CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105- 2219
VOICE AND TDD (415) 904- 5200
FAX (415) 904- 5400

Th10b

9-18-0629

(SOUTHERN CALIFORNIA MARINE INSTITUTE)

MAY 9, 2019

EXHIBITS

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EXHIBIT 1 – Project Location

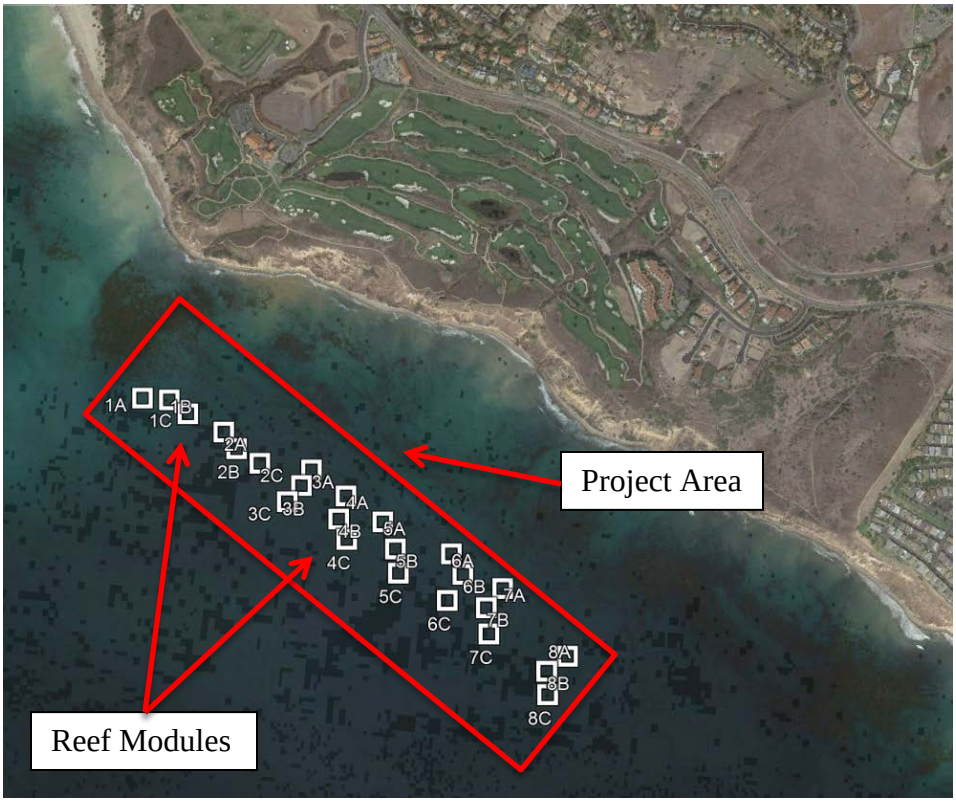

EXHIBIT 2 – Proposed Reef Configuration (page 1 of 2)

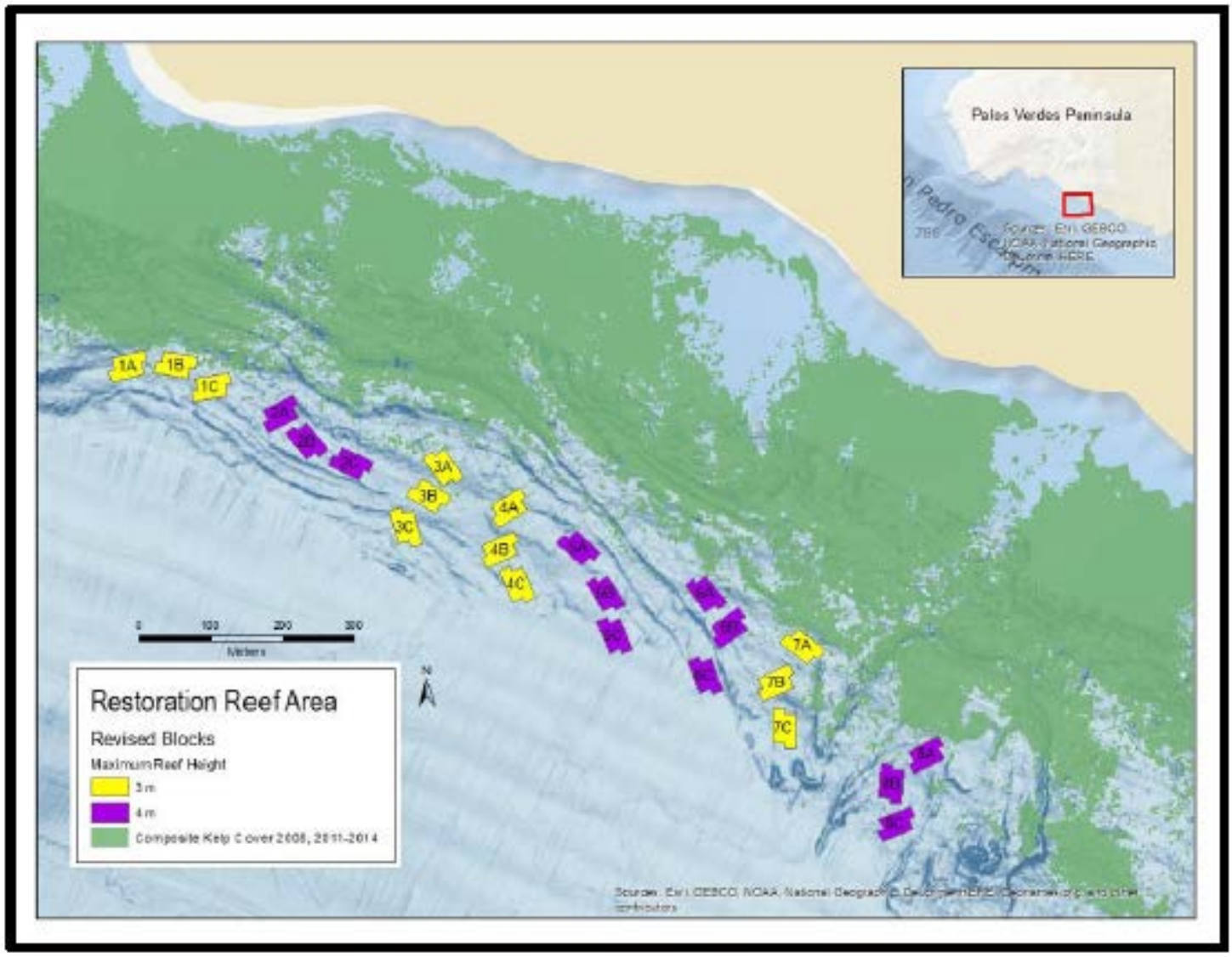

Figure 24. Proposed locations for the restoration reef blocks (1-8) at the Bunker Point restoration site study area with kelp canopy, side scan imagery. Each block consists of 3 modules (A-C). Blocks have a maximum reef height of either 3 m (yellow) or 4 m (purple).

EXHIBIT 2 – Proposed Reef Configuration (page 2 of 2)

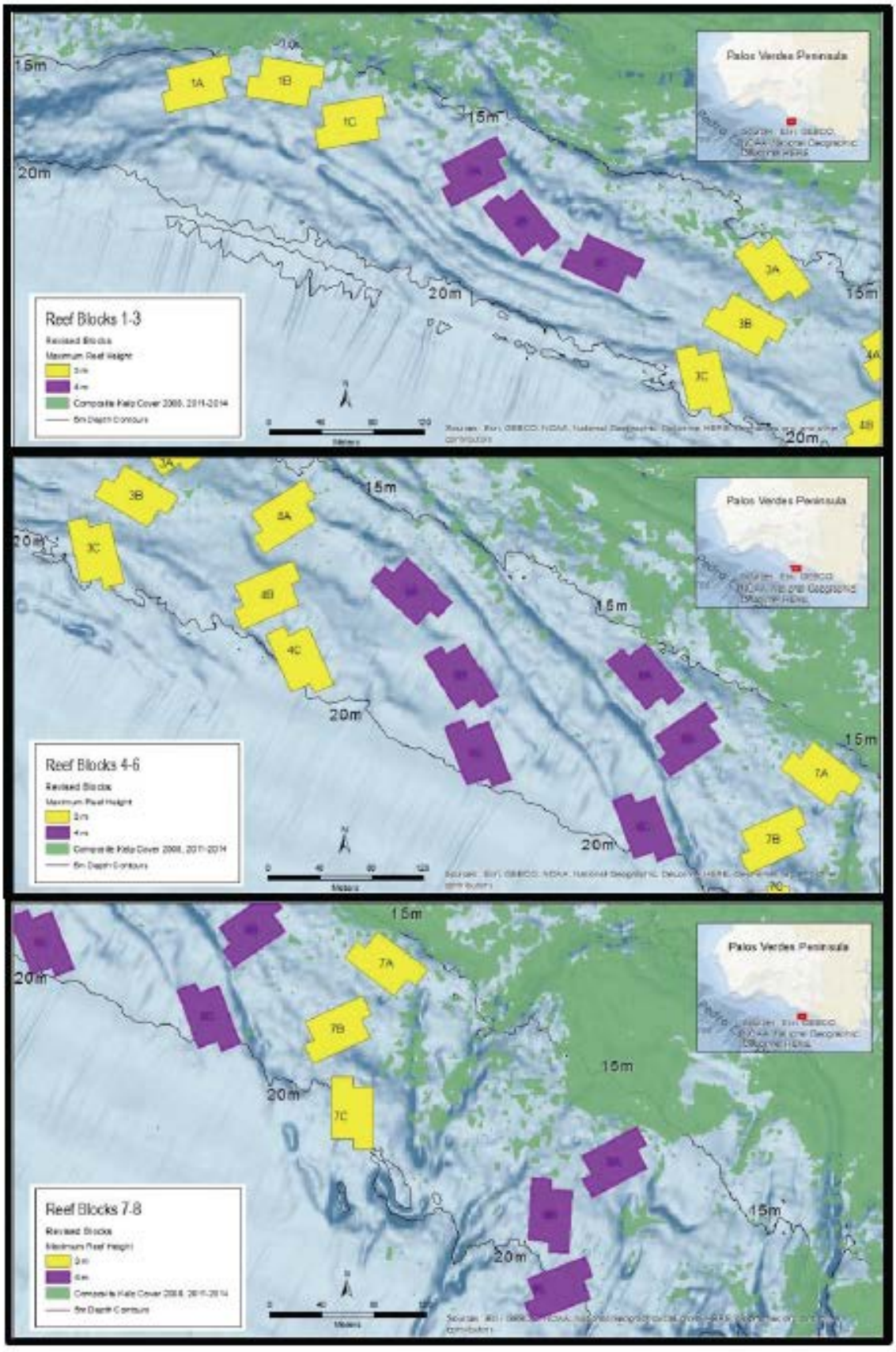

Figure 25. Close-up maps of the proposed locations for the restoration reef blocks (1-8) at the Bunker Point restoration site study area with kelp canopy, side scan imagery. Each block consists of 3 modules (A-C). Blocks have a maximum reef height of either 3 m (yellow) or 4m (purple).

EXHIBIT 3 – Proposed Configuration of Reef Modules (page 1 of 2)

Figure 23. Design of 3m blocks and 4m blocks. Each block contains three modules (A, B, C). Each module consists of a 3 x 2 set of piles, offset by ½ pile length. Each pile is a 16 m x 16 m square pyramid of quarry rock with the overall height listed. There is a 10 to 20 m wide sand channel between modules and at least 50 m of space between blocks (construction design, control and precision details are contained in Appendix I).

EXHIBIT 3 – Proposed Configuration of Reef Modules (page 2 of 2)

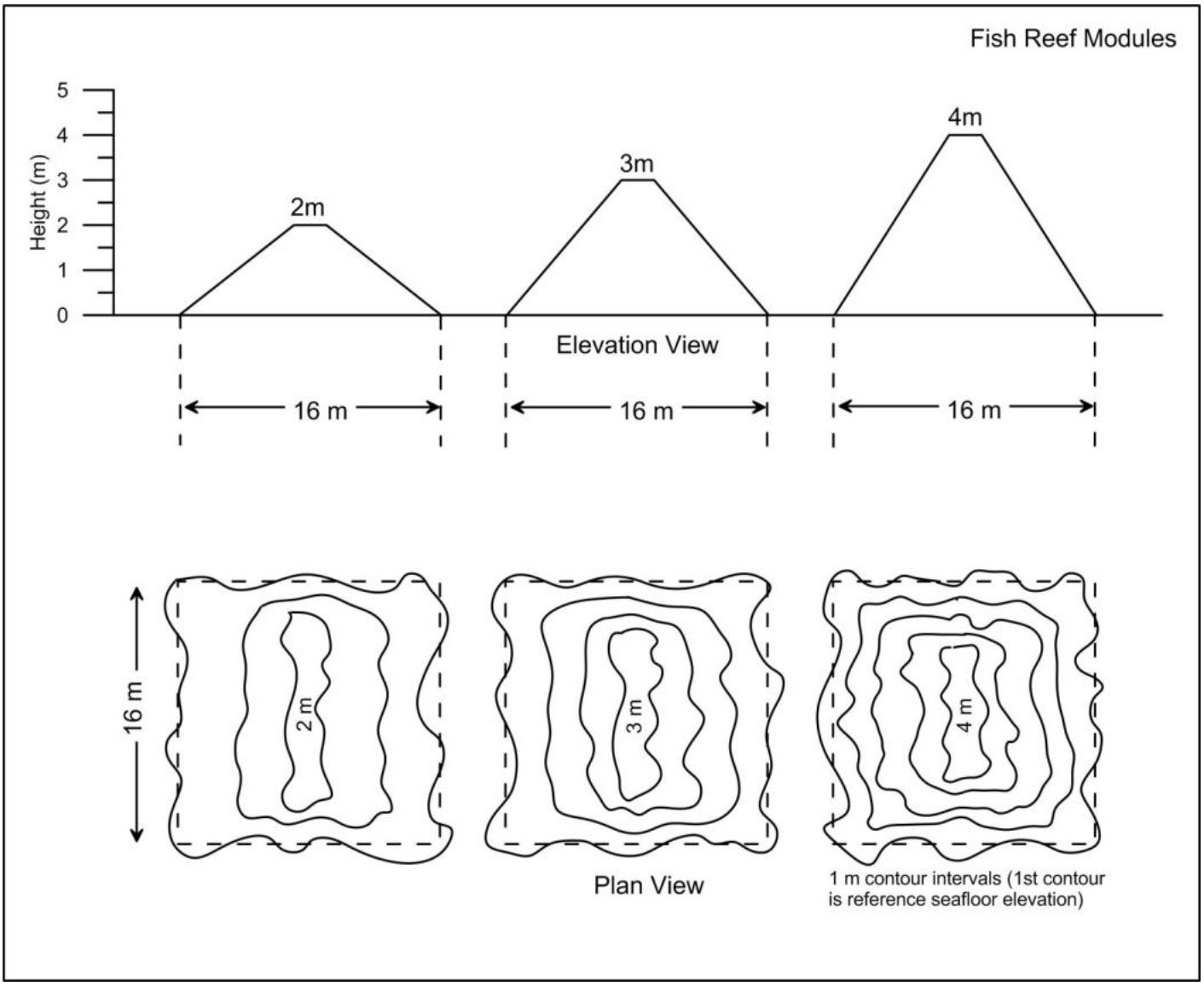

EXHIBIT 4 – Photos and Figure of Proposed Installation Method (page 1 of 2)

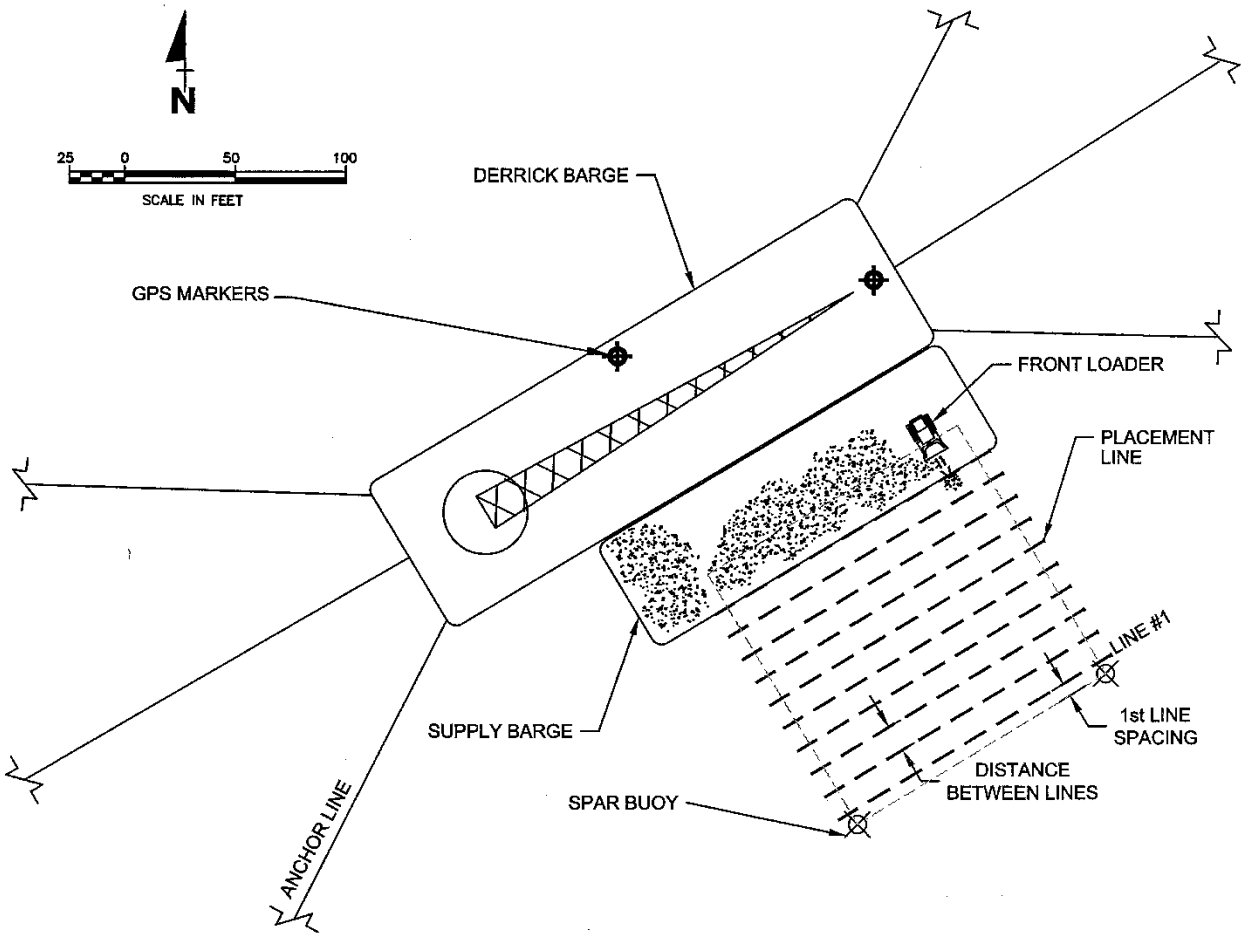

EXHIBIT 4 – Photos and Figure of Proposed Installation Method (page 2 of 2)

Front-end Loader Pushing off Rock Boulders for Reef

Derrick Barge with Crane

RECORDED AT THE REQUEST OF
AND WHEN RECORDED MAIL TO:
STATE OF CALIFORNIA
California State Lands Commission
Attn: Title Unit
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

STATE OF CALIFORNIA
OFFICIAL BUSINESS
Document entitled to free recordation
pursuant to Government Code Section 27383

SPACE ABOVE THIS LINE FOR RECORDER'S USE

A.P.N.
County: Los Angeles

W 26853

LEASE NO. PRC 9448.9

This Lease consists of this summary and the following attached and incorporated parts:

Section 1	Basic Provisions
Section 2	Special Provisions Amending or Supplementing Section 1 or 3
Section 3	General Provisions
Exhibit A	Land Description
Exhibit B	Site and Location Map

SECTION 1

BASIC PROVISIONS

THE STATE OF CALIFORNIA, hereinafter referred to as Lessor acting by and through the **CALIFORNIA STATE LANDS COMMISSION** (100 Howe Avenue, Suite 100-South, Sacramento, California 95825-8202), pursuant to Division 6 of the Public Resources Code and Title 2, Division 3 of the California Code of Regulations, and for consideration specified in this Lease, does hereby lease, demise, and let to **Southern California Marine Institute**, hereinafter referred to as Lessee, those certain lands described in Exhibit A hereinafter referred to as Lease Premises, subject to the reservations, terms, covenants, and conditions of this Lease.

MAILING ADDRESS: 820 South Seaside Avenue
Terminal Island, CA 90731

LEASE TYPE: General Lease – Other

LAND TYPE: Submerged

LOCATION: Pacific Ocean, approximately 0.3 miles offshore of Bunker Point and White Point on the Palos Verdes Peninsula, near Rancho Palos Verdes, as described in Exhibit A, attached and by this reference made a part hereof.

LAND USE OR PURPOSE: Construction, restoration, enhancement, use, and maintenance of the Palos Verdes Reef Restoration Project.

TERM: 25 years; beginning February 27, 2018; ending February 26, 2043, unless sooner terminated as provided under this Lease.

CONSIDERATION: Public use and benefit with the State reserving the right to fix a different rent during the lease term, as provided in the lease.

AUTHORIZED IMPROVEMENTS:

_____ **EXISTING:** None

X **TO BE CONSTRUCTED:** Artificial reef.

CONSTRUCTION MUST BEGIN BY:

AND BE COMPLETED BY:

LIABILITY INSURANCE: Liability insurance in an amount no less than $1,000,000 per occurrence, or equivalent staff-approved self-insurance program.

SURETY BOND OR OTHER SECURITY: N/A

SECTION 2
SPECIAL PROVISIONS

BEFORE THE EXECUTION OF THIS LEASE, ITS PROVISIONS ARE AMENDED, REVISED, OR SUPPLEMENTED AS FOLLOWS

1. Construction may only occur between May 1 to September 30, to avoid the lobster-fishing season.

2. At least 30 days prior to start of construction, Lessee shall provide the following for Lessor's review and approval:

   (a) A contractor's work execution plan providing details of step-by-step procedures or the entire project, manpower, equipment, safety procedures, site clean-up, etc. Please note that dumping of any debris or other material not authorized by this Lease onto the beach and state waterways or other lands subject to Lessor's jurisdiction is not allowed.

   (b) A project specific hazardous spill contingency plan. It shall include but not be limited to procedures to be implemented, specific designation of the on-site person who will have responsibility for implementing the plan, on-site spill response materials/tools/equipment, and spill notification protocol and procedures. The plan shall include a complete list of the agencies (with telephone number) to be notified, including but not limited to California State Lands Commission's 24-hour emergency notification number (562) 590-5201, California Governor's Office of Emergency Services (Cal OES) contact number (800) 852-7550, etc.

      (i) The primary work vessel will be required to carry on board a minimum 400 feet of sorbent boom, 5 bales of sorbent pads at least 18-inch by 18-inch square and small powered boat for rapid deployment to contain and clean up any small spill or sheen on the water surface. The plan shall provide for the immediate call out of additional spill containment and cleanup resources in the event of an incident that exceeds the rapid clean up capability of the on-site work force.

   (d) A critical operations and curtailment plan. The plan shall define the limiting conditions of sea state, wind, or any other weather conditions that exceed the safe operation of offshore vessels and equipment or divers in the water, that hinder potential spill cleanup or in any way pose a threat to personnel or the safety of the environment. The plan shall provide for a minimum ongoing five (5) day advance favorable weather forecast during offshore operations. The plan shall also identify the on-site person with authority to determine critical conditions and suspend work operations when needed.

   (e) A vessel anchoring plan. The plan shall provide a map of the proposed anchor spread and anchor locations or offshore temporary mooring location for each work vessel, and a narrative description of the anchor setting and retrieval procedures to be employed that will result in minimal impacts on the ocean bottom.

   (f) A construction schedule time line chart showing all significant work activities planned during the course of the project.

3. Any equipment or machinery to be used on the Lease Premises are limited to those which are directly required to perform the authorized use and shall not include any, equipment or machinery that may cause damage to the Lease Premises or lands subject to Lessor's jurisdiction.

4. No vessel or equipment refueling, maintenance, or repairs will be permitted within the Lease Premises.

5. All waste material and debris created by Lessee shall be promptly and entirely removed from the Lease Premises and lands subject to Lessor's jurisdiction.

6. At least fifteen (15) days prior to start of construction, a Local Notice to Mariners shall be submitted to the U.S. Coast Guard (USGS). A copy of the published Notice is to be filed by the Lessee with the State Lands Commission office.

7. All construction activities shall be carried out in accordance with all applicable safety regulations, permits, and conditions of other involved agencies.

8. Lessee acknowledges and agrees that Lessor shall not be responsible for any damages to any property, including but not limited to, any vehicles, equipment, machinery, or tools within the Lease Premises or lands subject to Lessor's jurisdiction.

9. Within 15 days of the project completion, Lessee shall collect sediment samples from the reef site to analyze the collected samples for DDT and PCB contamination. Lessee shall promptly report the results of such analysis to Lessor's staff.

10. Lessee shall perform annual side-scan sonar surveys of the reef for 5 consecutive years, beginning one year after project completion. In conducting these surveys, Lessee shall comply with the California State Lands Commission's Offshore Geophysical Survey Permit Program.

11. Lessee shall provide Lessor's staff with an annual summary of all post-construction monitoring activities. Lessee shall provide Lessor's staff with copies of any monitoring reports upon request.

12. Within 60 days of the project completion, Lessee shall provide post construction project verification including:

    (a) A set of "as built" construction plans, certified (stamped, signed, and dated) by a California registered Civil/Structural Engineer, showing all design changes or other amendments to the construction as originally approved.

    (b) A post construction written narrative report confirming completion of the project with discussion of any significant field changes or other modifications to the approved design or execution plan, and providing details of any extraordinary occurrences such as spill incidents, critical operations curtailment, accidents involving serious injury or loss of life etc.

    (c) Revised Exhibits A and B describing and depicting the as-built location of the artificial reef, if artificial reef is constructed outside the Lease Premises as described herein.

    (d) Upon review and written approval by Lessor's staff, any revised Exhibits shall be incorporated into the Lease and replace previous Exhibits A and B.

13. During Project construction, Lessee shall not interfere with or otherwise cause to restrict the public's access, of any areas of state-owned lands or public easements within or adjacent to the Lease Premises except as necessary to ensure public safety during Project construction.

14. Two years prior to the termination of the Lease, the Lessee may submit a request to Lessor for authorization to waive the restoration of premises requirement pursuant to Section 3, Paragraph 13, and allow the Authorized Improvements to remain in place. Such request will be considered by the Commission at a publicly noticed meeting and must be accompanied by science-based evidence showing that the artificial reef is beneficial to the environment, not materially adverse to public health and safety, and otherwise in the best interests of the State.

Project Location: Approximately 0.3 miles offshore of Bunker Point past the existing kelp beds in 15–21 meters water depth, on the Palos Verdes Peninsula in the Pacific Ocean near the city of Palos Verde, Los Angeles County, California (at: ~33.723000 latitude, -118.356000 longitude).

The bounding coordinates of the entire reef are as follows (see Figure 1 below):
1. 33.723273° latitude, -118.353466° longitude (33 43 23.78280 N, -118 21 12.47760 W)
2. 33.724179° latitude, -118.352879° longitude (33 43 27.04500 N, -118 21 10.36300 W)
3. 33.724534° latitude, -118.350321° longitude (33 43 28.32300 N, -118 21 01.15500 W)
4. 33.717380° latitude, -118.340448° longitude (33 43 02.56800 N, -118 20 25.61280 W)
5. 33.719460° latitude, -118.339099° longitude (33 43 10.05600 N, -118 20 20.75640 W)

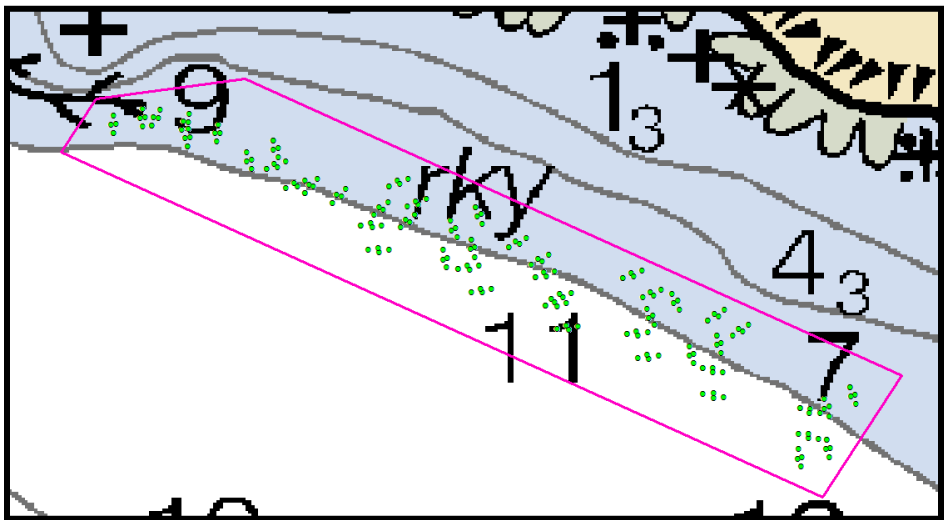

Figure 1: Representative photo of the 24 reef modules and the outer bounding box.

PERMIT CONDITIONS

General Conditions:

1. The time limit for completing the authorized activity ends on **April 5, 2024**. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification from this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of

what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you transfer the project associated with this permit, you must obtain the signature of the new responsible party in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished with the terms and conditions of your permit.

Special Conditions:

1. FINAL PLANS: Prior to initiating construction in waters of the United States, the Permittee shall submit to the Corps Regulatory Division a complete set of final detailed grading/construction plans showing all work and structures in waters of the United States. All plans shall be in compliance with the Final Map and Drawing Standards for the South Pacific Division Regulatory Program dated February 10, 2016. All plan sheets shall be signed, dated, and submitted on paper no larger than 11x 17 inches. No work in waters of the United States is authorized until the Permittee receives, in writing (by letter or email), Corps Regulatory Division approval of the final detailed grading/construction plans. The Permittee shall ensure that the project is built in accordance with the Corps-approved plans.

2. ARTIFICIAL REEF LIABILITY INSURANCE: Prior to initiating construction in waters of the United States, the Permittee shall provide a copy of the executed and active Liability Insurance Policy, in the amount of at least $1,000,000 USD, that demonstrates financial ability to assume liability for all damages that may arise with respect to artificial reefs, pursuant to 33 CFR 322.5(b)(4), in writing to Regulatory Division, and receive written acceptance. The purpose of this liability insurance is to guarantee the successful implementation and maintenance of the artificial reef should damages arise as a result of the constructed project. If the Liability Insurance Policy expires, the Permittee shall notify the Corps in advance to its expiration and provide an approved replacement.

3. WATER QUALITY CERTIFICATE: This permit is contingent upon the issuance of a Section 401 Water Quality Certification (WQC) from the Los Angeles Regional Water Quality Control Board (RWQCB). The Permittee shall abide by the terms and conditions of the Clean Water Act Section 401 WQC. The Permittee shall submit the Section 401 WQC to the Corps Regulatory Division (preferably via email) within two weeks of receipt from the issuing state agency. The Permittee shall not proceed with construction until receiving an email or other written notification from Corps Regulatory Division acknowledging the Clean Water Act 401 WQC has been received, reviewed, and determined to be acceptable. If the RWQCB fails to act

on a request for certification within 60 days after receipt of a complete application, please notify the Corps so we may consider whether a waiver of water quality certification is warranted pursuant to 33 CFR 325.2(b)(1)(ii).

4. CZMA CONSISTENCY: This permit is contingent upon the issuance of a Coastal Zone Management Act (CZMA) consistency certification by the California Coastal Commission. The Permittee shall abide by the terms and conditions of the CZMA consistency certification. The Permittee shall submit the CZMA consistency certification to the Corps Regulatory Division (preferably via email) within two weeks of receipt from the issuing state agency. The Permittee shall not proceed with construction until receiving an email or other written notification from Corps Regulatory Division acknowledging the CZMA consistency certification has been received, reviewed, and determined to be acceptable. If the California Coastal Commission fails to act on a request for concurrence with your certification within six months after receipt, please notify the Corps so we may consider whether to presume a concurrence pursuant to 33 CFR 325.2(b)(2)(ii).

5. INTERFERENCE WITH NAVIGATION: The permitted activity shall not interfere with the right of the public to free navigation on all navigable waters of the United States as defined by 33 C.F.R. Part 329.

6. DISCHARGES: No earthwork is authorized by this permit.

7. CLEAN CONSTRUCTION PRACTICES: The Permittee shall discharge only clean construction materials suitable for use in the oceanic environment. The Permittee shall ensure no debris, soil, silt, sand, sawdust, rubbish, cement or concrete washings thereof, oil or petroleum products, hazardous/toxic/radioactive/munitions from construction or dredging or disposal shall be allowed to enter into or placed where it may be washed by rainfall or runoff into waters of the United States. Upon completion of the project authorized herein, any and all excess material or debris shall be completely removed from the work area and disposed of in an appropriate upland site.

8. U.S. COAST GUARD NOTIFICATION: To ensure navigational safety, the Permittee shall provide appropriate notifications to the U.S. Coast Guard as described below:

Commander, 11th Coast Guard District (dpw)
TEL: (510) 437-2980
Email: d11LNM@uscg.mil
Website: http://www.uscg.mil/dp/lnmrequest.asp

U.S. Coast Guard, Sector LA-LB (COTP)
Email: D11-DG-SectorLALB-WWM@uscg.mil

A) The Permittee shall notify the U.S. Coast Guard, Commander, 11th Coast Guard District (dpw) and the U.S. Coast Guard, Sector LA-LB (COTP) (contact information shown above), not less than 14 calendar days prior to commencing work and as project information

changes. The notification shall be provided by email with at least the following information, transmitted as an attached Word or PDF file:

1) Project description including type of operation (i.e. dredging, diving, construction, etc).
2) Location of operation, including Latitude / Longitude (NAD 83).
3) Work start and completion dates and the expected duration of operations. The U.S. Coast Guard needs to be notified if these dates change.
4) Vessels involved in the operation (name, size and type).
5) VHF-FM radio frequencies monitored by vessels on scene.
6) Point of contact and 24 -hour phone number.
7) Potential hazards to navigation.
8) Chart number for the area of operation.
9) Recommend the following language be used in the Local Notice to Mariners: "Mariners are urged to transit at their slowest safe speed to minimize wake, and proceed with caution after passing arrangements have been made."

B) The Permittee and its contractor(s) shall not remove, relocate, obstruct, willfully damage, make fast to, or interfere with any aids to navigation defined at 33 C.F.R. chapter I, subchapter C, part 66. Not less than 30 calendar days in advance of operating any equipment adjacent to any aids to navigation that require relocation or removal, the Permittee shall notify, in writing, the Eleventh U.S. Coast Guard District and the Corps Regulatory Division. The Permittee and its contractor(s) are prohibited from relocating or removing any aids to navigation until authorized to do so by the Corps Regulatory Division and the U.S. Coast Guard.

C) The Permittee is prohibited from establishing private aids to navigation in navigable waters of the United States until authorized to do so by the Corps Regulatory Division and the U.S. Coast Guard. Should the Permittee determine the work requires the temporary placement and use of private aids to navigation in navigable waters of the United States, the Permittee shall submit a request in writing to the Corps Regulatory Division and the U.S. Coast Guard.

D) The COTP may modify the deployment of marine construction equipment or mooring systems to safeguard navigation during project construction. The Permittee shall direct questions concerning lighting, equipment placement, and mooring to the appropriate COTP.

9. OBSTRUCTIONS: The Permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the Permittee will be required, upon due notice from the Corps of Engineers Regulatory Division, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

10. COMMENCEMENT NOTIFICATION: The Permittee shall notify the Corps Regulatory Division of the date of commencement of work in navigable waters of the United States no less than 14 calendar days prior to commencing work, and shall notify the Corps of the date of completion of operations at least five (5) calendar days prior to such completion.

11. POST-CONSTRUCTION AS-BUILT SURVEY(S):
Within 30 calendar days of completion of the project authorized by this permit, the Permittee shall conduct a post-project as-built survey indicating the location of all new structures and their features, or the modification of structures and their features, or post-dredge hydrographic surveys, within navigable waters. The Permittee shall forward a copy of the survey, as well as a copy of this permit, to the Corps Regulatory Division (via email at: SPLregLASB@usace.army.mil), and to the National Oceanic and Atmospheric Administration, Marine Charting Division for updating nautical charts (via email at: ocs.ndb@noaa.gov) Post-project surveys/as-built plans should be provided electronically in two formats: .pts (xyz) and one of, .pdf or GIS. Include the following header metadata: project name, surveyor's name and company, area surveyed (acres), type of survey method, date of survey, geographic control points (for example: latitude/longitude, plane coordinates), geographic coordinate system (use NAD83), geographic projection, units (use US Survey Feet), and tide gage location. For all subsurface structures and dredge projects include elevation (z coordinate) datum indicated as a negative below MLLW, and also indicate the survey system and bin sizes as appropriate.

12. CULTURAL RESOURCES: Pursuant to 36 C.F.R. section 800.13, in the event of any discoveries during construction of either human remains, archeological deposits, or any other type of historic property, the Permittee shall notify the Corps' Archeology Staff within 24 hours (Danielle Storey at 213-452-3855 OR Meg McDonald at 213-452-3849). The Permittee shall immediately suspend all work in any area(s) where potential cultural resources are discovered. The Permittee shall not resume construction in the area surrounding the potential cultural resources until the Corps Regulatory Division re-authorizes project construction, per 36 C.F.R. section 800.13.

13. RESTORATION MONITORING: The Permittee shall monitor the restoration project following the “Palos Verdes Reef Restoration Project Monitoring Plan” (dated March 2019) in order to demonstrate the project results in a net increase in aquatic resource functions and services and thereby meets the definition of a restoration project. The responsible party for Implementation, Performance, and Long-term Management is Daniel Pondella, Southern California Marine Institute (SCMI). The Permittee retains ultimate legal responsibility for meeting the requirements of the permit. Your responsibility to complete the required monitoring will not be considered fulfilled until you have demonstrated a net increase in aquatic resources functions has occurred.

You shall submit monitoring reports annually by **October 1** of each year following the construction of project, for at least **five (5) consecutive years** after construction, or until you have demonstrated to the Corps that a net increase in aquatic resource functions has occurred (unless the Corps agrees earlier that success has been reached and maintained for a sufficient time period; or, if success is not demonstrated to the Corps’ satisfaction after the fifth (5th) year

of monitoring, additional monitoring may be required by the Corps as determined at that time). The monitoring period shall commence upon completion of the construction of the project.

GIS DATA: Within 60 days following permit issuance for Standard Individual Permits or within 60 days following written Corps approval of the mitigation plan for General Permits, you shall provide to this office GIS data (polygons only) depicting the boundaries of all compensatory mitigation sites, as authorized in the above, final mitigation plan. All GIS data and associated metadata shall be provided on a digital medium (CD or DVD) or via file transfer protocol (FTP), preferably using the Environmental Systems Research Institute (ESRI) shapefile format. GIS data for mitigation sites shall conform to the Regulatory_mitigation_template_20160115.lpk labeling requirements, as specified in the Final Map and Drawing Standards for the South Pacific Division Regulatory Program dated February 10, 2016, found on the following website, (http://www.spd.usace.army.mil/Missions/Regulatory/PublicNoticesandReferences/tabid/10390/Article/651327/updated-map-and-drawing-standards.aspx), and shall include a text file of metadata, including datum, projection, and mapper contact information. Within 60 days following completion of compensatory mitigation construction activities, if any deviations have occurred, you shall submit as-built GIS data (polygons only) accompanied by a narrative description listing and explaining each deviation.

14. ENDANGERED SPECIES ACT: This Corps permit does not authorize you to take any threatened or endangered species, in particular black abalone (*Haliotis cracherodii*), or adversely modify its designated critical habitat. In order to legally take a listed species, you must have separate authorization under the Endangered Species Act (ESA) (e.g. ESA Section 10 permit, or a Biological Opinion (BO) under ESA Section 7, with "incidental take" provisions with which you must comply). The United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) are the appropriate authorities to determine compliance with the ESA.

15. POST-CONSTRUCTION REPORT: Within 45 calendar days of completion of authorized work in waters of the United States, the Permittee shall submit to the Corps Regulatory Division a post-project implementation memorandum including the following information:

A) Date(s) work within waters of the United States was initiated and completed;
B) Summary of compliance status with each special condition of this permit (including any noncompliance that previously occurred or is currently occurring and corrective actions taken or proposed to achieve compliance);
C) Color photographs (including map of photopoints) taken at the project site before and after construction for those aspects directly associated with permanent impacts to waters of the United States such that the extent of authorized fills can be verified;
D) One copy of "as built" drawings for the entire project. Electronic submittal (Adobe PDF format) is preferred. All sheets must be signed, dated, and to-scale. If submitting paper copies, sheets must be no larger than 11 x 17 inches; and
E) Signed Certification of Compliance (attached as part of this permit package).

EXHIBIT 7 – Surfing Opportunities and the Bunker Point Restoration Project (4 pages)

Surfing Opportunities and the Bunker Point Reef Restoration Project

Summary

- High vertical relief is a critical requirement for restoring sediment-impacted rocky-reef habitat while avoiding further sedimentation impacts.
- Wave conditions along the Rancho Palos Verdes coastline are controlled by shallow, high relief natural reefs inshore of the project site.
- The restoration reef will not affect wave conditions at adjacent surf spots, even during 100-year-wave events.
- The restoration reef will not affect sediment transport and deposition patterns that could affect wave conditions.

The proposed restoration reef modules are modeled after a nearby, natural, high-relief reef (KOU Rock; **Figure 1**) that does not suffer the ill-effects of sedimentation that the low-relief reefs in the adjacent 69-acre restoration area do. High vertical relief is a critical requirement for restoring sediment-impacted rocky-reef habitat while avoiding further sedimentation impacts. Local residents have expressed concern that added rocky reef structure represents a potential barrier to wave action at local surf breaks inshore of the restoration area and will negatively affect surfing conditions. These concerns have been addressed by previous studies at other locations in the Southern California Bight (SCB) and are further addressed specific to the southern Palos Verdes Peninsula shoreline herein.

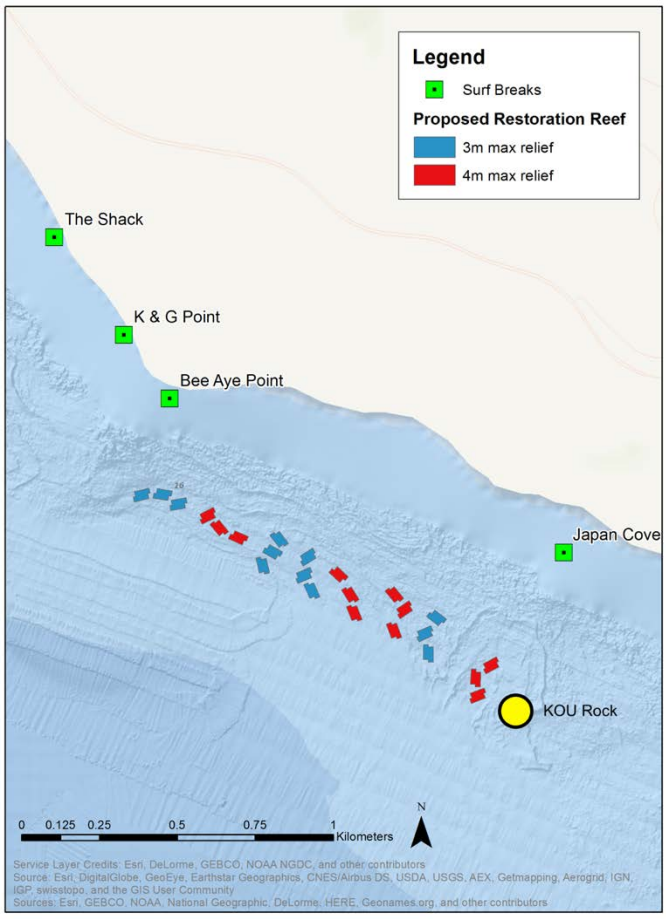

Figure 1. *Location and position of KOU Rock, the proposed restoration reef modules, and surf breaks along the Palos Verdes Peninsula.*

As a result of shadowing from the southern Channel Islands, Palos Verdes Peninsula has a relatively mild wave climate compared to other areas in the SCB. Most of the wind waves that reach the SCB originate in the north Pacific Ocean near the Gulf of Alaska and are diffracted by Point Conception, causing the swell to arrive at a more northwesterly angle. Northwest swell energy is both diffracted and attenuated due to the Channel Islands' creation of a wave shadow zone on the leeward side of the islands. Both south and west swells can strike the SCB shoreline more

directly than the more common northwest swell (Coastal Environments, 2015). The nearest surf breaks to the restoration site are The Shack, K & G Point, Bee Aye Point, and Japan Cove (**Figure 1**). The Shack is most ridable with west swell that will not pass over the restoration reefs. K & G, Bee Aye, and Japan Cove surf breaks are all best with swells from the south or south-southeast (Cleary and Stern, 1963). These swells will not pass over the restoration reef prior to reaching Japan Cove. They will, however, pass over the restoration reef before reaching K & G and Bee Aye.

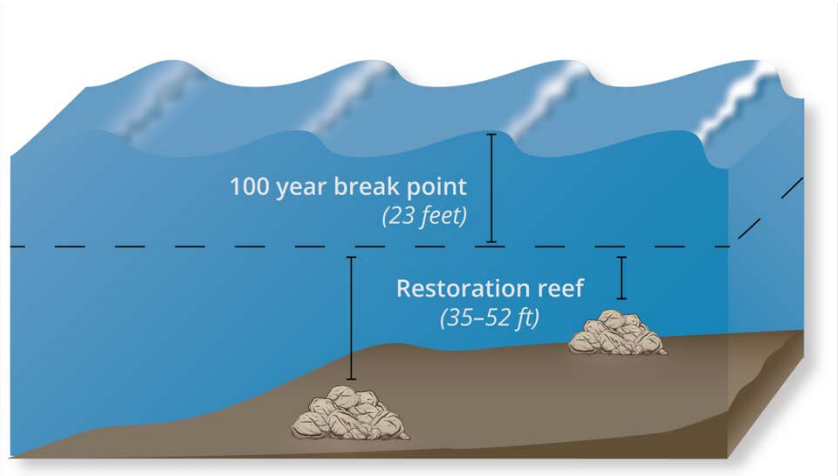

Figure 2. *A representation of the proposed restoration reef showing depth at maximum reef height and the depth at which a 100-year-wave would break.*

To determine whether the restoration reef will affect surfing conditions at these two sites, two interactions between swell and existing or proposed reef were considered. First, the water depth between mean sea level (MSL) and the top of the reef is between 10.6 and 15.8 m (35 and 52 ft; **Figure 2**). The corresponding ratio of wave height to water depth has the critical value of 0.78 (USACOE, 1984). This means that when the wave height reaches a value 0.78 times the water depth, the wave will break. Therefore, in order for the waves to break over any portion of the restoration reef, wave heights would need to exceed 8.5 m (28 ft; **Table 1**).

Mean wave heights at the restoration site are only about 1 m (3.3 ft) and exceed 1.5 m (5 ft) less than 20% of the time (CH2M Hill, 2007). Wave activity peaks in the winter (December–March) where maximum significant wave heights reach 3-4 m (9-13.2 ft) with 14- to 17-second periods during large storms (Wiberg et al., 2002). Large waves that are generated on or near the shelf have a wave height of about 2 m (6.6 ft), a period of 10 seconds, and arrive between five and ten times a year. Open-ocean waves, with a height of 2 m (6.6 ft) and 14- to 17-second periods, arrive about once a year. Waves propagating eastward from the open ocean arrive with a period of about 16- to 17-seconds and an approximate height of 3-5 m (9-16.5 ft) about once in 3 years (Seymour et al., 1984). Maximum wave heights of 5-8 m (16.5-26.4 ft) with 16- to 18-second periods are expected every five to ten years (Kolpack, 1987). These heights were recently met by swell from Hurricane Marie in August 2014 which generated maximum wave heights of 4.5-7.6 m (15 to 25 ft – estimates vary by source) from the south and closed coastal access points at Palos Verdes to the public. This event met or exceeded the predicted 100-year-wave height for the region (5.5 m/18 ft), a height that was last reached by Hurricane Linda in 1997 and would cause waves to break at a depth of 7 m (23 ft). Wave conditions along the Rancho Palos Verdes coastline are controlled by shallower natural reefs having high relief that lie inshore of the project site in water depths of about 3.9-6.1 m (13-20 ft). None of these actual or theoretical events would have caused waves to break over the restoration reef.

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Table 1. *Maximum height, period, break point depth, and frequency of wave types at Palos Verdes Peninsula including wave data from the two most recent 100-year-wave events (Hurricanes Linda and Marie). Also shown for comparison are minimum depth of the proposed restoration reef and wave height necessary to break on the proposed restoration reef.*

	Wave Type	Maximum Height (m)	Maximum Height (ft)	Period (s)	Break Point (m)	Break Point (ft)	Frequency
Annual	Average	1	3.3	–	1.3	4.2	–
	Above Average	1.5	5	–	1.9	6.4	18% of days
High Surf Event	Strong Winter Storm	4	13.2	14-17	5.1	16.9	–
	Large Shelf Origin	2	6.6	10	2.6	8.5	5-10x per year
	Large Open Ocean	2	6.6	14-17	2.6	8.5	once per year
	Large Open Ocean	5	16.5	16-17	6.4	21.2	once per 3 years
	Large Open Ocean	8	26.4	16-18	10.3	33.8	once per 5-10 years
	100-Year-Wave	5.5	18	–	7.1	23.1	once per 100 years
Hurricanes	Hurricane Linda	5.5	18	–	7.1	23.1	September 1997
	Hurricane Marie	7.6	25	–	9.7	32.1	August 2014

Wave Height to Break on Restoration Reef		Restoration Reef Minimum Depth	
8.5	28	10.6	35

The second consideration is whether the quarry rock might change regional sediment transport and deposition patterns that, in turn, might affect coastline geometry and therefore wave conditions. This concern is addressed by the concept of “closure depth” (Inman et al., 1993) which defines the water depth beyond which the ocean bottom does not change appreciably with time. The closure depth in the restoration area, where the ocean floor is at a depth of 15.2-20 m (50-66 ft), is about 9-13.6 m (30-45 ft). The restoration site is therefore located offshore of the coastal zone where regional sediment transport and deposition patterns would be affected. Consequently, the proposed restoration reef will not have an effect on nearshore sedimentation patterns or wave conditions at the adjacent surf spots.

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References

CH2M Hill. 2007. Final Palos Verdes Shelf Superfund Site Remedial Investigation Report. Prepared for: United States Environmental Protection Agency Region IX. EPA Contract No. 68-W-98-225. EPA Work Assignment No. 282-RICO-09CA

Cleary, B and D. Stern. 1963. "Surfing Guide to Southern California." Mountain and Sea Publishing.

Coastal Environments. 2015. Palos Verdes Reef Restoration Project: Biological Resources. Prepared for: Vantuna Research Group, Occidental College. 84 p.

Elwany, M.H.S., R. Flick, J. Reitzel, and A. Lindquist, 1998. Possible impacts of the SCE Kelp Reef of San Clemente on the marine environment. Coastal Environments, Encinitas, CA.

Inman, D.L., M.H.S. Elwany, and S.A. Jenkins, 1993. Shorerise and bar-berm profiles on ocean beaches. Journal of Geophysical Research. 98(C10): 18181–18199.

Kolpack, R.L. 1987. Environmental Processes Affecting DDT Contaminated Sediments off Palos Verdes, California. A Sediment Dynamic Workshop Sponsored by the County Sanitation Districts of Los Angeles County. 102 pp.

Seymour, R.J., R.R. Strange, D.R. Cayan, and R.A. Nathan. 1984. Influence of El Niños on California's wave climate. Proceedings of the 19th Coastal Engineering Conference: American Society of Civil Engineers. 1: 577–592.

Wiberg, P.L., D.E. Drake, C.K. Harris, and M. Noble. 2002. "Sediment Transport on the Palos Verdes Shelf over Seasonal to Decadal Time Scales: Sedimentation Processes, DDT, and the Palos Verdes Margin. Continental Shelf Research. 22: 987-1004.

U.S. Army Corps of Engineers. 1984. Shore Protection Manual. Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS, 2 vols.