INFORMATION HANDOUT

For Contract No. 07-316604
At 07-LA-1-41.8/42.1

Identified by
Project ID 0715000212

PERMITS

United States Army Corps of Engineers, Clean Water Act, Section 404 Nationwide Authorization, dated July 9, 2014

Los Angeles County Beaches and Harbors Permit, dated June 5, 2014

State of California Land Commission Permit, dated April 26, 2013

California Coastal Commission Permit, dated July 1, 2015

MATERIALS INFORMATION

Las Tunas Beach Wave Run-up Study Final, dated July 11, 2014

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
915 WILSHIRE BOULEVARD, SUITE 930
LOS ANGELES, CALIFORNIA 90017-3401

July 9, 2014

Mohammed Shaikh
California Department of Transportation, District 7
100 South Main Street, Suite 100, MS 16-A
Los Angeles, California 90012

DEPARTMENT OF THE ARMY NATIONWIDE PERMIT VERIFICATION

Dear Mr. Shaikh:

This correspondence is in reply to your request (SPL-2013-00415-SJH), dated January 17, 2014, for a Department of the Army permit to discharge temporary fill into waters of the United States (WOUS), in association with the Caltrans State Route (SR) 1, PM 41.8-42.1, Shoreline Maintenance project. The proposed work would take place within the intertidal zone of the Pacific Ocean, adjacent to SR-1, in the City of Malibu, Los Angeles County, California.

Because construction of this project would result in a discharge of dredged and/or fill material into WOUS and would place structures or consist of work in or affecting navigable waters of the United States a Department of the Army permit is required pursuant to section 404 of the Clean Water Act (33 USC 1344; 33 CFR parts 323 and 330) and section 10 of the Rivers and Harbors Act (33 USC 403). I have determined your proposed project, if constructed as described in your application, would comply with Nationwide Permit (NWP) 33 Temporary Construction, Access, and Dewatering. Specifically, and as shown in the enclosed figure(s), you are authorized to:

Discharge temporary fill into approximately 3 acres of WOUS to construct a temporary access road and perform associated dewatering activities associated with this construction. The access road shall be constructed at the toe of the existing slope, and will be approximately 1,700 feet in length and 10 feet in width. The associated berm or cofferdam will be approximately 1,750 feet in length and 20 feet in width. Existing rock will be temporarily discharged along the ocean side of the berm, impacting a 10-foot width over approximately 1,780 feet.

For this NWP verification letter to be valid, you must comply with all of the terms and conditions in Enclosure 1. Furthermore, you must comply with the non-discretionary Special Conditions listed below:

1. Prior to initiating construction in waters of the U.S., the Permittee shall submit to the Corps Regulatory Division a complete set of final detailed grading/construction plans showing all work and structures in waters of the U.S. All plans shall be in compliance with the Final Map and Drawing Standards for the South Pacific Division Regulatory Program dated August 6, 2012 (http://www.spd.usace.army.mil/Portals/13/docs/regulatory/standards/map.pdf). All plan sheets shall be signed, dated, and submitted on paper no larger than 11x 17 inches. No work in waters of the U.S. is authorized until the Permittee receives, in writing (by letter or e-mail), Corps Regulatory

Division approval of the final detailed grading/construction plans. The Permittee shall ensure that the project is built in accordance with the Corps Regulatory Division-approved plans.

2. The Permittee shall clearly mark the limits of the workspace with flagging or similar means to ensure mechanized equipment does not enter avoided waters of the U.S. shown in Figures L-1 and L-2, attached. Adverse impacts to waters of the U.S. beyond the Corps Regulatory Division-approved construction footprint are not authorized. Such impacts could result in permit suspension and revocation, administrative, civil or criminal penalties, and/or substantial, additional, compensatory mitigation requirements

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

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

5. The Permittee shall notify the Corps Regulatory Division of the date of commencement of operations not less than 14 calendar days prior to commencing work, and shall notify the Corps of the date of completion of operations at least five calendar days prior to such completion.

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

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

U.S. Coast Guard, Sector LA-LB (COTP)
TEL: (310) 521-3860
E-mail: john.p.hennigan@uscg.mil

A) The Permittee shall notify the U.S. Coast Guard, Commander, 11th Coast Guard District (dpw) and the U.S. Coast Guard, Sector LA-LB (COTP) (contact information shown above), not less than 14 calendar days prior to commencing work and as project information changes. The notification shall be provided by e-mail with at least the following information, transmitted as an attached Word or PDF file:

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

B) The Permittee and its contractor(s) shall not remove, relocate, obstruct, willfully damage, make fast to, or interfere with any aids to navigation defined at 33 C.F.R. chapter I, subchapter C, part 66. The Permittee shall ensure its contractor notifies the Eleventh Coast Guard District in writing, with a copy to the Corps Regulatory Division, not less than 30 calendar days in advance of operating any equipment adjacent to any aids to navigation that requires relocation or removal. Should any federal aids to navigation be affected by this project, the Permittee shall submit a request, in writing, to the Corps Regulatory Division as well as the U.S. Coast Guard, Aids to Navigation office (contact information provided above). The Permittee and its contractor are prohibited from relocating or removing any aids to navigation until authorized to do so by the Corps Regulatory Division and the U.S. Coast Guard.

C) Should the Permittee determine the work requires the temporary placement and use of private aids to navigation in navigable waters of the U.S., the Permittee shall submit a request in writing to the Corps Regulatory Division as well as the U.S. Coast Guard, Aids to Navigation office (contact information provided above). The Permittee is prohibited from establishing private aids to navigation in navigable waters of the U.S. until authorized to do so by the Corps Regulatory Division and the U.S. Coast Guard.

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

7. Within 30 calendar days of completion of the project authorized by this permit, the Permittee shall conduct a post-project survey indicating changes to structures and other features in navigable waters. The Permittee shall forward a copy of the survey, as well as a copy of this permit, to the Corps Regulatory Division (via e-mail at: Stephanie.J.Hall@usace.army.mil) and to the National Oceanic and Atmospheric Administration for updating nautical charts (via e-mail at: john.whiddon@noaa.gov). Post-project surveys/as-built plans should be provided electronically in two formats: .pts (xyz) and one of, .pdf, CAD, or GIS. Include the following header metadata:

project name, surveyor's name and company, area surveyed (acres), type of survey method, date of survey, geographic control points (for example: latitude/longitude, plane coordinates), geographic coordinate system (use NAD83), geographic projection, units (use US Survey Feet), and tide gage location. For all subsurface structures and dredge projects include elevation (z coordinate) datum indicated as a negative below MLLW, and also indicate the survey system and bin sizes as appropriate.

8. No later than one month following completion of authorized work in waters of the U.S., the Permittee shall ensure all sites within waters of the U.S. subject to authorized, temporary impacts are restored to pre-project alignments, elevation contours, and conditions to the maximum extent practicable to ensure expeditious resumption of aquatic resource functions. No later than 45 calendar days following completion of authorized work in waters of the U.S., the permittee shall submit a memorandum documenting compliance with this special condition.

9. This permit is contingent upon the issuance of a Coastal Zone Management Act (CZMA) consistency certification and section 401 Water Quality Certification (WQC). The Permittee shall abide by the terms and conditions of the CZMA consistency certification and Clean Water Act section 401 WQC. The Permittee shall submit the CZMA consistency certification and section 401 WQC to the Corps Regulatory Division (preferably via email) within two weeks of receipt from the issuing state agency. The Permittee shall not proceed with construction until receiving an e-mail or other written notification from Corps Regulatory Division acknowledging the CZMA consistency certification and Clean Water Act 401 WQC have been received, reviewed, and determined to be acceptable. If the RWQCB fails to act on a valid request for section 401 WQC within two months after receipt of a complete application, please notify the Corps Regulatory Division so we may consider whether a waiver of water quality certification has been obtained. If the California Coastal Commission fails to act on a valid request for concurrence with your CZMA consistency certification within six months after receipt, please notify the Corps Regulatory Division so we may consider whether to presume a concurrence has been obtained.

This verification is valid through **March 18, 2017**. If on March 18, 2017 you have commenced or are under contract to commence the permitted activity you will have an additional twelve (12) months to complete the activity under the present NWP terms and conditions. However, if I discover noncompliance or unauthorized activities associated with the permitted activity I may request the use of discretionary authority in accordance with procedures in 33 CFR § 330.4(e) and 33 CFR §§ 330.5(c) or (d) to modify, suspend, or revoke this specific verification at an earlier date. Additionally, at the national level the Chief of Engineers, any time prior to March 18, 2017, may chose to modify, suspend, or revoke the nationwide use of a NWP after following procedures set forth in 33 CFR § 330.5. It is incumbent upon you to comply with all of the terms and conditions of this NWP verification and to remain informed of any change to the NWPs.

A NWP does not grant any property rights or exclusive privileges. Additionally, it does not authorize any injury to the property, rights of others, nor does it authorize interference with any existing or proposed Federal project. Furthermore, it does not obviate the need to obtain other Federal, state, or local authorizations required by law.

Thank you for participating in the regulatory program. If you have any questions, contact Stephanie Hall at (213) 452-3410 or via e-mail at Stephanie.J.Hall@usace.army.mil. Please help me to evaluate and improve the regulatory experience for others by completing the customer survey form at http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey.

Sincerely,

Mark D. Cohen
Deputy Chief, Regulatory Division

Enclosures

LOS ANGELES DISTRICT
U.S. ARMY CORPS OF ENGINEERS

CERTIFICATE OF COMPLIANCE WITH DEPARTMENT OF THE ARMY NATIONWIDE PERMIT

Permit Number: *SPL-2013-00415-SJH*

Name of Permittee: *Mohammed Shaikh – California Department of Transportation, District 7*

Date of Issuance: *July 9, 2014*

Upon completion of the activity authorized by this permit and the mitigation required by this permit, sign this certificate, and return it by **ONE** of the following methods;

1) Email a digital scan of the signed certificate to Stephanie.J.Hall@usace.army.mil

OR

2) Mail the signed certificate to

U.S. Army Corps of Engineers
ATTN: Regulatory Division, SPL-2013-00415-SJH
Los Angeles District, Corps of Engineers
915 Wilshire Boulevard, Suite 930
Los Angeles, California 90017-3401

I hereby certify that the authorized work and any required compensatory mitigation has been completed in accordance with the NWP authorization, including all general, regional, or activity-specific conditions. Furthermore, if credits from a mitigation bank or in-lieu fee program were used to satisfy compensatory mitigation requirements I have attached the documentation required by 33 CFR 332.3(l)(3) to confirm that the appropriate number and resource type of credits have been secured.

_____ _____

Signature of Permittee Date

INDEX OF PLANS

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

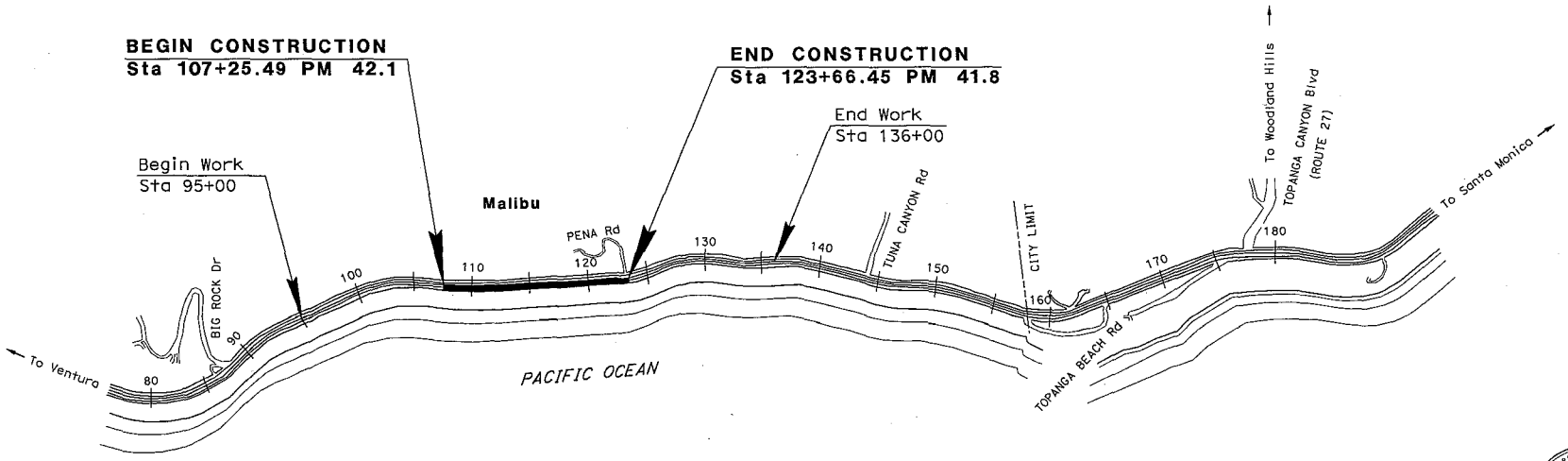
IN LOS ANGELES COUNTY AT MALIBU

FROM 1.3 MILES WEST OF TOPANGA CANYON BOULEVARD

TO PENA ROAD

TO BE SUPPLEMENTED BY STANDARD PLANS DATED 2010

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1	41.8/42.1	1	



PROJECT MANAGER

DESIGN ENGINEER

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER
DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

LAST REVISION 00-00-00
DATE PLOTTED => 03-JAN-2014
TIME PLOTTED => 09:25

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

NO SCALE

CONTRACT No.	07-3X4504
PROJECT ID	0712000164

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1	41.8/42.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

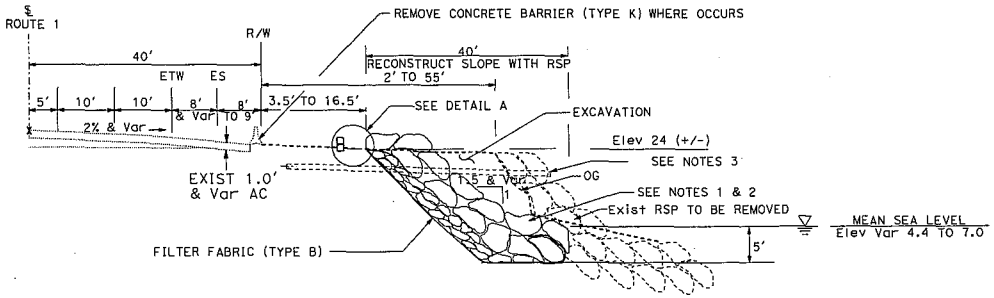
REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

NOTES:

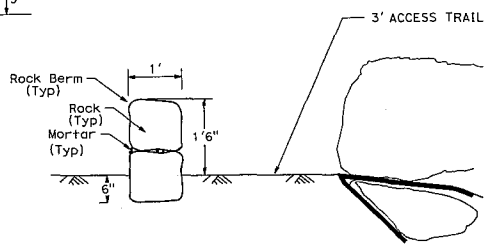
1. PLACE 4' THICK RSP (1/2 TON, METHOD B) IN TWO LAYERS AND 8' THICK RSP (8 TON, METHOD A) IN TWO LAYERS
2. PLACE FILTER FABRIC UNDERNEATH RSP WORK
3. FOR DRAINAGE PIPES AND WORK, SEE DRAINGE PLANS

STRUCTURAL SECTIONS

[1] 0.2' HOT MIX ASPHALT (HMA)



SECTION B-B
Sta 113+00.00 To Sta 116+36.36



DETAIL A
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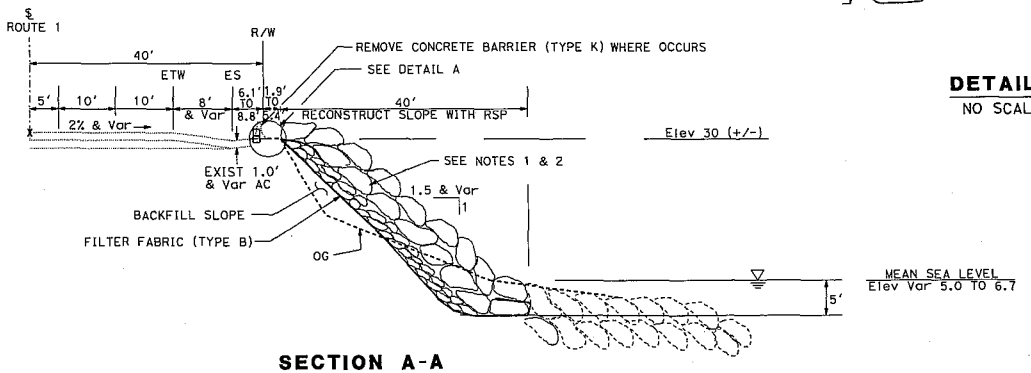

SECTION A-A
Sta 107+25.49 To Sta 113+00.00

TYPICAL CROSS SECTIONS

NO SCALE

X-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED

LAST REVISION 00-00-00
DATE PLOTTED => 03-JAN-2014
TIME PLOTTED => 09:25

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USERNAME => a129377
DGN FILE => 73x450cc001.dgn
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UNIT 1814
PROJECT NUMBER & PHASE 07120001641

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1	41.8/42.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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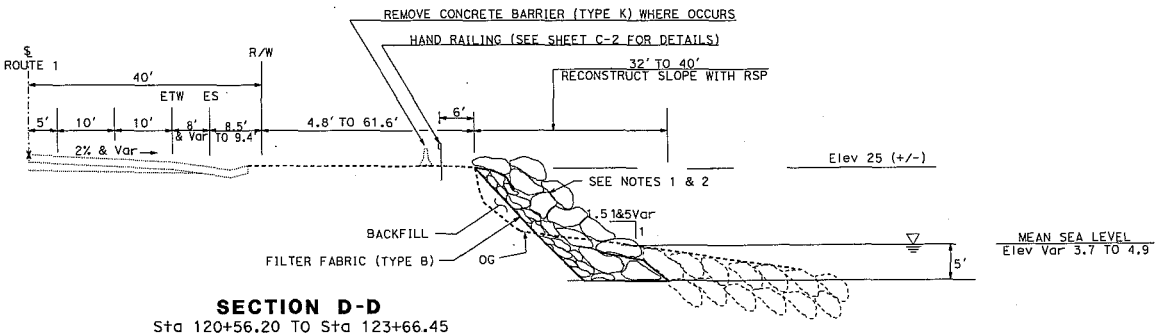
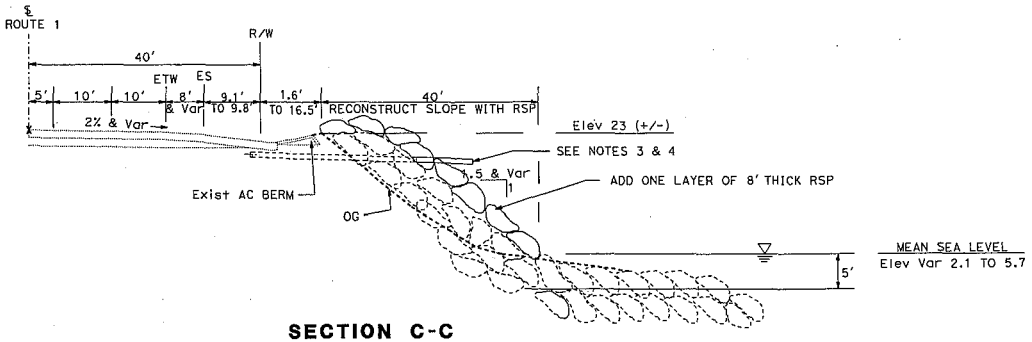
REGISTERED PROFESSIONAL ENGINEER — No. — EXP. — CIVIL — STATE OF CALIFORNIA

NOTES:

1. PLACE 4' THICK RSP (1/2 TON, METHOD B) WITH TWO LAYERS AND 8' THICK RSP (8 TON, METHOD A) IN TWO LAYERS
2. PLACE FILTER FABRIC UNDERNEATH RSP WORK
3. FOR DRAINAGE PIPES AND WORK, SEE DRAINGE PLANS



SECTION D-D
Sta 120+56.20 TO Sta 123+66.45



SECTION C-C
Sta 116+36.36 TO Sta 120+56.20

TYPICAL CROSS SECTIONS

NO SCALE

X-2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans — DESIGN

FUNCTIONAL SUPERVISOR

CALCULATED-DESIGNED BY

CHECKED BY

REVISED BY

DATE REVISED

LAST REVISED DATE PLOTTED => 03-JAN-2014
00-00-00 TIME PLOTTED => 09:25

BORDER LAST REVISED 7/2/2010

USERNAME => s129377
DGN FILE => 73x450co002.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 1814

PROJECT NUMBER & PHASE 07120001641

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1	41.8/42.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. EXP. CIVIL STATE OF CALIFORNIA

NOTE:

1. FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT DISTRICT OFFICE.

LEGEND:

- EXISTING ROCK SLOPE PROTECTION
- RECONSTRUCT SLOPE WITH ROCK SLOPE PROTECTION
- ADD ONE LAYER OF 8-TON ROCK SLOPE PROTECTION
- ROCK BERM
- EXISTING BEACH TRAIL
- PROPOSED BEACH TRAIL

SUMMARY OF QUANTITIES:

EXIST ROCK: 7,600 CY

NET IMPORTED RSP: 21,200 CY

RECONSTRUCT SLOPE WITH ROCK SLOPE PROTECTION: 48,100 SQFT

ADD ONE LAYER OF 8-TON ROCK SLOPE PROTECTION: 17,300 SQFT

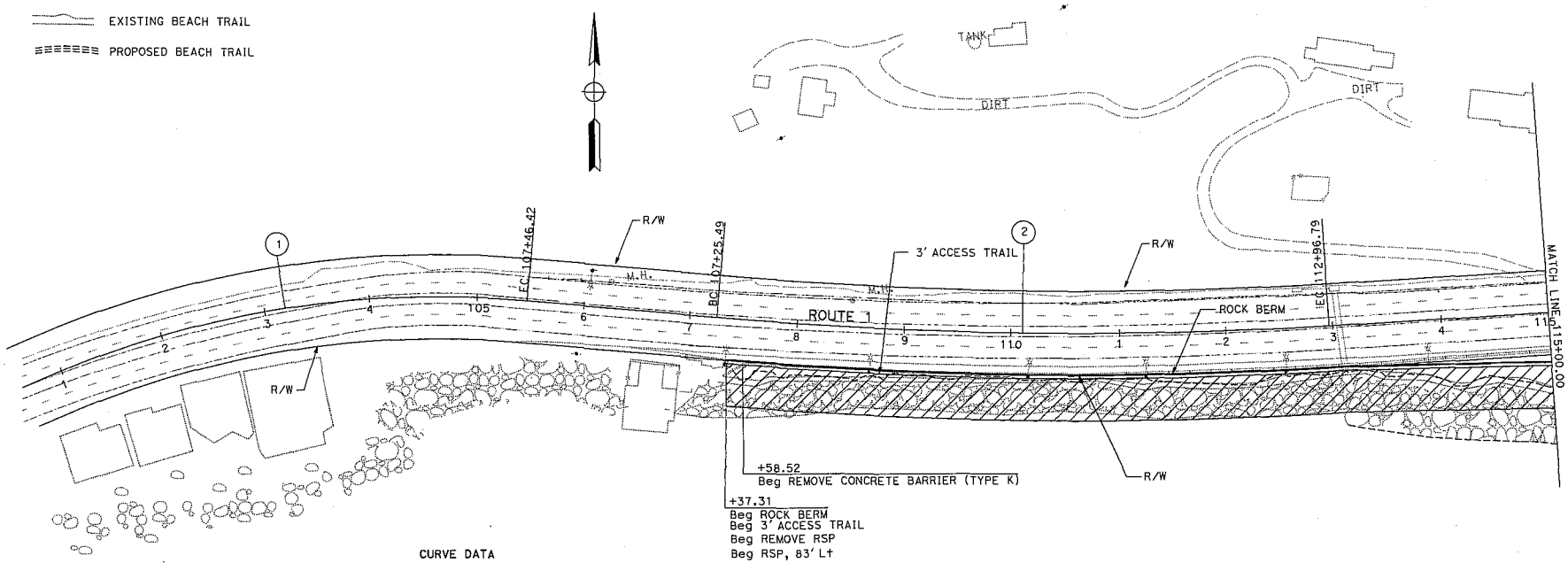
Temp ACCESS PATH: 1,700'x10'= 17,000 SQFT (SEE SHEET C-1)

Temp BERM OR COFFERDAM: 1,750'x20' = 35,000 SQFT (SEE SHEET C-1)

Exist ROCK Temp RELOCATED TO OCEAN: 1,780'x10'= 17,800 SQFT (SEE SHEET C-1)

Temp BERM OR COFFERDAM: 8,100 CY (SEE SHEET C-1)

Exist ROCK Temp RELOCATED TO OCEAN: 2,500 CY (SEE SHEET C-1)



CURVE DATA

No.	R	Δ	T	L
①	922	28°11'20"	231.39	453.40
②	4000	08°11'00"	286.14	571.30

LAYOUT

SCALE: 1:50

L-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED

LAST REVISED 00-00-00
DATE PLOTTED => 09-JAN-2014
TIME PLOTTED => 12:56

BORDER LAST REVISED 7/2/2010
USERNAME => s129377
DGN FILE => 73x450ea001.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0712000164

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1	41.8/42.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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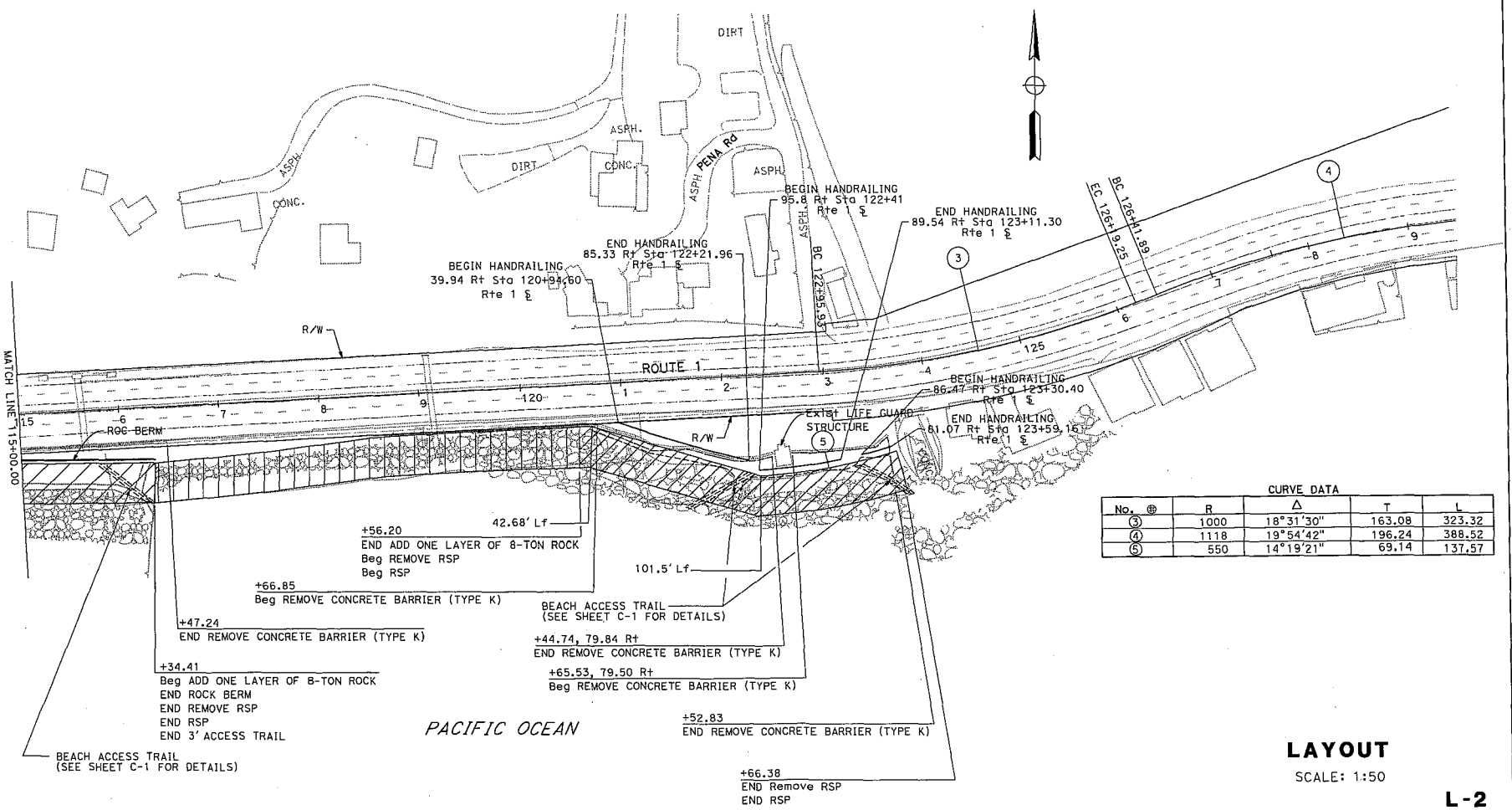
REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

NOTE:

1. FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT DISTRICT OFFICE.



CURVE DATA

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④	1118	19°54'42"	196.24	388.52
⑤	550	14°19'21"	69.14	137.57

LAYOUT

SCALE: 1:50

L-2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION | FUNCTIONAL SUPERVISOR | CALCULATED/DESIGNED BY | CHECKED BY | REVISED BY | DATE REVISED

Caltrans DESIGN

LAST REVISION 00-00-00 | DATE PLOTTED => 03-JAN-2014 | TIME PLOTTED => 09:25

BORDER LAST REVISED 7/2/2010 | USERNAME => s129377 | DGN FILE => 73x450ea0002.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 0712000164

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1	41.8/42.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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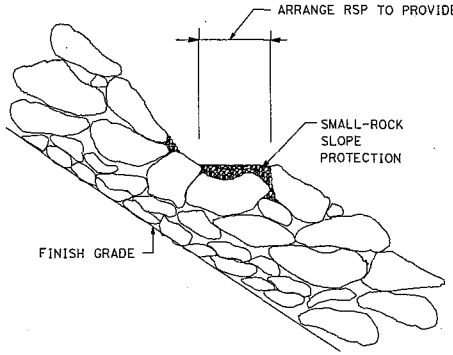
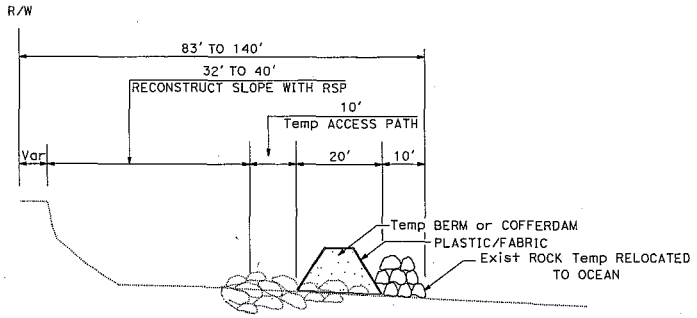
REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA



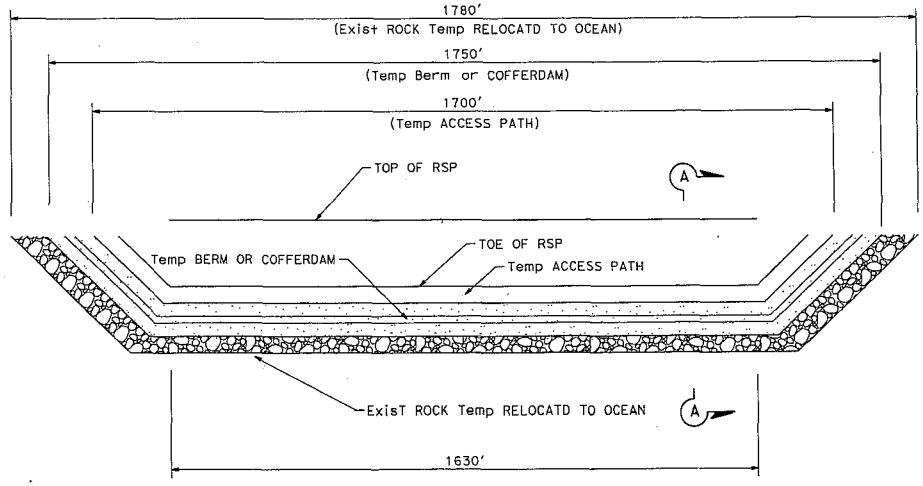
BEACH ACCESS TRAIL DETAILS

Sta 115+00 TO Sta 123+66.45

NO SCALE



SECTION A-A



Temp DEWATERING SYSTEM

STA 107+25.49 TO 116+36.36 AND 120+56.20 TO 123+66.45

(SEE SHEET X-1 & X-2 FOR DETAILS NOT SHOWN)

CONSTRUCTION DETAILS

NO SCALE

C-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED

LAST REVISION 00-00-00 DATE PLOTTED => 15-JAN-2014 TIME PLOTTED => 10:12

BORDER LAST REVISED 7/2/2010 | USERNAME => s129377 DGN FILE => 73x450ga001.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 0712000164

Enclosure 1: NATIONWIDE PERMIT NUMBER(S) NWP 33 Temporary Construction, Access, and Dewatering. TERMS AND CONDITIONS

1. Nationwide Permit(s) NWP 33 Temporary Construction, Access, and Dewatering. Terms:

Your activity is authorized under Nationwide Permit Number(s) NWP 33 Temporary Construction, Access, and Dewatering. subject to the following terms:

33. Temporary Construction, Access, and Dewatering. Temporary structures, work, and discharges, including cofferdams, necessary for construction activities or access fills or dewatering of construction sites, provided that the associated primary activity is authorized by the Corps of Engineers or the U.S. Coast Guard. This NWP also authorizes temporary structures, work, and discharges, including cofferdams, necessary for construction activities not otherwise subject to the Corps or U.S. Coast Guard permit requirements. Appropriate measures must be taken to maintain near normal downstream flows and to minimize flooding. Fill must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. The use of dredged material may be allowed if the district engineer determines that it will not cause more than minimal adverse effects on aquatic resources. Following completion of construction, temporary fill must be entirely removed to upland areas, dredged material must be returned to its original location, and the affected areas must be restored to pre-construction elevations. The affected areas must also be revegetated, as appropriate. This permit does not authorize the use of cofferdams to dewater wetlands or other aquatic areas to change their use. Structures left in place after construction is completed require a section 10 permit if located in navigable waters of the United States. (See 33 CFR part 322.) Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity (see general condition 27). The pre-construction notification must include a restoration plan showing how all temporary fills and structures will be removed and the area restored to pre-project conditions. (Sections 10 and 404)

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as appropriate, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP.

2. Nationwide Permit General Conditions: The following general conditions must be followed in order for any authorization by an NWP to be valid:

1. 1. Navigation. (a) No activity may cause more than a minimal adverse effect on navigation.
   (b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.
   (c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or

obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species.

3. Spawning Areas. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

7. Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects From Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows. To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization and storm water management activities, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

13. Removal of Temporary Fills. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers. No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

17. Tribal Rights. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

18. Endangered Species. (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless Section 7 consultation addressing the effects of the proposed activity has been completed.
(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address ESA compliance for the NWP activity, or whether additional ESA consultation is necessary.
(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or

designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed work or that utilize the designated critical habitat that might be affected by the proposed work. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the project, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification the proposed activities will have "no effect" on listed species or critical habitat, or until Section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.
(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific regional endangered species conditions to the NWPs.
(e) Authorization of an activity by a NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. FWS or the NMFS, The Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.
(f) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.noaa.gov/fisheries.html respectively.

19. Migratory Birds and Bald and Golden Eagles. The permittee is responsible for obtaining any "take" permits required under the U.S. Fish and Wildlife Service's regulations governing compliance with the Migratory Bird Treaty Act or the Bald and Golden Eagle Protection Act. The permittee should contact the appropriate local office of the U.S. Fish and Wildlife Service to determine if such "take" permits are required for a particular activity.

20. Historic Properties. (a) In cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.
(b) Federal permittees should follow their own procedures for complying with the requirements of Section 106 of the National Historic Preservation Act. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will review the documentation and determine whether it is sufficient to address section 106 compliance for the NWP activity, or whether additional section 106 consultation is necessary.
(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the authorized activity may have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties may be affected by the proposed work or include a

vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of or potential for the presence of historic resources can be sought from the State Historic Preservation Officer or Tribal Historic Preservation Officer, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of Section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted and these efforts, the district engineer shall determine whether the proposed activity has the potential to cause an effect on the historic properties. Where the non-Federal applicant has identified historic properties on which the activity may have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects or that consultation under Section 106 of the NHPA has been completed.
(d) The district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA Section 106 consultation is required. Section 106 consultation is not required when the Corps determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR §800.3(a)). If NHPA section 106 consultation is required and will occur, the district engineer will notify the non-Federal applicant that he or she cannot begin work until Section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.
(e) Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. Discovery of Previously Unknown Remains and Artifacts. If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters. Critical resource waters include NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated

by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.
(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.
(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with general condition 31, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that adverse effects on the aquatic environment are minimal:
(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).
(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.
(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse effects of the proposed activity are minimal, and provides a project-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment. Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.
    (1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in minimal adverse effects on the aquatic environment.
    (2) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, wetland restoration should be the first compensatory mitigation option considered.
    (3) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) – (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).
    (4) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.
    (5) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring

requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan.

(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation, such as stream rehabilitation, enhancement, or preservation, to ensure that the activity results in minimal adverse effects on the aquatic environment.

(e) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any project resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that a project already meeting the established acreage limits also satisfies the minimal impact requirement associated with the NWPs.

(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the restoration or establishment, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, riparian areas may be the only compensatory mitigation required. Riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to establish a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or establishing a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(g) Permittees may propose the use of mitigation banks, in-lieu fee programs, or separate permittee-responsible mitigation. For activities resulting in the loss of marine or estuarine resources, permittee-responsible compensatory mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(h) Where certain functions and services of waters of the United States are permanently adversely affected, such as the conversion of a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse effects of the project to the minimal level.

24. Safety of Impoundment Structures. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA Section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require

additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

    "When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

    _____
    (Transferee)

    _____
    (Date)

30. Compliance Certification. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized work was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;
(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and
(c) The signature of the permittee certifying the completion of the work and mitigation.

31. Pre-Construction Notification. (a) Timing. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:
    (1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or
    (2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or in the vicinity of the project, or to notify the Corps pursuant to general condition 20 that the activity may have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or Section 106 of the National Historic Preservation (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).
(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:
    (1) Name, address and telephone numbers of the prospective permittee;
    (2) Location of the proposed project;
    (3) A description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause, including the anticipated amount of loss of water of the United States expected to result from the NWP activity, in acres, linear feet, or other appropriate

unit of measure; any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. The description should be sufficiently detailed to allow the district engineer to determine that the adverse effects of the project will be minimal and to determine the need for compensatory mitigation. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the project and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(4) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many waters of the United States. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(5) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse effects are minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(6) If any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, for non-Federal applicants the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act; and

(7) For an activity that may affect a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, for non-Federal applicants the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property. Federal applicants must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.

(c) Form of Pre-Construction Notification: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is a PCN and must include all of the information required in paragraphs (b)(1) through (7) of this general condition. A letter containing the required information may also be used.

(d) Agency Coordination: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

(2) For all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States, for NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of intermittent and ephemeral stream bed, and for all NWP 48 activities that require pre-construction notification, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (U.S. FWS, state natural resource or water quality agency, EPA,

State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Office (THPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to telephone or fax the district engineer notice that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects to the aquatic environment of the proposed activity are minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(3) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(4) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

3. Regional Conditions for the Los Angeles District:

In accordance with General Condition Number 27, "Regional and Case-by-Case Conditions," the following Regional Conditions, as added by the Division Engineer, must be met in order for an authorization by any Nationwide to be valid:

1. For all activities in waters of the U.S. that are suitable habitat for federally listed fish species, the permittee shall design all road crossings to ensure that the passage and/or spawning of fish is not hindered. In these areas, the permittee shall employ bridge designs that span the stream or river, including pier- or pile-supported spans, or designs that use a bottomless arch culvert with a natural stream bed, unless determined to be impracticable by the Corps.

2. Nationwide Permits (NWP) 3, 7, 12-15, 17-19, 21, 23, 25, 29, 35, 36, or 39-46, 48-52 cannot be used to authorize structures, work, and/or the discharge of dredged or fill material that would result in the "loss" of wetlands, mudflats, vegetated shallows or riffle and pool complexes as defined at 40 CFR Part 230.40-45. The definition of "loss" for this regional condition is the same as the definition of "loss of waters of the United States" used for the Nationwide Permit Program. Furthermore, this regional condition applies only within the State of Arizona and within the Mojave and Sonoran (Colorado) desert regions of California. The desert regions in California are limited to four USGS Hydrologic Unit Code (HUC) accounting units (Lower Colorado -150301, Northern Mojave-180902, Southern Mojave-181001, and Salton Sea-181002).

3. When a pre-construction notification (PCN) is required, the appropriate U.S. Army Corps of Engineers (Corps) District shall be notified in accordance with General Condition 31 using either the South Pacific Division PCN Checklist or a signed application form (ENG Form 4345) with an attachment providing information on compliance with all of the General and Regional Conditions. The PCN Checklist and application form are available at: http://www.spl.usace.army.mil/missions/regulatory. In addition, the PCN shall include:
   a. A written statement describing how the activity has been designed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States;
   b. Drawings, including plan and cross-section views, clearly depicting the location, size and dimensions of the proposed activity as well as the location of delineated waters of the U.S. on the site. The drawings shall contain a title block, legend and scale, amount (in cubic yards) and area (in acres) of fill in Corps jurisdiction, including both permanent and temporary fills/structures. The ordinary high water mark or, if tidal waters, the mean high water mark and high tide line, should be shown (in feet), based on National Geodetic Vertical Datum (NGVD) or other appropriate referenced elevation. All drawings for projects located within the boundaries of the Los Angeles District shall comply with the most current version of the *Map and Drawing Standards for the Los Angeles District Regulatory Division* (available on the Los Angeles District Regulatory Division website at: www.spl.usace.army.mil/missions/regulatory/); and

   c. Numbered and dated pre-project color photographs showing a representative sample of waters proposed to be impacted on the project site, and all waters proposed to be avoided on and immediately adjacent to the project site. The compass angle and position of each photograph shall be documented on the plan-view drawing required in subpart b of this regional condition.

4. Submission of a PCN pursuant to General Condition 31 and Regional Condition 3 shall be required for all regulated activities in the following locations:
   a. All perennial waterbodies and special aquatic sites within the State of Arizona and within the Mojave and Sonoran (Colorado) desert regions of California, excluding the Colorado River in Arizona from Davis Dam to River Mile 261 (northern boundary of the Fort Mojave Indian Tribe Reservation). The desert region in California is limited to four USGS HUC accounting units (Lower Colorado -150301, Northern Mojave-180902, Southern Mojave-181001, and Salton Sea-181002).
   b. All areas designated as Essential Fish Habitat (EFH) by the Pacific Fishery Management Council (i.e., all tidally influenced areas - Federal Register dated March 12, 2007 (72 FR 11092)), in which case the PCN shall include an EFH assessment and extent of proposed impacts to EFH. Examples of EFH habitat assessments can be found at: http://www.swr.noaa.gov/efh.htm.
   c. All watersheds in the Santa Monica Mountains in Los Angeles and Ventura counties bounded by Calleguas Creek on the west, by Highway 101 on the north and east, and by Sunset Boulevard and Pacific Ocean on the south.
   d. The Santa Clara River watershed in Los Angeles and Ventura counties, including but not limited to Aliso Canyon, Agua Dulce Canyon, Sand Canyon, Bouquet Canyon, Mint Canyon, South Fork of the Santa Clara River, San Francisquito Canyon, Castaic Creek, Piru Creek, Sespe Creek and the main-stem of the Santa Clara River.

5. Individual Permits shall be required for all discharges of fill material in jurisdictional vernal pools, with the exception that discharges for the purpose of restoration, enhancement, management or scientific study of vernal pools may be authorized under NWPs 5, 6, and 27 with the submission of a PCN in

accordance with General Condition 31 and Regional Condition 3.

6. Individual Permits shall be required in Murrieta Creek and Temecula Creek watersheds in Riverside County for new permanent fills in perennial and intermittent watercourses otherwise authorized under NWPs 29, 39, 42 and 43, and in ephemeral watercourses for these NWPs for projects that impact greater than 0.1 acre of waters of the United States. In addition, when NWP 14 is used in conjunction with residential, commercial, or industrial developments the 0.1 acre limit would also apply.

7. Individual Permits (Standard Individual Permit or 404 Letter of Permission) shall be required in San Luis Obispo Creek and Santa Rosa Creek in San Luis Obispo County for bank stabilization projects, and in Gaviota Creek, Mission Creek and Carpinteria Creek in Santa Barbara County for bank stabilization projects and grade control structures.

8. In conjunction with the Los Angeles District's Special Area Management Plans (SAMPs) for the San Diego Creek Watershed and San Juan Creek/Western San Mateo Creek Watersheds in Orange County, California, the Corps' Division Engineer, through his discretionary authority has revoked the use of the following 26 selected NWPs within these SAMP watersheds: 03, 07, 12, 13, 14, 16, 17, 18, 19, 21, 25, 27, 29, 31, 33, 39, 40, 41, 42, 43, 44, 46, 49, and 50. Consequently, these NWPs are no longer available in those watersheds to authorize impacts to waters of the United States from discharges of dredged or fill material under the Corps' Clean Water Act section 404 authority.

9. Any requests to waive the 300 linear foot limitation for intermittent and ephemeral streams for NWPs 29, 39, 40 and 42, 43, 44, 51 and 52 or to waive the 500 linear foot limitation along the bank for NWP 13, must include the following:
   a. A narrative description of the stream. This should include known information on: volume and duration of flow; the approximate length, width, and depth of the waterbody and characters observed associated with an Ordinary High Water Mark (e.g. bed and bank, wrack line, or scour marks); a description of the adjacent vegetation community and a statement regarding the wetland status of the associated vegetation community (i.e. wetland, non-wetland); surrounding land use; water quality; issues related to cumulative impacts in the watershed, and; any other relevant information.
   b. An analysis of the proposed impacts to the waterbody in accordance with General Condition 31 and Regional Condition 3;
   c. Measures taken to avoid and minimize losses, including other methods of constructing the proposed project; and
   d. A compensatory mitigation plan describing how the unavoidable losses are proposed to be compensated, in accordance with 33 CFR Part 332.

10. The permittee shall complete the construction of any compensatory mitigation required by special condition(s) of the NWP verification before or concurrent with commencement of construction of the authorized activity, except when specifically determined to be impracticable by the Corps. When mitigation involves use of a mitigation bank or in-lieu fee program, the permittee shall submit proof of payment to the Corps prior to commencement of construction of the authorized activity.

4. Further information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

(X) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).
(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).
( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.
(a) This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.
(b) This permit does not grant any property rights or exclusive privileges.
(c) This permit does not authorize any injury to the property or rights of others.
(d) This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:
(a) Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.
(b) Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.
(c) Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.
(d) Design or construction deficiencies associated with the permitted work.
(e) Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:
(a) You fail to comply with the terms and conditions of this permit.
(b) The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).
(c) Significant new information surfaces which this office did not consider in reaching the original public interest decision.
Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 330.5 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measure ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. This letter of verification is valid for a period not to exceed two years unless the nationwide permit is modified, reissued, revoked, or expires before that time.

7. You must maintain the activity authorized by this permit in good condition and in conformance with the

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

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

LOS ANGELES COUNTY DEPARTMENT OF BEACHES AND HARBORS
13837 Fiji Way, Marina del Rey, California 90292

RIGHT OF ENTRY PERMIT NO. RE-007-14 ("Permit")
(REp# R90133)

Effective Date: **09/01/14** Expiration Date: **12/01/15**

BEACH/FACILITY ("Premises"): **Las Tunas Beach, as shown on Exhibit A**

PERMITTEE:
State of California
Department of Transportation
100 South Main Street
Los Angeles, CA 90012

CONTACT:
Mr. David Lewis
Phone #: (213) 897-1952
Email: David.Lewis@dot.ca.gov

PURPOSE OF PERMIT: (a) staging, and (b) ingress/egress access, as shown in Exhibit A, during Permittee's work on its No. 0712000164 ("Project") as shown in Exhibit B ("Plan and Profile"), and Exhibit C ("Traffic Control Plan")

EQUIPMENT TO BE USED: General industry standard construction equipment and appurtenances customarily utilized for the performance of the activities set forth under the Purpose of Permit: (a) trucks, and (b) crane

STAGING AREA: As depicted in Exhibit A ("Staging Area")

APPLICATION DATE: 02/25/14
PROCESSING FEE: $ (waive)
STAGING AREA FEE: $ (waive)
DEPOSIT: $ 20,000.00

TOTAL DUE: **$ 20,000.00**

AMOUNT PAID: _____
RECEIPT NO. _____

ISSUE DATE: 6/5/14

COUNTY OF LOS ANGELES ("COUNTY"), DEPARTMENT OF BEACHES AND HARBORS ("DEPARTMENT")

GARY JONES, ACTING DIRECTOR or Authorized Representative

By: _____
Chief Property Manager
Asset Management Division

THIS PERMIT IS SUBJECT TO THE TERMS AND CONDITIONS AND AMENDMENTS LISTED BELOW AND TO THE PROVISIONS LISTED UNDER THE "GENERAL PROVISIONS" SECTION HEREIN

SPECIAL CONDITIONS:

1. **Limited Access.** Permittee acknowledges that the limited purpose of Permit ("Purpose of Permit"), as stated above, is to grant Permittee access to County-owned, controlled or managed beaches, and is not in any

Permittee's Initials: _____

manner authorizing access to beaches NOT owned, controlled or managed by the County. For access to beaches NOT owned, controlled or managed by the County, including but not be limited to those owned by private homeowners, operated or managed by homeowner associations, or under the jurisdiction of any federal, state, or local municipalities, Permittee shall obtain prior written consent from said proprietor(s) before starting any work within those jurisdictions.

2. **Express Consent of Coastal Development Permit.** In addition to the requirement set forth in General Provision Nos. 3 and 4, Permittee acknowledges that the Coastal Development Permit or waiver of Coastal of Development Permit issued or to be issued for work under this Project shall expressly state or include the Staging Area and Work Area on the Premises. Permittee shall provide the Department all copies thereof. Failure to comply with this condition shall constitute a material breach of contract upon which the Department may immediately terminate or suspend this Permit.

3. **Coordination with Department.** To coordinate access and minimize interference with any Department's projects or operations, no later than three weeks before starting any work under this Permit, Permittee shall hold an on-site pre-construction meeting for this Project. Permittee shall coordinate such meeting with the Department by emailing the Department's contact, Real Property Agent, Stephen Nguyen, at **SNguyen@bh.lacounty.gov**

4. **Coordination with Department.** To coordinate access and minimize interference with any Department's projects or operations, Permittee shall contact the Department, Facilities and Property Maintenance Division - Northern Beaches District Manager John Giles, at (310) 454-7962 or by email at **JGiles@bh.lacounty.gov**, at least 48 hours before starting any work under this Permit.

5. **Notification to Los Angeles County Lifeguards.** Permittee shall not interfere with any Lifeguard activities or operation, and shall contact and coordinate with the Los Angeles County Lifeguards, North Lifeguard Battalion, Section Chief Fernando Boiteux, at (310) 577-5700, or by email at **Fernando.Boiteux@fire.lacounty.gov**, at least 48 hours before starting any work under this Permit.

6. **Underground Utility Locator Service.** Permittee shall contact Underground Service Alert at (800) 227-2600 or Goldak at (800) 240-2666, at least 48 hours before commencing any excavation or other below surface work authorized under this Permit.

7. **No Change to Approved Exhibits.** Permittee shall make no changes to the Staging Area and Work Area as shown in Exhibit A without the prior written approval from the Department. Permittee may request Department's approval to any changes to Exhibit A by sending such request in writing by email, to the Department, Real Property Agent, Stephen Nguyen. The Department shall have the right to deny any changes Exhibit A in its sole and absolute discretion.

   Additionally, Permittee shall notify the Department in advance of any changes to Plan and Profile as shown in Exhibit B. Department shall have an opportunity to provide inputs on such changes, insofar as those changes may negatively impact Department's projects or operations.

8. **Additional Submittal of Exhibit.** No later than two weeks before starting any work under this Permit, Permittee shall submit to the Department, Real Property Agent, Stephen Nguyen, copies the Traffic Control Plan (Exhibit C).

   Department shall have an opportunity to provide inputs on such Traffic Control Plan, on matters that may negatively impact Department's projects or operations.

9. **Working Hours.** Permittee's work hours shall be between 7:00 a.m. to 5:00 p.m. Monday through Friday. No work is allowed on weekends or holidays. All work including, but not limited to, the prepping or warming up of heavy equipment, shall fall within the prescribed time period.

10. **Limited Work during Summer Months**. Between May 23rd and August 29th ("Summer Months") during the term of this Permit, Permittee warrants that all work authorized under this Permit shall be limited to existing

Permittee's Initials:_____

non-sandy portions of the Premises. Further, all existing sandy portions of the Premises shall be accessible by the general public.

11. **Public Notice.** Before commencement of any work under this Permit, Permittee shall provide notices ("Public Notice") to residences and businesses within 500 feet of the Staging Area and construction areas, informing them about the Project. Such Public Notice shall include a brief description of the Project's (a) background; (b) purpose of work; (c) approximate duration of work; (d) map showing location of work; and (e) contact information.

12. **Staging Area.** Permittee shall (a) take photos to document the conditions of the entire Premises prior to Permittee's work, and submit such photos to the Department within one week after they were taken; (b) secure and enclose the Staging Area with temporary fencing panels; (c) post Public Notices on said fencing panels; (d) open the fencing gates inwardly (toward the Staging Area) and not outwardly (toward the dirt lot); (e) reduce the footprint of the Staging Areas, when such areas are no longer needed during the term of this Permit; (f) store all equipment and materials inside the Staging Area; (g) not allow any overnight storage of any kinds on the Premises outside the Staging Area; (h) examine the Premises on a daily basis for damages caused by Permittee's work, and notify the Department of such damages within 24 hours; (i) cover dirt, soil or rocks stockpile, if any, at the end of each working day, or when such stockpile is not actively being used during a period longer than four hours; and (j) display signage to alert the general public of construction traffic.

13. **Beach Driving and Vehicle Operation Policy.** Permittee has read and understood, and shall abide by the Department's Beach Driving and Vehicle Operation Policy (No. 2918) when driving vehicles of any kind on County-owned, controlled or managed beaches or any of its sandy portions. A copy of the Department Beach Driving and Vehicle Operation Policy (No. 2918) is attached hereto.

    Prior to the issuance of this Permit, Permittee and Permittee's representative who will drive vehicles of any kind on County-owned, controlled or managed beaches, shall both sign a copy of the Beach Driving and Vehicle Operation Policy (No. 2918) to show that he or she has read and understood the Policy, and provide said signed copy to the Department's real Property Agent, Stephen Nguyen.

14. **Best Efforts to Minimize Negative Impact.** Permittee shall use best efforts to minimize the negative impact on any of the County operations, which shall include, but not limited to, ensuring that all vehicles and equipment belonging to Permittee, its agents, employees, contractors, subcontractors, invitees, visitors, servants, and anyone holding under the Permit (collectively, "Permittee Parties") do not block any driveways, entrances or exits, parking spaces, emergency access ways or bike paths, except as expressly permitted under this Permit. Emergency vehicles must be able to navigate safely and freely in and out of the Premises at all times.

15. **Parking.** Permittee is not granted parking privileges on the Premises or at any County parking lots. Permittee Parties shall pay the posted parking lot entry fee for each vehicle upon entry into any County parking lots and shall obey all posted parking lot rules and regulations. Any vehicles found without the paid parking permit clearly visible and appropriately displayed on the left side of the dashboard will be subject to a $63 parking citation or such fine as may be in force and effect at the time of citation issuance. Citations will not be waived under any circumstances.

16. **Best Efforts to Ensure Public Safety.** Permittee Parties shall exercise all the necessary precautions to safeguard the public from injury. Such precautions shall include, but not limited to (a) providing the sufficient number of flagmen or other personnel to warn the public of any active construction area, and to coordinate traffic throughout the Premises; and (b) not allowing any equipment or machinery to sit idle or left unattended anywhere outside the Staging Area or anywhere else on the Premises.

17. **County Not Responsible for Permittee's Property.** Permittee understands and agrees that County shall not be responsible for any theft of or damage to the equipment, tools, vehicles, materials or other property of Permittee or any Permittee Parties or for any personal injury associated with Permittee's entry onto the Premises or incurred in connection with the work under this Permit. Permittee agrees to indemnify, defend, and hold harmless the County for all claims, liabilities, damages, losses, costs and expenses (including

Permittee's Initials: _____

without limitation legal fees and costs) incurred by or brought against County in connection with or related to any of the matters set forth in the immediately preceding sentence.

18. **Repair and Restoration of Premises.** Permittee shall repair or restore the Premises to the same or better condition than it was at the time Permittee first entered the Premises. Such repair and restoration to the Premises shall include, but not limited to: (a) backfilling, compacting and resurfacing all holes, excavations and trenches; (b) restoring the Premises and all improvements on the Premises to at least as good condition as existing immediately prior to Permittee's entry onto the Premises; (c) repairing or replacing all damaged properties identified by the Department; (d) removing all trash or debris and returning the Premises in a broom-clean condition; (e) removing all excavated road base, gravel rocks, or foreign materials; and (f) using a screening device to sanitize the sand once the permitted activity has been completed, and said screen or mesh used in the sanitizing device shall have openings not exceeding 3/8-inch square.

    Two weeks before the Expiration Date, completion of the Project, or termination of the Permit, whichever comes first, Permittee shall notify the Department in writing to schedule a final walk-through of the Premises by emailing the Department's contact, Real Property Agent, Stephen Nguyen.

    The Department shall have the right to inspect and require Permittee to perform further repair or restoration work if it deems the initial repair or restoration to be unsatisfactory.

19. **Permit Extension for Repair and Restoration Purpose.** Following the Expiration Date, the Permit may be automatically extended upon all of the terms and conditions set forth herein, for the limited purposes of Permittee's repair and restoration work as required in above Special Condition No. 18. (if required by County).

20. **Security Deposit.** Prior to the starting of any work under this Permit, Permittee shall submit to the County a security deposit in the amount of $20,000.00 ("Security Deposit"). The Security Deposit shall be used to cover any cost incurred by the County for repair or restoration to the Premises not completed by Permittee or not competed to the Department's satisfaction. Notwithstanding the Security Deposit provisions prescribed herein, Permittee remains responsible for the cost of any damages beyond the limit of the Security Deposit. Thereafter, any unused portion of the Security Deposit shall be refunded to Permittee.

21. Permittee shall solely be responsible for all aspects of the monitoring, inspections, operation, maintenance and repair this Project in accordance to accepted general industry standards.

    Additionally, notwithstanding any contrary term or provision of this Permit or any permits issued by the Department, no expiration or termination thereof shall release or relieve Permittee from (a) any obligations or liabilities that arise or accrue prior to such expiration or termination; and (b) any obligations or liabilities of Permittee relating to the repair, restoration or surrender of the Premises. Permittee's obligations and liabilities set forth in the immediately preceding sentence shall survive any expiration or termination of this Permit or any permits issued by the Department.

22. **Failure to Comply with Permit's Terms and Conditions.** The failure of Permittee to comply with all terms and conditions of this Permit, including without limitation, these Special Conditions or the General Provisions set forth below, shall constitute a material breach of this Permit by Permittee and shall entitle Department, in addition to any other rights or remedies, to immediately terminate or suspend this Permit.

GENERAL PROVISIONS

1. **Notification to Permittee's Parties.** Permittee shall be responsible for informing Permittee's Parties of the conditions of this Permit, and that a copy of this Permit shall be given to the contractor(s) and any subcontractor(s). Further, a copy of this Permit shall be kept at the work site at all times during the term of this Permit.

Permittee's Initials:

2. **Additional Conditions.** This Permit is subject to further conditions as the Director of the Department or his representative may issue during the term of this Permit. When possible, such additional conditions shall be delivered in writing to the address or email address shown on the first page of this Permit.

3. **Compliance with other Permits and Approvals.** Permittee is advised that work under this Permit may require a permit, an approval, or a waiver from the regulatory agencies, including but not limited to United States Army Corps of Engineers, the California Coastal Commission, and/or the California Department of Transportation. Permittee shall obtain all required permits, approvals or waivers from any regulatory agencies prior to commencing work. Permittee agrees to keep and perform all provisions contained in any permits, approvals, or waivers issued or to be issued to Permittee by any governmental agency or commission.

4. **Provide Department with all other Permits and Approvals.** Permittee shall provide the Department with a copy of all permits, approvals, or waivers for the work under this Permit (including any and all extensions, updates, amendments or addenda) issued or to be issued to Permittee by any regulatory agencies and Permittee shall comply with the terms, provisions, requirements and conditions of all such permits, approvals, or waivers. Prior to the commencement of work under this Permit, Permittee must demonstrate to the satisfaction of the Department that it has obtained and will maintain for the duration of this Permit all permits, approvals, or waivers necessary for the work on the Premises, and other related work to be performed by Permittee on any other surrounding land. Failure to comply with this condition shall constitute a material breach of contract upon which the Department may immediately terminate or suspend this Permit.

5. **Best Management Practices.** Permittee shall be responsible for the selection and implementation of Best Management Practices (BMPs) to prevent contamination of the Premises, adjacent land or local sand. Such BMPs shall include but not be limited to covering the work areas with plastic sheeting, placing oil absorbent pads under all vehicles and equipment, and having absorbent material readily available to prevent any hazardous runoff or spill.

6. **General Maintenance.** Permittee's general maintenance of the Premises shall include, but not limited to: (a) on a daily bases, removing all trash, debris or other materials generated in connection with the work under this Permit, removing any graffiti tagged on the Premises or the property of Permittee or Permittee Parties within 24 hours from the earlier of the discovery of such graffiti by Permittee or Permittee Parties or the receipt of notice from the Department; (b) promptly repairing or replacing all damaged properties caused by Permittee or Permittee Parties as soon as Permittee is aware of the damage but not later than five calendar days after receipt of notification from the Department; and (c) keeping the Premises affected by Permittee's work under this Permit and any of its property on the Premises in good working order and maintain such property in a neat, clean, and orderly condition at all times during the term hereof and not permit graffiti, rubbish, tin cans, garbage, etc., to accumulate, nor to use or allow use of the Premises for any illegal or unauthorized purposes, and to comply with all federal, state, and local law, statute, and ordinances concerning Premises and the use thereof.

7. **Covering Trenches.** Permittee shall abide by all CAL OSHA rules, regulations, and guidelines, including but not limited to, if applicable, covering or securing all open holes, excavations, or trenches when those are not being worked on, with CAL OSHA approved handrails or trench plates.

8. **Advertising and Marketing Materials.** Permittee shall not exhibit or permit any Permittee Parties to exhibit any advertising signs or other marketing material on the Premises, other than signs displaying the name and telephone number of Permittee or information permanently affixed to Permittee's or Permittee Parties' vehicles, unless prior written approval of the Director of the Department is first obtained.

9. **Public Courtesy.** Permittee agrees to conduct work in a courteous, non-profane, and first-class workmanlike manner. Permittee shall not interfere with the use of the Premises by the County or the public. Permittee shall promptly remove or cause to be removed from the Premises any Permittee Parties that fails to conduct activities in the manner heretofore described.

10. **Right of Use.** Permittee acknowledges that this Permit is issued by County of Los Angeles to Permittee for the intended activities and is not intended, and shall not be construed to create the relationship of agent,

Permittee's Initials:

servant, employee, partnership, joint venture, association or landlord/tenant, as between County and Permittee. It is expressly understood by Permittee that in permitting the right to use the Premises, no estate or interest in real property is being conveyed to Permittee, and that the right to use the Premises pursuant to this Permit is only a nonexclusive, revocable and un-assignable license to conduct work in accordance with the terms and conditions of this Permit.

11. **Costs of Improvements.** Permittee has examined the Premises and is familiar with the condition thereof. Permittee accepts the Premises in its present state and condition and waives any and all rights or demands against County for any alteration, repair, modification or improvement thereof. Permittee shall make no alterations or improvements to the Premises without prior written approval from the County. Permittee shall arrange for and bear the cost of any other required governmental permits, site preparation, utility installation, surface treatment, Premises containment or enclosure, insurance or utility service, and other costs of any nature whatsoever, which are incurred by Permittee or Permittee Parties or otherwise required in connection with Permittee's activities on the Premises. Permittee shall be entitled to no reimbursement, credit or offset from County for any of such costs, or for any work performed by or on behalf of Permittee.

12. **Permittee's Right to Terminate.** Permittee may terminate this Permit at any time by giving County no less than thirty (30) calendar days' advance written notice of intention to terminate. However, such termination shall not be effective unless Permittee has complied with all of the following:

    - Permittee shall vacate the Premises, including the removal of all equipment or property of Permittee or Permittee Parties and return the Premises in the condition required under this Permit. Permittee acknowledges that it shall be responsible for all costs of vacating the Premises.

    - Permittee shall comply with all of its obligations under this Permit with respect to the work performed prior to such termination or required to be completed by Permittee notwithstanding such termination, including without limitation, all repair and restoration obligations under this Permit and any additional work required to be performed pursuant to Special Condition No 18.

    - An authorized County representative shall have the right to inspect the Premises for compliance with this Permit. Until such compliance is confirmed in writing by an authorized County representative, Permittee shall continue to be responsible for the condition of the Premises.

13. **County's Right to Terminate.** County may terminate this Permit at any time by giving Permittee a thirty (30) calendar day written notice of termination. Upon receipt of such notice, Permittee shall vacate the Premises as required herein. Permittee agrees that if it fails to vacate and return the Premises to County as herein provided, then County or its authorized agents may enter upon the Premises, remove Permittee's personal property therefrom and perform any obligations of Permittee that Permittee fails to perform hereunder. Permittee shall reimburse County for all expenses incurred by the County pursuant to the immediately preceding sentence, plus interest at the maximum rate allowed by law accruing from the day County incurred the expense until such time as the principal and interest are fully paid by Permittee. Permittee waives any and all claims for damages against the County, its officers, agents, or employees in connection with any such termination. This paragraph shall be in addition to, and no term or provision of this Permit shall be deemed a waiver of, any rights of the County to demand and obtain possession of the Premises in accordance with law in the event Permittee violates any part of the terms or conditions herein.

14. **County Right of Temporary Termination or Suspension.** It is understood and agreed that County may temporarily suspend or terminate the Permit without prior notice to Permittee in order to allow the performance by County, its officers, agents, and employees, of work necessary to protect or safeguard persons or property, including the Premises, from impending danger, hazard, or harm; provided, however, that County shall have no duty, obligation or responsibility with respect to any such dangers, hazards or harms, or with respect to any such protections or safeguards.

15. **Prior Agreements.** This Permit shall cancel, terminate and supersede any prior oral or written agreement, correspondence, understandings or commitments, if any, between County and Permittee for use of the Premises, as of the Issue Date of this Permit.

Permittee's Initials:

16. **Possessory Interest.** This Permit may create a possessory interest upon which a property tax may be levied. In such event, Permittee shall pay before delinquency, all such taxes and assessments.

17. **Permittee's Waiver and Release.** It is understood and agreed that County shall not be responsible for, on behalf of itself and all Permittee Parties, and Permittee hereby releases and waives County from and against, any claims or liabilities for damage to the Premises or injuries to persons that may arise from or be incidental to the use and occupancy of Premises, or for damages to the property of Permittee or any Permittee Parties, or for injuries to the person of Permittee, any Permittee Parties or any other person, including without limitation, any person who may be on the Premises at anyone's invitation.

18. **Indemnification and General Insurance Requirements.** Except for such claim, liability or financial loss or damage arising from the sole negligence or willing misconduct of the County, as determined by final arbitration or court decision or by agreement of the County an Permittee, Permittee and Permittee Parties shall indemnify, defend (with counsel reasonably satisfactory to County), and hold harmless County, its Special Districts, elected and appointed officers, employees and agents, from and against any and all liabilities, demands, claims, injury, illness or death, causes of action whatsoever nature or character, losses, damage to or destruction of property which arises out of or is in any way connected to this Permit, fees, costs, expenses (including court costs, attorney and expert witness fees, and other litigation costs), arising from or related to the entry by, or the activities of, Permittee or any Permittee Parties, or connected with the design, construction, or the use or operation of the Project, on the Premises or any adjacent or surrounding property.

    Such indemnification shall survive in its entirety the termination or revocation of this Permit, and shall remain in full force and effect in perpetuity, unless agreed to otherwise in writing by the County.

    Without limitation of the indemnification or other obligations and liabilities of Permittee under this Permit, Permittee shall at its own expense, maintain in full force and effect, and require its contractors to maintain in full force and effect, at all times during the term of this Permit (and including any period after the expiration or termination of this Permit prior to when Permittee completes all of its repair, restoration or other obligations under this Permit), a policy or polices of insurance covering the Premises affected by Permittee's work under this Permit. Such insurance shall be provided by insurer(s) satisfactory to the County. Permittee, at its sole option, may satisfy all or any part of this insurance requirement through use of a program of self-insurance (self-funding of its liabilities). Permittee shall deliver to the Department evidence of such insurance coverage or letter evidencing self-funding as reasonably acceptable to the Department prior to any entry onto the Premises or the performance of any work under this Permit.

    Certificate evidencing coverage or letter evidencing self-funding will be provided to County prior to the execution of this Permit.

    At all times during the terms of this Permit, Permittee shall also cause its contractor(s), including any subcontrator(s), to provide and maintain the following programs of insurance coverage. At a minimum, the policy shall meet the following minimum criteria:
    • Commercial General Liability insurance (providing scope of coverage equivalent to ISO policy form CG 00 01), naming County of Los Angeles, its Special Districts, elected officials, officers, agents, employees and volunteers (collectively, **"County and its Agents"**) as an additional insured with limits of not less than:

General Aggregate:	$2 million
Products/Completed Operations Aggregate:	$1 million
Personal and Advertising Injury:	$1 million
Each Occurrence:	$1 million

    The Products/Completed Operations coverage shall continue to be maintained in the amount indicated above for at least two (2) years from the date when work under this Permit completed and accepted by the Permittee.

    • The County and its Agents shall be provided additional insured status under Permittee's and contractor(s) and/or subcontractor(s)' General Liability policies with respect to liability arising out of Permittee's and its

Permittee's Initials: _____

contractor(s)' and/or subcontractor(s)' ongoing and completed operations performed on the Premises. County and its Agents' additional insured status shall apply with respect to liability and defense of suits arising out of the Permittee's acts or omissions, whether such liability is attributed to Permittee or to the County. If County is not named as an Additional Insured in the original general liability policy, an endorsement will be necessary to satisfy this provision.

• This Permit No. RE-007-14 is included as part of the insured premises to be evidenced by an endorsement or a similar instrument. (If the Premises or this Permit is not named as an Additional Insured in the original policy, an endorsement will be necessary to satisfy this provision.)

• Automobile Liability insurance (providing scope of coverage equivalent to ISO policy form CA 00 01) with limits of not less than $1 million for bodily injury and property damage, in combined or equivalent split limits, for each single accident. Insurance shall cover liability arising out of Permittee's use of autos pursuant to this Permit, including owned, leased, hired, and/or non-owned autos, as each may be applicable.

• Workers' Compensation and Employers' Liability insurance in an amount and form to meet all applicable requirements of the Labor Code of the State of California, which includes Employers' Liability coverage with limits of not less than $1 million per accident and which specifically covers the persons and risks involved in this Permit. Permittee understands and agrees that all persons furnishing services pursuant to this Permit are, for purposes of Workers' Compensation liability, employees solely of Permittee and not of County. Permittee shall bear the sole responsibility and liability for furnishing Workers' Compensation benefits to any person for injuries arising from or connected with services performed on behalf of Permittee pursuant to this Permit.

Coverage shall be placed with insurers acceptable to the County with A.M. Best ratings of not less than A:VII unless otherwise approved by County.

All policies of insurance or comparable programs of self-insurance shall be with a company or companies authorized by law to transact insurance business in the State of California. Prior to the Issue Date of this Permit, Permittee shall furnish to the County a certificate of insurance (Certificate of Insurance) or other proof of coverage evidencing Permittee's insurance coverage.

Copies of certificates of insurance or other proof of insurance coverage by Permittee and its contractors shall be delivered by Permittee to:

County of Los Angeles
Department Beaches and Harbors
Asset Management Division
Attention: Right of Entry Permit Administrator
13837 Fiji Way
Marina del Rey, CA 90292

Permittee also shall promptly report to County (a) any personal injury or property damage accident or incident, including any injury to an employee or agent of Permittee or Permittee Parties occurring on the Premises or in connection with the work under this Permit; and (b) any third party claim or suit filed or threatened against Permittee or any Permittee Parties which arises from or relates to the Permit.

Failure on the part of Permittee to procure or maintain required insurance or to verify its contractor(s)' required insurance shall constitute a material breach of this Permit entitling the Department to immediately terminate this Permit.

Upon renewal of any of the policies of insurance, Permittee shall furnish to the County a Certificate of Insurance evidencing Permittee's continued insurance coverage. The County shall be given notice in writing at least 30 days in advance of cancellation or modification of such policy.

Permittee shall provide County with written notice of cancellation or any change in the above noted minimum requirements, including insurer, limits of coverage, and term of coverage or policy period. The written notice

Permittee's Initials:

shall be provided to County at least ten (10) days in advance of cancellation for non-payment of premium and thirty (30) days in advance for any other cancellation or policy change. Failure to provide written notice of cancellation or any change in above noted minimum requirements may constitute a material breach of the Permit, in the sole discretion of the County, upon which the County may suspend or terminate this Permit.

19. **No Improvements Permitted.** Permittee shall not commence nor permit any construction, alteration, or placement of any improvements on or within the Premises without first submitting plans and specifications for advance written approvals by the Department and the Los Angeles County Department of Public Works, Building and Safety Division.

20. **No Improvements Permitted.** Permittee shall not construct or place any improvements on the Premises.

21. **Environmental Site Assessments.** County may, at its sole discretion, enter Premises to conduct Environmental Site Assessments. Upon review of such Assessments, County may, at its sole discretion, terminate this Permit consistent with the general provisions herein. Permittee shall bear any and all responsibility, expense, and liability incurred in the cleanup and treatment of any hazardous materials or condition found on the Premises caused by Permittee's use, storage, or treatment of any hazardous materials on or within the Premises.

22. **County Lobbyist.** Each County Lobbyist as defined in Los Angeles County Code Section 2.160.010, retained by Permittee, shall fully comply with the County Lobbyist Ordinance, Los Angeles County Code Chapter 2.160. Failure on the part of any Lobbyist retained by Permittee to fully comply with the County Lobbyist Ordinance shall constitute a material breach of this Permit upon which the County may terminate or suspend this Permit.

23. **Surviving Obligations.** Notwithstanding any contrary term or provision of this Permit, no expiration or termination of this Permit shall release or relieve Permittee from (a) any obligations or liabilities that arise or accrue prior to such expiration or termination; and (b) any obligations or liabilities of Permittee relating to the repair, restoration or surrender of the Premises. Permittee's obligations and liabilities set forth in the immediately preceding sentence shall survive any expiration or termination of this Permit.

24. **Suspected Fraud.** County requests that Permittee Parties shall report any suspected fraud or wrongdoing by any County employee. Such report may be made anonymously, at the County Fraud Hotline (800) 544-6861, or www.lacountyfraud.org.

25. **Appropriateness or Suitability of Permittee's work under Permit.** County makes no representations or warrants as to the review, if any, by County for any work plans, specifications, or documentation as to Permittee's work, submitted by Permittee Parties. Permittee further acknowledges that the issuance of this Permit to allow for the entry for the work under this Permit, does not constitute any approval, either implied or explicit, on the part of the County, as to the appropriateness or suitability of Permittee's work under this Permit.

26. **Governing Law.** This Agreement shall be controlled by and construed under the laws of the State of California, excluding California's choice of law rules. Venue for any such action relating to the Permit shall be in the Los Angeles County Superior Court.

Permittee's Initials:

ACCEPTANCE

Permittee represents and warrants that the signatory to this Permit is fully authorized to obligate Permittee hereunder and that all acts necessary for the execution of this Permit have been accomplished.

The undersigned Permittee acknowledges that it has read, understands and agrees to all the terms, conditions, and restrictions contained in this Permit.

PERMITTEE:

State of California
Department of Transportation

Signature: _____

Name in Print: O. C. Lee

Title: Senior Transportation Engineer

Date: 6-4-2014

WARNING: COMPLETION OF AN APPLICATION CONFERS NO PRIVILEGES UPON THE APPLICANT. DO NOT ATTEMPT TO ENTER OR USE THE PREMISES UNTIL YOU HAVE RECEIVED A FULLY EXECUTED PERMIT. ANY ATTEMPT TO ENTER OR USE THE PREMISES MAY CAUSE YOUR APPLICATION TO BE REJECTED AND MAY SUBJECT YOU TO CIVIL OR CRIMINAL PROSECUTION.

File Ref: W 26667
PRC 9064.9

STATE OF CALIFORNIA
STATE LANDS COMMISSION

DEPARTMENT OF TRANSPORTATION

RIGHT-OF-WAY MAPS

WHEREAS, the Department of Transportation, pursuant to the provisions of Section 101.5 of the Streets and Highways Code, has filed with the State Lands Commission maps, copies of which are attached hereto as Exhibit "A", and by reference made a part hereof, delineating and describing lands of the State of California situate near the city of Malibu, Los Angeles County, under the jurisdiction of the State Lands Commission needed for highway purposes; and

WHEREAS, the State Lands Commission, under the provisions of Section 6210.3 of the Public Resources Code, may award easements and rights-of-way to the Department of Transportation for purposes of rights-of-way for highways and for use in protecting highways from damage or destruction by natural forces.

NOW, THEREFORE, as provided for in and pursuant to Section 101.5 and Section 6210.3 and in consideration of the deposit by the Department of Transportation of appropriate funds into the State Parks and Recreation Fund, the State Lands Commission does hereby reserve and convey a right-of-way for the Department of Transportation on the lands described on said maps, and authorizes the approval of said maps, subject, however, to the following conditions:

1. The right-of-way granted hereby may be released at any time by written certificate of the Director of the Department of Transportation (DOT), filed with the State Lands Commission (SLC); but if after said DOT has entered upon and used said right-of-way for any of the purposes specified in Section 6210.3 of the Public Resources Code and such use or uses have been discontinued for a consecutive period of 365 days and said right-of-way has not been released as provided above, said right-of-way shall, at the option of the SLC, and upon written notice to said DOT, cease and terminate.

2. There is retained by the SLC the right to convey, issue, or otherwise transfer rights in the lands that are subject to this right-of-way, subject and subordinate to the rights of the DOT therein. There is also retained by said SLC on the right to grant permits, leases, or easements, for crossings over, upon and under said lands, provided, however, that any such easement or crossing within 100 feet of the surface of such lands shall be in a form and manner acceptable to, and shall be expressly approved by said DOT.

3. All tools, equipment, or other property taken onto or placed upon the right-of-way by the DOT shall remain the property of the DOT. Such property shall be properly removed by the DOT, at its sole risk and expense.

4. The SLC is not responsible for any damage to any property, including any equipment, tools, or machinery within the right-of-way.

5. The DOT shall adhere to the 2006 DOT Standard Specifications and provide to the SLC a detailed work schedule upon completion of the project.

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

7. No refueling, maintenance, or repairs to any equipment or vehicles will be permitted within the right-of-way.

8. The DOT shall, at its own expense, keep and maintain the right-of-way and all improvements in good order and repair and in safe condition. The SLC shall have no obligation for such repair and maintenance.

9. The DOT agrees to replace any existing corroded drainage pipes and remove any corroded existing sheet metal within the right-of-way.

10. The DOT agrees to maintain the existing concrete groin until such time the DOT determines it should be removed.

11. Upon completion of the Las Tunas Rock Slope Stabilization Project, the DOT will provide the SLC a copy of as-built drawings confirming that all structures and improvements were completed according to design specifications as submitted with the application. The DOT shall also provide descriptive photographs of the completed project.

12. The DOT shall agree to indemnify, hold harmless and, at the option of the SLC, defend the SLC, its agencies, officers, agents, and employees, against and for any and all liability, claims, damages, or injuries of any kind and from any cause arising out of or connected in any way with any actions by the DOT regarding this right-of-way.

This agreement will become binding on the State only when duly executed on behalf of the State Lands Commission of the State of California.

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the date hereafter affixed.

DEPARTMENT OF TRANSPORTATION*

By: Dan Stardock

Title: Surveying Right of Way Agent

Date: 4-19-13

STATE OF CALIFORNIA
STATE LANDS COMMISSION

By: _____

Chief
Land Management Division

Date: MAY 09 2013

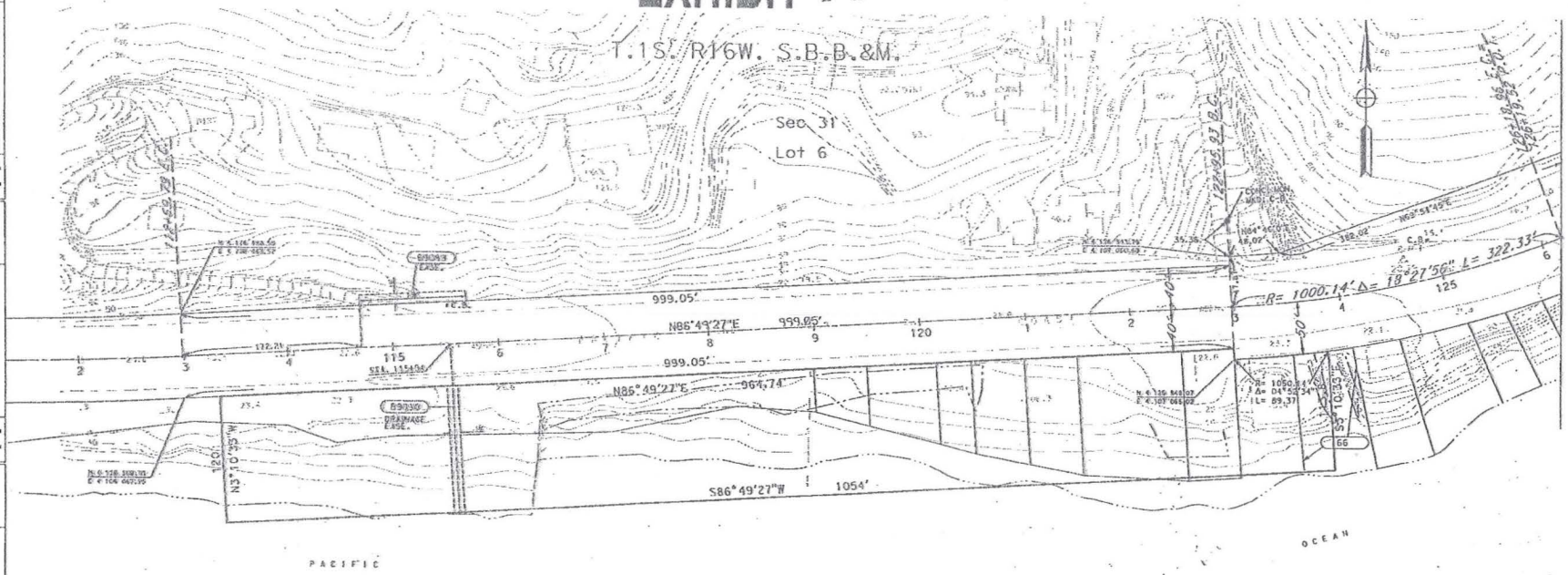
Approval of the Right-of-Way Map was authorized by the State Lands Commission on: April 26, 2013

* If the document is executed by any person other than the Director of the Department of Transportation, a certified copy of the executor's authority must be attached hereto.

EXHIBIT A

T.1S. R16W. S.B.B.&M.

NOTE: The State of California or its officers or agents shall not be responsible for the accuracy or completeness of digital images of this map.



PARCEL #	TITLE CODE	GRANTOR/GRANTEE	AREAS (square feet or as noted) TOTAL	REQUIRED ① (UF)	EXCESS ② (UF)	REMAINDER	REMARKS	RECORDATION TYPE ③	DATE	DOC.# ④
66		TITLE INS. & TRUST CO.						FEE	04-11-1940	17427-156
B9089		MALIBU PALISADES						EASE.	04-12-1962	D1571-665
B9050		DIVISION OF BEACHES & PARKS						EASE.	07-10-1962	
									- -	
									- -	

MAP SHOWING SOVEREIGN LANDS OF THE STATE OF CALIFORNIA IN LOS ANGELES COUNTY, IN THE CITY OF MALIBU, DEFINED AS A RIGHT OF WAY FOR AND FOR THE PROTECTION OF A STATE HIGHWAY. ROAD -LA-1- P.M. 42

SURVEYOR'S STATEMENT

THIS MAP WAS PREPARED BY ME OR UNDER MY DIRECTION TO DESCRIBE AN APPLICATION FOR STATE LANDS MADE PURSUANT TO SECTION 101.5 OF THE STREETS AND HIGHWAYS CODE.

PROFESSIONAL LAND SURVEYOR

DATE

STATE OF CALIFORNIA
STATE LANDS COMMISSION

THIS MAP IS HEREBY APPROVED AND FILED FOR RECORD WITH THE STATE LANDS COMMISSION PURSUANT TO THE PROVISIONS OF SECTION 101.5 OF THE STREETS AND HIGHWAYS CODE. THE SOVEREIGN LANDS UNDER THE JURISDICTION OF THE STATE LANDS COMMISSION AS THEY MAY LIE WITHIN THE RIGHT OF WAY LINES SHOWN UPON THIS MAP ARE HEREBY RESERVED FOR HIGHWAY PURPOSES.

APPROVED: MEETING _____ 20 ___

STATE LANDS COMMISSION

BY _____
CHIEF, DIVISION OF LAND MANAGEMENT

NOTES

Coordinates and bearings are on CCS NAD 1927 Zone 7. Distances and stationing are grid distances.

All distances are in feet unless otherwise noted.

LEGEND

- Access Prohibited
- Access Superseded
- Existing R/E Superseded
- Access Opening (Private)
- (N) Indicates Radial Bearing
- ⊕ Indicates Found Monument as noted
- ○ Indicates calculated point. (Does not imply monument set)
- Title to State Requires for Others

STATE OF CALIFORNIA
BUSINESS, TRANSPORTATION AND HOUSING AGENCY
DEPARTMENT OF TRANSPORTATION

STATE APPLICATION MAP

MAP NO. P,3618-A

FOR PREVIOUS R/W INFORMATION SEE MAP(S) P,3618, P,3618-1

FEET 0 25 50 100 150

PROJECT ID: 07 1200 0164

TO DESIGN: / / EA[a]:3X4504 FAH

DISTRICT	COUNTY	ROUTE	SHEET PU	SHEET NO.	TOTAL SHEETS
7	LA	1	42		

R/W PROJECT SURVEYOR: DATE BY REVISIONS DATE BY REVISIONS DATE BY REVISIONS DATE BY REVISIONS

CALIFORNIA JURAT WITH AFFIANT STATEMENT

☒ See Attached Document (Notary to cross out lines 1–6 below)
☐ See Statement Below (Lines 1–6 to be completed only by document signer[s], *not* Notary)

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____ _____

Signature of Document Signer No. 1 — Signature of Document Signer No. 2 (if any)

State of California

County of Los Angeles

Subscribed and sworn to (or affirmed) before me on this 19th (Date) day of April (Month), 2013 (Year), by

(1) Dan Murdoch,
Name of Signer

proved to me on the basis of satisfactory evidence to be the person who appeared before me (.) (,)

(and

(2) _____,
Name of Signer

proved to me on the basis of satisfactory evidence to be the person who appeared before me.)

KATHRINE BRYAN
Commission # 1904897
Notary Public - California
San Luis Obispo County
My Comm. Expires Sep 20, 2014

Place Notary Seal Above

Signature _____
Signature of Notary Public

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Further Description of Any Attached Document

Title or Type of Document: _____

Document Date: _____ Number of Pages: _____

Signer(s) Other Than Named Above: _____

RIGHT THUMBPRINT OF SIGNER #1	RIGHT THUMBPRINT OF SIGNER #2
Top of thumb here	Top of thumb here

File Ref: W 26667
PRC 9064.9

STATE OF CALIFORNIA
STATE LANDS COMMISSION

DEPARTMENT OF TRANSPORTATION

RIGHT-OF-WAY MAPS

WHEREAS, the Department of Transportation, pursuant to the provisions of Section 101.5 of the Streets and Highways Code, has filed with the State Lands Commission maps, copies of which are attached hereto as Exhibit "A", and by reference made a part hereof, delineating and describing lands of the State of California situate near the city of Malibu, Los Angeles County, under the jurisdiction of the State Lands Commission needed for highway purposes; and

WHEREAS, the State Lands Commission, under the provisions of Section 6210.3 of the Public Resources Code, may award easements and rights-of-way to the Department of Transportation for purposes of rights-of-way for highways and for use in protecting highways from damage or destruction by natural forces.

NOW, THEREFORE, as provided for in and pursuant to Section 101.5 and Section 6210.3 and in consideration of the deposit by the Department of Transportation of appropriate funds into the State Parks and Recreation Fund, the State Lands Commission does hereby reserve and convey a right-of-way for the Department of Transportation on the lands described on said maps, and authorizes the approval of said maps, subject, however, to the following conditions:

1. The right-of-way granted hereby may be released at any time by written certificate of the Director of the Department of Transportation (DOT), filed with the State Lands Commission (SLC); but if after said DOT has entered upon and used said right-of-way for any of the purposes specified in Section 6210.3 of the Public Resources Code and such use or uses have been discontinued for a consecutive period of 365 days and said right-of-way has not been released as provided above, said right-of-way shall, at the option of the SLC, and upon written notice to said DOT, cease and terminate.

2. There is retained by the SLC the right to convey, issue, or otherwise transfer rights in the lands that are subject to this right-of-way, subject and subordinate to the rights of the DOT therein. There is also retained by said SLC on the right to grant permits, leases, or easements, for crossings over, upon and under said lands, provided, however, that any such easement or crossing within 100 feet of the surface of such lands shall be in a form and manner acceptable to, and shall be expressly approved by said DOT.

3. All tools, equipment, or other property taken onto or placed upon the right-of-way by the DOT shall remain the property of the DOT. Such property shall be properly removed by the DOT, at its sole risk and expense.

4. The SLC is not responsible for any damage to any property, including any equipment, tools, or machinery within the right-of-way.

5. The DOT shall adhere to the 2010 DOT Standard Specifications and provide to the SLC a detailed work schedule upon completion of the project.

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

7. No refueling, maintenance, or repairs to any equipment or vehicles will be permitted within the right-of-way.

8. The DOT shall, at its own expense, keep and maintain the right-of-way and all improvements in good order and repair and in safe condition. The SLC shall have no obligation for such repair and maintenance.

9. The DOT agrees to replace any existing corroded drainage pipes and remove any corroded existing sheet metal within the right-of-way.

10. The DOT agrees to maintain the existing concrete groin until such time the DOT determines it should be removed.

11. Upon completion of the Las Tunas Rock Slope Stabilization Project, the DOT will provide the SLC a copy of as-built drawings confirming that all structures and improvements were completed according to design specifications as submitted with the application. The DOT shall also provide descriptive photographs of the completed project.

12. The DOT shall agree to indemnify, hold harmless and, at the option of the SLC, defend the SLC, its agencies, officers, agents, and employees, against and for any and all liability, claims, damages, or injuries of any kind and from any cause arising out of or connected in any way with any actions by the DOT regarding this right-of-way.

This agreement will become binding on the State only when duly executed on behalf of the State Lands Commission of the State of California.

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the date hereafter affixed.

DEPARTMENT OF TRANSPORTATION*

By: _____

Title: _____

Date: _____

STATE OF CALIFORNIA
STATE LANDS COMMISSION

By: _____

Date: _____

Approval of the Right-of-Way Map was authorized by the State Lands Commission on: _____

* If the document is executed by any person other than the Director of the Department of Transportation, a certified copy of the executor's authority must be attached hereto.

Tongnaka, Torry@DOT

From: Ancheta, Efren V@DOT
Sent: Wednesday, August 05, 2015 10:28 AM
To: Tongnaka, Torry@DOT
Subject: FW: State Lands language resolved
Attachments: 9064.9 Las Tunas 101.5.pdf

FYI…

Efren V. Ancheta, P.E.
Senior Transportation Engineer
District 7 Office Engineer/PS&E Unit
Tel: (213)897-0756
Fax: (213)897-2521

From: Lee, Orlance C@DOT
Sent: Tuesday, July 14, 2015 2:59 PM
To: Ancheta, Efren V@DOT; Fong, Stewart@DOT; Huq, Syed A@DOT
Cc: Nguyen, Mike K@DOT; Lewis, David A@DOT
Subject: State Lands language resolved

Resolved. Please see attached and make it part of final agreement.

From: Lewis, David A@DOT
Sent: Tuesday, July 14, 2015 2:53 PM
To: Lee, Orlance C@DOT; Murdoch, Dan E@DOT; Nguyen, Mike K@DOT
Cc: Podesta, Tami L@DOT
Subject: FW: Comparative Schedule

Please see the attachment. They just changed the first page language. That should take care of that…

David Lewis
Associate Environmental Planner
Coastal Commission Liaison

California Department of Transportation
District 7, Division of Environmental Planning
100 South Main Street
Los Angeles, CA 90012
Phone: 213-897-1952

From: Simpkin, Drew@SLC
Sent: Tuesday, July 14, 2015 2:51 PM
To: Lewis, David A@DOT
Subject: RE: Comparative Schedule

Hi David,
A change that small will not require an amendment or Commission authorization. I've attached a revised page 1 with the change. If that works for you, please replace the first page and we will do the same on our end.

Thanks,

Drew Simpkin
Public Land Management Specialist
Land Management Division
California State Lands Commission
Phone: (916) 574-2275
Fax: (916) 574-1835

From: Lewis, David A@DOT
Sent: Tuesday, July 14, 2015 2:16 PM
To: Simpkin, Drew@SLC
Subject: FW: Comparative Schedule

Hi Drew,

We have a small minor change in the language of the previous permit. Please see the email below. Do we need to amend anything or are we ok to proceed? We received the CDP last week from the Coastal Commission, which is attached for you as well. Please let me know. Thanks

David Lewis
Associate Environmental Planner
Coastal Commission Liaison

California Department of Transportation
District 7, Division of Environmental Planning
100 South Main Street
Los Angeles, CA 90012
Phone: 213-897-1952

From: Lee, Orlance C@DOT
Sent: Tuesday, July 14, 2015 2:07 PM
To: Lewis, David A@DOT
Cc: Podesta, Tami L@DOT; Murdoch, Dan E@DOT; Nguyen, Mike K@DOT
Subject: FW: Comparative Schedule

Hello David,

Please see attached State Land Agreement.
Conditional #5 : 2006 DOT Standard Specifications *should read* 2010 DOT Standard Specifications

Do we need to inform State Lands to make amendment??

OCLee
7-0717

CALIFORNIA COASTAL COMMISSION
SOUTH CENTRAL COAST DISTRICT OFFICE
89 SOUTH CALIFORNIA STREET, SUITE 200
VENTURA, CALIFORNIA 93001-2801
PH (805) 585-1800 FAX (805) 641-1732
WWW.COASTAL.CA.GOV

July 1, 2015

Permit Application No.: **4-13-010**

COASTAL DEVELOPMENT PERMIT

On March 11, 2015, the California Coastal Commission granted to **California Department of Transportation** this permit subject to the attached Standard and Special conditions, for development consisting of: **Construction of a 1,640 linear foot rock revetment ranging from 5 ft. to 30 ft. in height and using 23,000 cu. yds. of rip rap to stabilize the undermined bluff on the seaward side of Pacific Coast Highway. A 1,260 linear ft. segment of the rock revetment will be constructed using a stacked concrete-filled sack foundation which would be covered by rip rap (40 linear feet of these stacked concrete bags were previously installed pursuant to Emergency Permit No. G-4-14-0032 and would be permanently authorized as part of this application). In addition, the project includes 11,200 cu. yds. of grading (10,000 cu. yds. of cut and 1,200 cu. yds. of fill); removal of existing concrete road barriers along the road shoulder; construction of a 1.6¿ ft. high rock berm and 6-inch high dike wall; replacement of an existing public beach vertical accessway/trail with four new vertical public accessways/trails and a bluff top trail, one new ADA-compliant parking space; surface improvements to an existing dirt parking area and installation of two new public coastal access signs,** more specifically described in the application filed in the Commission offices.

The development is within the coastal zone at **PACIFIC COAST HIGHWAY BETWEEN POSTMILE 41.8 AND 42.1, LAS TUNAS BEACH, CITY OF MALIBU, LOS ANGELES COUNTY.**

Issued on behalf of the California Coastal Commission by

Charles Lester
Executive Director

Denise Venegas

Denise Venegas
Coastal Program Analyst

ACKNOWLEDGMENT:

The undersigned permittee acknowledges receipt of this permit and agrees to abide by all terms and conditions thereof.

COASTAL DEVELOPMENT PERMIT

The undersigned permittee acknowledges that Government Code Section 818.4 which states in pertinent part of that: "A Public entity is not liable for injury caused by the issuance... of any permit..." applies to the issuance of this permit.

IMPORTANT: THIS PERMIT IS NOT VALID UNLESS AND UNTIL A COPY OF THE PERMIT WITH THE SIGNED ACKNOWLEDGEMENT HAS BEEN RETURNED TO THE COMMISSION OFFICE. 14 Cal. Admin. Code Section 13158(a).

Date: 7/10/15 Signature: _____

STANDARD CONDITIONS:

1. **Notice of Receipt and Acknowledgment**. The permit is not valid and development shall not commence until a copy of the permit, signed by the permittee or authorized agent, acknowledging receipt of the permit and acceptance of the terms and conditions, is returned to the Commission office.

2. **Expiration.** If development has not commenced, the permit will expire two years from the date on which the Commission voted on the application. Development shall be pursued in a diligent manner and completed in a reasonable period of time. Application for extension of the permit must be made prior to the expiration date.

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

4. **Assignment**. The permit may be assigned to any qualified person, provided assignee files with the Commission an affidavit accepting all terms and conditions of the permit.

5. **Terms and Conditions Run with the Land**. These terms and conditions shall be perpetual, and it is the intention of the Commission and the permittee to bind all future owners and possessors of the subject property to the terms and conditions.

SPECIAL CONDITIONS:

1. Final Project Plans

A. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the applicant shall submit, for the review and approval of the Executive Director, two sets of final revised project plans to the Executive Director for review and approval. All plans must be drawn to scale with dimensions shown. Said plans shall be in substantial conformance with the

COASTAL DEVELOPMENT PERMIT

preliminary plans submitted with this application on February 17, 2015, but shall be revised to include the following:

(1) Improvements of the existing parking lot located at the downcoast end of the project site. The parking lot shall be improved with Class D aggregated base.

(2) Correction to the revetment width dimensions located on cross section for Sta. 116+35 to Sta. 120+69 on sheet X-1. Dimensions shall be replaced to read 28' to 41'.

(3) Correction to the revetment width dimensions located on cross section for Sta. 107+25 to Sta. 116+35 and Sta. 120+69 to Sta. 123+67 on sheet X-1. Dimensions shall be replaced to read 28' to 57'.

(4) Correction to sheet L-2 to include a fourth public accessway.

(5) Any changes necessary conform with the final Project Construction Method and Staging Plan required pursuant to subsection B. below.

B. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the applicant shall submit, for the review and approval of the Executive Director, two sets of final project construction method and staging project plans to the Executive Director for review and approval. All plans must be drawn to scale with dimensions shown. Said plans shall show that construction activities and staging shall occur primarily from the top of bluff using a temporary ramp to the maximum extent feasible consistent with the draft construction method and staging plan submitted on February 26, 2015 and attached as Exhibit 11.

C. The Permittee shall undertake development in accordance with the final approved plans. Any proposed changes to the approved final plans shall be reported to the Executive Director. No change to the approved final plans shall occur without a Coastal Commission approved amendment to the coastal development permit, unless the Executive Director determines that no amendment is legally required.

2. Plans Conforming to Geotechnical Engineer's Recommendations

By acceptance of this permit, the applicant agrees to comply with the recommendations contained in all of the geology, geotechnical, and/or soils reports referenced as Substantive File Documents. These recommendations, including recommendations concerning foundations, sewage disposal, and drainage, shall be incorporated into all final design and construction plans, which must be reviewed and approved by the consultant prior to commencement of development.

The final plans approved by the consultant shall be in substantial conformance with the plans approved by the Commission relative to construction, grading, and drainage. Any substantial changes in the proposed development approved by the Commission that may be required by the consultant shall require amendment(s) to the permit(s) or new Coastal Development Permit(s).

COASTAL DEVELOPMENT PERMIT

3. Assumption of Risk, Waiver of Liability and Indemnity

By acceptance of this permit, the applicants acknowledges and agrees (i) that the site may be subject to hazards from erosion, liquefaction, waves, flooding, tsunami, and sea level rise; (ii) to assume the risks to the applicant and the property that is the subject of this permit of injury and damage from such hazards in connection with this permitted development; (iii) to unconditionally waive any claim of damage or liability against the Commission, its officers, agents, and employees for injury or damage from such hazards; and (iv) to indemnify and hold harmless the Commission, its officers, agents, and employees with respect to the Commission's approval of the project against any and all liability, claims, demands, damages, costs (including costs and fees incurred in defense of such claims), expenses, and amounts paid in settlement arising from any injury or damage due to such hazards.

PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the applicant shall submit a written agreement, in a form and content acceptable to the Executive Director, incorporating all of the above terms of this condition.

4. Other Federal, State, or Local Approvals

PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the applicant shall submit for the review and approval of the Executive Director, either evidence of final required approvals or evidence that no approval is needed from the U.S. Army Corps of Engineers, Regional Water Quality Control Board, California Department of Fish and Wildlife Service, United States Fish and Wildlife, and the National Marine Fisheries Service.

5. Removal of Existing Rock Revetment and Construction of Public Access Improvements

The applicant shall, by accepting this permit, agree and ensure that:

A. Where the new rock revetment is proposed, all portions of the existing rock revetment (including any errant, exposed loose rocks) would be removed and either reused on site for the new rock revetment or relocated off site. In addition, the existing concrete road barriers and any existing concrete and/or debris located within the existing rock revetment shall be removed and relocated off site at a location outside the coastal zone or within the coastal zone authorized to receive such material.

B. Construction of the new four vertical public accessways and 3 foot wide trail pathway along the bluff top shall be completed concurrent with the construction of the new revetment authorized by the approval of this permit. Striping for the ADA-compliant parking space, placement of public access signage, and improvements to the existing parking area shall be completed concurrent with, or immediately following completion of paving the road shoulder.

COASTAL DEVELOPMENT PERMIT

6. Biological Monitoring During Construction

The applicant shall retain the services of a qualified biologist or environmental resource specialist (hereinafter, "environmental resources specialist") with appropriate qualifications acceptable to Executive Director, to conduct California Grunion pre-construction surveys. If any construction activity occurs on the sandy beach including but not limited to, removal of existing rip rap and/or construction of the new rock revetment, between March 1st and September 1st, then the applicant shall have the environmental resource specialist conduct a survey of the project site, to determine presence of California Grunion during the seasonally predicted run period and egg incubation period, as identified by the California Department of Fish and Wildlife Services. If the environmental resources specialist determines that any grunion spawning activity is occurring and/or that grunion are present in or adjacent to the project site, then no construction/demolition activities shall occur on the area of the beach where grunion have been observed to spawn until the next predicted run in which no grunion are observed. Surveys shall be conducted for all seasonally predicted run periods in which material is proposed to be placed or removed at any of the above sites. The applicant shall have the environmental resource specialist provide inspection reports after each grunion run observed and shall provide copies of such reports to the Executive Director and to the California Department of Fish and Wildlife Services.

7. Public Access Signage Plan

PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the applicant shall submit, for the review and approval of the Executive Director, a public access signage plan, that describes the location, number, size, and contents of signs to be placed along Pacific Coast Highway and the subject site and which meets, at a minimum, the following requirements:

1. Signs shall indicate the availability of public access to the beach at the project site.
2. A minimum of two signs shall be installed along Pacific Coast Highway; and
3. Signs shall be maintained in good condition onsite for the duration of the project.

The public access signs shall be installed by the applicant in the manner described in the approved signage plan concurrent with the construction of the rock revetment and public access improvements on site, or within such additional time as the Executive Director may grant for good cause.

8. Operations and Maintenance Responsibilities

By accepting this permit, the applicant shall agree to comply with the following construction-related requirements:

A. The applicant shall not store or place any construction materials or waste where it will be or could potentially be subject to wave erosion and dispersion. In addition, no machinery shall be stored or placed in the intertidal zone at any time, except for that necessary to remove errant rocks from the beach seaward of the existing rock revetment

COASTAL DEVELOPMENT PERMIT

and for use of the temporary berm/rip rap barrier for an approximately 565 linear feet segment of the proposed rock revetment as shown on Exhibit 11.

B. Construction equipment shall not be cleaned on the beach or in the adjacent beach parking areas.

C. Construction debris and sediment shall be properly contained and secured on site with best management practices to prevent the unintended transport of sediment and other debris into coastal waters by wind, rain or tracking.

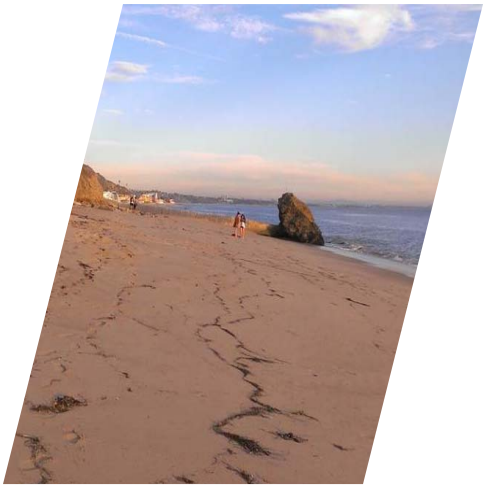
D. Construction debris and sediment shall be removed from construction areas as necessary to prevent the accumulation of sediment and other debris which may be discharged into coastal waters. Any and all debris resulting from construction activities shall be removed from the project site within 24 hours. Debris shall be disposed at a debris disposal site outside the coastal zone or at a location within the coastal zone authorized to receive such material.

E. During construction activities authorized pursuant to this permit, the applicant shall be responsible for removing all unsuitable material or debris within the area of placement should the material be found to be unsuitable for any reason, at any time, when the presence of such unsuitable material/debris can reasonably be attributed to the placement material. Debris shall be disposed at a debris disposal site outside of the coastal zone or at a location within the coastal zone authorized to receive such material.

9. Removal of Excavated Material

PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the applicant shall provide evidence to the Executive Director of the location of the disposal site for all excess excavated material from the site. If the disposal site is located in the Coastal Zone, the disposal site must have a valid coastal development permit for the disposal of fill material. If the disposal site does not have a coastal permit, such a permit will be required prior to the disposal of material.

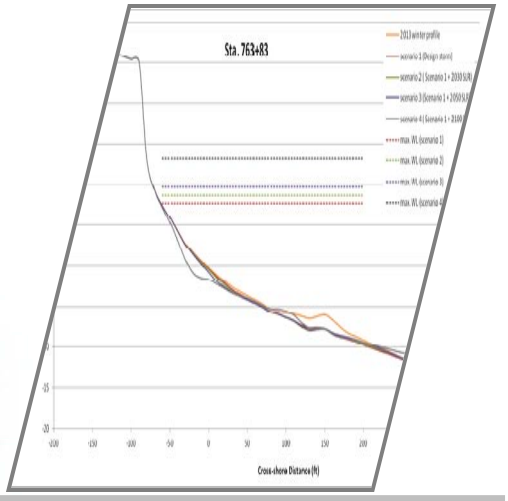
California Department of Transportation
100 S. Main Street
Los Angeles, California 90012



Las Tunas Beach

Wave Run-up Study FINAL

July 11, 2014



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Las Tunas Beach Wave Run-up Study

FINAL

Prepared for:

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July 11, 2014

Executive Summary

Caltrans is proposing to repair and expand a rock slope protection revetment along the oceanfront roadway embankment between State Route 1 / Pacific Coast Highway (PCH) and Las Tunas State Beach (PM 41.8/42.1). The project lies within the City of Malibu within the County of Los Angeles. The existing embankment within the project limits is 1,660 feet long, approximately 20 feet high, and up to 40 feet wide. Caltrans is proposing a full Bank and Shore Rock Slope Protection (RSP) with an embedded toe and RSP fabric with anchor ties to stabilize the embankment and prevent further undermining of the roadway.

The California Coastal Commission requires a wave run-up study to obtain the Coastal Development Permit for this project. The studies in this report were conducted in accordance with the Coastal Commission's Beach Erosion and Response (BEAR) Guidance Document. The studies also utilized methods consistent with the Federal Emergency Management Agency (FEMA) Coastal Flood Hazard Analysis and Mapping for the Pacific Coast of the United States Guidelines, the U.S. Army Corps of Engineers' (USACE) Coastal Engineering Manual (CEM), and the Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 25 – Highways in the Coastal Environment. Using current engineering standards and practices for the analysis and design of coastal structures, the technical analyses within this report were conducted to provide a sound understanding of the beach and coastal characteristics in the vicinity of the project site. The technical studies included determining the design water level, sea level rise (SLR) effects, wave transformation, wave run-up on coastal structures, short/long-term beach evolution, potential tsunami impacts, and coastal structure susceptibility. The studies were also supported by on-site investigations for summer and winter beach conditions and topographic data collected of Las Tunas beach.

Important findings and conclusions determined through this study include:

1. The SLR projections for the target year 2100, have a range between 1.38 to 5.48 feet due to uncertainties in currently accepted predictions. The large uncertainties lead to diverse design water depths for the Las Tunas Beach coastal region. The highest SLR projection was used in determining the adequacy of the revetment for protecting the highway.

2. Near-shore design wave height, a significant parameter in evaluating the wave impacts to the proposed revetment, is estimated using both a simple empirical calculation and the RCPWAVE numerical model. The RCPWAVE model needs more data, but is able to estimate site-specific wave conditions. Based on the RCPWAVE modeling output, wave heights range between 6.2 and 9.3 feet for the highest 2100 SLR water depth scenario at six beach profile locations. Wave run-up height estimates on coastal structures were calculated by the Technical Advisory Committee on Water Retaining Structures (TAW) and Automated Coastal Engineering System (ACES) approaches. The two approaches demonstrate comparable results accounting for various SLR scenarios. The design total water level consisting of 2% and maximum wave run-up calculated was 29.96 and 32.22 feet respectively for 2100 SLR scenario.

3. Based on the analysis of historical and current beach surveys, aerial imagery, and a numerical model (SBEACH), the beach profiles demonstrate a long-term erosional trend. Among the profiles, Station 774+01 shows the highest beach recession rates and depths and is considered the most degradational beach section within the study area.

4. No severe tsunami hazards have been observed historically based on the historical tsunami investigation from the NGDC database. Tsunami forecast model results and the inundation map derived by NCTR numerical modeling suggest the probability of severe impacts resulting from future tsunamis on the project site are smaller than the design wave impacts.

5. The degradational trend of the beach has impacted all properties along this portion of the coast. The western most properties upbeach from the project will not be impacted at all by the project since the littoral drift is from west to east and groins or other stabilization structures will not be placed along the revetment. The beach area, which is operated by Los Angeles County Department of Beaches and Harbors will continue in a degradational trend, while the revetment will protect the highway from the continued erosion. The parking area for beach access at the downstream end of the revetment will need to be protected so that wave action at the end of the revetment does not erode the parking area and lifeguard building. Downbeach from the parking area, there is a concrete drain. The properties east of the drain are protected by RSP revetments.

6. The size and weight of the RSP to withstand the design waves were determined using FHWA and Caltrans design guidelines. The project is adequate to withstand the expected wave uprush at the 100-year recurrence interval. Although the revetment height does not extend to the top of the wave uprush in all locations along the highway, the revetment is tied into the road surface so that any flows overtopping the revetment will flow onto the road, across to the bluff, and then into the surface drainage system for return to the beach. Potential scour depths for the revetment were calculated to be between 5.51 and 5.84 feet below MLLW depending on selected SLR projections. The revetment toe should extend to a depth of at least 6 feet below MLLW.

7. The proposed revetment is as far landward as possible and will replace the revetment that has previously protected the PCH. The footprint of the revetment will be similar to the historic revetment footprint and will not extend past the rocks that are already found on the beach. Repairing the revetment may slightly increase erosional rates along the beach due to influence on beach sediment and sediment transport properties. However, in order to reduce the footprint of the rock on the beach, the RSP should be trenched into the beach to final design toe-down, rather than "launching" the RSP, which involves placing the rock on the beach as a rock apron and allowing the RSP to scour itself into final placement as large storms occur.

8. The existing cement groin keeps sediment from being transported littorally from west to east along the Las Tunas Beach coast. The groin does not necessarily provide protection to the roadway embankment. It provides some minimal protection by keeping a small beach that dissipates some energy. The groins were installed during a period of regional beach replenishment projects when sand was added to the beach as beach nourishment. However, this beach is naturally eroding and the groins only provided temporary protection for the nourishment sand. Over time, the other groins were removed as they were uncovered and became a hazard for surfers and swimmers. The last groin is the most stable and is tied to a natural rock structure. Removal of this groin will result in diminished beach width on Las Tunas Beach.

9. Beach nourishment may slow the erosion of the beach, but this section of the coast is erosional due to limited sediment delivery and high wave action. The erosion of this beach has been artificially slowed through the addition of beach nourishment sand and groins along Las Tunas Beach. Approximately 70,000 cubic yards of sediment was place on the beach in the 1970s. Historically, Caltrans had a permit that allowed annual placement of an additional 5,000 cubic yards of sediment along the Las Tunas Beach revetment. This placement helped slow the erosion process and provided nourishment for the beach. However, this was not enough to prevent the degradation of the beach to the point where removal of the steel groins was necessary due to safety concerns. Caltrans was unable to renew the permit after the mid 1990's. The lack of beach nourishment and removal of the dilapidated metal groins have accelerated the wave erosion processes at Las Tunas Beach.

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List of Acronyms

BEAR	Beach Erosion and Response
CalEMA	California Emergency Management Agency
CCSTWS	Coast of California Storm and Tidal Waves Study
CEDAS	Coastal Engineering Design and Analysis System
CEM	Coastal Engineering Manual
CGS	California Geological Survey
CO-CAT	Coastal and Ocean Working Group of the California Climate Action Team
DART	Deep-ocean Assessment and Reporting of Tsunamis
DIM	Direct Integration Method
DTL	Mean Diurnal Tide Level
DWL	Design Water Level
FEMA	Federal Emergency Management Agency
LP3	Log-Pearson Type III
MHHW	Mean Higher-High Water
MHW	Mean High Water
MLLW	Mean Lower-Low Water
MLW	Mean Low Water
MOST	Method of Splitting Tsunami
MSL	Mean Sea Level
MTL	Mean Tide Level
NAVD 88	North American Vertical Datum of 1988
NCTR	NOAA Center for Tsunami Research
NGDC	National Geophysical Data Center

NRC	National Research Council
PCH	Pacific Coast Highway
PMEL	Pacific Marine Environmental Laboratory
RCPWAVE	Regional Coastal Processes Monochromatic Wave Model
RSP	Rock Slope Protection
SBEACH	Storm-induced BEAch CHange Model
SLR	Sea Level Rise
STND	Station Datum
SWL	Stillwater Level
TAW	Technical Advisory Committee for Water Retaining Structures
USACE	U.S. Army Corps of Engineers
WIS	USACE Wave Information Studies
WSAV	Wave Statistical Analysis & Visualization

1. Introduction

Caltrans is proposing to repair and expand a rock slope protection revetment along the oceanfront roadway embankment between State Route 1 / Pacific Coast Highway (PCH) and Las Tunas State Beach (PM 41.8/42.1). The project lies within the City of Malibu and the County of Los Angeles.

The embankment along the beach is being eroded by waves, which have steadily encroached on the embankment, threatening the roadway shoulder along PCH, as well as several utilities. The existing embankment within the project limits is 1,660 feet long, approximately 20 feet high, and up to 40 feet wide. Caltrans is proposing a full Bank and Shore Rock Slope Protection (RSP) with an embedded toe and RSP fabric with anchor ties to stabilize the embankment and prevent further undermining of the roadway. Other alternatives were considered for this location, such as soldier pile and retaining walls, drilled shafts, micropiles, and a viaduct. However, the PCH and embankment lie within the Las Tunas/ Le Grande Bulge Landslide, any structural alternatives would require mitigation of the slide, use of extremely deep foundations, and work outside the state right-of-way. These alternatives were rejected as infeasible.

The project involves total reconstruction of the existing embankment and removal of all affected existing RSP. The existing RSP would be stocked on site and reused to reconstruct the embankment. Once the RSP is removed, the exposed embankment will be graded to a 1.5:1 slope. The irregular areas will be pushed landward and backfilled in some areas before being compacted. Once the embankment is compacted, filter fabric will be installed with anchor ties and rock revetment will be installed on the new slope with a 4-foot thick 8-Ton RSP layer on top of a 4-foot thick ½ Ton RSP layer. An asphalt berm and adequate drainage along the shoulder will be provided.

The California Coastal Commission requires a wave run-up study to obtain the Coastal Development Permit for this project. The studies in this report were conducted in accordance with the Coastal Commission's Beach Erosion and Response (BEAR) Guidance Document. The studies also utilized methods consistent with the Federal Emergency Management Agency (FEMA) Coastal Flood Hazard Analysis and Mapping for the Pacific Coast of the United States Guidelines, the U.S. Army Corps of Engineers' (USACE) Coastal Engineering Manual (CEM), and the Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 25 – Highways in the Coastal Environment.

The technical studies were supported by on-site investigations and topographic data collected for Las Tunas beach. The technical analyses within this report were conducted to provide a sound understanding of the beach and coastal characteristics in the vicinity of the project site. The studies included determination of the design water level, sea level rise (SLR) effects, wave transformation, wave run-up on coastal structures, short/long-term beach evolution, potential tsunami impacts, and coastal structure susceptibility. The studies were conducted using current engineering standards and practices for the analysis and design of coastal structures. This report details the methods used and the results of the studies.

2. Site Investigations and Data Collection

Two site investigations were conducted to survey the summer and winter beach conditions. The first visit on June 21, 2013 evaluated 27 investigation sites on the beach for the winter conditions. The results are documented in **Appendix A**. The second investigation took place on November 7, 2013. The investigation documented the summer beach conditions prior to the winter storm season. The results of the second investigation are documented in **Appendix B**. The purpose of the field investigations was to document seasonal changes to the beach caused by waves, coastal topography, and littoral sand transport at the end of the two seasons that define the general range of beach conditions in Southern California.

Historic data and reports on the coastal conditions were collected and reviewed to better understand the beach and coast. The data collected included the existing and proposed revetment designs, topographic surveys describing on-site condition, bathymetric surveys, off-shore wave measurements, historical tide records, and SLR prediction. These data are necessary input for engineering analysis and numerical model simulations and evaluations of beach impacts under extreme coastal weather conditions (i.e., extreme waves, tides and water levels).

The California Coastal Commission requires winter and summer beach profile data to be submitted as part of the Coastal Development Permit package. This requires topographic and bathymetric surveys conducted in late spring for the winter profile and late fall for the summer profile. Topographic survey data was collected via an aerial survey for the road surface and revetment. The aerial survey provided topography and an ortho-rectified aerial image for the project. The topography data was collected at a 1-foot contour level that is acceptable to FEMA for flood studies and can be used for design projects. The extent of the survey was approximately 2,300 linear feet along the coast to provide detailed data for the beaches adjacent to Las Tunas Beach.

Bathymetric data was collected using sonar technology outside the surf zone and by a swimming rodman within the surf zone and up onto the beach. Shown in **Figure 2-1**, six (6) transects were taken for the bathymetry consistent with historic transects taken by the Corps from 2002 through 2005 for the Coast of California Storm and Tidal Waves Study (CCSTWS). A representative winter profile for Sta. 774+01 is presented in **Figure 2-2**. All transect profiles for Las Tunas Beach are documented in **Appendix C** and **Appendix D**. **Appendix C** contains the winter beach profiles and **Appendix D** contains the summer profiles. Special attention was given to collecting reef and rock contours wherever feasible, while ensuring the safety of the swimming rodman.

Once the topographic and bathymetric data was collected, the surveys were merged into a seamless digital terrain model that was used for determining beach profiles and for developing detailed coastal models.

Figure 2-1 Location of Six Surveyed Beach Profiles

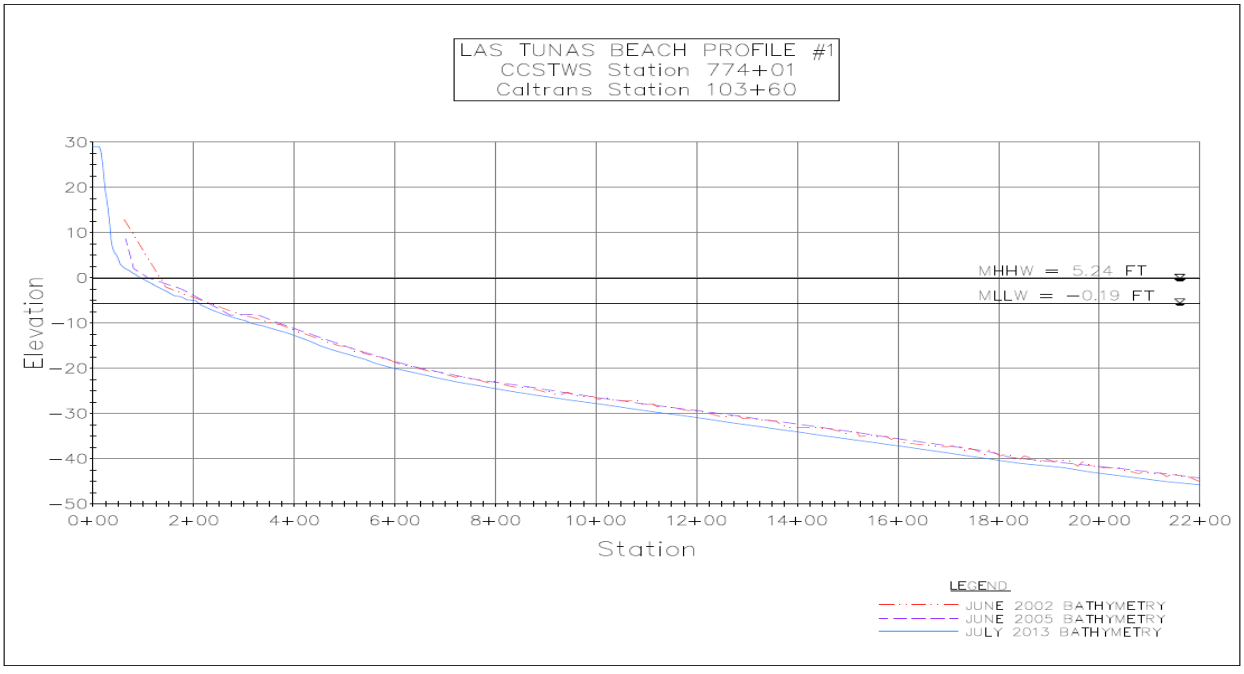


Figure 2-2 The Surveyed Profiles at CCSTWS Sta. 774+01

3. Technical Studies for Las Tunas Beach

Several technical studies were conducted to determine the impacts to the revetment, highway, and beach during extreme storm events. The main focus of these studies was to determine the design stillwater level (SWL), evaluate wave transformations from deep to shallow water, evaluate wave run-up, evaluate impacts of the revetment on beach evolution, and provide insight into effects of tsunamis on the project. The methods used for these analyses and the results are provided herein.

3.1 Design Stillwater Level and Depth

Determining SWL is the initial step for most aspects of coastal engineering design. Based on the definition given by the FEMA (2005a), the SWL represents the sea water level excluding the effects of waves, e.g. wave amplitude and wave setup, but includes storm surges and astronomic tides. In addition, gradually increasing sea levels induced by global climate change or coastal settlement are important factors for future SWL determinations.

SLR is an important consideration for coastal engineering that is related to tidal sea levels. These levels are changing due to increased melting of polar ice caps. As the volume of water in the ocean increases, the sea level rises. For the SLR component, elevated water level for a specific future time (e.g., year 2100) is usually chosen to evaluate their impact.

Storm surges are related to wind velocities and fetch lengths on the open ocean. These two components need to be evaluated separately with different design protection standards. For the extreme storm surge component, the value with respect to a specific return period or design annual exceedance probability (e.g., 1% exceedance probability) is adopted to determine the design characteristics. The calculation methods for the two water level components for the project site are described in the **Subsections 3.1.1 and 3.1.2**.

Once the design SWL has been determined, the stillwater water depth is another important factor that must be determined for coastal engineering design. The design stillwater depth for this project is the difference between the design SWL elevation and the structure toe/ocean bed elevation. However, ocean beds are often impacted by erosion during large storms. The waves scour holes at the toes of revetments, which result in increased water depth. For this reason, potential scour depths associated with the proposed RSP design need to be analyzed (**Subsection 3.1.3**). The total depth from the SWL to the eroded bed elevation is designated as the design water depth for wave run-up analysis.

3.1.1 Extreme Stillwater Analysis

This subsection introduces the approach used to determine the extreme SWLs majorly contributed by astronomic tides and storm surges. Storm surges, in comparison with astronomic tides, cause SWL changes in a more random manner for long time periods. In accordance with the Coastal Flood Hazard Analysis and Mapping Guidelines (FEMA, 2005a), Pacific Coast surges are of smaller magnitude than Atlantic and Gulf Coast surges. The guidelines suggest that water levels that are elevated/depressed by storm surges along the Pacific Coast can be reasonably estimated by tide gauge analyses with adequate tide records. Adequate records are considered to be those longer than 30 years.

Stochastic or low-frequency SWL components such as surge effects, wave setup, and even tsunamis can be extracted from the tide gauge record by removing regular astronomic tides (FEMA, 2005a). However, high tides and intensive storm surges do not necessarily occur simultaneously. Comprehensive water levels resulting from a combination of astronomic tides, surge effects, wave setup, and potential tsunami are important for evaluating the SWL for this project. The Santa Monica tide gage, Station 9410840, is located approximately 6-miles southeast of Las Tunas Beach along the Malibu coast. The station has

representative water levels for the project site. NOAA's direct observations of water levels at the Santa Monica tide gage recorded water levels with all of the impacts from storm surge, tides, wave setup, and distant tsunamis. **Table 3-1** shows the datum levels of the Santa Monica tide station on the basis of North American Vertical Datum of 1988 (NAVD 88) in the epoch 1983-2001. The records had verified water levels from 1974 to 2013, representing a 40 year record length. These tide measurements were utilized for frequency analysis of extreme water levels.

Table 3-1 Santa Monica Tide Station Datum Levels (Epoch: 1983-2001)

Datum Description	Value (ft)
Mean Higher-High Water (MHHW)	5.24
Mean High Water (MHW)	4.50
Mean Tide Level (MTL)	2.62
Mean Sea Level (MSL)	2.60
Mean Diurnal Tide Level (DTL)	2.53
Mean Low Water (MLW)	0.74
North American Vertical Datum of 1988 (NAVD 88)	0.00
Mean Lower-Low Water (MLLW)	-0.19
Station Datum (STND)	-2.63

The annual maximum water level data was analyzed using the Gumbel and Log-Pearson Type III (LP3) extreme value distributions. The analysis corresponding to exceedance probabilities calculated by the Gumbel distribution are shown in **Figure 3-1**. **Figure 3-2** shows the analysis results for the LP3 analysis.

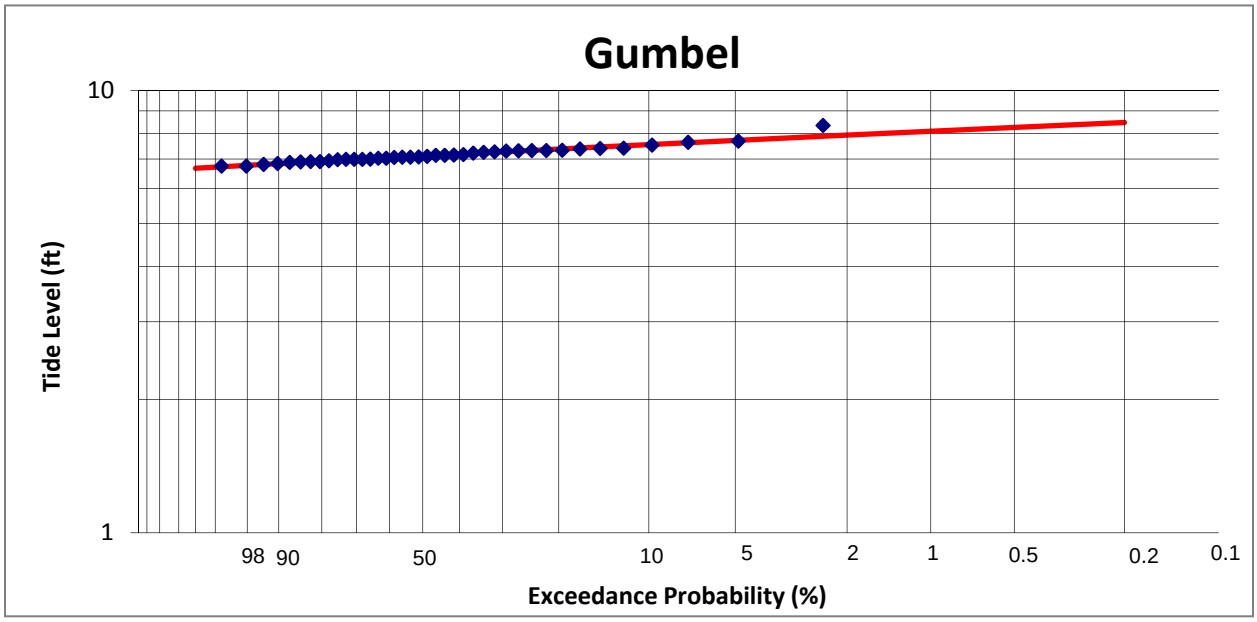


Figure 3-1 Gumbel Extreme Value Analysis of Santa Monica Tide Gage Annual Maximum Series

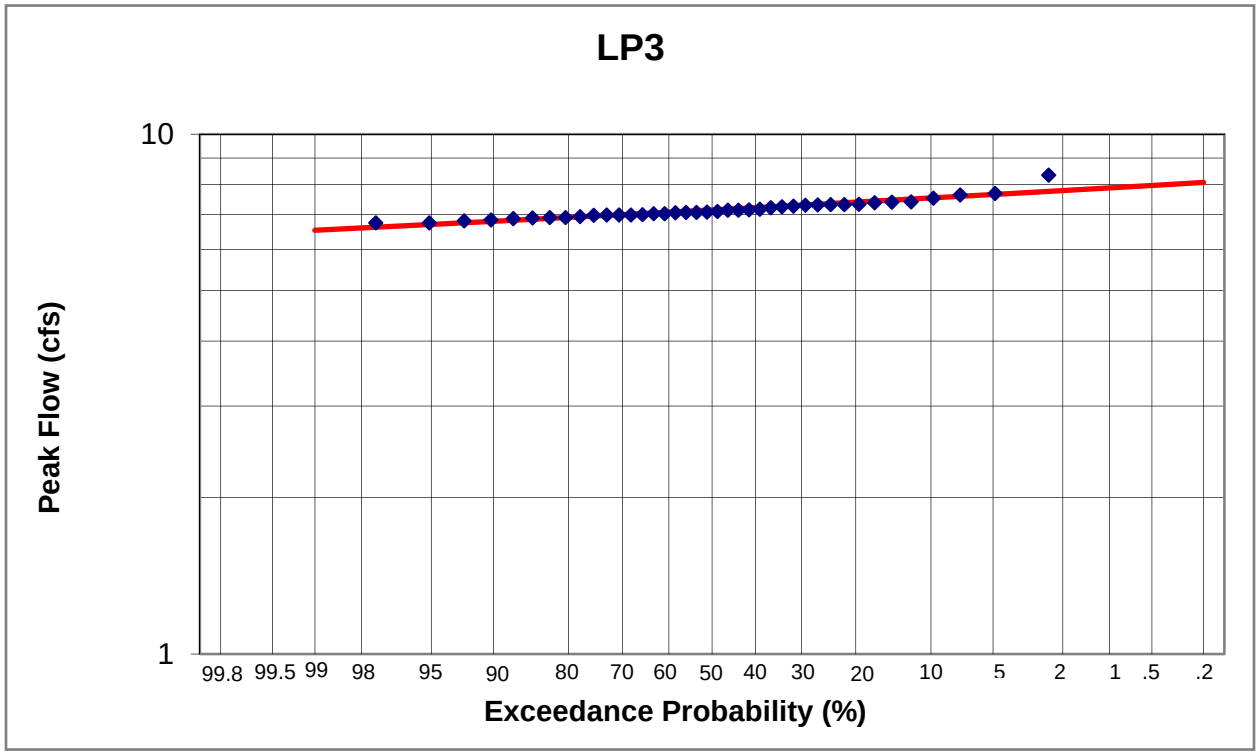


Figure 3-2 LP3 Extreme Value Analysis of Santa Monica Tide Gage Annual Maximum Series

FEMA requires use of the 1% annual exceedance probability, which corresponds to the 100-year return period (FEMA, 2005a). The 100-year recurrence interval for the station without considering SLR is 8.09 feet and 7.88 feet above the NAVD 88 datum estimated by the Gumbel and LP3 distributions, respectively. The analyses conducted with the two distributions show less than a 1-foot difference between the 2-year and 100-year water levels. The result implies that extreme event combinations of storm surge with astronomical tides have a reasonably limited range within the Santa Monica Bay. The CEM suggests using the LP3 analysis to fit extreme water level distributions (USACE, 2002), and so the 100-year recurrence interval design SWL of 7.88 feet above the NAVD 88 datum was adopted for further calculations. This is slightly less than Santa Monica station's historical record on November 30, 1982. The maximum value was 8.34 feet above the NAVD 88 datum, which is 0.46 feet higher than the selected SWL.

3.1.2 Sea Level Rise Past Trend and Projection

SLR is considered to have a long-term and continuous effect on the SWL and has a significant impact on engineering designs. Utilizing the historical mean sea level record in **Figure 3-3** from the Santa Monica tide gage, the mean sea level increased at a rate of 1.46 mm/year with a 95% confident interval of +/- 0.4 mm/year from year 1933 to 2006. This rate is equivalent to a SLR of 0.48 feet in 100 years. However, other studies have found that the future SLR rate will be faster, and suggest that future SLR by analyzing historical data is incorrect. Currently, the most reliable estimates for future SLR rely on climate numerical modeling.

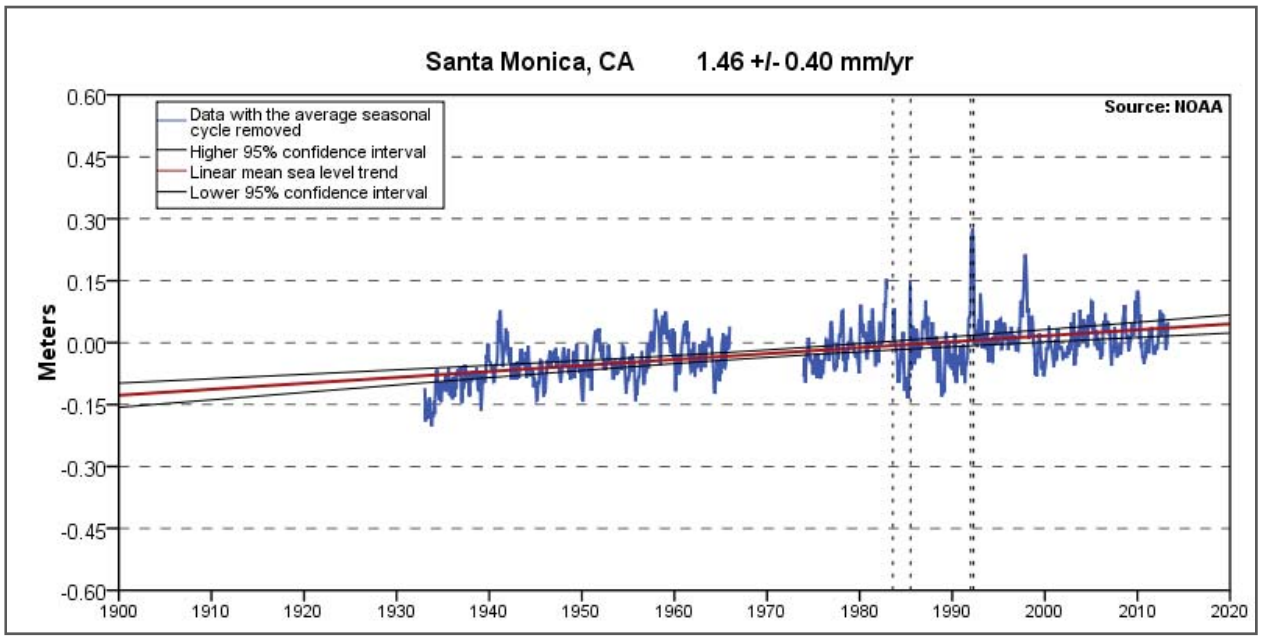


Figure 3-3 Historic Sea Level Rise at Santa Monica Tide Gage (Station 9410840)

This study utilizes future SLR projection results from the final report by the National Research Council (NRC) "Sea-Level Rise for the Coasts of California, Oregon, and Washington" (NRC, 2012). This NRC report is the latest scientific study for SLR along the Pacific Coast, and its SLR projections were adopted into the "State of California Sea-Level Rise Guidance Document" developed by Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT, 2013). These SLR rates were included in the guidance for incorporating SLR projections into planning and decision making for projects in California. The coast is divided into two segments at Cape Mendocino. This project is located in the region south of Cape Mendocino.

Using year 2000 as the baseline, the report provided SLR projections along the California Coastline in 2030, 2050, and 2100 as shown in **Figure 3-4** and **Table 3-2**. The report mentions that the projections after mid-century are more uncertain, and CO-CAT suggests data users should consider timeframes, adaptive capacity, and risk tolerance when selecting the estimated SLR values. The best estimates for the expected values are shown by the dark lines within the wider bands that represent the range of possible values. The brown band represents overlapping values for 2050 and 2100. The expected design life for this project extends past the year 2100. For this reason, the SLR projection of year 2100 ranging between 1.38 and 5.48 feet was used as the best estimated SLR range for Las Tunas Beach.

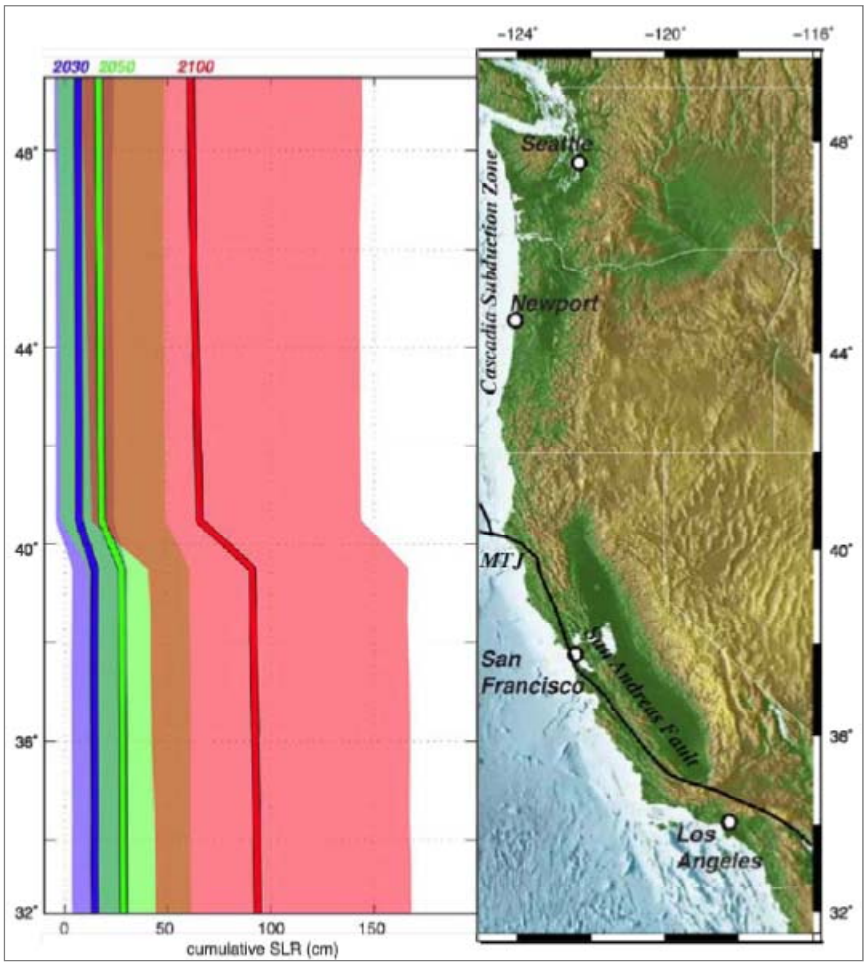


Figure 3-4 National Research Council's Future Sea Level Rise Projections for the Target Year 2030, 2050, and 2100

Table 3-2 Sea-Level Rise Projections Using 2000 as the Baseline (National Research Council, 2012)

Time Period	North of Cape Mendocino	South of Cape Mendocino
2000 - 2030	-4 to 23 cm (-0.13 to 0.75 ft)	4 to 30 cm (0.13 to 0.98 ft)
2000 – 2050	-3 to 48 cm (-0.1 to 1.57 ft)	12 to 61 cm (0.39 to 2.0 ft)
2000 – 2100	10 to 143 cm (0.3 to 4.69 ft)	42 to 167 cm (1.38 to 5.48 ft)

3.1.3 Design Water Depth

The design water depth is comprised of the predicted water depth, which includes the SWL, SLR, and potential scour. The stillwater depth is defined as the distance from the bed elevation at revetment toe to the SWL. Using 2010 as the baseline, the 20-, 40- and 90-year extreme SWLs interpolated from LP3 extreme analysis (**Figure 3-1**) were calculated and used to account for potential highest water levels associated with the 2030, 2050 and 2100 SLRs. The low and high SLR projections may cause substantial variations. Six design water depth scenarios were considered in the calculations to account for the variations. The reasonable assumption that the bed elevation equals the Mean Lower Low Water (MLLW, -0.19 ft NAVD88) was made for evaluating scour depth. As shown in **Table 3-3**, the corresponding

design water depths range between 7.94 and 13.50 feet depending on the SLR projections. The calculations for erosion depths are provided in **Section 3.6**.

Table 3-3 Design Water Depth Calculation

Target Year	2030		2050		2100	
Design Stillwater Level (ft, NAVD88)	7.62		7.71		7.83	
SLR Projection (ft)	Low	High	Low	High	Low	High
	0.13	0.98	0.39	2.00	1.38	5.48
Design Water Level (DWL, ft)	7.75	8.60	8.10	9.71	9.21	13.31
Bed Elevation at Toe/MLLW (ft, NAVD88)	-0.19		-0.19		-0.19	
Design Water Depth (ft)	7.94	8.79	8.29	9.90	9.40	13.50

3.2 Wave Transformation

Understanding the characteristics of near-shore extreme waves is important to ensure sound coastal engineering designs. On-site measurements and observations of near-shore to deep water wave heights are often unavailable or inadequate. As an alternative, wave transformation simulations have been adopted as a way obtain wave field information for desired near-shore locations based on measured deep water waves. Conceptually, wave transformation is a series of hydrodynamic processes which include shoaling, refraction, diffraction, wave breaking, and frictional dissipation as waves propagate from one location to another. The processes of wave transformation are strongly correlated to the underlying bathymetry. Complicated transformation phenomena commonly occur in areas with highly irregular bathymetry including shoals and canyons.

Detailed theories and mathematical descriptions of wave transformation are beyond the study focus but are available in relevant references such as Section II-3-2 in the CEM (USACE, 2002) and the "Wave Transformation" section in the FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report (FEMA, 2005b). Numerical models with rapid data processing and computational abilities are extensively utilized to perform wave transformation analyses. In this study, a FEMA-accepted wave transformation model, Regional Coastal Processes Monochromatic Wave Model (RCPWAVE) is used to simulate wave filed characteristics including wave heights, peak periods, and directions near the Las Tunas Beach. The model was used to evaluate the waves formed by extreme events. The transformed waves were utilized to evaluate the proposed highway protection structure.

The data and statistical properties of deep-water waves adopted for use in the RCPWAVE model are introduced in **Subsection 3.2.1**. **Subsection 3.2.2** discusses the adopted RCPWAVE model and its configuration for the simulations. Finally, **Subsection 3.2.3** presents the results of the wave transformation simulation with discussion on the model results and transformed wave heights in the project area.

3.2.1 Deep-Water Waves

Deep-water wave records are fundamental data for wave transformation modeling. This study utilized data from a USACE Wave Information Studies (WIS) offshore buoy (WIS #83098). This buoy was the nearest deep-water buoy with the necessary wave data. The data included significant wave heights, peak periods, and wave directions. **Figure 3-5** shows the buoy location at 33.92°N, 118.75°W. The buoy is located in 2,244 feet of water and has long-term wave records back to 1980. The highest significant wave height of 18.24 feet (5.56 m) with a peak period of 11.53 seconds was observed on January 18th, 1988. Another event with significant wave heights above 5 meters was on March 2nd, 1983. A hindcast wave height frequency analysis conducted by WIS for the 32-year record period between 1980

and 2011 indicates extreme wave heights of 19.16 feet (5.84 m) and 20.93 feet (6.38 m) for the 50-year and 100-year storm return periods, respectively. **Figure 3-6** shows the wave height frequency analysis results.

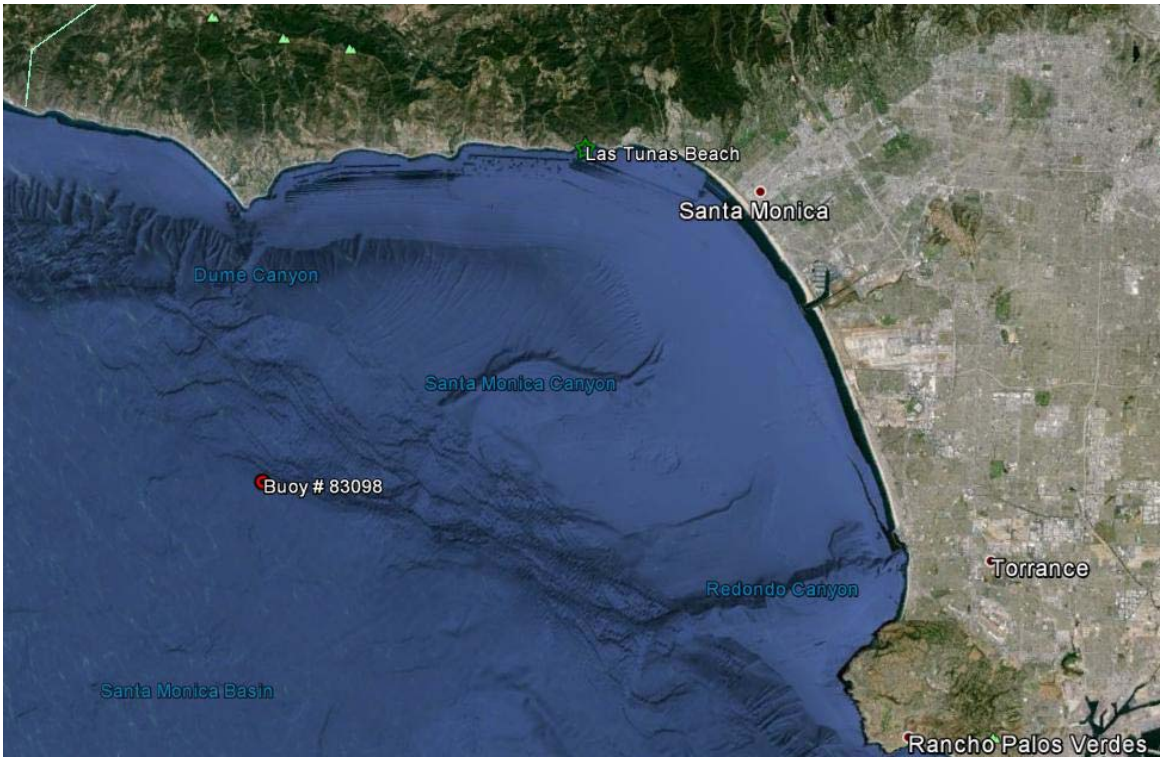


Figure 3-5 Locations of WIS Buoy #83098 and Las Tunas Beach

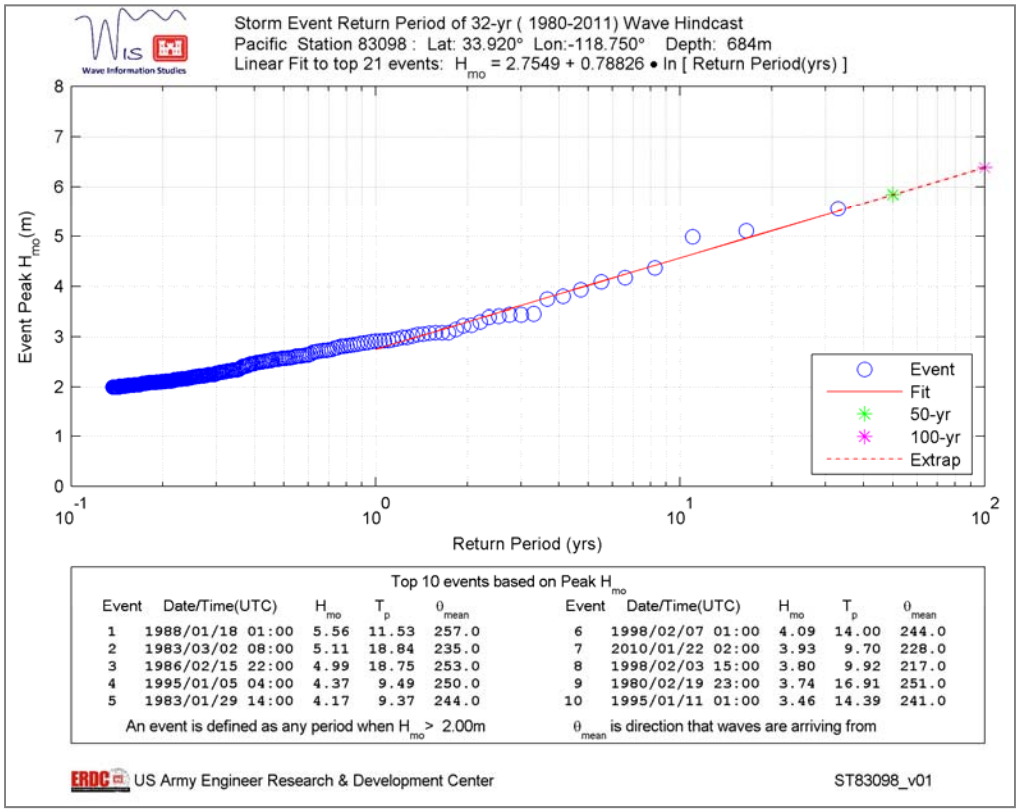


Figure 3-6 WIS Hindcast Analysis for Extreme Wave Heights

The distributions of long-term, hourly-based wave properties were analyzed using WSAV (Wave Statistical Analysis & Visualization), which evaluates the wave environment over time. The results of the analysis are shown in **Figure 3-7**. The results reveal that over ninety-nine percent of the waves have heights smaller than 8 feet. Extreme wave heights greater than 16 feet are very rare and only occurred during three events. Wave periods generally ranged between 5 and 16 seconds. The most extreme wave periods, with times longer than 18 seconds, are less likely to occur with extreme wave heights, while the coincident wave heights are all less than 4.5 feet. The wave directions observed at this buoy are from the south to southwest. Eighty-five percent of all the waves have a directionality that falls within a small range of 220-280 meteorological degrees. Over ninety-nine percent are captured within the range of 180-300 degrees. **Figure 3-6** shows the wave climate for wave directions, periods, and heights.

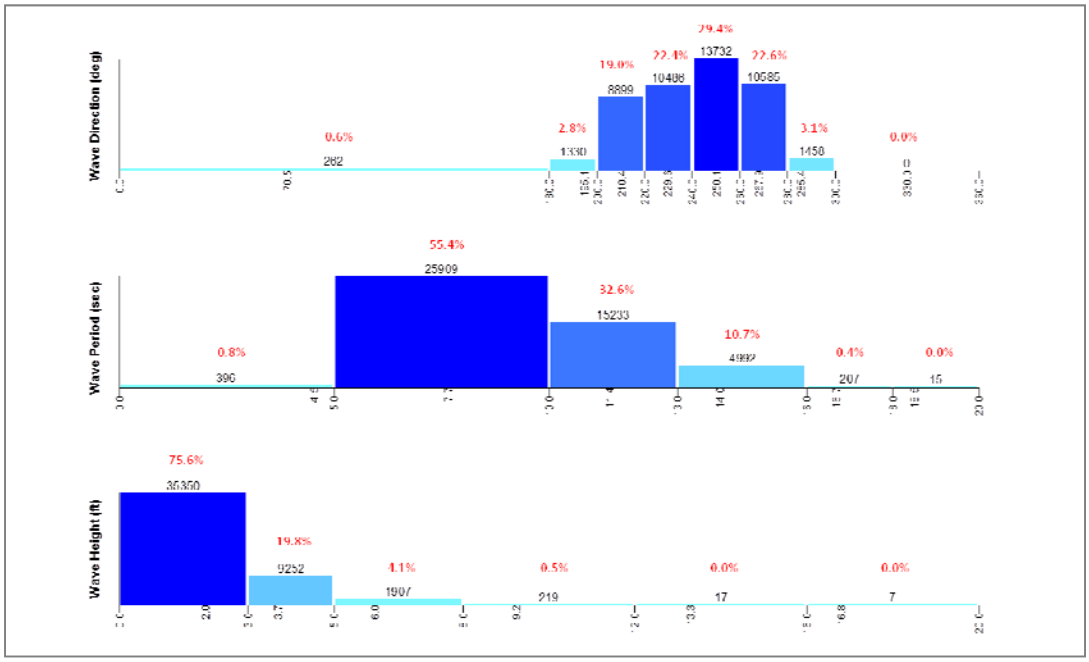


Figure 3-7 Wave Heights, Peak Periods, and Directions – WIS Buoy #83098

A notable seasonal trend of wave directions is seen in **Figure 3-8**. Highly influenced by the ocean winds, waves in the winter months tend to move toward more easterly as shown by higher meteorological directions. For example, monthly-mean directions above 250 degrees are found in December, January, February, and March. During the summer months of July, August, and September, lower wave directions (< 225°) are more common. **Figure 3-9** shows rose diagrams for height-direction and period-direction relationships and percentage distributions are illustrated.

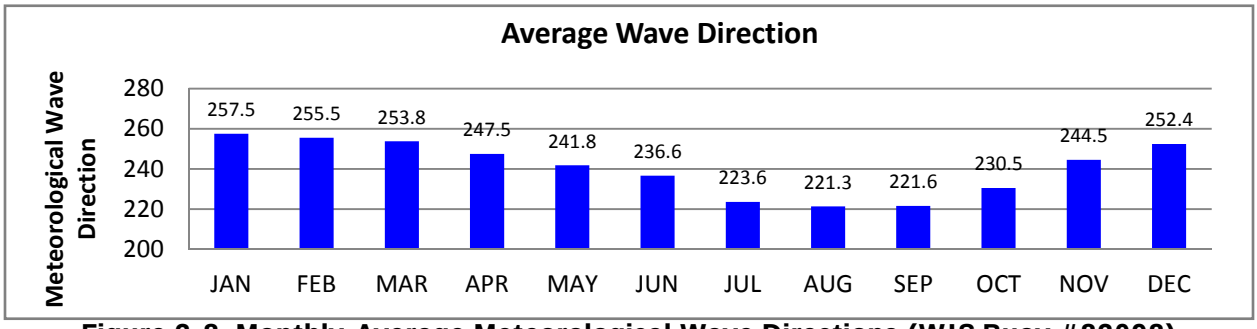


Figure 3-8 Monthly-Average Meteorological Wave Directions (WIS Buoy #83098)

The rose charts of hourly deep-water data from WIS Buoy #83098 show how significantly the coastal topography and wind patterns in this part of the pacific influence the wave climate. The wind direction moves from southwest to northeast with minimal variation. In the figure, the darker colors represent higher percentage of height and period classifications.

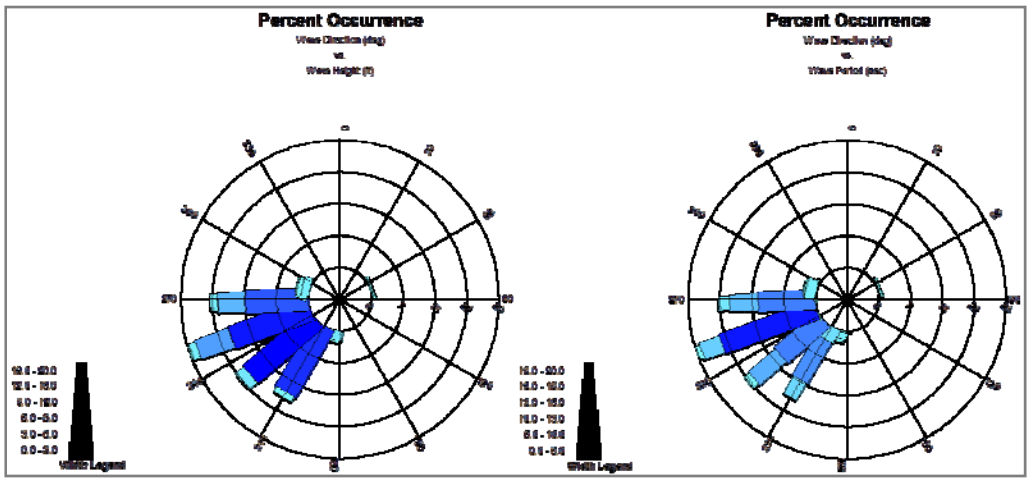


Figure 3-9 Rose Graphs Illustrating Height-Direction and Period-Direction Relationships

3.2.2 RCPWAVE Model and Model Configuration

The Regional Coastal Processes Monochromatic Wave Model (RCPWAVE) is a short-wave propagation model based on linear-wave theories and assumptions of steady state and mild slope. The model was developed by USACE in early 1980 and has been nationally accepted by FEMA as one of the coastal wave height estimation models for its flood hazard mapping studies. RCPWAVE solves equations formulating wave magnitude, energy conservation, and irrotationality of the wave phase gradient as waves propagate from deep to shallow water and eventually break. More detailed information regarding the RCPWAVE model theories and examples is available in the RCPWAVE technical report (Ebersole et al., 1986).

The RCPWAVE model used in this study is integrated in the Coastal Engineering Design and Analysis System (CEDAS). As one of the CEDAS beach modules, the RCPWAVE model can be developed using a more intuitive interface. In order to perform wave transformation in a more effective and efficient manner, setting the model configurations of RCPWAVE has to comprehensively consider model geometry settings such as the study domain, grid size, and bathymetry/topography data. It must also integrate input the wave conditions wave source location and water depth. Simulation scenarios require specifying incident wave data, water levels, and determining output station locations.

The RCPWAVE model for the Las Tunas Beach revetment utilized two data sets with different data resolutions. The data sets covered different domains to provide the necessary bathymetric and topographic data for the model. The coarse-resolution data set utilized spacing of 1/3 arc and covered the entire Santa Monica Bay. This data set was acquired from the National Geophysical Data Center, NOAA (Caldwell et al., 2011). The other data source was from the topographic and bathymetric surveys conducted by this study in July 2013 for the local near-shore region of the Las Tunas Beach.

A three-layer nesting model domain including one parent and two nested layers (as shown in **Figure 3-10**) was established to simulate wave propagations from deep- to shallow-water regions. The nested model is a more effective and efficient manner model than utilizing on grid with a very fine resolution. The parent layer was developed using a coarse 100-m resolution grid cells, as shown by the purple box in **Figure 3-10**. The parent layer comprises the biggest region of 17 (long-shore) x 14 (cross-shore) kilometers for deep-water wave transformation from the buoy to a model station, referred to as the 100-m station, located on the boundary of the first nested layer. The first nested layer utilizes 50-m grids and has a smaller domain of 2700 m long-shore x 7000 m cross-shore meters. The first nested model is shown as the red box in **Figure 3-10**. Water depths on the seaward boundary of this layer are approximately 150 meters, and the middle point of the seaward boundary is set as an output

station in the parent-layer simulation to provide the incident wave information as a boundary condition for the first nested layer.

The second nested layer utilizes a 10-m grid with the smallest domain, 1200 long-shore x 2200 cross-shore meters. The second layer is shown by the yellow box in **Figure 3-10**. The deepest water depths on the seaward boundary range from 24 to 27 meters. Similarly, the boundary conditions for simulating this layer are provided by an output station, known as the 50-m station, on the seaward boundary from the first-nested-layer simulation. The water level, used as a significant model boundary condition, is given by three design water levels (DWLs) of 8.60, 9.71, and 13.31 feet. These depths represent the 2030, 2050, and 2100 higher SLR scenarios. Although the simulation focus is near-shore wave conditions, particularly locations near potential revetment toe, output stations were also placed in the grids corresponding to the six winter beach profiles surveyed in 2013. The grids were selected based on the Mean Lower Low Water elevation.

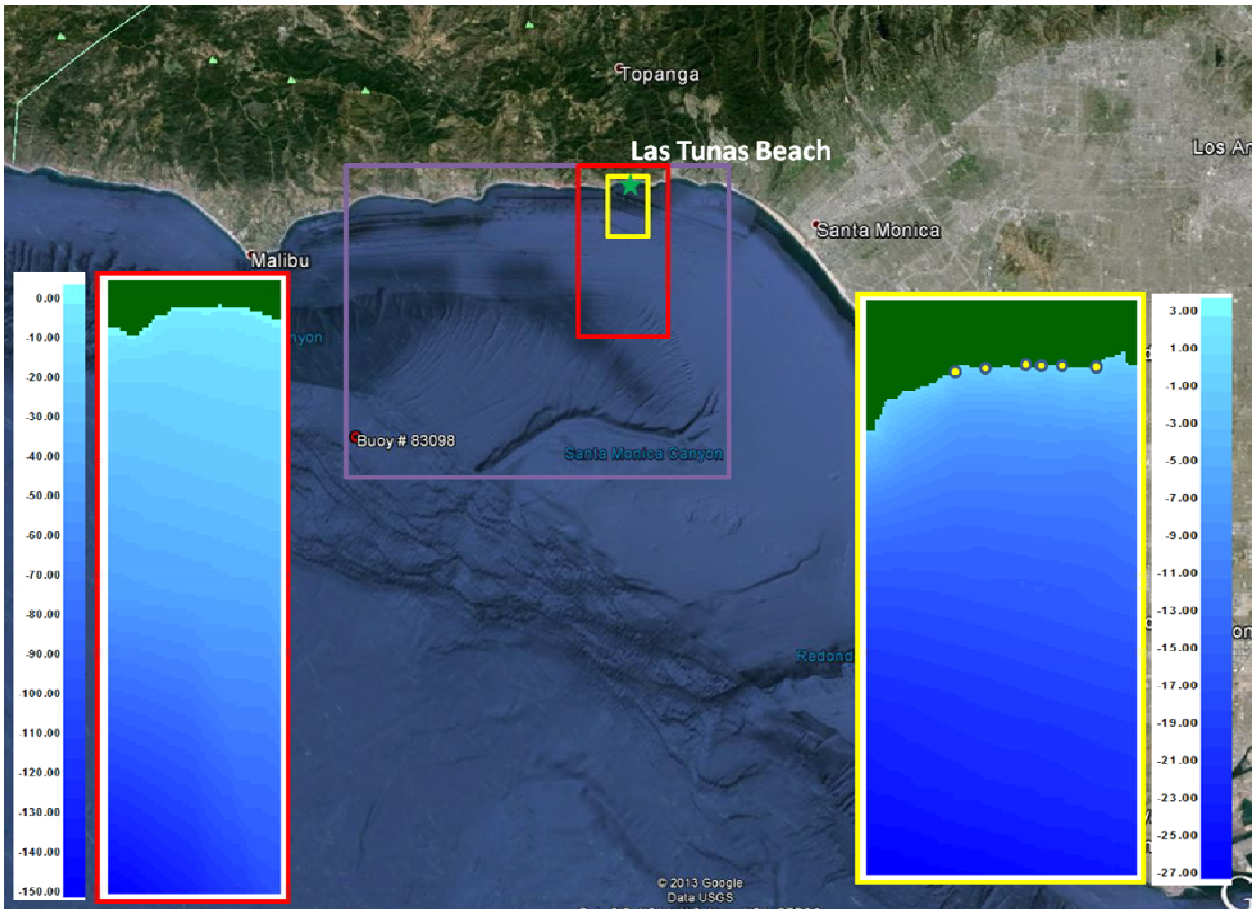


Figure 3-10 RCPWAVE Nested Grid Layout Map

3.2.3 Wave Transformation Analysis

The estimate of near-shore wave heights is dominated by the off-shore wave heights, wave periods, and local bathymetry. Offshore waves with great heights have a potential to cause high near-shore wave heights. However, the most extreme near-shore wave is not necessarily propagated from the offshore wave with the greatest height. The propagation of an extreme wave may be impacted by water depth and topography, causing the wave to break further out in the ocean. In order to evaluate the wave transformation properties on Las Tunas Beach under extreme conditions, 96 events were analyzed based on the 3 most extreme events determined by off-shore wave height from the WIS buoy.

The input for RCPWAVE included off-shore the incident wave height, peak wave period, and wave direction given as a permutation file for the parent layer. The 96 extreme event wave parameters are shown in **Figure 3-11**. A preliminary test for incident wave parameters indicated that the RCPWAVE model would be numerically unstable if incident wave directions angles were greater than 45° referenced from a line normal to the shore. Therefore, the analysis adopts an identical wave direction scenario for all events to maintain model stability and conservatively evaluate all adopted events. As a result, the incident waves are assumed to move perpendicularly towards the shoreline in the simulations for all events.

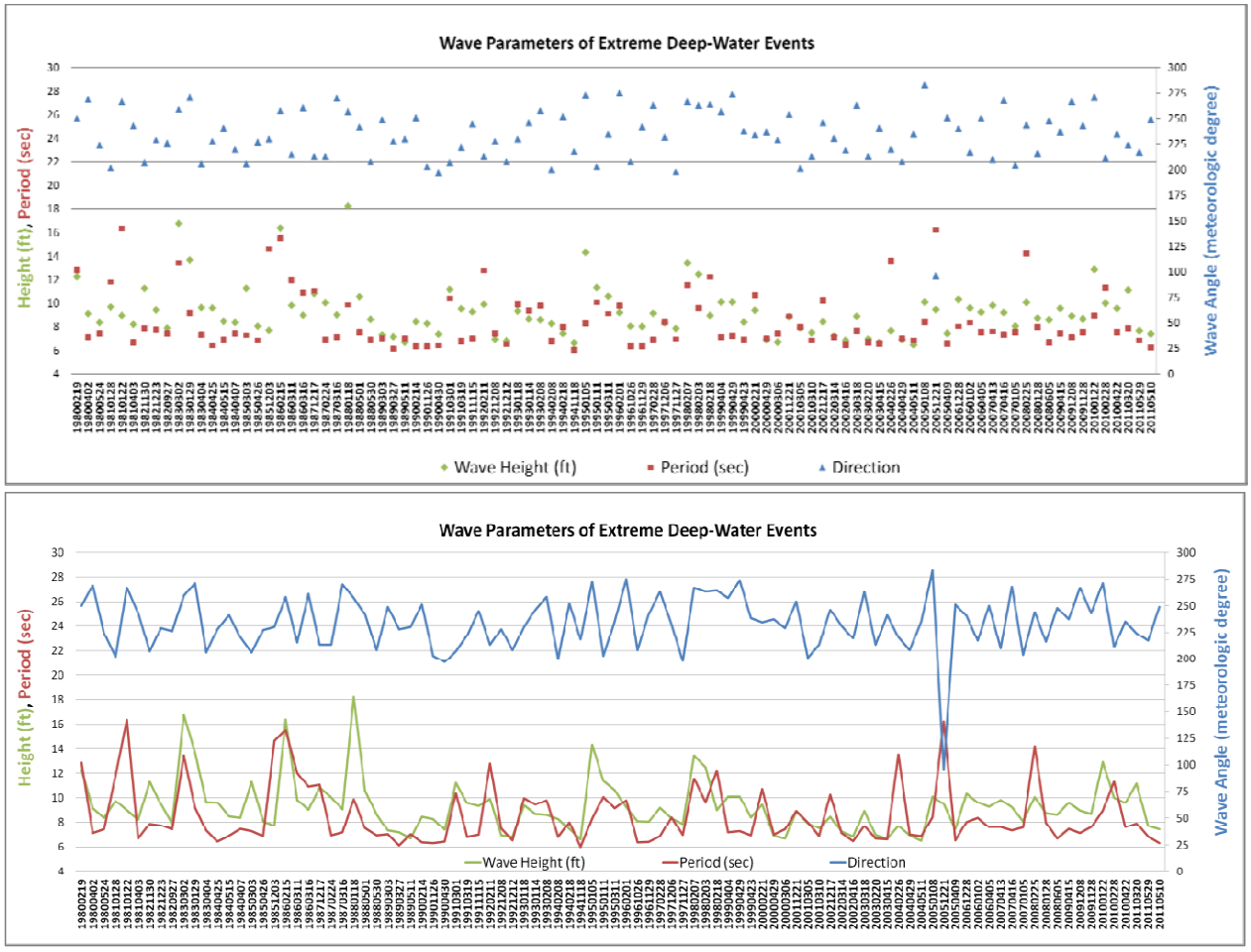


Figure 3-11 Deep-Water Wave Statistics for RCPWAVE Transformation of Extreme Events

As mentioned, three DWLs were used to account for three higher SLR scenarios. The wave transformation results corresponding to each scenario are shown in **Figure 3-12**, **Figure 3-13**, and

Figure 3-14. The wave heights at the deep-water 100-m station have very limited differences from the buoy wave heights for all DWL scenarios. This implies the transformations are insignificantly influenced by bathymetric changes. Wave heights at the 50-m station, in contrast, are lower than the wave heights measured at the buoy and 100-m station. The height reductions vary among the simulation events. Water level differences still have limited impact on the wave heights at the 50-m station (yellow lines), in comparison with the near-shore stations. Wave heights vary most significantly near-shore and the change in depths from the 50-m station to the beach is much more substantial. In the simulation with the lowest DWL, the near-shore heights are lower than their initial deeper-water heights mainly because waves have broken before arriving at the simulated stations. However, at some output locations, for example, Sta. 764+00 and 761+50, wave heights could be amplified in several less extreme events. In particular, wave heights at near-shore Sta. 764+00 are more extreme than heights at other stations.

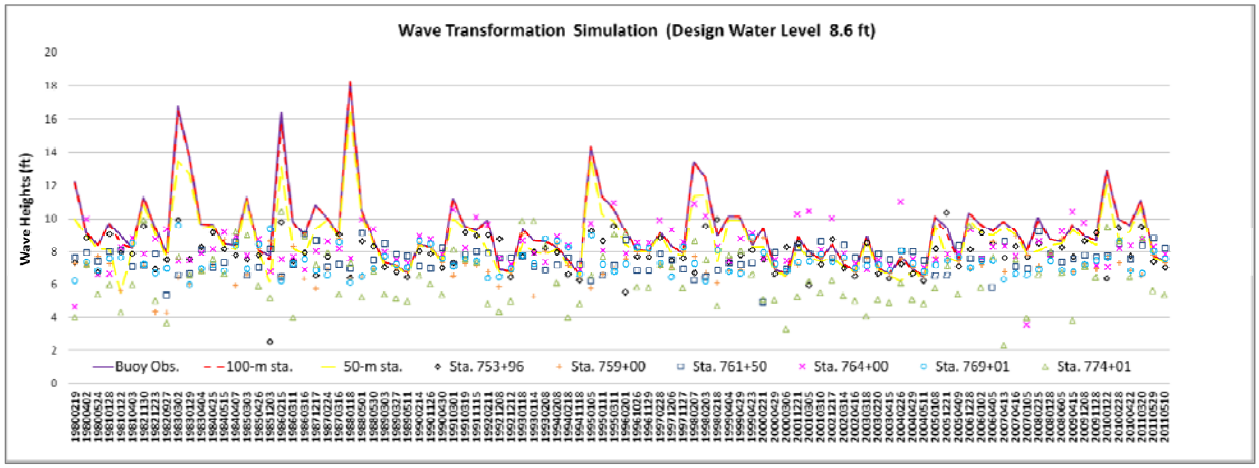


Figure 3-12 Results of Wave Transformation Simulation with Design Water Level 8.6 Feet

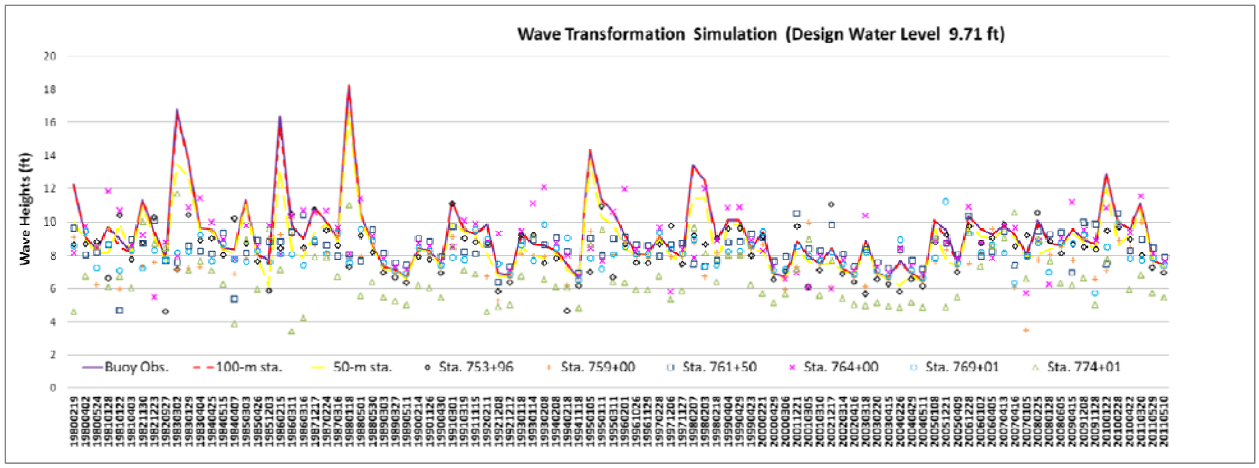


Figure 3-13 Results of Wave Transformation Simulation with Design Water Level 9.71 Feet

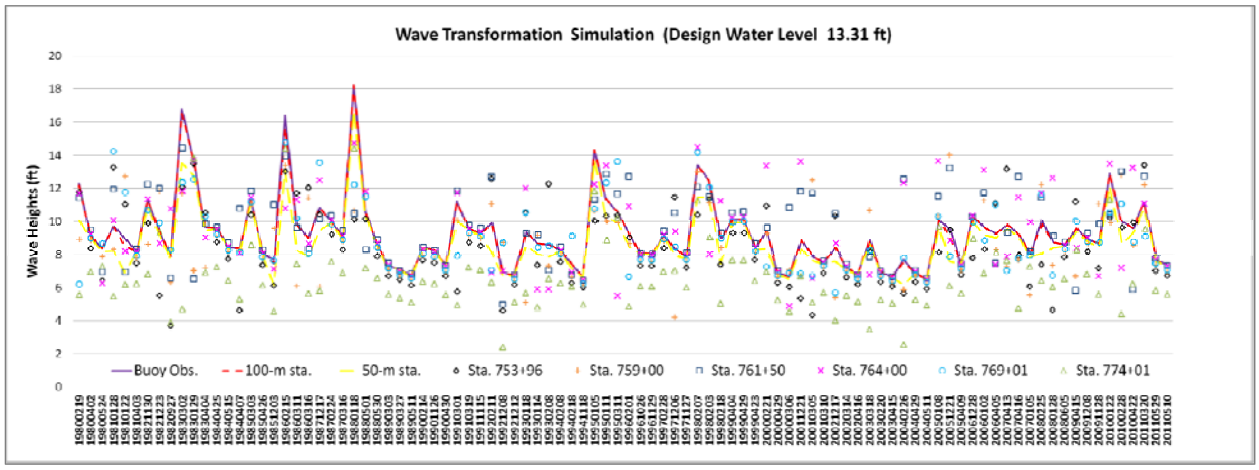


Figure 3-14 Results of Wave Transformation Simulation with Design Water Level 13.31 Feet

The simulations using a DWL of 9.71 feet display more diverse wave height distributions among the stations. Overall, higher DWLs result in less broken waves at the stations during the extreme events. The height magnitude is not necessarily consistent between the stations. The variation of near-shore waves is smaller than the variation in deep-water waves, especially for those tallest deep-water waves. This result suggests there is a shoaling effect in varying degrees, which influences wave heights during the near-shore wave propagations.

The results for the simulations using deepest DWL demonstrate the most complicated scenario, which produces very diverse near-shore wave height distributions. For Sta. 764+00 and 761+50, near-shore wave heights could exceed the deep-water wave heights especially for the minor extreme events with smaller wave heights. This observation also implies that near-shore wave heights are less correlated to their deep-water heights in this deepest DWL scenario. The shoreline topography and beach profile have significant impacts on the wave heights at the proposed revetment.

Figure 3-15 provides a comprehensive comparison for all the simulation events using box plots. The figure shows the statistics of wave height for the three DWLs. The numbers 1, 2, and 3 represent simulation cases for DWLs of 8.6, 9.71, and 13.31 feet, respectively.

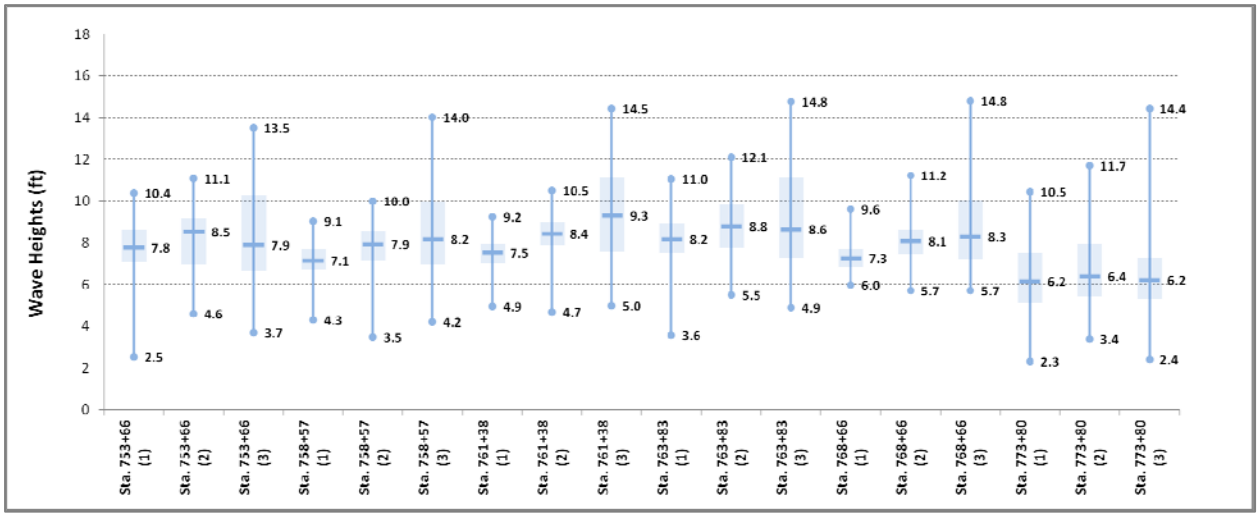


Figure 3-15 Box Plots of the Near-Shore Wave Heights

Several findings regarding the wave heights among the stations are summarized:

1. Near-shore wave heights vary between stations and the selected extreme events. In general, the deeper the DWL used, the greater the variation.

2. For each station, the most extreme height normally occurs when the deepest DWL is adopted, but the median and lowest heights do not necessarily behave the same way. In other words, DWL has more influence in producing very extreme near-shore wave heights. Additionally, as mentioned, the near-shore extreme does not necessarily correspond with the most extreme off-shore event.

3. For most stations in extreme storm cases, simulated wave heights could be as high as 9, 11, and 14 feet for years 2030, 2050, and 2100 DWL scenarios, respectively. In this case, the wave heights may be overestimated due to use of the identical wave direction normal to the shore. Actual wave heights might be lower under the same situations when other angles are adopted as the reference for coastal engineering designs.

3.3 Wave Run-up Estimates

When a wave breaks on a beach or structure, there is still momentum and energy that must be dissipated. The energy and momentum are lost to gravity and friction as the wave runs up the structure. Wave run-up heights are a function of wave energy, beach and structure slopes, roughness, and permeability. This section discusses the calculation methods used to evaluate wave run-up on the revetment proposed for the PCH along Las Tunas Beach.

FEMA's current guidelines for wave run-up and overtopping calculations utilize total wave run-up, which refers to the height above the stillwater elevation reached by the swash as shown in **Figure 3-16** (FHWA, 2008). In other words, run-up includes the wave setup. In this section, a study to estimate potential wave run-up heights over the proposed revetment is presented. In **Subsection 3.3.1**, two FEMA-recommended approaches used for wave run-up estimate are introduced. **Subsection 3.3.2** applies the run-up estimation methods utilizing wave and water level conditions developed in the previous sections.

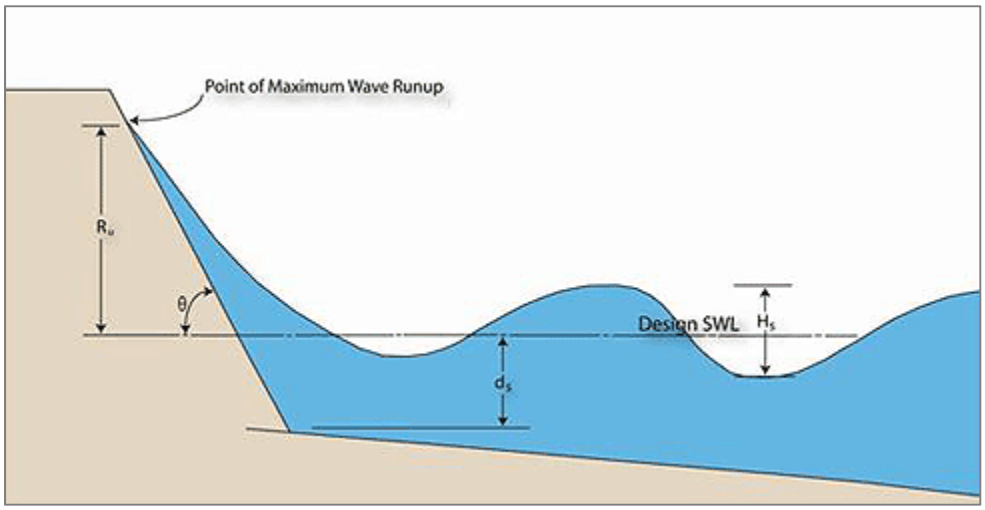


Figure 3-16 Wave Run-up Sketch (Source: FHWA, 2008)

3.3.1 Approach Introduction

Wave Setup

One of the common definitions for wave setup is the increase due to momentum transfer to the water column by waves that are breaking or otherwise dissipating their energy (FEMA, 2005c). Waves convey both energy and momentum while approaching shorelines. The wave energy is dissipated during the breaking processes, but the momentum is never dissipated. Instead, it is transferred to the water column resulting in a slope of the water surface to balance the onshore component of the flux of momentum (Dean, 2008).

In this study the extreme stillwater analysis utilizes observed tide data which inherently comprises all setup effects, it is not necessary to calculate setup separately. However, FEMA suggests using the Direct Integration Method (DIM) approach to calculate the setup if no observation is available. DIM approach separates total run-up into three components accounting for the static setup ($\overline{\eta}$), dynamic setup (η_{rms}), and incident wave run-up (R_{inc}). **Figure 3-17** shows a conceptual illustration of static and dynamic wave setup. The static and dynamic wave setups represent the mean magnitude and fluctuating effects respectively and can be calculated individually by with the following two equations:

$$\overline{\eta} = 4.0\ F_H F_T F_{Gamma} F_{Slope}$$

$$\eta_{rms} = 2.7\ G_H G_T G F_{Gamma} G_{Slope}$$

In the above equations, F and G are the factors for the static and dynamic setups and the subscripts H, T, Gamma and Slope stand for the specific factor terms for wave height (H_0), wave period (T), JONSWAP spectrum narrowness factor ($Gamma$) and near-shore slope (m). **Table 3-4** lists values of these factors adopted by the DIM.

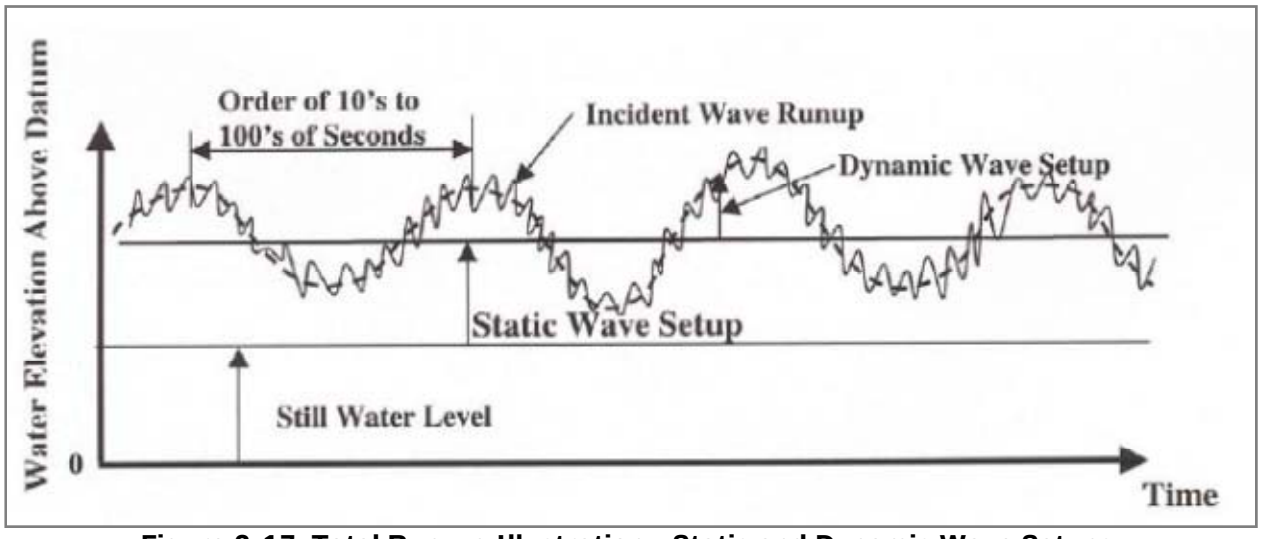


Figure 3-17 Total Run-up Illustration - Static and Dynamic Wave Setups and Incident Wave Run-up (Source: FEMA, 2005c)

Table 3-4 Factors for Static and Dynamic Setups				
Variable	**Factor for**			
	Wave Height	**Wave Period**	**Spectral Narrowness**	**Near-shore Profile Slope**
$\overline{\eta}(F)$	$(H_0/26.2)^{0.8}$	$(T/20)^{0.4}$	1.0	$(m/0.01)^{0.2}$
$\eta_{rms}(G)$	$(H_0/26.2)^{0.8}$	$(T/20)^{0.4}$	$Gamma^{0.16}$	$(m/0.01)^{0.2}$

Wave Run-up

FEMA recommends using the Technical Advisory Committee on Water Retaining Structures (TAW) approach (van der Meer, 2002) to estimate the incident wave run-up on coastal structures. This approach is also addressed in the CEM for performing wave run-up calculations. The TAW-calculated run-up height $R_{2\%}$ is defined as the height exceeded by 2% of the run-up events. It is noteworthy that the calculation is a short-term statistic associated with a group of waves or associated with a particular storm. The TAW calculation is based on the Iribarren number or surf similarity parameter ξ and various reduction factors accounting for the influences of surface roughness, berm, and angled wave attack and structure permeability. The Iribarren number for a wave on a natural beach (ξ) is defined as:

$$\xi = \frac{m}{\sqrt{H_0/L_0}}$$

In the above equation, m denotes the beach slope, and H_0 and L_0 are the spectral significant wave height and wave length. The deep-water wave length (L_0) is the function of the incident wave period (T) and can be calculated using the equation:

$$L_0 = \frac{g}{2\pi}T^2$$

For the Iribarren number on a sloping structure (ξ_{om}), incident significant wave height (H_{m0}) and mean period ($T_{m-1.0}$) are used. These two variables are defined as:

$$H_{m0} = 4.0\sqrt{m_0}$$

$$T_{m-1.0} = \frac{T_p}{1.1}$$

Here, m_0 is the zeroth-moment of the variance spectrum and $T_p$is the peak wave period. In most cases that water levels at toes of the structure is depth-limited, breaking wave heights (H_b, 0.78 times design water depth) can be substituted for H_{m0}.

As mentioned, the 2% run-up is applied to various reduction factors developed by Battjes (1974), van der Meer (1988), and de Waal & van der Meer (1992). A general form of 2% wave run-up ($R_{2\%}$) can be expressed as:

$$R_{2\%} = H_{m0} * 1.77\gamma_r\gamma_b\gamma_\beta\gamma_P\xi_{om} \quad \text{for } 0.5 \le \gamma_b\xi_{om} \le 1.8$$

$$R_{2\%} = H_{m0} * \gamma_r\gamma_b\gamma_\beta\gamma_P(4.3 - \frac{1.6}{\sqrt{\xi_{om}}}) \quad \text{for } 1.8 \le \gamma_b\xi_{om}$$

Where γ_r, γ_b, γ_β and γ_P stand for reduction factor relevant to influences of surface roughness, berm, angled wave attack and structure permeability respectively. **Table 3-5** lists recommended values for the reduction factors with various wave and structure properties.

Table 3-5 Suggested Values of Reduction Factors for TAW Ru2 % Calculation		
Run-up Reduction Factor	**Characteristic / Condition**	**Value of γ for Run-up**
Roughness Reduction Factor, γ_r	Smooth Concrete, Asphalt and Smooth Block Revetment	$\gamma_r = 1.0$
	1 Layer of Rock With Diameter, D. Hs / D = 1 to 3.	$\gamma_r = 0.55\ to\ 0.60$
	2 or More Layers of Rock. Hs / D = 1.5 to 6.	$\gamma_r = 0.5\ to\ 0.55$
	Quadratic Blocks	$\gamma_r = 0.7\ to\ 0.95$
Berm Section in Breakwater, γ_b; B = Bern Width; $\frac{\pi d_h}{x}$ in radians	Berm Present in Structure Cross-section.	$\gamma_b = 1 - \frac{B}{2L_{Berm}}\left[1 + \cos\left(\frac{\pi d_h}{x}\right)\right]$, $0.6 < \gamma_b < 1.0$ $x = \begin{cases} R \quad if \frac{-R}{H_{mo}} \le \frac{d_h}{H_{mo}} \le 0 \\ 2H_{mo} \quad if 0 \le \frac{d_h}{H_{mo}} \le 2 \end{cases}$ Minimum and maximum values of γ_b =0.6 and 1.0 respectively
Wave Direction Factor, γ_β; β is in degrees and = 0° for normally incident waves	Long-Crested Waves	$\gamma_\beta = \begin{cases} 1.0, & 0 < \lvert\beta\rvert < 10° \\ \cos\left(\lvert\beta\rvert - 10°\right), & 10° < \lvert\beta\rvert < 63° \\ 0.63, & \lvert\beta\rvert > 63° \end{cases}$
	Short-Crested Waves	$1 - 0.0022\ \lvert\beta\rvert$, $\lvert\beta\rvert < 80°$ $1 - 0.0022\ \lvert 80\rvert$, $\lvert\beta\rvert \ge 80°$
Porosity Factor, γ_P	Permeable Structure Core	$\gamma_P = 1.0$, $\xi_{om} < 3.3$ $\gamma_P = \frac{2.0}{1.17(\xi_{om})^{0.46}}$, $\xi_{om} > 3.3$ and porosity = 0.5 for smaller porosities, Proportion γ_P according to porosity.

Another adopted approach to calculate run-up on coastal structures is the Automated Coastal Engineering System (ACES) developed by the USACE (USACE, 1992). The ACES model is also recommended by FEMA and is included as a module of CEDAS. CEDAS can provide computer-based run-up analysis and other coastal engineering calculations. A screenshot of the ACES interface in CEDAS is shown in **Figure 3-18**. This ACES approach was developed on the basis of small-scale laboratory tests by Ahrens and Heimbaugh (1988) and works well for both shallow and deep water run-up calculations at the toe of the revetment (FEMA, 2005).

ACES can deal with three types of run-up calculations: irregular wave run-up on beaches, irregular wave run-up on riprap, and wave run-up and overtopping on impermeable structures. In this study, the irregular wave run-up on riprap calculation is most suitable for the riprap revetment design for the Las Tunas Beach. The calculation aims to estimate the expected maximum run-up elevation, and is also

correlated to the Iribarren number ξ and incident significant wave height H_0, as shown in the equation below:

$$\frac{R_{max}}{H_0} = a\xi/(1 + b\xi)$$

The constants *a* and *b* are two parameters related to material properties. Parameter values for different revetment armor materials are recommended in ACES. For riprap design, 0.956 (*a*) and 0.398 (*b*) are recommended.

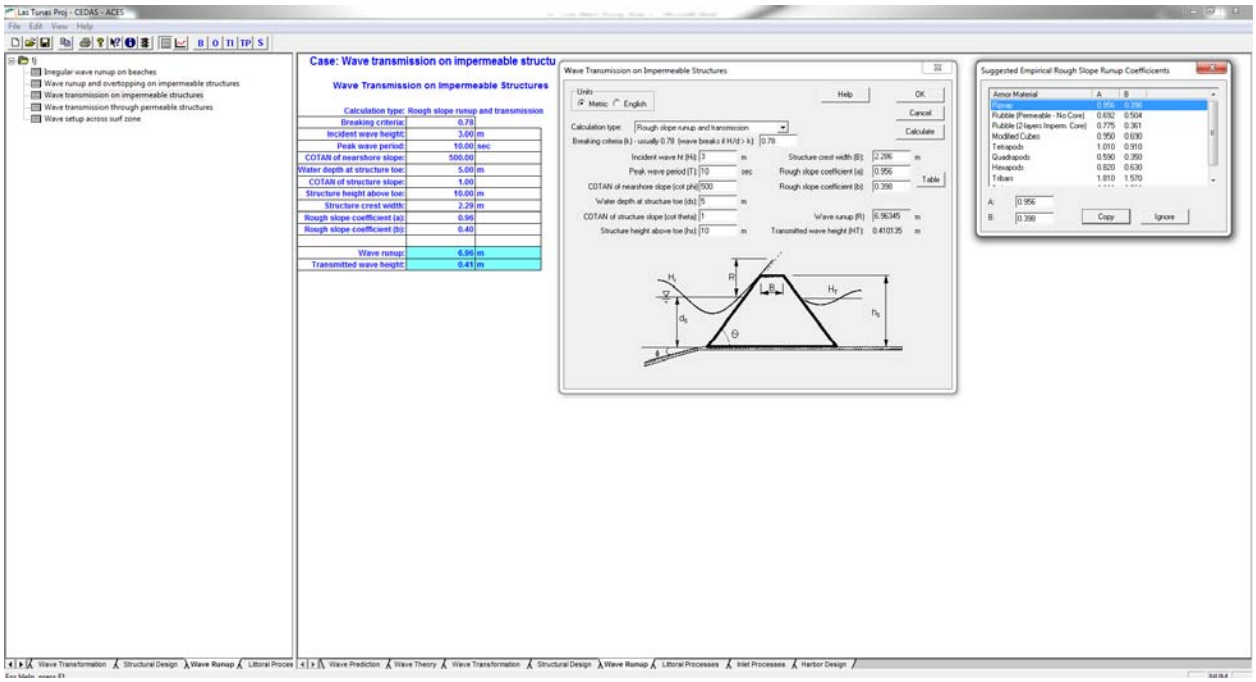


Figure 3-18 The Run-up Calculation Interface of ACES Model

3.3.2 Run-up and Total Water Level Calculation

Wave run-up heights and total water levels are estimated using the lower and higher SLR projections to account for the potentially varying water depths. Wave run-up heights are estimated by both the TAW and ACES methods.

Table 3-5 is provides the TAW reduction factors for use in the wave run-up calculations. The factor $\gamma_r = 0.53$ is used to account for the assumption of a 2-layer RSP revetment design and in-situ wave conditions; the factor $\gamma_b = 1$ is used because no berm section is designed for the proposed revetment. Moreover, γ_β ranges between 0.824 and 0.934 since the most prevalent incident short-crested wave directions range between 200-280 degrees as shown in **Figure 3-7**. The porosity factor, γ_P, is determined on basis of the calculated Iribarren number.

Three mean wave periods of 8, 12, and 16 seconds were chosen for the run-up analysis to account for wave height – period relationships noted for the majority of high-height deep-water waves from the WIS buoy. **Figure 3-19** provides a graphical comparison of wave height versus wave period.

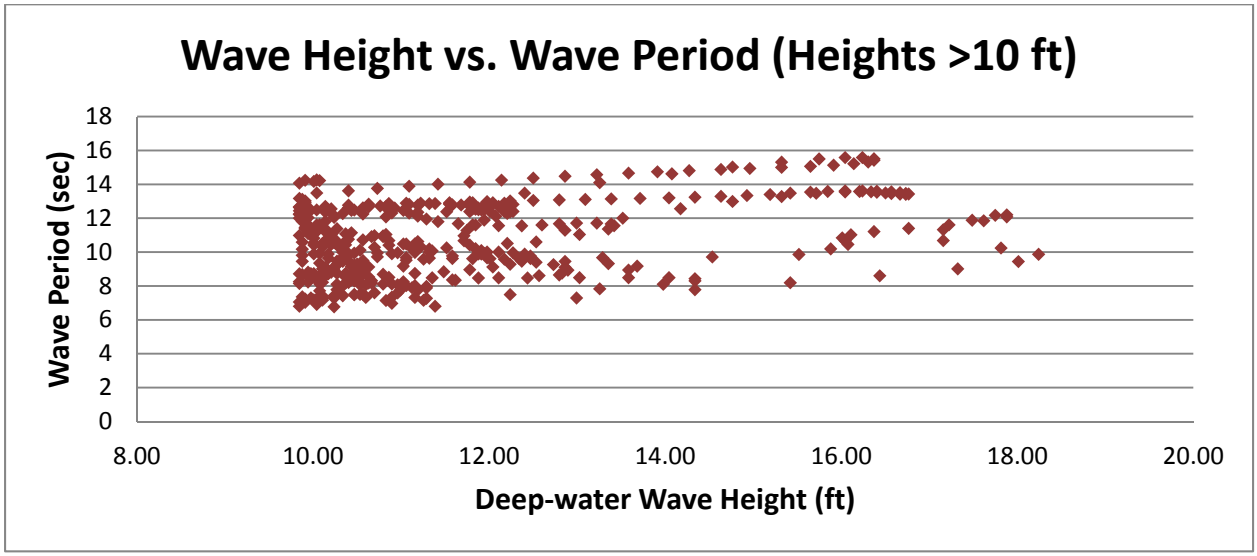


Figure 3-19 Deep-water Wave Height vs. Wave Period Relationship for Large (>10ft) Waves

The run-up calculations resulting for the DWLs for target years 2030, 2050, and 2100 are shown in **Table 3-6**, **Table 3-7**, and **Table 3-8**, respectively. The results from the two run-up approaches are diverse under the same wave conditions mainly because the TAW approach considers more factors related to the run-up reduction effects than the ACES approach. In general, longer wave periods result in greater ACES R_{max} values. However, longer wave periods often cause lower TAW $Ru_{2\%}$.

For wave run-up with respect to the 12-second mean wave period (T_{mo}), the two approaches show better agreement. The two approaches have different run-up definitions and the results sometimes contradict each other, where the maximum run-up could be smaller than the 2% run-up under same wave conditions. Nevertheless, the run-up calculations from both approaches provide valuable information for the different target future scenarios. Overall, the maximum and minimum run-up heights for the target year 2030 are 8.21 and 12.93 feet NAVD88. For the year 2050, the run-up heights could increase to 8.65 and 14.38 feet NAVD88. The extreme run-up height in the target year 2100 could reach 18.91 feet, while the most optimistic estimate could still reach 10.03 feet NAVD88.

The design total water level defined in this study includes the design SWL, SLR projections, and the TAW 2% wave run-up height. The calculations for various SLR scenarios are listed in the tables. Overall, the highest total water level has an estimated height of 15.96 feet height in target year 2030; the worst case estimation for total water level in the 2100 SLR scenario can be as high as 29.96 feet.

Table 3-6 Wave Run-up Calculations for the Target Year 2030						
ACES Method						
Extreme Stillwater (Tide+Surge)	7.62 ft					
SLR Scenarios	**Low**			**High**		
	0.13			0.98		
Design Water Depth (ft)	7.94			8.79		
Incident Wave Height H_{mo} (ft)	6.19			6.86		
T_p(sec)	8.80	13.20	17.60	8.80	13.20	17.60
T_{mo} (sec)	8.00	12.00	16.00	8.00	12.00	16.00
L_{mo} (ft)	99.92	224.83	399.70	99.92	224.83	399.70
Structure Slope (tan θ)	0.67	0.67	0.67	0.67	0.67	0.67
Deep-water Iribarren Number, ξ_0 (ft)	2.69	4.04	5.38	2.56	3.84	5.11
ACES R_{max} (ft)	9.79	11.05	11.8	10.65	12.07	12.93
Design Total Water Level = Stillwater+SLR+ R_{max} (ft)	17.54	18.8	19.55	19.25	20.67	21.53
TAW Method						
Spectral Deep-water Iribarren Number(for TAW), ξ_{om} (ft)	2.96	4.44	5.92	2.81	4.22	5.63
Reduction Factor γ_r	0.53			0.53		
Reduction Factor γ_b	1.00			1.00		
Reduction Factor γ_β	0.88			0.88		
Reduction Factor γ_p	1.00	0.86	0.75	1.00	0.88	0.77
TAW $Ru_{2\%}$ (ft)	9.60	9.10	8.21	10.56	10.26	9.27
Design Total Water Level = Stillwater+SLR+ $Ru_{2\%}$ (ft)	17.35	16.85	15.96	19.16	18.86	17.87

Table 3-7 Run-up Calculations for the Target Year 2050						
ACES Method						
Extreme Stillwater (T+S)	7.71 ft					
SLR Scenarios	**Low**			**High**		
	0.39			2.00		
Design Water Depth (ft)	8.23			9.90		
Incident Wave Height H_{mo} (ft)	6.42			7.72		
T_p (sec)	8.80	13.20	17.60	8.80	13.20	17.60
T_{mo} (sec)	8.00	12.00	16.00	8.00	12.00	16.00
L_{mo} (ft)	99.92	224.83	399.70	99.92	224.83	399.70
Structure Slope (tan θ)	0.67	0.67	0.67	0.67	0.67	0.67
Deep-water Iribarren Number, ξ_0 (ft)	2.64	3.96	5.29	2.41	3.62	4.82
ACES Rmax (ft)	10.1	11.41	12.2	11.75	13.38	14.38
Design Total Water Level = Stillwater+SLR+ R_{max} (ft)	18.2	19.51	20.3	21.46	23.09	24.09
TAW Method						
Spectral Deep-water Iribarren Number(for TAW), ξ_{om} (ft)	2.63	3.95	5.27	2.41	3.62	4.82
Reduction Factor γ_r	0.53			0.53		
Reduction Factor γ_b	1.00			1.00		
Reduction Factor γ_β	0.88			0.88		
Reduction Factor γ_p	1.00	0.91	0.80	1.00	0.95	0.83
TAW $Ru_{2\%}$ (ft)	10.00	9.58	8.65	11.77	11.79	10.66
Design Total Water Level = Stillwater+SLR+ $Ru_{2\%}$ (ft)	18.10	17.68	16.75	21.48	21.50	20.37

Table 3-8 Run-up Calculations for the Target Year 2100						
ACES Method						
Extreme Stillwater (T+S)	7.83 ft					
SLR Scenarios	**Low**			**High**		
	1.38			5.48		
Design Water Depth (ft)	9.60			13.50		
Incident Wave Height H_{mo} (ft)	7.49			10.53		
T_p (sec)	8.80	13.20	17.60	8.80	13.20	17.60
T_{mo} (sec)	8.00	12.00	16.00	8.00	12.00	16.00
L_{mo} (ft)	99.92	224.83	399.70	99.92	224.83	399.70
Structure Slope (tanθ)	0.67	0.67	0.67	0.67	0.67	0.67
Deep-water Iribarren Number, ξ_0 (ft)	2.45	3.67	4.89	2.06	3.10	4.13
ACES R_{max} (ft)	11.46	13.04	14	15.09	17.44	18.91
Design Total Water Level = Stillwater+SLR+ R_{max} (ft)	20.67	22.25	23.21	28.4	30.75	32.22
TAW Method						
Spectral Deep-water Iribarren Number(for TAW), ξ_{om} (ft)	2.47	3.71	4.95	2.06	3.10	4.13
Reduction Factor γ_r	0.53			0.53		
Reduction Factor γ_b	1.00			1.00		
Reduction Factor γ_β	0.88			0.88		
Reduction Factor γ_p	1.00	0.94	0.82	1.00	1.00	0.89
TAW $Ru_{2\%}$ (ft)	11.22	11.09	10.03	15.65	16.65	15.36
Design Total Water Level = Stillwater+SLR+ $Ru_{2\%}$ (ft)	20.43	20.30	19.24	28.96	29.96	28.67

3.4 Storm-induced Short-term Beach Evolution for Las Tunas Beach

Beach evolution deals with the erosion and accretion of sediment on the beach, which results in beach landform changes. Beach evolution is influenced by coastal engineering designs, including beach protection structures. Severe storms are the most common force causing short-term beach changes. To properly assess erosional or accretional trends and their impacts on the Las Tunas Beach, a comprehensive analysis integrating historical topography and bathymetry surveys and numerical modeling was performed.

Three (3) summer and winter beach surveys were available for the study. Two of the surveys of winter and summer profiles were conducted for the CCSTWS in 2002 and 2004/2005 as part of a larger regional analysis. The other survey of winter and summer profiles was conducted in 2013. All surveys used the same six survey transects on the Las Tunas Beach as documented in **Appendix C** (winter profiles) and **Appendix D** (summer profiles). The surveys help identify recent beach changes, and numerical modeling was conducted to verify beach evolution induced by historical storm events in this survey period. A case study for the winter beach on basis of model simulations was performed to estimate potential impacts under a design extreme storm event with various SLR scenarios. The beach evolution model and its configurations for the study case are introduced in **Subsection 3.4.1**; the analysis results are elaborated in the **Subsection 3.4.2** and **Subsection 3.4.3**.

3.4.1 Analysis of Historic Beach Conditions

An analysis for the historic beach conditions was conducted using historic aerial photos shot over Las Tunas Beach. The photos were taken in years 1971, 1981, 1985, and 1998 (**Figure 3-20**). The most recent aerial photo (**Figure 3-21**), which was taken by the CWE aerial survey team in July 2013 is used as a reference for the historic photos.

The Las Tunas Beach was replenished by 50,000 cubic yards of sand between 1960-1974 (Clayton, 1991). This produced the widest beach in the historic photo series, as observed in 1971. Another reason for the wider beach in 1971 is the installed jetties on the beach. These jetties functioning effectively to accumulate drift sand from west. In spite of that water levels prevent some of the sediment from being transported down beach away from Las Tunas Beach. In the photos, the beach in years 1981 and 1985 shows a gradual recessional trend in the 1980s. With less protection resulting from shortened jetties, the beach width decreased and the sand volume between the jetties decreased. By 1998, most jetties were removed or non-functional. With only one jetty left, the beach receives limited sand depositions, particularly on the down beach side of the jetty. The beach recessional trend decreases after 1998, which was a significant El Nino year with large storms. The difference of beach widths between year 1998 and 2013 is minor. However, more RSP protection was constructed during this period to protect the highway, which protected the beach from a certain level from erosion.

Figure 3-20 Historic Aerial Photos of the Las Tunas Beach in 1971, 1981, 1985, and 1998

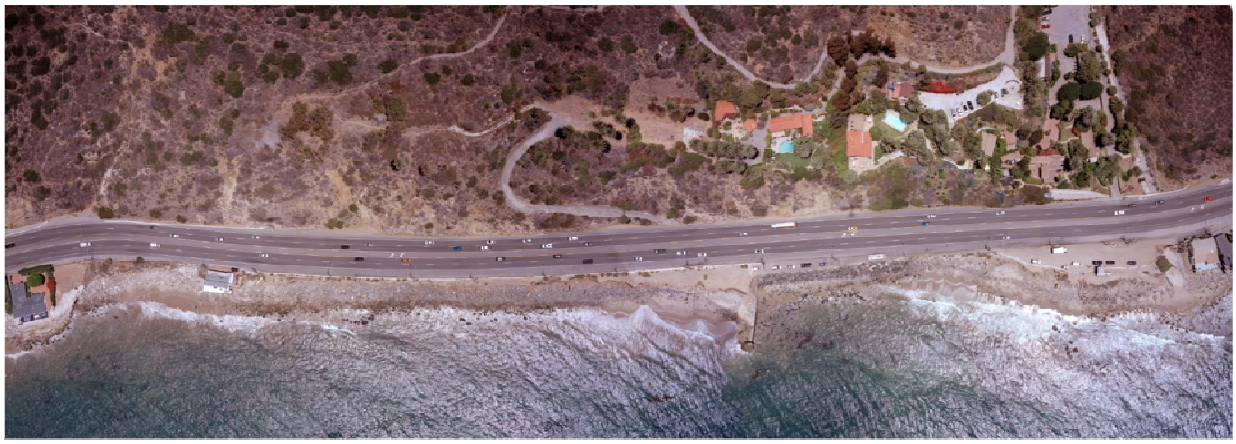


Figure 3-21 Aerial Photo Taken in July 2013

The littoral drift along the beach occurs from west to east. This can be verified based on the deposition of sand on the updrift side of jetties. As shown in **Figure 3-20** and **Figure 3-21**, the sand accumulation is on the western side of the jetties on Las Tunas Beach. Las Tunas Beach is in Littoral Cell 20 – Santa Monica Bay (Patsch and Griggs, 2006). It is the balance between sand sources and sinks within each littoral cell that governs the long-term width of beaches within a beach compartment. If there is a significant reduction in the amount of sand reaching a particular stretch of coast, the beach should gradually erode or narrow. Conversely, if there is an increase of sand in a particular area, the beach should advance seaward, or widen.

The greatest reduction in sediment supplied to Southern California results from the damming of rivers. Such damming has reduced the apparent volume of sand reaching the beaches in Southern California cells 47 percent (Patsch and Griggs, 2006). The reduction in Southern California equates to nearly 2.4 million yds^3 of sand annually (Willis and Griggs, 2003). Seacliff armoring has reduced the sand supplied to southern California's beaches by 10 percent. The Southern California reduction is about 35,000 yds^3 annually, still less than 7% of the total sand input to all of these littoral cells.

In the Santa Monica littoral cell, over 29 million yd^3 of sand has been placed on the beaches since 1938 for projects where the primary objective was not specifically beach nourishment. Although the majority of beach fill was placed prior to 1970, beaches in this area are still wider than their natural pre-nourished state. This is mainly related to the construction of retention structures to hold the sand in place from Topanga Canyon to Malaga Cove, effectively retaining the sand before it is lost into Redondo Submarine Canyon (Patsch and Griggs, 2006). Sand retention structures have maintained wide artificial beaches in parts of the Santa Monica littoral cell because of the nearly unidirectional longshore transport to the southeast.

The crescent shape of the shoreline between Big Rock and Malibu Creek impacts longshore transport to Las Tunas Beach. There is limited sediment supply from bluff erosion and stream input within this section of the coast. Cross-shore transport also impacts sediment supply on a beach as either a source or sink for sediments. Cross-shore transport occurs on many scales including tidal, seasonal, and decadal time frames.

Placement of beach nourishment sand at Las Tunas Beach in the 1970s slowed the erosion of the beach and bluff. The groins that were installed along the beach provided some protection from littoral drift to the beach nourishment sand. However, as large storms changed the wave environment, sand was moved cross-shore and into deeper water. This sand was not returned during subsequent years and wave cycles, resulting in a loss of beach sand. Caltrans historically held a permit that allowed annual placement of 5,000 cubic yards (yd^3) along the Las Tunas Beach revetment. This placement of sediment

slowed erosional rates. However, annual placement of the 5,000 yd^3 ended in the mid-1990s when the permit was not renewed. This allowed the beach to return to the natural erosion rate. **Figure 3-22** shows the Caltrans replenishment efforts in 1996.

Figure 3-22 Photographs of Caltrans Beach Replenishment Activities November 1996

3.4.2 SBEACH Model and Model Configurations

Numerical modeling is employed extensively in beach erosion evaluations. In this study, the Storm-induced BEAch CHange (SBEACH) model was chosen to simulate 2-dimensional erosion/accretion on Las Tunas Beach. Given necessary storm characteristics (e.g., incident wave and water level data) as the driving forces and boundary conditions, as well as beach geometric information from the coastal topography and bathymetry data, this model is able to evaluate sediment transport in the cross-shore direction and corresponding evolutions of beach landforms (e.g., dune, berm, trough and bar). The analysis assumes that long-shore sediment sources and drift flux are insignificant and negligible in comparison with cross-shore sediment transport during short-term storm events. More details regarding model's theories and developments are available in the SBEACH documentation at the Coastal and Hydraulics Laboratory of the USACE. (USACE, 1989).

Two SBEACH models were developed, one for historical beach evolution and the other for erosion impact assessment. The first model was used to verify beach evolution induced by historical storm events during a selected historical period. The model was based on available data for wave characteristics and water levels. In the existing conditions model, the 2002 beach survey served as the beach landform baseline. Water levels were measured by the Santa Monica tide station during the period 2002-2011 as shown in **Figure 3-23**. Off-shore wave height and period data from WIS Buoy #83098 was used with a 4-hour resolution. Most wave heights were lower than 10 feet, and the water levels ranged between 2 and 7 feet NAVD 88 during the simulation period. The maximum wave heights during the simulation period were less intense than the 10-year design storm determined by the WIS hindcast analysis.

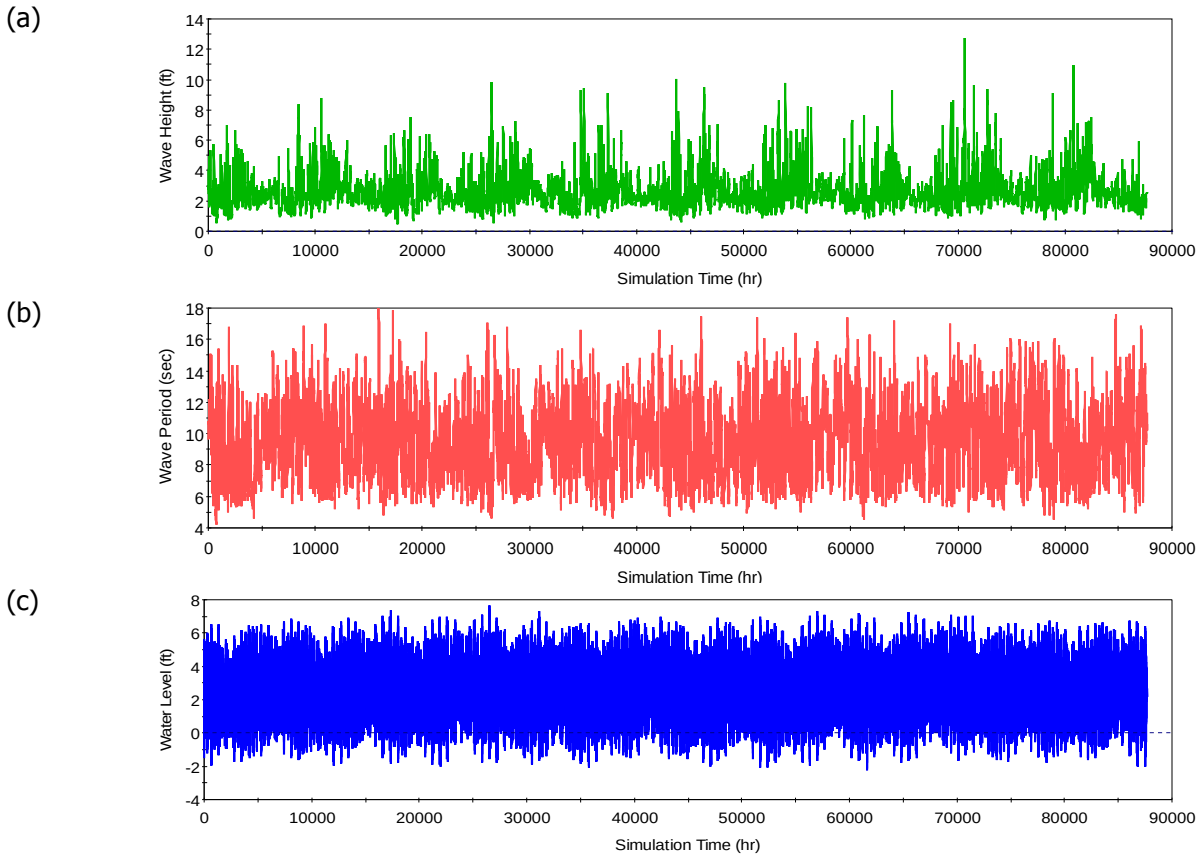


Figure 3-23 Four-hour Time Series of (a) Wave Height , (b)Wave Period and (c) Water Level during the Simulation Period 2002-2011

The second model was used to assess beach erosion under the extreme conditions associated with future sea levels. The model used the 72-hour historical storm of January 17th-19th, 1988. This storm has the historically highest wave height recorded by the buoy and is used as the design wave climate. The hourly wave height and period are shown in **Figure 3-24**. This 72-hour design water level time series is adopted to account for potential high tide and storm surge effects. Scenario No. 1 uses the historically highest tide levels recorded at the Santa Monica tide station on January9th-11th, 2005, due to the absence of hourly tide data for this event. Scenarios No. 2, 3, and 4 represent the higher projected SLR values of 0.98, 2.00, and 5.48 ft estimated for years 2030, 2050, and 2100. These SLR values are added to the design water level to represent the Water Level Scenarios No. 2, 3, and 4 shown by the light to dark blue lines in **Figure 3-24**.

Except for storm input, the model requires sediment properties as an input parameter. The site investigation showed that the beach contains a wide range of sediments ranging from sand, to local rocks, and damaged revetment debris. However, the model does not consider transport of sediments with a median diameter D_{50} greater than 1 mm and assumes they are non-transportable. Erosion/accretion phenomena are dominated by the cross-shore transport rates of finer sediments, and the representative median diameter D_{50} (0.1-1mm) of the local beach sediments is required as a model input. Due to the absence of local D_{50} data, this input is treated as a parameter and is calibrated along with other two sediment transport parameters, transport rate coefficient (ranging from 2.5e-7 to 2.5e-6 m^4/N) and coefficient for slope-dependent term (ranging from 0.001 to 0.005). In this study, the calibration for the parameters was conducted individually for each profile by comparing beach changes between the 2002 and 2013 surveys profiles.

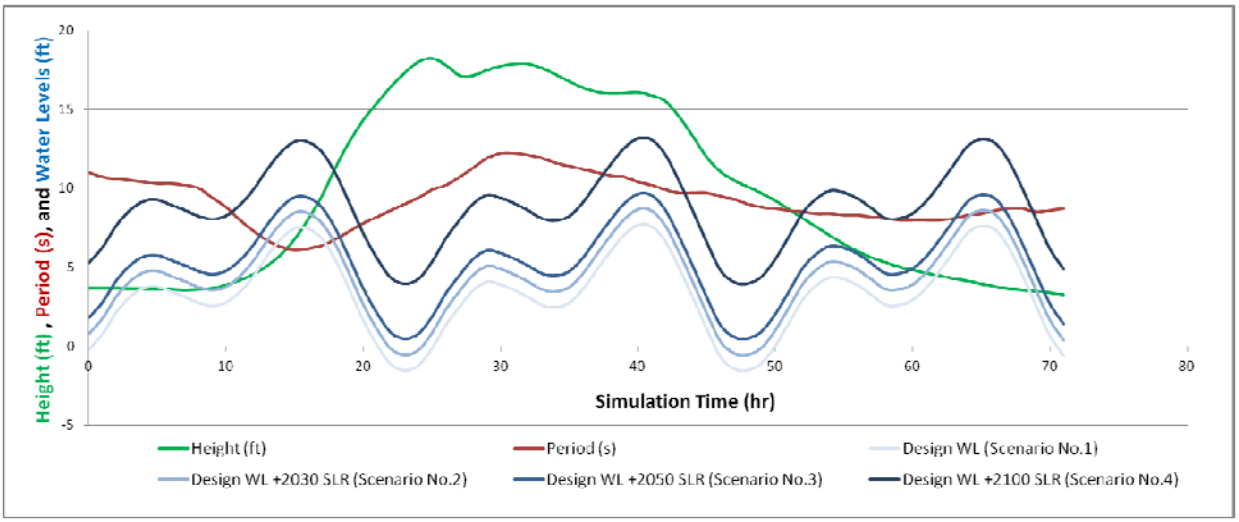


Figure 3-24 Hourly Time Series of the Wave Height, Wave Period and Water Level Scenarios of the 72-hour Design Strom Event (9th-11th Jan 2005)

The horizontal reference point was set at elevation 0-ft NAVD88 on the each profile in the 2002 survey to compare profile changes between the surveyed and the simulated profiles. The profile zones were analyzed from the beach bluffs/road revetment with elevations 20 feet higher than the beach elevation to seabed points 300 feet seaward from the reference point where elevations are less than -10 ft NAVD 88.

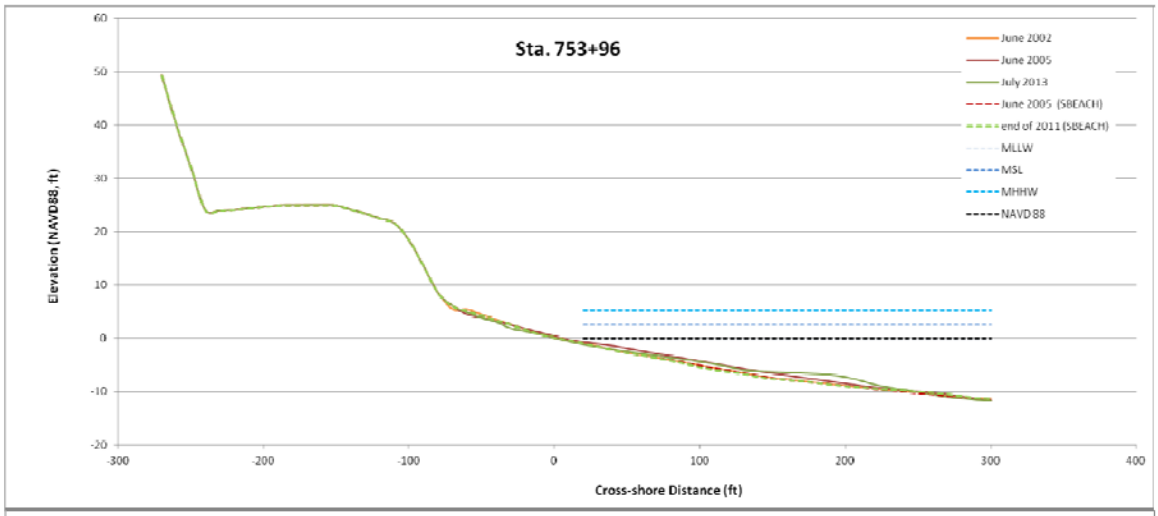
3.4.3 Long-Term Beach Evolution Analysis

The historical beach evolution analysis utilized the model developed for long-term simulations discussed above to evaluate beach evolution at Las Tunas Beach. The model was run using the input values discussed above to see how well the SBEACH model results would compare to the 2013 survey data. Comparisons between the multi-year surveys and model simulation results (**Figure 3-25**) suggest common characteristics. The beach evolutions among different profiles during the 2002-2011 study period are highly variable. The profiles at Sta. 753+96 and 764+00 display stable conditions in evaluation years 2005 and 2011 as shown in **Figure 3-25a** and **Figure 3-25d**. No evident erosional or accretional trends throughout the study period implies the beach near these spots have likely reached an equilibrium state.

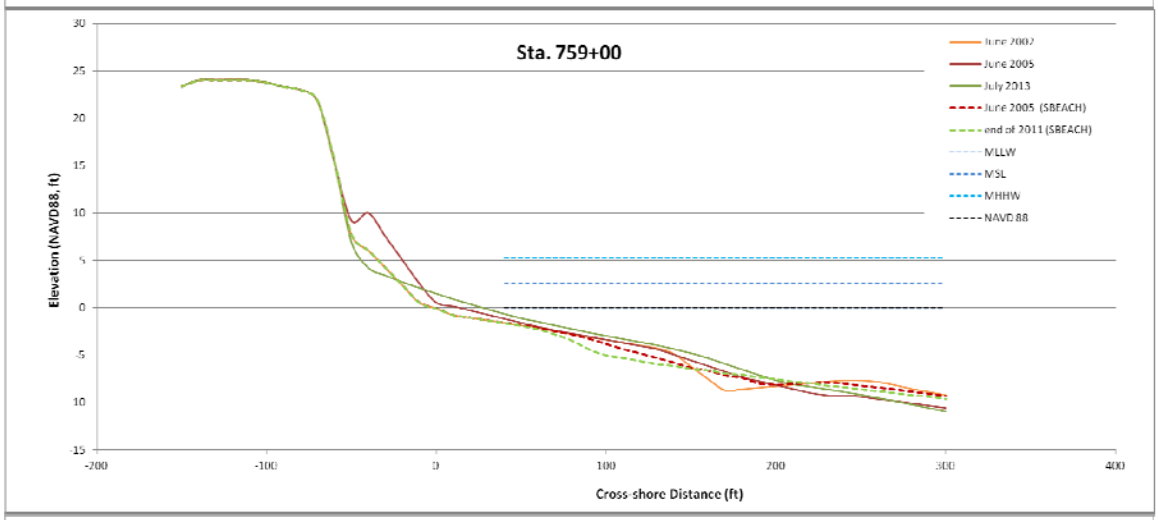
The profiles of Sta. 759+00, 761+50, and 769+01, the 2005 survey indicates more pronounced changes above 0 feet NAVD88, in comparison with minor changes shown in the 2013 survey. Among them, two profiles Sta. 759+00 and 761+50 show considerable depositions over the beach region above 0-ft contour in the 2005 survey (**Figure 3-25b** and **Figure 3-25c**). These two profiles are eroded and retreat back to near the extent of the 2002 survey by the end of 2011. This result suggests these two profiles might be still developing and have not reached to stable states yet.

On the other hand, the profile Sta. 769+01 shows a slightly eroded beach in the region of beach between the 5 and 15 ft contours. The model results do fully simulate the 2002-2005 beach evolution. Nevertheless, using the 2013 survey as the reference, the profiles at the end of the simulation time are more reasonably predicted. For the last profile, Sta. 774+01, the results indicate that it is the most active of the evaluated profiles. **Figure 3-25f** shows an aggressive and continuous erosional trend throughout the simulation period. As for the model simulation for this profile, SBEACH predicts beach erosion consistent with the surveys.

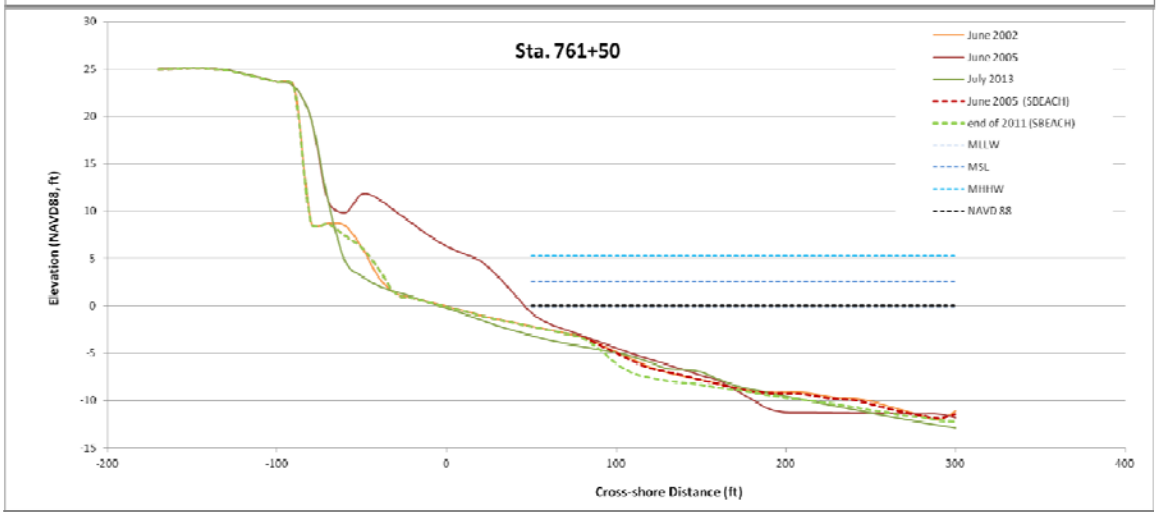
(a)


Sta. 753+96
June 2002
June 2005
July 2013
June 2005 (SBEACH)
end of 2011 (SBEACH)
MLLW
MSL
MHHW
NAVD 88
Elevation (NAVD88, ft)
Cross-shore Distance (ft)

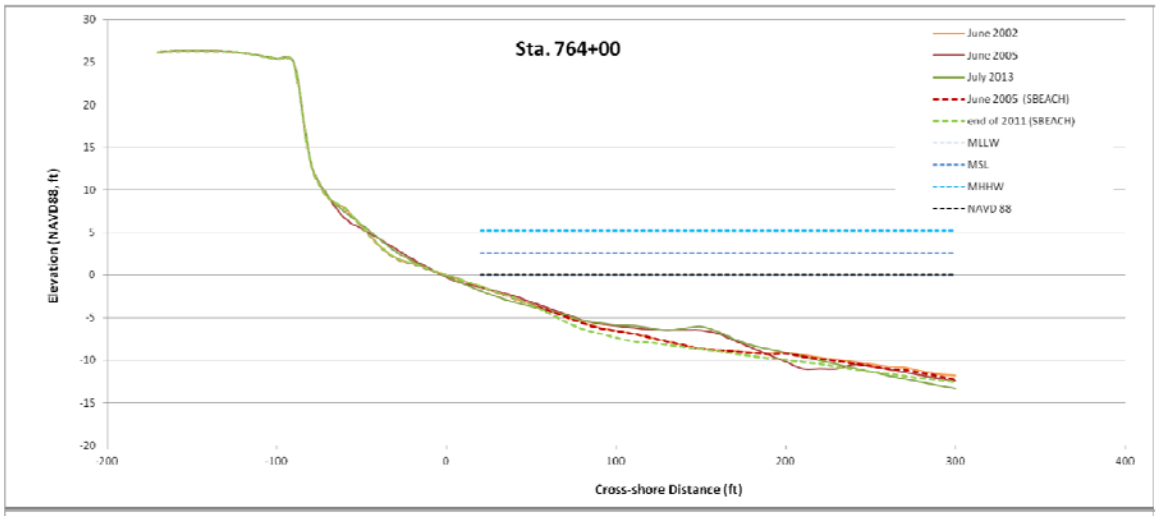
(b)


Sta. 759+00
June 2002
June 2005
July 2013
June 2005 (SBEACH)
end of 2011 (SBEACH)
MLLW
MSL
MHHW
NAVD 88
Elevation (NAVD88, ft)
Cross-shore Distance (ft)

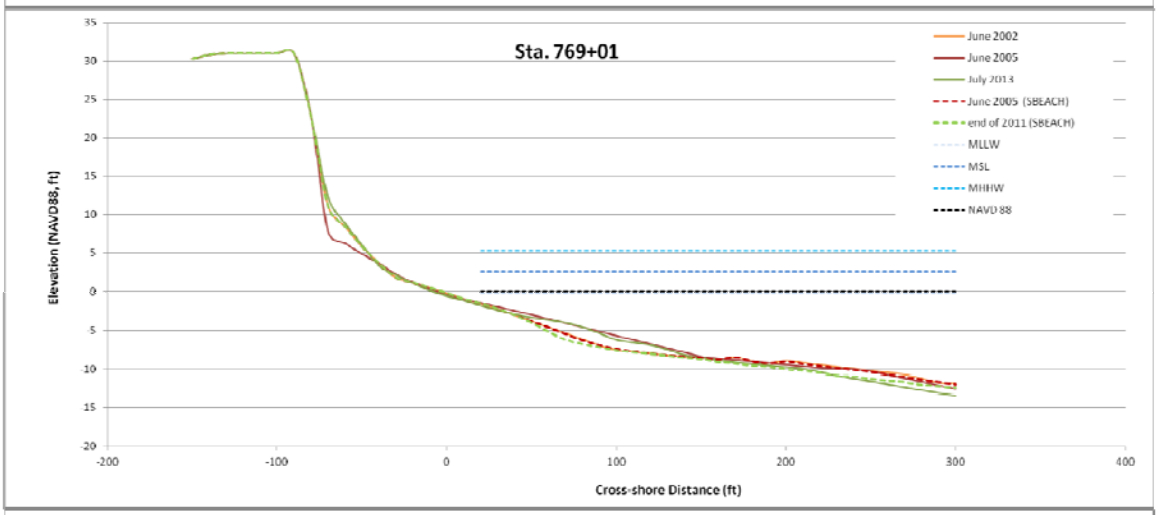
(c)


Sta. 761+50
June 2002
June 2005
July 2013
June 2005 (SBEACH)
end of 2011 (SBEACH)
MLLW
MSL
MHHW
NAVD 88
Elevation (NAVD88, ft)
Cross-shore Distance (ft)

(d)



(e)



(f)

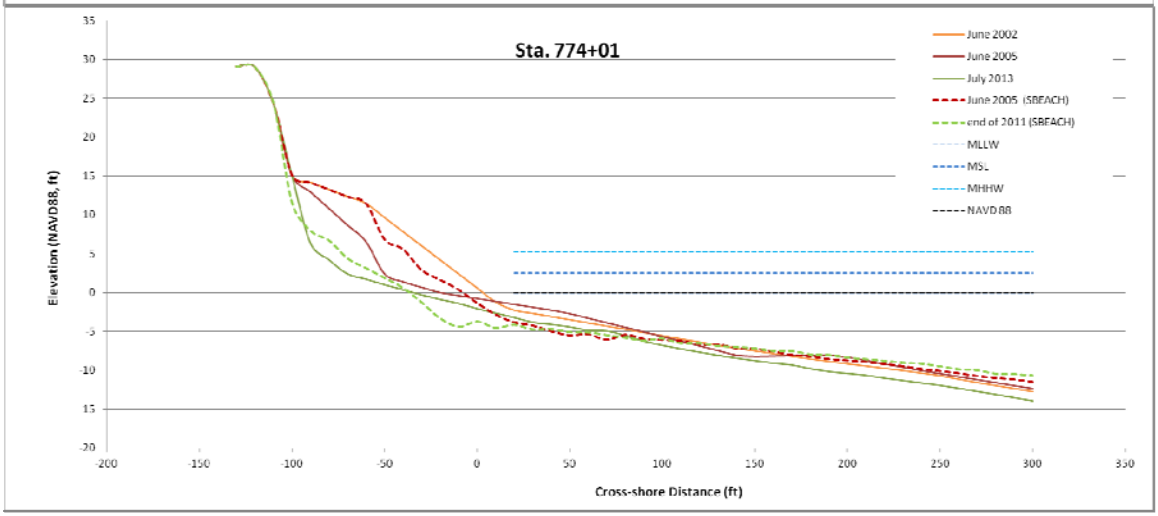
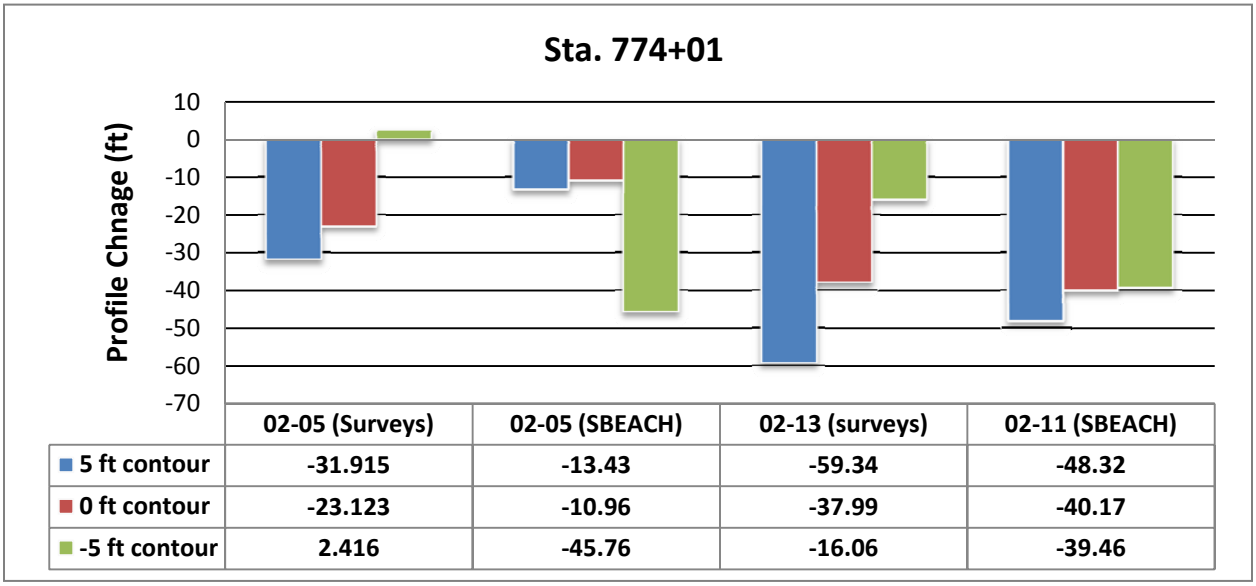


Figure 3-25 Surveyed (Solid Lines) and SBEACH-Simulated (Dashed Lines) Profiles at Stations 753+96(a), 759+00(b), 761+50(c), 764+00(d), 769+01(e) and 774+01(f)

Movement of contour lines oceanward indicates aggradation, while contours moving toward the shore indicate erosion. The distance a contour moves indicates the magnitude of erosion. **Figure 3-26** shows

the erosional trends from the surveys and models at Station 774+01 for the 5, 0, and -5ft contours. Comparisons can be made between the model and surveys for 2002-2005 and 2002-2011 periods. For example, the survey displays -57.34, -37.99 and -16.06 feet recessions at 5, 0 and -5ft contours, and the simulation values of -48.32, -40.17 and -39.46 feet match well respectively. The estimated quantities may vary somewhat for the 2002-2005 surveys due to the time periods, but the surveyed maximum eroding trends between year 2005 and 2013 are well correlated.



	02-05 (Surveys)	02-05 (SBEACH)	02-13 (surveys)	02-11 (SBEACH)
5 ft contour	-31.915	-13.43	-59.34	-48.32
0 ft contour	-23.123	-10.96	-37.99	-40.17
-5 ft contour	2.416	-45.76	-16.06	-39.46

Figure 3-26 Comparison of Surveyed vs. Simulated Beach Changes for Profile Sta. 774+01

Scenario 5 modeled a long-term beach simulation to predict future beach evolution trends. The wave conditions in the future were estimated as the reoccurrences of the historical period from 1995 to 2011 in which the hourly data for simulation is available. The water levels are given to response the SLR predictions for three periods 2013-2030, 2031-2050 and 2051-2100. Besides, the 72-hour design event is applied to the beach condition in the beginning of 2100 to evaluate the impact of the extreme short-term storm on the predicted 2100 beach profiles.

Shown in **Figure 3-27**, the simulation results demonstrate similar trends for all the profiles except Sta. 774+01. All station show insignificant changes for the 5- and 0-ft contours, which indicates that the 72-hour design storm might cause very minor impacts on those contours. For the -5 ft contours, similar erosional trends occur from 2013 to 2050 and then depositional trends are shown from 2050 to 2100 among all the profiles. For the most eroded station, Sta. 774+01, the erosion at the 5- and 0-ft contours occur between 2013-2030, but all the erosion appears to stop afterward 2030 as the depth increase.

A calculation for scour depth at the potential toe location (MLLW) is presented in Figure 3-27. Essentially, substantial scour depths only respond to extreme short-term events except for at Sta. 774+01. Scour depths could be as great as almost 4-foot for most evaluated profiles. The most serious scour 8.78 feet in depth could occur at sta. 774+01, **Figure 3-28**.

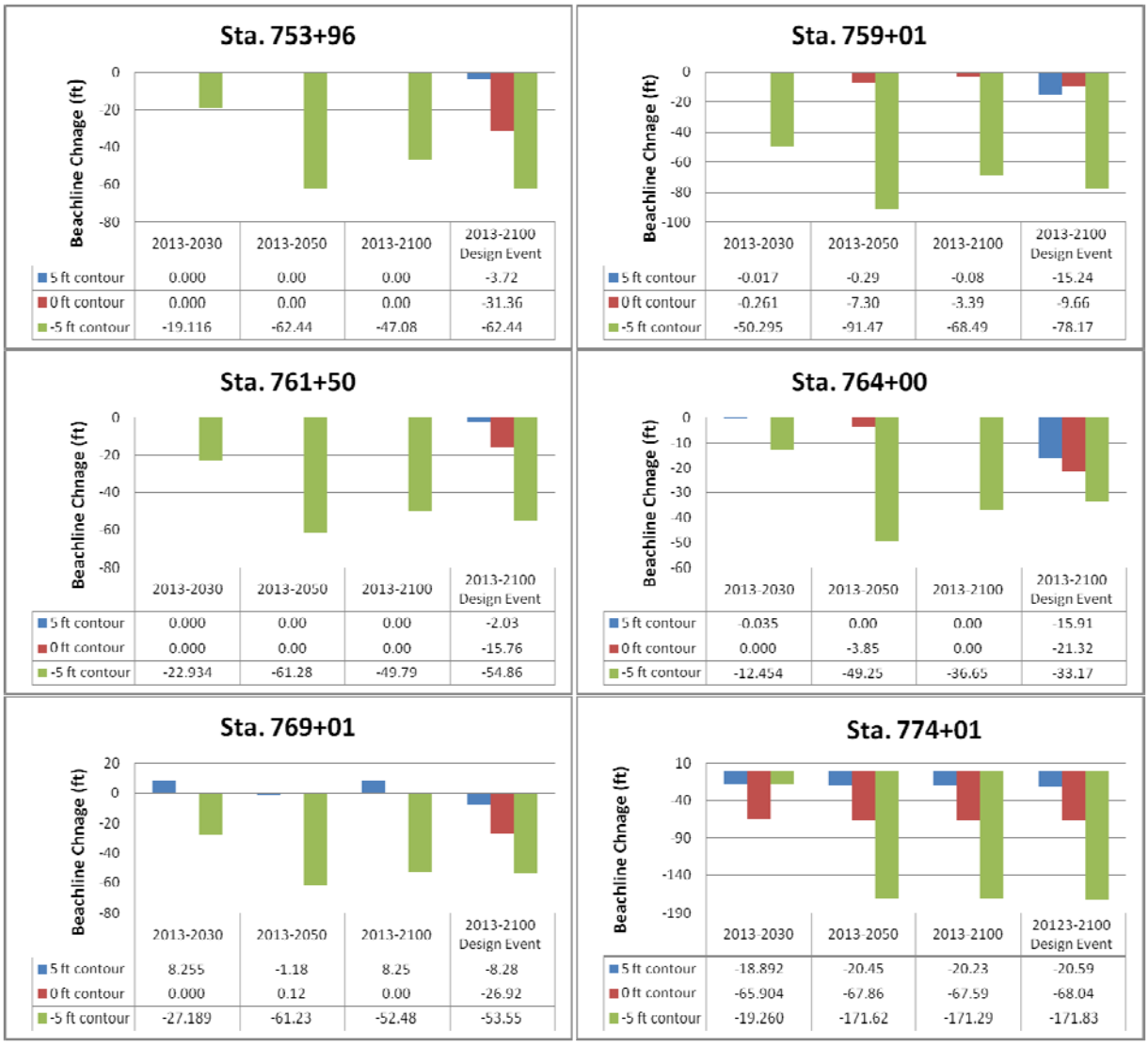
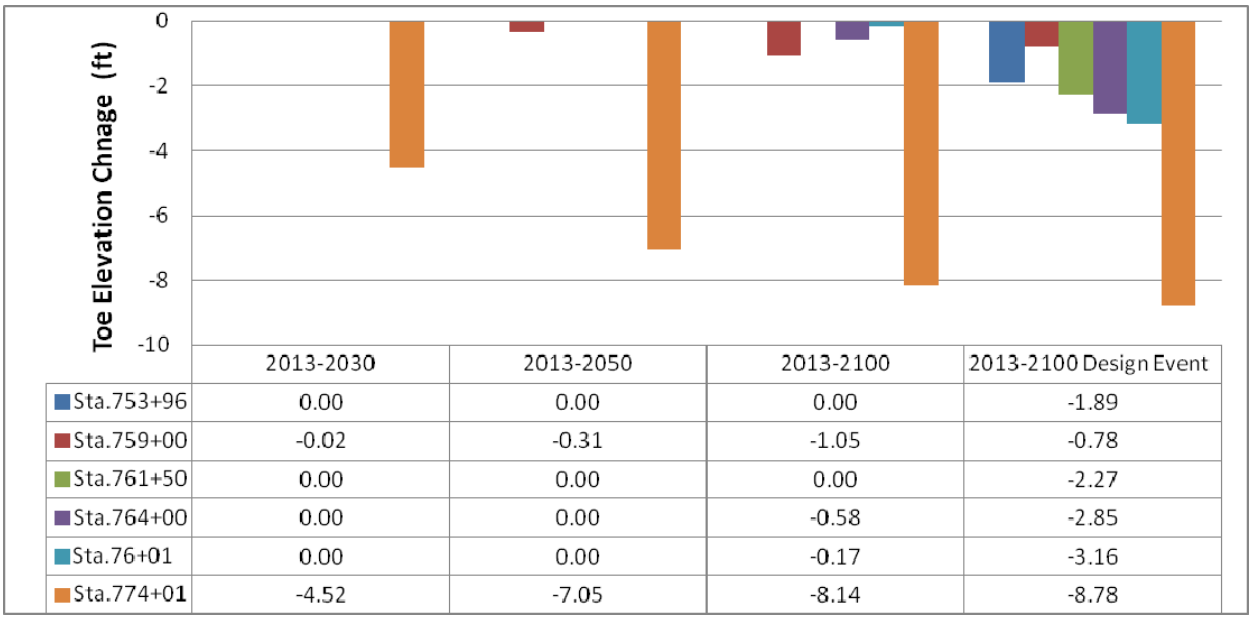


Figure 3-27 Beachline Evolution Simulation for the Future Scenarios



	2013-2030	2013-2050	2013-2100	2013-2100 Design Event
Sta.753+96	0.00	0.00	0.00	-1.89
Sta.759+00	-0.02	-0.31	-1.05	-0.78
Sta.761+50	0.00	0.00	0.00	-2.27
Sta.764+00	0.00	0.00	-0.58	-2.85
Sta.76+01	0.00	0.00	-0.17	-3.16
Sta.774+01	-4.52	-7.05	-8.14	-8.78

Figure 3-28 Scour Depth Predictions Based on Predicted Beach Profile Changes

3.4.4 SBEACH Erosion Assessment under a Design Extreme Storm

The beach erosion assessment uses two topographic data sets. The first analysis scenario uses the 2013 survey as the topographic baseline with the same sediment parameters used for the model input. The erosion analysis for a large storm event also uses four scenarios with the same 72-hour storm wave climate but different in the water levels corresponding to various the SLR water depths increased from the 2013 depth by 0, 0.98, 2, and 5.48 ft. SBEACH uses the input data and estimates the profile changes after encountering the wave attack of the design storm with the various water level scenarios. The simulated profiles (solid lines) and the maximum water levels (dashed lines) associated with the four scenarios are shown in **Figure 3-29**. The simulation results illustrate a similar evolution trend among the evaluated profiles. Deeper water levels in general result in deeper erosion of the beach, with associated elevation and volume changes. Most of the significant erosion occurs in the beach zone between elevations -5 and 5 feet NAVD 88, despite the fact that the water levels range as high as 7.66 feet in Scenario No. 1 to 13.14 feet in Scenario No. 4. This suggests the SLRs negatively impact the beach system.

In comparison with other profiles, the 2013 profile at Sta. 774+01 is most erodible during the design extreme storm event as shown in **Figure 3-29f**. This result is consistent with the conclusion of the beach evolution analysis for the period 2002-2011. Quantitatively, this profile could be eroded vertically from 5.67 feet to 8.81 feet at the beach spot 90 feet landward from the reference. On the other hand, the impact assessment is performed by categorizing all the profiles into low, medium, and high erodibility using beach recession lengths at the -5, 0 and 5-foot contours as the indicators.

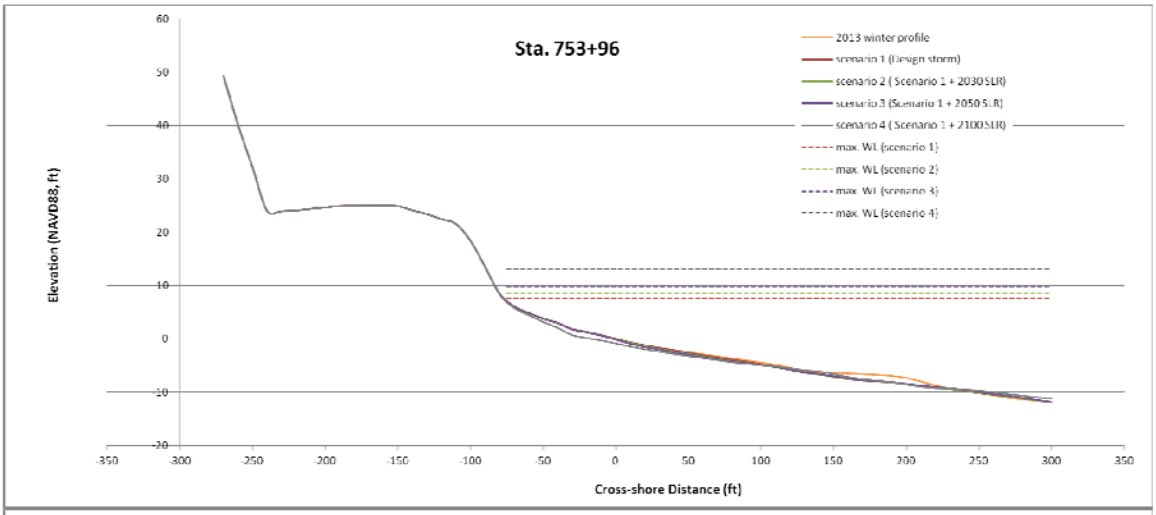
Figure 3-30 shows three profiles at Sta. 753+96, 759+00 and 764+00 with minor erosion of with a contour recession of less than 10 feet in Scenarios No. 1, 2, and which are classified into the low erosion category. The two profiles at Sta. 761+50 and 769+01 show larger contour recessions greater 15 feet and are classified in the medium erosion category. This is particularly evident at the -5 -foot contour in the same scenarios. These are considered to be in the medium erosion category. The last profile at Sta. 774+01 is categorized into the high erosion category because of the largest beach recession shown in all indictors. In spite of the variety of erodibility, the simulations suggest a common property that lower-elevation beach zones seem to be more erodible under these three scenarios. On the other hand, under the most influential scenario 4 (2100 SLR), the most severe impacts on all the profiles are

simulated. Therein, the indicator at 0-foot contour reveals the most vulnerable conditions for the most profiles (except for the one at Sta. 759+00). In them, the recession degrees reach to the least of 16.17 feet (Sta. 753+96) and the most of 56.68 feet (Sta. 774+01).

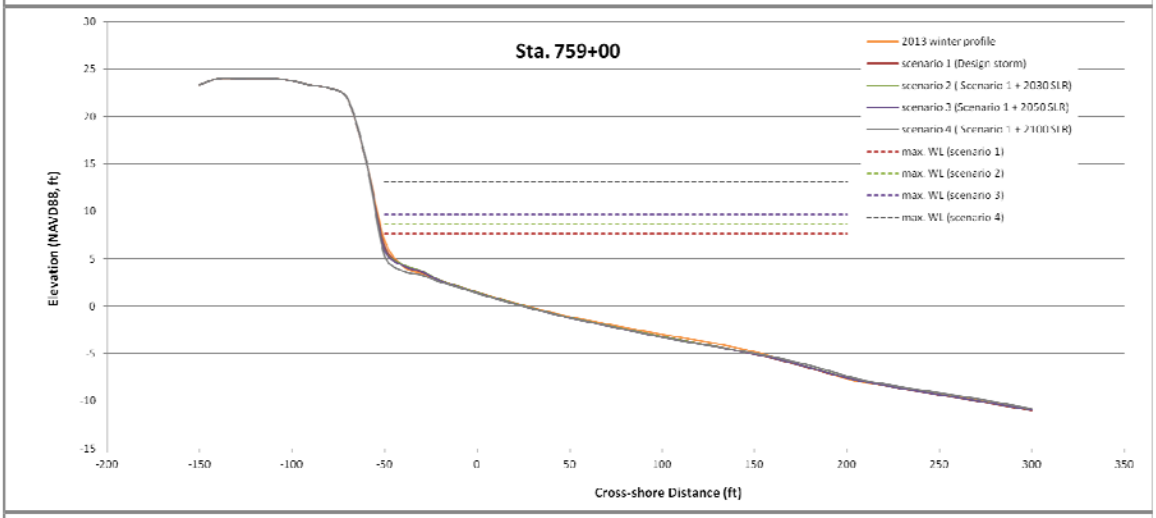
The model simulations evaluating trends and impacts to the beach based on SLR shows that the overall trend is erosional and that further erosion is induced by the design extreme storm event. However, the erosional severity varies with regard to the factors including beach locations in both long-shore and cross-shore directions and the design water levels. This analysis was performed to assess the impacts of a short-term design storm at various times throughout design lifetime of the project and assuming the 2013 profile remains fairly constant throughout the life of the project. The fifth scenario evaluated the potential scour if a design storm occurs at the end of the project life.

Some factors in the future will have significant impacts on beach erosion. These factors may vary significantly from those found in the field today. These factors include changing climate conditions, landforms changed naturally or artificially, uncertain SLR, changes in sediment delivery to the coastal system, etc. In addition to this impact assessment, proper design principles (e.g., safety factors and conservative design standards), protection extents and degrees, and economic benefits must be taken into consideration in coastal engineering work on the Las Tunas Beach.

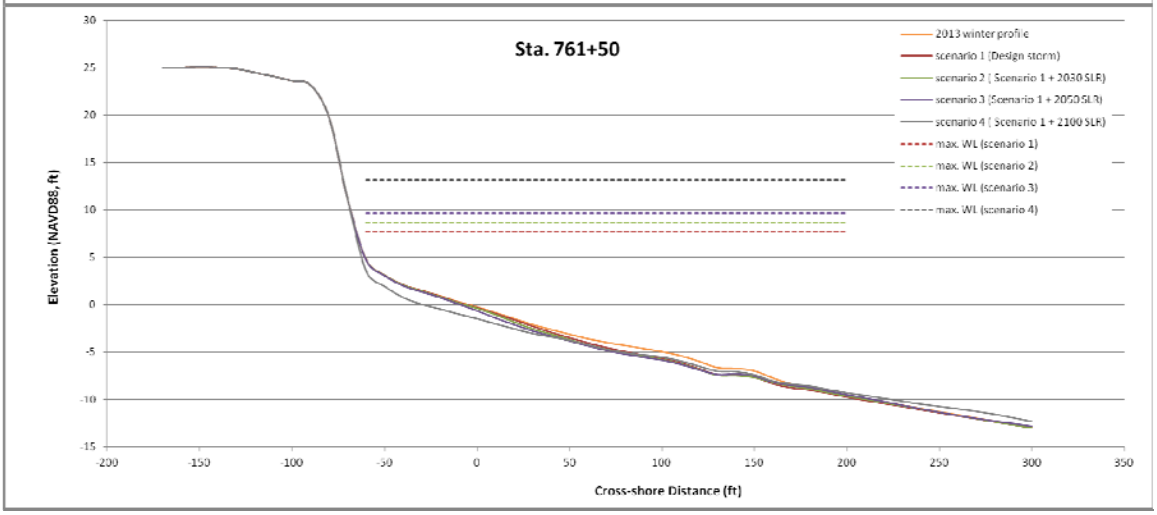
(a)


Sta. 753+96
2013 winter profile
scenario 1 (Design storm)
scenario 2 (Scenario 1 + 2030 SLR)
scenario 3 (Scenario 1 + 2050 SLR)
scenario 4 (Scenario 1 + 2100 SLR)
max. WL (scenario 1)
max. WL (scenario 2)
max. WL (scenario 3)
max. WL (scenario 4)
Elevation (NAVD88, ft)
Cross-shore Distance (ft)

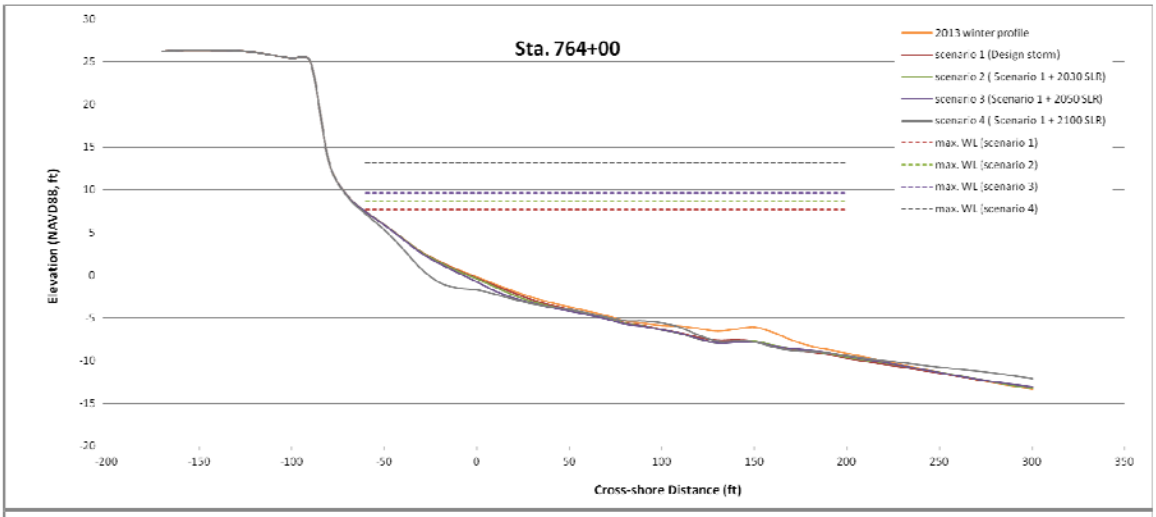
(b)


Sta. 759+00
2013 winter profile
scenario 1 (Design storm)
scenario 2 (Scenario 1 + 2030 SLR)
scenario 3 (Scenario 1 + 2050 SLR)
scenario 4 (Scenario 1 + 2100 SLR)
max. WL (scenario 1)
max. WL (scenario 2)
max. WL (scenario 3)
max. WL (scenario 4)
Elevation (NAVD88, ft)
Cross-shore Distance (ft)

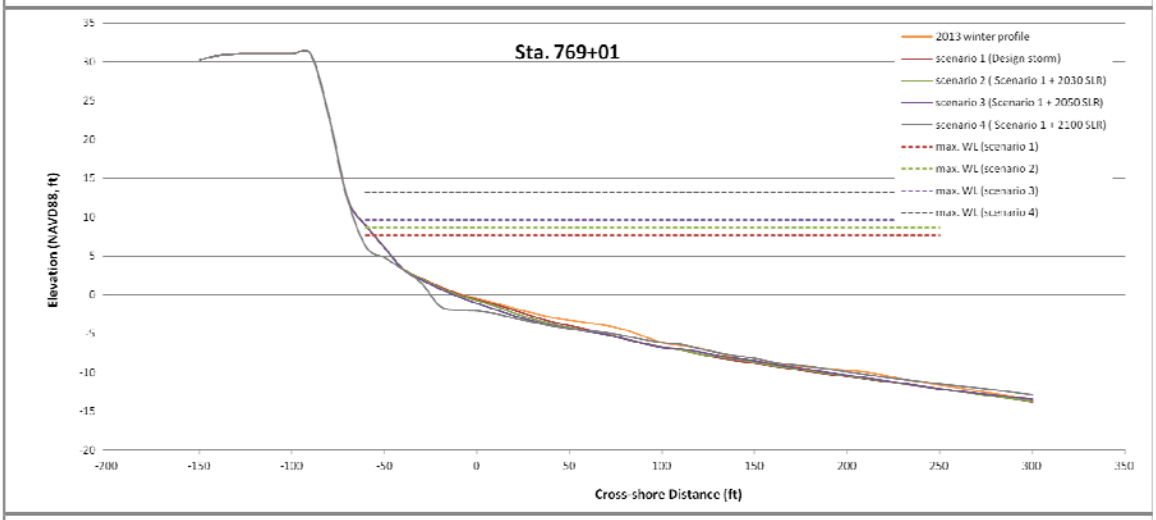
(c)


Sta. 761+50
2013 winter profile
scenario 1 (Design storm)
scenario 2 (Scenario 1 + 2030 SLR)
scenario 3 (Scenario 1 + 2050 SLR)
scenario 4 (Scenario 1 + 2100 SLR)
max. WL (scenario 1)
max. WL (scenario 2)
max. WL (scenario 3)
max. WL (scenario 4)
Elevation (NAVD88, ft)
Cross-shore Distance (ft)

(d)



(e)



(f)

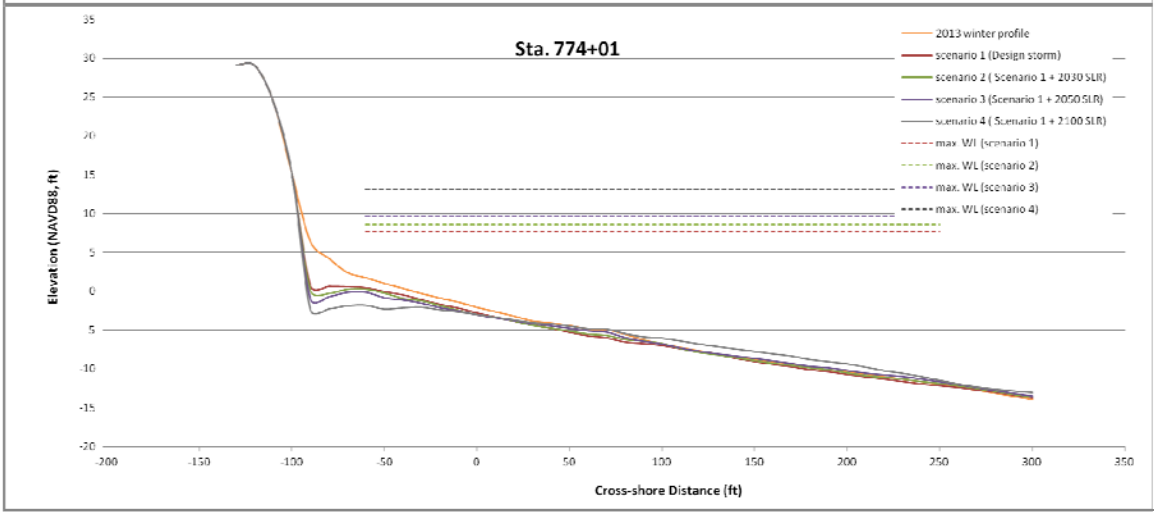


Figure 3-29 SBEACH-modeled Beach Profiles at Sta. 753+96(a), 759+00(b), 761+50(c), 764+00(d), 769+01(e), and 774+01(f) under Four SLR Scenarios

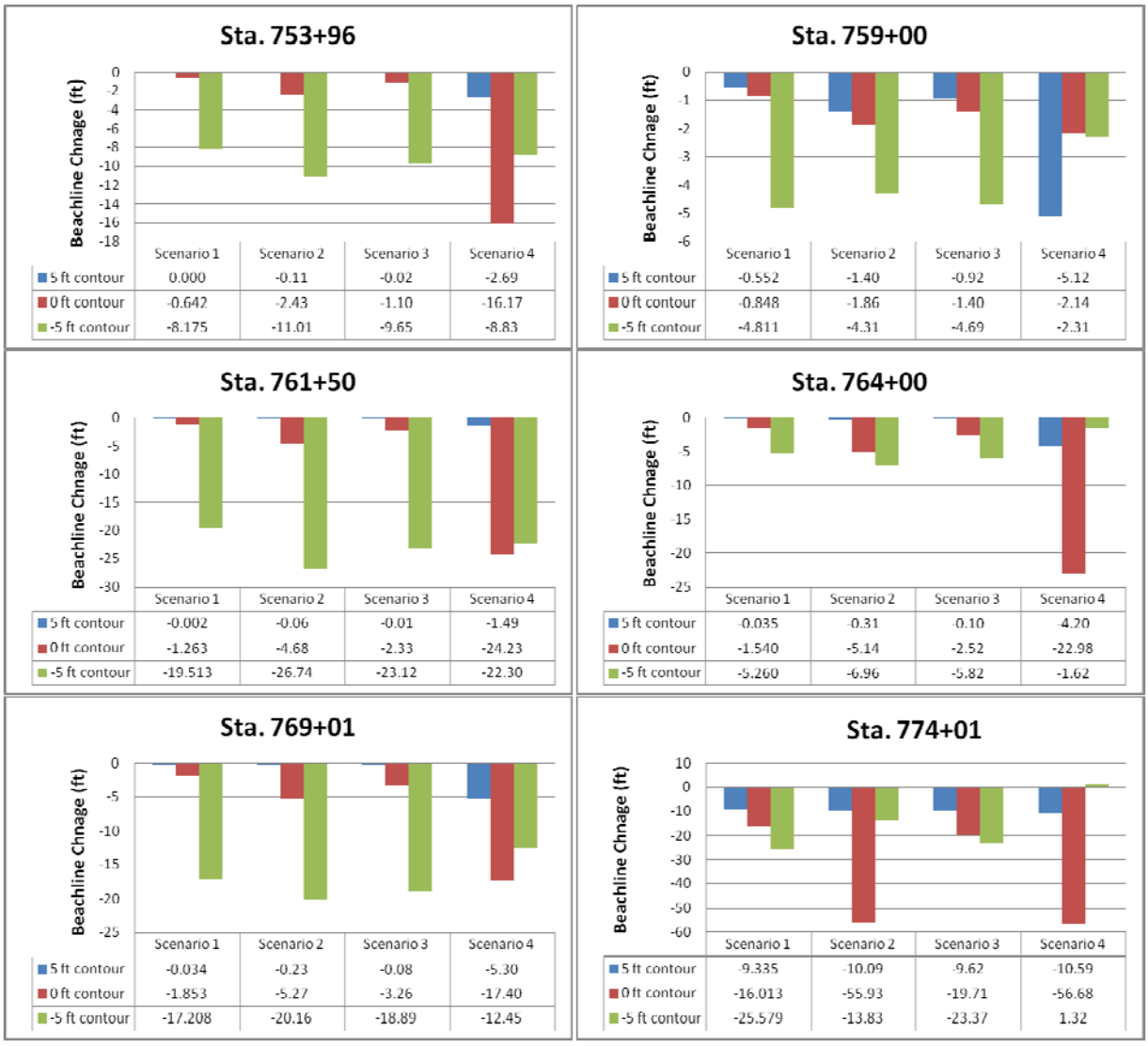


Figure 3-30 Beach Contour Recession Assessments for Design SLR Scenarios

3.5 Tsunami Effect Analysis

A tsunami is a series of ocean waves generated by sudden displacements in the sea floor, landslides, or volcanic activity. In the deep ocean, the tsunami wave may only be a few inches high. The tsunami wave may come gently ashore or may increase in height to become a fast moving wall of turbulent water several meters high (NOAA, 2014). These waves can propagate across the deep-water portions of the ocean at a speed of over 300 miles per hour. Tsunami waves are distinguished from ordinary ocean waves by their extremely long wave lengths greater than 100 miles and wave periods of 10 to 60 minutes. Tsunamis cause destructive damage to coastal communities (IOC, 2012). Over sixty percent of tsunamis occur in the Pacific Ocean, making tsunamis a recognized potential hazard to the Pacific coasts and islands. According to the National Tsunami Hazard Mitigation Program administered by NOAA and the USGS, the U.S. West Coast is classified as a tsunami "high" hazard region based on the evaluation indices of tsunami run-ups, tsunami frequency, and local earthquakes (Dunbar and Weaver, 2008).

An analysis of tsunami effects was conducted for Las Tunas Beach to provide an understanding of potential tsunami impacts on the project site. The analysis included gathering relevant historical tsunami

data, quantifying historical tsunami hazards, and summarizing and analyzing verified tsunami forecasts and inundation mapping results for the project area.

3.5.1 Historical Tsunamis and Local Effects

The National Geophysical Data Center (NGDC) archives global historic tsunami observations into two databases. The first database tracks tsunami sources and includes the epicenter location, the date and time of occurrence, the source type, magnitude, etc. The second database tracks tsunami run-up measurements and includes travel times, maximum run-up height, inundation distance, and loss of life and property. There are no database entries for tsunami run-up events or measurements specifically located at Las Tunas Beach. However, from 1879 to 2013, thirty-two tsunami events caused influential effects in the Santa Monica Bay. These events have been identified and are shown in **Table 3-9**.

The identified event sources were distributed throughout the earthquake zone located along the Pacific Rim. Among the recorded tsunamis, most are triggered by earthquakes or undersea landslides. The 1960 Chile and 1975 Hawaii tsunamis were related to volcanic eruptions. Influential local tsunamic events with sources less than 30 miles away occurred only before 1935. After 1935, the event with the closest source occurred British Columbia, Canada on Oct 28, 2012. The epicenter was 1600 miles from Santa Monica Bay. The distant tsunami sources imply longer tsunami travel times. The travel time to Santa Monica Bay from the British Columbia event took 4 hours and 19 minutes. All of the other major tsunami events took over 5 hours to arrive. The longest travel time recorded is from the December 26, 2004, Sumatra Indonesia tsunami, which took over 34 hours to arrive. In terms of tsunami run-up effects, historical records show only minor impacts.

As listed in **Table 3-9**, the highest tsunami water height for the Santa Monica Bay of 10 feet was observed by eyewitnesses during the 1930 local tsunami event. Fortunately, no loss of life or property was reported for this event. The two other highest gauge-measured water heights were 5.25 and 3.38 feet, observed after the Central Chile (1960) and Prince William Sound, AK (1964) events. The only inundation distance record was 300 feet for the Central Chile event, which had a wave period of 46 minutes. The Prince William Sound event caused very limited property damage of $100,000. No major tsunami-related damages have been recorded after this event.

Table 3-9 NGDC Tsunami Run-up and Effect Records for Santa Monica

Date						Tsunami Source					Distance from Source (km)	Travel Time		Max Water Height (meters)	Max Inundation Distance (meters)	Tsunami Run-up Measurements			Tsunami Run-up Location Effects									
																			Deaths		Injuries		Damage		Houses Destroyed		Houses Damaged	
Year	Mo	Dy	Hr	Min	Sec	Val*	Tsunami Cause**	Source	Earthquake Magnitude	Volcano		Hours	Min			Type	Period (mins)	First Motion	Num	De	Num	De	$Mill	De ***	Num	De	Num	De
1879	8	10	21	7		2	3	S. CALIFORNIA			25					Eyewitness												
1930	8	31	0	40	38	3	3	S. CALIFORNIA	5.2		13			3.05		Eyewitness												
1933	3	2	17	30	54	4	1	SANRIKU, JAPAN	8.4		8225	10	55	0.07		Tide-gauge												
1934	8	21				0	9	S. CALIFORNIA			45					Eyewitness												
1934	8	21				0	9	S. CALIFORNIA			44					Seiche								1				
1938	5	19	17	8	21	4	1	MAKASSAR STRAIT, INDONESIA	7.6		12934			0.1		Tide-gauge												
1938	11	10	20	18	41.2	4	1	SHUMAGIN ISLANDS, AK	8.2		3868	5	1	0.05		Tide-gauge	35											
1944	12	7	4	35		4	1	OFF SOUTHEAST COAST KII PENINSULA, JAPAN	8.1		9103			0.07		Tide-gauge												
1946	4	1	12	28	56	4	1	UNIMAK ISLAND, AK	8.1		4095					Eyewitness												
1952	11	4	16	58		4	1	KAMCHATKA, RUSSIA	9		6562	9	26	0.48		Tide-gauge												
1957	3	9	14	22	31.9	4	1	ANDREANOF ISLANDS, AK	8.6		4908	6	37	0.46		Tide-gauge	11											
1960	5	22	19	11	17	4	1	CENTRAL CHILE	9.5	Vol	9344	14	11	1.6	91	Tide-gauge	46	Rise										
1964	3	28	3	36	14	4	3	PRINCE WILLIAM SOUND, AK	9.2		3659	5	39	1.03		Tide-gauge	39	Rise					0.1	1				
1965	2	4	5	1	21.6	4	1	RAT ISLANDS, ALEUTIAN ISLANDS, AK	8.7		5313			0.08		Tide-gauge												
1968	5	16	0	48	55.4	4	1	OFF EAST COAST OF HONSHU ISLAND, JAPAN	8.2		8236			0.2		Tide-gauge												
1975	11	29	14	47	40.4	4	3	HAWAII	7.1	Vol	3956					Tide-gauge												
1994	10	4	13	22	55.8	4	1	S. KURIL ISLANDS, RUSSIA	8.3		7777			0.09		Tide-gauge												
1995	7	30	5	11	23.6	4	1	S. KURIL ISLANDS, RUSSIA	8		8164	12	33	0.13		Tide-gauge												
1995	12	3	18	1	8.9	4	1	S. KURIL ISLANDS, RUSSIA	7.9		7591			0.1		Tide-gauge												
1996	2	17	5	59	30.5	4	1	IRIAN JAYA, INDONESIA	8.2		11404			0.05		Tide-gauge												
1996	6	10	4	3	35.4	4	1	ANDREANOF ISLANDS, AK	7.9		5047					Tide-gauge												
2001	6	23	20	33	14.1	4	1	S. PERU	8.4		7336			0.1		Tide-gauge												

Table 3-9 NGDC Tsunami Run-up and Effect Records for Santa Monica

Date						Tsunami Source					Distance from Source (km)	Travel Time		Max Water Height (meters)	Max Inundation Distance (meters)	Tsunami Run-up Measurements			Tsunami Run-up Location Effects									
																			Deaths		Injuries		Damage		Houses Destroyed		Houses Damaged	
Year	Mo	Dy	Hr	Min	Sec	Val*	Tsunami Cause**	Source	Earthquake Magnitude	Volcano		Hours	Min			Type	Period (mins)	First Motion	Num	De	Num	De	$Mill	De ***	Num	De	Num	De
2004	12	26	0	58	53.4	4	1	OFF W. COAST OF SUMATRA, INDONESIA	9.1		14520	34	24	0.19		Tide-gauge												
2006	5	3	15	26	40.2	4	1	TONGA	8		8424	11	18	0.1		Tide-gauge	1	Rise										
2006	11	15	11	14	13.5	4	1	S. KURIL ISLANDS, RUSSIA	8.3		7221	10	8	0.15		Tide-gauge		Fall										
2007	4	1	20	39	56.3	4	1	SOLOMON ISLANDS	8.1		10030			0.11		Tide-gauge												
2007	8	15	23	40	57.8	4	1	S. PERU	8		6887	11	12	0.07		Tide-gauge		Rise										
2009	9	29	17	48	10.9	4	1	SAMOA ISLANDS	8		7903	10	51	0.15		Tide-gauge		Rise										
2009	10	7	22	3	14.4	4	1	VANUATU ISLANDS	7.6		9479			0.05		Tide-gauge												
2010	2	27	6	34	11.5	4	1	SAMOA ISLANDS	8.8		9123	13	47	0.64		Tide-gauge												
2011	3	11	5	46	24.1	4	1	HONSHU ISLAND, JAPAN	9		8443	10	56	0.85		Tide-gauge		Rise										
2012	10	28	3	4	8.8	4	1	BRITISH COLUMBIA, CANADA	7.7		2351	4	19	0.08		Tide-gauge	10	Rise										
2013	2	6	1	12	25.8	4	1	SANTA CRUZ ISLANDS	7.9		9454			0.08		Tide-gauge												

Notes:
* 0 = event that only caused a seiche or disturbance in an inland river; 2 = questionable tsunami; 3 = probable tsunami; 4 = definite tsunami
** 1 = Earthquake; 3 = Earthquake and Landslide; 9=Meteorological
*** 1 = Few (~1 to 50 deaths)

3.5.2 NCTR Tsunami Forecast and Inundation Mapping Modeling

Forecasting tsunami characteristics such as propagation speed, arrival time, wave height, and inundation extent is very helpful for tsunami hazard preparedness, warning, and mitigation. The NOAA Center for Tsunami Research (NCTR) has been developing numerical models for faster and more reliable tsunami forecasts and accurate inundation mapping to support Tsunami Warning Centers (TWC) forecasting operations.

The leading model for tsunami modeling is (MOST), the Method of Splitting Tsunami developed by Titov of PMEL and Synolakis of University of Southern California (Titov and Gonzalez, 1997). The model is used at the NCTR to simulate the three processes of tsunami evolution: earthquake, transoceanic propagation, and inundation of dry land. The MOST model is supported with data from the Deep-ocean Assessment and Reporting of Tsunamis (DART) real-time tsunami monitoring systems and NGDC's bathymetry and topography data.

3.5.3 Tsunami Effect Analysis for the Project Site and Vicinity

The NCTR at Pacific Marine Environmental Laboratory (PMEL) has published a series of tsunami forecast reports for major West Coast cities based on MOST modeling. Among them, one report documented the study developing the forecast model for Santa Monica (Arcas, 2013). This subsection summarized the relevant findings useful for the tsunami effect analysis at the project site.

Conceptually, the study established three spatially nested domains to develop the tsunami model for Santa Monica. **Figure 3-31** shows the nested domains, which have different grid resolutions. As demonstrated in the enlarged domains in **Figure 3-32**, the smallest domain (C-Grid) includes only the City of Santa Monica, its neighboring cities, and near-shore sea areas. The second domain (B-Grid) covers a larger area including the entire Santa Monica Bay. The referenced study selected thirteen historical events and nineteen Mw 9.3 synthetic events originating in different subduction zones throughout the Pacific Ocean to examine the effects from short- and long-distance tsunami sources. The tsunami source locations used for the study are shown in **Figure 3-33**.

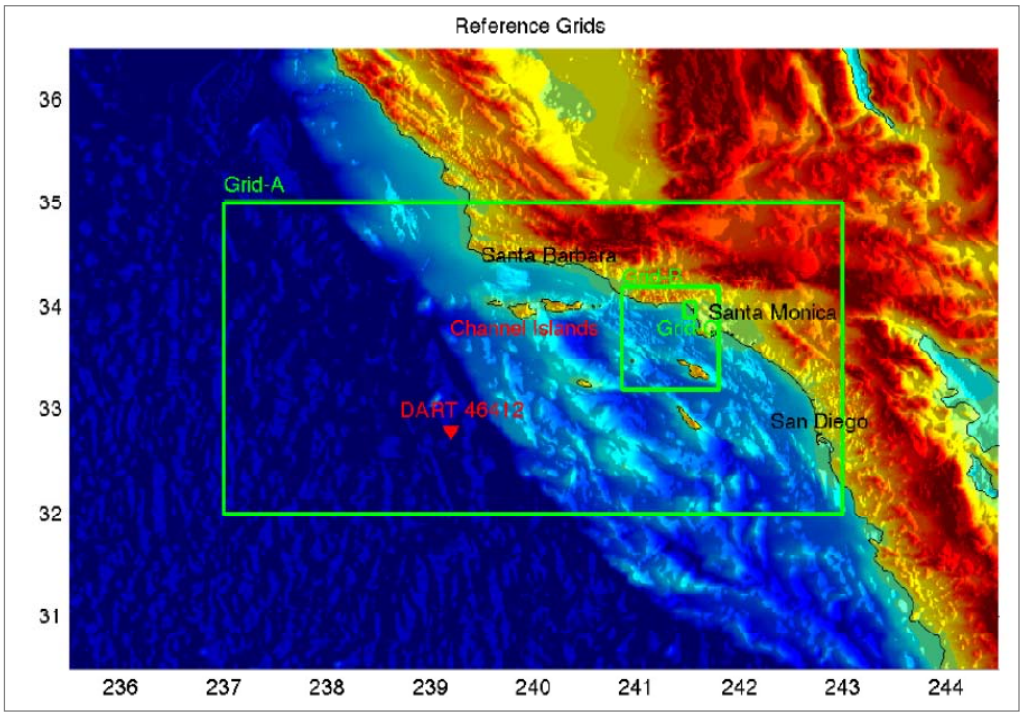


Figure 3-31 Nested Domains Setting Adopted by NCTR Tsunami Forecast Study for Santa Monica (Arcas, 2013)

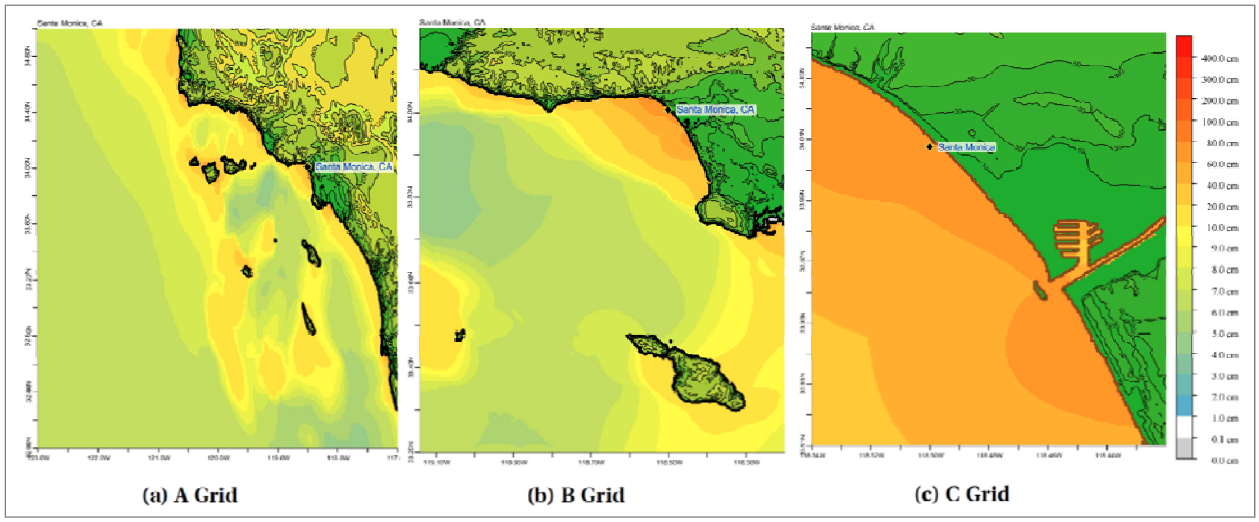


Figure 3-32 Closer Views of Nested Grids A, B, and C in Figure 3-26. The Colors Denote the Tsunami Wave Amplitude Distribution in Each Domain.

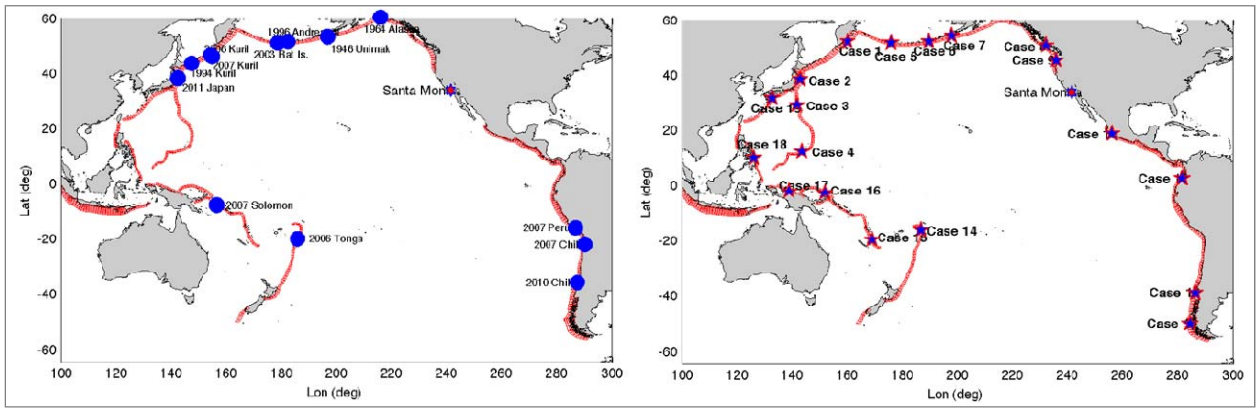


Figure 3-33 Locations of Thirteen Historical (left) and Nineteen Synthetic Tsunami Events (Right) for the Santa Monica Study (Arcas, 2013)

Validated by Santa Monica tide gauge observations, the historical simulations reveal consistent effects with NGDC's database records. Santa Monica has been free from major tsunami impacts in recent history. However, among the 19 synthetic simulations examining tsunami-generating earthquakes in certain areas of the Pacific Ocean, most scenario cases suggest the energy propagation patterns do not cause significant effects on Santa Monica, except for the Scenario 16. As shown in **Figure 3-34a**, Scenario 16 models the tsunami propagation from the Manus OCB subduction zone in the Melanesia area of the Pacific Ocean. This synthetic event potentially directs tsunami waves towards the Southern California area in general, and to Santa Monica in particular. The synthetic simulations reveal another notable phenomenon: despite their closer sources, local tsunamis for example, Scenario 9 from the Cascadia subduction zone and Scenario 10 from the Pacific Mexican coast cause only limited impacts on Santa Monica (**Figure 3-30b** and **Figure 3-30c**). Scenario 16 shows the worst case for Santa Monica due to energy directivity. The other two scenarios show lower impacts due to the relatively local tsunami sources.

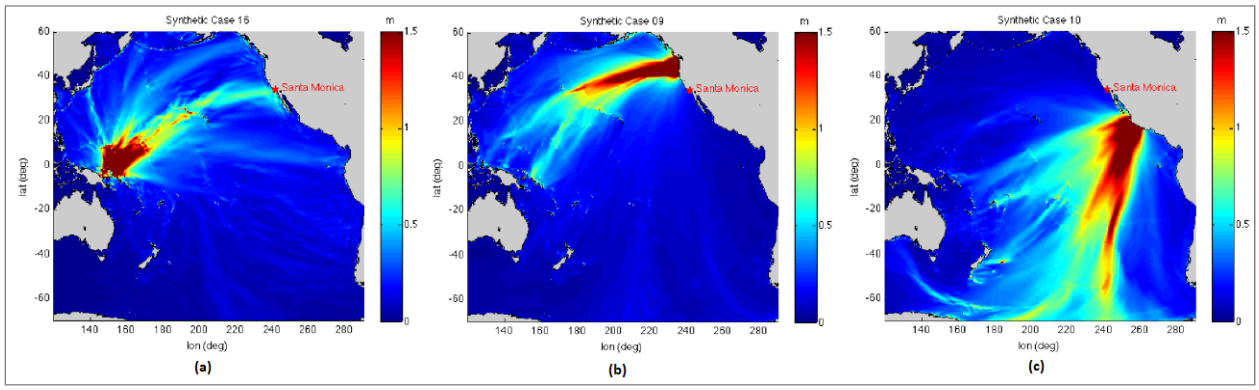


Figure 3-34 Energy Propagation Patterns of the Synthetic Scenario No. 16 (left), Scenario No. 9 (middle) and Scenario No. 10 (right)

The second nested domain (Grid-B) completely covers Las Tunas Beach. of this project's interest. Taking advantage of the results of SIFT (Short-term Inundation Forecast of Tsunamis) testing for the Santa Monica tsunami forecast model, the tsunami effect for the project site can be quantitatively analyzed by Grid-B results. **Figure 3-35** shows the wave amplitude distributions for 5 selected tsunami events (Arcas, 2013). The events include Synthetic scenarios No. 2, 4, 12, and 14, and the historical 2011 Tohoku, Japan event. The most severe event, Scenario No. 14, generates a modeled wave amplitude of 8.28 ft at the Santa Monica tide gauge. As for Las Tunas Beach, shown by the white dots in the figure,

the wave amplitudes are observed to be no higher than those near the tide gauge. The study shows that the tsunami wave amplitudes expected at Las Tunas Beach range between 1.31 and 6.56 feet.

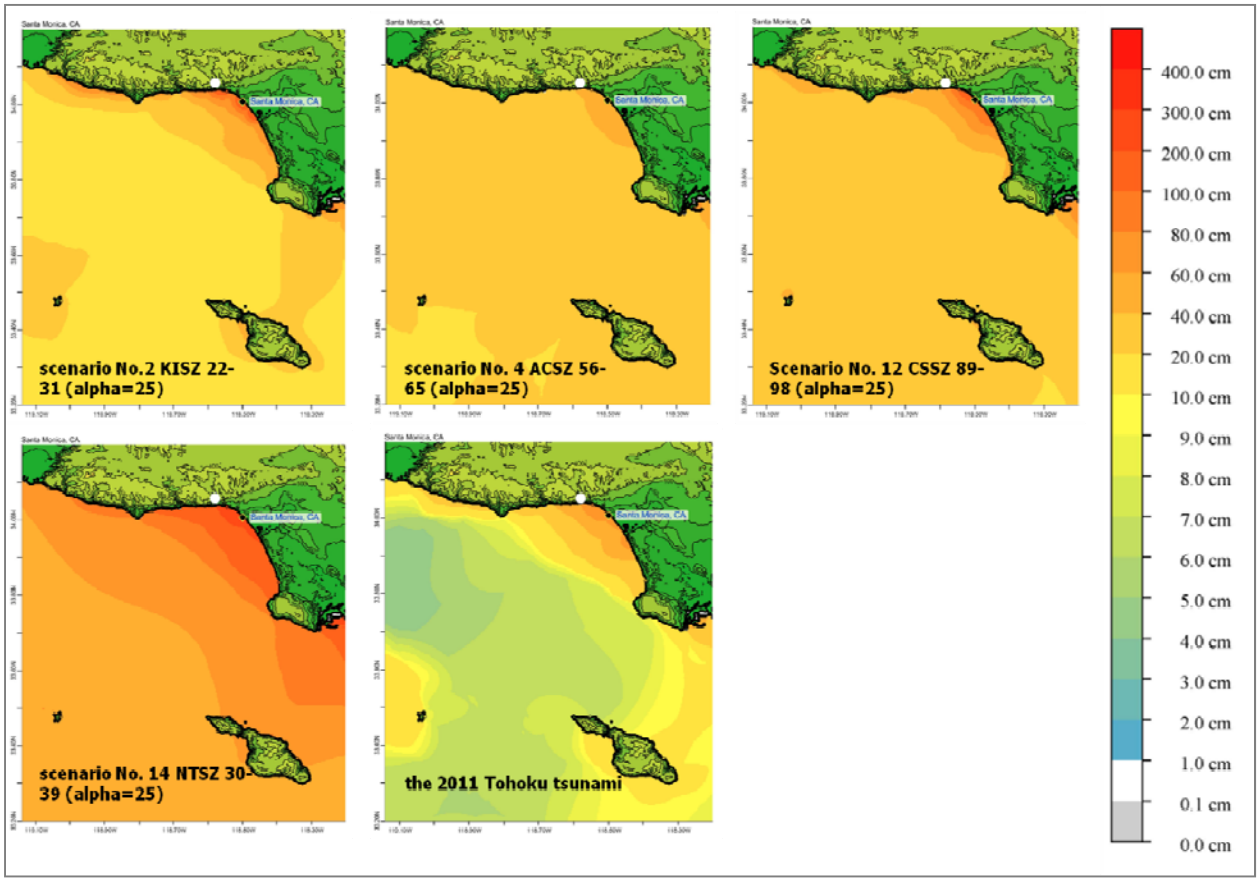


Figure 3-35 Tsunami Wave Amplitude Distribution Maps of Five SIFT Testing Events for the Santa Monica Bay (Arcas, 2013)

In addition to the NCTR's studies, the California Geological Survey (CGS), California Emergency Management Agency (CalEMA), and the Tsunami Research Center at the University of Southern California have worked together to produce statewide tsunami inundation maps and preparedness information for California. By using models developed with MOST, the tsunami inundation maps are particularly helpful in assisting cities and counties in identifying their tsunami hazard. The Topanga Quadrangle map (**Figure 3-36**) displays the inundation line and area for the Las Tunas Beach and its vicinity. The inundation map was generated based on the greatest inundation caused by 18 historical and synthetic events. In the enlarged inundation map for Las Tunas Beach, the tsunami inundation extent is less than 300 feet and mostly constrained within the beach zones before reaching the Pacific Coastal Highway. This map provides another evidence of relatively minor tsunami effects on the project site.

The tsunami wave depths of no greater than 6.56 ft are lower than the design wave. Therefore, the tsunami effects on the project are not critical.

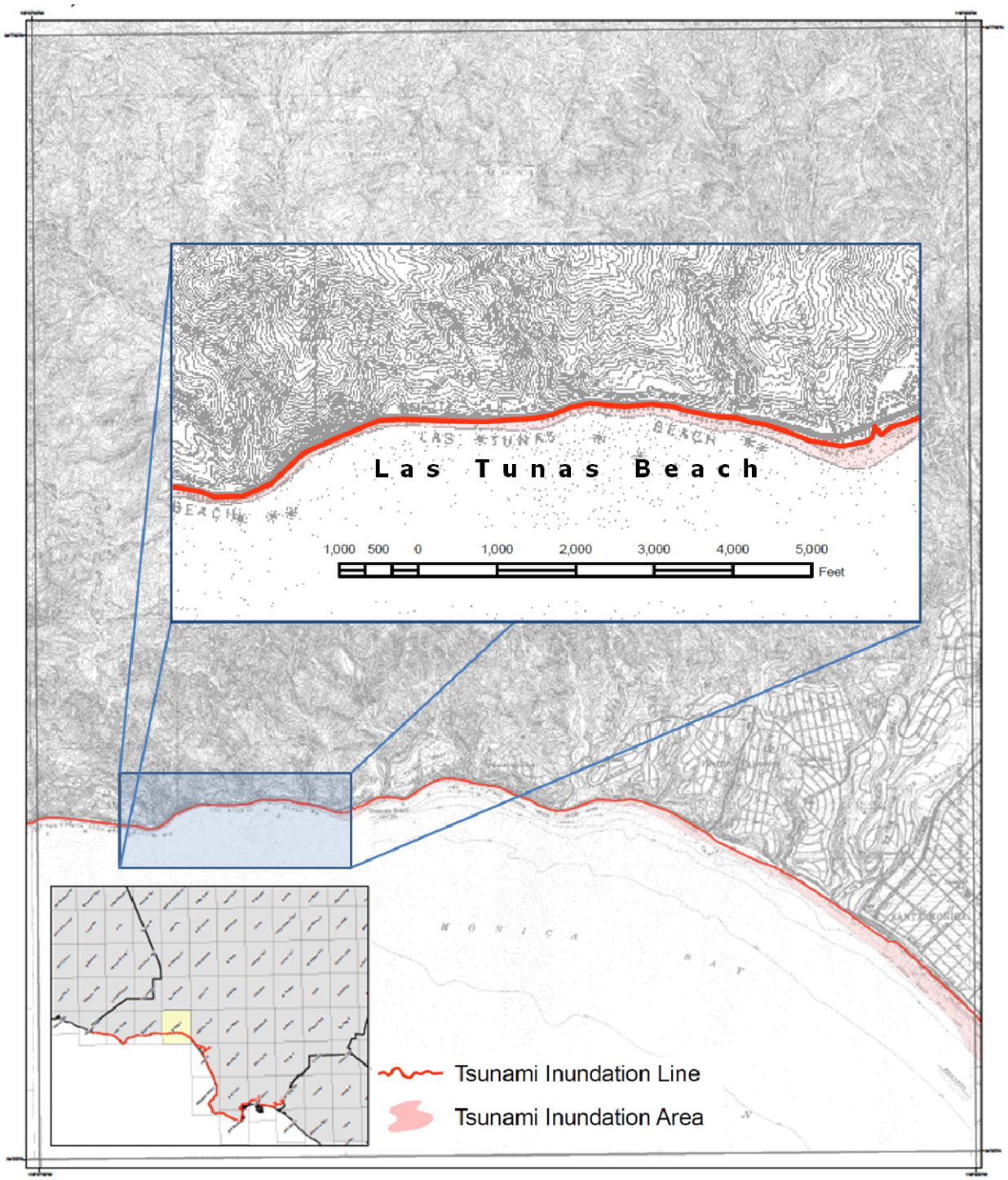


Figure 3-36 Tsunami Inundation Map for Topanga Quadrangle with Enlarged View of the Project Site

3.6 Estimate Scour Depth at the Toe of Coastal Structures

Currently, there are no robust mathematical theories developed for predicting maximum scour at the toe of a sloping shore protection structure. However, several practical rules of thumb are suggested by the CEM for engineering designs involving scour/erosion issues:

1. Maximum scour at the toe of a sloping structure is expected to be somewhat less than scour calculated for a vertical wall at the same location and under the same wave conditions. Therefore, a conservative scour estimate is provided by the vertical wall scour prediction equations. For example, maximum scour depths are not greater than the incident regular wave heights.

2. Depth of scour decreases with the structure reflection coefficient. Therefore, structures with milder slopes and greater porosity will experience less wave-induced scour.

3. Scour depths are significantly increased when along-structure currents act in conjunction with waves.

4. Obliquely incident waves may cause greater scour than normally incident waves because the short-crested waves increase in size along the structure (Lin et al. 1986) due to the mach-stem effect. Also, oblique waves generate flows parallel to the structure.

In addition to the above general rules, the FHWA Hydraulic Engineering Circular No. 11 - Design of Riprap Revetments, suggests equations to calculate probable maximum depth of scour $ds\,(m)$ as a function of the size of the bed material or applied riprap (D_{50}). The equations are expressed as follows:

$$ds = 3.66\,m \qquad for\ D_{50} < 0.0015\,m$$

$$ds = 1.74{D_{50}}^{-0.11} \qquad for\ D_{50} > 0.0015\,m$$

According to the FHWA Hydraulic Engineering Circular No. 25 – Highways in the Coastal Environment (FHWA, 2008) for riprap design for wave attack, the riprap median diameter $\mathrm{D_{50}}$ can be designed by using the Hudson method:

$$W_{50} = \frac{\gamma_r H^3 (\tan\theta)}{K_d (S_r - S_w)^3}$$

$$D_{50} = \sqrt[3]{\frac{W_{50}}{0.85\gamma_r}}$$

Where:
$\mathrm{W_{50}}$ = Weight of the median riprap particle size, lb (kg);
γ_r= Unit weight of riprap, $\mathrm{lb/ft^3}$ $(\mathrm{kg/m^3})$;
H = Design wave height, ft (m);
$\mathrm{K_d}$ = Empirical coefficient equal to 2.2 for riprap;
$\mathrm{S_r}$ = Specific gravity of riprap;
$\mathrm{S_w}$ = Specific gravity of water;
θ = Angle of slope inclination;
$\mathrm{D_{50}}$ = Riprap median diameter ft (m)

The design wave heights are assumed to be the height of breaking waves occurring in front of the toe of structures and estimated as 0.78 times the design water depths.

The scour depths (ds) associated with various design water level (DWL) scenarios were calculated using above empirical equations. The following parameters use the recommended parameter values: γ_r (165 $\mathrm{lb/ft^3}$), $\tan\theta$ (0.67, based on the proposed revetment design), K_d (2.2), S_r (2.65), and S_w (1.00).

The results for the resulting scour calculations are provided in **Table 3-10**. The calculations show that the maximum scour could range from 5.51 to 5.84 feet below the MLLW level. The riprap median size (D_{50}) and weight (W_{50}) riprap rocks applied to resist design wave heights are calculated as well.

Table 3-10 Riprap Size and Maximum Scour Depth Calculation

Target Year	**2030**		**2050**		**2100**	
Design Stillwater Level (ft, NAVD88)	7.62		7.71		7.83	
SLR Projection (ft)	**Low**	**High**	**Low**	**High**	**Low**	**High**
	0.13	0.98	0.39	2.00	1.38	5.48
Design Water Level (DWL, ft)	7.75	8.60	8.10	9.71	9.21	13.31
Bed Elevation at Toe/MLLW (ft, NAVD88)	-0.19		-0.19		-0.19	
Design Water Depth (ft)	7.94	8.79	8.23	9.90	9.60	13.50
Design Wave Height (ft)	6.19	6.86	6.42	7.72	7.49	10.53
Riprap Median Weight W_{50} for Resisting Design Waves (lb)	2,657	3,605	2,959	5,151	4,697	13,061
Riprap Median Size D_{50} for Resisting Design Waves (ft)	2.67	2.95	2.76	3.32	3.22	4.53
Maximum Scour Depth (ft)	5.84	5.78	5.82	5.70	5.72	5.51

The proposed revetment is as far landward as possible and will replace the revetment that has previously protected the PCH. The footprint of the revetment will be similar to the historic revetment footprint and will not extend past the rocks that are already found on the beach. The revetment may slightly increase erosional rates along the beach due to influences from higher velocities and turbulence during large events on beach sediment and sediment transport properties. However, in order to reduce the footprint of the rock on the beach, the RSP should be trenched into the beach to final design toe-down, rather than "launching" the RSP, which involves placing the rock on the beach as a rock apron and allowing the RSP to scour itself into final placement as large storms occur.

3.7 Revetment Susceptibility to Wave Attack

Table 3-10 demonstrates the estimated riprap median sizes for various design stillwater levels (DWLs) associated with SLR scenarios (2030, 2050 and 2100 target year). Riprap dimensions are designed to prevent scour at the toe of the revetment and withstand wave attack associated with extreme near-shore wave heights. Wave heights are determined based on the DWLs. This report assumes that the most damaging waves break right in front of the toe of revetments due to the deeper water depth during extreme wave climate scenarios. In consideration of the greatest depth and largest wave, the year 2100 high SLR projection, the median weight and size of riprap are 13,061 pounds (6.53 tons) and 4.53 feet. As a result, 8T RSP is required for the armor layer of this riprap revetment (Caltrans, 2000) in order to resist potential wave attacks.

3.8 Beach Impact Analysis

Las Tunas Beach is an erosional beach as discussed in **Section 3.4**. The existing revetment protecting the PCH has been damaged by storms over many years and the PCH is currently in danger of being damaged by bluff erosion. Several other utilities are also being threatened. The impacts associated with failure of the road, telephone, and water lines would be significant, and therefore, the revetment needs to be replaced to prevent these impacts. However, the replacement of the revetment along Las Tunas Beach will impact the beach. The impacts and potential mitigation are discussed in this section.

The proposed revetment will extend onto the beach within the footprint of the previous revetment and will physically occupy an area that has the potential for public use. As detailed in the Coastal Commission's Beach Erosion and Response (BEAR), one drawback of a revetment is the base width and extent of the footprint (BAER, 1999). This study shows that the design total water levels could range from 16.92 to 29.71 feet (NAVD88) depending on the selected SLR scenario (see **Table 3-6**, **Table 3-7**, and **Table 3-8** for details). The elevation of the road surface ranges from 24 to 30 feet. The calculations take stillwater, SLR, and wave run-up estimates into account. The tsunami effects are excluded since the maximum tsunami impacts are projected to be milder than the lowest wave run-up estimate. Based on the total water level calculations, the revetments with a designed height of 17 to 30 feet could extend 25.5 to 45 feet from the shoulder of the road on basis of the 1.5 (H):1 (V) slope. In most cases along this stretch of beach and highway, the area to be impacted by the new revetment is already covered with the remains of historic revetment efforts.

The other potential beach impact is related to the proposed revetment is accelerated erosion of the beach. The main function of the revetment is to keep the upland sediments from being eroded by wave action. Preventing the natural erosion reduces the sediment supply that helps sustain the beach and may accelerate the rate of beach erosion (BEAR, 1999). The riprap revetment design could also change the beach particle gradation and further alter the parameters relevant to beach evolution. As a result, the revetment construction could change width and position of the beach.

Due to the importance of the PCH for residents and for tourist travel along the coast, allowing the bluff erosion to continue is not an acceptable solution. Beach nourishment has been suggested as a soft approach for preventing coastal erosion while providing beaches for the public. This has worked in other areas within the Santa Monica Littoral Cell. However, as discussed by Patsch and Griggs (2006):

> "While beach nourishment appears to be an attractive alternative to either armoring the coastline with seawalls, riprap or revetments, or to relocating threatened structures inland, as with any large construction project, there are a number of issues or considerations that need to be carefully evaluated and addressed. In California, littoral cells span large stretches of the coastline, from 10 miles to over 100 miles in length, and, in most locations, experience high net littoral drift rates (from 150,000 yd^3/year to over 1 million yd^3/year). As a result, the life span or longevity of sand placed on a particular beach may be short (less than a single winter, in some cases) due to the prevailing winter waves transporting the sand alongshore as littoral drift. Properly constructed and filled retention structures (groins, for example) can help increase the longevity of beach fill."

As evidenced by historic and current beach conditions, construction of groins provided some benefit to the system by keeping beach nourishment sands in the area for a longer time period than expected without the structures. Many of these groins have been shortened or removed as the sand has migrated from the area due to safety concerns for beach visitors. However, with estimated SLR, eventually, the entire beach area will be covered by water and inaccessible as a beach. Based on the historic beach evolution, beach nourishment with groins as a mitigation measure may provide some longevity to the beach and provide added protection to the revetment toe.

The degradational trend of the beach has impacted all properties along this portion of the coast. The western most properties upbeach from the project will not be impacted by the project since the littoral drift is from west to east, and groins or other stabilization structures will not be placed along the revetment. The beach area, which is operated by Los Angeles County Department of Beaches and Harbors will continue in a degradational trend, while the revetment will protect the highway from the continued erosion. The parking area for beach access at the downstream end of the revetment will need to be protected so that wave action at the end of the revetment does not erode the parking area and lifeguard building. Downbeach from the parking area, there is a concrete drain. The properties east of the drain are protected by similar RSP revetments.

4. Discussion & Conclusion

The RSP revetment proposed on Las Tunas Beach will replace a previously installed revetment to protect the PCH from damage caused by bluff erosion along the beach. Based on the technical studies for the Las Tunas Beach revetment, several crucial findings are provided below:

1. This study applied the Gumbel extreme value distribution to analyze the long-term (1974-2013) water level records from the Santa Monica tide gauge to determine DWLs. The SWL was then increased based on expected SLR projections for target years 2030, 2050, and 2100. The SLR projections contain larger uncertainties in for more distant years. For the target year 2100, the SLR projections have a wide range between 1.38 to 5.48 feet for the Las Tunas Beach coastal region. The uncertainties of the SLR projections are the main reason of the diverse design water depths shown in **Table 3-3**.

2. Near-shore design wave height is a significant parameter in evaluating the wave impacts to the proposed revetment. To more reasonably estimate wave heights under extreme scenarios, two approaches were adopted. The first was a simple empirical calculation, while the second was a more complicated wave transformation simulation using the RCPWAVE model. The design wave heights were estimated by the empirical approach with high projections of SLRs and resulted in depths of 6.86, 7.72 and 10.53. The RCPWAVE simulation considered more off-shore parameters to provide site-specific near-shore wave characteristics. The results demonstrate the impacts of wave behavior complexity related to off-shore wave conditions, bathymetry, wave direction, and design water levels. The resulting median wave heights were 6.2 to 9.3 feet among the six simulated profiles for the highest 2100 SLR water depth scenario.

3. Wave run-up height estimates on coastal structures were calculated by the TAW and ACES approaches. The two approaches demonstrate comparable results accounting for various SLR scenarios. However, for this study, the maximum wave run-up heights were selected from the results for each SLR analysis. The design total water level consisting of 2% and maximum wave run-up calculated was 29.96 and 32.22 feet respectively for 2100 SLR scenario.

4. The multiple-year surveys and historical model simulations show that the beach is in a long-term erosion mode. An assessment was conducted for the beach erosion trend under the extreme water levels conditions. The potential impacts caused by a large design wave embedded in a series of historic waves showed potential short-term scour on the 2013 winter profiles and a projected year 2100 beach profile generated by SBEACH. The modeling results for the eroded beach profiles were used for the wave run-up studies. Station 774+01 presents the highest beach recession rates and depths and is considered the most erodible beach section within the study area.

5. The degradational trend of the beach has impacted all properties along this portion of the coast. The western most properties upbeach from the project will not be impacted at all by the project since the littoral drift is from west to east and groins or other stabilization structures will not be placed along the revetment. The beach area, which is operated by Los Angeles County Department of Beaches and Harbors will continue in a degradational trend, while the revetment will protect the highway from the continued erosion. The parking area for beach access at the downstream end of the revetment will need to be protected so that wave action at the end of the revetment does not erode the parking area and lifeguard building. Downbeach from the parking area, there is a concrete drain. The properties east of the drain are protected by RSP revetments.

6. Based on the historical tsunami investigation from the NGDC database, no severe tsunami hazards have been observed historically. Additionally, tsunami forecasts and the inundation map

derived by NCTR numerical modeling shows that the probability of severe impacts resulting from future tsunamis on the project site are smaller than the design wave. In 5 short-term inundation forecasts of tsunamis (SIFT) testing scenarios, the simulated tsunami wave amplitudes were between 1.31 and 6.56 feet.

7. The size and weight of the RSP to withstand the design waves were determined by FHWA and Caltrans design guidelines. The project is adequate to withstand the expected wave uprush at the 100-year recurrence interval. Although the revetment height does not extend to the top of the wave uprush in all locations along the highway, the revetment is tied into the road surface so that any flows overtopping the revetment will flow onto the road, across to the bluff, and then into the surface drainage system for return to the beach. Potential scour depths for the revetment were calculated to be between 5.51 and 5.84 feet below MLLW depending on selected SLR projections. The revetment toe should extend to a depth of at least 6 feet below MLLW.

8. Potential scour depths at the RSP toe were calculated for appropriate toe protection design. The toe-down depths for the revetment were calculated to be between 5.51 and 5.84 feet below MLLW depending on selected SLR projections (**Table 3-9**). Based on these calculations, the revetment toe should extend to a depth of at least 6 feet below MLLW. The calculations provide numerical reference for revetment design with different levels of protection.

9. The proposed revetment is as far landward as possible and will replace the revetment that has previously protected the PCH. It will encroach onto the beach and may slightly increase erosional rates along the beach due to influence on beach sediment and sediment transport properties. In order to reduce the footprint of the rock on the beach, the RSP should be trenched into the beach to final design toe-down, rather than "launching" the RSP, which involves placing the rock on the beach as a rock blanket and allowing the RSP to scour itself into final placement as large storms occur.

10. The existing cement groin keeps sediment from being transported littorally from west to east along the Las Tunas Beach coast. The groin does not necessarily provide protection to the roadway embankment. It provides some minimal protection by keeping a small beach that dissipates some energy. The groins were installed during the beach replenishment time frame when sand was added to the beach as beach nourishment. However, this beach is naturally eroding and the groins only provided temporary protection for the nourishment sand. Over time, the other groins were removed as they were uncovered and became a hazard for surfers and swimmers. The last groin is the most stable and is tied to a natural rock structure. Removal of this groin will result in diminished beach width on Las Tunas Beach.

11. Beach nourishment may slow the erosion of the beach, but this section of the coast is erosional due to limited sediment delivery and high wave action. The erosion of this beach has been artificially slowed through the addition of beach nourishment sand and groins along Las Tunas Beach. Approximately 70,000 cubic yards of sediment was place on the beach in the 1970s. Historically, Caltrans had a permit that allowed annual placement of an additional 5,000 cubic yards of sediment along the Las Tunas Beach revetment. This placement helped slow the erosion process and provided nourishment for the beach. However, this was not enough to prevent the degradation of the beach to the point where removal of the steel groins was necessary due to safety concerns. Caltrans was unable to renew the permit after the mid 1990's. The lack of beach nourishment and removal of the dilapidated metal groins have accelerated the wave erosion processes at Las Tunas Beach.

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Appendix A

Field Investigation I (June 21, 2013)

Figure 1 Field Investigation Site Locations

Figure 2 Site 1 – Looking East from Storm Drain Outlet

Figure 3 Site 1 – View of House Foundation Piles

Figure 4 Site 2 – Storm Drain Outlet with Dominant Fine Deposition at Site 2

Figure 5 Site 3 – Looking West Towards the County Lifeguard Tower. Broken Concrete Seawall in Pieces on the Beach.

Figure 6 Site 4 – Rock Slope Protection at the Toe of the Slope Near the Lifeguard Tower

Figure 7 Site 5 – Cobble and Boulders on the Beach with Toe Erosion Observed

Figure 8 Site 6 – Cobble on Exposed Beach

Figure 9 Site 7 – Scour Observed on the Eroded Slope Impacting the Shoulder of the Pacific Coast Highway

Figure 10 Site 7 – Embankment Scour

Figure 11 Site 8 – Rock Slope Protection and with Cobble and Small Boulders on the Beach

Figure 12 Site 9 – Narrow Sand Beach with Cobble at the Toe of the Rock Slope Protection. Sheet Pile Exposed Near Storm Drain Outfall.

Figure 13 Site 10 – Road Culvert Crossing Below the Pacific Coast Highway

Figure 14 Site 11 – Western View of the Remaining Road Shoulder West of the Lifeguard Station

Figure 15 Site 12 – View Looking West at a Jetty Connected to a Large Natural Rock Outcrop

Figure 16 Site 13 Looking East Towards the Lifeguard Station Along the Existing Pacific Coast Highway RSP Revetment

Figure 17 Site 14 – Looking West from Jetty. Wider Beach Area and Eroded Embankment without RSP.

Figure 18 Site 15 – Toe Scour and Damaged Drainage Pipe

Figure 19 Site 16 – Native Boulders and Imported Granite Boulders on Beach Providing No Protection for Embankment

Figure 20 Site 17 – Timber Foundation Piles on the Beach. Exposed Sheet Pile in Background.

Figure 21 Site 18 –Steel Sheet Pile Surrounded by Cobble and Boulder. Not Embankment Protection.

Figure 22 Site 19 – Coastal Erosion along Pacific Coast Highway Embankment

Figure 23 Site 20 – Proximity of Coastal Erosion to Road Shoulder

Figure 24 Site 20 – Rock Distribution over the Breaking Wave Zone at this Site

Figure 25 Site 21 – Endangered Pole on the Edge of the Eroded Embankment

Figure 26 Site 21 – Infrastructure at Risk from Coastal Erosion

Figure 27 Site 22 – Broken Pieces of Reinforced Concrete and Timber Piles Found at this Site

Figure 28 Site 23 – K-Rail Loss Along Pacific Coast Highway

Figure 29 Site 24 – House with Suspended Foundation Being Impacted by Erosion Along Las Tunas Beach

Figure 30 Site 24 – Eroded Timber Piles Abandoned Beneath House. Long-term Scour Shown on the Piles

Figure 31 Site 24 – RSP and Gabion Retention Wall and Coastal Protection on the West Side of the House

Figure 32 Site 25 – Western View of Shoreline with Coastal Erosion Along Embankment

Figure 33 Site 26 – Fallen Fences Along Embankment

Figure 34 Site 27 – Failures of a Grouted Retention Wall Found at Western End of Project Site

Figure 35 Site 27 – Loose Soil and Broken Concrete on the West Side the Project Site

Appendix B

Field Investigation II (November 7, 2013)

Figure 1 Field Investigation Site Locations

June 21st 2013

Nov 7th 2013

Figure 2 Looking at the beach East at Site 1. The winter beach shown in the June 21st photo has more exposed RSP. The summer profile shown in the November 7th photo has more sand deposition, as expected due to a more mild wave climate.

June 21st 2013

Nov 7th 2013

Figure 3 Depositions accumulated in the storm drain outlet at Site 2. Depositions of over two feet in depth are observed in the later photo.

June 21st 2013

Nov 7th 2013

Figure 4 Rocky beach at Site 3. Slight erosion is revealed by evaluating the height of the numbered rocks.

June 21st 2013

Nov 7th 2013

Figure 5 Showing no evident landform changes during the summer months from July through October.

June 21st 2013

Nov 7th 2013

Figure 6 Comparing depositions on the scoured bluff near Site 7. In the later investigation, more cobbles were found accumulated on the slope. This may have been done by beach users as it is unlikely they were moved by wave action.

June 21st 2013

Nov 7th 2013

Figure 7 An eroded hole near Site 7 found in the previous investigation. No significant change in size was observed.

June 21st 2013

Nov 7th 2013

Figure 8 Rock slope protection at Site 8. More fine deposition was found in the November investigation.

June 21st 2013

Nov 7th 2013

Figure 9 Looking west from Site 9 to Site 14 located at the groin. The pictures demonstrate a wider summer beach covered by finer depositions in the November investigation.

June 21st 2013

Nov 7th 2013

Figure 10 The shoreline view on the east side of the groin. The pictures show fewer big rocks but more sand in the later investigation.

June 21st 2013

Nov 7th 2013

Figure 11 Shoreline view looking East at Site 13. The beach is covered by finer sediments found in the November investigation. The June photo shows a steeper winter profile reflecting wave climate differences between June and November.

Figure 12 Beach ground elevation differences of 5-8 feet between the updrift and downdrift beaches found at the remaining groin.

June 21st 2013

Nov 7th 2013

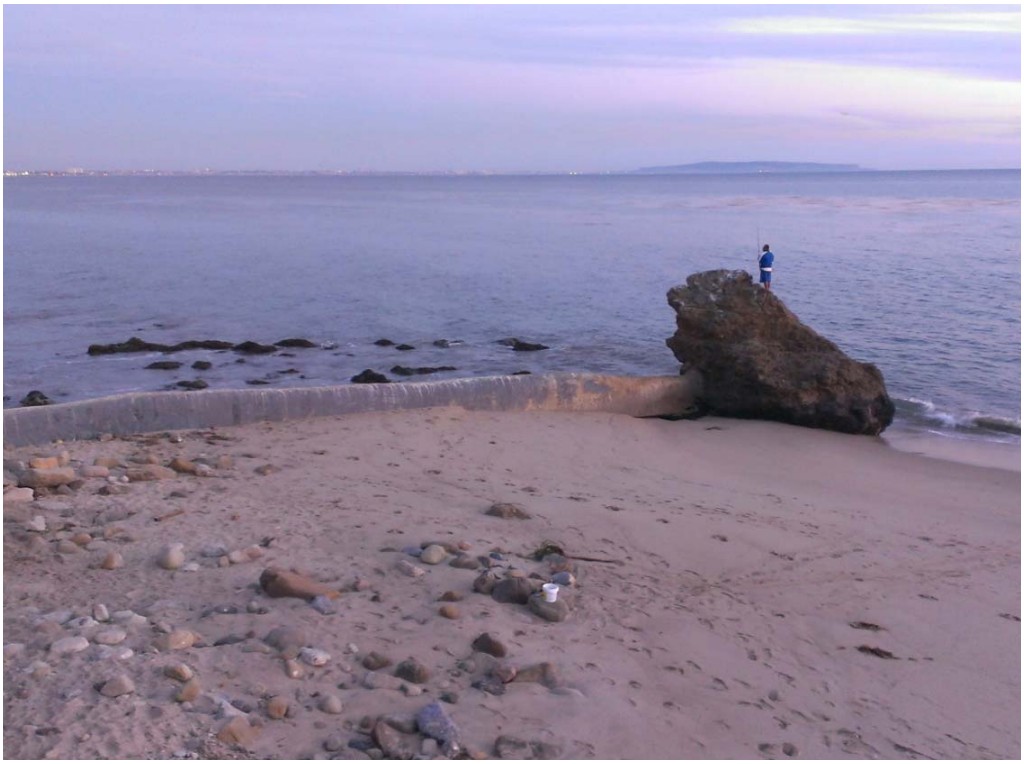


Figure 13 Comparison of two investigations at Site 14. The largest beach accretions are caused by the groin.

Figure 14 Looking East at Site 15. The picture shows the widest (70-80 feet) beach section found during the field investigations.

June 21st 2013

Nov 7th 2013

Figure 15 Sand deposition near a steel sheet pile at Site 18. More sand and finer sediments were found in the November investigation.

June 21st 2013

Nov 7th 2013

Figure 16 Undermined embankment at Site 22.

June 21st 2013

Nov 7th 2013

Figure 17 Looking West at Site 25. Finer deposition found on a broader beach in the November investigation.

June 21st 2013

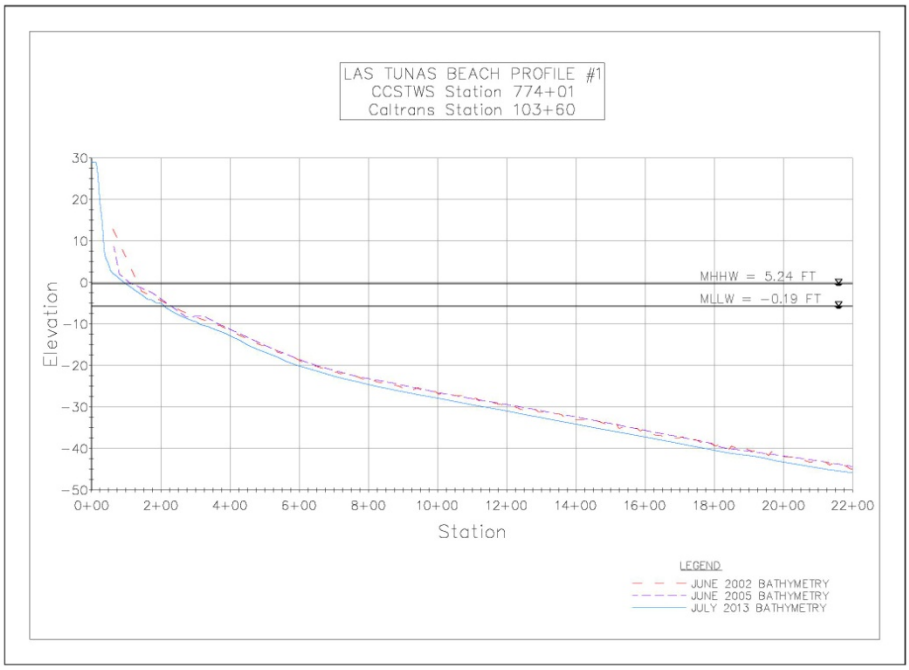
Nov 7th 2013

Figure 18 Large debris from the broken concrete slope protection at Site 27. No evident changes at this site between the investigations.

Appendix C

2013 Winter Beach Profile Survey

Figure 1 Location of Six Surveyed Winter Beach Profiles



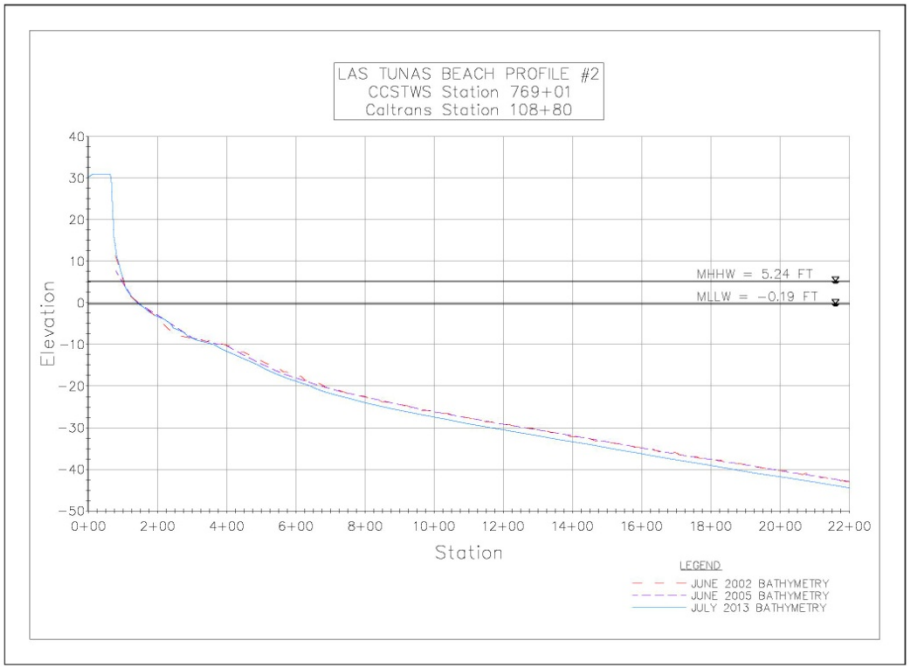
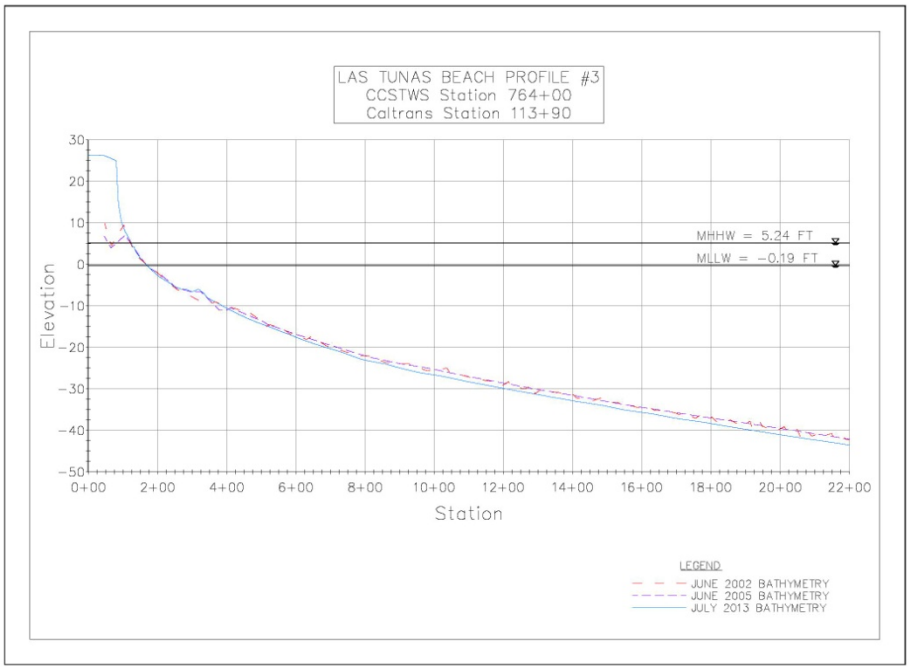


Figure 2 Las Tunas Winter Beach Profiles in 2002, 2005 and 2013 at CCSTWS Sta. 774+01 and 769+01



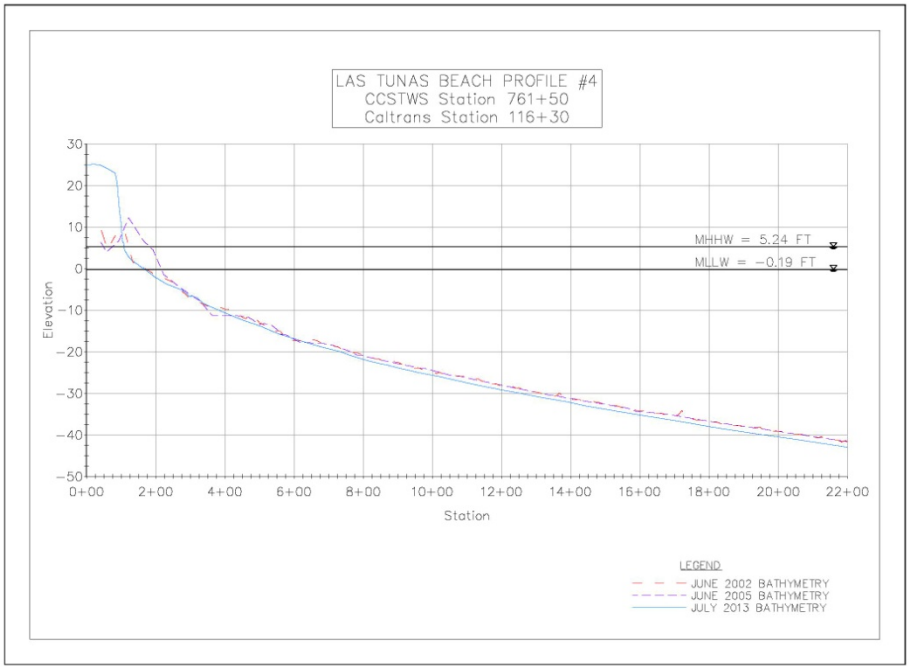
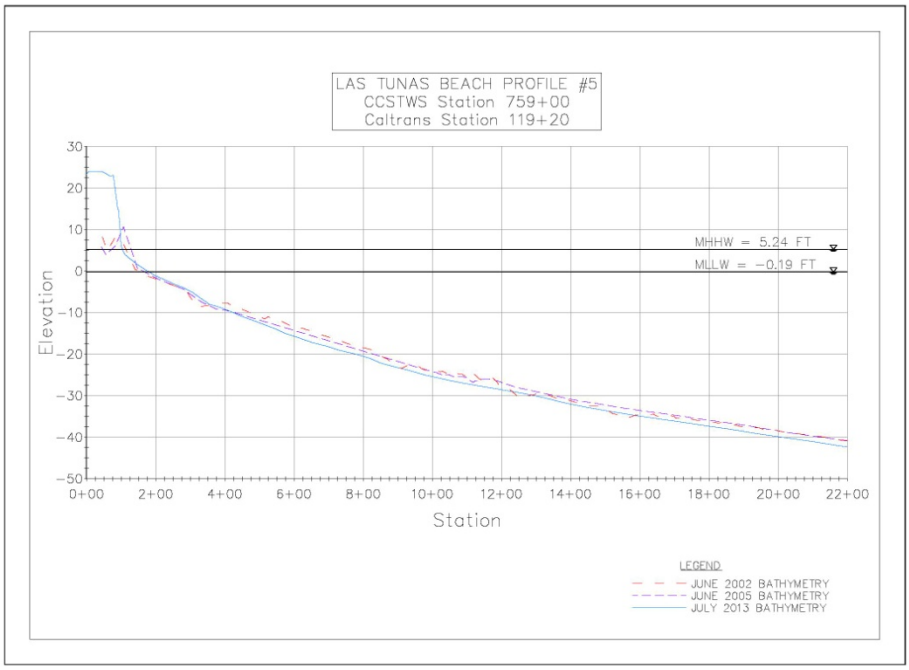


Figure 3 Las Tunas Winter Beach Profiles in 2002, 2005 and 2013 at CCSTWS Sta. 764+00 and 761+50



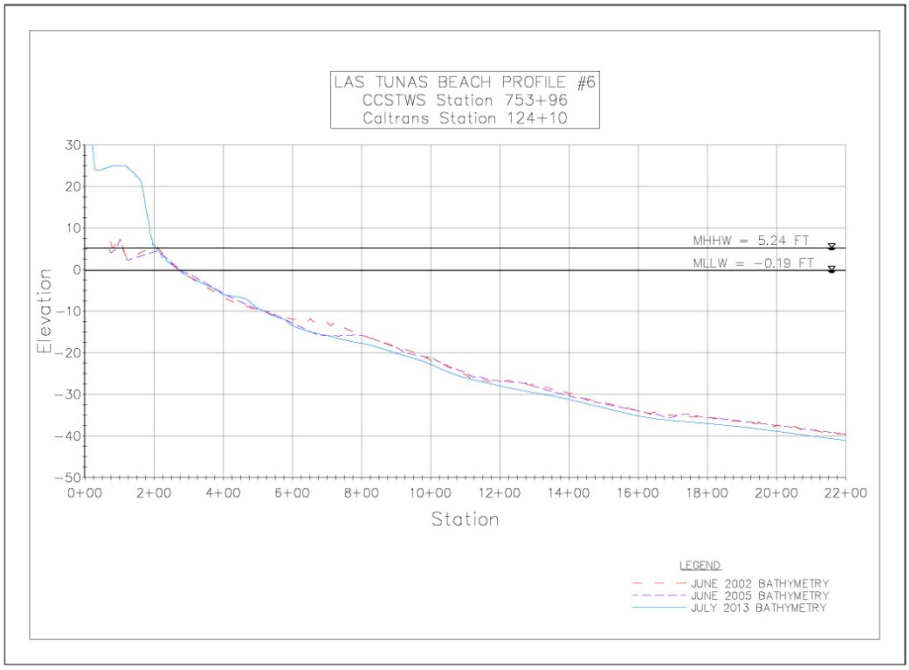


Figure 4 Las Tunas Winter Beach Profiles in 2002, 2005 and 2013 at CCSTWS Sta. 759+00 and 753+96

Appendix D

2013 Summer Beach Profile Survey

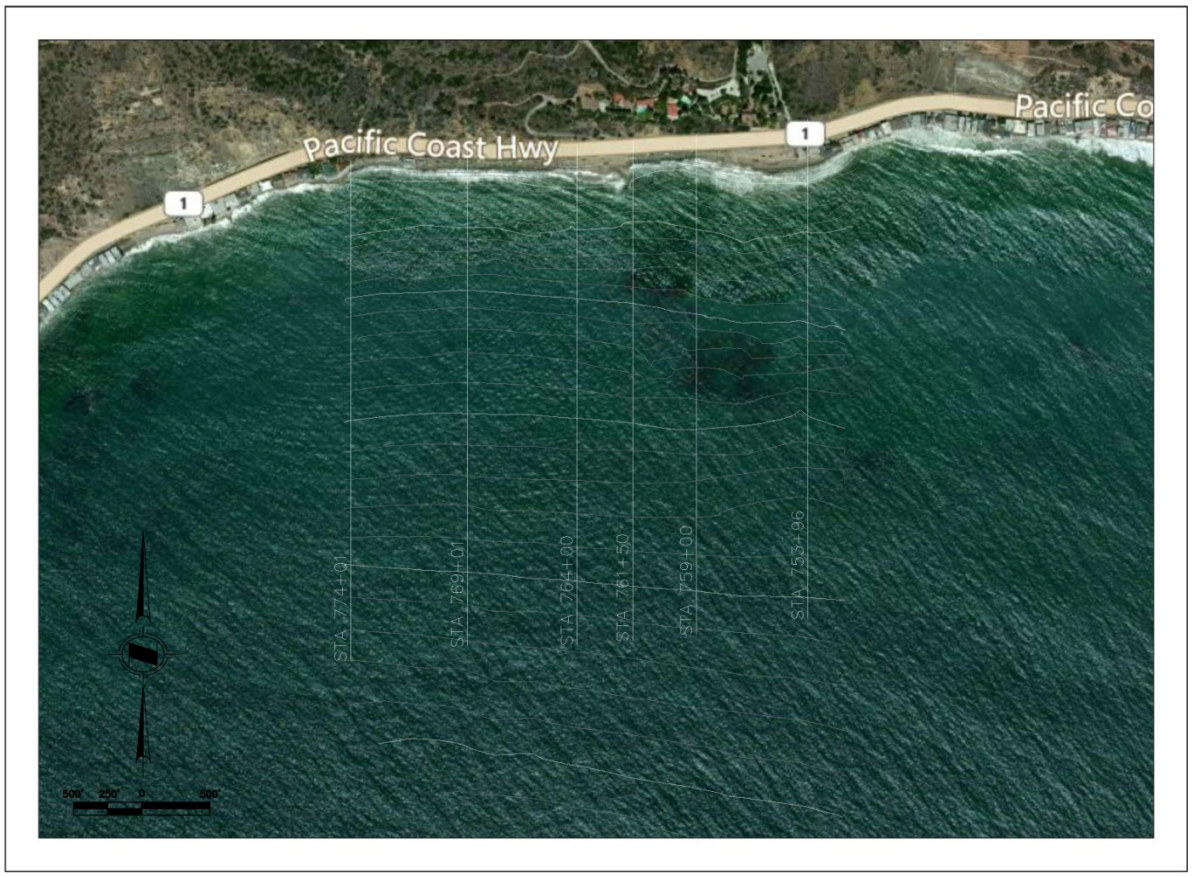
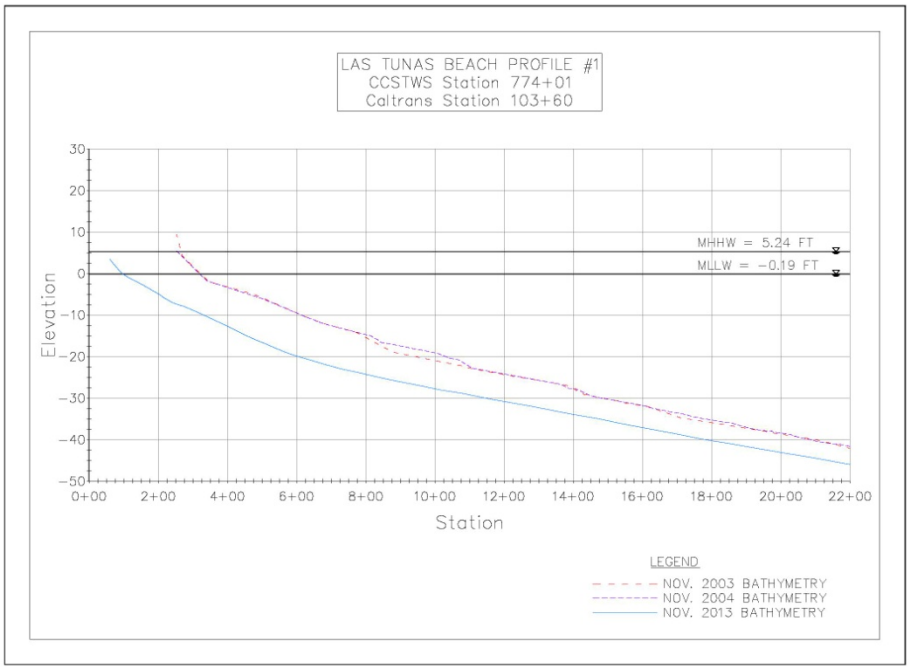


Figure 1 Location of Six Surveyed Summer Beach Profiles



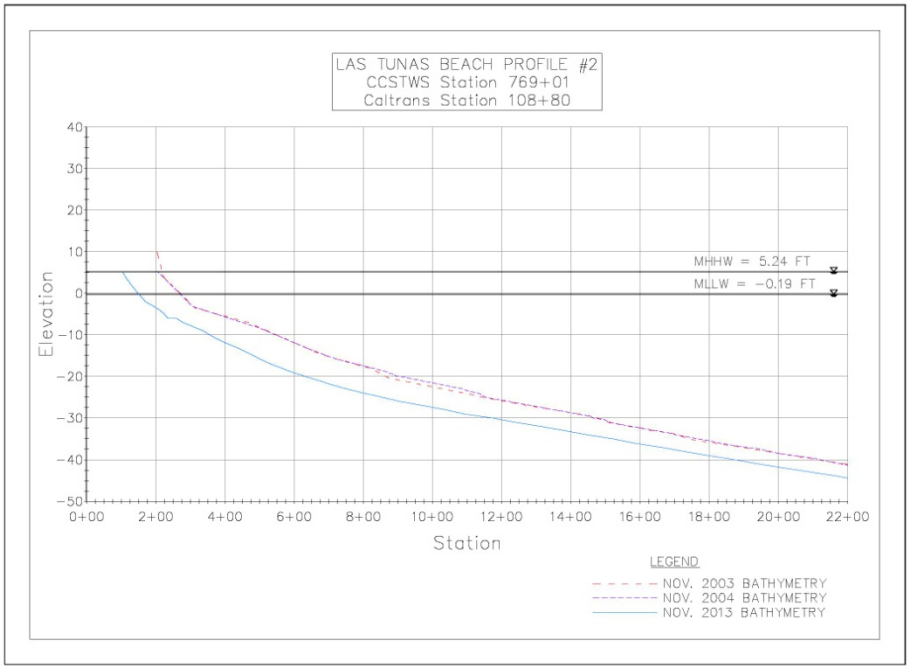
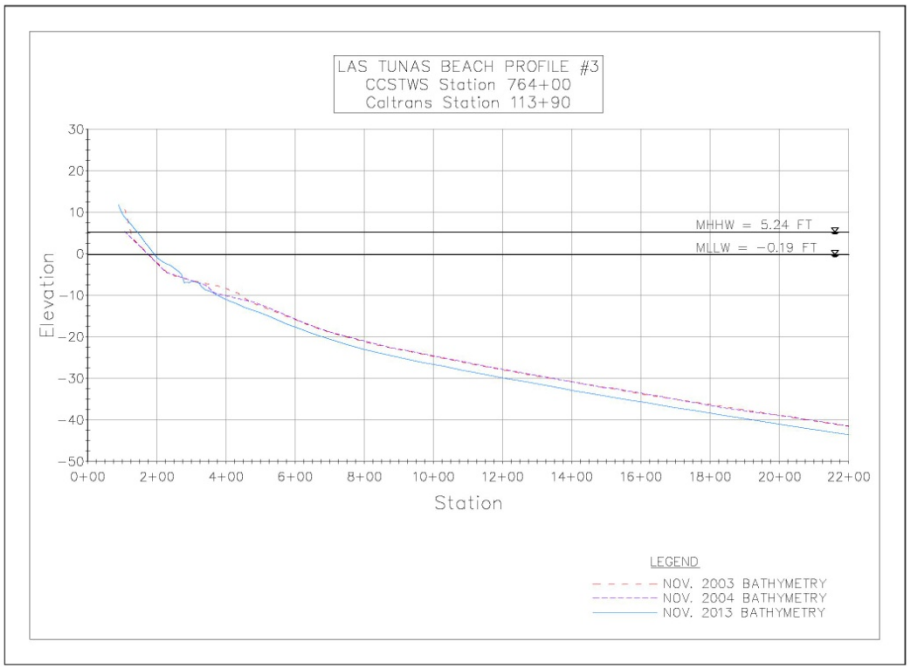


Figure 2 Las Tunas Summer Beach Profiles in 2003, 2004 and 2013 at CCSTWS Sta. 774+01 and 769+01



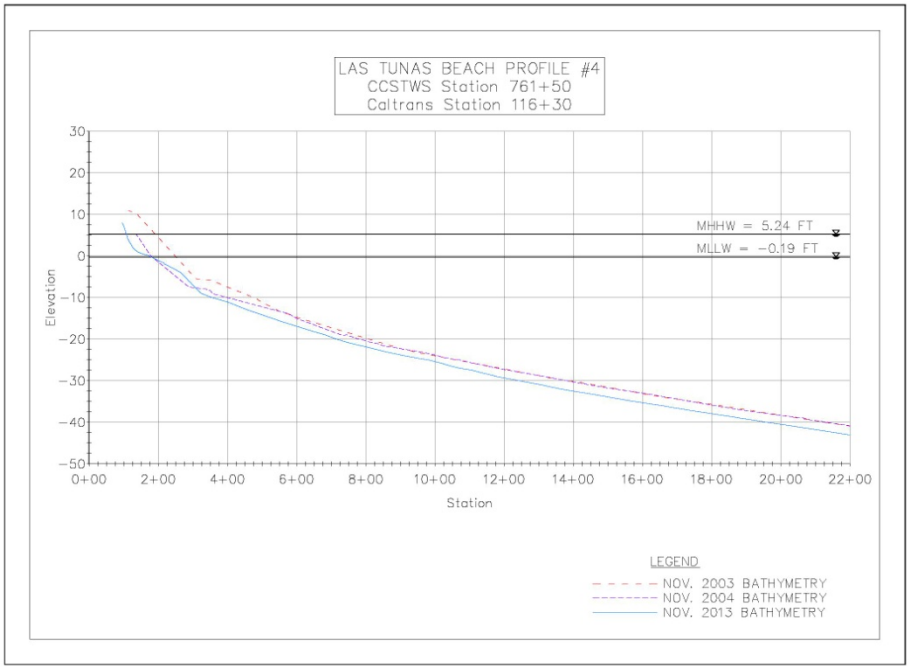
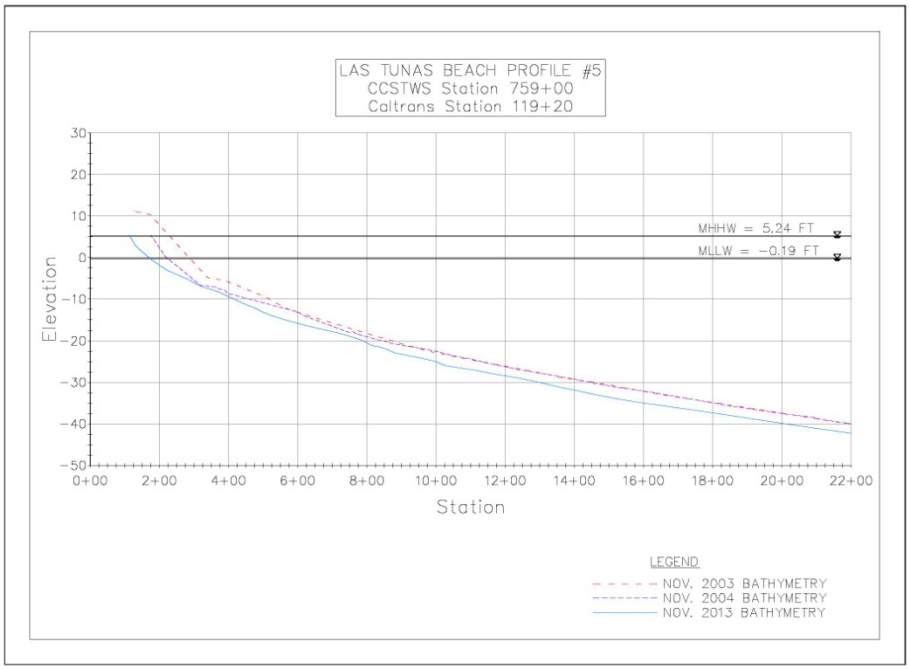


Figure 3 Las Tunas Summer Beach Profiles in 2003, 2004 and 2013 at CCSTWS Sta. 764+00 and 761+50



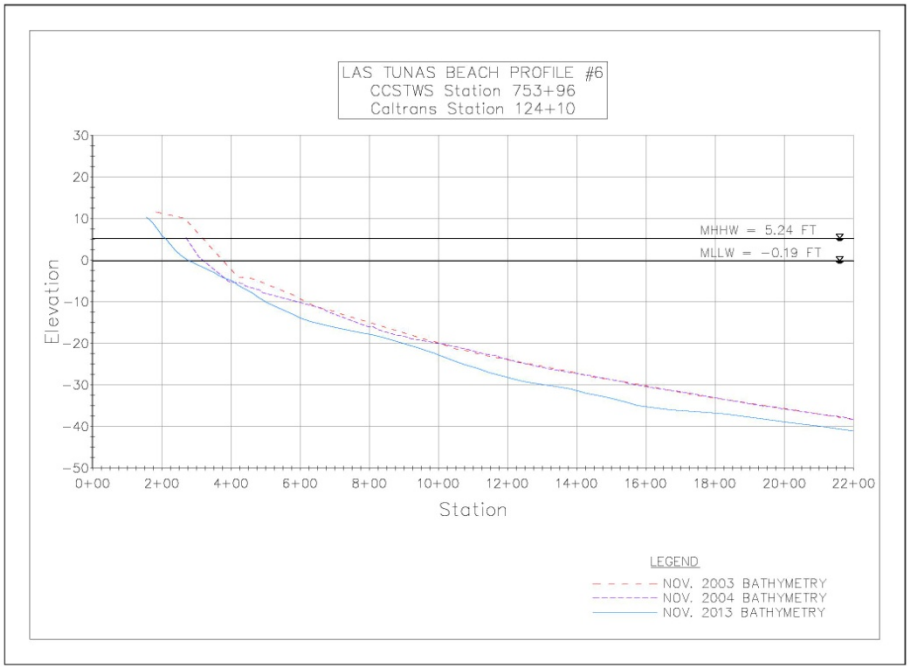


Figure 4 Las Tunas Summer Beach Profiles in 2003, 2004 and 2013 at CCSTWS Sta. 759+00 and 753+96