Appendix H

Proposed Shoreline Improvements

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Table H-1. Description of Existing Shoreline Conditions and Proposed Improvement Concepts				
Parcel or Area	***Location***	***Proposed Use***	***Existing Shoreline Conditions***	***Proposed Improvement Concepts***
North Shore	Grasslands South, Bayview Gardens North, Last Rubble	Waterfront Recreation	The slope protection on the north portion of the segment is a mixture of concrete rubble, rock riprap, and brick. The slope protection varies in size from cobbles to 4 feet in diameter. The north shoreline shows two small areas of unprotected shoreline that are fronted by exposed mud flats and vegetation.	Improve the present riprap edge along the shoreline to required elevations (placing riprap) to remain consistent with the present configuration. At the two reaches where opportunities exist for a natural edge, lay back the slope at a flatter configuration and plant marsh plantings.
East Shore	Last Rubble, Heart of the Park	Waterfront Recreation	The eastern shoreline is mainly riprap protected, except for one small sandy beach area built as a demonstration project by Art Ecology, a local community group. Burrowing from ground squirrels and other rodents was noted along the eastern, unprotected portions of this segment.	Improve the present riprap edge along the shoreline to required elevations (placing riprap) to remain consistent with the present configuration. At the mid-point of the Wind Meadow reach, construct a sandy recreational beach by laying the slope back at a 6H:1V or flatter configuration.
South Shore	Point, Heart of the Park, Neck, Last Port	Waterfront Recreation	The slope protection on the south portion of the Candlestick segment is primarily rock riprap. The slope protection varies in size from 1 to 4 feet in diameter. Along the majority of the south-facing shoreline, active erosion was observed in the higher portions of the embankment.	Improve the present riprap edge along the shoreline to required elevations (placing riprap) to remain consistent with the present configuration.
B	Drydocks 5 to 7	Northside Park/Waterfront Promenade	The portion of shoreline west of the submarine drydocks (Drydocks 5, 6, 7) is an embankment protected by riprap, with some sandy pocket beach areas in the sheltered coves. This segment is part of the Navy's proposed remediation action, and is therefore not included in the analysis. The submarine drydocks consist of three slipways (Drydocks 5, 6, and 7) with concrete bulkheads on either side of each slipway. The portion between adjacent bulkheads consists of timber pile-supported deck. Portions of this segment are part of the Navy's remediation action, wherein the timber structures will be demolished and any contaminated sediments at the bottom of the drydocks will be dredged by the Navy. The remaining portions (shoreline and concrete structures perpendicular to shoreline) are part of the Redevelopment project.	This portion of shoreline will be improved to a riprap revetment by the Navy. The Navy will demolish the timber portions of the drydocks, and excavate any contaminated sediments. As part of the redevelopment project, the following improvements are envisioned: ■ Concrete bulkheads will be left in place but disconnected from the shoreline by demolishing the sections near the shoreline to prevent public access to the walls for safety reasons ■ For slope stability reasons, a rock buttress will be placed along the quay-wall extending from the bottom of the docks to about mid-tide level elevation (to be determined after geotechnical studies are complete) ■ Weep-holes will be constructed in the quay-wall above low tide elevation to relieve the loading from the backfill along the shoreline

Table H-1. Description of Existing Shoreline Conditions and Proposed Improvement Concepts				
B	Wharf—Berths 55 to 61	Waterfront Promenade	The wharf at berths 55-61 is approximately 1100 ft long. Berths 55, 56, 57, and 58 are located along two piers perpendicular to the wharf and constructed of timber decking and supported by timber piles. The pier for berths 59 and 60 (located just to the east of berths 57 and 58) no longer exists. The wharf is a reinforced concrete structure and the timber piers are connected to the concrete wharf. Each bent is supported by four 4-ft diameter concrete-filled caissons, the bents are spaced at 40 ft on center. The deck is a reinforced concrete slab supported by reinforced concrete beams and a deck elevation of +13.25 ft MLLW. The record drawings indicate precast beams and cast in place deck slab with a thickness of 14 inches. Based on drawing information found, the Design Live Load for this wharf is 600 pounds per square foot (psf). Furthermore, it is also designed for a truck crane loading of 21,000 lbs. per wheel (truck crane with 6 wheels). The riprap slope protection underneath the wharf is a minimum 2 ft thick based on the drawings and has a slope of 1.5 horizontal to 1 vertical (1.5H:1V). <u>Riprap-Protected Slope East of Berth 55 (Heritage Park)</u> This segment of shoreline is protected by concrete debris and riprap, and is part of the Navy's remediation action. Therefore, it is not included in the analysis.	The wharf at Berths 55 through 61 will need to be repaired and upgraded so that it can be used as a promenade for public access. Proposed repairs are: ■ Repairs to the 4-ft diameter steel caisson piles, which could range from limiting ongoing corrosion by wrapping or encasing the piles in concrete, to structural retrofit of piles by welding additional steel plates to the piles ■ Repairs to the reinforced concrete beams and deck slab including spall repair using shotcrete, grout, and/or epoxy injections. <u>Riprap Protected Slope East of Berth 55 (Heritage Park)</u> This portion of shoreline will be improved to a riprap revetment by the Navy.
C	Drydock 3	Heritage Park	Drydock 3 is a reinforced concrete structure with concrete sidewalls. The cross-section of the drydock varies from trapezoidal to rectangular, and the bottom surface is reinforced concrete. The concrete sidewalls vary between smooth-surfaced and stepped, depending on location and elevation. The concrete steps at some places of the concrete sidewalls apparently provided operational access during drydocking.	The drydock is proposed to remain at its current configuration but with the following modifications: ■ Add weep holes on the sidewall to reduce pressure behind it. These weep holes shall be located above the lowest tide and shall extend to near the top of the drydock walls ■ Add rock or sand buttress on the face of the drydock walls at the bottom. This will result in additional passive resistance with the intent of increasing slope stability ■ Patching all exposed spalls, replacement of reinforcing bars if necessary, epoxy material injection to cracks, and filling any holes and/or depressions.

Table H-1. Description of Existing Shoreline Conditions and Proposed Improvement Concepts				
C	Wharf—Drydocks 2 & 3	Heritage Park	There is a timber pile-supported wharf designated as Wharf No. 2 located between Drydock No. 2 and 3. The deck framing consist of 4 x 12 timber planks, 4 x 14 stringers, and 14 x 14 timber pile caps. The supporting timber piles are spaced at 10 ft maximum. The deck elevation is indicated on the drawings as +12.0 ft MLLW.	This portion of shoreline will be removed by the Navy.
	Drydock 2	Heritage Park	Drydock 2 is very similar to Drydock 3 but smaller (shorter and shallower).	Drydock 2 is similar to Drydock 3 and the repairs described above shall be applied here too.
	Wharf—Berths 1& 2	Waterfront Promenade[a]	The wharf along Berths 1 and 2 is about 1000 ft long and 40 ft wide, and is backed by a concrete bulkhead along the shoreline. It is a reinforced concrete structure consisting of reinforced cast in place deck slab 8-inch thick, 16-inch wide x 36-inch deep beams, 2.5 ft wide x 5 ft deep girders, 4 ft wide x 6.5 ft deep pile caps, and 3 ft diameter concrete-filled steel cylindrical piles. There is a steel (wide-flange section) batter pile connected to the pile cap on the inboard side of the wharf. The batter piles are spaced at 6.25 ft. and the cylindrical piles are spaced at 25 ft on center. The deck elevation is indicated as +12.0 ft MLLW and has a rail track that runs parallel to the face of the wharf. The reviewed drawings indicate a design live load of 600 psf, 15-ton capacity Re-gunning crane, and 25-ton locomotive.	The wharf structure can be repaired and left in its present configuration. Recommended repairs include: ■ Construct a new sheet pile bulkhead behind the existing steel bulkhead because it has very likely corroded to a point past its serviceable life. The new sheet piles will be driven and tied back to form the new shoreline location. ■ Inspect the pile-supported wharf portion of the structure and assess structural integrity of the deck and piles. If the structure is determined to be adequate, or repairable to current codes with relatively minor repairs, conduct the repairs for continued use as a waterfront promenade for public use. If the investigation finds the structure to be significantly deficient or expensive to repair, it will be demolished or left in place with appropriate landscaping improvements that will deter public access and yet serve as open-space.
	Berths 3 to 5	Waterfront Promenade	The shoreline along Berths 3 and 4 is about 1100 ft long. It is constructed as a filled-in quay-wall 58 ft wide using timber cribs and filled with bank run rock fill. The top is at elevation +12.0 ft MLLW. The timber crib wall is founded on a 5 ft thick sand blanket and 18-inch sand piles spaced at 20 ft on centers. The facing of the wharf is a reinforced concrete wall anchored to the timber cribbing. Timber fenders are attached to the concrete wall (at the top), which extend below the MLLW line. The shoreline along Berth 5 is about 400 ft long. It was constructed exactly the same as the quay-wall along Berths 3 and 4.	Based on visual observations and engineering judgment, it is likely that the structure can be repaired and left in its present configuration. Recommended repairs would include the following: ■ Remove the upper portions (10 to 15 ft) of the concrete wall facing including the timber cribbing and bank run rock fill. The facing shall be sloped back at a 2H:1V slope and protected with rock facing to provide a more natural-looking surface without any additional bayfill and related impacts. ■ Patching all exposed spalls, replacement of reinforcing bars if necessary, epoxy material injection to cracks, and filling any holes and/or depressions.

Table H-1. Description of Existing Shoreline Conditions and Proposed Improvement Concepts				
C	Berths 6 to 9	Waterfront Promenade[b]	The shoreline along Berths 6 though 9 is a 120 ft wide structure, 1000 ft long. Its construction is similar to the wharf for Berths 3 and 4 as filled-in quay-wall. The top is at elevation +12.0 ft MLLW. It is constructed using timber cribs extending the full width and height of the pier and filled with bank run rock fill. The timber crib wall is founded on a 5 ft thick sand blanket underneath a variable thickness bank run rock blanket. The facing of the wharves on each side of the pier is a reinforced concrete wall anchored to the timber cribbing and extends the full height of the pier. Timber fenders are attached to the concrete wall (at the top), which extend below the MLLW line. There are rail tracks along each side and parallel to the face of the pier.	Since this is the same type of construction as for Berths 3 and 4, the recommended modifications are the same. Refer to the description above. However, if additional investigations indicate that the timber cribs have been attacked by marine borers and are beyond repair, the repairs would be more extensive and may include complete demolition of the pier and replacement with a concrete or steel sheetpile bulkhead to serve as wave protection for the proposed marina in its lee.
	Drydock 4	Waterfront Promenade	Drydock 4 is a reinforced concrete structure with concrete sidewalls. The cross section of the drydock varies in trapezoidal shapes – the entrance has steeper sloping walls compared to the main drydock with flatter sloping walls. It is larger compared to Drydocks 2 and 3.	Since this is the same type of construction as for Drydocks 2 and 3, the recommended modifications are the same.
D	Berths 10 through 13	Waterfront Promenade[c]	The shoreline along Berths 10 through 13 was constructed in exactly the same manner as for Berths 6 through 9 (timber crib structure).	Since this is the same type of construction as for Berths 3 and 4, the recommended modifications are the same (see description above). However, if additional investigations indicate that the timber cribs have been attacked by marine borers and are beyond repair, the repairs would be more extensive and may include complete demolition of the pier and replacement with a concrete or steel sheetpile bulkhead to serve as wave protection for the proposed marina in its lee.

Table H-1. Description of Existing Shoreline Conditions and Proposed Improvement Concepts				
D	Berths 14; Berths 16 to 20	Waterfront Promenade	The shoreline along Berth 14 was constructed exactly the same as for Berths 3 through 5 (timber crib structure). The shoreline along Berths 16 through 20 is a quay-wall type filled-in structure. The pier was designated by the navy as the Regunning Pier. It is 400 ft wide and about 1650 ft long on the north side and about 1000 ft on the south side. The quay wall around the pier is a cellular type cofferdam using steel sheet piles with semi-circular shaped facing (in plan). Each cell is about 31 ft x 65 ft in plan with the sheet piles varying in lengths from 64 ft to 76 ft. The longer piles are along the exterior portion of each cell which represents the wall of the pier. The shorter piles are the "tie back" piles buried within the pier. The cells are filled with hydraulic sand fill. At the outer edge of the cells near the top of the pier, the cells are filled with "Quarry run chips and fines" 9.5 ft thick 5 ft wide at the top and 15 ft wide at the bottom according to the drawings. The rest of the pier is filled with sand or selected bank run fill. Refer to Figure D4 for a typical section of the pier cellular wall and details of its upper portion. The top of the pier is at elevation +12 ft MLLW. Along the edges, there is a 1.5 ft thick concrete cap on top of the steel sheet piles which provides a straight edge for the pier facing. Timber fenders are installed along the face of the pier for berthing. The top is surfaced with a concrete pavement and asphalt-wearing surface. There are rail tracks on top of the pier. At this pier, there is a large overhead crane rated at 450 tons. The crane is supported by steel-framed towers and the foundation for the towers is supported by steel H-shaped piles (14HP89). There are four towers. Each tower is supported by four legs. The foundation for each leg has thirty H-shaped steel piles. The foundation for this crane is independent from the pier cellular wall system. Various sections of the sheet pile wall are dilapidated or sheared off above the water line. The shoreline supported by the sheet pile wall is eroding and failing in locations where the sheet pile wall has been undermined.	<u>Berth 14 (Waterfront Promenade)</u> Since this is the same type of construction as for Berths 3 and 4, the recommended modifications are the same. Refer to the description above. <u>Berths 16 through 20 (Wildlife Habitat)</u> Visual observations of advanced corrosion and deterioration indicate that the steel sheetpile cellular bulkhead, that provides the shoreline facing for the pier, is beyond repair. The improvement options that could be implemented include replacing the bulkhead with a riprap edge or replacing it with a natural shoreline edge. Since the proposed land use is wildlife habitat, the recommended modification is as follows: Lay back the upper portion of the slope by saw-cutting the concrete deck at some distance from the shoreline and removing the sand fill at a 5H:1V slope (or gentler) Cutting the steel sheet piles at about mid-height (approximately low tide) or even lower Placing a coarse sand layer over the excavated slope to serve as substrate for grasses and other plants Constructing a boardwalk along the centerline of the smaller peninsula created as described above

Table H-1. Description of Existing Shoreline Conditions and Proposed Improvement Concepts				
D	Berths 15, 21, 22, & 29	Waterfront Promenade	The shoreline along Berths 15, 21, 22, and 29 are very similar in construction to the pier for berths 16 through 20 (described above). The wharf facing is a cellular type quay wall consisting of steel sheet piles with the cell filled with hydraulic sand fill. Each cell is 31 ft along the face of the wharf and about 65 ft wide. These berths do not have a concrete cap on top of the steel sheet piles.	Berth 15 (Waterfront Promenade) Visual observations of advanced corrosion and deterioration indicate that the steel sheetpile cellular bulkhead, that provides the shoreline facing for the pier, is beyond repair. The recommended improvement is to remove the upper portion (10 to 15 ft) of the sheetpile wall and sand fill behind it. The facing shall be sloped back at a 2H:1V slope and protected with rock facing to provide a more natural-looking surface without any additional bayfill and related impacts.
	Berths 23 to 28	Wildlife Habitat	The shoreline in this segment consists of a concrete pile-supported pier which is deteriorating. No active reuse is envisioned for the pier, and it will provide habitat for shorebirds.	Since the pier is very likely beyond its serviceable life, the recommended improvement is to detach it from shore and let it convert to a habitat for shorebirds that already use it. The detachment will prevent public access to this unstable pier, as well as raptors from accessing the habitat.
E	Berths 30 to 35	Wildlife Habitat	The shoreline in this segment consists of a concrete pile-supported pier which is deteriorating. No active reuse is envisioned for the pier, and it will provide habitat for shorebirds.	Since this is the same shoreline configuration (pier) as for Berths 23 through 28, the recommended modifications are the same (see description above).
	Berth 36	Grasslands Ecology Park	The shoreline in this segment is very similar in construction to Berth 29 (described above). The wharf facing is a cellular type quay wall consisting of steel sheet piles with the cell filled with hydraulic sand fill. Each cell is 31 ft along the face of the wharf and about 65 ft wide. The berth does not have a concrete cap on top of the steel sheet piles.	Since this is the same type of construction as for Berth 15, the recommended modifications are the same (see description above).
	Berth 37 to 42; Natural Edge/Riprap	Wildlife Habitat	The shoreline in this segment consists of a concrete pile-supported pier which is deteriorating. No active reuse is envisioned for the pier, and it will provide habitat for shorebirds. Riprap Protected Slope (Grasslands Ecology Park) The portion of shoreline west of Berth 36 is an embankment protected by a combination of riprap and concrete debris. Slope protection varies significantly in size from small rock and bricks, 4 to 8 inches in size, to large 4' blocks of concrete debris. This segment is part of the Navy's proposed remediation action, and is therefore not included in the analysis.	Since this is the same shoreline configuration (pier) as for Berths 23 through 28, the recommended modifications are the same (see description above). Riprap Protected Slope (Grasslands Ecology Park) This portion of shoreline will be improved to a riprap revetment by the Navy. However, the presence of vegetation and marshlands in this reach implies that there may be an opportunity to enhance this segment to a more natural marsh / mudflat edge. The recommended improvements include placing a suitable substrate in front of the revetment constructed by the Navy, and seeding it (or allowing natural propagation) with marsh plants.

Table H-1. Description of Existing Shoreline Conditions and Proposed Improvement Concepts				
E2	Natural Edge/Riprap	Grasslands Ecology Park	The shoreline along Parcel E-2 is an unprotected natural shoreline with some debris (broken concrete, broken bricks and random pieces of rock) lining the edges, as well as beach-fronted, unprotected slopes. Similar to Parcel E, this segment of the project shoreline is characterized by slopes protected by riprap or concrete debris, as well as beach-fronted, unprotected slopes. The shoreline shows areas of erosion as well as areas of vegetation/habitat growth within the intertidal zone. Slope protection, where it exists, consists of small rock and bricks, 4 to 8 inches in size.	This portion of shoreline will be improved to a riprap revetment by the Navy. However, the presence of vegetation and marshlands in this reach implies that there may be an opportunity to enhance this segment to a more natural marsh / mudflat edge. The recommended improvements include placing a suitable substrate in front of the revetment constructed by the Navy, and seeding it (or allowing natural propagation) with marsh plants.
Source: SFRA 2009, Draft EIR for Candlestick Park – Hunters Point Shipyard				

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