BROAD BEACH GEOLOGIC HAZARD ABATEMENT DISTRICT

REGULAR MEETING AGENDA

Sunday May 22, 2016; 9:00 a.m.
Private Residence: 31454 Broad Beach Road, Malibu, CA 90265

Regular Session

1) **Call to Order**

2) **Roll Call**

3) **Adoption of Agenda**

Closed Session

4) **Conference With Legal Counsel; Anticipated Litigation (Gov. Code § 54956.9(d)(2))**

In the opinion of the Board of Directors on the advice of its legal counsel, a point has been reached where, based on the existing facts and circumstances, a significant exposure to litigation exists against the District.

Facts and Circumstances: Dispute over the gap in the revetment seaward of 30822 Broad Beach Road and responsibility for fees and costs associated with filling the gap and related activities.

5) **Conference with Real Property Negotiators (Gov. Code § 54956.8)**

Property: 30780 Pacific Coast Highway – 6525 Point Lechuza (BBGHAD boundaries)
BBGHAD Negotiators: Mark Goss, Ken Ehrlich
Negotiating Parties: California State Lands Commission
Under Negotiation: Price and terms of lease payments

6) **Conference With Legal Counsel; Pending Litigation (Gov. Code § 54956.9(d)(1))**

Conference with legal counsel: Discussion of County of Ventura and City of Fillmore v. City of Moorpark and Broad Beach Geologic Hazard Abatement District, Ventura County Superior Court Case No. 56-2016-00479937-CU-WM-VTA.

Resumption of Regular Session: approximately 10:30 a.m.

7) **Approve Summary of Actions from April 10, 2016 Meeting**

Staff Recommendation: Chair to conduct vote on approving Summary of Actions from April 2016 meeting. If passed, Chair to sign Summary of Actions.

8) Ceremonial/Presentations

None.

9) Consent Calendar

None.

10) Public Hearings

None.

11) Old Business

a. Permitting and Regulatory Process Status. Report to include project regulatory status update, including:
   (i) Lead Agency update: CCC, SLC, and Army Corps.
   (ii) Responsible & Consulting Agency update: RWQCB, NMFS, Cal. DFW, CalTrans, etc. (Project Manager and Engineer)

b. Permitting Outreach & Strategy Update. Report to include status update on agency advocacy, stakeholder outreach, and related matters. (Project Manager)

c. BBGHAD Insurance: Scope of Directors & Officers Coverage, Potential Addition of Liability Coverage, and Indemnity and "Additional Insured" Provisions. (Project Counsel). As a follow up to March 2016 discussion, additional consideration of BBGHAD insurance coverage. Staff to present policy memo in connection with proposed policy on contractual indemnity and "additional insured" provisions.

12) New Business

None.

13) BBGHAD Officer Reports

a. Project Manager Report (Project Manager)

b. Treasurer's Report (GHAD Treasurer)

14) BBGHAD Board Member Reports

15) Public Comment - Non-Agenda Items

Communications from the public concerning matters that are not on the agenda but for which the BBGHAD Board has subject matter jurisdiction. The BBGHAD Board may not act on non-agendized matters except to refer the matters to staff or schedule the matters for a future agenda.

16) Future Meeting

Next Meeting: June 26, 2016, 9:00 a.m., followed by July 24, 2016, 9:00 a.m.
Location: TBD

17) Adjournment

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Summary of Actions

BROAD BEACH GEOLOGIC HAZARD ABATEMENT DISTRICT

REGULAR SESSION MEETING

Sunday April 10, 2016; 9:00 a.m.

31030 Broad Beach Road, Malibu, CA 90265

1. CALL TO ORDER

The Chair called the meeting to order at 9:04 a.m.

2. ROLL CALL

PRESENT: Chair Norton Karno, Vice Chair Marshall Grossman, and Board Member Jeff Lotman.

ABSENT: Board Member Jeff Marine and Board Member Bill Curtis.

BBGHAD STAFF ALSO PRESENT: Board Advisor Chris Spiros, Project Manager Mark Goss, Project Counsel Ken Ehrlich, and Clerk/Treasurer Heike Fuchs.

3. ADOPTION OF AGENDA

The Chair recognized the Project Manager, who reported that the Agenda was posted on April 7, 2016 at 8:30 a.m. within the BBGHAD boundaries and concurrently posted on the BBGHAD website. Board Member Lotman moved to adopt the Agenda as presented. The Chair requested a minor edit in Section 12) (ii). The Chair recognized Board Member Lotman, who amended his Motion to include the correction announced by Chair. The Vice Chair seconded the motion, and the Motion passed 3-0.

Closed Session

At 9:08 a.m. the Chair announced, without objection, that the Board would move into Closed Session.

Resumption of Regular Session

The Chair resumed Regular Session at approximately 10:31 a.m. Project Counsel summarized the subject matter of the Closed Session proceedings.

8. APPROVE SUMMARY OF ACTIONS FROM MARCH 13, 2016 MEETING

The Chair recognized Board Member Lotman, who moved to approve the Summary of Actions from the March 13, 2016 Board Meeting. Vice Chair Grossman seconded the Motion, and the Motion passed 3-0.

9. CEREMONIAL/PRESENTATIONS

None.

10. CONSENT CALENDAR

None.

11. PUBLIC HEARINGS

None.

12. OLD BUSINESS

a. Permitting and Regulatory Process Status.

(i) CCC, SLC, and Army Corps.

CCC

The Chair recognized the Project Manager, who reported that the sand samples from Calleguas Creek have been tested twice and that he met with the Acting CCC Executive Director Ainsworth on April 20, 2016 to discuss the Calleguas Creek sand sample findings. The Project Manager asserted that the purpose of the meeting was to persuade the CCC to approve the new sand source, sand from which is slightly coarser than the CCC specification. If approved, the Project Manager stated that Calleguas sand source could reduce costs for the BBGHAD and reduce Project carbon emissions.

The Chair recognized Project Counsel, who briefly summarized the history of, and current issues concerning, the SAP. Project Counsel briefed the Board on SAP issues relating to the scope and breadth of CCC-imposed monitoring requirements. The BBGHAD believes that the SAP is trying to impose a more extensive and expansive monitoring plan on the BBGHAD than required in the CDP. In an attempt to reach a mutually agreeable compromise, BBGHAD sub-contractor Keith Merkel has agreed to re-draft part of the proposed monitoring plan. The Project Counsel stated that the Project Manager has Mr. Merkel to clarify if the re-draft entails the same scope of work as originally contemplated by the BBGHAD-- or if it goes beyond the CDP requirements. Project Counsel then voiced a concern that the CCC staff may be attempting to expand the monitoring work and consequently increase the BBGHAD's costs for same.

The Chair recognized Project Manager, who updated the Board on the SAP proceedings. The Project Manager reported that an increasing number of agencies are participating in SAP meetings, the number of opinions has increased, and the productivity of the meetings have decreased. The Project Manager further stated that BBGHAD sub-contractor Keith Merkel is primarily responsible for creating a monitoring plan that satisfies the CCC's proposed scope and the BBGHAD budget constraints. Mr. Merkel met with the SAP Chair Pete Ramondi to further refine the parameters of the monitoring plan and that this process has not been concluded. The Project Manager further suggested that Project Counsel and he should meet with the SAP Chair and CCC staffer (and SAP member) Jonna Engel to: a) reiterate that the BBGHAD has a limited budget for the monitoring and measuring plans and, b) further clarify the extent of the BBGHAD's ability to comply with monitoring requests. The Project Manager further stated that it remains imperative that the parties reach agreement on this issue quickly since the first monitoring survey must be completed within the May-June timeframe. The Project Manager added that he would contact Mr. Merkel on Monday to seek his input/advice on how to expedite this process.

The Chair asked the Project Manager if the BBGHAD has agreed to a budget with the CCC or if the budget can increase significantly. The Project Manager responded that the BBGHAD budget contains a limit for these tasks, but there is no maximum budget amount negotiated with the CCC or evident in the CDP.

The Chair recognized Board Advisor Spiros, who asked the Project Manager if Mr. Merkel could draft and approve a plan that exceeds the BBGHAD budget. The Project Manager asserted that Mr. Merkel well understands that: a) any monitoring plan cannot exceed the BBGHAD budge, and b) he cannot submit a monitoring plan proposal to the CCC without meeting BBGHAD approval. The Chair questioned the Project Manager if the SAP Chair is waiting for the monitoring plan submittal. The Project Manager responded affirmatively.

The Chair recognized the Vice Chair who inquired about a March 2016 Board discussion regarding the role of BBGHAD Engineer Chris Webb and his continued interaction with SAP members. The Chair responded that this issue will be covered under the New Business item on the agenda.

Army Corps

The Chair recognized the Project Manager, who reported that he and Project Counsel successfully met with Congressman Lieu, Lieu's Chief of Staff Lisa Pinto, and three Army Corps staffers to facilitates the completion of the Army Corps' review of the Project. At the meeting, the Army Corps staff appeared to agree to divide federal mitigation into two (2) components: a) the revetment and its impact, and b) significant impacts, if any, after Project construction. The BBGHAD staff proposed a mitigation ratio and received a counter proposal from the Army Corps. The Project Manager stated further negotiations should occur soon.

The Chair recognized the Vice Chair, who inquired about the dollar difference of the BBGHAD proposed mitigation and the Army Corps demand. The Chair recognized Project Counsel who recalled that the BBGHAD originally offered a revetment mitigation ratio of 1.2:1 and the Army Corps countered with a proposed 5:1 ratio. Project Counsel further stated that Richard Beck, a BBGHAD consultant, estimates a settlement ratio of between 2:1 and 3:1 with corresponding dollars approximating $250,000. The Chair asked Project Counsel if the BBGHAD or the individual homeowner is responsible for the encroachment. Project Counsel responded that it is the GHAD's responsibility and that the BBGHAD assumed liability with the CDP.

The Chair recognized the Vice Chair. The Vice Chair suggested that the Board should accept the Army Corps mitigation conditions if total payment equates to $100,000 to $150,000 explaining the BBGHAD would otherwise spend those monies on lobbyist and other fees. The Vice Chair further stated that he would like to resolve the differences with the various agencies and individuals to finalize the permitting process. The Chair voiced a concern that, if the BBGHAD seeks to resolve mitigation issues for past actions with one agency, such BBGHAD action may set a precedent for future negotiations with the other agencies. The Chair inquired if the Board has taken actions authorizing a dollar amount for mitigation negotiations. The Chair recognized the Project Manager, who responded that BBGHAD staff has not received authorization for mitigation payments from the Board.

The Chair recognized the Vice Chair. The Vice Chair asked for the staff's proposed strategy for finalizing these negotiations. The Chair recognized Project Counsel, who responded by requesting guidance from the Board to settle the revetment mitigation negotiations with the Army Corps within a specific dollar amount range.

MOTION: The Chair recognized the Vice Chair, who moved that the Board approve a maximum amount of $175,000 for the Army Corps' claimed mitigation in connection with the revetment and to direct Project Counsel and Project Manager to direct the lead negotiator, Mr. Richard Beck, to negotiate no more than a $175,000 maximum payment to the Army Corps. If the resolution number exceeds $175,000, Mr. Beck is not authorized to agree to it and must return to the Board for additional guidance. Board Member Lotman seconded the Motion, and the Motion passed 3-0.

SLC

The Chair recognized the Project Manager, who informed the Board that he and Project Counsel will meet with SLC staff and Commissioners on April 21 regarding the lease.

The Chair recognized the Vice Chair, who inquired about the precedential effect, if any, on the SLC of any resolution with the Army Corps. The Chair recognized Project Counsel, who responded that the SLC claims: a) the revetment has encroached on public lands for the past 6 years, and b) private property owners have solely benefitted from same. Therefore, according to the SLC staff, the BBGHAD must now pay something to mitigate for the encroachment. However, Project Counsel added that, from a jurisdiction perspective, the SLC's claimed mitigation is different from that of the Army Corps and, arguably, the SLC encroachment is less than the encroachment claimed by the Army Corps. Project Counsel added that public records would show that the BBGHAD paid monies to the Army Corps due to the revetment encroachment and, in his opinion, could set a cap on any SLC payment, as well as covering the same time period and encroachment. Project Counsel added that the SLC may, nonetheless, claim a higher amount than the Army Corps based on the SLC's alleged value of the real property encroached upon and such formulation is different from that posed by the Army Corps.

The Chair recognized Board Member Lotman who asked the Project Manager if he could provide the Board with a document listing every agency with their mitigation demands and asked if the Project has a mitigation budget. The Chair recognized the Project Manager who responded that no mitigation budget exists. The Chair followed up by questioning if there are more than 2 (two) agencies that require mitigation. The Chair recognized Project Counsel who asserted that in addition to Army Corps and SLC, the RWQCB has the authority to do so, but historically has not demanded mitigation separate from the Army Corps.

The Chair questioned the Project Manager, in his point of view, if the SLC would be entitled to more monies than Army Corps because the Army Corps' jurisdiction is the waters of the United States and SLC's jurisdiction is real property owned by the State of California. The Project Manager responded by stating that the SLC mitigation amount should likely exceed that of the Army Crops in that he understands the concept of the rock revetment encroaching on the property of the State of California for the past 6 years, but does not see the negative impact on U.S. waters. The Chair then asked if the SLC and the Army Corps follow the same formulation of the mean high tide line separating public from private property. The Chair recognized the Vice Chair, who opined that the MHTL divides private property from public property, but is not a demarcation of U.S. waters as U.S. water extend at least 12 miles out to sea. The Chair recognized Project Counsel, who explained that the Army Corps has an expanded view of its jurisdiction. The Army Corps does not use the MHTL as the limit of the encroachment, but claims that the revetment encroaches 6-10 acres into the waters of the U.S., as it purportedly limits the natural course of tidal waters.

(ii) RWQCB, NMFS, Cal. DFW, CalTrans, etc.

The Chair recognized Project Manager, who reported that he has a meeting with Caltrans in 2 (two) weeks and that BBGHAD consultant, Michael Baker International, is handling the RWQCB.

The Chair recognized the Vice Chair who followed up on tasks assigned to BBGHAD staff during the Old Business discussion at the March 13, 2016 Board meeting regarding the inclusion of the side letter in the Board Packet, updated schedule by BBGHAD Engineer Moffat & Nichol, follow up with Caltrans and the SLC predecessor. The Chair recognized Project Counsel and Project Manager who explained the completion of the tasks and referred the Board to same.

The Chair recognized the Vice Chair, who asked the Board to retain the insurance coverage item on the May Board Meeting Agenda.

13. NEW BUSINESS

a. BBGHAD Engineer

The Chair recognized the Project Manager, who updated the Board on the BBGHAD's relationship with BBGHAD Engineer Moffat & Nichol ("MN"). The Project Manager reported that MN senior executives have expressed concerns with the BBGHAD due to: a) the BBGHAD requesting a significant reduction on recent MN fees, b) MN's recent resolution of a litigation claim unrelated to the BBGHAD involving a private property owner adjacent to a coastal area nourished by the SANDAG II project. The Project Manager further stated that the BBGHAD Engineer reassured the BBGAHD staff that MN remains interested in working on the Project.

The Project Manager informed the Board that he has 2 (two) concerns with the BBGHAD Engineer: a) the BBGHAD Engineer's desire to change the language in the contract regarding liability and indemnity issues, and b) a lack of confidence in the talent and capabilities of certain MN staffers other than Russ Boudreau. The Project Manager further reported that he and Project Counsel have discussed with Richard Beck of Michael Baker International ("MBI") the potential of an expanded MBI role on the Project in the event that the Board chooses to limit MN's continuing Project role, especially certain administrative tasks. The Chair asked about Mr. Beck's qualifications. The Chair recognized Project Counsel, who stated that he has worked with Mr. Beck on the Project for more than six months and found him completely professional and quite effective at the tasks assigned to him. Project Counsel added his belief that the subcontractor could add value to the Project by performing the overall Project and program Management and facilitation with the SAP, freeing the BBGHAD Engineer to focus on key coastal engineering and technical issues.

The Chair recognized the Project Manager who updated the Board on BBGHAD Engineer staff member performance and the potential liability factor for the BBGHAD. The Board discussed various approaches to solve this problem. The Chair voiced his concern regarding the completion of the CCC's prior-to-issuance conditions and questioned the Project Manager's recommendation on how to move forward with the BBGHAD Engineer. The Project Manager responded by asking for direction from the Board on contractual issues and language with the BBGHAD Engineer.

MOTION: The Chair recognized the Vice Chair, who moved to direct staff to: a) instruct BBGHAD Engineer to remove Engineer Chris Webb from the Project immediately, b) transfer administration of the SAP to MBI, c) reject any third-party vendor add-on fees by MN or MBI, d) maintain the current contract indemnification language with MN, and, e) enter into a direct contract with MBI for the tasks delegated to MBI, f) withhold further payment to MN until the Board receives an updated schedule for completion of the CDP's prior-to-issuance conditions. Board Member Lotman seconded the motion. Hearing no further debate, the Chair called the question. The Motion passed 3-0.

14. BBGHAD OFFICER REPORTS

a. Project Manager Report

None.

b. Treasurer's Report

The Treasurer reported that, as of April 5, 2016, the cash balance was $3,075,517.69 and the estimated unpaid bills amount to $51,293.04.

15. BBGHAD BOARD MEMBER REPORTS

None.

16. PUBLIC COMMENT

Although quorum was lost, the Chair and Vice Chair fielded questions from the public for approximately 10 minutes. Board Advisor Spiros asked the Board if mitigation payment to the agencies is contingent upon completion of the Project. The Chair recognized Project Counsel who stated that monies are typically paid upfront. More questions and answers primarily covered comments, input and opinions of the indemnity issues and relationship with the BBGHAD Engineer, as well as the lifeguard issue with Malibu West.

17. FUTURE MEETING

The Chair suggested future meetings for May 22, 2016, and June 26, 2016, with 9:00 a.m. start times for both. At 11:58 a.m., Board Member Lotman departed the meeting and a quorum was lost.

Approved and adopted by the Broad Beach GHAD
Board on ____________________, 2016

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NORTON KARNO, Chair

ATTEST:

____

HEIKE FUCHS, Clerk

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BROAD BEACH RESTORATION PROJECT STATUS REPORT – May 22, 2016

CURRENT ENTITLEMENT STATUS WITH PERMIT AGENCIES

CALIFORNIA COASTAL COMMISSION (CCC)

- *Jurisdiction: Coastal Development Permit (CDP)*
- 10/9/15: CDP with condition modifications approved at CCC hearing.
  - BBGHAD proposed revetment alignment (Alt 4C) accepted.
  - Public access compromise identified.

  Notice of Intent and Final Condition language dated 1/11/16 and received 1/29/16
  Matrix prepared for "Prior to Issuance" conditions; proposed completion: late July 2016
  3/11/16: Received MN proposal for completion of "prior to issuance" conditions

CALIFORNIA STATE LANDS COMMISSION (CSLC)

- *Jurisdiction: Lease and certification of APTR*
- September 11, 2015: CSLC issued letter deeming the BBGHAD application (in support of updated project Alt 4C) incomplete.
- 2/9/16: BBGHAD response to SLC lease letter sent.
- 5/20/16: Mtg with SLC staff
- August 6, 2016: SLC consideration of Project.

US ARMY CORPS OF ENGINEERS (USACE)

- *Jurisdiction: National Environmental Policy Act (NEPA) Compliance and certification; Section 10 and 404 permits*
- Degree of NEPA compliance: Unknown. BBGHAD advocating for EA. USACE staff may insist on Environmental Impact Statement (EIS).
- Public Notice process complete.
- November 5, 2014: USACE initiated contact with tribal communities re cultural resource issues. USACE to submit cultural records search results to SHPO.
- August 5, 2015: Team submitted 404b(1) alternatives analysis to USACE; supplemented Jan 2016 in response to questions posed in 10/15.
- September 21, 2015: USACE initiated formal consultation with USFWS.
- November 2015: Cultural investigation records search and pedestrian survey requested by USACE completed.
- 2/15/16: BBGHAD received Draft Biological Opinion from USFWS.
- 3/18/16: Technical Decision Makers meeting with Congressman Ted Lieu and Colonel Gibbs.
- May 2016: Revetment mitigation negotiations progressing; ACE conceptually agrees to SAP format.

REGIONAL WATER QUALITY CONTROL BOARD (RWQCB)

- *Jurisdiction: 401 certification and, potentially, waste discharge requirements (WDRs)*

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- Jan. 2016: BBGHAD submitted draft Water Quality Certification. RWQCB staff review in progress.

CALTRANS

- *Jurisdiction: Encroachment permit for temporary traffic signal on PCH*
- Requires full engineering of the signal, a deceleration lane, an access to the west Zuma lot, and an egress point out of the west Zuma lot.
- 11/14/14: Permit package issued. Permit to be revised based on latest traffic plan.

LA COUNTY DEPT OF BEACHES AND HARBORS

- *Jurisdiction: Owner of Zuma Parking Lot 12 (Project Staging Area); BBGHAD needs Right of Entry Permit to use parking lot; LACDBH also coordinates with Caltrans and City of Malibu on traffic issues.*
- Right of Entry Permit Application to be submitted. GHAD Counsel advised holding off on submitting LA County permit application until dates of construction are better defined (dependent on timing of all other permits).
- Permit pending progress w/CCC and USACE.

CITY OF MALIBU

- Once construction start date solidified, will coordinate re traffic permits etc.

CONSULTING AND COORDINATING AGENCIES

National Marine Fisheries Service (NMFS), California Department of Fish and Wildlife (CDFW), & SM Bay Restoration Commission (SMBRC)

- *Jurisdiction: No discretionary permits, but consult with and provide input to permitting agencies.*
- NMFS: Essential Fish Habitat consultation completed 1/7/15.
- CDFW: Responsible for Marine Protective Areas (MPAs), including that off Broad Beach. Concerned with Project effects on MPA - subtidal, intertidal, and turbidity. Not presently anticipated that a streambed alteration agreement will be required. BBGHAD contacted USFWS re CCC developments in early November 2015.
- Table below shows primary concerns with selected agencies:

Agency	Next Action	Concern
USACE	Formal consultation by NMFS and CDFW.	Possibility that EIS will replace EA for NEPA analysis; ACE appears agreeable to integrating mitigation into adaptive management program
CCC	Submittal of final design reports prior to permit issuance.	Substantial liaison with Science Advisory Panel (SAP) required to finalize monitoring and dune plans prior to permit issuance.
SLC	Review of final Project (Alt 4C) items	Hearing will occur after the CCC hearing.
RWQCB	APTR review	Potential for request of RWQCB-specific additional info.

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PERMIT SCHEDULE STATUS AS OF 3/11/16

AGENCY	ACTION	DURATION ESTIMATE	COMPLETION DATE (earliest possible)
CCC	Commission consideration	1 day	October 9, 2015. CDP approved with edits to condition language
	Review/Negotiation of Permit Conditions	5-6 months	Feb. 2016
	BBGHAD completion of "Prior to Issuance" Conditions	5-6 months	July 2016
	Permit Issue	1-2 months	Fall 2016
SLC	Lease App. Completeness Notice	1 month	November 13, 2015
	Lease Negotiations	3 months - ongoing	N/A
	Commission consideration	1 day	August 2016
	Issue Final Lease	1 month	September 2016
	Lease Signature	1 week	September 2016
USACE	Submit 404b(1) alternatives analysis	2 months	August 5, 2015 **SUBMITTED**
	Respond to 404b(1) questions; submission of supplemental 404(b)(1) analysis	2 months	January 16, 2016
	End formal biological consultations with CDFW re snowy plover	120 days (legal maximum)	February 2016- Draft Bio Opinion issued
	Finalize EA[1]	2 months	July 2016
	Issue Draft Permit	1 week	August 2016
	Review/Negotiation of Draft Permit Conditions	2 weeks	August-Sept 2016
	Issue Final Permit	1 week	Sept 2016
RWQCB	Submit draft 401 Certification	3 weeks	January 2016
	Negotiate 404/WDRs	2 month	June-July 2016
	RWQCB approval of 404/WDRs	1-2 months	August 2016
CALTRANS	Encroachment Permit	4.5 months	November 2014 **ISSUED**
LA COUNTY	Parking Lot Permit	1 month	Unknown
CITY MALIBU	Traffic/signal approvals	Unknown	Unknown

[1] Longer duration if EIS is required.

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AGENDA
12A

Merkel & Associates, Inc.
5434 Ruffin Road, San Diego, CA 92123
Tel: 858/560-5465 • Fax: 858/560-7779
San Diego, CA • Sacramento, CA • Arcata, CA • Nehalem, OR

April 29, 2016
M&A #14-029-01

Ms. Lauren Garske-Garcia
California Coastal Commission
45 Freemont Street, Suite 2000
San Francisco, CA 94105

Ms. Jonna Engel
California Coastal Commission
89 S California Street, Suite 200
Ventura, CA 93001

MEMORANDUM: Broad Beach Marine Habitat Monitoring and Mitigation Plan Framework Outline

Dear Lauren and Jonna,

Please find attached our most recent efforts to address the Commission's request to provide an outline for the monitoring program required by the SAP. The enclosed outline fulfills the requirements of CDP Special Condition 6. Nonetheless, a number of items require SAP engagement prior to final resolution. Most specifically, using the required 20-20-20 statistical treatment, a few monitoring components dictate unreasonably high replication where the costs of the monitoring far outweigh any benefit obtained from such repetitive sampling. In some cases, the sampling demand would exceed the capacity to sample without violation of independence of samples. This is not an uncommon issue where limited resources occur within an impact area. On issues such as these, we would appreciate SAP guidance. We suggest a full day SAP working meeting to finalize this effort.

The enclosed outline may exceed the CCC staff's anticipated length. We firmly believe that the substance requested actually requires the length and detail provided here. CDP Special Condition 6 requires extensive information and you have requested considerable specific information including: existing conditions, data available, reference site information and selection justification, field sampling, sampling schedules, analytical methods, statistical treatments, drivers for adverse effects, methodology for identifying adverse effects, and triggers for adaptive management tools by types of effect. We have also addressed specific marine habitats. Redundancy associated with each discrete habitat feature (9 total habitats) including all of the constituent elements of the monitoring plan (including definition of "adverse impact" and identifying the measures proposed to address the impacts) mandate a substantial deliverable.

You requested a "simple" outline to include the analysis of all elements by habitat to make it manageable to complete reviews in discrete finite sittings. For the final plan, the inclusion of tables specifying all habitats and consolidated descriptions of elements (such as existing data, reference site selection, sampling methods, and analyses) would streamline the document, increase clarity, and reduce the scale of the overall document. The CCC staff may prefer the outline format to ensure that the BBGHAD and CCC/SAP agree conceptually on the scope of work, but for the final plan, we strongly prefer an approach which would include addressing sampling methods once, addressing the existing background data available for the site and reference areas once, and then addressing the application of these components to the habitat elements. The requested outline approach has resulted in the omission of a number of tables and matrices (Appendix A is the Summary Version and

Appendix B is the Expanded Version). For our own purposes, we have also captured the essence of the program in a single table attached to this memo. This may prove useful in your review as well.

A few issues of critical concern remain: 1) the replication suggested by power analyses using the data on hand for subtidal surfgrass habitats and sandy beach invertebrate communities is unreasonably high; 2) in the preparation of the plan, we have identified monitoring concepts that would provide the needed assessment methods for a particular stressor of concern (sand) and would lower the intensity of sampling required. Our proposed census monitoring approach is somewhat atypical in comparison to classical academic ecological studies. Nonetheless, they warrant thorough SAP consideration in light of the existing site conditions.

We have reviewed an abundance of intertidal investigations conducted for MPA, ASBS, and other monitoring pursuits and do not believe that these studies contribute directly to a quantitative baseline for Broad Beach. However, they provide information and insights into the available reference sites, the sampling that has been conducted, and the sampling distribution targeted by these regional sampling efforts. Our proposed program relies strongly on the census of habitats at the project site and reference sites, and tracking the changes of these habitat areas over time. At our recent meeting with Pete Raimondi and you in San Francisco, the CCC/SAP requested the BBGHAD to add a habitat quality component to the census. We have incorporated this component in most instances, and explain the rationale for not doing so in certain limited instances.

We propose to develop a map of mean or median grain size change coupled with the coastal profiles (the most appropriate metric remains under consideration). This map would assist in tracking the distribution of sand and assessing the model's initial predictive accuracy, assessing project effects, and steering adaptive management actions. We would conduct he grain size monitoring at each monitoring interval. Shallow cores equal to the beach sampling core depths of 20 cm would be taken at elevations of +2, +1, 0, -1, -3, -5, -10, and -15 m on each transect and the deviation from the baseline grain sizes at each point would be determined. This would allow for development of an isopleth map illustrating both the distribution and general proportional contribution of project sand to the beach. Because we believe that some of the sampling will reveal no change, we would propose the deletion of certain sampling as the monitoring progresses.

Barring the implementation of some specific MHMMP program-based sampling or pilot sampling, complications will exist in overcoming high replication suggested by existing study data and monitoring methods not intended to address the specific project effect questions. As such, we plan to collect some data at the Broad Beach site and analyzing the power for these data as a preferred tool to get at the actual power required to address the required questions in the context of the statistical requirements of the permit.

While sampling indicator species can prove useful tool in assessing potential project-related impacts, we request the CCC and SAP to consider the relative abundance of these indicator species prior to trying to design a monitoring program. For example, sandy subtidal areas use indicator species such as sand dollars and Pismo clams. Previous surveys (both mapping and SCUBA surveys) did not detect any sand dollar beds off Broad Beach and, while subtidal surveys for Pismo clams were not conducted, only 1 Pismo clam was detected in swash zone samples at Broad Beach (no Pismo clams were detected during MPA surveys at the six (6) different sampled beaches bracketing the site, including Leo Carillo and Dume Cove. Given the relatively low abundance of these indicator species at both Broad Beach and possibly at the reference sites, a great deal of effort would be expended to meet the CDP statistical requirements with no clear indication that it would provide any evidence of a project-related effect.

The sand beach presents a different issue in that a good indicator species does exist in mole crabs (*Emerita analog*). Still, densities and patchiness are so variable as to dictate extreme sampling demands to meet the 20-20-20 standard. As a result, the SAP should address this issue as well.

Upon your review of the enclosed, we request a working meeting with the SAP. The spring is short; it is important that we obtain input in the near future to meet the baseline sampling requirements. The best tide series to support this sampling is June 5-10. Therefore, we propose these dates for field sampling with the finalization of the plan ahead of this window.

If you have any questions, please contact either Lawrence or me.

Sincerely,

Keith W. Merkel
Principal Ecologist

Cc: Pete Raimondi
Bob Hoffman
Mark Paige
Russ Boudreau
Richard Beck
Mark Goss
Ken Ehrlich

Broad Beach GHAD Marine Habitat Monitoring and Mitigation Plan: Supratidal, Intertidal, and Subtidal Habitat Monitoring Summary of Activities Matrix

Habitat Type	Primary Habitat Features	Existing Data/Info						Monitoring Methodology	Habitat Characterization Sampling	Sampling Period	Analysis	Adverse Impact Determination	Additional Lines of Evidence
				Potential Reference Sites									
		Broad Beach	Dume Cove	Leo Carillo	El Pescador / El Matador	Paradise Cove	Malibu Bluffs						
Marine Nearshore: Supratidal													
Vegetated Dune	Dune Vegetation							UAV + groundtruthing		Semi-Annually (Spring and Fall)	Annual change (%) compared to reference		
Unvegetated Dry Beach	Sand	MPA Mapping 2015, M&A 2014	MPA Mapping 2015	MPA Mapping 2015	MPA Mapping 2015	MPA Mapping 2015		UAV + groundtruthing		Semi-Annually (Spring and Fall)	Annual change (%) compared to reference		
Artificial Substrate	Rip Rap	MPA Mapping 2015, M&A 2014			MPA Mapping 2015	MPA Mapping 2015		UAV + groundtruthing		Semi-Annually (Spring and Fall)	Annual change (%) compared to reference		
Marine Nearshore: Intertidal													
Marine: Intertidal: Rock Substrate	Bedrock/Boulder (Lechuza Point)	PISCO, MPA 2015, M&A 2014a, Chambers 2011, 2012, 2013a, 2013b, M&A/Chambers 2016		PISCO, MPA 2015, M&A/ Chambers 2016	MPA 2015, Chambers 2013	PISCO Biodiversity, MPA 2012, M&A/ Chambers 2016	M&A/ Chambers 2016	UAV + groundtruthing	1/4 m2 photoquadrats (% cover persistent species) **(N=43)**	Semi-Annually (Spring and Fall)	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)
	Intertidal Surfgrass	MPA Mapping 2015, M&A 2014a, Chambers 2011, 2012, 2013a, 2013b, M&A/Chambers 2016		M&A/ Chambers 2016	Chambers 2013a	M&A/ Chambers 2016	M&A/ Chambers 2016	UAV + groundtruthing	1/4 m2 photoquadrats (surfgrass cover) **(N=16)**	Semi-Annually (Spring and Fall)	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)
Marine: Intertidal: Artificial Substrate	Rip Rap	MPA Mapping 2015, M&A 2014a						UAV + groundtruthing		Semi-Annually (Spring and Fall)	Annual change (%) compared to reference		
Marine: Intertidal: Unconsolidated Substrate	Rubble/Cobble (boulder field)	MPA Mapping 2015, M&A 2014a, Chambers 2011, 2012, 2013a, 2013b, M&A/Chambers 2016		M&A/ Chambers 2016	Chambers 2013a	M&A/ Chambers 2016	M&A/ Chambers 2016	UAV + groundtruthing	1/4 m2 quadrats (% cover species) **(N=200**); point transects substrate **(N=8)**	Semi-Annually (Spring and Fall)	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)
	Sand	MPA Mapping 2015, M&A 2014a, Chambers 2011, 2012, 2013a, 2013b, M&A/Chambers 2016	MPA Mapping 2015, MPA Sandy Beach 2015	M&A/ Chambers 2016, MPA Sandy Beach 2015	Chambers 2013a			UAV + groundtruthing	Kelp wrack density (UAV mapping) Infaunal sampling (40 cores/shore normal transect x N transects) **(N=239 needs revision)**	Semi-Annually (Spring and Fall) for mapping and physical sampling Annually (Fall) for infaunal sampling	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)

Habitat Type	Primary Habitat Features	Existing Data/Info						Monitoring Methodology	Habitat Characterization Sampling	Sampling Period	Analysis	Adverse Impact Determination	Additional Lines of Evidence
		Broad Beach		Reference Sites									
			Zuma Beach	Leo Carillo	El Pescador / El Matador	Paradise Cove	Malibu Bluffs						
Marine Nearshore: Subtidal													
Marine: Subtidal: Rock Substrate	Bedrock/Boulder without kelp or surfgrass	MPA Mapping 2015, M&A 2014a and b			MPA Mapping	MPA Mapping M&A/ Chambers 2016		ISS + groundtruthing	20 m2 circular plot (indicator species density) **(N=22)**	Semi-Annually (Spring and Fall)	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)
	Bedrock/Boulder with Kelp	MPA Mapping 2015, M&A 2014a and b, CDFW, Consortium		CDFW, Consortium	CDFW, Consortium	CDFW, Consortium	CDFW, Consortium	ISS/UAV + groundtruthing	20 m2 circular plot (indicator species density) **(N=22)**	Semi-Annually (Spring and Fall)	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)
	Subtidal Surfgrass	MPA Mapping 2015, M&A 2014a and b		M&A/ Chambers 2016	Chambers 2013a	M&A/ Chambers 2016		ISS/UAV + groundtruthing	1/4 m2 quadrats (surfgrass cover) **(N=198, based on transects, to revise by pilot)**	Semi-Annually (Spring and Fall)	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)
Marine: Subtidal: Unconsolidated Substrate	Rubble/Cobble	MPA Mapping 2015, M&A 2014a and b						ISS + groundtruthing		Semi-Annually (Spring and Fall)	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)
	Sand without eelgrass	MPA Mapping 2015, M&A 2014a and b						ISS/UAV + groundtruthing Mapping subunits include: sand dollar beds shell hash rips	1/4 m2 quadrats (in mapped sand dollar beds only)	Semi-Annually (Spring and Fall)	Annual change (%) compared to reference		Physical Data (Coastal Profiles, Grain Size)
	Eelgrass	Chambers 2013b, M&A 2014a and b, NMFS 2015		NMFS 2015	NMFS 2015	NMFS 2015	NMFS 2015	ISS + groundtruthing	1/16 m2 quadrats (turion density) **(N=20)**	Semi-Annually (Spring and Fall)	Annual change (%) compared to reference	Decrease beyond reference range detected	Physical Data (Coastal Profiles, Grain Size)

Shaded cells are not used in monitoring but to be mapped for completeness and necessity to calculate percent change in represented habitat elements of interest (the whole is the sum of all parts)

UAV - unmanned aerial vehicle; ISS – Interferometric Sidescan Sonar (acoustic backscatter + multi-beam like bathymetry)

Existing information ranging from qualitative presence/absence to quantitative biodiversity surveys. References include:

Chambers 2011 - Reconnaissance Survey of Marine Biological Resources at Broad Beach

Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

Chambers 2013a - Quantitative surveys of rocky intertidal and sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach

Chambers 2013b - Mapping of eelgrass off Broad Beach

M&A 2014a – Habitat mapping within Broad Beach Project Area

M&A 2014b - Quantitative surveys of rocky subtidal and sandy subtidal habitats

M&A/Chambers 2016 - Reconnaissance intertidal surveys

APPENDIX A
OUTLINE - SUMMARIZED VERSION
See Expanded Version in Appendix B for Tables and Images

BROAD BEACH RESTORATION PROJECT
MARINE HABITAT MONITORING AND MITIGATION PLAN FRAMEWORK OUTLINE

Merkel & Associates

April 29, 2016

1. **This Marine Habitat Monitoring and Mitigation Plan framework is structured to address conditions outlined in the Coastal Development Permit (CDP) 4-15-0390**

1.1. Existing Conditions & Historical Review.

1.1.1. Description of current marine resources in project area including:

1.1.1.1. subtidal rocky habitats (e.g., kelp forest, rocky reef, surfgrass)

1.1.1.2. subtidal habitats, unconsolidated sediment (e.g., eelgrass, sand dollar beds)

1.1.1.3. rocky intertidal habitats (Lechuza Point and boulder field)

1.1.1.4. sandy beach habitats in the vicinity of the beach replenishment project

1.1.2. Historical review - summary of past quantitative sampling and survey work to document trends:

1.1.2.1. species composition

1.1.2.2. habitat areal extent

1.1.2.3. temporal changes for comparison with post-project marine habitat monitoring findings.

1.2. Monitoring Objectives.

1.2.1. Fine scale mapping of the marine habitats listed in section A of CDP;

1.2.2. Identification of any adverse impacts to sandy beach ecosystem due to sand replenishment;

1.2.3. Identification of direct or indirect adverse impacts to subtidal or intertidal habitats;

1.2.4. Identification of likely causes of any documented adverse impacts, and;

1.2.5. Recommendations for adaptive management to avoid continuing adverse impacts.

1.3. Monitoring Design.

1.3.1. Pre-construction monitoring (spring and fall) initiated one year prior to project construction.

1.3.1.1. If two seasons of pre-construction monitoring are not feasible, pre-construction spring monitoring must be conducted.

1.3.1.2. Existing data from other programs (e.g., PISCO) if deemed appropriate by the SAP.

1.3.1.3. Pre-construction monitoring is to establish baseline conditions.

1.3.2. Post-construction monitoring for 10 years (life of the permit).

1.3.3. Determination of frequency of various monitoring methods.

1.4. Monitoring Methods.

1.4.1. Monitoring methods and schedule to meet monitoring objectives

1.4.1.1. Methods to monitor for and quantify potential direct and indirect adverse impacts upon one or more of the marine habitats listed in 1.1.1.

1.4.1.2. Consider following methods.

- Develop methods with SAP
- Remote Sensing – to map rocky subtidal (with and without kelp) and rocky intertidal (with and without surfgrass) habitats in the project area and minimum of two reference sites outside influence of project area.
    - Multi-Spectral Aerial Surveys - similar to that employed by applicant in July 2014, using an airplane fitted with specialized camera equipment designed to capture imagery within a specific array of spectral bands optimized to discern coastal marine habitats including kelp forest, understory canopy algae, eelgrass, and surfgrass. Survey results shall be groundtruthed.
    - Multi-beam and Sidescan Sonar Surveys - similar to that conducted by applicant in May 2014, to distinguish surficial features and map nearshore marine benthic habitat types.
- Subtidal and Intertidal Field Monitoring - methods must be capable of discriminating between habitats influenced by sand inundation and habitats rarely or never influenced by sand inundation, the length of time respective habitats have been inundated with sand, and the sand source (natural or project derived).
    - The subtidal marine habitats = rocky bottom (with and without kelp) and unconsolidated substrates (with and without eelgrass). The intertidal habitats = Lechuza Point and boulder field east of Lechuza Point and the sandy beach. A minimum of two reference sites for each of the above habitat types must be monitored.
    - Reference site selection must be based on proximity and similarity to respective marine habitats in project area, after consultation with applicant, resource agencies, and SAP. Eelgrass mapping must be in substantial conformance with NOAA's California Eelgrass Mitigation Policy and Implementing Guidelines (October 2014).

- Monitoring of minimum of two undisturbed beaches within Malibu littoral cell, and section of Broad Beach in the project footprint to compare with macroinvertebrate assemblage at Broad Beach. Section of Broad Beach west of replenishment project and Zuma Beach east of replenishment project must be monitored.
- Beach monitoring methods to determine; 1) whether the portion of Broad Beach covered by imported sand develops a sandy beach macroinvertebrate fauna similar to the reference beaches, and, 2) whether the project adversely impacts the beach ecosystem west and east of the project. 3) must identify approximately 80% of organisms present.
- Subtidal and intertidal monitoring must be designed to adhere to 20, 20, 20 rule.

1.5. Criteria for Detecting Adverse Impacts.

1.5.1. Criteria must detect adverse impacts upon one or more of the marine habitats described in 1.1.1.

1.5.2. Criteria must be amenable to quantitative assessment and must include estimates of the areas of kelp forest, eelgrass, and surfgrass lost as a result of the project.

1.6. Monitoring Reports.

1.6.1. Annual report by December 31st of each year for review by the SAP and review and approval by the Executive Director.

1.6.2. A report at the end of 5 years shall determine whether adverse impacts to marine habitats have occurred as a result of the project as required pursuant to special condition 2C.

1.6.3. If adverse impacts are detected that is when the need for mitigation will be determined.

1.7. Marine Habitat Mitigation and Monitoring.

1.7.1. If adverse impacts are detected, mitigation will be required.

1.7.1.1. Mitigation ratio of minimum 4:1 for impacts upon subtidal rocky or intertidal rocky habitat.

1.7.1.2. Adverse eelgrass impacts mitigated according to California Eelgrass Mitigation Policy.

1.7.2. Upon detection of adverse impacts upon one or more habitats, the applicant, in consultation with the SAP, shall develop a habitat specific mitigation plan for each impacted habitat that will provide the overall framework to guide the mitigation work, for review and approval of the Executive Director.

2.0 Bedrock Rocky Intertidal (Lechuza Point)

2.1 Existing Conditions at Broad Beach/Lechuza Cove

2.1.1 Summary of Previous Studies/Data

2.1.1.1 Marine Protected Area (MPA) Monitoring Enterprise

- Habitat census mapping via auto-classified multi-spectral imaging
- Conducted in 2012, 1m x 1m pixel size, 65% overall classification accuracy
- Does not detect eelgrass habitat or subtidal rocky habitat conditions.

2.1.1.2 PISCO/MARINe

- Biodiversity Survey using fixed transect and quadrat sampling distributed from high to low intertidal
- Data collected in 2009 and 2013

2.1.1.3 Rocky Intertidal ASBS Assessment (Raimondi et al 2012)

- Coastal Biodiversity Survey methods, point contact transects and quadrat sampling
- Sampling period single event (likely 2009)
- Important findings: 1) Lechuza Point performed different from other sites 2) Lechuza's community characteristic of sand influenced site with intermittent emergent rock

2.1.1.4 Chamber's Group

- Chamber's Group 2012 - Survey of Marine Biological Resources of Broad Beach
- Chambers 2013a - Quantitative surveys of rocky intertidal and sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach (Table 1 a and b, at end of expanded outline)
    - Rocky intertidal survey by transects and quadrats
    - Sand beach sampled by core sampling

2.1.1.5 Merkel & Associates 2014 – Census mapping of subtidal habitat

- Surveys conducted 2014
    - Acoustic surveys by interferometric sidescan sonar (backscatter and multi-beam like bathymetry) up to low intertidal zone
    - Subtidal diver transects in all habitats
- Identified and mapped eelgrass and non-eelgrass supporting unconsolidated habitats as well as subtidal reef habitats. Did not locate any sand dollar beds
- Inventories of macrofauna in habitats

2.1.1.6 Google Earth History

- Examination of historic survey record to evaluate project site changes in substrate conditions over time.
- Data reflect intermittent sanding and rock within Lechuza Cove and boulder/cobble environment as well as highly variable kelp canopy at the site. Data also provide information about similar resource issues at potential reference sites.

2.2 Reference Sites

2.2.1 Selection Criteria

2.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat (Google Earth review)

2.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity (used Mugu Lagoon to Malibu Lagoon, approx. 13 miles each direction) (Google Earth review)

2.2.1.3 Similar coastal orientation (southerly)

2.2.1.4 Similar littoral sediment sources and substrate mix as Broad Beach

2.2.1.5 Similar habitat features of interest as project area

2.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features for efficiency and interpretive capacity)

2.2.2 Potential Reference Sites (Table 2, at end of outline)

2.2.2.1 Old Stairs

- Summary of Previous Studies/Data
  - PISCO Biodiversity Surveys (2001 and 2008)
  - Long-term (since 1994)

2.2.2.2 Deer Creek

- Summary of Previous Studies/Data
  - PISCO Biodiversity Survey (2013)

2.2.2.3 Sequit Point/Leo Carillo

- Summary of Previous Studies/Data
  - PISCO Biodiversity Surveys (2009 and 2013)

2.2.2.4 El Pescador

- Summary of Previous Studies/Data
  - M&A/Chambers (2016) site recon for reference evaluation

2.2.2.5 Point Dume

- Summary of Previous Studies/Data
  - Biodiversity Survey (2013)

2.2.2.6 Paradise Cove

- Summary of Previous Studies/Data
  - Biodiversity Surveys (2001, 2006, and 2010)
  - Long-term (since 1994)

2.2.2.7 Malibu Bluffs

- Summary of Previous Studies/Data
  - M&A/Chambers (2016) site recon for reference evaluation

2.2.3 Selected Reference Site (Table 3, at end of outline) based on best fit of 6 factors (2.2.1)

2.2.3.1 Leo Carillo

2.2.3.2 El Pescador

2.2.3.3 Paradise Cove

2.2.3.4 Malibu Bluffs

2.3 Potential Project-Related Change to Habitat and/or Habitat Quality

2.3.1 Direct (i.e., within initial fill footprint)

2.3.2 Indirect (outside of placement footprint)

2.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

- Decrease in rocky habitat may result in change in areal extent of habitat or potential decrease of cover by persistent indicator species (e.g., Balanus, Mytilus, Pollicipes, or fucoid algae) and increase in cover contra indicators (e.g., bare rock, sand, ephemeral green algae, Porphyra, or other non-persistent species)

2.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

- Increase in rocky habitat may result in change or potential increase of indicator species (see above)
- Analyses will be one-tail tests (i.e., a reduction of rock or decrease in persistent indicator species cover would constitute a potential effect).

2.4 Habitat Mapping

2.4.1 UAV census (intertidal-supratidal)

2.4.2 Interferometric sidescan sonar census (low intertidal)

2.4.3 Project sand tracking based on beach profiles and change in mean or median (TBD) grain size of sand in project area

2.4.3.1 Spring and fall beach profiles used to track changes in beach morphology and sand migration.

2.4.3.2 Sand samples (20 cm deep cores) will be collected at elevations of +2, +1, 0, -1, -3, -5, -10 and -15 meter MLLW along each beach profile and in intermittent areas.

2.4.3.3 Samples will be analyzed for mean grain size to determine the probable relative contribution of native and project sand to the sediment.

2.5 Habitat Quality

2.5.1 Indicator species

2.5.1.1 Absolute percent cover of persistent indicators = metric for scour and burial impact.

2.5.1.2 Monitoring by fixed photo quadrats (located by dGPS)

- Initial sampling replication by site is to use (N=43)
    - Power analysis of Chambers 2013 quadrat data suggests N=43 for barnacles (Table 1a, at end of outline)
    - Power analysis for PISCO Cardiff RBSP barnacle data – suggests a range from N=2 to 143; mean of range (N=32)
    - By pooling indicator species (Table 4) for an absolute cover, variability unrelated to sand influence should be reduced and it

is expected that after initial sampling, the replication may be reduced based on power analyses conducted on project data.

2.6 Sampling Schedule

2.6.1 Pre-Construction Survey

2.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

2.6.2 Post-Construction Survey

2.6.2.1 Spring (April through June) and Fall (August through November) following construction

2.7 Analytical Techniques

2.7.1 Habitat Extent

2.7.1.1 Annual change in featured habitat from pre-nourishment census compared to similar features at reference areas. Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics.

2.7.1.2 Detected differences do not necessarily indicate that a difference is an adverse effect as discussed below.

2.7.2 Habitat Quality

2.7.2.1 Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change for a given indicator at Broad Beach not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.

2.8 Determination of Impact/Adverse Change

2.8.1 Adverse effects are associated with the loss or reduction of hard-bottom substrata and/or a reduction of persistent indicator species due to an increase or persistence of project sand at elevated levels that exacerbate sand scour or sand inundation.

2.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities (e.g., loss of mussels due to heat stress would not constitute a project adverse impact, while loss of mussels due to sand overrun would.).

2.9 Adaptive Management

2.9.1 From Direct Impact

2.9.1.1 Adjust/modify receiver site footprint

2.9.2 From Indirect Impact

2.9.2.1 Reduction of rocky habitat due to burial

- Adjust/modify receiver site footprint
- Adjust volume of future nourishment cycles
- Adjust grain size of material for future nourishment cycles

2.9.2.2 Scour associated w/ increased sedimentation

- Adjust/modify receiver site footprint
- Adjust volume of future nourishment cycles
- Adjust grain size of material for future nourishment cycles

2.9.2.3 Grain size effects

- Adjust/modify receiver site footprint
- Adjust volume of future nourishment cycles
- Adjust grain size of material for future nourishment cycles

3.0 Intertidal Surfgrass

3.1 Existing Conditions at Broad Beach/Lechuza Cove

3.1.1 Summary of Previous Studies/Data

3.1.1.1 Marine Protected Area (MPA)

- Habitat mapping via multi-spectral imaging

3.1.1.2 Chambers

- Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

3.1.1.3 Merkel & Associates/Chambers 2016– Site reconnaissance for monitoring program development

3.2 Reference Sites – **See Section 2.2**

3.3 Potential Project-Related Change to Habitat and/or Habitat Quality

3.3.1 Direct (i.e., within fill footprint)

3.3.2 Indirect

3.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

- Decrease in rocky habitat may result in reduction in areal extent or density of surfgrass

3.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

- Increase in rocky habitat may result in change or potential increase of indicator species

3.4 Habitat mapping and determination of areal extent of surfgrass

3.4.1 UAV census (intertidal)

3.4.2 Project sand distribution mapping

3.5 Habitat Quality

3.5.1 Indicators

3.5.1.1 Surfgrass sampling by bed targeted 0.5m x 0.5m photo quadrat for percent cover assessment coupled with census mapping (i.e., mapped area x sample coverage mean).

- Sampling replication by site to use (N=16) (basis for power analyses was transect sampling)
  - Power to achieve 20-20-20 (N=3) using Chambers 2013 transect data (Table 1b, at end of outline)
  - Power to achieve 20-20-20 range for PISCO Cardiff RBSP data – range N=2 to 68; mean of range (N=16)
  - Changing from transects to targeted density sampling within surfgrass and relying on the inventory to capture spatial extent is expected to increase power.

3.6 Sampling Schedule - **See Section 2.6**

3.7 Analytical Techniques

3.7.1 Surfgrass - based on composite of areal extent of mapped surfgrass habitat times mean percent cover of surfgrass within mapped beds

3.7.1.1 Annual change in surfgrass from pre-nourishment census compared to similar features at reference areas. Determination of similarity employed for the Wheeler North Reef (Range Test) will be used.

3.7.1.2 Detected differences do not indicate that a difference is an adverse project effect as discussed below

3.8 Determination of Impact/Adverse Change

3.8.1 Adverse effects - loss or reduction of intertidal surfgrass or reduction of surfgrass coverage within a bed due to an increase or persistence of project sand at elevated levels thereby resulting in bed senescence or thinning.

3.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

3.9 Adaptive Management

3.9.1 From Direct Impact

3.9.1.1 Adjust/modify receiver site footprint

3.9.2 From Indirect Impact

3.9.2.1 Reduction of rocky habitat due to burial

- Adjust/modify receiver site footprint
- Adjust volume of future nourishment cycles
- Adjust grain size of material for future nourishment cycles

3.9.2.2 Scour associated w/ increased sedimentation

- Adjust/modify receiver site footprint
- Adjust volume of future nourishment cycles
- Adjust grain size of material for future nourishment cycles

4.0 Rocky Intertidal (Boulder Field)

4.1 Existing Conditions at Broad Beach/Lechuza Cove

4.1.1 Summary of Previous Studies/Data

4.1.1.1 Marine Protected Area (MPA)

- Habitat mapping via multi-spectral imaging

4.1.1.2 Chambers

- Chambers 2012 - Survey of Marine Biological Resources of Broad Beach
- Chambers 2013a - Quantitative surveys of rocky intertidal and sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach (Table 1 a and b)

4.1.1.3 Merkel & Associates 2014 – Mapping of intertidal habitat

4.2 Reference Sites - **See Section 2.2**

4.3 Potential Project-Related Change to Habitat and/or Habitat Quality

4.3.1 Direct (i.e., within fill footprint)

4.3.2 Indirect

4.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

- Decrease in rocky habitat may result in change or potential decrease of indicator species

4.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

- Increase in rocky habitat may result in change or potential increase of indicator species

4.4 Habitat Mapping

4.4.1 UAV census (intertidal)

4.4.2 Interferometric sidescan sonar census (low intertidal)

4.4.3 Project sand distribution mapping

4.5 Habitat Quality

4.5.1 Indicator species (Sampling for indicators of persistence of habitat and moderate and low sand influence).

4.5.1.1 Absolute percent cover of persistent indicators will be used as a metric for scour and burial impact.

4.5.1.2 Monitoring by fixed photo quadrats (located by dGPS)

4.5.2 Indicator sampling methods

4.5.2.1 Photo quadrats to assess indicator species status

- 0.5 x 0.5 m (1/4 m2 quadrat) sampling
- Based on barnacles alone the power analyses suggests that an N=200 would be required using Chambers 2013 quadrat data (Table 1a)
- However, by pooling indicator status and using pooled persistent species and omitting neutral species the variance may be controlled and the replication requirement is expected to be lowered somewhat.

Challenge exists with supporting statistical evaluation to support 20-20-20 requirements.

4.5.2.2 Characterize extent of sanding within the mapped boulder field.

4.5.2.2.1 10-meter point-intercept transects are proposed. Using Chambers 2013 transect data (Table 1b) power analyses suggest that a low N=2 is required to characterize the extent of sand and rock in the field, but a replication of N=8 is recommended.

4.6 Sampling Schedule - **See Section 2.6**

4.7 Analytical Techniques

4.7.1 Habitat Mapping (habitat area x percent rock from transect sampling)

4.7.1.1 Annual change in surfgrass from pre-nourishment census compared to similar features at reference areas. Determination of similarity employed for the Wheeler North Reef (Range Test) will be used.

4.7.1.2 Each Primary Habitat Feature would be examined by range comparisons.

4.7.1.3 Detected differences do not indicate that a difference is an adverse effect as discussed below.

4.7.2 Habitat Quality

4.7.2.1 **(NOT BELIEVED POSSIBLE TO MEET STATISTICAL REQUIREMENTS)** Evaluating whether habitat quality at Broad Beach is performing similarly to that at reference sites requires that annual change for a given indicator at Broad Beach not be significantly lower than mean annual change at lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.

4.8 Determination of Impact/Adverse Change

4.8.1 Adverse effects are associated with the loss or reduction of hard-bottom substrata and/or a reduction of low scour or sand burial indicator species due to an increase or persistence of project sand at elevated levels **(WILL LIKELY DROP SECOND ELEMENT AS NOT TESTABLE IN THE SAND IMPACTED BOULDER FIELD)**.

4.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

4.9 Adaptive Management - **See Section 2.9**

5.0 Sandy Beach

5.1 Existing Conditions at Broad Beach/Lechuza Cove

5.1.1 Summary of Previous Studies/Data

5.1.1.1 Marine Protected Area (MPA)

- Habitat mapping via multi-spectral imaging

5.1.1.2 Chambers

- Chambers 2012 - Survey of Marine Biological Resources of Broad Beach
- Chambers 2013a - Quantitative surveys of sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach (Table 5)

5.1.1.3 Merkel & Associates 2014 – Mapping of intertidal habitat

5.2 Reference Sites

5.2.1 Selection Criteria **See Section 2.2.1**

5.2.2 Potential Reference Sites (Table 2)

5.2.2.1 Sequit Point/Leo Carillo

- Summary of Previous Studies/Data
    - MPA Baseline Survey (2015)

5.2.2.2 El Pescador

- Summary of Previous Studies/Data
    - M&A/Chambers (2016)

5.2.2.3 Point Dume

- Summary of Previous Studies/Data
    - MPA Baseline Survey (2015)

5.2.2.4 Zuma Beach

- Summary of Previous Studies/Data
    - Chambers 2013a - Quantitative surveys of sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach

5.2.3 Sample Locations

5.2.3.1 Broad Beach (Project Site)

5.2.3.2 Broad Beach west of the replenishment area (per CDP condition);

5.2.3.3 Zuma Beach east of the replenishment area (per CDP condition);

5.2.3.4 Leo Carillo (Reference Site; served as MPA monitoring location); and

5.2.3.5 Point Dume (Reference Site; served as MPA monitoring location)

5.3 Potential Project-Related Change to Habitat and/or Habitat Quality

5.3.1 Direct (i.e., within fill footprint)

5.3.2 Indirect

5.3.2.1 Transport of project sand outside fill footprint

5.4 Habitat Mapping

5.4.1 UAV census (intertidal) – Includes quantification of kelp wrack as a percent of the beach area available

5.4.2 Interferometric sidescan sonar census (low intertidal)

5.4.3 Project sand distribution mapping

5.5 Habitat Quality

5.5.1 Transect sampling of composited cores

5.5.1.1 Shore normal transects (40 core samples (10 cm dia. x 20 cm deep) evenly distributed between the wrackline and the swash zone, composited to single sample (meets Schlacher *et al.* 2008 sample area recommendation of $0.3m^2$ per sample)

5.5.1.2 Replicate samples are based on indicator species abundance for *Emerita analoga*. Using Chambers 2013 intertidal data (based on individual cores as the sample with a sample size of N=5, a power analyses would indicate the need for an **N = 239 (1,195 SAMPLES ACROSS 5 SITES PER EVENT)**. **REPLICATION FOR BEACH SAMPLING REMAINS PROBLEMATIC – IT MAY BE MORE APPROPRIATE TO CHOSE A DIFFERENT METRIC FOR BEACH ASSESSMENT TO ACHIEVE THE 20-20-20 STANDARD DO TO HIGH VARIABILITY IN ORGANISM ABUNDANCE, PATCHINESS OF DISTRIBUTION, AND SEASONALITY. INVESTIGATIONS ARE UNDERWAY TO EXAMINE POTENTIAL FOR USING SPECIES RICHNESS OR ANOTHER METRIC FOR ASSESSMENT THAT MAY REQUIRE LOWER REPLICATION.**

5.6 Sampling Schedule

5.6.1 Pre-Construction Survey

5.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

5.6.2 Post-Construction Survey

5.6.2.1 Habitat mapping Spring (April through June) and Fall (August through November) for each year following construction

5.6.2.2 Infaunal sampling to occur in Fall (August through November) each year following construction

5.6.2.3 Physical monitoring of project sand distribution to occur in Spring (April through June) and Fall (August through November) each year post-construction.

5.7 Analytical Techniques

5.7.1 Habitat Mapping

5.7.1.1 Annual change in featured habitat (sandy beach area and percent kelp wrack) from pre-nourishment census compared to similar features at reference areas. A determination of similarity employed for the Wheeler North Reef (Range Test) will be used.

5.7.1.2 Kelp wrack would be examined by range comparisons.

5.7.1.3 Project sand distribution mapping would be assessed as an areal extent deviation from: 1) the initial placement footprint, and 2) model predictions of sand distribution over time. Assessment will be based on mean (or median) grain size differences from pre-project Spring and Fall sampling results.

5.7.1.4 Detected differences do not indicate that a difference is an adverse effect as discussed below.

5.7.2 Habitat Quality

5.7.2.1 Community richness (detect 80% of organisms present)

- Analyses will examine changes in community richness on the project beach and potentially affected adjacent beaches. Estimators of species richness will be based on species-accumulation curves derived from randomly drawn subsamples as well as Total Species (T-S) curve.

5.7.2.2 Abundance of *Emerita analog* as dominant indicator species

- Density of Emerita analog will be compared between pre-construction and post-construction Fall survey results for Broad Beach, potentially affected adjacent beaches (Lechuza Cove, Zuma Beach), and outside reference sites.

5.7.2.3 Statistical design for both richness and indicator abundance will follow Beyond-BACI design similar to Schlacher et al. (2012).

5.8 Determination of Impact/Adverse Change

5.8.1 Habitat Mapping

5.8.2 Habitat Quality

5.8.2.1 Documented spread of project sand influence beyond that predicted by modeling and an associated reduction in species richness or abundance of Emerita beyond 20 percent reduction from that observed at the lowest performing reference site condition

5.8.2.2 An impact will be indicated by statistically significant Treatment × Time interaction, while no impact or recovery will be indicated by non-significant Treatment × Time interactions when the effect is set at a 20 percent change.

5.9 Adaptive Management

5.9.1 From Direct Impact

5.9.1.1 Adjust/modify receiver site footprint

5.9.2 From Indirect Impact

5.9.2.1 Grain size effects

- Adjust/modify receiver site footprint
- Adjust volume of future nourishment cycles
- Adjust grain size of material for future nourishment cycles

6.0 Rocky reef with kelp (kelp forest)

6.1 Existing Conditions at Broad Beach/Lechuza Cove

6.1.1 Summary of Previous Studies/Data

6.1.1.1 Marine Protected Area (MPA)

- Habitat mapping via multi-spectral imaging

6.1.1.2 Chambers

- Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

6.1.1.3 Merkel & Associates 2014 – Mapping of habitat, diving survey

6.2 Reference Sites

6.2.1 Selection Criteria - **See Section 2.2.1**

6.2.2 Potential Reference Sites

6.2.2.1 Old Stairs

- Summary of Previous Studies/Data
  - No subtidal data

6.2.2.2 Deer Creek

- Summary of Previous Studies/Data
  - No subtidal data

6.2.2.3 Leo Carillo

- Summary of Previous Studies/Data
  - PISCO/MPA Surveys (2008, 2011, 2012)

6.2.2.4 El Pescador

- Summary of Previous Studies/Data
  - PISCO/MPA Surveys (2011, 2012)

6.2.2.5 Paradise Cove

- Summary of Previous Studies/Data
  - PISCO/MPA Surveys (2008, 2011, 2012)

6.2.2.6 Point Dume

- Summary of Previous Studies/Data
  - PISCO/MPA Surveys (2008, 2011, 2012)

6.2.2.7 Malibu Bluffs

- Summary of Previous Studies/Data
  - PISCO (2004)

6.2.3 Selected Reference Site (Table 3)

6.2.3.1 Leo Carillo

6.2.3.2 El Pescador

6.2.3.3 Paradise Cove

6.2.3.4 Malibu Bluffs

6.3 Potential Project-Related Change to Habitat and/or Habitat Quality

6.3.1 Direct (i.e., within fill footprint)

6.3.2 Indirect

6.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

- Decrease in rocky habitat may result in change or potential decrease of indicator species

6.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

- Increase in rocky habitat may result in change or potential increase of indicator species

6.4 Habitat Mapping

6.4.1 UAV census (shallow subtidal fringe)

6.4.2 Interferometric Sidescan Sonar census (all subtidal areas)

6.5 Habitat Quality

6.5.1 Indicators

6.5.1.1 Kelp Canopy

- Regional kelp canopy data from CDFW and Central Region Kelp Survey Consortium with nine delineated survey areas with Lechuza Cove (impact area) and eight reference areas

6.5.1.2 Fixed location diver radial plots intended to fall on rocky reef habitat only. However, small rocks with kelp may preclude 100 percent reef substrate in sampling layout.

- 20m2 plot with a 2.52 m radial plot from center point. Data collected for density of perennial indicator species (mature Macrocystis, Pteryogophora, Muricea)
- Sampling will include quantification of urchins as potential biotic factors in changing abundance of indicators
- Sampling will include quantification of the percent cover of plot dominated by different substrates (rock, sand, sand on rock)
- Sample Size required based on power analysis is N=22 using M&A 2014 data (Table 6)

6.6 Sampling Schedule – See Section 2.6

6.7 Analytical Techniques

6.7.1 Habitat Mapping

6.7.1.1 Annual change in featured habitat (sandy beach area and percent kelp wrack) from pre-nourishment census compared to similar features at reference areas. A determination of similarity employed for the Wheeler North Reef (Range Test) will be used.

6.7.1.2 Each Primary Habitat Feature would be examined by range comparisons.

6.7.1.3 Detected differences do not indicate that a difference is an adverse effect as discussed below.

6.7.2 Habitat Quality

6.7.2.1 Kelp Canopy

- Beyond-BACI design with response variable including canopy coverage before and after nourishment

6.7.2.2 Other Indicators

- Annual change for a given indicator at Broad Beach must not be significantly lower than the mean annual change at the lowest performing reference site. A one-sample, one-tailed approach will be used for all comparisons, similar to at Wheeler North Reef.

6.8 Determination of Impact/Adverse Change

6.8.1 Adverse effects are associated with the loss or reduction of hard-bottom substrata and/or a reduction of low scour or sand burial indicator species due to an increase or persistence of project sand at elevated levels.

6.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities (e.g., loss of kelp due to urchins would not constitute a project adverse impact, while loss of kelp due to sand overrun would).

6.8.3 Habitat Quality

6.8.3.1 Kelp Canopy

- An impact will be indicated by statistically significant Treatment × Time interaction (i.e. temporal trajectories from before to after the intervention differ between treatment and impact locations) with a 20 percent effect level

6.9 Adaptive Management – **See Section 3.9**

7.0 Rocky reef without kelp

7.1 Existing Conditions at Broad Beach/Lechuza Cove

7.1.1 Summary of Previous Studies/Data

7.1.1.1 Marine Protected Area (MPA)

- Habitat mapping via multi-spectral imaging

7.1.1.2 Chambers

- Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

7.1.1.3 Merkel & Associates 2014 – Mapping of habitat, diving survey

7.2 Reference Sites – **see Section 2.2**

7.3 Potential Project-Related Change to Habitat and/or Habitat Quality

7.3.1 Direct (i.e., within fill footprint)

7.3.2 Indirect

7.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

7.3.2.1.1 Decrease in rocky habitat may result in change or potential decrease of indicator species

7.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

7.3.2.2.1 Increase in rocky habitat may result in change or potential increase of indicator species

7.4 Habitat Mapping

7.4.1 UAV census

7.4.2 Interferometric sidescan sonar census

7.5 Habitat Quality

7.5.1 Indicators (Table 6)

7.5.1.1 Quadrats **(N=22)** for indicator species (same as Section 4.5.1.2)

7.5.1.1.1 Substrate

7.5.1.1.2 Urchin

7.6 Sampling Schedule – **See Section 2.6**

7.7 Analytical Techniques

7.7.1 Habitat Mapping

7.7.1.1 Annual change in featured habitat (sandy beach area and percent kelp wrack) from pre-nourishment census compared to similar features at reference areas. A determination of similarity employed for the Wheeler North Reef (Range Test) will be used.

7.7.1.2 Each Primary Habitat Feature would be examined by range comparisons.

7.7.1.3 Detected differences do not indicate that a difference is an adverse effect as discussed below.

7.7.2 Habitat Quality

7.7.2.1 Annual change for a given indicator at Broad Beach must not be significantly lower than the mean annual change at the lowest performing reference site. A one-sample, one-tailed approach will be used for all comparisons, similar to at Wheeler North Reef.

7.8 Determination of Impact/Adverse Change

7.8.1 Adverse effects are associated with the loss or reduction of hard-bottom substrata and/or a reduction of low scour or sand burial indicator species due to an increase or persistence of project sand at elevated levels.

7.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

7.9 Adaptive Management – **See Section 3.9**

8.0 Rocky reef with surfgrass

8.1 Existing Conditions at Broad Beach/Lechuza Cove

8.1.1 Summary of Previous Studies/Data

8.1.1.1 Marine Protected Area (MPA)

- Habitat mapping via multi-spectral imaging

8.1.1.2 Chambers

- Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

8.1.1.3 Merkel & Associates 2014 – Mapping of habitat, diving survey

8.2 Reference Sites

8.2.1 Selection Criteria - **See Section 2.2.1**

8.2.2 Potential Reference Sites - **See Section 6.2.2.**

8.2.3 Selected Reference Site (Table 3)

8.2.3.1 Leo Carillo

8.2.3.2 El Pescador

8.2.3.3 Paradise Cove

8.2.3.4 Malibu Bluffs

8.3 Potential Project-Related Change to Habitat and/or Habitat Quality

8.3.1 Direct (i.e., within fill footprint)

8.3.2 Indirect

8.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

- Decrease in rocky habitat may result in change or potential decrease of indicator species

8.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

- Increase in rocky habitat may result in change or potential increase of indicator species

8.4 Habitat Mapping

8.4.1 UAV census (shallow)

8.4.2 Interferometric sidescan sonar census (deeper fringe to shallow)

8.5 Habitat Quality

8.5.1 Indicators (0.5m x 0.5m quadrat sampling for surfgrass coverage and substrate percent sand)

8.5.1.1 Subtidal Surfgrass

- **N=198** using M&A 2014 data (Table 6). Transect sampling not targeting surfgrass and thus higher variance than would be expected by quadrat sampling of surfgrass beds. It is unlikely that 198 independent samples could be taken within subtidal beds. Power analysis is to be performed on randomly selected quadrats from first sampling event to determine ultimate number of samples required. The total sampling effort would then be reduced to the level required based on sampling performed.

8.6 Sampling Schedule – **See Section 2.6.**

8.7 Analytical Techniques

8.7.1 Habitat Mapping and Habitat Quality as combined metric

8.7.1.1 The mapped areal cover is to be multiplied by the mean percentage of surfgrass within sampled quadrats for each sampled site (Lechuza Point and reference sites).

8.7.1.2 Annual change in featured habitat (sandy beach area and percent kelp wrack) from pre-nourishment census compared to similar features at reference areas. A determination of similarity employed for the Wheeler North Reef (Range Test) will be used.

The percent change values would be examined by range comparisons using a one-tail t-test.

8.7.1.3 Detected differences do not indicate that a difference is an adverse effect as discussed below.

8.8 Determination of Impact/Adverse Change

8.8.1 An adverse effect occurs when: 1) loss or reduction of surfgrass is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

8.9 Adaptive Management – **See Section 3.9.**

9.0 Unconsolidated habitat with eelgrass

9.1 Existing Conditions at Broad Beach/Lechuza Cove

9.1.1 Summary of Previous Studies/Data

9.1.1.1 Marine Protected Area (MPA)

- Habitat mapping via multi-spectral imaging

9.1.1.2 Chambers

- Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

9.1.1.3 Merkel & Associates 2014 – Mapping of intertidal habitat, diving survey

9.2 Reference Sites

9.2.1 Selection Criteria –See Section 2.2.1

9.2.2 Potential Reference Sites (Table 2) – **See Section 6.2.2**

9.2.3 Selected Reference Site (Table 3) Based on presence of resource, proximity, and bracketing project site

9.2.3.1 Leo Carillo

9.2.3.2 El Pescador

9.2.3.3 Malibu Bluffs

9.3 Potential Project-Related Change to Habitat and/or Habitat Quality

9.3.1 Direct (i.e., within fill footprint)

9.3.2 Indirect

9.3.2.1 Transport of project sand outside fill footprint

9.4 Habitat Mapping

9.4.1 Interferometric sidescan sonar census

9.4.2 Project sand grain size mapping

9.5 Habitat Quality

9.5.1 Shoot density indicators

9.5.1.1 Eelgrass turion density based on 1/16 m^2 quadrat sampling

9.5.1.2 Broad Beach 2014 data power analysis suggests N=2 adequate (use **N=20** per standardized CEMP sampling)

9.6 Sampling Schedule – **See Section 2.6.**

9.7 Analytical Techniques

9.7.1 Habitat Mapping

9.7.1.1 Annual change in featured habitat from pre-nourishment census compared to similar features at reference areas. Comparison of extent change to follow CEMP protocols for assessment of affect.

9.7.2 Habitat Quality

9.7.2.1 Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change in turion density within the Broad Beach beds are not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.

9.7.2.2 Detected differences do not indicate that a difference is an adverse effect as discussed below.

9.8 Determination of Impact/Adverse Change

9.8.1 Adverse effects are associated with the loss or reduction of indicator species due to an increase or persistence of project sand at elevated levels.

9.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

9.9 Adaptive Management

9.9.1 From Direct Impact

9.9.1.1 Adjust/modify receiver site footprint

9.9.2 From Indirect Impact

9.9.2.1 Grain size effects

- Adjust/modify receiver site footprint
- Adjust volume of future nourishment cycles
- Adjust grain size of material for future nourishment cycles

10.0 Unconsolidated habitat without eelgrass (subunits: sand dollar beds, shell hash rips)

10.1 Existing Conditions at Broad Beach/Lechuza Cove

10.1.1 Summary of Previous Studies/Data

10.1.1.1 Marine Protected Area (MPA)

- Habitat mapping via multi-spectral imaging

10.1.1.2 Chambers

- Chambers 2012 - Survey of Marine Biological Resources of Broad Beach
- Chambers 2013a - Quantitative surveys of rocky intertidal and sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach (Table 4)

10.1.1.3 Merkel & Associates 2014 – Mapping of intertidal habitat, diving survey

10.2 Reference Sites

10.2.1 Selection Criteria - **See Section 2.2.1**

10.2.2 Potential Reference Sites (Table 2) – **See Section 6.2.2.**

10.2.3 Selected Reference Site (Table 3)

10.2.3.1 Leo Carillo

10.2.3.2 El Pescador

10.2.3.3 Paradise Cove

10.2.3.4 Malibu Bluffs

10.3 Potential Project-Related Change to Habitat and/or Habitat Quality

10.3.1 Direct (i.e., within fill footprint)

10.3.2 Indirect

10.3.2.1 Transport of project sand outside fill footprint

10.4 Habitat Mapping

10.4.1 UAV census

10.4.2 Interferometric Sidescan Sonar census (including mapping of shell hash rips and sand dollar beds if present)

10.4.3 Project sand grain size distribution map

10.5 Habitat Quality

10.5.1 Indicators

10.5.1.1 Sand dollar bed sampling, if present within the project area during baseline investigations, sampling will be done by quadrat sampling. Sampled using randomly placed 0.5m x 0.5m quadrats within mapped sand dollar beds for percent bottom cover. If sand dollars are present at project site, similar beds will be sought at reference sites or nearby.

- At present sand dollar beds have not been identified at Broad Beach and it is not expected that sampling will occur for this resource.

10.5.1.2 Pismo clams are not known to occur in high numbers in the region and were not detected during Merkel and Chambers field surveys. This species is generally uncommon along the coast between Ventura and San Diego with MPA sandy beach monitoring program not locating Pismo clams at any of six beach sampling sites from Leo Carrillo to San Elijo (Dugan et al. 2015). As a result, it is expected that encounters in the subtidal would be extremely rare. For this reason, no sampling for Pismo clams is proposed subtidally. Pismo clams would be expected to be noted as juveniles if they occur intertidally as a result of the sand beach sampling.

10.6 Sampling Schedule

10.6.1 Pre-Construction Survey

10.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

10.6.2 Post-Construction Survey

10.6.2.1 Spring (April through June) and Fall (August through November) following construction

10.7 Analytical Techniques

10.7.1 Habitat Mapping

10.7.1.1 Annual change in featured habitat (sandy beach area and percent kelp wrack) from pre-nourishment census compared to similar features at reference areas. A determination of similarity employed for the Wheeler North Reef (Range Test) will be used. Evaluation would be as a one-tailed test.

10.7.1.2 Documented spread of project sand based on grain size mapping beyond that predicted by modeling that results in a 20 percent increase in the grain size from native

10.7.1.3 If sand dollar beds are encountered and therefore tracked, this habitat element would be examined as range comparisons with reference site beds for change over time in cover adjusted mapped area (i.e., the mean percent cover as determined by quadrat sampling times the total mapped bed area). **(DENDRASTER EXCENTRICUS DOES NOT HAVE A PREFERENCE FOR FINE OR COARSE SAND AND THEREORE UNLIKELY THAT A TRUE EFFECT NEXUS COULD BE DRAWN BETWEEN SAND DOLLARS AND CHANGING SEDIMENT CHARACTER. M&A DOES NOT THINK THIS IS A GOOD METRIC FOR ASSESSMENT OF EFFECT)**.

10.7.1.4 Detected differences do not indicate that a difference is an adverse effect as discussed below.

10.7.2 Habitat Quality

10.7.2.1 Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change of sand dollar bed distribution at Broad Beach not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.

10.8 Determination of Impact/Adverse Change

10.8.1 Adverse effects are associated with the loss or reduction of indicator species due to an increase or persistence of project sand at elevated levels.

10.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

10.9 Adaptive Management

10.9.1 From Direct Impact

10.9.1.1 Adjust/modify receiver site footprint

10.9.2 From Indirect Impact

10.9.2.1 Grain size effects

10.9.2.1.1 Adjust/modify receiver site footprint

10.9.2.1.2 Adjust volume of future nourishment cycles

10.9.2.1.3 Adjust grain size of material for future nourishment cycles

11.0 Marine Habitat Mitigation

11.1 If adverse impacts are detected, mitigation will be required.

11.1.1 The mitigation ratio for impacts upon subtidal rocky or intertidal rocky habitat shall be mitigated at a minimum of 4:1 because of the uncertainty and difficulty of mitigating for these habitats.

11.1.2 Adverse impacts upon eelgrass shall be mitigated according to the California Eelgrass Mitigation Policy. (1.38:1 minimum restoration effort size with a stable mitigation success ratio of 1.2:1)

11.1.3 Upon detection of adverse impacts upon one or more habitats, the applicant, in consultation with the SAP, shall develop a habitat specific mitigation plan for each impacted habitat that will provide the overall framework to guide the mitigation work, for review and approval of the Executive Director.

11.1.4 The revised mitigation and monitoring program shall be processed as an amendment to the coastal development permit unless the Executive Director determines that no permit amendment is required.

11.2 While impact type, scale and capacity to cure through adaptive management activities would govern the determination of best options for habitat mitigation, a starting point would be to use the review of potential subtidal and intertidal habitat compensatory mitigation approaches prepared for the California State Lands Commission EIR document (APTR) and incorporated in this document as Appendix C.

APPENDIX B
OUTLINE - EXPANDED VERSION

BROAD BEACH RESTORATION PROJECT
MARINE HABITAT MONITORING AND MITIGATION PLAN FRAMEWORK OUTLINE

Merkel & Associates

April 29, 2016

1. This Marine Habitat Monitoring and Mitigation Plan framework is structured to address conditions outlined in the Coastal Development Permit (CDP) 4-15-0390

1.1. Existing Conditions.

1.1.1. Description and historical review of the marine resources located within the project area including:

1.1.1.1. subtidal rocky habitats (e.g., kelp forest, rocky reef, surfgrass)

1.1.1.2. subtidal habitats comprised of unconsolidated sediment (e.g., eelgrass, sand dollar beds)

1.1.1.3. rocky intertidal habitats (Lechuza Point and boulder field)

1.1.1.4. sandy beach habitats in the vicinity of the beach replenishment project

1.1.2. The historical review must include a summary of past quantitative sampling and survey work (e.g. yearly kelp canopy areal extent data from 1984 to present, and Partnership for Interdisciplinary Studies of Coastal Oceans, State Water Resources Control Board Areas of Special Biological Significance, Marine Protected Area Monitoring Enterprise, and Multi-Agency Rocky Intertidal Network survey work) to document trends:

1.1.2.1. species composition

1.1.2.2. habitat areal extent

1.1.2.3. temporal changes for comparison with the post-project marine habitat monitoring findings.

1.2. Monitoring Objectives.

1.2.1. Fine scale mapping of the marine habitats listed in section A of CDP;

1.2.2. Identification of any adverse impacts to the sandy beach ecosystem resulting from sand replenishment with source sand that does not match existing beach sand;

1.2.3. Identification of direct or indirect adverse impacts to subtidal or intertidal habitats resulting from the proposed project;

1.2.4. Identification of likely causes of any documented adverse impacts (burial, scouring, turbidity, sand grain size, etc.), and;

1.2.5. Recommendations for adaptive management (e.g., future sand replenishment grain size adjustments, volume of future sand replenishment, sand placement adjustments) to avoid continuing adverse impacts, if adverse impacts are detected.

1.3. Monitoring Design.

1.3.1. Pre-construction monitoring (spring and fall) initiated one year prior to project construction.

1.3.1.1. If two seasons of pre-construction monitoring are not feasible, pre-construction spring monitoring must be conducted.

1.3.1.2. Existing data from other programs (e.g., PISCO) may be used if deemed appropriate by the SAP.

1.3.1.3. Pre-construction monitoring is to establish pre-project ecological (physical and biological) baseline conditions.

1.3.2. Post-construction monitoring for 10 years (life of the permit) after construction is complete.

1.3.3. The highly dynamic nature of the nearshore marine ecosystem and the potential for one or more marine habitats to be adversely impacted by the project must be considered in determining the frequency of monitoring (i.e. the frequency of the respective methods employed for monitoring).

1.4. Monitoring Methods.

1.4.1. Monitoring methods and a schedule for their execution with the intention of meeting the monitoring objectives

1.4.1.1. Methods to monitor for and quantify potential direct and indirect adverse impacts upon one or more of the marine habitats listed in 1.1.1.

1.4.1.2. Consider using the following methods in the final "Marine Habitat Monitoring and Mitigation Plan".

1.4.1.2.1. Develop methods with the SAP

1.4.1.2.2. Remote Sensing. Remote sensing techniques shall be employed to map rocky subtidal (with and without kelp) and rocky intertidal (with and without surfgrass) habitats in the project area and a minimum of two reference site outside the influence of the project area with the highest accuracy possible.

1.4.1.2.2.1. Multi-Spectral Aerial Surveys. Multi-spectral aerial surveys, similar to that employed by the applicant in July 2014, using an airplane fitted with specialized camera equipment designed to capture imagery within a specific array of spectral bands optimized to discern coastal marine habitats including kelp forest, understory canopy algae, eelgrass, and surfgrass. Survey results shall be groundtruthed.

1.4.1.2.2.2. Multi-beam and Sidescan Sonar. Multi-beam and sidescan sonar surveys, similar to that conducted by the applicant in May 2014, to distinguish surficial features and to map nearshore marine benthic habitat types.

1.4.1.2.3. Subtidal and Intertidal Field Monitoring. The subtidal and intertidal monitoring methods employed must be capable of discriminating between habitats influenced by sand inundation and habitats rarely or never influenced by sand inundation, the length of time respective habitats have been inundated with sand, and the sand source (natural or project derived).

1.4.1.2.3.1. The subtidal marine habitats that must be monitored are rocky bottom (with and without kelp) and unconsolidated substrates (with and without eelgrass). The intertidal habitats that must be monitored are Lechuza Point and the boulder field east of Lechuza Point and the sandy beach. A minimum of two reference sites for each of the above habitat types must be monitored. The reference sites should be as close as possible to the potential impact area within an area outside the project's influence. The marine habitat monitoring locations in the immediate project area must be established based on the project footprint and model-predicted sedimentation patterns, after consultation with the applicant, resource agencies, and the SAP.

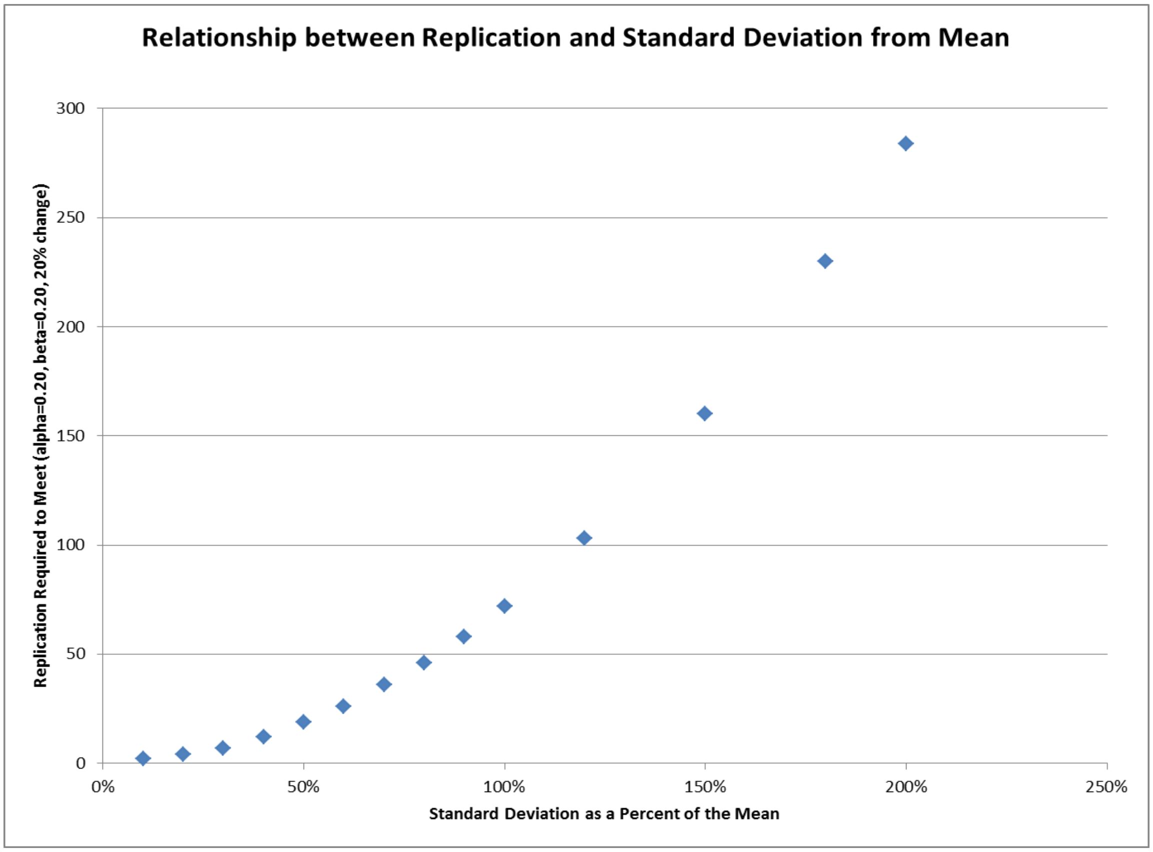
1.4.1.2.3.2. Reference site locations must be based on proximity and similarity to the respective marine habitats in the project area, after consultation with the applicant, resource agencies, and the SAP. Eelgrass mapping must be in substantial conformance with NOAA's California Eelgrass Mitigation Policy and Implementing Guidelines published in October 2014.

1.4.1.2.3.3. In order to assess whether the macroinvertebrate assemblage that colonizes Broad Beach following sand replenishment is what would be there but for on-going disturbance, a minimum of two undisturbed beaches within the Malibu littoral cell, as well as the section of Broad Beach in the project footprint, must be monitored. The undisturbed beaches must be chosen based on having sand characteristics as similar as possible to the existing Broad Beach sand (well sorted, D50 =0.25), having similar geomorphology (intermediate dissipative beaches) that face in the same general direction, and having the same general wave regime. In addition to these beaches, the section of Broad Beach west of the replenishment project and Zuma Beach east of the replenishment project must be monitored.

1.4.1.2.3.4. The beach monitoring methods must be capable of determining; 1) whether the portion of Broad Beach covered by quarry sand develops a sandy beach macroinvertebrate fauna similar to the reference beaches, and, 2) whether the project adversely impacts the beach ecosystem west and east of the project. The beach monitoring methods must be designed to identify approximately 80% of the organisms present; in order to capture this percentage of the community, approximately 3 square meters [**0.3 square meters from reference**] of surface area must be surveyed (Schlacher et al. 2008). In order to compare results to past surveys, the beach sampling must employ 10 cm diameter by 20 cm deep cores and sieve the samples using a 1.5mm/1.0mm aperture sieve. This monitoring shall be conducted before construction in the spring and fall and semi-annually in spring and fall for the life of the project at the replenished beach, the reference beaches and the beach west of the replenished beach and the beach east of the replenished beach.

1.4.1.2.3.5. The subtidal and intertidal monitoring must be designed to pick up, at a minimum, a 20% change between the respective impact and reference sites. That is, the monitoring must be designed to have an 80% chance of picking up a 20% change. This is sometimes referred to as the 20, 20, 20 rule where Type I error (the null hypothesis is true but rejected) or alpha is set at .20, Type II error (the null hypothesis is false but accepted) or beta is set at .20, and power is equal to 1-beta or .80.

Independent replicates (N) required to achieve the 20, 20, 20 standards increase exponentially as a ratio of the standard deviation to mean of mean of the samples.



1.5. Criteria for Detecting Adverse Impacts.

1.5.1. The Plan must include criteria for determining whether the project has resulted in direct or indirect adverse impacts upon one or more of the marine habitats described in 1.1.1, above.

1.5.2. The criteria must be amenable to quantitative assessment and must include estimates of the areas of kelp forest, eelgrass, and surfgrass lost as a result of the project.

1.6. *Monitoring Reports.*

1.6.1. Annual reports that review the results of past monitoring and report on the most recent work must be submitted no later than December 31st of each year for review by the SAP and review and approval by the Executive Director.

1.6.2. A report at the end of 5 years shall determine whether adverse impacts to marine habitats have occurred as a result of the project as required pursuant to special condition 2C.

1.6.3. If adverse impacts are detected that is when the need for mitigation will be determined.

1.7. Marine Habitat Mitigation and Monitoring.

1.7.1. If adverse impacts are detected, mitigation will be required.

1.7.1.1. The mitigation ratio for impacts upon subtidal rocky or intertidal rocky habitat shall be mitigated at a minimum of 4:1 because of the uncertainty and difficulty of mitigating for these habitats.

1.7.1.2. Adverse impacts upon eelgrass shall be mitigated according to the California Eelgrass Mitigation Policy.

1.7.2. Upon detection of adverse impacts upon one or more habitats, the applicant, in consultation with the SAP, shall develop a habitat specific mitigation plan for each impacted habitat that will provide the overall framework to guide the mitigation work, for review and approval of the Executive Director. The revised mitigation and monitoring program shall be processed as an amendment to the coastal development permit unless the Executive Director determines that no permit amendment is required.

This document provides an outline of the monitoring approach to satisfy the Marine Habitat Monitoring and Mitigation Plan (MHMMP) as required under CDP Special Condition 6; as outlined above. As requested by Commission staff, this outline is organized by discrete habitat elements rather than being treated holistically under the same structure as the permit condition. Because most of the habitat elements share existing conditions data sources, reference sites, potential impact considerations, and monitoring and analytical methods, the habitat-by-habitat outline format is highly redundant. However, this format may assist in focusing the review and assessing each component independently.

To streamline the outline review, the first discussion of background data, site conditions, reference site selection, mapping and monitoring methods, or analyses methods is more detailed than subsequent references and the subsequent references are abbreviated unless modifications to the methods are warranted. Photographs have been incorporated at various locations to assist in illumination of the habitat conditions to be sampled.

The monitored habitats within this MHMMP include the following discussed in the identified outline sections:

Habitat Type	Section	Primary Habitat Feature
Marine Nearshore: Intertidal: Rock Substrate	2.0	Bedrock Rocky Intertidal (Lechuza Point)
	3.0	Intertidal Surfgrass
Marine Nearshore: Intertidal: Unconsolidated Substrate	4.0	Rocky Intertidal (Boulder Field)
	5.0	Sandy Beach

Marine Nearshore: Subtidal: Rock Substrate	6.0	Rocky reef with kelp (kelp forest)
	7.0	Rocky reef without kelp
	8.0	Rocky reef with surfgrass
Marine Nearshore: Subtidal: Unconsolidated Substrate	9.0	Unconsolidated habitat with eelgrass
	10.0	Unconsolidated habitat w/o eelgrass (subunits: sand dollar beds, shell hash rips)

2.0 Bedrock Rocky Intertidal (Lechuza Point)

2.1 Existing Conditions at Broad Beach/Lechuza Cove

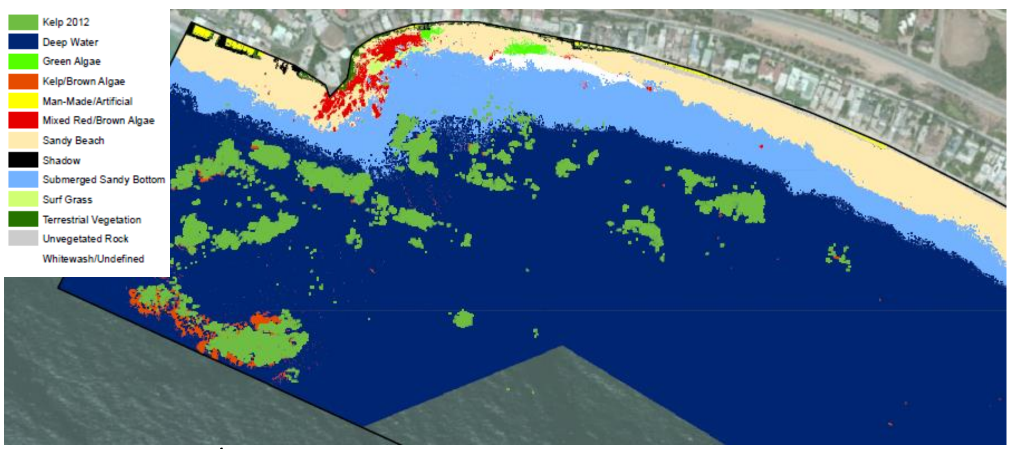
2.1.1 Summary of Previous Studies/Data

2.1.1.1 Marine Protected Area (MPA) Monitoring Enterprise

2.1.1.1.1 Habitat census mapping via auto-classified multi-spectral imaging

2.1.1.1.2 Conducted 2012, 1m x 1m pixel size, 65% overall classification accuracy

2.1.1.1.3 Does not detect eelgrass habitat or subtidal rocky habitat conditions. Pixel-based spectral dominance affects classification error



2.1.1.2 PISCO/MARINe

2.1.1.2.1 Biodiversity Survey using fixed transect and quadrat sampling distributed from high to low intertidal (data not parsed by elevation or other sanding exposures). Work conducted principally on higher elevation Lechuza Point but extending off shoulders to low relief margins

2.1.1.2.2 Data collected in 2009 and 2013

- 2.1.1.3 Rocky Intertidal ASBS Assessment (Raimondi et al 2012)
  - 2.1.1.3.1 Surveys using Coastal Biodiversity Survey methods, point contact transects and quadrat sampling
  - 2.1.1.3.2 Sampling period single event but the season and year are not clear (likely 2009)
  - 2.1.1.3.3 Important findings are 1) Lechuza Point performed different from other sites likely due to influence of sand burial and scour (distinct from the other 20 sites investigated); 2) Lechuza's community is characteristic of a sand influenced site with intermittent emergent rock
- 2.1.1.4 Chamber's Group
  - 2.1.1.4.1 Chamber's Group 2012 - Survey of Marine Biological Resources of Broad Beach
  - 2.1.1.4.2 Chambers 2013a - Quantitative surveys of rocky intertidal and sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach (Table 1 a and b, at end of outline)
    - 2.1.1.4.2.1 Rocky intertidal survey by transects and quadrats
    - 2.1.1.4.2.2 Sand beach sampled by core sampling
- 2.1.1.5 Merkel & Associates 2014 – Census mapping of subtidal habitat
  - 2.1.1.5.1 Surveys conducted 2014
    - 2.1.1.5.1.1 Acoustic surveys by interferometric sidescan sonar (backscatter and multi-beam like bathymetry) up to low intertidal zone
    - 2.1.1.5.1.2 Subtidal diver transects in all habitats
  - 2.1.1.5.2 Identified and mapped eelgrass and non-eelgrass supporting unconsolidated habitats as well as subtidal reef habitats. Did not locate any sand dollar beds

2.1.1.5.3 Inventories of macrofauna in habitats

2.1.1.6 Google Earth History

2.1.1.6.1 Examination of historic survey record to evaluate changes in substrate conditions over time relative to potential reference site conditions that were also examined in Google Earth photographic history. Photographs were also used to identify presence of habitats of interest at potential reference sites.

2.1.1.6.2 Data reflect intermittent sanding and rock within Lechuza Cove and boulder/cobble environment as well as highly variable kelp canopy at the site. Data also provide information about similar resource issues at potential reference sites.

Google Earth photo history of Lechuza Point and Cove displaying variable sanding conditions of the site.

- 2.2 Reference Sites
  - 2.2.1 Selection Criteria
    - 2.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat (Google Earth review)
    - 2.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity (used Mugu Lagoon to Malibu Lagoon, approx. 13 miles each direction) (Google Earth review)
    - 2.2.1.3 Similar coastal orientation (southerly)
    - 2.2.1.4 Similar littoral sediment sources and substrate mix as Broad Beach
    - 2.2.1.5 Similar habitat features of interest as project area
    - 2.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features for efficiency and interpretive capacity)
  - 2.2.2 Potential Reference Sites (Table 2, at end of outline)
    - 2.2.2.1 Old Stairs
      - 2.2.2.1.1 Summary of Previous Studies/Data
        - 2.2.2.1.1.1 PISCO Biodiversity Surveys (2001 and 2008)
        - 2.2.2.1.1.2 Long-term (since 1994)
    - 2.2.2.2 Deer Creek
      - 2.2.2.2.1 Summary of Previous Studies/Data
        - 2.2.2.2.1.1 PISCO Biodiversity Survey (2013)
    - 2.2.2.3 Sequit Point/Leo Carillo
      - 2.2.2.3.1 Summary of Previous Studies/Data
        - 2.2.2.3.1.1 PISCO Biodiversity Surveys (2009 and 2013)
    - 2.2.2.4 El Pescador
      - 2.2.2.4.1 Summary of Previous Studies/Data
        - 2.2.2.4.1.1 M&A/Chambers (2016) site recon for reference evaluation
    - 2.2.2.5 Point Dume
      - 2.2.2.5.1 Summary of Previous Studies/Data
        - 2.2.2.5.1.1 Biodiversity Survey (2013)
    - 2.2.2.6 Paradise Cove
      - 2.2.2.6.1 Summary of Previous Studies/Data
        - 2.2.2.6.1.1 Biodiversity Surveys (2001, 2006, and 2010)
        - 2.2.2.6.1.2 Long-term (since 1994)
    - 2.2.2.7 Malibu Bluffs
      - 2.2.2.7.1 Summary of Previous Studies/Data
        - 2.2.2.7.1.1 M&A/Chambers (2016) site recon for reference evaluation
  - 2.2.3 Selected Reference Site (Table 3, at end of outline) based on best fit of 6 factors (2.2.1)

2.2.3.1 Leo Carillo
2.2.3.2 El Pescador
2.2.3.3 Paradise Cove
2.2.3.4 Malibu Bluffs

2.3 Potential Project-Related Change to Habitat and/or Habitat Quality
2.3.1 Direct (i.e., within initial fill footprint)
2.3.2 Indirect (outside of placement footprint)
2.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat
2.3.2.1.1 Decrease in rocky habitat may result in change in areal extent of habitat or potential decrease of cover by persistent indicator species (e.g., *Balanus*, *Mytilus*, *Pollicipes*, or fucoid algae) and increase in cover contra indicators (e.g., bare rock, sand, ephemeral green algae, *Porphyra*, or other non-persistent species)
2.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat
2.3.2.2.1 Increase in rocky habitat may result in change or potential increase of indicator species (see above)
2.3.2.2.2 There are no pathways by which the project would be expected to yield a reduction of sand and greater rocky habitat, or reduced scour. As such, all analyses are to be one-tail tests (i.e., a reduction of rock or decrease in persistent indicator species cover would constitute a potential effect).

2.4 Habitat Mapping
2.4.1 UAV census (intertidal-supratidal)
2.4.2 Interferometric sidescan sonar census (low intertidal)
2.4.3 Project sand tracking is to be done based on beach profiles and change in mean (or median-TBD) grain size of sand in project area
2.4.3.1 Spring and fall beach profiles will be used to track changes in beach morphology and sand migration in the project area.
2.4.3.2 Sand samples (20 cm deep cores) will be collected at elevations of +2, +1, 0, -1, -3, -5, -10 and -15 meter MLLW along each beach profile and in intermittent areas as appropriate to physical indicators of sediment character change.
2.4.3.3 Samples will be analyzed for mean grain size to determine the probable relative contribution of native and project sand to the sediment (e.g., with approximately 0.25mm native sand and approximately 0.60 mm project sand, it is expected that a post-project mean grain size that rises from 0.25 to 0.40 would be comprised of 42.9% project sand and 57.1% native sand). Using these ratios, an isopleth map illustrating distribution of project sand contribution to the beach would be prepared to create a spatial extent estimator of project sand distribution to support analyses.

2.5 Habitat Quality

2.5.1 Indicator species (Sampling for indicators of persistence of habitat and moderate and low sand influence).

2.5.1.1 The mix of organisms may vary for many reasons unrelated to sand influence for this reason, the absolute percent cover of persistent indicators will be used as a metric for scour and burial impact.

2.5.1.2 Monitoring is to be by fixed photo quadrats (located by dGPS)

2.5.1.2.1 Initial sampling replication by site is to use (N=43)

2.5.1.2.1.1 Power analysis of Chambers 2013 quadrat data suggests N=43 for barnacles (Table 1a, at end of outline)

2.5.1.2.1.2 Power analysis for PISCO Cardiff RBSP barnacle data – suggests a range from N=2 to 143; mean of range (N=32)

2.5.1.2.1.3 By pooling indicator species (Table 4) for an absolute cover, variability unrelated to sand influence should be reduced and it is expected that after initial sampling, the replication may be reduced based on power analyses conducted on project data. In addition, to further increase sampling robustness, cover by neutral or unknown indicator status species will be omitted thus forcing stronger signals for persistent or ephemeral species cover by reducing the denominator in the cover calculations.

2.6 Sampling Schedule

2.6.1 Pre-Construction Survey

2.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

2.6.2 Post-Construction Survey

2.6.2.1 Spring (April through June) and Fall (August through November) following construction

2.7 Analytical Techniques

2.7.1 Habitat Extent

2.7.1.1 Annual change in featured habitat from pre-nourishment census compared to similar features at reference areas. Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics.

2.7.1.2 Detected differences do not necessarily indicate that a difference is an adverse effect as discussed below.

2.7.2 Habitat Quality

2.7.2.1 Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change for a given indicator at Broad Beach not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons. Because it is believed that Lechuza Cove exhibits different seasonality of sand migration than other segments of the coast, it is intended that the analyses of performance be conducted on the mean of the two seasons for each sampling event, or that the two seasons be treated independently without pairing across sites.

2.8 Determination of Impact/Adverse Change

2.8.1 Adverse effects are associated with the loss or reduction of hard-bottom substrata and/or a reduction of persistent indicator species due to an increase or persistence of project sand at elevated levels that exacerbate sand scour or sand inundation.

2.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities (e.g., loss of mussels due to heat stress would not constitute a project adverse impact, while loss of mussels due to sand overrun would. Similarly, change in habitat due to scour that occurs outside of the influence of project sand would also not be considered an adverse project effect).

2.9 Adaptive Management

2.9.1 From Direct Impact

2.9.1.1 Adjust/modify receiver site footprint

2.9.2 From Indirect Impact

2.9.2.1 Reduction of rocky habitat due to burial

2.9.2.1.1 Adjust/modify receiver site footprint

2.9.2.1.2 Adjust volume of future nourishment cycles

2.9.2.1.3 Adjust grain size of material for future nourishment cycles

2.9.2.2 Scour associated w/ increased sedimentation

2.9.2.2.1 Adjust/modify receiver site footprint

2.9.2.2.2 Adjust volume of future nourishment cycles

2.9.2.2.3 Adjust grain size of material for future nourishment cycles

2.9.2.3 Grain size effects

2.9.2.3.1 Adjust/modify receiver site footprint

2.9.2.3.2 Adjust volume of future nourishment cycles

2.9.2.3.3 Adjust grain size of material for future nourishment cycles

3.0 Intertidal Surfgrass

- 3.1 Existing Conditions at Broad Beach/Lechuza Cove
  - 3.1.1 Summary of Previous Studies/Data
    - 3.1.1.1 Marine Protected Area (MPA)
      - 3.1.1.1.1 Habitat mapping via multi-spectral imaging
    - 3.1.1.2 Chambers
      - 3.1.1.2.1 Chambers 2012 - Survey of Marine Biological Resources of Broad Beach
    - 3.1.1.3 Merkel & Associates/Chambers 2016– Site reconnaissance for monitoring program development
- 3.2 Reference Sites
  - 3.2.1 Selection Criteria
    - 3.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat
    - 3.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity
    - 3.2.1.3 Similar coastal orientation (southerly)
    - 3.2.1.4 Similar sediment sources
    - 3.2.1.5 Similar habitat features of interest as project area
    - 3.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features)
  - 3.2.2 Potential Reference Sites (Table 2, at end of outline)
    - 3.2.2.1 Old Stairs
      - 3.2.2.1.1 Summary of Previous Studies/Data
        - 3.2.2.1.1.1 PISCO Biodiversity Surveys (2001 and 2008)
        - 3.2.2.1.1.2 Long-term (since 1994)
    - 3.2.2.2 Deer Creek
      - 3.2.2.2.1 Summary of Previous Studies/Data
        - 3.2.2.2.1.1 PISCO Biodiversity Survey (2013)
    - 3.2.2.3 Sequit Point/Leo Carillo
      - 3.2.2.3.1 Summary of Previous Studies/Data
        - 3.2.2.3.1.1 PISCO Biodiversity Surveys (2009 and 2013)
    - 3.2.2.4 El Pescador
      - 3.2.2.4.1 Summary of Previous Studies/Data
        - 3.2.2.4.1.1 M&A/Chambers (2016) site recon for reference evaluation
    - 3.2.2.5 Point Dume
      - 3.2.2.5.1 Summary of Previous Studies/Data
        - 3.2.2.5.1.1 Biodiversity Survey (2013)
    - 3.2.2.6 Paradise Cove

3.2.2.6.1 Summary of Previous Studies/Data

3.2.2.6.1.1 Biodiversity Surveys (2001, 2006, and 2010)

3.2.2.6.1.2 Long-term (since 1994)

3.2.2.7 Malibu Bluffs

3.2.2.7.1 Summary of Previous Studies/Data

3.2.2.7.1.1 M&A/Chambers (2016) site recon for reference evaluation

3.2.3 Selected Reference Site (Table 3)

3.2.3.1 Leo Carillo

3.2.3.2 El Pescador

3.2.3.3 Paradise Cove

3.2.3.4 Malibu Bluffs

3.3 Potential Project-Related Change to Habitat and/or Habitat Quality

3.3.1 Direct (i.e., within fill footprint)

3.3.2 Indirect

3.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

3.3.2.1.1 Decrease in rocky habitat may result in reduction in areal extent or density of surfgrass

3.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

3.3.2.2.1 Increase in rocky habitat may result in change or potential increase of indicator species

3.4 Habitat mapping and determination of areal extent of surfgrass

3.4.1 UAV census (intertidal)

3.4.2 Project sand distribution mapping

3.5 Habitat Quality

3.5.1 Indicators

3.5.1.1 Surfgrass sampling by bed targeted 0.5m x 0.5m photo quadrat for percent cover assessment coupled with census mapping (i.e., mapped area x sample coverage mean).

3.5.1.1.1 Sampling replication by site to use (N=16) (basis for power analyses was transect sampling)

3.5.1.1.1.1 Power to achieve 20-20-20 (N=3) using Chambers 2013 transect data (Table 1b, at end of outline)

3.5.1.1.1.2 Power to achieve 20-20-20 range for PISCO Cardiff RBSP data – range N=2 to 68; mean of range (N=16)

3.5.1.1.1.3 Changing from transects to targeted density sampling within surfgrass and relying on the inventory to capture spatial extent is expected to increase power over that met in the analyzed data.

3.6 Sampling Schedule

3.6.1 Pre-Construction Survey

3.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

3.6.2 Post-Construction Survey

3.6.2.1 Spring (April through June) and Fall (August through November) following construction

3.7 Analytical Techniques

3.7.1 Surfgrass is to be assessed based on a composite of areal extend of mapped surfgrass habitat times the mean percent cover of surfgrass within the mapped beds

3.7.1.1 Annual change in surfgrass from pre-nourishment census compared to similar features at reference areas. Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics.

3.7.1.2 Detected differences do not indicate that a difference is an adverse project effect as discussed below

- 3.8 Determination of Impact/Adverse Change
  - 3.8.1 Adverse effects are associated with the loss or reduction of intertidal surfgrass or the reduction of surfgrass coverage within a bed due to an increase or persistence of project sand at elevated levels thereby resulting in bed senescence or thinning.
  - 3.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.
- 3.9 Adaptive Management
  - 3.9.1 From Direct Impact
    - 3.9.1.1 Adjust/modify receiver site footprint
  - 3.9.2 From Indirect Impact
    - 3.9.2.1 Reduction of rocky habitat due to burial
      - 3.9.2.1.1 Adjust/modify receiver site footprint
      - 3.9.2.1.2 Adjust volume of future nourishment cycles
      - 3.9.2.1.3 Adjust grain size of material for future nourishment cycles
    - 3.9.2.2 Scour associated w/ increased sedimentation
      - 3.9.2.2.1 Adjust/modify receiver site footprint
      - 3.9.2.2.2 Adjust volume of future nourishment cycles
      - 3.9.2.2.3 Adjust grain size of material for future nourishment cycles

4.0 Rocky Intertidal (Boulder Field)

4.1 Existing Conditions at Broad Beach/Lechuza Cove

4.1.1 Summary of Previous Studies/Data

4.1.1.1 Marine Protected Area (MPA)

4.1.1.1.1 Habitat mapping via multi-spectral imaging

4.1.1.2 Chambers

4.1.1.2.1 Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

4.1.1.2.2 Chambers 2013a - Quantitative surveys of rocky intertidal and sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach (Table 1 a and b)

4.1.1.3 Merkel & Associates 2014 – Mapping of intertidal habitat

4.2 Reference Sites

4.2.1 Selection Criteria

4.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat

4.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity

4.2.1.3 Similar coastal orientation (southerly)

4.2.1.4 Similar sediment sources

4.2.1.5 Similar habitat features of interest as project area

4.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features)

4.2.2 Potential Reference Sites (Table 2)

4.2.2.1 Old Stairs

4.2.2.1.1 Summary of Previous Studies/Data

4.2.2.1.1.1 Biodiversity Surveys (2001 and 2008)

4.2.2.1.1.2 Long-term (since 1994)

4.2.2.2 Deer Creek

4.2.2.2.1 Summary of Previous Studies/Data

4.2.2.2.1.1 Biodiversity Survey (2013)

4.2.2.3 Sequit Point/Leo Carillo

4.2.2.3.1 Summary of Previous Studies/Data

4.2.2.3.1.1 Biodiversity Surveys (2009 and 2013)

4.2.2.4 El Pescador

4.2.2.4.1 Summary of Previous Studies/Data

4.2.2.4.1.1 M&A/Chambers (2016)

4.2.2.5 Point Dume

4.2.2.5.1 Summary of Previous Studies/Data

4.2.2.5.1.1 Biodiversity Survey (2013)

- 4.2.2.6 Paradise Cove
  - 4.2.2.6.1 Summary of Previous Studies/Data
    - 4.2.2.6.1.1 Biodiversity Surveys (2001, 2006, and 2010)
    - 4.2.2.6.1.2 Long-term (since 1994)
- 4.2.2.7 Malibu Bluffs
  - 4.2.2.7.1 Summary of Previous Studies/Data
    - 4.2.2.7.1.1 M&A/Chambers (2016)

- 4.2.3 Selected Reference Site (Table 3)
  - 4.2.3.1 Leo Carillo
  - 4.2.3.2 El Pescador
  - 4.2.3.3 Paradise Cove
  - 4.2.3.4 Malibu Bluffs

4.3 Potential Project-Related Change to Habitat and/or Habitat Quality

- 4.3.1 Direct (i.e., within fill footprint)
- 4.3.2 Indirect
  - 4.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat
    - 4.3.2.1.1 Decrease in rocky habitat may result in change or potential decrease of indicator species
  - 4.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat
    - 4.3.2.2.1 Increase in rocky habitat may result in change or potential increase of indicator species

4.4 Habitat Mapping

- 4.4.1 UAV census (intertidal)
- 4.4.2 Interferometric sidescan sonar census (low intertidal)
- 4.4.3 Project sand distribution mapping

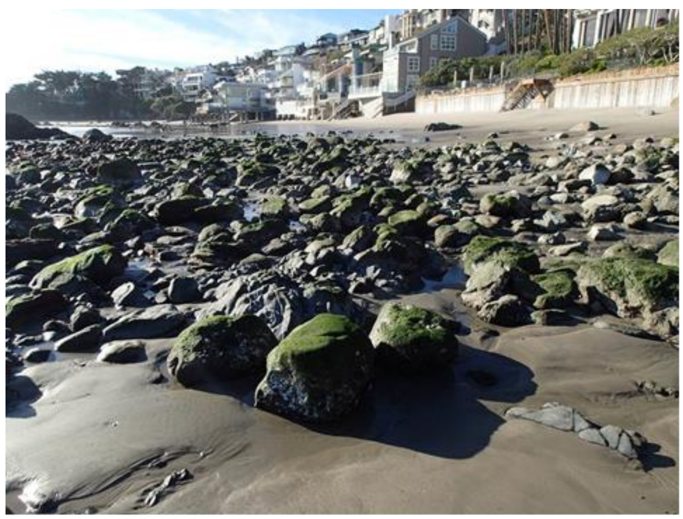
4.5 Habitat Quality

- 4.5.1 Indicator species (Sampling for indicators of persistence of habitat and moderate and low sand influence).
  - 4.5.1.1 The mix of organisms may vary for many reasons unrelated to sand influence for this reason, the absolute percent cover of persistent indicators will be used as a metric for scour and burial impact.
  - 4.5.1.2 Monitoring is to be by fixed photo quadrats (located by dGPS)
- 4.5.2 Indicator sampling methods
  - 4.5.2.1 Photo quadrats to assess indicator species status
    - 4.5.2.1.1 0.5 x 0.5 m (1/4 m2 quadrat) sampling
    - 4.5.2.1.2 Based on barnacles alone the power analyses suggests that an N=200 would be required using Chambers 2013 quadrat data (Table 1a)
    - 4.5.2.1.3 However, by pooling indicator status and using pooled persistent species and omitting neutral species the variance may be controlled and the replication requirement is expected to be lowered somewhat. However, because the

boulder field is very sand affected as it presently exists, it is not believed that adequate persistent indicators occur within this habitat to support a statistical evaluation with pseudo-independent sampling that would achieve the 20-20-20 requirements in a test of the null hypothesis that project sand does not affect this habitat feature.

4.5.2.2 Characterize extent of sanding within the mapped boulder field.

4.5.2.2.1 10-meter point-intercept transects are proposed to be extended through the boulder field to determine the extent of sand and rock present within the field. Using Chambers 2013 transect data (Table 1b) power analyses suggest that a low N=2 is required to characterize the extent of sand and rock in the field. However, having reviewed the boulder field, it is believed that a greater replication is truly required and that the low replication suggested is an artifact of limited initial sampling and coincidence. For this reason, a replication of N=8 is recommended.



4.6 Sampling Schedule

4.6.1 Pre-Construction Survey

4.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

4.6.2 Post-Construction Survey

4.6.2.1 Spring (April through June) and Fall (August through November) following construction

4.7 Analytical Techniques

4.7.1 Habitat Mapping (habitat area x percent rock from transect sampling)

4.7.1.1 Annual change in featured habitat from pre-nourishment census compared to similar features at reference areas. Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics.

4.7.1.2 Each Primary Habitat Feature would be examined by range comparisons.

4.7.1.3 Detected differences do not indicate that a difference is an adverse effect as discussed below.

4.7.2 Habitat Quality

4.7.2.1 **(NOT BELIEVED POSSIBLE TO MEET STATISTICAL REQUIREMENTS)** Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change for a given indicator at Broad Beach not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.

4.8 Determination of Impact/Adverse Change

4.8.1 Adverse effects are associated with the loss or reduction of hard-bottom substrata and/or a reduction of low scour or sand burial indicator species due to an increase or persistence of project sand at elevated levels **(LIKELY DROP SECOND ELEMENT AS NOT TESTABLE IN THE SAND IMPACTED BOULDER FIELD)**.

4.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

4.9 Adaptive Management

4.9.1 From Direct Impact

4.9.1.1 Adjust/modify receiver site footprint

4.9.2 From Indirect Impact

4.9.2.1 Reduction of rocky habitat due to burial

- 4.9.2.1.1 Adjust/modify receiver site footprint
- 4.9.2.1.2 Adjust volume of future nourishment cycles
- 4.9.2.1.3 Adjust grain size of material for future nourishment cycles

4.9.2.2 Scour associated w/ increased sedimentation

- 4.9.2.2.1 Adjust/modify receiver site footprint
- 4.9.2.2.2 Adjust volume of future nourishment cycles
- 4.9.2.2.3 Adjust grain size of material for future nourishment cycles

4.9.2.3 Grain size effects

- 4.9.2.3.1 Adjust/modify receiver site footprint
- 4.9.2.3.2 Adjust volume of future nourishment cycles
- 4.9.2.3.3 Adjust grain size of material for future nourishment cycles

5.0 Sandy Beach

- 5.1 Existing Conditions at Broad Beach/Lechuza Cove
  - 5.1.1 Summary of Previous Studies/Data
    - 5.1.1.1 Marine Protected Area (MPA)
      - 5.1.1.1.1 Habitat mapping via multi-spectral imaging
    - 5.1.1.2 Chambers
      - 5.1.1.2.1 Chambers 2012 - Survey of Marine Biological Resources of Broad Beach
      - 5.1.1.2.2 Chambers 2013a - Quantitative surveys of sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach (Table 5)
    - 5.1.1.3 Merkel & Associates 2014 – Mapping of intertidal habitat
- 5.2 Reference Sites
  - 5.2.1 Selection Criteria
    - 5.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat
    - 5.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity
    - 5.2.1.3 Similar coastal orientation (southerly)
    - 5.2.1.4 Similar sediment sources
    - 5.2.1.5 Similar habitat features of interest as project area
    - 5.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features)
  - 5.2.2 Potential Reference Sites (Table 2)
    - 5.2.2.1 Sequit Point/Leo Carillo
      - 5.2.2.1.1 Summary of Previous Studies/Data
        - 5.2.2.1.1.1 MPA Baseline Survey (2015)
    - 5.2.2.2 El Pescador
      - 5.2.2.2.1 Summary of Previous Studies/Data
        - 5.2.2.2.1.1 M&A/Chambers (2016)
    - 5.2.2.3 Point Dume
      - 5.2.2.3.1 Summary of Previous Studies/Data
        - 5.2.2.3.1.1 MPA Baseline Survey (2015)
    - 5.2.2.4 Zuma Beach
      - 5.2.2.4.1 Summary of Previous Studies/Data
        - 5.2.2.4.1.1 Chambers 2013a - Quantitative surveys of sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach
  - 5.2.3 Sample Locations
    - 5.2.3.1 Broad Beach (Project Site)

5.2.3.2 Broad Beach west of the replenishment area (per CDP condition);
5.2.3.3 Zuma Beach east of the replenishment area (per CDP condition);
5.2.3.4 Leo Carillo (Reference Site; served as MPA monitoring location); and
5.2.3.5 Point Dume (Reference Site; served as MPA monitoring location)

5.3 Potential Project-Related Change to Habitat and/or Habitat Quality

5.3.1 Direct (i.e., within fill footprint)

5.3.2 Indirect

5.3.2.1 Transport of project sand outside fill footprint

5.4 Habitat Mapping

5.4.1 UAV census (intertidal) – Includes quantification of kelp wrack as a percent of the beach area available

5.4.2 Interferometric sidescan sonar census (low intertidal)

5.4.3 Project sand distribution mapping

5.5 Habitat Quality

5.5.1 Transect sampling of composited cores

5.5.1.1 Shore normal transects (40 core samples (10 cm dia. x 20 cm deep) evenly distributed between the wrackline and the swash zone, composited to single sample (meets Schlacher *et al.* 2008 sample area recommendation of $0.3m^2$ per sample)

5.5.1.2 Replicate samples are based on indicator species abundance for *Emerita analoga*. Using Chambers 2013 intertidal data (based on individual cores as the sample with a sample size of N=5, a power analyses would indicate the need for an **N = 239 (1,195 SAMPLES ACROSS 5 SITES PER EVENT)**. This estimator of sample size required is likely an over estimate based on several factors. First, the area of the sample is only 2.7 percent of that recommended by Schlacher *et al.* 2008 for sandy beach assessments. Second, the samples taken by Chambers were distributed at variable tidal zones for inventory purposes rather than analyses while the composite sampling approach recommended would capture the width of the intertidal zone in every sample. Finally, the Chambers' sampling was performed in June (spring) and thus was subject to immense recruitment period variability in organism counts (Table 4). For the MPA monitoring, it was noted that *Emerita* varied by orders of magnitude across beaches and seasons. (**REPLICATION FOR BEACH SAMPLING REMAINS PROBLEMATIC – IT MAY BE MORE APPROPRIATE TO CHOSE A DIFFERENT METRIC FOR BEACH ASSESSMENT TO ACHIEVE THE 20-20-20 STANDARD DO TO HIGH VARIABILITY IN ORGANISM ABUNDANCE, PATCHINESS OF DISTRIBUTION, AND SEASONALITY. INVESTIGATIONS ARE UNDERWAY TO EXAMINE POTENTIAL FOR USING SPECIES RICHNESS OR ANOTHER METRIC FOR ASSESSMENT THAT MAY REQUIRE LOWER REPLICATION)**

5.6 Sampling Schedule

5.6.1 Pre-Construction Survey

5.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

5.6.2 Post-Construction Survey

5.6.2.1 Habitat mapping Spring (April through June) and Fall (August through November) for each year following construction

5.6.2.2 Infaunal sampling to occur in Fall (August through November) each year following construction

5.6.2.3 Physical monitoring of project sand distribution to occur in Spring (April through June) and Fall (August through November) each year post-construction.

5.7 Analytical Techniques

5.7.1 Habitat Mapping

5.7.1.1 Annual change in featured habitat (sandy beach area and percent kelp wrack) from pre-nourishment census compared to similar features at reference areas. Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics.

5.7.1.2 Kelp wrack would be examined by range comparisons.

5.7.1.3 Project sand distribution mapping would be assessed as an areal extent deviation from: 1) the initial placement footprint, and 2) model predictions of sand distribution over time. The assessment will be based on mean (or median) grain size differences from pre-project Spring and Fall sampling results.

5.7.1.4 Detected differences do not indicate that a difference is an adverse effect as discussed below.

5.7.2 Habitat Quality

5.7.2.1 Community richness (detect 80% of organisms present)

5.7.2.1.1 Analyses will examine changes in community richness on the project beach and potentially affected adjacent beaches. Estimators of species richness will be based on species-accumulation curves derived from randomly drawn subsamples as well as Total Species (T-S) curve that is obtained by calculation of the species–accumulation curve for all combinations of samples. The (T–S) curve can then be extrapolated to estimate the probable total number of species in the area studied (Ugland et al. 2003. The species-accumulation curve and estimation of species richness. J. Animal Ecol.).

5.7.2.2 Abundance of *Emerita analog* as dominant indicator species

5.7.2.2.1 Density of Emerita analog will be compared between pre-construction and post-construction Fall survey results for Broad Beach, potentially affected adjacent beaches (Lechuza Cove, Zuma Beach), and outside reference sites.

5.7.2.3 Statistical design for both richness and indicator abundance will follow Beyond-BACI design similar to Schlacher et al. (2012) using an asymmetrical ANOVA with response variables including species richness (S) and the total abundance (N) of macroinvertebrates

5.8 Determination of Impact/Adverse Change

5.8.1 Habitat Mapping

5.8.2 Habitat Quality

5.8.2.1 Documented spread of project sand influence beyond that predicted by modeling and an associated reduction in species richness or abundance of Emerita beyond 20 percent reduction from that observed at the lowest performing reference site condition

5.8.2.2 An impact will be indicated by statistically significant Treatment × Time interaction, while no impact or recovery will be indicated by non-significant Treatment × Time interactions when the effect is set at a 20 percent change.

5.9 Adaptive Management

5.9.1 From Direct Impact

5.9.1.1 Adjust/modify receiver site footprint

5.9.2 From Indirect Impact

5.9.2.1 Grain size effects

5.9.2.1.1 Adjust/modify receiver site footprint

5.9.2.1.2 Adjust volume of future nourishment cycles

5.9.2.1.3 Adjust grain size of material for future nourishment cycles

6.0 Rocky reef with kelp (kelp forest)

- 6.1 Existing Conditions at Broad Beach/Lechuza Cove
  - 6.1.1 Summary of Previous Studies/Data
    - 6.1.1.1 Marine Protected Area (MPA)
      - 6.1.1.1.1 Habitat mapping via multi-spectral imaging
    - 6.1.1.2 Chambers
      - 6.1.1.2.1 Chambers 2012 - Survey of Marine Biological Resources of Broad Beach
    - 6.1.1.3 Merkel & Associates 2014 – Mapping of habitat, diving survey
- 6.2 Reference Sites
  - 6.2.1 Selection Criteria
    - 6.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat
    - 6.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity
    - 6.2.1.3 Similar coastal orientation (southerly)
    - 6.2.1.4 Similar sediment sources
    - 6.2.1.5 Similar habitat features of interest as project area
    - 6.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features)
  - 6.2.2 Potential Reference Sites
    - 6.2.2.1 Old Stairs
      - 6.2.2.1.1 Summary of Previous Studies/Data
        - 6.2.2.1.1.1 No subtidal data
    - 6.2.2.2 Deer Creek
      - 6.2.2.2.1 Summary of Previous Studies/Data
        - 6.2.2.2.1.1 No subtidal data
    - 6.2.2.3 Leo Carillo
      - 6.2.2.3.1 Summary of Previous Studies/Data
        - 6.2.2.3.1.1 PISCO/MPA Surveys (2008, 2011, 2012)
    - 6.2.2.4 El Pescador
      - 6.2.2.4.1 Summary of Previous Studies/Data
        - 6.2.2.4.1.1 PISCO/MPA Surveys (2011, 2012)
    - 6.2.2.5 Paradise Cove
      - 6.2.2.5.1 Summary of Previous Studies/Data
        - 6.2.2.5.1.1 PISCO/MPA Surveys (2008, 2011, 2012)
    - 6.2.2.6 Point Dume
      - 6.2.2.6.1 Summary of Previous Studies/Data
        - 6.2.2.6.1.1 PISCO/MPA Surveys (2008, 2011, 2012)
    - 6.2.2.7 Malibu Bluffs

6.2.2.7.1 Summary of Previous Studies/Data

6.2.2.7.1.1 PISCO (2004)

6.2.3 Selected Reference Site (Table 3)

6.2.3.1 Leo Carillo

6.2.3.2 El Pescador

6.2.3.3 Paradise Cove

6.2.3.4 Malibu Bluffs

6.3 Potential Project-Related Change to Habitat and/or Habitat Quality

6.3.1 Direct (i.e., within fill footprint)

6.3.2 Indirect

6.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

6.3.2.1.1 Decrease in rocky habitat may result in change or potential decrease of indicator species

6.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

6.3.2.2.1 Increase in rocky habitat may result in change or potential increase of indicator species

6.4 Habitat Mapping

6.4.1 UAV census (shallow subtidal fringe)

6.4.2 Interferometric Sidescan Sonar census (all subtidal areas)

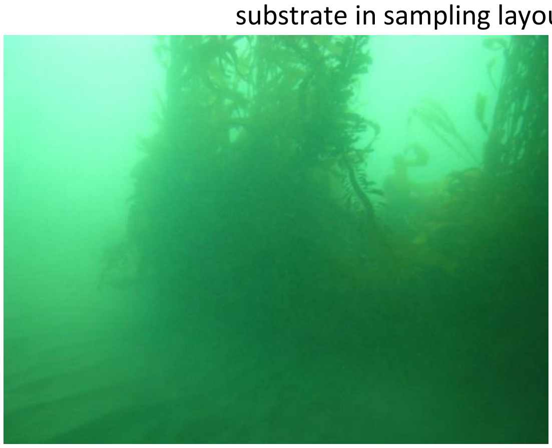
6.5 Habitat Quality

6.5.1 Indicators

6.5.1.1 Kelp Canopy

6.5.1.1.1 Regional kelp canopy data from CDFW and Central Region Kelp Survey Consortium with nine delineated survey areas with Lechuza Cove (impact area) and eight reference areas

6.5.1.2 Fixed location diver radial plots intended to fall on rocky reef habitat only. However, small rocks with kelp may preclude 100 percent reef substrate in sampling layout.




6.5.1.2.1 20m^2 plot with a 2.52 m radial plot from center point. Data collected for density of perennial indicator species (mature *Macrocystis, Pterogophora, Muricea*)

6.5.1.2.2 Sampling will include quantification of urchins as potential biotic factors in changing abundance of indicators

6.5.1.2.3 Sampling will include quantification of the percent cover of plot dominated by different substrates (rock, sand, sand on rock)

6.5.1.2.4 Sample Size required based on power analysis is **N=22** using M&A 2014 data (Table 6)

6.6 Sampling Schedule

6.6.1 Pre-Construction Survey

6.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

6.6.2 Post-Construction Survey

6.6.2.1 Spring (April through June) and Fall (August through November) following construction

6.7 Analytical Techniques

6.7.1 Habitat Mapping

6.7.1.1 Annual change in featured habitat from pre-nourishment census compared to similar features at reference areas. Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics.

6.7.1.2 Each Primary Habitat Feature would be examined by range comparisons.

6.7.1.3 Detected differences do not indicate that a difference is an adverse effect as discussed below.

6.7.2 Habitat Quality

6.7.2.1 Kelp Canopy

6.7.2.1.1 Beyond-BACI design with response variable including canopy coverage before and after nourishment

6.7.2.2 Other Indicators

6.7.2.2.1 Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change for a given indicator at Broad Beach not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.

6.8 Determination of Impact/Adverse Change

6.8.1 Adverse effects are associated with the loss or reduction of hard-bottom substrata and/or a reduction of low scour or sand burial indicator species due to an increase or persistence of project sand at elevated levels.

6.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities (e.g., loss of kelp due to urchins would not constitute a project adverse impact, while loss of kelp due to sand overrun would).

6.8.3 Habitat Quality

6.8.3.1 Kelp Canopy

6.8.3.1.1 An impact will be indicated by statistically significant Treatment × Time interaction (i.e. temporal trajectories from before to after the intervention differ between treatment and impact locations) with a 20 percent effect level

6.9 Adaptive Management

6.9.1 From Direct Impact

6.9.1.1 Adjust/modify receiver site footprint

6.9.2 From Indirect Impact

6.9.2.1 Reduction of rocky habitat due to burial

6.9.2.1.1 Adjust/modify receiver site footprint

6.9.2.1.2 Adjust volume of future nourishment cycles

6.9.2.1.3 Adjust grain size of material for future nourishment cycles

6.9.2.2 Scour associated w/ increased sedimentation

6.9.2.2.1 Adjust/modify receiver site footprint

6.9.2.2.2 Adjust volume of future nourishment cycles

6.9.2.2.3 Adjust grain size of material for future nourishment cycles

7.0 Rocky reef without kelp

- 7.1 Existing Conditions at Broad Beach/Lechuza Cove
  - 7.1.1 Summary of Previous Studies/Data
    - 7.1.1.1 Marine Protected Area (MPA)
      - 7.1.1.1.1 Habitat mapping via multi-spectral imaging
    - 7.1.1.2 Chambers
      - 7.1.1.2.1 Chambers 2012 - Survey of Marine Biological Resources of Broad Beach
    - 7.1.1.3 Merkel & Associates 2014 – Mapping of habitat, diving survey
- 7.2 Reference Sites
  - 7.2.1 Selection Criteria
    - 7.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat
    - 7.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity
    - 7.2.1.3 Similar coastal orientation (southerly)
    - 7.2.1.4 Similar sediment sources
    - 7.2.1.5 Similar habitat features of interest as project area
    - 7.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features)
  - 7.2.2 Potential Reference Sites
    - 7.2.2.1 Old Stairs
      - 7.2.2.1.1 Summary of Previous Studies/Data
        - 7.2.2.1.1.1 No subtidal data
    - 7.2.2.2 Deer Creek
      - 7.2.2.2.1 Summary of Previous Studies/Data
        - 7.2.2.2.1.1 No subtidal data
    - 7.2.2.3 Leo Carillo
      - 7.2.2.3.1 Summary of Previous Studies/Data
        - 7.2.2.3.1.1 PISCO/MPA Surveys (2008, 2011, 2012)
    - 7.2.2.4 El Pescador
      - 7.2.2.4.1 Summary of Previous Studies/Data
        - 7.2.2.4.1.1 PISCO/MPA Surveys (2011, 2012)
    - 7.2.2.5 Paradise Cove
      - 7.2.2.5.1 Summary of Previous Studies/Data
        - 7.2.2.5.1.1 PISCO/MPA Surveys (2008, 2011, 2012)
    - 7.2.2.6 Point Dume
      - 7.2.2.6.1 Summary of Previous Studies/Data
        - 7.2.2.6.1.1 PISCO/MPA Surveys (2008, 2011, 2012)
    - 7.2.2.7 Malibu Bluffs

7.2.2.7.1 Summary of Previous Studies/Data

7.2.2.7.1.1 PISCO (2004)

7.2.3 Selected Reference Site (Table 3)

7.2.3.1 Leo Carillo

7.2.3.2 El Pescador

7.2.3.3 Paradise Cove

7.2.3.4 Malibu Bluffs

7.3 Potential Project-Related Change to Habitat and/or Habitat Quality

7.3.1 Direct (i.e., within fill footprint)

7.3.2 Indirect

7.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

7.3.2.1.1 Decrease in rocky habitat may result in change or potential decrease of indicator species

7.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

7.3.2.2.1 Increase in rocky habitat may result in change or potential increase of indicator species

7.4 Habitat Mapping

7.4.1 UAV census

7.4.2 Interferometric sidescan sonar census

7.5 Habitat Quality

7.5.1 Indicators (Table 6)

7.5.1.1 Quadrats **(N=22)** for indicator species (same as Section 4.5.1.2)

7.5.1.1.1 Substrate

7.5.1.1.2 Urchins

7.6 Sampling Schedule

7.6.1 Pre-Construction Survey

7.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

7.6.2 Post-Construction Survey

7.6.2.1 Spring (April through June) and Fall (August through November) following construction

7.7 Analytical Techniques

7.7.1 Habitat Mapping

7.7.1.1 Annual change in featured habitat from pre-nourishment census compared to similar features at reference areas. Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics.

7.7.1.2 Each Primary Habitat Feature would be examined by range comparisons.

7.7.1.3 Detected differences do not indicate that a difference is an adverse effect as discussed below.

7.7.2 Habitat Quality

7.7.2.1 Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change for a given indicator at Broad Beach not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.

7.8 Determination of Impact/Adverse Change

7.8.1 Adverse effects are associated with the loss or reduction of hard-bottom substrata and/or a reduction of low scour or sand burial indicator species due to an increase or persistence of project sand at elevated levels.

7.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

7.9 Adaptive Management

7.9.1 From Direct Impact

7.9.1.1 Adjust/modify receiver site footprint

7.9.2 From Indirect Impact

7.9.2.1 Reduction of rocky habitat due to burial

7.9.2.1.1 Adjust/modify receiver site footprint

7.9.2.1.2 Adjust volume of future nourishment cycles

7.9.2.1.3 Adjust grain size of material for future nourishment cycles

7.9.2.2 Scour associated w/ increased sedimentation

7.9.2.2.1 Adjust/modify receiver site footprint

7.9.2.2.2 Adjust volume of future nourishment cycles

7.9.2.2.3 Adjust grain size of material for future nourishment cycles

8.0 Rocky reef with surfgrass

8.1 Existing Conditions at Broad Beach/Lechuza Cove

8.1.1 Summary of Previous Studies/Data

8.1.1.1 Marine Protected Area (MPA)

8.1.1.1.1 Habitat mapping via multi-spectral imaging

8.1.1.2 Chambers

8.1.1.2.1 Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

8.1.1.3 Merkel & Associates 2014 – Mapping of habitat, diving survey

8.2 Reference Sites

8.2.1 Selection Criteria

8.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat

8.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity

8.2.1.3 Similar coastal orientation (southerly)

8.2.1.4 Similar sediment sources

8.2.1.5 Similar habitat features of interest as project area

8.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features)

8.2.2 Potential Reference Sites

8.2.2.1 Old Stairs

8.2.2.1.1 Summary of Previous Studies/Data

8.2.2.1.1.1 No subtidal data

8.2.2.2 Deer Creek

8.2.2.2.1 Summary of Previous Studies/Data

8.2.2.2.1.1 No subtidal data

8.2.2.3 Leo Carillo

8.2.2.3.1 Summary of Previous Studies/Data

8.2.2.3.1.1 PISCO/MPA Surveys (2008, 2011, 2012)

8.2.2.4 El Pescador

8.2.2.4.1 Summary of Previous Studies/Data

8.2.2.4.1.1 PISCO/MPA Surveys (2011, 2012)

8.2.2.5 Paradise Cove

8.2.2.5.1 Summary of Previous Studies/Data

8.2.2.5.1.1 PISCO/MPA Surveys (2008, 2011, 2012)

8.2.2.6 Point Dume

8.2.2.6.1 Summary of Previous Studies/Data

8.2.2.6.1.1 PISCO/MPA Surveys (2008, 2011, 2012)

8.2.2.7 Malibu Bluffs

8.2.2.7.1 Summary of Previous Studies/Data

8.2.2.7.1.1 PISCO (2004)

8.2.3 Selected Reference Site (Table 3)

8.2.3.1 Leo Carillo

8.2.3.2 El Pescador

8.2.3.3 Paradise Cove

8.2.3.4 Malibu Bluffs

8.3 Potential Project-Related Change to Habitat and/or Habitat Quality

8.3.1 Direct (i.e., within fill footprint)

8.3.2 Indirect

8.3.2.1 Increase in sandy habitat – implies decrease in rocky habitat

8.3.2.1.1 Decrease in rocky habitat may result in change or potential decrease of indicator species

8.3.2.2 Decrease in sandy habitat – implies increase in rocky habitat

8.3.2.2.1 Increase in rocky habitat may result in change or potential increase of indicator species

8.4 Habitat Mapping

8.4.1 UAV census (shallow)

8.4.2 Interferometric sidescan sonar census (deeper fringe to shallow)

8.5 Habitat Quality

8.5.1 Indicators (0.5m x 0.5m quadrat sampling for surfgrass coverage and substrate percent sand)

8.5.1.1 Subtidal Surfgrass

8.5.1.1.1 **N=198** using M&A 2014 data (Table 6). Transect sampling not targeting surfgrass and thus higher variance than would be expected by quadrat sampling of surfgrass beds. It is unlikely that 198 independent samples could be taken within subtidal beds. Power analysis is to be performed on randomly selected quadrats from first sampling event to determine ultimate number of samples required. The total sampling effort would then be reduced to the level required based on sampling performed.

8.6 Sampling Schedule

8.6.1 Pre-Construction Survey

8.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

8.6.2 Post-Construction Survey

8.6.2.1 Spring (April through June) and Fall (August through November) following construction

8.7 Analytical Techniques

8.7.1 Habitat Mapping and Habitat Quality as combined metric

8.7.1.1 The mapped areal cover is to be multiplied by the mean percentage of surfgrass within sampled quadrats for each sampled site (Lechuza Point and reference sites).

8.7.1.2 Annual percentage change in subtidal surfgrass habitat from pre-nourishment census compared to similar features at reference areas (based on the mean of the Spring and Fall surveys). Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics.

8.7.1.3 The percent change values would be examined by range comparisons using a one-tail t-test.

8.7.1.4 Detected differences do not indicate that a difference is an adverse effect as discussed below.

8.8 Determination of Impact/Adverse Change

8.8.1 An adverse effect occurs when: 1) loss or reduction of surfgrass is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

8.9 Adaptive Management

8.9.1 From Direct Impact

8.9.1.1 Adjust/modify receiver site footprint

8.9.2 From Indirect Impact

8.9.2.1 Reduction of rocky habitat and loss of surfgrass due to prolonged or deep burial

8.9.2.1.1 Adjust/modify receiver site footprint

8.9.2.1.2 Adjust volume of future nourishment cycles

8.9.2.1.3 Adjust grain size of material for future nourishment cycles

8.9.2.2 Scour associated w/ increased sedimentation

8.9.2.2.1 Adjust/modify receiver site footprint

8.9.2.2.2 Adjust volume of future nourishment cycles

8.9.2.2.3 Adjust grain size of material for future nourishment cycles

9.0 Unconsolidated habitat with eelgrass

9.1 Existing Conditions at Broad Beach/Lechuza Cove

9.1.1 Summary of Previous Studies/Data

9.1.1.1 Marine Protected Area (MPA)

9.1.1.1.1 Habitat mapping via multi-spectral imaging

9.1.1.2 Chambers

9.1.1.2.1 Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

9.1.1.3 Merkel & Associates 2014 – Mapping of intertidal habitat, diving survey

9.2 Reference Sites

9.2.1 Selection Criteria

9.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat

9.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity

9.2.1.3 Similar coastal orientation (southerly)

9.2.1.4 Similar sediment sources

9.2.1.5 Similar habitat features of interest as project area

9.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features)

9.2.2 Potential Reference Sites (Table 2)

9.2.2.1 Old Stairs

9.2.2.1.1 Summary of Previous Studies/Data

9.2.2.1.1.1 NMFS Regional Eelgrass (Merkel 2015)

9.2.2.2 Deer Creek

9.2.2.2.1 Summary of Previous Studies/Data

9.2.2.2.1.1 NMFS Regional Eelgrass (Merkel 2015)

9.2.2.3 Leo Carillo

9.2.2.3.1 Summary of Previous Studies/Data

9.2.2.3.1.1 NMFS Regional Eelgrass (Merkel 2015)

9.2.2.3.1.2 PISCO/MPA Surveys (2008, 2011, 2012)

9.2.2.4 El Pescador

9.2.2.4.1 Summary of Previous Studies/Data

9.2.2.4.1.1 NMFS Regional Eelgrass (Merkel 2015)

9.2.2.4.1.2 PISCO/MPA Surveys (2011, 2012)

9.2.2.5 Paradise Cove

9.2.2.5.1 Summary of Previous Studies/Data

9.2.2.5.1.1 NMFS Regional Eelgrass (Merkel 2015)

9.2.2.5.1.2 PISCO/MPA Surveys (2008, 2011, 2012)

9.2.2.6 Point Dume

9.2.2.6.1 Summary of Previous Studies/Data

9.2.2.6.1.1 NMFS Regional Eelgrass (Merkel 2015)

9.2.2.6.1.2 PISCO/MPA Surveys (2008, 2011, 2012)

9.2.2.7 Malibu Bluffs

9.2.2.7.1 Summary of Previous Studies/Data

9.2.2.7.1.1 NMFS Regional Eelgrass (Merkel 2015)

9.2.2.7.1.2 PISCO (2004)

9.2.3 Selected Reference Site (Table 3) Based on presence of resource, proximity, and bracketing project site

9.2.3.1 Leo Carillo

9.2.3.2 El Pescador

9.2.3.3 Malibu Bluffs

9.3 Potential Project-Related Change to Habitat and/or Habitat Quality

9.3.1 Direct (i.e., within fill footprint)

9.3.2 Indirect

9.3.2.1 Transport of project sand outside fill footprint

9.4 Habitat Mapping

9.4.1 Interferometric sidescan sonar census

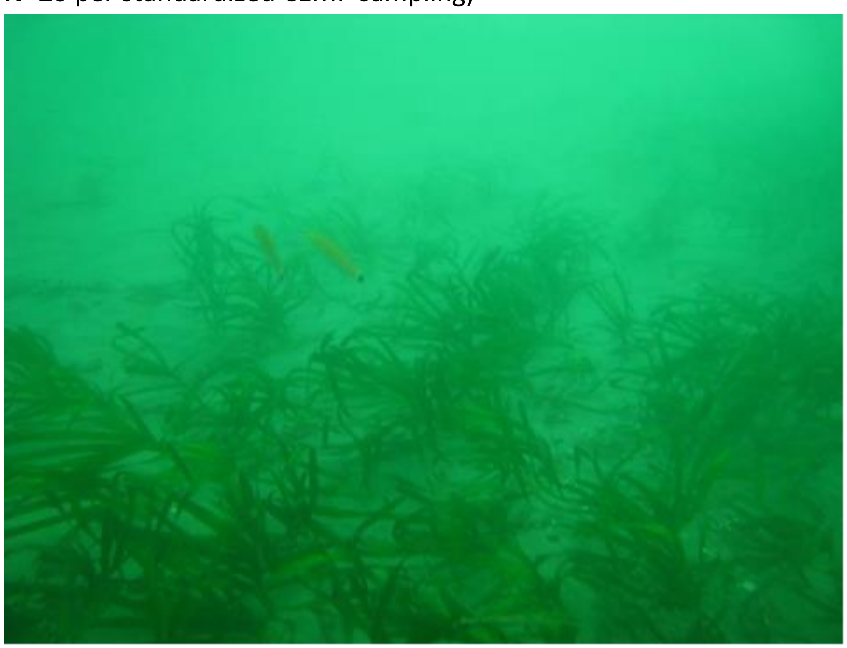
9.4.2 Project sand grain size mapping

9.5 Habitat Quality

9.5.1 Shoot density indicators

9.5.1.1 Eelgrass turion density based on 1/16 m^2 quadrat sampling

9.5.1.2 Broad Beach 2014 data power analysis suggests N=2 adequate (use **N=20** per standardized CEMP sampling)



- 9.6 Sampling Schedule
  - 9.6.1 Pre-Construction Survey
    - 9.6.1.1 Spring (April through June) and Fall (August through November) prior to construction
  - 9.6.2 Post-Construction Survey
    - 9.6.2.1 Spring (April through June) and Fall (August through November) following construction
- 9.7 Analytical Techniques
  - 9.7.1 Habitat Mapping
    - 9.7.1.1 Annual change in featured habitat from pre-nourishment census compared to similar features at reference areas. Comparison of extent change to follow CEMP protocols for assessment of affect.
  - 9.7.2 Habitat Quality
    - 9.7.2.1 Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change in turion density within the Broad Beach beds are not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.
    - 9.7.2.2 Detected differences do not indicate that a difference is an adverse effect as discussed below.
- 9.8 Determination of Impact/Adverse Change
  - 9.8.1 Adverse effects are associated with the loss or reduction of indicator species due to an increase or persistence of project sand at elevated levels.
  - 9.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.
- 9.9 Adaptive Management
  - 9.9.1 From Direct Impact
    - 9.9.1.1 Adjust/modify receiver site footprint
  - 9.9.2 From Indirect Impact
    - 9.9.2.1 Grain size effects
      - 9.9.2.1.1 Adjust/modify receiver site footprint
      - 9.9.2.1.2 Adjust volume of future nourishment cycles
      - 9.9.2.1.3 Adjust grain size of material for future nourishment cycles

10.0 Unconsolidated habitat without eelgrass (subunits: sand dollar beds, shell hash rips)

10.1 Existing Conditions at Broad Beach/Lechuza Cove

10.1.1 Summary of Previous Studies/Data

10.1.1.1 Marine Protected Area (MPA)

10.1.1.1.1 Habitat mapping via multi-spectral imaging

10.1.1.2 Chambers

10.1.1.2.1 Chambers 2012 - Survey of Marine Biological Resources of Broad Beach

10.1.1.2.2 Chambers 2013a - Quantitative surveys of rocky intertidal and sandy beach habitats at Broad Beach, Zuma Beach, and El Matador Beach (Table 4)

10.1.1.3 Merkel & Associates 2014 – Mapping of intertidal habitat, diving survey

10.2 Reference Sites

10.2.1 Selection Criteria

10.2.1.1 Similar physical characteristics - rocky headland with rocky intertidal (bedrock and boulder/cobble) and subtidal habitat with adjacent sandy beach and sandy subtidal habitat

10.2.1.2 Location and proximity – Close enough to be subjected to similar regional changes in oceanographic conditions, but removed from project-related activity

10.2.1.3 Similar coastal orientation (southerly)

10.2.1.4 Similar sediment sources

10.2.1.5 Similar habitat features of interest as project area

10.2.1.6 Multiple habitat features of interest (i.e., can serve as reference site for other habitat features)

10.2.2 Potential Reference Sites (Table 2)

10.2.2.1 Old Stairs

10.2.2.1.1 Summary of Previous Studies/Data

10.2.2.1.1.1 No subtidal data

10.2.2.2 Deer Creek

10.2.2.2.1 Summary of Previous Studies/Data

10.2.2.2.1.1 No subtidal data

10.2.2.3 Leo Carillo

10.2.2.3.1 Summary of Previous Studies/Data

10.2.2.3.1.1 PISCO/MPA Surveys (2008, 2011, 2012)

10.2.2.4 El Pescador

10.2.2.4.1 Summary of Previous Studies/Data

10.2.2.4.1.1 PISCO/MPA Surveys (2011, 2012)

10.2.2.5 Paradise Cove

10.2.2.5.1 Summary of Previous Studies/Data

10.2.2.5.1.1 PISCO/MPA Surveys (2008, 2011, 2012)

10.2.2.6 Point Dume

10.2.2.6.1 Summary of Previous Studies/Data

10.2.2.6.1.1 PISCO/MPA Surveys (2008, 2011, 2012)

10.2.2.7 Malibu Bluffs

10.2.2.7.1 Summary of Previous Studies/Data

10.2.2.7.1.1 PISCO (2004)

10.2.3 Selected Reference Site (Table 3)

10.2.3.1 Leo Carillo

10.2.3.2 El Pescador

10.2.3.3 Paradise Cove

10.2.3.4 Malibu Bluffs

10.3 Potential Project-Related Change to Habitat and/or Habitat Quality

10.3.1 Direct (i.e., within fill footprint)

10.3.2 Indirect

10.3.2.1 Transport of project sand outside fill footprint

10.4 Habitat Mapping

10.4.1 UAV census

10.4.2 Interferometric Sidescan Sonar census (including mapping of shell hash rips and sand dollar beds if present)

10.4.3 Project sand grain size distribution map

10.5 Habitat Quality

10.5.1 Indicators

10.5.1.1 Sand dollar bed sampling, if present within the project area during baseline investigations, sampling will be done by quadrat sampling. Sampled using randomly placed 0.5m x 0.5m quadrats within mapped sand dollar beds for percent bottom cover. If sand dollars are present at project site, similar beds will be sought at reference sites or nearby.

10.5.1.1.1 At present sand dollar beds have not been identified at Broad Beach and it is not expected that sampling will occur for this resource.

10.5.1.2 Pismo clams are not known to occur in high numbers in the region and were not detected during Merkel and Chambers field surveys. This species is generally uncommon along the coast between Ventura and San Diego with MPA sandy beach monitoring program not locating Pismo clams at any of six beach sampling sites from Leo Carrillo to San Elijo (Dugan et al. 2015). As a result, it is expected that encounters in the subtidal would be extremely rare. For this reason, no sampling for Pismo clams is proposed subtidally. Pismo clams would be expected to be noted as juveniles if they occur intertidally as a result of the sand beach sampling.

10.6 Sampling Schedule

10.6.1 Pre-Construction Survey

10.6.1.1 Spring (April through June) and Fall (August through November) prior to construction

10.6.2 Post-Construction Survey

10.6.2.1 Spring (April through June) and Fall (August through November) following construction

10.7 Analytical Techniques

10.7.1 Habitat Mapping

10.7.1.1 Annual change in featured habitat from pre-nourishment census compared to similar features at reference areas. Using a determination of similarity employed for the Wheeler North Reef (Range Test), a particular habitat feature or performance variable at Broad Beach would be considered similar if annual percent change falls within the range of values observed at any reference area. Therefore, for a change to be determined to have occurred, the Broad Beach metrics must fall outside of the range of any reference area equivalent metrics. It is not anticipated that the project could result in a reduction of sand in the habitat mapping and therefore this would be evaluated as a one-tailed test.

10.7.1.2 Documented spread of project sand based on grain size mapping beyond that predicted by modeling that results in a 20 percent increase in the grain size from native

10.7.1.3 If sand dollar beds are encountered and therefore tracked, this habitat element would be examined as range comparisons with reference site beds for change over time in cover adjusted mapped area (i.e., the mean percent cover as determined by quadrat sampling times the total mapped bed area). **(SAND DOLLAR BEDS OCCUR IN FINE TO VERY COARSE SEDIMENTS AND THEIR OCCURRENCES ARE UNPREDICTABLE AND NOT WELL UNDERSTOOD. DENDRASTER EXCENTRICUS DOES NOT HAVE A PREFERNCE FOR FINE OR COARSE SAND (Timko, P.L. 1975. High-density aggregation in Dendraster excentricus (Eschsholtz). Ph.D. Thesis, U.C. San Diego) AND THUS IT IS NOT CLEAR THAT A TRUE EFFECT NEXUS COULD BE DRAWN BETWEEN SAND DOLLARS AND CHANGING SEDIMENT CHARACTER. M&A DOES NOT THINK THIS IS A GOOD METRIC FOR ASSESSMENT OF EFFECT)**.

10.7.1.4 Detected differences do not indicate that a difference is an adverse effect as discussed below.

10.7.2 Habitat Quality

10.7.2.1 Evaluating whether habitat quality at Broad Beach is performing similarly to that at the reference sites requires that the annual change of sand dollar bed distribution at Broad Beach not be significantly lower than the mean annual change at the lowest performing reference site. Similar to monitoring at the Wheeler North Reef, a one-sample, one-tailed approach will be used for all comparisons.

10.8 Determination of Impact/Adverse Change

10.8.1 Adverse effects are associated with the loss or reduction of indicator species due to an increase or persistence of project sand at elevated levels.

10.8.2 An adverse effect occurs when: 1) loss or reduction is below pre-construction condition; 2) a change beyond reference range is detected; and 3) the effect is due to project sand or activities.

10.9 Adaptive Management

10.9.1 From Direct Impact

10.9.1.1 Adjust/modify receiver site footprint

10.9.2 From Indirect Impact

10.9.2.1 Grain size effects

10.9.2.1.1 Adjust/modify receiver site footprint

10.9.2.1.2 Adjust volume of future nourishment cycles

10.9.2.1.3 Adjust grain size of material for future nourishment cycles

11.0 Marine Habitat Mitigation

11.1 If adverse impacts are detected, mitigation will be required.

11.1.1 The mitigation ratio for impacts upon subtidal rocky or intertidal rocky habitat shall be mitigated at a minimum of 4:1 because of the uncertainty and difficulty of mitigating for these habitats.

11.1.2 Adverse impacts upon eelgrass shall be mitigated according to the California Eelgrass Mitigation Policy. (1.38:1 minimum restoration effort size with a stable mitigation success ratio of 1.2:1)

11.1.3 Upon detection of adverse impacts upon one or more habitats, the applicant, in consultation with the SAP, shall develop a habitat specific mitigation plan for each impacted habitat that will provide the overall framework to guide the mitigation work, for review and approval of the Executive Director.

11.1.4 The revised mitigation and monitoring program shall be processed as an amendment to the coastal development permit unless the Executive Director determines that no permit amendment is required.

11.2 While impact type, scale and capacity to cure through adaptive management activities would govern the determination of best options for habitat mitigation, a starting point would be to use the review of potential subtidal and intertidal habitat compensatory mitigation approaches prepared for the California State Lands Commission EIR document and incorporated in this document as Appendix C.

Table 1a. Rocky Intertidal Indicator Quadrat Data Summary

Percent Cover of Indicators in 0.25-Square-Meter Quadrats						
	Boulder Field (N=16)				Lechuza (N=8)	
HIGH INTERTIDAL	**Mean**	**SD**		**HIGH INTERTIDAL**	**Mean**	**SD**
Bare rock	68.9	28.3		Bare rock	33.7	18.7
Sand	16.6	29.7		Sand	1.5	2.4
Balanus/ Chthamalus	3.8	6.7		Balanus/Chthamalus	29.3	22.8
Ulva/ Enteromorpha	3.8	10.3		Ulva/Enteromorpha	19.2	22.0
Porphyra	1.5	3.8		Other red algae	15.6	12.8
Anthopleura	1.4	2.6		Anthopleura spp.	0.8	1.5
Limpet	0.6	1.2				
Other invertebrate	3.3	4.8				
MID INTERTIDAL	**Mean**	**SD**		**MID INTERTIDAL**	**Mean**	**SD**
Bare Rock	0.4	1.5		Bare rock	6.6	6.0
Sand	66.1	33.2		Sand	1.0	1.9
Egregia	20.0	31.1		Balanus/Chthamalus	2.3	3.7
Ulva/ Enteromorpha	6.4	8.4		Endarachne /Petalonia	0.8	2.2
Other red algae	5.0	8.3		Other red algae	59.0	28.4
Anthopleura	1.9	3.5		Ulva/Enteromorpha	17.4	17.0
Other invertebrate	0.3	1.0		Articulated corallines	0.8	1.5
				Anthopleura spp.	6.9	10.6
LOW INTERTIDAL	**Mean**	**SD**		Other brown algae	4.3	6.9
Sand	47.1	35.8		Diatom	1.3	2.2
Egregia	6.3	11.3				
Chondracanthus canaliculata	0.9	2.5				
Other Invertebrate	0.1	0.5		**LOW INTERTIDAL**	**Mean**	**SD**
Anthopleura	0.4	0.8		Bare rock	1.5	1.8
Articulated corallines	2.4	4.9		Sand	4.3	3.7
Mastocarpus papillatus	12.9	23.4		Phyllospadix	5.7	6.3
Other red algae	27.9	18.7		Articulated corallines	0.3	0.7
Ulva/ Enteromorpha	0.3	1.1		Other red algae	63.5	27.9
Phyllospadix	0.6	1.4		Ulva/Enteromorpha	4.6	7.2
Porphyra	0.1	0.5		Egregia	20.2	28.5
Fabric	0.9	3.6				
Pisaster ochraceus	0.1	0.5				

Table 1b. Rocky Intertidal Indicator Transect Data Summary

Percent Cover of Indicators in 10-Meter Transect						
	Boulder Field (N=4)				Lechuza Cove (N=2)	
HIGH INTERTIDAL	**Mean**	**SD**		**HIGH INTERTIDAL**	**Mean**	**SD**
Boulder	79.6	2.6		Cobble	18.2	6.4
Sand	7.9	4.4		Boulder	77.3	12.9
Porphyra	3.4	4.4		Bedrock	0.0	0.0
Green algae	2.3	2.6		Sand	4.6	6.4
Chthamalus	6.8	5.9		Red algal turf	0.0	0.0
				Phyllospadix	0.0	0.0
				Egregia	0.0	0.0
MID INTERTIDAL	**Mean**	**SD**				
Sand	70.5	16.0		**MID INTERTIDAL**	**Mean**	**SD**
Anthopleura	6.8	5.9		Cobble	18.2	12.9
Egregia	11.4	11.5		Boulder	45.5	0.0
Fleshy red algae	3.4	2.3		Bedrock	0.0	0.0
Green algae	8.0	5.7		Sand	41.0	6.4
				Red algal turf	0.0	0.0
				Phyllospadix	0.0	0.0
LOW INTERTIDAL	**Mean**	**SD**		Egregia	0.0	0.0
Sand	47.7	16.8				
Red algae turf	1.1	2.3		**LOW INTERTIDAL**	**Mean**	**SD**
Egregia	12.5	22.1		Cobble	13.7	6.4
Fleshy red algae	35.2	12.5		Boulder	29.6	28.9
Phyllospadix	3.4	4.4		Bedrock	18.2	12.9
				Sand	17.1	20.9
				Red algal turf	9.1	12.9
				Phyllospadix	14.6	2.6
				Egregia	1.1	1.0

Table 2. Rocky Intertidal Reference Site Selection Matrix

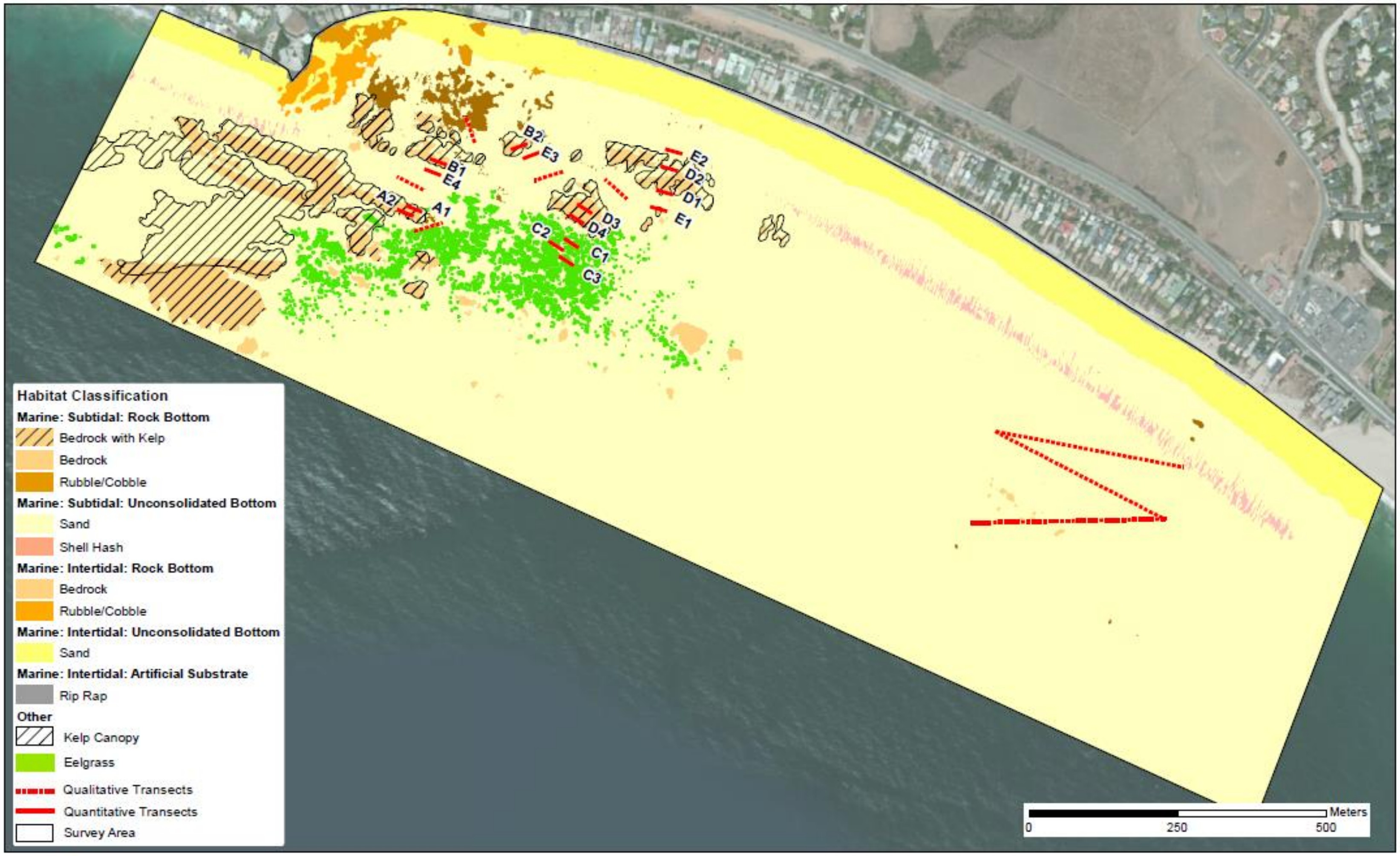
	Broad Beach	Old Stairs	Deer Creek	Sequit Point/ Leo Carillo	El Pescador	Point Dume	Paradise Cove	Malibu Bluffs
Similar physical characteristics as Broad Beach (rocky headland/point, adjacent sandy beach)	NA	No	No	Yes	Yes	No	Yes	Yes
Close proximity (Mugu-Malibu ±13 miles)	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Similar coastal orientation	South (S)	Yes (SE)	Yes (SE)	Yes (S)	Yes (S)	Yes (S)	Yes (SE)	Yes (S)
Nearby Sediment sources	Encinal Canyon Creek; Trancas Creek	La Jolla Canyon; Sycamore Canyon	Sycamore Canyon; Deer Creek	San Nicholas Canyon Creek; Sequit Creek	Lachuza Creek; Encinal Canyon Creek	Dume Creek; Ramirez Canyon Creek; Escondido Canyon Creek Latigo Canyon Creek	Ramirez Canyon Creek; Escondido Canyon Creek; Latigo Canyon Creek; Solstice Creek	Latigo Canyon Creek; Solstice Creek; Malibu Creek
Similar habitat features of interest as Broad Beach	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Serve as reference for other habitat features of interest	NA	Yes, but no eelgrass	Yes, but no eelgrass	Yes	Yes	Yes, but no eelgrass	Yes, but no eelgrass	Yes
Selected	NA	No (5 of 6)	No (5 of 6)	**Yes (6 of 6)**	**Yes (6 of 6)**	No (5 of 6)	**Yes (6 of 6)**	**Yes (6 of 6)**

Table 3. Habitat Features of Interest of Selected Reference Sites

Mapped Habitat	Habitat Classification	Broad Beach	Old Stairs	Deer Creek	Sequit Point/ Leo Carillo	El Pescador	Point Dume	Paradise Cove	Malibu Bluffs
Marine Nearshore: Supratidal									
Vegetated Dune		**Not Present**	NA	NA	**Not Present**	**Not Present**	NA	**Not Present**	**Not Present**
Unvegetated Dry Beach		Present	NA	NA	Present	Present	NA	Present	Present
Artificial Substrate		Present	NA	NA	**Not Present**	**Not Present**	NA	**Not Present**	**Not Present**
Marine Nearshore: Intertidal									
Marine: Intertidal: Rock Bottom	Bedrock or Large Boulders	Present	NA	NA	Present	Present	NA	Present	Present
	Surfgrass	Present	NA	NA	Present	Present	NA	Present	Present
	Rubble/Cobble	Present	NA	NA	Present	Present	NA	Present	Present
Marine: Intertidal: Artificial Substrate	Rip Rap	Present	NA	NA	**Not Present**	**Not Present**	NA	**Not Present**	**Not Present**
Marine: Intertidal: Unconsolidated Bottom	Sand	Present	NA	NA	Present	Present	NA	Present	Present
	Kelp Wrack	Varies	NA	NA	Varies	Varies	NA	Varies	Varies
Marine Nearshore: Subtidal									
Marine: Subtidal: Rock Bottom	Bedrock with Kelp	Present	NA	NA	Present	Present	NA	Present	Present
	Bedrock/Boulder	Present	NA	NA	Present	Present	NA	Present	Present
	Rubble/Cobble	Present	NA	NA	Present	Present	NA	Present	Present
	Surfgrass	Present	NA	NA	Present	Present	NA	Present	Present
Marine: Subtidal: Unconsolidated Bottom	Sand	Present	NA	NA	Present	Present	NA	Present	Present
	Shell Hash	Present	NA	NA	**Unknown**	**Unknown**	NA	**Unknown**	**Unknown**
	Eelgrass	Present	NA	NA	Present	Present	NA	**Not Present**	Present
	Sand Dollar Beds	**Unknown**	**Unknown**	**Unknown**	**Unknown**	**Unknown**	**Unknown**	**Unknown**	**Unknown**

Shaded rows are censused for completeness of spatial inventory but are not considered in project impact assessments

M&A #14-029-01

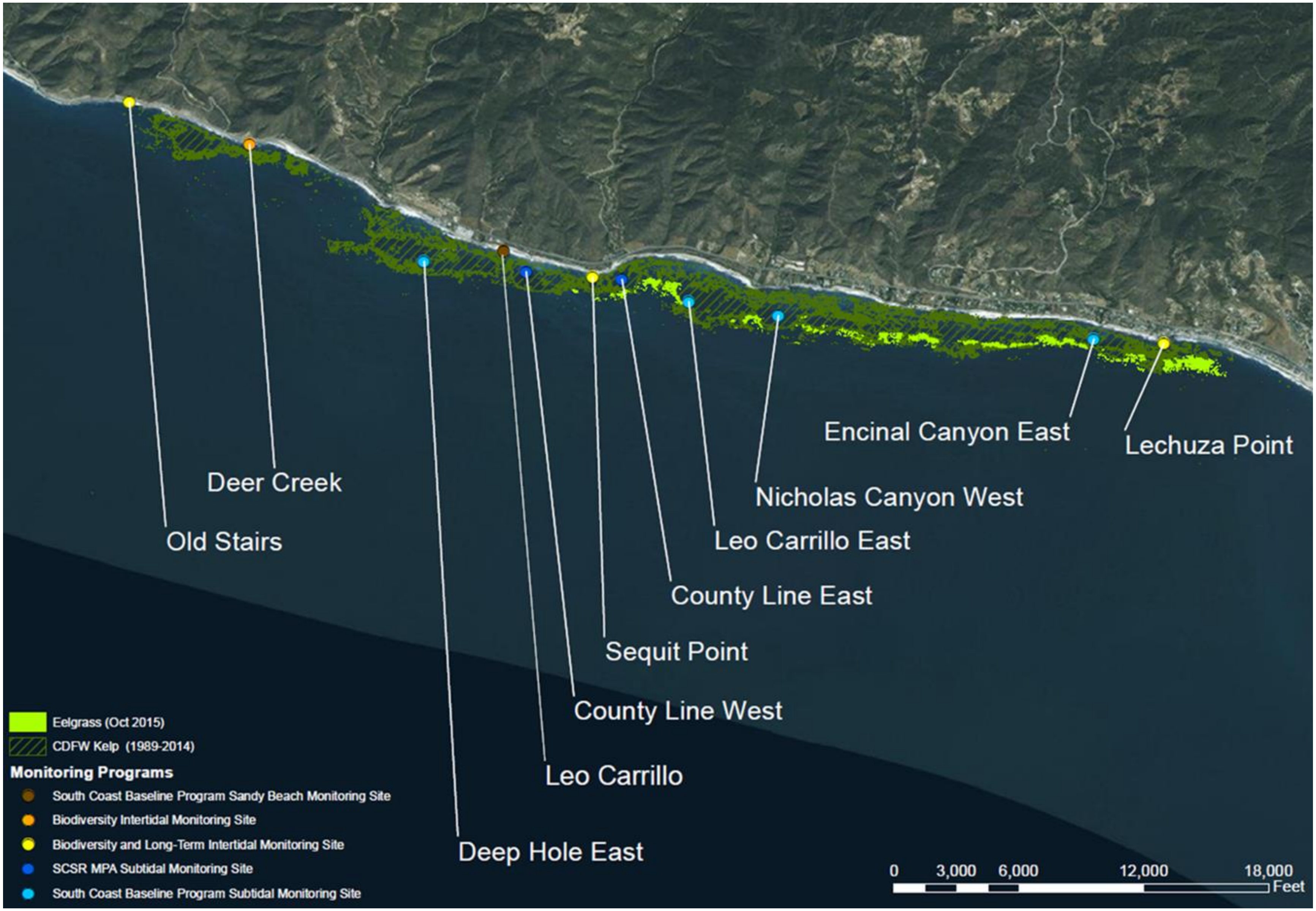


Marine Habitat Map - 2014

Broad Beach Restoration Project

Figure 5

Merkel & Associates, Inc.


Old Stairs
Deer Creek
Deep Hole East
Leo Carrillo
County Line West
Sequit Point
County Line East
Leo Carrillo East
Nicholas Canyon West
Encinal Canyon East
Lechuza Point
Eelgrass (Oct 2015)
CDFW Kelp (1989-2014)
Monitoring Programs
South Coast Baseline Program Sandy Beach Monitoring Site
Biodiversity Intertidal Monitoring Site
Biodiversity and Long-Term Intertidal Monitoring Site
SCSR MPA Subtidal Monitoring Site
South Coast Baseline Program Subtidal Monitoring Site
0 3,000 6,000 12,000 18,000
Feet

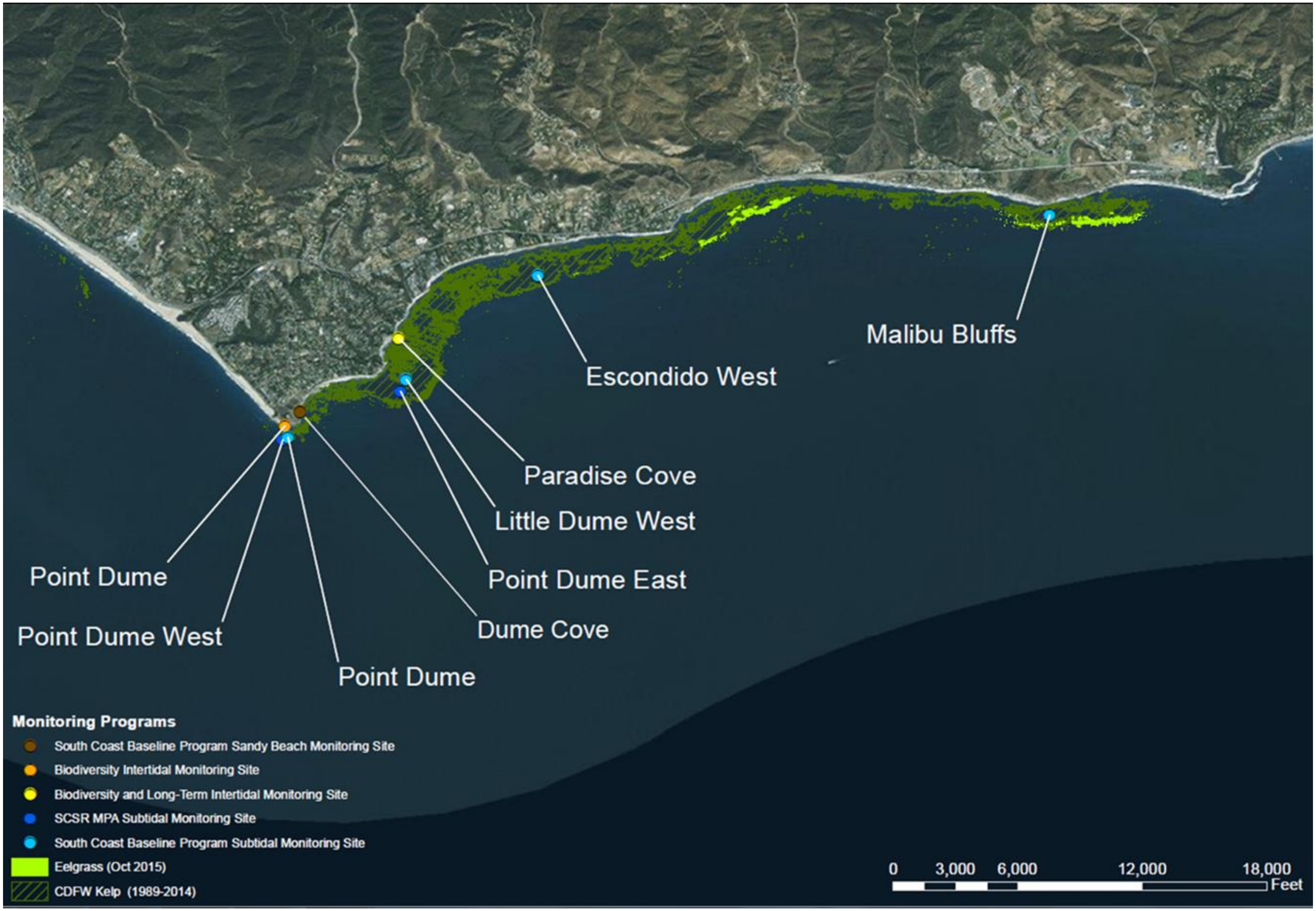

Malibu Bluffs
Escondido West
Paradise Cove
Little Dume West
Point Dume East
Dume Cove
Point Dume
Point Dume West
Point Dume
Monitoring Programs
South Coast Baseline Program Sandy Beach Monitoring Site
Biodiversity Intertidal Monitoring Site
Biodiversity and Long-Term Intertidal Monitoring Site
SCSR MPA Subtidal Monitoring Site
South Coast Baseline Program Subtidal Monitoring Site
Eelgrass (Oct 2015)
CDFW Kelp (1989-2014)
0 3,000 6,000 12,000 18,000
Feet

Table 4. Rocky Intertidal Indicator Species for Quadrat Sampling (working list to be expanded based on sampling conducted)

Persistent Indicators (low scour or sand inundation)	Neutral or Unknown (tolerant to sanding or status unknown)	Ephemeral Indicators (sand disturbance associates)
Balanus (mature) *Mytilus* (mature) *Pollicipes* fucoid algae	*Anthopleura elegantissima* *Phragmatopoma* *Phyllospadix scouleri, P. torreyi* turf red algae upright coralline algae	*Ulva* *Enteromorpha* *Chaetomorpha* *Porphyra* bare rock barnacle spat crustose coralline algae

Table 5. Sandy Beach Indicator Data Summary

BROAD BEACH June 2013	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
Transect 1 - Emertia analoga	5	11	0	7	2	5.8	4.6
Transect 2 - Emertia analoga	35	24	37	22	48	29.5	7.6
Transect 3 - Emertia analoga	5	7	20	10	20	10.5	6.7
						16.9	**14.6**
EL MATADOR June 2013	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
Transect 1 - Emertia analoga	3		4	1	1	2.7	1.5
Transect 2 - Emertia analoga	6	26	21	20	22	18.3	8.6
						10.5	**11.0**
ZUMA BEACH June 2013	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
Transect 1 - Emertia analoga	0	6	0	0	0	1.5	3.0
Transect 2 - Emertia analoga	0	1	0	0	0	0.3	0.5
Transect 3 - Emertia analoga	2	1	0	0	1	0.8	1.0
						0.8	**0.6**
core size = 78.5 cm2							

Table 6. Subtidal Indicator Data Summary

		Shallow Reef		Deep Reef		Sand		Eelgrass	
		N=4		N=4		N=5		N=3	
		Average	SD	Average	SD	Average	SD	Average	SD
Substrate	Cobble	5.8	11.7	21.3	15.4	0.0	0.0	0.0	0.0
% cover	Boulder	0.0	0.0	15.0	30.0	0.0	0.0	0.0	0.0
	Rock Reef	51.7	25.0	17.9	13.7	0.0	0.0	0.0	0.0
	Sand	42.5	30.7	45.8	23.4	100.0	0.0	100.0	0.0
Relief	Low-relief (<1m)	65.0	24.4	68.3	25.0	100.0	0.0	100.0	0.0
% cover	High-relief (>1m)	35.0	24.4	31.7	25.0	0.0	0.0	0.0	0.0
Counts	Macrocystis pyrifera (>1m)	1.9	1.1	3.2	3.1	0.0	0.0	0.0	0.0
per 20 m2	# stipes	11.2	4.7	16.4	7.5	0.0	0.0	0.0	0.0
	Pteryogphora	4.8	5.9	5.1	7.4	0.0	0.0	0.0	0.0
	Cystoseira	5.8	2.9	2.6	3.3	0.0	0.0	0.0	0.0
	Laminaria	0.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0
	Aplysia	0.9	1.3	0.3	0.3	0.0	0.0	0.0	0.0
	Asterina	0.1	0.2	4.7	4.3	0.0	0.0	0.0	0.0
	Astropectin	0.0	0.0	0.0	0.0	0.0	0.0	1.8	3.1
	California halibut	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
	Crassadoma	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0
	Diopatra	6.4	4.4	23.8	6.4	17.9	13.3	3.8	2.2
	Elbow crab	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2
	Globe crab	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
	Kelletia	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0
	Loxorhynchus	0.6	0.6	0.0	0.0	0.1	0.1	0.0	0.0
	Megathura	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0
	Muricea	1.3	2.5	13.6	16.0	0.0	0.0	0.0	0.0
	Nassarius	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0
	Parastichopus	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0
	S. francisanus	226.5	257.0	4.9	2.3	0.0	0.0	0.0	0.0
	S. purpuratus	400.0	583.5	58.8	57.4	0.0	0.0	0.0	0.0
	Sanddollar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sea pen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Speckled sanddab	0.3	0.7	0.0	0.0	1.7	1.3	3.3	3.0
	Styela	1.1	0.8	0.3	0.5	0.0	0.0	0.0	0.0
Percent Cover	Desmarestia	4.7	2.5	15.8	20.6	0.0	0.0	0.0	0.0
	Egregia	1.1	0.7	0.0	0.0	0.1	0.3	0.0	0.0
	Surfgrass	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	Eelgrass	0.0	0.0	0.0	0.0	0.0	0.0	44.4	6.3
	Eelgrass Density (16th m2)	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.4

Preliminary Power Analyses indicate the number of the samples required to meet the 20, 20, 20, based on existing data

Habitat	Indicator	Method (Sample Unit)	Estimated Number of Sample Units
Rocky Intertidal	Barnacle cover (Intend use of overall persistent species cover also will omit neutral indicators in analyses to increase the robustness)	Quadrat (Point Contact)	43
Rocky Intertidal	Surfgrass	10m Point Intercept Transect	16
Boulder field	Barnacle cover (Intend use of overall persistent species cover also will omit neutral indicators in analyses to increase the robustness)	Quadrat (Point Contact)	200
Sandy beach	Emerita	Core	50-239
Rocky reef with kelp	Kelp, Muricea, Urchins	10x2m transect Migrating to a $20m^2$ round plot	22
Rocky reef without kelp	Substrate and Relief	10x2m transect Migrating to a $20m^2$ round plot	22
Subtidal rocky reef with surfgrass	Surfgrass	30x2m transect Migrating to a 0.5m x 0.5m quadrat targeted sampling of cover	198
Unconsolidated habitat with eelgrass	Eelgrass	0.25m by 0.25 m quadrat	2 (20 for CEMP)
Unconsolidated habitat without eelgrass	Sand dollars ?	0.5m x 0.5m quadrat ?	?

RBSP Intertidal Monitoring Results conducted by UCSB (MARINe) for surfgrass and barnacles at Cardiff from Fall 1997 to Spring 2005.

surfgrass		rep 1	rep 2	rep 3	mean	sd	se	20% decrease	Power Analysis	
Cardiff	F97	58	80	51	63.0	15.1	8.7	50.4	5	
	S98	35	68	51	51.3	16.5	9.5	41.1	8	
	F98	75	93	59	75.7	17.0	9.8	60.5	5	
	S99	52	88	88	76.0	20.8	12.0	60.8	6	
	F99	90	98	99	95.7	4.9	2.8	76.5	2	
	S00	88	99	97	94.7	5.9	3.4	75.7	2	
	F00	95	99	94	96.0	2.6	1.5	76.8	2	
	S01	81	86	71	79.3	7.6	4.4	63.5	2	
	F01	97	72	81	83.3	12.7	7.3	66.7	3	
	S02	79	61	53	64.3	13.3	7.7	51.5	4	
	F02	81	33	30	48.0	28.6	16.5	38.4	26	
	S03	80	25	10	38.3	36.9	21.3	30.7	68	
	F03	99	62	30	63.7	34.5	19.9	50.9	21	
	S04	77	44	18	46.3	29.6	17.1	37.1	24	
	F04	59	41	7	35.7	26.4	15.2	28.5	39	Mean
	S05	24	20	4	16.0	10.6	6.1	12.8	32	16
	Note: these were targeted areas									

Barnacles		rep 1	rep 2	rep 3	rep 4	rep 5	mean	sd	20% decrease	Power Analysis	
Cardiff	F97	60	54	75	52	44	57.0	11.6	45.6	4	
	S98	46	4	12	62	46	34.0	24.8	27.2	39	
	F98	0	0	0	19	17	7.2	9.9	5.8	143	
	S99	3	1	0	27	33	12.8	15.9	10.2	107	
	F99	8	2	1	16	34	12.2	13.6	9.8	92	
	S00	36	9	14	27	41	25.4	13.8	20.3	22	
	F00	32	8	12	3	46	20.2	18.1	16.2	59	
	S01	40	10	17	42	43	30.4	15.7	24.3	20	
	F01	72	43	60	59	64	59.6	10.6	47.7	3	
	S02	69	55	73	56	69	64.4	8.3	51.5	2	
	F02	36	40	39	53	30	39.6	8.4	31.7	4	
	S03	43	40	39	41	36	39.8	2.6	31.8	2	
	F03	68	62	69	69	58	65.2	5.0	52.2	2	
	S04	79	82	87	75	64	77.4	8.7	61.9	2	
	F04	59	82	63	79	54	67.4	12.4	53.9	3	Mean
	S05	84	76	77	79	73	77.8	4.1	62.2	2	32
	Note: these were targeted areas										

AGENDA
13B

Broad Beach GHAD
Cash Flow
Board Meeting 5/22/2016

Cash in Bank April 5, 2016 **$3,075,517.69**

Sources of Cash:

Cash collected

4/20/16	L.A. County 09721 GHAD Assessment Fund		623,361.00
4/27/16	Swim Club		29,750
		TTL	653,111.00

Disbursements from April 5th through May 17th, 2016

Date	Check#	Description		
4/12/16	3599	Heike Fuchs, Clerk/Treasurer	$	1,312.94
4/14/16	3604	Mark Goss, Project Manager	$	6,931.25
4/15/16	3596	Elkins Kalt Weintraub	$	8,120.11
4/15/16	3603	Elkins Kalt Weintraub	$	65,221.15
4/20/16	3597	Moffatt & Nichol	$	41,859.99
4/20/16	3601	Moffatt & Nichol	$	73,923.21
4/27/16	3608	Mark Goss, Project Manager	$	5,796.09
5/2/16	3607	Heike Fuchs, Clerk/Treasurer	$	1,255.83
5/3/16	3602	Colantuono, Highsmith	$	1,861.00
5/5/16	3606	Moffatt & Nichol	$	59,148.54
5/9/16	3605	Vectis Strategies	$	10,000.00
5/12/16	3610	Mark Goss, Project Manager	$	5,595.66
Total invoices paid April/May 2016			$	281,025.77

Cash Ending Balance as of May 17, 2016 **$3,447,602.92**

UNPAID BILLS

Date Received	Invoice#	Vendor Name	Amount
May-16	437485-7	Elkins Kalt	$ 48,212.09
May-16	BB 2582	Vectis	$ 10,000.00
May-16		Colantuono	$ 47.50
		Estimated Unpaid Bills	$ 58,259.59

TR 5-22-2016