent in southern California probably because of higher density coastal populations and development, despite lower nearshore wave energies. Rock rebound values were relatively low in the San Diego area (Table 2), but generally varied widely in the sampled areas (Fig. 3e).

4.2. Cliff changes

Recent (1998 to 2009–2010) cliff changes >10 m^3 were detected in 45% of the 5 m alongshore compartments (267 of 595 km; Table 3, Fig. 4d). Recent net volumetric cliff change rates ranged from −527 (erosion) to 128 (accretion) m^3/m/yr with a mean of −1.78 m^3/m/yr (Table 3). Recent net cliff face retreat ranged from −3.8 (landward) to 0.67 (seaward) m/yr with a mean of −0.042 m/yr (Table 3, Fig. 4c). Recent cliff top retreat rates ranged from −4.2 to 0.0 m/yr, with a mean of −0.12 m/yr (Table 3, Fig. 4b) for the 236 km evaluated. In comparison, historical (1929–1934 to 1998/2002) cliff top retreat rates ranged from −3.1 to 0.0 m/yr, with a mean of −0.25 m/yr (Table 3, Fig. 4a) for the 283 km evaluated. Across the 169 km of cliffs where both historical and recent cliff top rates exist, the mean historical and recent cliff top retreat rates were −0.22 and −0.12 m/yr, respectively.

Numerous cliff erosion and retreat hot spots were detected throughout the study area (Fig. 5). Many of the erosion hot spots were related to deep-seated and/or complex coastal landslides such as in Daly City,

Table 3
Summary of cliff change statistics.

	Maximum erosion or landward movement	Maximum accretion or seaward movement	Mean	Standard deviation	Percentage of nonzero compartment observations (%)
Cliff volume change rate (m^3/m/yr)					
1998 to 2009–2010					
Negative (erosion)	−527	0	−1.95	9.66	44
Positive (accretion)	0	136	0.17	2.27	4
Net	−527	128	−1.78	9.56	45
Cliff face retreat rate (m/yr)					
1998 to 2009–2010					
Negative (erosion)	−4	0	−0.045	0.141	44
Positive (accretion)	0	1.12	0.0023	0.028	4
Net	−3.8	0.67	−0.042	0.14	45
Cliff top retreat rate (m/yr)					
1998/2002 to 2009–2010					
Negative (landward)	−4.2	0	−0.12	0.27	55
Cliff top retreat rate (m/yr)					
1929–1934 to1998/2002					
Negative (landward)	−3.1	0	−0.25	0.28	99

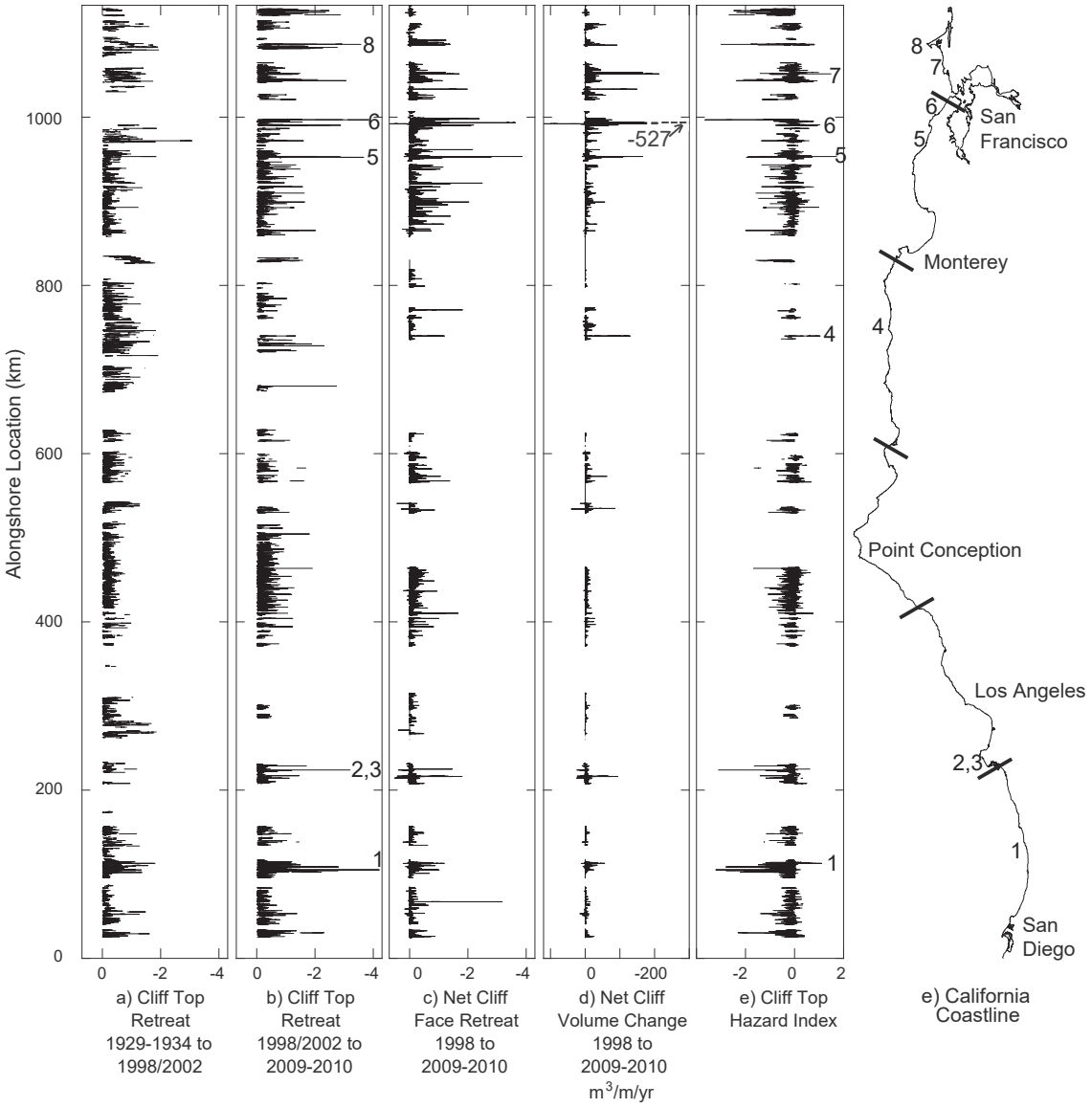


Fig. 4. Alongshore comparison of (a) historical cliff top retreat (b) recent cliff top retreat (c) recent net cliff face retreat, (d) recent volumetric cliff change, (e) cliff top hazard index, and (f) coastline reference map with hashes at 200 km intervals. Positive cliff top hazard index numbers indicate higher hazard and slope steepening. Numbers show cliff retreat hot spots and high cliff top hazard locations at (1) San Onofre State Beach, (2) Portuguese Bend, (3) Palos Verdes, (4) Big Sur, (5) Martins Beach, (6) Daly City, (7) Double Point, and (8) Point Reyes. The net cliff volume change (d) at about km 1000 extends beyond the plot (dashed line) to −527 $m^3/m/yr$.

Portuguese Bend, and San Onofre, consistent with previous studies (Hapke et al., 2009; Young et al., 2009b; Young, 2015).

4.3. Cliff top hazard index

The cliff top hazard index ranged from −3.7 to 1.7 (Fig. 4e) with a mean of −0.07, indicating more areas experienced cliff flattening as opposed to cliff steepening. However, 33% of compartments with both cliff top retreat and cliff face retreat observations had a positive hazard index. Locations with large cliff top hazard values (>1) include San Onofre State Beach, Big Sur, Martin's Beach, Daly City, and near Double Point in Point Reyes National Seashore. San Luis Obispo County had the highest overall mean hazard index but the mean index of cliff steeping locations (positive hazard values) was relatively low (Table 2). Marin, San Francisco, and San Mateo Counties, all in the northern part of the study area, had the highest mean index of cliff steepening locations. Marin, San Luis Obispo, and Santa Barbara Counties had the highest percentages (42–62%) of cliff steepening locations (Table 2). Additional future surveys are needed to test the applicability of this experimental hazard index.

5. Discussion

5.1. Influence of coastal setting

Correlations between total water level metrics and recent cliff changes were not significant at spatial scales between 5 m–0.5 km (averaging alongshore), but became statistically significant ($p < 0.01$) at 0.5 km scale, and increased to a maximum of ~0.15 (r^2) at 15 km scales. At larger scales, the correlations became unstable with high r^2 fluctuations. Although not available for this study, incorporating time series data of beach widths and elevations to assess wave-cliff impacts may improve correlations between marine forcing and cliff retreat. Neither precipitation nor rock rebound metrics were well correlated with cliff retreat at any spatial scales. This could be because of the relatively low sampling resolution for rainfall and rock strength compared with cliff changes, or that other local parameters such as sea spray,

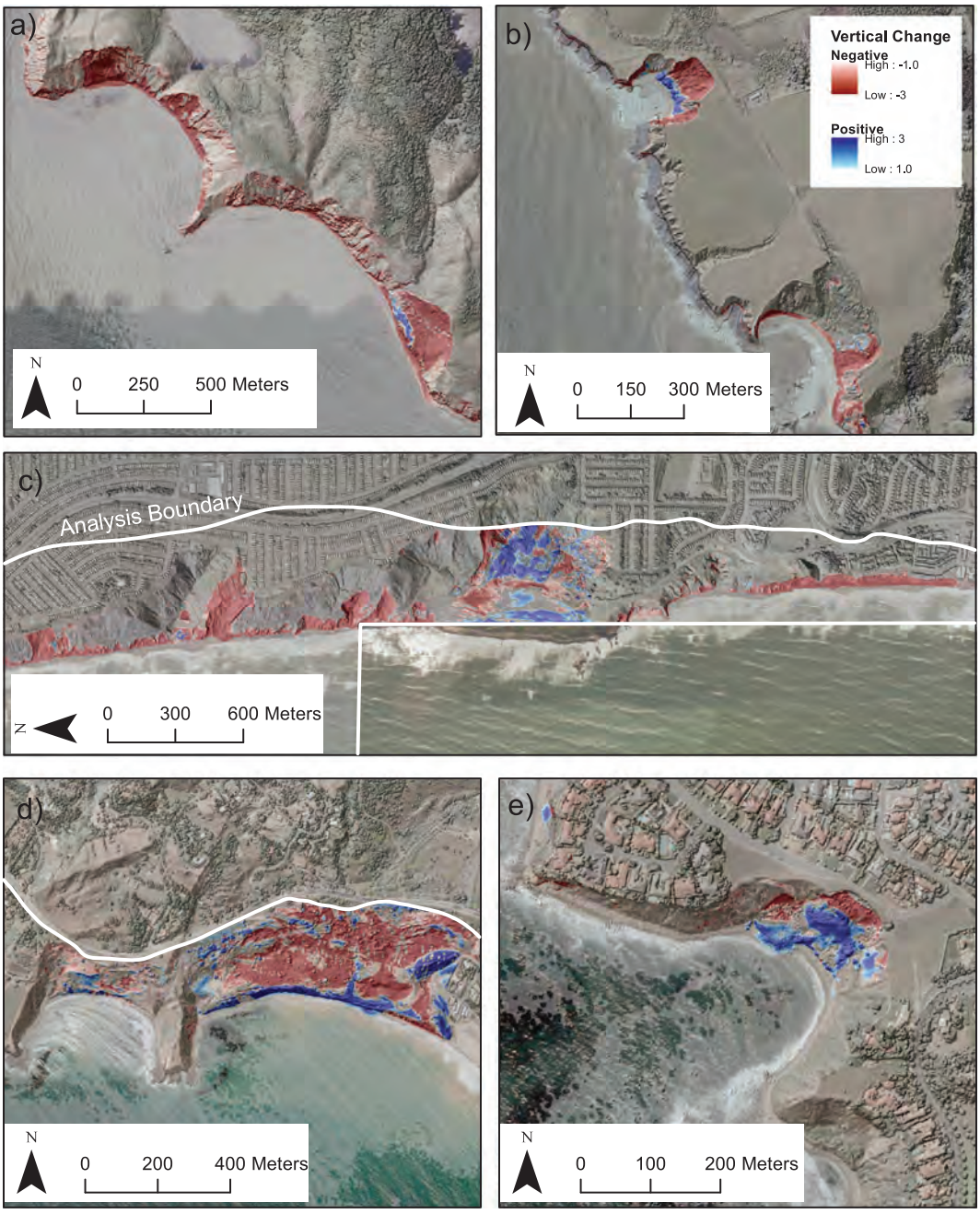


Fig. 5. Examples of significant coastal cliff changes at (a) Point Reyes National Seashore, (b) Martin's Beach, (c) Daly City and Pacifica, (d) Portuguese Bend, and (e) Palos Verdes. Inland lines in panels c and d show LiDAR analysis boundary, indicating possible additional cliff changes occurring further inland. See Fig. 4 for mapped locations.

wind, and beach elevations are influencing cliff retreat. For example, rainfall runoff directed onto specific cliff areas can create erosion hot spots unrelated to cliff hardness or regional rainfall quantities. Additionally, the decadal time span averages out high magnitude rain and wave events causing the cliff erosion. The processes driving cliff erosion vary in space and time, and alongshore differences in cliff stage profile development and the stochastic nature of cliff failures probably also limited cliff erosion correlations. As identified in previous work (*e.g.* Young et al., 2009b; Young, 2015), rainfall may be better correlated with cliff erosion when compared in time series rather than the spatial comparison used here because time series analysis of a particular cliff section reduces cliff setting variables (such as geologic conditions) that are difficult to quantify.

Mean cliff face and cliff top retreat rates in central California were 86% and 30% larger, respectively, compared to southern California. Similarly, mean metrics of wave-impact and precipitation were also higher in central California, suggesting possible relationships at these regional scales; however additional data are needed to test this relationship statistically.

On average, unarmored cliffs retreated (−0.054 m/yr cliff face retreat) about 3 times more than armored cliffs (−0.019 m/yr, Fig. 6a). Cliffs fronted by beaches retreated 49% more (−0.061 m/yr cliff face retreat) than those without beaches (−0.041 m/yr, Fig. 6a). This observation is counter-intuitive because beaches protect cliffs from wave erosion (Jones and Williams, 1991; Lee, 2008), but is consistent with previous studies (Robinson, 1977). This observation suggests beaches in the study area tend to form at locations with relatively weak cliffs and where sufficient sand supply exists. It also highlights the possible role of beach sediment as an abrasive that may accelerate cliff retreat (Sunamura, 1982, 1992; Kline et al., 2014). Additional rock

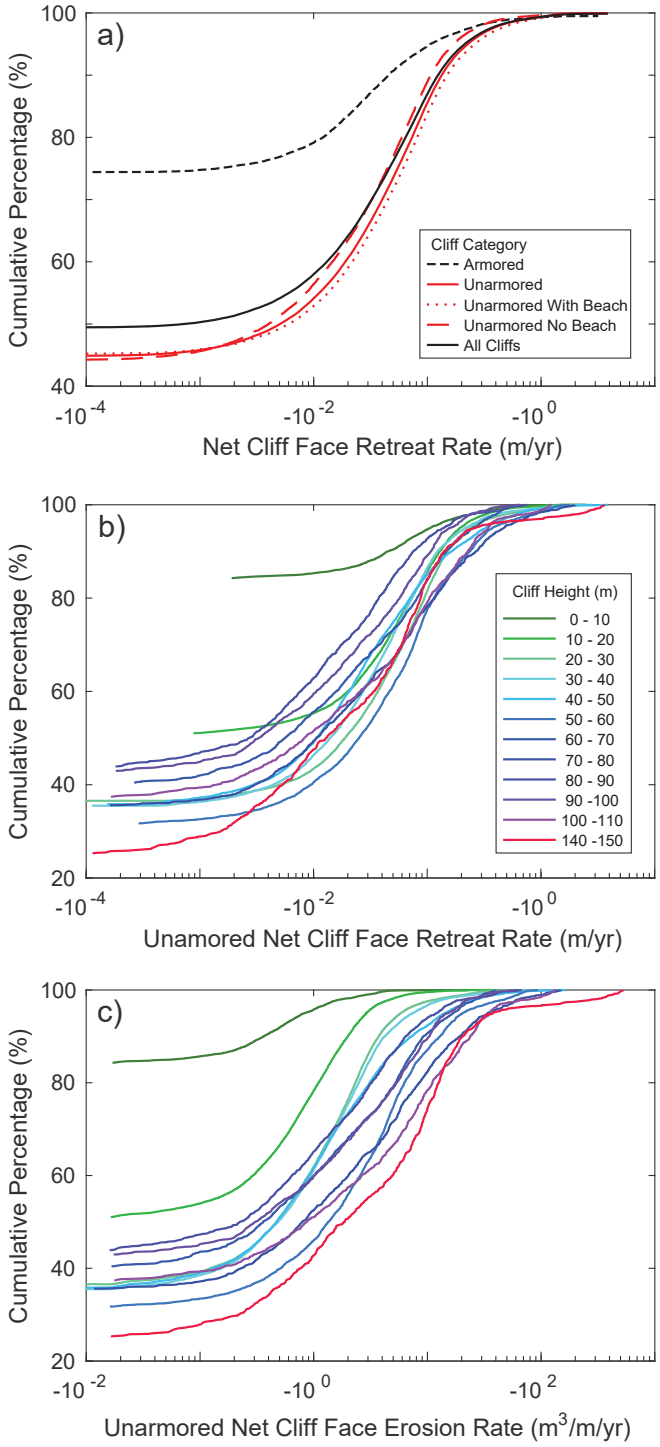


Fig. 6. Cumulative distributions of recent 1998 to 2009–2010 (a) cliff face retreat rate for armored, all unarmored, unarmored with/out beaches, and all cliffs, (b) cliff face retreat rate (erosion normalized by cliff height) for cliffs separated by cliff height (colors), and (c) cliff face erosion rate for cliffs separated by cliff height (colors). For panels b & c, only binned height ranges with at least 1000 observations are shown.

strength sampling at sites without beaches, and an evaluation of the beach protective capacity may help test this hypothesis. It is unknown if this relationship will hold over longer time periods, however it is consistent with long-term modeling (Limber et al., 2014; Limber and Murray, 2014) suggesting beaches accumulate in embayments composed of weak rock. This finding is also consistent with wave refraction around headlands that generate gradients in alongshore sediment flux and sediment deposition in embayments (May and Tanner, 1973; Komar, 1985; Carter et al., 1990; Trenhaile, 2016).

Taller cliffs experienced more overall erosion (Fig. 6c), but cliff face retreat rates were generally uninfluenced by cliff height except for low height cliffs (0–10 m) that retreated slower than all other cliffs (Fig. 6b). The reason for the small retreat rates of low cliffs is unknown, but could be from erosion-resistant low cliffs that sometimes lack the weaker upper Quaternary layer (for example in the Monterey area). At 5 m compartment scale, cliff height was not correlated with recent cliff retreat or erosion. However when retreat rates from unarmored cliffs were binned by height (10 m bins), the mean cliff height for each bin was significantly correlated with mean erosion rate when bins with fewer than 1000 observations were excluded ($r^2 = 0.71$, Fig. 6c). This correlation between mean binned cliff retreat rates and unarmored cliff height decreased when bins with fewer observations were considered.

5.2. Comparison to historical retreat rates

Distributions of historical and recent retreat rates were all skewed towards smaller magnitude events, but historical retreat rates were more evenly distributed and included higher percentages of large magnitude retreat rates (Fig. 7). The more evenly distributed historical cliff retreat could be because longer time periods average out the stochastic nature of cliff retreat, and suggests the system moves towards more spatially uniform retreat rates with time. 12.6, 4.7, and 1.3% of historical cliff top, recent cliff top, and recent cliff face retreat rates, respectively, exceeded −0.5 m/yr. Mean recent cliff top and cliff face retreat rates were lower than mean historical cliff top retreat rates by 52% and 83%, respectively (mean rates include zero change locations). The reason for the substantially lower rates is unknown but could be related to extensive anthropogenic alterations to the coastal system, different overall time scales (~70 *vs.* ~10 years), the episodic nature of cliff retreat, changes in ocean or subaerial forcing between these time periods, and/or variable quality of data sources. Additional retreat measurements over a wider variety of timescales are needed to test for timescale-dependence of erosion rates observed in other natural systems with intermittent erosion events (*e.g.* Finnegan et al., 2014; Ganti et al., 2016). However, in these other systems erosion rates are higher over shorter time intervals, opposite to the smaller decadal scale rates observed here. This opposition could be from the large spatial area evaluated here that can reduce the timescale-dependence of erosion rates (Sadler and Jerolmack, 2015; Ganti et al., 2016). Historical and recent maximum retreat rates were of similar magnitude.

Overall comparison of historical and recent individual compartment retreat rates (Fig. 8a, b) suggests they are not well correlated. However, historical and recent retreat rates are significantly ($p < 0.01$) inversely correlated for areas that experienced relatively large historical or recent cliff retreat, such that recent retreat rate decreases with elevated historical retreat. The strength of the inverse correlation increases with cliff change magnitudes up to $r^2 = 0.91$ (Fig. 8d, e). This result suggests that using site-specific historical retreat rates to predict or project future decadal scale cliff retreat (and possibly longer time scales) using historical data could be problematic because of the varying timescales, forcing mechanisms, and system feedbacks. The stochastic nature of cliff retreat also complicates predictions when time scales vary and the time elapsed since previous failures is not considered. The inverse correlation is probably driven by geomorphic feedbacks, such that after a large cliff top failure, the cliff becomes relatively inactive from (1) a decrease in cliff slope and (2) increased wave protection from talus (and resulting beaches, when the cliffs contain sufficient beach-size sediment). These findings are consistent with Lee (2008) who found that extrapolating historical retreat is problematic without incorporating cliff-beach dynamics and forcing mechanisms over the observation period.

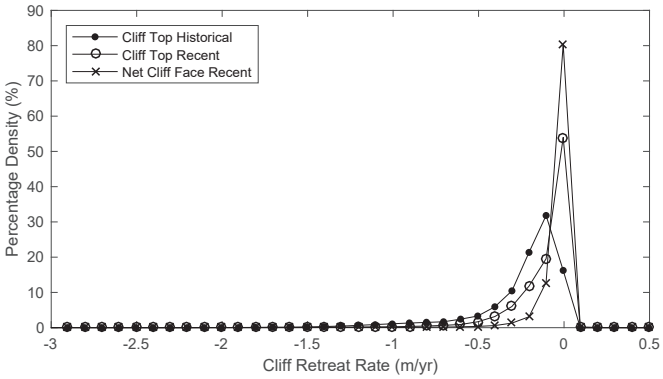


Fig. 7. Binned (0.1 m) distribution of historical and recent cliff retreat rates. Negative values indicate landward retreat.

6. Summary

LiDAR data collected in 1998 and 2009–2010 were used to measure decadal scale coastal cliff erosion and cliff top retreat from the Mexico/California border to Bodega Head, California. Cliff face erosion was detected along 44% of the 595 km of cliffs evaluated. Mean cliff face and cliff top retreat rates were −0.04 and −0.12 m/yr, respectively, notably lower than historical (1929–1934 to 1998/2002) retreat rates of −0.25 m/yr. The lower recent rates could be from anthropogenic changes, varying time periods and forcing mechanisms, the stochastic nature of cliff retreat, and variable quality data sources. Distributions of historical retreat rates were spread more evenly and included higher percentages of large magnitude retreat rates, probably because the longer time span captured more locations that experienced episodic large cliff retreat events, thus spatially averaging out retreat rates. Large magnitude historical cliff retreat rates were inversely correlated with recent cliff retreat rates, suggesting possible problems with using historical retreat rates to project future cliff positions. The inverse correlation is probably driven by the episodic nature of large cliff retreat events, geomorphic feedbacks, and the cliff retreat cycle.

Maximum landward cliff top and cliff face retreat rates were about 4 m/yr, similar to maximum historical retreat rates. Localized high rates of coastal cliff change were found in Palos Verdes, Daly City, San Onofre State Beach, Point Reyes National Seashore, and Martin's Beach and were often related to deep-seated and/or complex coastal landslides. Alongshore metrics of wave-cliff impact, precipitation, and cliff hardness generally did not correlate well with recent cliff retreat rates. On average, unarmored cliff faces retreated about three times further than armored cliffs. Although beaches can prevent wave-driven erosion, cliffs fronted by beaches retreated faster than those without beaches. However, the influence of beach width was not considered here, and narrow beaches that provide little erosion protection might have influenced this outcome. These findings highlight the need to monitor beach and cliff changes concurrently and examine the protective role of beaches in cliff processes.

The difference between cliff face change and cliff top retreat were used to quantify cliff steeping and establish a cliff top hazard index. Locations with relatively large cliff steeping and cliff top hazard values include San Onofre State Beach, Big Sur, Martin's Beach, Daly City, and near Double Point. Additional surveys are needed to test the hazard index and identify hazard thresholds and probable timing of future failures.

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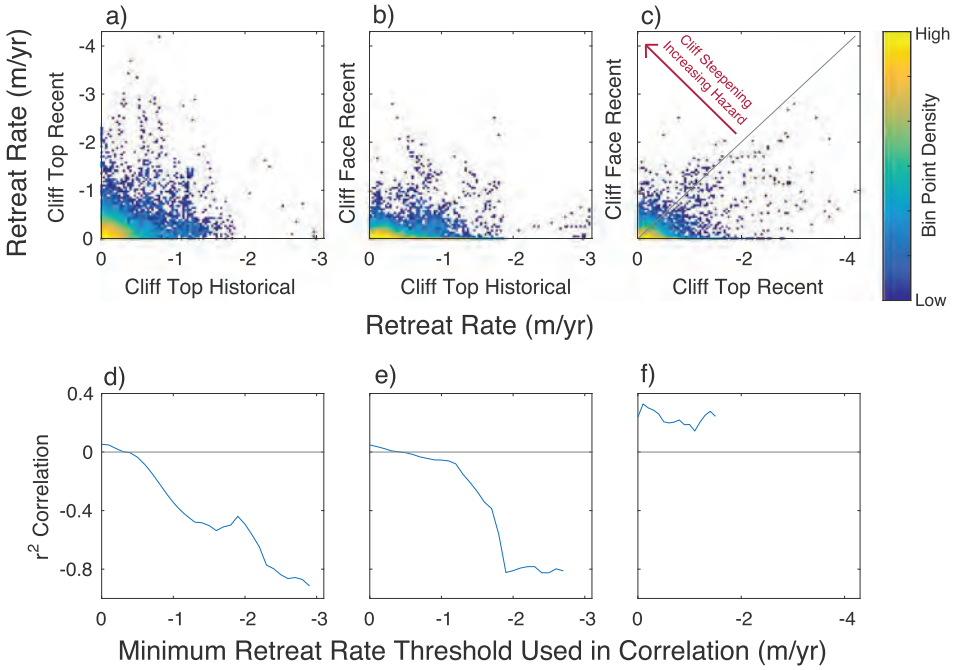

Fig. 8. Comparison of (a) historical (1929–1934 to 1998/2002) cliff top and recent (1998/2002 to 2009–2010) cliff top retreat, (b) historical cliff top and recent cliff face retreat, and (c) recent cliff top and recent cliff face retreat. Color bars represent grid point density. (d–f) Correlations of retreat rates of corresponding top panels (a–c) for alongshore compartments with minimum historical or recent retreat rate magnitudes.

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UC San Diego
UC San Diego News Center

By Lauren Fimbres Wood May 26, 2022

As California Cliffs Erode, UC San Diego Team Works to Track and Understand these Changes

The Coastal Process Group at Scripps Instiution of Oceanography deploys a drone to conduct a LiDAR survey. Photo by Erik Jepsen/University Communications.

Advanced imaging and geotechnical technology are powering understanding of our coastline and its hazards

The cliff-top parking lot was fenced off and the trail marked “Unstable Cliffs - Active Landslide Area - Stay Back,” but that didn’t stop Adam Young and City of Encinitas officials from carefully traversing the uneven landscape at the Beacon’s Beach switchback trail to get a closer look.

“There are definitely new cracks here,” said Young, a coastal geomorphologist and researcher at UC San Diego’s Scripps Institution of Oceanography.

Young studies coastal erosion, overseeing coastline surveys throughout the state of California that use advanced laser imaging technology—called LiDAR, which stands for Light Detection and Ranging—to create high-resolution maps of cliffs to measure how they are eroding and changing over time.

On May 2, 2022, a landslide at the Leucadia, California beach damaged part of the trail, closing the popular access point. Young and a team of fellow scientists from Scripps Oceanography went into rapid response mode, working with city officials to conduct a LiDAR survey of the landslide and install advanced geophysical instruments to determine if the landslide was still moving.

The Beacons Beach switchback trail suffered damage in a landslide on May 2, 2022. Photo credit: Lauren Fimbres Wood.

At the site, a seismometer now monitors any shaking in the cliff face, a GPS monument allows for measuring ongoing changes in position of the cliff top, and wave pressure sensors measure wave impacts hitting the base of the cliff. These pressure sensors allow scientists to measure how often the waves reach the base of the cliff and potentially contribute to the movement of the slide.

“Right now the beach is pretty eroded, and you can see the high tide water line is all the way up to the base of the cliff,” said Young on May 17, when he was back for the installation and monitoring of equipment.

Tiltmeters, which Scripps geophysical engineer Frank Wyatt typically uses to measure movement of the San Andreas Fault, are instruments that can monitor slope stability, measuring to an accuracy of 10 micrometers if the ground is continuing to move. Tiltmeters have also been widely used across the U.S. and Europe to monitor

Scripps researcher Adam Young points to an area north of the beach trail showing new cracks, indicating the area was still in an active landslide on May 17, 2022. Photo credit: Lauren Fimbres Wood.

railroad tracks. They get adhered to railroad ties to determine if a track has gone askew, and provide real-time monitoring to officials.

Warning Signs of Potential Cliff Failure

"It's very important to keep your distance from cliffs," said Young. "Elevated rainfall and groundwater can trigger failures in our area, but cliff failures can happen any time."

Young outlines some warning signs to look out for.

Warning Signs of Potential Cliff Failure:

- Relatively steep or over vertical cliffs
- Cliffs that are undercut, where they are cut away at the bottom from wave activity
- Cracks in the cliff face or cliff top
- Fresh debris at the bottom of a cliff. Cliff failures can be active for days, weeks, or even months. If you see fresh debris at the bottom of a cliff, stay away

Most of the data is disseminated from the instruments using cellular signals to "the cloud." Results of the data collected will be shared with city geotechnical experts to help determine when the landslide is done moving, and when the trail can reopen.

And while the team went into rapid response following the landslide, Beacon's Beach is an area where Young and Scripps geophysicist Mark Zumberge are already conducting ongoing enhanced coastal monitoring. This research is funded as part of Assembly Bill 66, which was introduced by Assemblymember Tasha Boerner Horvath, whose district includes San Diego's coastal North County. The legislation was spurred in part by a fatal accident in which a 30-by-25-foot sandstone chunk broke loose and fell onto three women at Grandview Beach in Encinitas in August 2019.

The bill has allowed for an expansion of coastal LiDAR surveys from Black's Beach to Carlsbad. The surveys are now being conducted weekly. The LiDAR system, which can be operated by a truck-mounted system or drone depending on the width of the beach and other factors, sends hundreds of thousands of laser pulses per second. When the laser pulse hits an object, the laser signal bounces back to the LiDAR instrument, yielding a detailed measurement of the time it takes the laser to return to the

Adam Young and Lucian Perry conduct a truck-based LiDAR scan of the cliffs at Torrey Pines State Beach.

sensor. This results in a centimeter-scale resolution point cloud map of the cliff face, beach elevation and beach cobble—the smooth rocks that are often found on San Diego beaches in the winter.

"Each LiDAR survey provides a snapshot that we compare to previous surveys, to measure and track erosion over time," said Young. "We use these surveys to quantify the erosion processes, identify erosion patterns on cliffs and beach, and examine stability conditions. The LiDAR surveys allow us to examine the site conditions before and after a landslide and help inform coastal management."

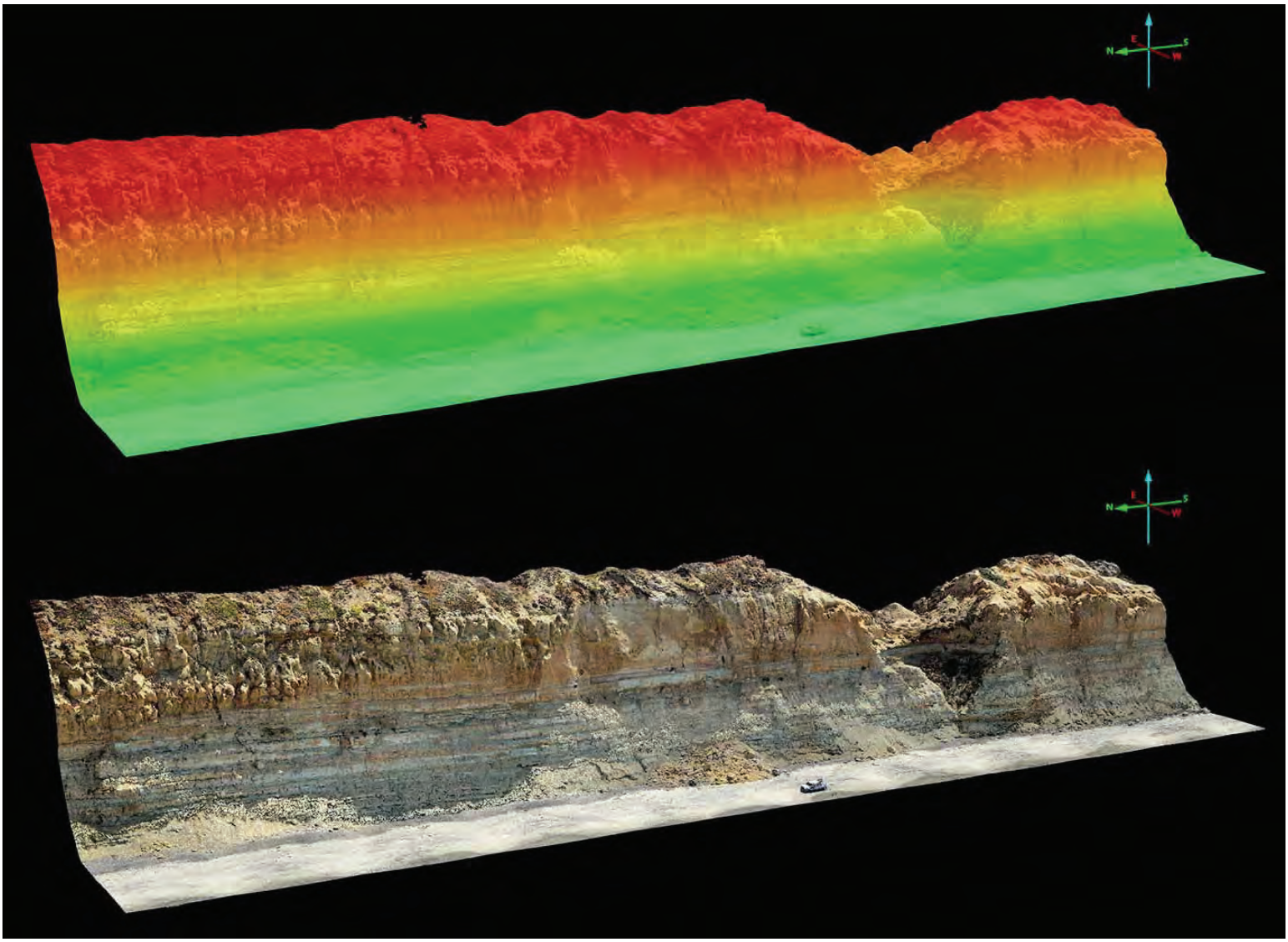
Brian Woodward with the Coastal Processes Group at Scripps conducts a survey at Torrey Pines State Beach. Here they are tracking the beach cobble to better understand how the rocks on the beach build up and retreat, and potentially act as a barrier to coastal erosion. Photo by Erik Jepsen/University Communications.

High tides, large surf, wave run up, groundwater intrusion, rainfall, weathering and sea-level rise can all contribute to beach and cliff erosion. Young and Zumberge are hoping to gain a better understanding of the complex processes that lead up to cliff failures.

Better understanding this interplay may help answer the question of whether signals exist that can forecast where and when an increased risk for collapse is developing. If these signals exist, they would be foundational to informing recommendations towards the development of a potential early landslide warning system also envisioned in the AB 66 bill.

The second phase of AB 66, which is still awaiting permitting approval, would also see the installation of optical-fiber strainmeters at key locations along the cliffs. The strainmeters, which were also developed at Scripps for earthquake research, can measure earth movements at the scale of nanometers.

The strainmeters would be installed by embedding a fiber cable near the cliff top. The quarter-inch cable "uses light as a measuring tape," according to Wyatt, to capture any strains of movements in the ground, sampling as quickly as 50,000 times per second.



LiDAR scanning creates high resolution spatial maps of the cliff face and beach elevation. These two maps show scans of Torrey Pines colored by elevation (green being lower and red higher elevation), and in true color. The 3D model shown here is made up of more than 11 million data points. Comparing these models over time allows scientists to measure the volume of cliff or beach that has eroded. Photo credit: Coastal Processes Group at Scripps.

Any movement detected is measured instantly, creating a record similar to that from an earthquake seismograph. These important measurements may help identify small ground movement signals that precede a large cliff failure event.

These innovations are part of a suite of instruments helping oceanographers and geologists project the future of California's coastline in an era of changing climate. Other programs that complement this research include the Coastal Data Information Program at Scripps, which generates wave model forecasts that can help estimate how waves may interact with the coastline, and the Resilient Futures program, which works with the City of Imperial Beach to provide enhanced flood forecasting to help the community better prepare for sea-level rise.

The beaches in San Diego County are among the most studied in California. Routine beach surveys conducted by Scripps using all-terrain vehicles and GPS date back more than twenty years. The newer mobile LiDAR surveys provide improved coastal coverage including the cliffs and other coastal features. The surveys have expanded over time thanks to advances in technology and increased demand for this critical research to understand threats to infrastructure. The new truck- and drone-based mobile data collection have facilitated higher frequency repeat surveys and are proving critical to better understanding coastal processes.

The California coastline is home to significant and costly infrastructure on the coastline, including homes, railways, highways, wastewater treatment plants, military facilities, power plants and more. The railway corridor connecting San Diego to Los Angeles runs along the beach-top bluffs, with closures and service disruptions following cliff failures. There are calls to relocate the tracks off the bluffs, estimates of which could cost several billion dollars.

“By better understanding how the coastline is evolving now, we can make better predictions for the future,” said Young.

The Scripps Coastal Processes Group conducts a LiDAR survey in Del Mar following a cliff collapse next to the rail corridor in February 2021. Photo credit: Coastal Process Group at Scripps Institution of Oceanography.