

Date: September 25, 2026

To: Thomas B. Modica, City Manager



From: Joshua Hickman, Director of Public Works



For: Mayor and Members of the City Council

Subject: **Peninsula Update – Hurricane Marie Response and Next Steps**

The City of Long Beach is actively responding to significant damage to the Peninsula Beach (Peninsula) boardwalk and shoreline caused by the recent Hurricane Marie, a tropical storm event, whose impacts were most pronounced between September 5-8, 2026. The combination of an unusually large, long-period southerly swell, wave energy, and elevated tides resulted in substantial beach erosion, exposed portions of the existing bulkhead that had been buried for years, and damaged portions of the Peninsula boardwalk and bulkhead. City staff responded immediately to assess conditions, protect public infrastructure, and begin recovery efforts. This memorandum provides an update on the City's immediate response, ongoing repairs, interim shoreline protection efforts, and provides an overview of general Peninsula Beach shoreline erosion management strategies, which are comprised of near-term and mid-term strategies, where implementation is on-going or imminent. This memorandum also discusses possible long-term erosion management strategies surrounding planning and development and considerations associated with advancing these efforts.

### **Background and Context**

The Long Beach coastline is unique in that it is protected by both the Alamitos Bay jetty system and the federal breakwater, which typically reduce wave energy reaching the shoreline. As a result, significant wave impacts along the Peninsula are less common than seen in neighboring coastal communities. However, an opening at the eastern end of the breakwater allows swells from certain directions to reach the coast. The southerly swell generated by Hurricane Marie aligned with this exposure, allowing elevated wave energy to impact the Peninsula.

The Peninsula beach, generally described as the area of shoreline between 54th Place and 72nd Place including the west jetty, serves as an important protective buffer between the Pacific Ocean and a number of important assets and resources including private property, primarily single-family homes, City facilities inclusive of leased buildings, recreational facilities, and parking lots, a public boardwalk and rights-of-ways, and utility infrastructure. The Peninsula beach features a wooden boardwalk, which serves as public access and a key part of the City's coastal trail amenities. The adjacent bulkhead is the vertical timber face which separates the residences and intersecting streets from the Peninsula beach, and functions primarily as a sand retention structure for wind-blown sand in this dynamic coastal environment.

The boardwalk was constructed in the 1920s and is approximately 9 feet wide and 3,600 feet

long, extending along the oceanfront between approximately 55th and 69th Place. The boardwalk consists of timber decking supported by a wood structural system and driven timber piles. The boardwalk is said to be the last wooden boardwalk in Los Angeles County and has provided nostalgia and public access for over 100 years. Sited directly between private homes and the sandy beach, many user groups from the local community and region utilize the boardwalk for direct access to the beach and recreation such as dog walking. Along the beach side of the boardwalk is a timber bulkhead that provides a low barrier wall between the boardwalk and beach. The bulkhead is supported by the boardwalk's pile system but is structurally separate from the boardwalk deck and does not support the deck itself. Under typical beach conditions for the last 70+/- years, most of the approximately 22-foot-high bulkhead is buried in sand, with only the upper portion visible above the beach.

Historically, the Peninsula beach has been part of a dynamic coastal and estuarine environment, and these characteristics persist today with conditions that are influenced by coastal development. The littoral processes which consist of dynamic wave forces, tides, and winds predominantly move water and sediment in a westerly direction within Long Beach and are cutoff from natural sources of sediment input. This is a result of navigation, coastal, and flood control structures, in addition to the harbor breakwater. These in combination have constrained the natural sand source and supply and have altered the littoral processes along the Peninsula.

In the 1940s, the Peninsula benefited from dredge spoils from construction efforts within the Alamitos Bay. During this period, 3,000,000 cubic yards (CY) was deposited to the beach comprising the last known major beach nourishment effort. However, by 1980, much of this sand was depleted.

There were smaller scale nourishment and beach stabilization efforts between the 1950s-1980s, including some forms of nourishment or pilot projects, including a 1979 beach nourishment effort to place 100,000 CY of sand along the Peninsula. Other efforts to stabilize the beach in the 1980-1990s included placement of “birdseye” gravel (smaller smooth gravel rock), placement of 50,000 cubic yards of imported river sand, and installation of an artificial offshore reef approximately 300 ft long and eight ft high in size, comprised of sand-filled polyester bags. Both the placement of birdseye gravel and the offshore reef were found to be ineffective resulting in the removal of the reef.

During the 1980s, the California Coastal Commission permitted various City efforts including the installation of several offshore, artificial kelp beds along 2,500 feet of the Peninsula. The initial beds were installed six to eight-hundred feet offshore in an effort to reduce wave energy and beach erosion. Additional kelp beds were added in 1985 and 1987. There is no evidence these kelp beds have reduced the rate of erosion. Beach nourishment activities continued from 1991-1993 moving approximately 145,000 CY of sand from the areas between 55th Place and Belmont Shore Pier, approved by the Commission under emergency conditions.

### **Impacts of Hurricane Season, High Tides, and El Niño**

The Eastern Pacific hurricane season, which officially extends from May 15 through November

30, coincides with the period when Long Beach is most likely to experience south swells generated by tropical storms and hurricanes off the coast of Mexico and Baja California. These storms can produce long-period southerly swells that propagate northward into Southern California and depending on wave direction and local conditions, can reach the Long Beach area and affect coastal conditions. South swells are not limited to the hurricane season, however, and can occur at other times of the year from a variety of storm systems, including Southern Hemisphere storms and other Pacific weather systems. During El Niño winters, storm activity in the North Pacific can increase and storms may track farther south, but the resulting waves are generally associated with west to west-northwest directions. These predominantly westerly winter swells are more effectively sheltered by the Long Beach Breakwater, reducing exposure and impacts to the protected Long Beach shoreline relative to more southerly-directed swells. The highest astronomical tides, also known as king tides, generally occur during the fall and winter months. During El Niño conditions, elevated water levels associated with regional oceanographic and atmospheric conditions can further increase coastal water levels; when these elevated water levels coincide with a south swell or other energetic wave event, the resulting combination can increase wave runup, overtopping, erosion, and coastal flooding impacts.

### **Typical Erosion Management Strategies**

The two primary causes of erosion and sediment transport occur due to longshore wave energy from prevailing westerly winds and occasional, large southerly swells caused primarily by storms. Under normal conditions, the City manages this dynamic shoreline, in part, through routine sand back passing by City crews, in which sand that has migrated west along the shoreline is mechanically moved east, back toward areas where additional beach width is needed.

Erosion management strategies employed by the Parks Recreation and Marine Department (PRM) include utilizing heavy equipment, such as bulldozers, front loaders, 10-ton dump trucks and 20-ton rock trucks, to relocate sand back to the eastern portion of the Peninsula from a sand harvest location between 54<sup>th</sup> and 55<sup>th</sup> Places. This sand back passing is typically done 5 days a week throughout the year. During inclement weather and high tide occurrences the sand back passing operation is conducted six or seven days per week for the duration of the event dependent on the severity of the weather and high tide. A typical working shift is 8 hours; however, crews perform overtime and additional staff support is added for shifts up to 18 hours. The heavy equipment is utilized to build sand berms and to replenish sand at the waterline. PRM spends between \$1 million to \$1.5 million annually to move harvested sand back to the eastern portion of the Peninsula.

### **Hurricane Marie Storm Preparation**

In anticipation of the Labor Day weekend hurricane, the City's teams worked collaboratively to prepare for impacts to the coastal zone and peninsula.

PW staff inspected all 23 City managed pump stations to ensure adequate operation. Pump station #7 was vandalized and not functioning properly requiring a staffing plan to manually

operate the pumps during the storm. The 5,600 catch basins were inspected and cleaned during the dry season and areas of known flooding including the peninsula were recleaned during the week leading up to the storm. Three pumps were rented to assist with localized flooding at a cost of \$12,000 per pump per week. Staff also proactively cleaned roofs and roof drains of City facilities to avoid roof drain clogs that would ultimately backup into the facility.

PRM activated elevated 12hr work schedules on Thursday, September 3, 2026 to build berms in preparation of the event.

### **Impacts from Hurricane Marie 2026**

The combination of unusually large swell and elevated high tides resulted in waves breaking at higher elevations than under typical conditions, causing significant beach erosion, wave run-up, and wave overtopping along the Peninsula.

The September event was unusual because several factors occurred simultaneously:

- **Long-period- south swell:** Hurricane Marie generated a powerful long-period southerly swell while remaining hundreds of miles offshore. Long-period swell retains more energy and has a higher energy when it reaches shallow water.
- **Elevated tides:** Astronomical high tides increase the water levels.
- **Warmer Water:** Warmer ocean waters create expansion contributing to higher water levels than typically experienced.
- **Direct swell exposure:** The southerly swell direction fell within the direct exposed area between the west jetty and the breakwater.

The combination of a long-period swell, coupled with an elevated astronomical high tide cycle, and increase in water levels resulted in multiple days of consistent, direct wave run up, overtopping of the beach berm, significant coastal erosion, and impacts to the shoreline, boardwalk, and bulkhead. Preliminary records of observed tides were greater than those predicted by the National Oceanic Atmospheric Administration (NOAA) at Los Angeles tide station 9410660 by nearly one foot. It is important to note tides are measured at relatively slow-changing water level tide gauges at the point of measurement. As a result, waves broke at higher elevations and eroded the beach the protective sand berms, which were constructed to dissipate energy, were knocked down leading to sand and water overtopping and accumulation of sediment in City streets.

During the event 8- to 10-foot waves rolling in at high frequency overtopped and eroded the sand berm structure between 63<sup>rd</sup> Place and 68<sup>th</sup> Place, requiring continued emergency response and reconstruction by City crews. Due to concerns regarding the integrity of the shoreline and adjacent properties, berm construction was halted, approximately 20 residences were temporarily evacuated, and the boardwalk was closed while City staff assessed conditions and implemented emergency stabilization measures.

On Monday, September 7, 2026 work schedules were enhanced to 16 hour shifts to address water intrusion, street flooding and sand/ debris removal. The 16 hour shift remained active through the conclusion of the emergency response on Wednesday, September 9, 2026.

The cumulative effects resulted in direct damage to portions of the public boardwalk including the vertical bulkhead and decking, with additional impacts to private property. For more information on the City's preparation efforts and response, please view the [City's press release](#).

### **Immediate Post-Storm Response**

Immediately following the storm, City staff transitioned to response and recovery activities, including:

- Established and enforced a security perimeter
- Rebuilding and maintaining the protective sand berms where possible
- Removing sand and debris from affected areas and roadways
- Constructed temporary repairs and bracing for damaged sections of the bulkhead including installation of 130 sheets of plywood.
- Responding to flooding and localized impacts
- Inspecting and assessing bulkhead and boardwalk repairs
- Inspecting and assessing private property for habitation
- In the south swell impact zone between 63<sup>rd</sup> Place and 68<sup>th</sup> Place made immediate repairs to damaged sections of the Peninsula Boardwalk Wall.

Staff were on site during the event and immediately following the peak impacts to address localized seawater flooding, assess the condition of the shoreline, bulkhead, boardwalk, and adjacent infrastructure.

Given the magnitude and unusual nature of the erosion, the City immediately engaged Moffatt & Nichol (M&N) at a not-to-exceed cost of \$75,000 to provide coastal engineering expertise and evaluate both the immediate condition and potential interim protection measures. This includes evaluating the exposed shoreline, bulkhead, beach profile, and potential interim measures that could provide additional protection while the City advances longer-term shoreline management efforts.

Based on City staff observations, impacts to private property were observed to be interior flooding, external damage to patios and terraces, and exposure of the foundations of certain homes within the direct exposure area. No homes within the Long Beach Peninsula have been determined unsafe to enter and unsafe to occupy (red-tagged). One home continues to be yellow tagged due to unsafe access restricting its use.

Community Development has been on-site evaluating structures in the storm impact area and working with impacted residents. Permits for repair work on private property are the private property owners' responsibility and are required for any work to be done. Community Development will be providing assistance to homeowners and will prioritize processing of permits and scheduling of inspections. Permit costs and repairs are typically covered by a homeowner's property or flood insurance.

The total cost of the Hurricane Marie Response are still being calculated. Timesheets and invoices for the work performed are in the review and approval process. At this time, we are anticipating the total response efforts to exceed \$1 million.

### **Boardwalk and Bulkhead Repairs**

The City is currently undertaking several efforts to restore public infrastructure, stabilize the boardwalk and bulkhead, and improve its resilience to future storm events. PRM has removed a substantial amount of damaged material and debris to begin the cleanup, allow for engineering inspections, and prepare the site for repairs. Sand is being placed to fill in areas of depressions on the north side of the bulkhead underneath the boardwalk to replace materials that were eroded as part of the storm. PW has performed initial investigations and completed the design for repairs to the damaged Peninsula boardwalk and bulkhead. Approximately 200 linear feet (LF) of boardwalk is expected to require full deck and support beam replacement, and approximately 1,000 LF of bulkhead, a majority being top cap replacement. Approximately 450 LF of vertical bulkhead wall planks needs to be restored and reinforced with horizontal framing members or whalers. These repairs are necessary to maintain safe and equitable public access to the beach and waterfront as well as access to private property. A repaired boardwalk will allow for community members to traverse the beachfront area with mobility devices, strollers, wagons and other recreational equipment safely and conveniently.

The like-kind repairs will utilize similar materials to what previously existed such as dimensional lumber materials. The City is working with on-call Job Order Contracting (JOC) contractor, Bitech Construction, to complete the necessary boardwalk repairs. The completed plans were provided to Bitech on September 22, 2026 and they are in the process of assembling the proposal. We anticipate receiving the proposal by the end of the month, reviewing and authorizing the contractor to proceed with an anticipated start in early October. Barring any unforeseen conditions or inclement weather, we are anticipating to be substantially complete in November 2026. Much of the work on the waterside of the bulkhead is tide dependent requiring dry sand to work effectively. This limits the available working hours each day to periods before and after low tide. As the time of low tide fluctuates so does the available working window to make the necessary water side repairs. As the procurement process is still underway, we do not yet have a final cost of the project however we anticipate the immediate repairs to cost approximately \$1 to 1.5 million. These repairs are intended to restore public access while the City continues to evaluate ongoing shoreline erosion and beach stabilization measures. However, the boardwalk, given its age and deteriorated condition has limited resilience to future storm events as it requires deck replacement and timber bulkhead plank replacement across the entire run.

Areas of the boardwalk that need to be removed to address repairs to private property should be coordinated through PW, PRM and Community Development and shall be replaced in kind upon completion of the repairs to private property.

These repairs do not require any additional Coastal permits as they are a maintenance project and replacing what was already there. Projects that enhance or significantly alter previously approved infrastructure is required to undergo a Coastal Permitting process.

### **Short Term Support – Alamitos Bay Channel Dredging Project**

For several years, the City has been planning for a project to substantially build out the peninsula beach, which is now slated to begin in mid October. In 2023, the City initiated the Alamitos Bay Entrance Channel Dredging Project to restore navigable depths within the entrance channel to -20 ft mean lower-low water (MLLW). The entrance channel provides recreational and commercial vessels access to the City's marinas, boating facilities, and waterfront destinations including Marine Stadium, Spinnaker Bay, Davies Boat Launch Ramp, and Naples Island. Over time, natural coastal processes have deposited sediment within the channel creating shallow areas (shoals) that can pose impediments to navigation during lower tides. The maintenance dredging effort will restore authorized dredge depths to -20 ft MLLW to reduce safety risks and prevent vessel grounding. The work in turn will result in approximately 415,000 cubic yards (CY) of sediment which has to be managed accordingly. The proposed work will beneficially reuse these sediments along the Peninsula as a beach nourishment opportunity.

On August 11, 2026, the City Council approved the \$9.27 million [construction contract](#) for this work, with an estimated total project cost of \$11.4 million inclusive of planning, sediment characterization, design, regulatory permitting, and construction monitoring and oversight. While the primary objective of the project is to restore navigable depths for safe ingress and egress within the channel, a secondary advantage is local retention of the material and reduced barge trips to an Environmental Protection Agency (EPA) offshore disposal site.

Dredging projects in Southern California are reviewed under guidance from the Southern California Dredged Material Management Team (SC-DMMT), which includes representatives from state and federal regulatory and resource agencies. The guidance prioritizes beneficial reuse of suitable dredged material to support habitat and restore shorelines over offshore or landfill disposal. For this project, the SC-DMMT reviewed the proposed sediment characterization work, sediment chemistry and grain size data, and potential habitat impacts from dredging and direct beach placement. The SC-DMMT concurred with the City's proposed approach which allowed the City to submit the permit applications to the U.S. Army Corps of Engineers, the Regional Water Quality Control Board, and the California Coastal Commission. The Coastal Development Permit was issued in July 2025, and the City advertised the project for bids in September 2025.

The City received two bids, approximately \$13 million and \$14 million, resulting in a \$7 million total project funding gap. To address the gap, the City pursued grant funding and revised the construction plans and bid requirements to encourage greater competition. The City received

four bids in April 2026 and identified a lowest responsive bid of \$8.06 million, approximately \$5 million below the lowest September 2025 bid. The City Manager identified additional Tidelands dollars and proposed those in the FY 27 Proposed Budget as a priority project. The project was fully funded through the FY 2027 Capital Improvement Program and approved by the Mayor and City Council in August 2026, in an accelerated effort ahead of the normal budget process to help speed the project to initiation.

The approved project will be supported by a large-scale barge placed offshore. Dredge material will be hydraulically pumped, piped, and placed along the Peninsula, and crews are expected to mechanically spread and grade the beach using excavators and front loaders to achieve the required beach nourishment grades. The project, as engineered, was expected to nourish the Peninsula extending the beach by as much as 200-250 feet. However, baseline topographic and hydrographic conditions have changed due to Hurricane Marie necessitating updates to the engineering plans. The project's engineers of record are scheduled to perform updated surveys of both the entrance channel and beach to inform baseline conditions prior to the start of dredging. Pre-construction activities are underway, and the staff are actively coordinating with the awarded Contractor. Construction is anticipated to begin mid-October 2026. While the expected completion was early 2027, the city team has worked with the contractor to expedite to the extent possible with a goal of finishing the project by the end of November. This effort is expected to help restore the eroded shoreline and provide a buffer prior to subsequent storm events and anticipated El Nino conditions.

### **Interim Coastal Engineering Evaluation**

In addition to the typical back passing maintenance activities and the upcoming dredging and beach nourishment projects, Moffatt & Nichol has been onboarded to evaluate the feasibility of interim options that could be implemented between 63<sup>rd</sup> Place and 67<sup>th</sup> Place in the near-term in anticipation of subsequent coastal storm events and the probability of El Nino conditions. Interim coastal protection measures have been reviewed based on their ability to provide timely coastal protection during the upcoming storm season, constructability, permitting requirements, environmental impacts, cost, compatibility with the City's planned Alamitos Bay Entrance Channel Dredging Project, and adaptability for long-term beach management strategies. It is important to understand that these alternatives were developed in a very short period with limited supporting engineering analyses. Thus, the specific designs (quantities and costs) of these alternatives may change upon detailed design.

The interim protection measures under consideration are outlined within the attached letter (Attachment A) from M&N and are summarized below:

#### *Full Profile Rock Revetment (Alternative 1)*

An engineered rock revetment extending approximately two feet above the existing bulkhead would be designed to dissipate wave energy, limit wave runoff and wave overtopping. This type of revetment could not reasonably be buried in sand and maintaining a dry beach seaward of the revetment would require large-scale beach nourishment and back passing. Following design, permitting and mobilization, revetment construction

duration is anticipated to be 2-3 months. Total project costs are anticipated to range from \$7.4M-\$9.5M.

#### *Low Profile Rock Revetment by Bulkhead (Alternative 2)*

This revetment option would provide a 30 ft profile or base where underlayer rock is held in place with armor rock strategically placed at top of slope approximately at +11 ft MLLW (adjacent to bulkhead) and at the toe of the revetment slope. This revetment would not be conducive for covering with sand as it is located immediately adjacent to the bulkhead and boardwalk and creates possible conditions of windblown sand, which would migrate onto the boardwalk and properties adjacent to it. With this option, preliminary review indicates wave velocities at the timber bulkhead would remain below FEMA damage thresholds.

Wave overtopping and localized water intrusion onto the boardwalk could still occur during more severe storm events. Cumulatively, however, this alternative is expected to require about 9,000 tons of both underlayer and armor rock combined. Following design, permitting and mobilization, revetment construction duration is anticipated to be 2-3 months. The estimated cost to implement is \$3.5-\$4.75 million.

#### *Low Profile Rock Revetment (Alternative 3)*

The revetment footprint for Alternative 3 is approximately 45 feet wide and follows the same general geometry of Alternative 1. The distinction between Alternative 2 and Alternative 3 is in its profile, dimension, and its location placed further seaward from the timber bulkhead. Given its larger footprint compared to Alternative 2, it is estimated to require approximately 14,000 tons of underlayer and armor rock. Similar to Alternative 2, the top elevation of armor rock would be approximately +11 ft MLLW, but given its flatter wide base and top profile, the structure could be fully buried with sand and covered with vegetated dunes. However, nourishment would still be required seaward of the revetment to sustain any vegetated dunes from wave energy and erosion. This option provides continued shoreline protection more than Alternative 2 even in future beach erosion conditions. M&N notes a potential long lead time for rock procurement from quarries. Following design, permitting and mobilization, revetment construction duration is anticipated to be 2-3 months. The estimated cost to implement is \$5-\$7 million depending on the desired sand depth cover.

#### *Large-scale beach nourishment and back passing (Alternative 4)*

Replacing lost sand provides immediate restoration of beach width which serves as a protective storm buffer for the bulkhead and boardwalk. This measure is compatible with the City's existing beach management practices. However, sand can be rapidly eroded during another major swell, requiring ongoing maintenance and potentially significant recurring costs. In order for this measure to be successful, large quantities of sand (at least 100,000 CY) must be strategically placed in a short period of time, prior to a coastal storm event, and a beach berm width of at least 75 ft – 100 ft must be maintained. Placing smaller quantities of sand or distributing recommended quantities throughout the year does not provide the same coastal protection benefit. Back passing is already a permitted activity,

two sand borrow sites have been identified within the City, and additional large-scale back passing could be accommodated through emergency contracts or through change orders to existing contracts. Following mobilization, back passing work duration is anticipated to be 8 weeks. Total project costs are anticipated to range from \$4.2M-\$7M.

#### *Sheet Piles (Alternative 5)*

Sheet piles could be installed to incorporate or reconstruct the existing bulkhead and boardwalk. The sheet pile wall would only halt erosion landward of its installation. In order to provide improved protection from wave runup and overtopping the sheet pile wall would need to be higher than the existing bulkhead with modified geometry and a beach berm width of at least 75 ft – 100 ft must be maintained through large-scale beach nourishment and back passing. Potential sheet pile materials include fiber reinforced polymer or steel which have a different aesthetic from the existing timber boardwalk. There is a potential long lead time for sheet pile procurement and constructability challenges. Following design, permitting and mobilization, construction duration is anticipated to be 3-4 months. Total project costs are anticipated to range from \$2.1M-\$3.8M and do not include costs for large-scale beach nourishment and back passing which would be required to provide wave runup and overtopping protection. It should be noted that these estimates are very preliminary and the scope is limited to sheet pile installation only versus recent Naples Seawall projects that are orders of magnitude more and include additional scope elements such as pile caps and other hard scape improvements.

#### **Interim Engineering Recommendations**

Below is an excerpt from page 6 of the attached letter:

“Based on the M&N assessment, limited funding, and the highly constrained timeframe to implement actions, M&N recommends a combined approach of large-scale sand backpassing (100,000 cubic yards) follow by, or in conjunction with, the entrance channel dredge project to nourish Peninsula Beach in the immediate term.”

The City agrees with this recommendation and, as noted previously in the memorandum, is working diligently to expedite the dredge project as well as onboard additional support to implement alternative #4 above in the coming months.

The recommendation further notes:

“Simultaneously, the City should move forward with the design and permitting of a rock revetment and establish ‘trigger criteria’ based on beach width to implement the revetment when/if needed.”

The City also supports this recommendation and will continue to work with M&N and the regulatory agencies in conjunction with the parameters as outlined within the recent emergency proclamations (discussed further in this memorandum) to establish feasible projects and “trigger criteria”.

As described above, large scale beach nourishment is a co-benefit of the permitted and planned Alamitos Bay Entrance Channel Dredging Project and is the most compatible considering the anticipated timing of the Project starting in mid-October 2026. This alternative also has the shortest lead time and can be quickly implemented in advance of the forecasted storm season. Rock revetments (small or large) would require postponing the dredging project, require additional large-scale back passing activities, and increase the duration of current exposure with eroded conditions at the peninsula.

Looking beyond the Alamitos Bay Entrance Channel Dredging Project in an adaptive approach, future projects could include additional large-scale back passing to maintain protective beach widths. When trigger criteria are met, rock revetment could be constructed to provide robust coastal protection. Upon completion of the revetment, future adaptation approaches could include large-scale beach nourishment and back passing to bury the revetment in sand. Nature-based solutions could also be implemented such as vegetated dunes over the revetment to support retention of sand and additional protective buffer for wave runup and overtopping.

### **Future Planning – Port Deep Draft Project**

The City, in collaboration with the Port of Long Beach (Port), is evaluating opportunities to leverage a future dredging project, Deep Draft Navigation Project, expected to occur within the harbor district. A joint effort between the United States Army Corps of Engineers (USACE) and Port plans to deepen and widen selected waterways to facilitate access and turning for large containers ships and vessels to increase safety and efficiency. The project is expected to occur in phases over the next few years and is expected to generate over 7,000,000 CY of dredge spoils. A portion, approximately 900,000 to 1,000,000 CY was preliminarily determined to be compatible with the Peninsula sediment grain size envelope. For Peninsula Beach to be included as a receiver or disposal site, the USACE and Port will have to amend a consolidated Environmental Impact Statement (EIS) and Environmental Impact Report (EIR) identifying the Peninsula as a disposal location. Initial phases of the work are expected to begin in 2029. Funding is necessary for environmental, design, sediment testing, characterization and biological studies and could be approximately \$3,000,000. The added cost to accept the material and place on the peninsula is expected to be roughly \$20-30 million.

City Staff are continuing discussions with the Port to determine what regulatory approvals are necessary to facilitate the work, identify funding, and look for opportunities to expedite the project. While the Port project is not expected to provide an immediate solution to the Peninsula's current condition, the identification of a potential compatible sand source, represents a significant future opportunity to address future erosion. If available, this material could substantially replenish the Peninsula beach and establish a stronger baseline condition from which longer-term shoreline protection measures can be developed.

### **Partnerships with United States Army Corps of Engineers (USACE)**

In 2007, the USACE studied and modeled the effectiveness of various structures to mitigate the rate of erosion along the Peninsula via multiple alternatives and models. The USACE study evaluated the benefits and tradeoffs of concepts that included two submerged groins, four

submerged groins and a submerged reef against beach nourishment. The groins were deemed to reduce the rate of erosion, but erosion was still expected in all hardening options. In addition, the USACE's model indicated sand would accumulate on one side of the groin and erode from another thereby not really eliminating the erosion issue. A submerged reef option was also studied and determined to protect the beach behind the reef but would still result in the same sand loss in front of it and possibly create other erosion issues westward of the structure. Lastly, advanced beach fill of greater than 1,230,000 CY was determined to be the most effective method of slowing down that rate of erosion but not eliminating it. However, the 2007 study notes that these are based on typical wave conditions and longer-term coastal processes but was limited as it did not model elevated coastal storm-water levels, swells, and astronomical high tide cycles which cause wave run up.

The East San Pedro Bay Ecosystem Restoration Study (Study) was a joint partnership between the USACE and City, which began in 2010 culminated in 2022 with the release of a [Final Integrated EIS/EIR](#). The preferred concept referred to as the National Ecosystem Restoration Plan (NER) included the installation of 24 kelp beds, 2 open water rocky reefs, 6 nearshore rocky reefs, and eelgrass beds. The estimated total first cost of the project based on pricing from 2020 was \$262 million with the city cost share estimated at \$92 million. Due to the significant and growing cost estimates, lack of funding and lack of local community support, the project was [terminated](#) by the Federal government. In 2023, the Study was formally deauthorized to allow the advancement of aspects of ESPB Study at the local level. The overall Study was primarily focused on restoring and improving aquatic ecosystem structure and function and increasing marine habitat and biodiversity not long-term erosion management. The Study cites literature that discusses kelp's potential to dissipate energy that causes shoreline erosion by its ability to create drag, slows currents, and reduce possible wave action reaching shore, however the benefits were not modeled and was simply stated for planning considerations. Additional modeling and studies would need to be conducted to understand their performance during south swells and storms as kelp could potentially be dislodged and create unintended consequences. In addition, given the kelp beds were permitted and introduced in the early 1990s, additional studies would likely be required and necessary to review the performance of the previously installed kelp beds.

### **Future Planning – Peninsula Ecosystem Restoration**

To build upon previous efforts, in 2024, the City retained Moffatt & Nichol (M&N) to prepare conceptual studies for a project combining shoreline protection with a habitat mitigation bank. Concepts included major beach nourishment, shoreline headlands, pier groin, offshore rocky reefs staggering the headlands along with eelgrass and kelp habitat, and public access improvements (Attachment B). The rough order magnitude cost estimates range from \$150 million to \$350 million, which are Class 5 estimates, given lack of engineering or designs at this phase. The estimates are based on conceptual level acreages, fill volumes, and factors for entitlement and project delivery costs without any advanced modeling or engineering studies.

The estimates were developed to help identify a local or regional partner to support the mitigation bank's creation, including a feasibility study, technical studies and modeling, environmental review under the California Environmental Quality Act (CEQA), assembly of a

mitigation bank prospectus, final design and engineering, and construction and or mitigation.

The Colorado Lagoon project offers a potential funding model for this approach. Mitigation credits, and the established right of first refusal of these credits at project inception nearly two decades ago, helped secure early funding for studies, environmental review, and design. A large amount of federal and state grants along with limited Tidelands funds primarily supported the first three construction phases. However, the Port of Long Beach funded most of the technical studies, engineering reports, EIR, and a majority of the Open Channel construction costs.

As part of the FY2027 budget hearings, Councilmember Duggan requested the Budget Oversight Committee add an additional \$30,000 (funded by reallocating from a different project) to initiate an umbrella mitigation bank. The Budget Oversight Committee included this in their recommendations and it was approved by the full City Council. The \$30,000 would be used to research and explore the establishment of an umbrella mitigation bank, including regulatory engagement and stakeholder coordination. An umbrella mitigation bank could capture mitigation opportunities at the Peninsula, Los Cerritos Wetlands, and other properties that could generate mitigation credits.

Projects of this size and complexity require substantial technical expertise and staff time, as well as sustained involvement from consultants, legal counsel, executive leadership, and elected officials. They also require ongoing coordination with regulatory and resource agencies and potential grant funders. Environmental review, permitting, and design for a coastal project involving significant changes to the waterfront, shoreline, and habitat should be expected to take multiple years. As an example, the preliminary work including design, permitting and approved bank enabling instrument for the Colorado Lagoon took nearly 10 years.

## **El Niño Preparations**

While the timing and severity of individual storms cannot be predicted, residents are encouraged to take steps now to prepare their families, homes, and neighborhoods for potentially significant rain, high surf, strong winds, flooding and other severe weather conditions.

The anticipated 2026–2027 El Niño and winter storm season, on the wake of the impacts of Hurricane Marie, presents the potential for impacts beyond those recently experienced on the Peninsula. Depending on the timing and severity of individual storm events, the City may experience repeated periods of heavy rainfall, strong winds, high surf, large waves, coastal flooding, erosion, localized flooding, transportation disruptions, power outages, damage to homes and critical infrastructure, and interruptions to essential services. Storm impacts may be particularly significant when large waves and coastal storms coincide with high tides or elevated coastal water levels. In addition to the potential impacts to the Peninsula and coastal areas, severe winter weather may affect critical infrastructure and facilities in other parts of the city. Vulnerable residents and communities may experience disproportionate impacts from flooding, power outages, transportation disruptions, or interruptions to essential services.

On September 21, 2026, Governor Gavin Newsom proclaimed a State of Emergency related

to the anticipated impacts of the 2026–2027 El Niño season and directed State agencies to take early actions to protect vulnerable communities, critical infrastructure, and emergency response capabilities. He has directed many state agencies to begin preparations and work with local jurisdiction to mitigate potential impacts. This includes an expedited review by the Coastal Commission on proposed development to prepare for the impacts. After an application is received, the Commission shall respond with notification of any incomplete items within five days. After an application is complete, it shall be scheduled for hearing at the next Commission meeting. For emergency permit requests, the Commission shall accept both written and oral requests to its district offices. When necessary to address an urgent need related to this emergency, the Commission shall take action on emergency permit requests as quickly as possible and within twenty-four hours of receipt.

On September 21, 2026 the City Manager issued a Proclamation of Local Emergency due to the upcoming storm season. On September 22, 2026 the City Council ratified the City Manager's Proclamation of Local Emergency, which provides the City with the ability to take extraordinary preparedness measures and exercise the emergency powers authorized under State law and the Long Beach Municipal Code to prepare for and respond to the threatened impacts of the 2026–2027 El Niño and winter storm season. The proclamation supports the City's ability to rapidly identify, procure, stage, and pre-position equipment, supplies, materials, services, personnel, and other resources; enter into necessary agreements and contracts; coordinate preparedness and mitigation activities; and work with neighboring jurisdictions, regional agencies, Los Angeles County, the State (including Coastal Commission), federal agencies, utility providers, transportation agencies, and other private partners. These authorities will allow the City to respond more quickly as conditions develop and help protect life, property, critical infrastructure, and essential City services. The City Manager will report back to the City Council initially every two weeks to provide details on the emergency and the work both planned and completed.

In addition to efforts listed previously in the memorandum, the City team is actively preparing including:

- Inspection and cleaning of City managed pump stations
- Inspection and cleaning of over 5,600 catch basins, with extra focus on areas prone to flooding
- Purchase of a trailer-mounted pump
- Placing three additional rented pumps on hold
- Cleaning roofs and roof drains of City facilities to avoid roof drain clogs that would ultimately backup into the facility
- Back pass sand to areas of the peninsula from 70<sup>th</sup> Place east to 72<sup>nd</sup> Place and 62<sup>nd</sup> Place west to 54<sup>th</sup> Place

- Perform tabletop exercises for team collaboration, coordination and to model practical situations and scenarios
- Identifying emergency reserves and making them available to support storm response efforts
- Preparing sandbag operations
- Public information campaign

### **Recommended Plan of Action**

Given all the analysis and identification of options, City staff recommend the following approach over the next few months to address the potential for damage along the Peninsula:

1. Continue repairs of the boardwalk and bulkhead: PRM crews are currently working to reinforce the boardwalk cap. A Public Works contractor is expected to be onboarded in the next couple weeks and start boardwalk repairs by early or mid-October, continuing through November. It is very possible this work will be extended as damage from future storms could continue to affect the boardwalk.

Estimated Cost: \$1-1.5 Million

Funding Source: Tidelands Emergency reserves

2. Accelerate and start the dredging project to add 415,000 cubic feet of sand: This project is anticipated to start by mid-October and continue to November.

Estimated Cost: \$11.4 million

Funding Source: Already budgeted in the Marina Fund

3. Backpass additional sand in conjunction with the dredging project begins: PRM has obtained a quote to move additional sand right before the dredging starts, to help build out the beach in order to allow the dredging project to be as effective as possible. This would add approximately 50,000–100,000 additional cubic yards. PW and PRM will continue to onboard additional contractors as necessary to add the full 100,000CY as recommended by M&N.

Estimated Cost: \$230,000 for the initial effort.

Funding Source: Tidelands Emergency Reserves

4. Concurrently with the dredging project, design and approach the Coastal Commission with a low-profile rock revetment and coastal dune application: The City would start immediately with the design of the project, approach Coastal Commission on the feasibility of approach under the State and City declarations of emergency. The goal would be to have a project

permitted and approved as soon as possible, and ready to initiate if the beach nourishment project does not hold. This project can only be implemented when the sand is not present, so would be an available option if the El Nino storms removes the sand from the nourishment project.

Estimated Cost: Approximately \$6.8 million

Funding Source: Unfunded. Initial design funding of \$1 million to be funded by Tidelands Emergency Reserve.

5. Continue future discussions with the Port and Army Corps on accelerating the Deep Draft project and advocate for federal funding to cover the beach nourishment costs.
6. Review funding sources such as Proposition 4, State grants, and federal dollars to support beach nourishment and habitat restoration efforts.
7. Initiate the study of the Umbrella Mitigation Bank

Estimated Cost: \$30,000

Funding Source: Measure A Infrastructure dollars (already budgeted)

## **Funding**

Through the emergency proclamation, the City Manager will identify a funding plan for the recommended actions. As an immediate and emergency measure, the City Manager will recommend the Mayor and City Council allocate \$3 million of the \$10.3 million Tidelands Emergency Reserve to fund the immediate steps and will begin drawing down funding authorized under the emergency declaration immediately. Further funding decisions will be brought to the City Council as part of the emergency response.

## **Summary**

Hurricane Marie was a significant coastal storm event in which a large, long-period southerly swell coincided with elevated tides, resulting in significant erosion, flooding, and infrastructure damage along portions of Southern California, including the Long Beach Peninsula.

The City's immediate priorities are to restore damaged public infrastructure, maintain public safety, stabilize the shoreline, and provide interim protection while longer-term solutions are evaluated.

In the near term, the City's Alamitos Bay Channel Dredging Project, which is expected to nourish the Peninsula Beach by roughly 415,000 CY, on-going Moffatt & Nichol coastal engineering evaluation for interim adaptations, boardwalk repairs, and continued beach management will provide important components of the City's response. In parallel, staff will continue evaluating regional and long-term solutions, including coordination with Port projects that may generate large volumes of suitable beach material.

These efforts are particularly important as the region enters the anticipated 2026–27 El Niño season with an increased likelihood of above-normal precipitation across Southern California. While El Niño does not predict the occurrence or severity of any individual storm, the current outlook reinforces the need to maintain readiness for additional periods of elevated surf, coastal flooding, erosion, and storm-related impacts.

Staff will continue to monitor conditions, prepare for potential additional storm events, and provide updates as engineering evaluations are completed, interim protection recommendations are developed, and additional information becomes available.

For more information, please contact Joshua Hickman, Director of Public Works at [joshua.hickman@longbeach.gov](mailto:joshua.hickman@longbeach.gov) or (562) 570-5714.

ATTACHMENTS

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September 24, 2026

**ATTN: Thomas Modica, City Manager**

Long Beach City Manager Office  
411 W Ocean Blvd.  
Long Beach, CA 90802

**SUBJECT: LONG BEACH PENINSULA POST-HURRICANE MARIE INSPECTION SUMMARY AND CONCEPTUAL ALTERNATIVES**

Dear Mr. Modica,

In early September 2026, Hurricane Marie generated an unusually large, long-period southerly swell that coincided with elevated tides and water levels, resulting in significant beach erosion, wave runup, and wave overtopping along the Long Beach Peninsula. The event caused significant damage to the peninsula boardwalk and timber bulkhead, loss of sandy beach area, and impacted adjacent private properties.

Recognizing the need for both immediate protection and long-term resilience planning, the City retained Moffatt & Nichol (M&N) to evaluate the structural condition of the bulkhead and develop conceptual alternatives for near-term shoreline protection.

The following summarizes the findings of M&N's post-storm inspection and the engineering alternatives evaluated to improve protection of Peninsula Beach homes, public infrastructure, and shoreline assets from future storm events.

**Emergency Post-Event Bulkhead and Boardwalk Inspection Summary**

Following a request from the City on September 7, 2026, M&N coordinated a field response and conducted an emergency post-event inspection of the timber boardwalk and bulkhead between 63<sup>rd</sup> Place and 67<sup>th</sup> Place on September 8, 2026. The inspection was timed to be during the low tide to maximize visibility of sandy beach conditions and the lower sections of the bulkhead.

The inspection identified substantial beach sand erosion, including exposure of rocks that had previously been buried beneath sand. The timber bulkhead was found to be in poor to critical condition, with displaced and missing planks occurring throughout its length. Upper and lower timber wales were missing along approximately 20 to 30 percent of the inspected length. While access below the boardwalk was limited, the team did observe evidence of significant sand loss (below design grade) and undermining of the adjacent/upland structures' foundations. Overall, the inspection concluded that the existing timber bulkhead has experienced significant deterioration and erosion-related impacts, resulting in localized structural undermining and increased vulnerability to future storm events.

Based on these findings, M&N evaluated three potential bulkhead repair strategies:



- *Localized Timber Repairs (Patch Option)*. Replace damaged timber components, repair gaps, replace wales as needed, and restore approximately 1,000 cubic yards (cy) of backfill sand under the boardwalk. This option offers the fastest implementation but provides only short-term protection and leaves the structure vulnerable to future storm damage.
- *Timber Oversheeting*. Oversheet ~300 lf of bulkhead with new timber, install new wales, resecure the remaining timber planks to restore the integrity of the bulkhead, and restore approximately 1,000 cy under the boardwalk. This alternative preserves the existing aesthetic and minimizes environmental disturbance. However, its long-term effectiveness depends on the condition of the existing timber structure, portions of which may be beyond repair.
- *Seaward Sheet Pile Wall (FRP or Steel)*. Construct a new sheet pile wall along approximately 850 lf seaward of the existing timber bulkhead. Although this option requires more complex construction and access, it provides the most durable long-term solution, improves resistance to water intrusion, and offers opportunities for future storm resilience enhancements.

M&N understands the City is already in process of designing and implementing immediate repairs of the timber bulkhead, separate from the first two options cited above and thus the first two options are not further discussed in this letter. The third option (sheet pile) is further discussed below.

### **Conceptual Alternatives:**

To support the City's evaluation of potential shoreline protection measures for the Peninsula between 63<sup>rd</sup> Place and 67<sup>th</sup> Place, M&N developed several conceptual alternatives intended to reduce future storm-related erosion, flooding, and damage to public infrastructure and adjacent properties. In addition to the bulkhead repair options discussed above, M&N preliminarily developed and assessed:

- A “full profile” rock revetment, intended to meet coastal engineering design standards.
- A “low profile” (lower crest) rock revetment which could be buried in sand, but which still experiences wave overtopping.
- Sand placement (beach nourishment) using sand “backpassed” from other areas of the Long Beach shoreline.

The following table provides a comparison of high-level / rough-order-of-magnitude (ROM) construction costs, soft costs (e.g., design, permitting, construction administration, conservatively assumed to be approximately 40% of construction costs), and pros and cons of each of the conceptual alternatives. Two other alternatives were initially developed: a) sand placement using imported sand from a quarry and b) placement of sheet pile on the landward side of the existing bulkhead. The former was eliminated due to cost and the latter due to likely performance issues.

It is important to understand that these alternatives were developed in a very short period of time with no/little supporting engineering analyses. Thus, the specific designs (quantities and costs) of these alternatives may change upon detailed design.

These near-term alternatives do not preclude other long-term coastal resilience options such as nearshore rocky reefs, eelgrass beds, and shore-perpendicular groins/headlands. However, these other long-term options are not practical for implementation in the immediate/near term.



Table 1: Conceptual Alternatives Comparisons

| Alternative                                                                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ROM Construction Cost | Soft Costs      | Pros and Cons                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Full-Profile Rock Revetment (~850 linear ft)</b>                     | This rock revetment would be designed to current coastal engineering standards for shoreline protection. It would be constructed along the seaward side of the timber bulkhead. The revetment section would include import of armor rock (likely 3-5-ton size rock) and underlayer rock (likely 0.25-ton) (~22,000 tons total) and geotextile filter fabric. The revetment would extend approximately 55 ft seaward of the bulkhead. Preliminarily, the crest (top) elevation would be 16 feet above Mean Lower Low Water (approximately 2 ft higher than the top of the timber bulkhead). | ~\$5.3M-6.8M          | ~\$2.1M -2.7M   | <p><b>Pros:</b></p> <ul style="list-style-type: none"><li>• No wave overtopping with current sea levels.</li><li>• Provides 100-year-storm-event shoreline protection, commensurate with coastal engineering design standards.</li><li>• Provides last-line-of-defense protection during storm events and when/if beach nourishment has not occurred.</li></ul> <p><b>Cons:</b></p> <ul style="list-style-type: none"><li>• Potential long lead time for rock procurement from quarries</li><li>• 2-3 months of construction duration</li><li>• Haul truck traffic during construction.</li><li>• Would likely present the greatest permitting challenge (requires approvals from the CCC, USACE, and RWQCB). May be possible to mitigate agency issues if City agrees to keep revetment buried during nominal coastal conditions.</li><li>• Loss of sandy beach towel space due to rock footprint</li><li>• Aesthetics</li></ul>                                                                                                             |
| <b>2. Low-Profile Rock Revetment Adjacent to Bulkhead (~850 linear ft)</b> | A lower profile (lower crest) rock revetment would be constructed along the seaward side of the bulkhead. The revetment section would include armor rock (likely 3-5-ton size rock), underlayer rock (likely 0.25-ton) (~9,000 tons total) and geotextile filter fabric. The revetment would extend approximately 30 ft seaward of the bulkhead. The crest (top) elevation would be ~11 ft above Mean Lower Low Water (approximately the same elevation as the boardwalk).                                                                                                                 | ~\$2.5M-\$3.4M        | ~\$1M - \$1.36M | <p><b>Pros:</b></p> <ul style="list-style-type: none"><li>• Preliminary analysis indicates wave velocities at the timber bulkhead would remain below FEMA damage thresholds.</li><li>• Could be mostly buried with sand following the upcoming channel maintenance dredging and/or sand backpassing.</li></ul> <p><b>Cons:</b></p> <ul style="list-style-type: none"><li>• Potential long lead time for rock procurement from quarries</li><li>• Wave overtopping and localized water intrusion onto the boardwalk could still occur during more severe storm events.</li><li>• In contrast with the Alternative 3 revetment, this revetment would not be conducive for burying with vegetated dunes due to adjacency to boardwalk (high potential for eroded/windblown sand to get onto the boardwalk).</li><li>• Haul truck traffic during construction.</li><li>• Regulatory permitting challenges, although to a lesser extent than Alt 1.</li><li>• Loss of sandy beach towel space due to rock footprint</li><li>• Aesthetics</li></ul> |



| Alternative                                                                     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ROM Construction Cost                                                                                                    | Soft Costs       | Pros and Cons                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3. Low-Profile Rock Revetment with Vegetated Sand Dunes (~850 linear ft)</b> | The low-profile revetment in this alternative would have a similar lower crest elevation, but a different design section and location than Alternative 2, to allow for the revetment to be covered by sand and/or vegetated dunes. Whereas the crest of the Alternative 2 revetment is immediately adjacent to (seaward of) the bulkhead, this alternative 3 has its crest farther seaward from the bulkhead. The revetment section would include armor rock (likely 3-5-ton size rock), underlayer rock (likely 0.25-ton) (~14,000 tons total) and geotextile filter fabric. The revetment footprint is approximately 45 feet. Similar to Alternative 2, the crest (top) elevation would be ~11 ft above Mean Lower Low Water (approximately the same elevation as the boardwalk). The sand cover/dune would extend approximately 5 ft above the top of the rock (approximately 2 ft higher than the top of the timber bulkhead). | ~\$3.6M - \$4.9M (cost for revetment only; assume sand cover provided via Alt 3 or channel maintenance dredging project) | ~\$1.4M - \$1.9M | <b>Pros:</b> <ul style="list-style-type: none"><li>• Could be fully buried with sand and/or vegetated dunes following the upcoming channel maintenance dredging and/or sand backpassing.</li><li>• Would provide additional protection against wave overtopping if a wide (75-100 ft) beach berm width is maintained.</li><li>• If future erosion reduces sand cover, the underlying rock revetment would continue to provide shoreline protection comparable to that provided under Alternative 2.</li><li>• Enhanced habitat area with vegetated dunes</li></ul> <b>Cons:</b> <ul style="list-style-type: none"><li>• Potential long lead time for rock procurement from quarries</li><li>• Loss of sandy beach towel space if vegetated dunes are implemented.</li><li>• Haul truck traffic during construction.</li><li>• Regulatory permitting challenges although to a lesser extent than Alternatives 1 and 2.</li><li>• Need for sand re-nourishment</li><li>• Need to maintain wide fronting beach berm to sustain vegetated dunes (if implemented)</li></ul> |
| <b>4. Beach Nourishment using Large-Scale Sand Backpassing (100,000 cy)</b>     | This alternative would consist of 100,000 cubic yards of beach nourishment (sand placement), adding approximately 75 ft of beach width. Sand would be sourced (excavated and “backpassed”) from Alamitos Beach. Utilize higher-capacity sand haul equipment, e.g., scrapers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | \$3-5M, for closest borrow site and assuming outside construction contractor                                             | ~\$1.2M - \$2M   | <b>Pros:</b> <ul style="list-style-type: none"><li>• Sand immediately available.</li><li>• Could be implemented within two months using larger capacity sand haul equipment</li><li>• Assumed covered by existing City permits (e.g., CDP)</li><li>• Provides effective shoreline protection if beach berm width of at least 75 ft is maintained over time.</li></ul> <b>Cons:</b> <ul style="list-style-type: none"><li>• Haul truck traffic during construction and re-nourishment events.</li><li>• Lessens beach width and level of shoreline protection at sand source excavation areas.</li><li>• Need for sand re-nourishment following future major storm events to maintain the desired level of protection.</li></ul>                                                                                                                                                                                                                                                                                                                                        |



| Alternative                            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ROM Construction Cost                  | Soft Costs       | Pros and Cons                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>5. Sheet Piles (~850 linear ft)</b> | This alternative would consist of installing sheet pile directly adjacent to the seaward side of the bulkhead to reinforce the existing timber bulkhead. The sheet pile could be fiber-reinforced polymer (FRP) or steel sheet pile (SSP). This alternative would require a timber cap which spans and connects the existing bulkhead and new sheet pile structure. Additionally, approximately 1,000 cubic yards of sand would be placed under the boardwalk to backfill sand lost during the storm event (restore design grade and pile embedment capacity). The height of the new sheet pile would match the existing timber bulkhead. | FRP:<br>~\$1.5M<br><br>SSP:<br>~\$2.7M | ~\$0.6M<br>-1.1M | <p><b>Pros:</b></p> <ul style="list-style-type: none"><li>• Provides effective protection against water intrusion through the bulkhead, reducing the potential for continued erosion and loss of backfill material behind the wall.</li><li>• Existing timber piles may be reused.</li><li>• Possibility for engineering and installing the sheet pile higher than the existing timber bulkhead. Or may be able to design a system with the ability to add temporary height augmentation during storm events.</li><li>• Potential to encapsulate instead of demolish existing timber bulkhead. Demo costs may be high due to disposal of creosote-treated wood.</li><li>• Small beach footprint</li><li>• Longest lasting bulkhead options. May be viewed more favorably than rock by CCC because of minimal footprint (however, may be construction issue; see con below).</li></ul> <p><b>Cons:</b></p> <ul style="list-style-type: none"><li>• Will <u>not</u> prevent wave overtopping and flooding onto the boardwalk and backland during extreme storm events, based on the assumption that the new sheet pile would be no higher than the existing timber bulkhead and temporary height augmentation is not feasible.</li><li>• Potential long lead time for sheet pile procurement from suppliers.</li><li>• Constructability access challenges; no landside access available so would need to build work platform / berm on the sand to install sheet pile.</li><li>• Will need to temporarily remove boardwalk decking.</li><li>• Drainage must be installed behind the new sheet pile to ensure minimal water retention.</li><li>• Aesthetic changes to existing timber bulkhead.</li></ul> |



## Potential Consequences of Doing Nothing

The Hurricane Marie event resulted in substantial erosion of the Long Beach Peninsula beach, removal of a significant portion of the protective sand buffer, and exposure of portions of the existing bulkhead that had been buried for decades. As a result, the Peninsula is entering the upcoming winter storm season in a much more vulnerable condition than what is typical. If no near-term shoreline protection measures are implemented, El Niño-elevated water levels and large wave events would further impact the already damaged shoreline. Because the protective beach fronting the boardwalk is non-existent, deeper water depths can occur in front of the existing bulkhead, and therefore larger breaking waves can impact it. This will likely result in significant additional wave overtopping and damage to the boardwalk, bulkhead, utilities, public infrastructure, and adjacent private property.

The extent of future impacts cannot be predicted with certainty and will depend on the timing, magnitude, and frequency of future storm events. However, the State of California has declared a statewide emergency associated with the developing 2026-27 El Niño, citing a greater than 90% probability of a very strong event this winter and a 69% probability that it will reach historic strength. This El Niño brings an increased potential for elevated coastal water levels, large waves, coastal flooding, and beach erosion. While El Niño conditions do not guarantee damaging coastal storms at any specific location, the possibility of one or more significant coastal storm events occurring this winter is elevated. In the absence of interim protective measures, continued erosion and storm damage could reduce the City's ability to maintain a protective beach buffer, potentially requiring more extensive emergency repairs and resulting in greater economic, operational, and public safety consequences than would occur if protective actions were implemented before future storm events.

## Recommendation

*Based on this assessment, limited funding, and the highly constrained timeframe to implement actions, M&N recommends a combined approach of large-scale sand backpassing (100,000 cubic yards) followed by, or in conjunction with, the entrance channel dredge project to nourish Peninsula Beach in the immediate term. Simultaneously, the City should move forward with design and permitting of a rock revetment and establish “trigger criteria” based on beach width to implement the revetment when/if needed.*

M&N appreciates the opportunity to partner with the City of Long Beach in evaluating and developing potential engineering solutions to address the impacts of Hurricane Marie. We look forward to continuing to support the City as it advances the selected shoreline protection strategy and works toward implementing effective, sustainable solutions for the community. Should you have any questions regarding this letter or wish to discuss the alternatives proposed, please contact me at 657-261-2699 or Kim Garvey at 562-317-3527.

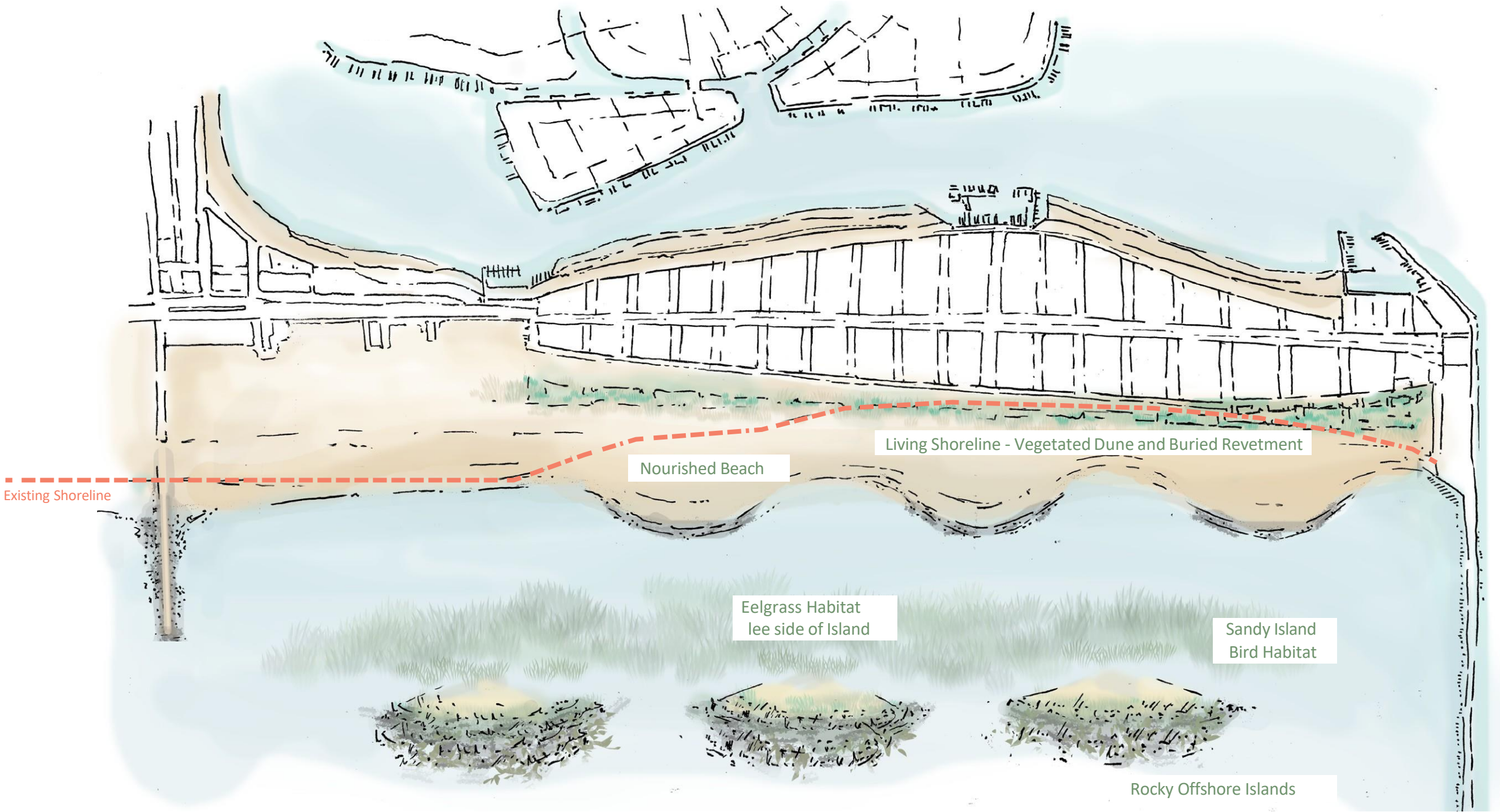
Sincerely,

**Moffatt & Nichol**

Weixia Jin, PhD, PE, BC.CE  
Vice President and SoCal Water Technical Director

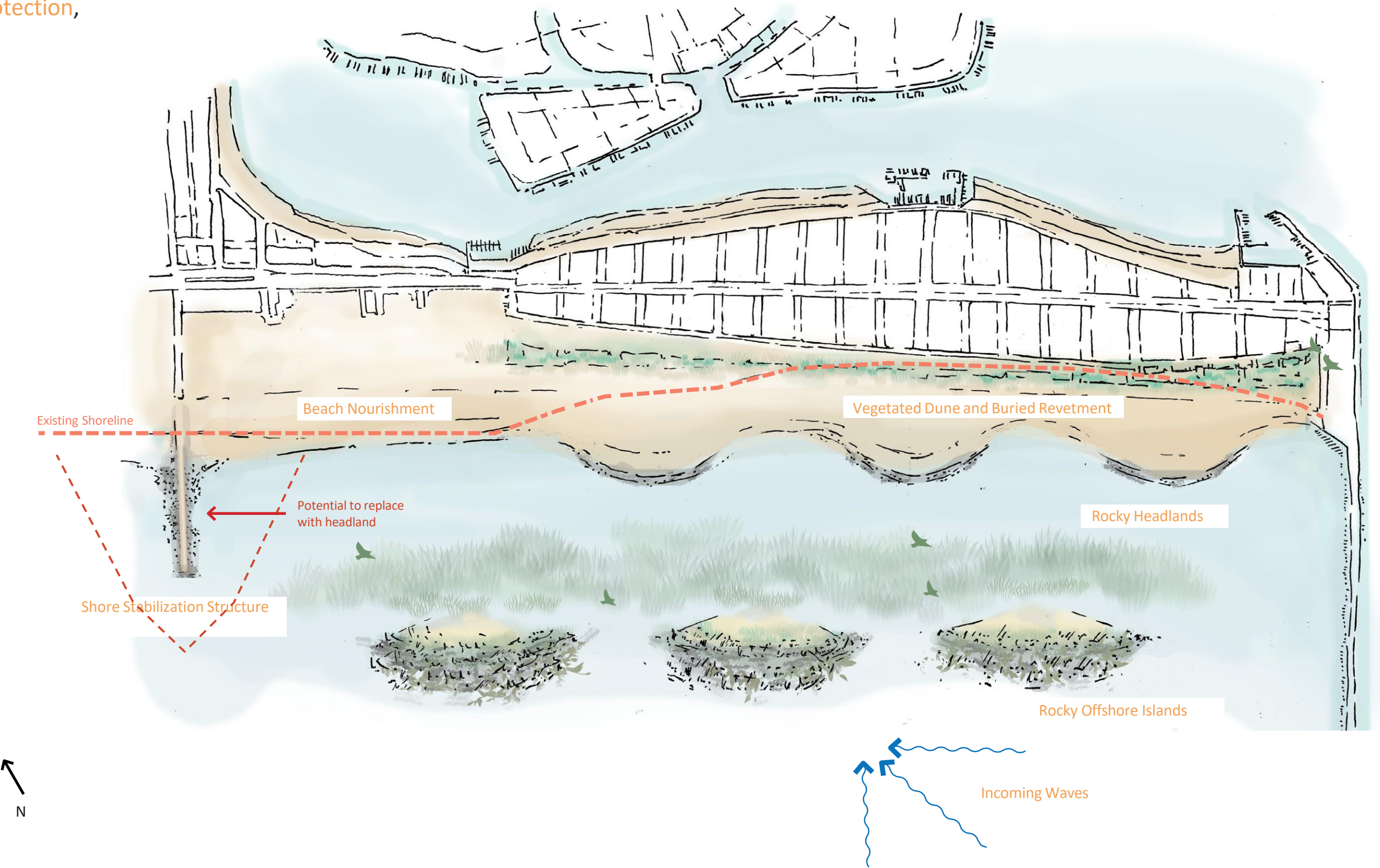
# A Multi-benefit Approach

A multilayer protection system that increases **habitat value**,



# A Multi-benefit Approach

A multilayer protection system that increases **habitat value**, provides **shoreline protection**,



# A Multi-benefit Approach

A multilayer protection system that increases **habitat value**, provides **shoreline protection**, and enhances **public access**.

