3.4 WATER AND AQUATIC SEDIMENT QUALITY

This section describes existing environmental conditions related to water and aquatic sediment quality in Buena Vista Lagoon during lagoon enhancement activities, as well as nearshore and offshore water quality in the ocean during construction and materials disposal/reuse activities. This section also identifies pertinent policies, regulations, and plans governing water and aquatic sediment quality in the project footprint and associated with project activities, and evaluates the impacts associated with implementation of the Enhancement Project and its alternatives. Some discussion provided in this section overlaps slightly with Section 3.2 Hydrology, and references are made to that section where appropriate.

This section, including the baseline condition for project analysis, is based primarily on information from the *Buena Vista Lagoon Enhancement Project Water Quality Analysis* (Everest 2014; Appendix D), the *Buena Vista Lagoon Enhancement Project Bacteria and Nutrient Modeling* (Everest 2015; Appendix M), the *Buena Vista Lagoon Restoration Program Sediment Characterization Data Report* (SAIC 2008a), the *Carlsbad Hydrologic Unit (CHU) Lagoon Monitoring Report* (MACTEC 2009), CWMA WQIP (CWMA Responsible Agencies 2014), and the *Buena Vista Lagoon Restoration Feasibility Study Sediment Characterization, Final Report* (Everest and Battelle 2003). Everest (2014; Appendix D) conducted a water quality analysis for the proposed alternatives. In the analysis, residence times (i.e., the average length of time during which water is in a given location) were used as a surrogate for comparing the potential changes in water quality among the alternatives. Typically, a higher residence time results in lower water quality, while a lower residence time results in improved water quality. For a given level of pollutant loading, a reduction in residence time would indicate improved water quality. Everest (2015; Appendix M) conducted a modeling study using existing monitoring data collected from 2007 through 2008 (MACTEC 2009) to assess potential changes in bacteria and nutrient levels in lagoon basins under each alternative.

These sources include studies that were published prior to the project NOP; however, no substantial changes to those baseline characteristics described in earlier studies have occurred. There have been no documented sewage spills or additional sources of nutrients, sediment, or other pollutants into the lagoon since baseline information was collected and conditions within the lagoon are expected to be similar to conditions at the time of the studies. Therefore, the components of those studies referred to in this analysis can be considered suitable baseline information at the time of NOP publication.

3.4.1 EXISTING CONDITIONS

The relevant policies and regulations dictating water and aquatic sediment quality at the project site are discussed within this section.

Certain regulatory actions related to water quality would be required prior to project initiation by various regulatory agencies. Prior to implementation, the Enhancement Project must obtain various permit approvals from Corps, RWQCB, CDFW, and governing municipalities (i.e., Cities of Carlsbad and Oceanside) for the selected alternative. Also, the standards mandated by the San Diego Regional Municipal Storm Water Permit, Order R9-2013-0001 (as amended by Order R9-2015-0001) (Municipal Permit) among other federal, state, and or local stipulations would apply to the Enhancement Project. As such, the project would be required to implement post-construction BMPs to address water quality-related impacts. Prior to implementation of the Enhancement Project, the construction approach for the selected alternative must comply with the Construction General Permit, Order 2009-009-DWQ (as amended by Orders 2010-0014-DWQ and 2012-0006-DWQ) and the Municipal Permit, for storm water pollution prevention, applicable requirements for hydrology management (e.g., SUSMP, LID BMPs and HMP), and applicable storm water ordinances from municipal copermittees (i.e., Cities of Carlsbad and Oceanside) to properly control erosion and sediment transport, provide sufficient flood protection, and incorporate suitable LID BMPs to provide sufficient post-construction storm water management (e.g., infiltration and minimize impervious area). In addition, in compliance with the Construction General Permit, a project SWPPP would be prepared before beginning project construction activities to identify BMPs that would be used to minimize pollutant discharges.

Regulatory Setting

A full description of the regulatory setting for this document can be found in Appendix B. The following laws, regulations, policies, and plans are applicable to this resource area:

- Clean Water Act
- Federal Antidegradation Policy
- Assembly Bill 411: Beach Sanitation: Posting
- California Ocean Plan
- Construction General Permit
- Porter-Cologne Water Quality Control Act
- State Antidegradation Policy
- Carlsbad Watershed Management Plan
- Carlsbad Watershed Management Area Water Quality Improvement Plan
- San Diego Municipal Storm Water Permit
- San Diego Regional Water Quality Control Board Basin Plan

Buena Vista Lagoon Study Area

As discussed in Section 3.2 Hydrology, Buena Vista Lagoon is a coastal lagoon dominated by freshwater inputs from Buena Vista Creek and tributary upland areas in the vicinity of the lagoon, and is affected by urban runoff from a primarily urbanized watershed. The lagoon is traversed by various transportation infrastructure, leading to hydraulic inefficiencies of the current channel network. In addition, a weir and beach berm located at the lagoon inlet essentially prevent tidal flow. As a result, these developments coupled with very limited tidal influence have contributed to flow constrictions, decreased water fluctuations within the lagoon, long residence times, and a consistent degradation of water quality.

The primary source of freshwater inflow into the lagoon is storm water and urban runoff from Buena Vista Creek upstream of the I-5 Basin. The lagoon also receives minor inflows from several local storm drains along the perimeter of the lagoon. Urban runoff includes storm water runoff from precipitation events, as well as dry weather runoff from nuisance water and irrigation return water. Flow measurements from Buena Vista Creek recorded from October 1, 2007 through October 31, 2008 showed that the average dry weather flow from April 2008 through December 2008 was approximately 3 cubic feet per second (cfs), and the average wet weather flow from January through March was approximately 50 cfs (MACTEC 2009).

Beneficial Uses

The RWQCB defines beneficial uses of water bodies within the San Diego region in the 1994 Water Quality Control Plan for the San Diego Basin (RWQCB 1994), as amended and updated. Beneficial uses form the cornerstone of water quality protection under the Basin Plan. Based on beneficial use designation, water quality objectives (WQOs) are established to help maintain or enhance water quality to protect these uses for the long term. Beneficial uses of Buena Vista Lagoon are listed in Table 2-3 of the Basin Plan (RWQCB 1994) and are:

- Contact Water Recreation (REC-1)
- Non-contact Water Recreation (REC-2)
- Preservation of Biological Habitats of Special Significance (BIOL)
- Wildlife Habitat (WILD)
- Rare, Threatened or Endangered Species (RARE)
- Marine Habitat (MAR)
- Warm Freshwater Habitat (WARM)

Beneficial uses of groundwater underlying Buena Vista Lagoon are listed in Table 2-5 of the Basin Plan (RWQCB 1994) and are:

- Municipal and Domestic Supply (MUN) and
- Agricultural Supply (AGR).

However, these beneficial uses do not apply west of the eastern boundary of I-5, and this area is excepted from the sources of drinking water policy (RWQCB 1994). Therefore, groundwater beneficial uses only apply to groundwaters underlying the I-5 Basin.

Water and Sediment Quality Objectives and Criteria

The following WQOs apply to Buena Vista Lagoon based on the beneficial uses of the lagoon designated in the Basin Plan (RWQCB 1994):

- Un-ionized ammonia shall not exceed 0.025 milligrams per liter (mg/L) (as N).
- Total phosphorus shall not exceed 0.1 mg/L.
- Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses. The natural color of fish, shellfish, or other resources shall not be impaired.
- Lagoon dissolved oxygen (DO) levels shall not be less than 5.0 mg/L and the annual mean concentration shall not be less than 7 mg/L more than 10 percent of the time. Ocean waters shall not have DO levels less than 10 percent from the normal.
- Waters shall not contain floating material, including solids, liquids, foams, and scum in concentrations which cause nuisance or adversely affect beneficial uses.
- Changes in normal ambient pH levels shall not exceed 0.2 units in the lagoon. The pH shall not be depressed below 7.0 nor raised above 9.0.
- Waters shall not contain oils, greases, waxes, or other materials in concentrations which result in a visible film or coating on the surface of the water or on objects in the water, or which cause nuisance or which otherwise adversely affect beneficial uses.
- Pesticides shall not be present in the water column, sediments, or biota at concentrations that adversely affect beneficial uses or human health, wildlife, or aquatic organisms.
- Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life and cannot result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life.

- The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in a manner that would cause nuisance or adversely affect beneficial uses.
- Waters shall not contain suspended and settleable solids that cause nuisance or adversely affect beneficial uses.
- Waters shall not contain taste or odor producing substances at concentrations which cause a nuisance or adversely affect beneficial uses. The natural taste and odor of fish, shellfish or other water resources used for human consumption shall not be impaired.
- The natural temperature of a receiving water body shall not be altered unless the alteration can be shown to not adversely impact beneficial uses.
- Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.
- The fecal coliform concentration shall not exceed 400 organisms per 100 milliliters (ml) for more than 10 percent of the total samples during any 30-day period.
- Total coliform shall be less than 1,000 organisms per 100 ml; provided that not more than 20 percent of the samples at any sampling station, in any 30-day period, may exceed 1,000 organisms per 100 ml. Total coliform organisms in no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 organisms per 100 ml.
- The median total coliform concentration throughout the water column for any 30-day period shall not exceed 70 organisms per 100 ml nor shall more than 10 percent of the samples collected during any 30-day period exceed 230 organisms per 100 ml for waters designated as shellfish harvesting and commercial fishing.

The Basin Plan also states that water should be maintained free of toxic substances in concentrations that are toxic to, or produce negative physiological responses in, human, plant, animal, or aquatic life. A list of toxic substances and their numerical limits is provided in 40 CFR 131.36, which includes polychlorinated biphenyls (PCBs) and the pesticides dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyldichloroethane (DDD).

According to the Clean Water Act (CWA) Section 303(d) list of impaired water bodies, Buena Vista Lagoon surface waters are listed as being impaired by nutrients, indicator bacteria, and sedimentation/siltation (SWRCB 2011). These conditions have originated from unspecified point and nonpoint sources (e.g., pipe discharges and runoff, respectively).

WQOs for groundwater underlying the I-5 Basin are the following (WQOs for groundwater do not apply west of the eastern boundary of I-5) (RWQCB 1994):

Total Dissolved Solids (TDS) = 3,500 mg/L
Chlorides (Cl) = 800 mg/L
Sulfate (SO_4) = 500 mg/L
Percent Sodium (%Na) = 60 mg/L
Nitrate (NO_3) = 45 mg/L
Iron (Fe) = 0.3 mg/L
Manganese (Mn) = 0.05 mg/L
Methylene Blue Activated Substances (MBAS) = 0.5 mg/L
Boron (B) = 2.0 mg/L
Turbidity = 5 NTU
Color = 15 units
Fluoride (F) = 1.0 mg/L

Sediment quality objectives within Buena Vista Lagoon (as stated in the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1, Sediment Quality [SWRCB 2009a]) include the following:

- Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities.
- Pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health.

<u>Salinity</u>

Currently, salinity levels within the lagoon are low due to the freshwater-dominated system. Although the weir limits ocean water entering the lagoon, some exchange of ocean and lagoon water occurs when severe high tide and wave conditions occur and the beach berm is breached. Field data show that salinity in the lagoon ranges from fresh to brackish. Everest (2015) shows salinity levels in the I-5 Basin ranging from 0 to 2 parts per thousand (ppt), and those in the Coast Highway Basin in the range of 0.5 to 2.5 ppt. For reference, average ocean water salinity is 35 ppt.

Dissolved Oxygen

Fluctuations in DO are typical in lagoon and estuary systems, and result from various environmental factors such as prolonged impoundment, minimal circulation and aeration, temperature, plant respiration, decomposition of organic matter, and stratification of the water column. Low DO concentrations are caused from one or more of the following factors: low insolation (solar radiation) that reduces oxygen production, increased freshwater inflow and impeded circulation that prevents turnover and ventilation of bottom waters, and poor bottom water ventilation due to stratification (MACTEC 2009). Data collected in 2008 by MACTEC (2009) indicate that DO levels in the lagoon occasionally fell below the WQO of 5 mg/L, approximately 19 percent of the time, with values ranging from 1.0 mg/L to 26.3 mg/L during dry weather, and from 3.2 mg/L to 17.2 mg/L during wet weather. Continuous monitoring was also conducted in the I-5 Basin and Coast Highway Basin from January through October 2008; average DO concentrations were 10.1 mg/L and 7.3 mg/L in the I-5 Basin and Coast Highway Basin, respectively (Everest 2015).

Nutrients

Excessive concentrations of nutrients such as nitrogen and phosphorus can lead to algal blooms that in turn promote eutrophication and hypoxia (depressed DO) that can stress aquatic organisms and cause unpleasant odors. Nutrient levels affect the DO levels in the water column, which are an important parameter for sustaining aquatic life. High nutrient levels can cause algae growth; algae can affect DO by releasing oxygen during the day, and by respiring and pulling DO out of the water column at night, thus lowering DO levels. Algae are also a sign of poor circulation and potentially compromised water quality for organisms. Accumulated sediment from the watershed upstream of Buena Vista Lagoon leads to decreasing water depths and increasing nutrient levels and low DO within the lagoon. Periodic algae blooms have been observed to cause localized fish kills in the lagoon and nutrient buildup in the sediments have promoted eutrophication in the lagoon (Geomorph 2014; Appendix D).

Everest (2015) indicates that nutrient concentrations were higher during winter and spring months compared with the summer and fall months, and concentrations typically exceeded WQOs during wet weather events. The ammonia WQO (0.025 mg/L) was exceeded in 83 percent of samples with an average concentration of 0.09 mg/L; the total nitrogen objective (1.0 mg/L) was exceeded in 83.5 percent of samples with an average concentration of 1.56 mg/L, and total phosphorus (0.1 mg/L) was exceeded in 100 percent of samples collected during wet weather with an average concentration of 0.21 mg/L (MACTEC 2009). During dry weather, 29 percent of samples exceeded the ammonia WQO (average concentration of 0.04 mg/L); 56 percent of samples exceeded the total nitrogen WQO (average concentration of 1.42 mg/L), and 37 percent of samples exceeded the total phosphorus WQO (average concentration of 0.15 mg/L) (MACTEC 2009).

Sediment

There is currently substantial sediment accumulation in Buena Vista Lagoon due to the effects of urbanization within the watershed and the lack of tidal flushing of the lagoon system. The weir and beach berm reduce sediment transport through the lagoon and out to the Pacific Ocean. The lagoon is currently listed as impaired for sedimentation/siltation (SWRCB 2011). Sediment can degrade water quality if present in sufficient concentrations. Many of the soil types within the lagoon are categorized as severely erodible silts, clays, and fines, and substantial sedimentation can occur when these soils are exposed during seasons of high runoff (CWN 2002).

In 2008, total solids (suspended and dissolved solids) were measured at multiple locations within each lagoon basin. Results ranged from 23.0 percent in the Weir Basin to 76.5 percent in the Coast Highway Basin. Total solids increased as depths increased in each basin (SAIC 2008a). Higher concentrations of suspended solids in a water body can often mean higher concentrations of bacteria, nutrients, pesticides, and metals in the water as these pollutants may attach to sediment particles. High total suspended solids (TSS) can also reduce DO levels in the water column by blocking light from reaching submerged vegetation and slowing photosynthesis. High TSS can also cause an increase in surface water temperature, which can further reduce DO levels.

The aquatic sediment quality analysis indicates the suitability of material identified for dredging from the lagoon for disposal/reuse at proposed sites from both a contamination and grain size perspective. To characterize chemical suitability of lagoon sediments, National Oceanic and Atmospheric Administration (NOAA) numerical sediment quality guidelines (SQGs) for aquatic sediment were used as an informal, interpretive tool, which include two SQG concentrations thresholds:

- "Effects Range-Low" (ERL), where adverse effects were not likely with concentrations below this level; and
- "Effects Range-Median" (ERM), concentrations above which adverse effects were more likely.

The SQGs do not suggest that no effects would occur below the ERL or that adverse effects would occur above the ERM. SQGs are intended to establish statistical guidelines that can be used to rank and prioritize sites of concern and chemicals of concern (NOAA 1999).

A chemical analysis of sediments in Buena Vista Lagoon was conducted following protocols in the *Buena Vista Lagoon Restoration Program Sediment Characterization Sampling and Analysis*

Plan/Quality Assurance Plan (SAIC 2008b). A total of 19 samples (17 cores and two surface grabs) were collected in the four basins. Borings were collected from upper and lower layers of sediments extending to a depth of 20 feet below ground surface (bgs). The chemical analysis showed that most of the tested analytes fell below their respective ERLs and no analytes were detected above their ERMs. There was minimal evidence of contamination of elemental or organic compounds. Sediment toxicity had at least a 92 percent survival rate in all samples collected. The analytes that exceeded their ERLs are shown in Table 3.4-1.

Table 3.4-1
Sediment Contaminant Concentrations

Lagoon Basin	Sample Composite ID	Contaminant	Units	ERL	ERM	Sample Concentration
I-5 (0–1 feet)	BVL-01	4,4'-DDE	µg/kg	2.2	27	9.8
I-5 (1–3 feet)	BVL-02	4,4'-DDE	µg/kg	2.2	27	6.4
Coast Highway (0–1 feet)	BVL-05	4,4'-DDE	µg/kg	2.2	27	4.2
Railroad (0–1 feet)	BVL-09	4,4'-DDE	µg/kg	2.2	27	6.6
Railroad (1–3 feet)	BVL-10	4,4'-DDE	µg/kg	2.2	27	8.5
Weir (0–1 feet)	BVL-13	4,4'-DDE	µg/kg	2.2	27	6.6
I-5 (0–1 feet)	BVL-01	Arsenic	mg/kg	8.2	70	8.3
Railroad (0–1 feet)	BVL-09	Arsenic	mg/kg	8.2	70	8.57
Railroad (0–1 feet)	BVL-09	Chromium	mg/kg	81	370	107
I-5 (0–1 feet)	BVL-01	Copper	mg/kg	34	270	59.8
I-5 (1–3 feet)	BVL-02	Copper	mg/kg	34	270	49.2
Coast Highway (0–1 feet)	BVL-05	Copper	mg/kg	34	270	50.4
Railroad (0–1 feet)	BVL-09	Copper	mg/kg	34	270	139
Weir (0–1 feet)	BVL-13	Copper	mg/kg	34	270	103
Railroad (0–1 feet)	BVL-09	Lead	mg/kg	46.7	218	69.3
Weir (0–1 feet)	BVL-13	Lead	mg/kg	46.7	218	59.5
Railroad (0–1 feet)	BVL-09	Mercury	mg/kg	0.15	0.71	0.363
Weir (0–1 feet)	BVL-13	Mercury	mg/kg	0.15	0.71	0.223
I-5 (0–1 feet)	BVL-01	Zinc	mg/kg	150	410	183
Railroad (0–1 feet)	BVL-09	Zinc	mg/kg	150	410	169
Weir (0–1 feet)	BVL-13	Zinc	mg/kg	150	410	153

mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Source: SAIC 2008a

Sediment grain size composition within the lagoon consists of varying mixtures of gravels, sands, silts, and clays. Based on preliminary sediment characterization studies (Everest and Battelle 2003; SAIC 2008a), the majority of sediments within the Weir Basin and Railroad Basin have a sand content higher than 70 percent and would be suitable for onshore or nearshore placement. Sediments below 4 feet in the Coast Highway Basin would be suitable for beach or nearshore placement. None of the sediment within the I-5 Basin would be suitable for beach or nearshore placement as the sand content is less than 70 percent, so these sediments and sediments above 4 feet NGVD in the Coast Highway Basin would be disposed of in an on-site or overdredge pit (per Approach 2) or at the offshore disposal site LA-5 (per Approach 1), depending on the construction approach ultimately selected.

Coliform Bacteria

Treated sewage was discharged directly into the lagoon until 1967 and sewage spills from 1991–1995 contributed to elevated bacteria levels within the lagoon. Storm water runoff may also contribute to the occasional exceedance of bacteria objectives. Feral duck populations within the lagoon area are another likely source of coliform contamination (CWN 2002). The CWA 303(d) list identifies point and nonpoint sources as potential sources of bacteria impairments (SWRCB 2011).

Data collected in 2008 (Everest 2015; MACTEC 2009) found that WQOs for bacteria were exceeded during dry and wet weather conditions, with more exceedances occurring during wet weather conditions. In general, REC-1 WQOs for bacteria were exceeded during most wet weather conditions with occasional exceedances during dry weather. Enterococcus and fecal coliform exceeded objectives in 83 percent of samples during wet weather and total coliform exceeded objectives in 50 percent of samples collected during wet weather. During dry weather, Enterococcus exceeded the single-sample maximum in 3 percent of samples; fecal coliform exceeded the objective in 8 percent of samples; and zero total coliform samples exceeded the single-sample maximum concentration.

Materials Disposal/Reuse Study Area

Areas available for materials disposal/reuse are located on-site (i.e., overdredge pit), and at onshore (Oceanside and North Carlsbad), nearshore (Oceanside), or offshore (LA-5) sites (Figure 2-10). Ocean water quality tends to be more homogenous than lagoons and estuaries due to the physical mixing dynamics of the ocean.

<u>Beneficial Uses</u>

Beneficial uses of the Pacific Ocean are listed in Table 2-3 in the Basin Plan (RWQCB 1994) and are:

- Industrial Service Supply (IND)
- Navigation (NAV)
- REC-1
- REC-2
- Commercial and Sport Fishing (COMM)
- BIOL
- WILD

- RARE
- MAR
- Aquaculture (AQUA)
- Migration of Aquatic Organisms (MIGR)
- Spawning, Reproduction, and/or Early Development (SPWN)
- Shellfish Harvesting (SHELL)

Ocean Water and Aquatic Sediment Quality Objectives

The *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan) (SWRCB 2012) outlines the following narrative water and sediment quality objectives for the physical characteristics of ocean waters and sediments in California:

- Floating particulates and grease and oil shall not be visible.
- The discharge of waste shall not cause aesthetically undesirable discoloration of the ocean surface.
- Natural light shall not be significantly reduced at any point outside the initial dilution zone as the result of the discharge of waste.
- The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded.

The Ocean Plan (SWRCB 2012) outlines the following narrative and numerical water and sediment quality objectives for the chemical characteristics of ocean waters and sediments in California:

- DO concentration shall not be depressed more than 10 percent from that which occurs naturally from the discharge waste materials.
- The pH shall not be changed more than 0.2 units from that which occurs naturally.
- Dissolved sulfide concentration of waters in and near sediments shall not be significantly increased above that present under natural conditions.
- The concentration of substances in Chapter II, Table 1, in marine sediments shall not degrade indigenous biota (refer to Table 1 in the Ocean Plan [SWRCB 2012] for specific sediment objectives).
- The concentration of organic materials in marine sediments shall not degrade marine life (see Table 1 in the Ocean Plan [SWRCB 2012] for specific sediment objectives).

- Nutrient materials shall not cause objectionable aquatic growths or degrade indigenous biota.
- Discharges shall comply with numerical WQOs listed in Table 1 in the Ocean Plan.

Both the State Water Resources Control Board (SWRCB) and DPH have established standards to protect water contact recreation and shellfish harvesting in coastal waters from bacterial contamination. The SWRCB and DPH water contact bacterial objectives are as follows (SWRCB 2012):

- 30-day Geometric Mean
  - Total coliform shall not exceed 1,000 per 100 ml;
  - Fecal coliform density shall not exceed 200 per 100 ml; and
  - *Enterococcus* density shall not exceed 35 per 100 ml.
- Single Sample Maximum
  - Total coliform density shall not exceed 10,000 per 100 ml;
  - Fecal coliform density shall not exceed 400 per 100 ml;
  - *Enterococcus* density shall not exceed 104 per 100 ml; and
  - Total coliform density shall not exceed 1,000 per 100 ml when the fecal coliform/total coliform ratio exceeds 0.1.

The shellfish harvesting bacterial objectives are as follows (SWRCB 2012):

- The median total coliform density shall not exceed 70 per 100 mL, and not more than 10 percent of the samples shall exceed 230 per 100 mL.

<u>Areas of Special Biological Significance</u>

Two Areas of Special Biological Significance (ASBS) are located along the Southern California coast: the La Jolla ASBS #29 and the San Diego-Scripps ASBS #31. In 1983, the SWRCB Ocean Plan officially prohibited polluted runoff and point-source discharges into an ASBS by requiring that runoff and discharge sources be located a sufficient distance from designated areas to maintain natural water quality conditions (the Construction General Permit also prohibits discharges of pollutants into an ASBS unless an exception is granted). Storm water runoff and coastal river discharges can cause large turbidity plumes and reduce near-surface salinity up to several miles, while adding suspended sediments, nutrients, bacteria/pathogens, and chemical contaminants to nearshore waters during storm events. The Oceanside and North Carlsbad materials disposal/reuse sites are located approximately 30 miles north of the La Jolla and San

Diego-Scripps ASBS locations. The LA-5 off-shore disposal site is located more than 15 miles from the ASBS locations.

Physical Parameters

During late spring through fall, solar heating of the ocean surface creates temperature gradients in the water column (thermocline) that induce correlating density gradients (pycnocline), which can restrict vertical mixing of most water quality parameters (SANDAG 2011). During winter and early spring, thermoclines are weakest in response to decreased insolation (solar heating) and increased mixing from winter storm activity and upwelling of deeper ocean waters.

Seasonal upwelling and downwelling affect marine water quality along the San Diego coast. Upwelling is initiated when wind patterns displace surface waters offshore, resulting in an upward replacement of colder, deeper waters with lower DO concentrations, and higher salinity and nutrient concentrations. Upwelling is generally present from late March through July in the San Diego County area. Downwelling occurs when wind forces surface water onshore and forces it downward, causing warmer temperatures and lower salinity in deeper waters.

Temperature

Surface water temperature along the coast of San Diego varies seasonally with solar heating, upwelling, and climatic conditions, ranging from approximately 53.6 degrees Fahrenheit (°F) in winter to 69.8°F in summer. Temperatures of bottom waters in the materials placement sites range from approximately 48.2°F (offshore locations) to 60.8°F (nearshore locations). Waters are stratified during the summer and early fall, unstratified during the winter, and transitional (e.g., stratification weakening or increasing) in late fall and spring.

Salinity

Salinity within the Southern California Bight is fairly uniform, ranging from approximately 32 to 34 ppt in offshore areas. Salinity tends to be homogenous throughout the water column, with differences between the surface and the bottom typically less than 1 ppt. Some seasonal and/or spatial differences in salinity may reflect upwelling of denser, more saline bottom waters or discharges of freshwater runoff from coastal wetlands and creeks (SANDAG 2011), resulting in slightly lower salinity levels in nearshore areas.

Nutrients

Nutrient concentrations for coastal waters typically are higher near the bottom than near the surface, except during upwelling periods. Nearshore nutrient concentrations may be elevated in areas of wastewater discharge and near the outlet of rivers, lagoons, bays, and harbors. Nitrate levels in nearshore surface waters may vary from 0.1 mg/L to >8 mg/L during upwelling, and phosphate levels may range from 0.5 to 0.8 mg/L (SANDAG 2011).

Sediment/Turbidity

The clarity of nearshore coastal waters is dependent on localized and temporal changes induced by coastal river and lagoon discharges (normal tidal exchange and/or urban storm water runoff), and plankton blooms. Waters may be more turbid in the winter due to greater wave energy, surface runoff, and river discharges, although seasonal patterns are also subject to considerable variation in storm magnitude and duration. Runoff-related discharges and associated natural turbidity tend to occur in pulses rather than as continual discharges or consistent seasonal inputs. Water clarity in spring and summer also may reflect plankton blooms (e.g., red tides) and suspended particles concentrating near the thermocline.

Rip currents also influence nearshore turbidity by transporting higher turbidity water beyond the surf zone. TSS concentrations of more than 1,000 mg/L were measured in rip currents off Imperial Beach (SANDAG 2011). Generally, rip currents are more pronounced during high wave conditions associated with higher tides, high winds, and/or storm swells. In general, water clarity and light transmittance tend to increase with distance from shore.

Similar to transmissivity values, TSS concentrations typically are relatively lower offshore than nearshore. TSS concentrations ranged from <1 to 47 mg/L offshore of Carlsbad over a 13-year monitoring period, with highest concentrations recorded after storm events or occasionally in the summer (probably due to phytoplankton blooms) (SANDAG 2011).

Turbidity levels may be substantially higher near the mouths of coastal lagoons due to river discharges, storm runoff, and/or algal blooms. TSS concentrations of 100 mg/L were recorded just inside Batiquitos Lagoon at the same time that concentrations of 20 mg/L were recorded in the adjacent nearshore zone during a non-storm period (SANDAG 2011).

Contaminants

The quality of nearshore ocean water within the project area is generally good, and water quality parameters are within Basin Plan limits. However, conditions in some areas can be affected by local storm water runoff discharges. In general, bacterial levels along the beaches in San Diego County are elevated occasionally by storm water runoff.

3.4.2 SIGNIFICANCE CRITERIA

A significant impact to water and aquatic sediment quality would occur if implementation of the Enhancement Project would result in any of the following:

A. Discharges of pollutants that would cause a violation of any water quality standards or waste discharge requirements or degradation of beneficial uses, based on existing conditions;

B. Discharges of pollutants that would cause a violation of applicable federal or state standards, or conditions that are hazardous to human health, or deleterious to biological organisms or that increase pollutants for which a water body is already listed as impaired on the CWA Section 303(d) list;

C. Disposal or removal of dredged sediments/excavated soils that would result in substantial adverse changes to water or sediment quality, toxicity or bioaccumulation of contaminants in aquatic biota, or decreases in wildlife habitat; or

D. Substantial increase in erosion (sediment) or siltation into receiving surface waters.

These thresholds are derived from CEQA Guidelines Appendix G, as well as similar coastal enhancement projects, which were incorporated because Appendix G sample questions do not specifically address water quality issues unique to coastal restoration. Thresholds associated with currently listed 303(d) water bodies, which indicate impaired waters pursuant to the San Diego Basin Plan, and sediment removal/dredging were developed because they are not addressed in Appendix G but have the potential to impact water quality.

3.4.3 IMPACT ANALYSIS

Lagoon Enhancement

Freshwater Alternative

Temporary Impacts

The Freshwater Alternative would involve the least amount of initial vegetation and sediment removal and would not require periodic maintenance for sediment removal at the lagoon inlet. Approximately 129,000 cy and 562,000 cy of vegetation and sediment, respectively, would be removed during initial implementation of the Freshwater Alternative. Construction activities associated with vegetation removal, lagoon dredging, weir replacement, Boardwalk construction, perimeter and access road grading, and equipment staging have the potential to impact lagoon water quality through the release of pollutants such as sediment and adhered pollutants, soil stabilization residues, oil and grease, and trash and debris. Dredging and vegetation removal activities could result in increased turbidity and sedimentation and excess vegetative (organic) material in the water column. Upland soil disturbance from access roads or staging areas would expose soil to erosion from wind and water that could also result in sedimentation to receiving surface waters. Weir replacement and Boardwalk construction activities could release pollutants such as oil and grease, concrete, and metals, as well as sediment. The project would be required to comply with applicable regulations (e.g., Municipal Permit, Construction General Permit) to minimize pollutant transport during construction activities. As discussed in Section 3.2 Hydrology, the Construction General Permit, Order 2009-0009-DWQ, requires the development of a project SWPPP that identifies BMPs that would be used to protect water quality, minimize erosion, prevent pollutant discharge, and avoid sediment transport during construction.

Through development and implementation of the SWPPP as required pursuant to the General Construction Permit, BMPs would provide protection of lagoon and ocean receiving waters. BMPs, such as silt curtains, filtration devices (e.g., gunderbooms), flocculants, and jute netting, would be implemented during sediment and vegetation removal to control turbidity and sedimentation within the water column. Removed vegetation would be taken out of the water column to avoid potential increases in nutrient and bacteria levels as a result of decaying organic material. Typical construction BMPs (e.g., spill prevention and control, housekeeping practices) would be implemented during construction activities (e.g., sediment and vegetation removal, weir replacement, and Carlsbad Boulevard bridge and Boardwalk construction) to control pollutant discharge. In addition, erosion- and sediment-control BMPs such as, fiber rolls, silt fences, gravel bag barriers, hydraulic mulch, soil binders, and stabilized access roads and construction entrances, would also be implemented during construction activities to minimize sediment disturbance and erosion potential. Since Buena Vista Lagoon is CWA Section 303(d) listed as impaired by sedimentation/siltation, nutrients, and indicator bacteria, BMPs would be required to target construction-related sources of these pollutants. In addition, the project would be required to implement a dewatering plan during weir replacement activities and BMPs, such as sediment basins, sediment traps, and dewatering tanks, would be implemented during dewatering to avoid pollutant discharge. See Table 3.4-2 for typical BMPs that are anticipated to be used during construction activities.

Construction activities would be conducted in a phased approach; equipment would be mobilized to the project site, access to the construction areas would be developed, and staging areas would be prepared. Then vegetation removal would occur starting at the I-5 Basin and move downstream until reaching the Weir Basin; dredging work would then occur, starting in the Coast Highway Basin and moving to the I-5 Basin, then the Railroad and Weir Basins; the weir replacement work would be conducted last. During the construction process, the lagoon's mouth would remain closed. The closed weir, however, would limit these adverse impacts to the lagoon and prevent adverse impacts associated with inadvertent discharges of sediment and vegetative material to the ocean.

Table 3.4-2
Potential Construction-Phase BMPs

Type of BMP	Description and Purpose
Turbidity Control	
Flocculants	Promotes the coagulation of suspended particles to induce settling and decrease turbidity. Nontoxic polyacrylamide flocculants would be based on site-specific lagoon soil and water samples to maximize effectiveness. Application would be as close to the area of disturbance as possible. Flocculant would be used in tandem or combination with other BMPs presented in this table.
Jute Netting	Captures suspended particles in the water column, when used in conjunction with flocculant polymers to enhance coagulation of suspended particles directly on webbing. Jute netting is an organic product.
Cofferdams/Temporary Dikes	Helps to minimize the impact of dredge-related turbidity within a localized work area. Implementation would depend on contractor preference. Used for short-term control.
Silt Curtains	Allows suspended sediment to settle out of the water column in a controlled area, minimizing the area that is affected by potential increased suspended sediment within the water column. Silt curtains are an impermeable barrier constructed of a flexible reinforced thermoplastic material. Provides similar temporary turbidity control where tidal surge is minimal. If used, they would likely be most effective in smaller tributary channels far from the lagoon mouth (i.e., higher in the watershed).
Filtration Device (gunderbooms)	Allows water to flow through the curtain while filtering suspended dredged sediment from the flow. Gunderbooms extend from the water surface to the bottom. Gunderbooms are permeable geotextile fabrics.
Sediment Control	
Silt Fence	Detains sediment-laden water, promoting sedimentation behind the fence. Suitable for use at edge of disturbance areas; around temporary stockpiles; along the perimeter of a site; below areas where sheet flows discharge from the site; below the toe or downslope of exposed and erodible slopes.
Fiber Rolls	Intercept runoff, reduce flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). Suitable for use along the perimeter of a site; downslope of exposed soil areas; around temporary stockpiles.
Gravel Bag Berm/Sand Bag/Straw Bale Barrier	Intercepts and ponds sheet flow runoff, allowing sediment to settle out. Suitable for use along the perimeter of a site; below the toe of slopes and erodible slopes; downslope of exposed soil areas; around temporary stockpiles; at the top of slopes to divert runoff away from disturbed slopes.
Biofilter Bags	Detain flow and allow a slow rate of discharge through the wood media; remove suspended sediment through gravity settling of the detained water and filtration within the bag. Suitable for use along the perimeter of disturbed sites; around temporary stockpiles; below the toe of slopes and erodible slopes; downslope of exposed soil areas.

Type of BMP	Description and Purpose
Erosion Control	
Hydraulic Mulch	Sprayed onto soil surface to provide a layer of temporary protection from wind and water erosion. Suitable for disturbed areas that require temporary stabilization to minimize erosion or prevent sediment discharges until permanent vegetation is established. Can be applied in combination with seeding/planting efforts.
Soil Binders	Soil stabilizer applied to the soil surface to temporarily prevent water- and wind-induced erosion of exposed soils. Suitable for disturbed areas requiring temporary erosion and sedimentation protection until permanent vegetation is established. Can be applied in combination with seeding/planting efforts.
Straw/Wood Mulch	Minimizes erosion by protecting bare soil from rainfall impact, increasing infiltration, and minimizing runoff. Suitable for disturbed areas requiring temporary erosion and sedimentation protection until permanent vegetation is established. Can be applied in combination with seeding/planting efforts.
Hydroseeding	Seed applied to soil surface to temporarily protect exposed soils from water and wind erosion. Suitable for disturbed areas requiring temporary erosion and sedimentation protection until permanent vegetation is established. Can be used to apply permanent stabilization. Hydraulic seed should be applied with hydraulic/straw mulch for adequate erosion control.
Materials Management	
Spill Prevention and Control	Prevent the discharge of pollutants to watercourses from leaks and spills by minimizing the chance for spills, stopping the source of spills, containing and cleaning up spills, and properly disposing of spill materials. Cover and berm outdoor storage/equipment areas, store spill cleanup materials in clearly marked locations, and clean spills immediately. Suitable for pollutants including sediment, nutrients, trash, metals, and oil and grease.
Stockpile Management	Minimize storm water pollution from stockpiles by locating stockpiles as far away as possible from storm water flows, watercourses, and inlets, and covering stockpiles. Protect stockpiles from storm water runon using temporary perimeter sediment barriers such as silt fences, fiber rolls, sandbags, gravel bags, or biofilter bags.
Solid Waste Management	Prevent the discharge of pollutants from solid waste by providing waste collection areas and an adequate number of containers, arranging for regular disposal, collecting site trash daily, and cleaning up spills immediately. Suitable for construction and domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes. Targeted pollutants include sediment, nutrients, bacteria, trash, oil and grease, and metals.
Housekeeping Practices	Maintain clean and orderly work sites; properly dispose of wash water, sweepings, and sediments; properly recycle or dispose of fluids; and train contractors in BMPs and pollution prevention. Targeted pollutants include sediment, nutrients, bacteria, trash, oil and grease, and metals.
Dewatering Operations	
Sediment Basin/Trap	Detains sediment-laden runoff and allows sediment to settle out before discharging. Effective for removal of gravel, sand, silt, metals that settle out with the sediment, and trash.
Weir Tanks	Separates water and waste by using weirs; the configuration of the weirs maximizes the residence time in the tank and determines the waste to be removed from the water. Effective for removal of trash, gravel, sand, silt, oil and grease, and metals (removed with sediment).
Dewatering Tanks	Removes debris and sediment by filtering out solids. Effective for removal of trash, gravel, sand, silt, oil and grease, and metals (removed with sediment).

As discussed in Section 2.8 Construction Methods, Schedule, and Design Features, several construction methods would be employed that would minimize water quality impacts. For instance, the use of cofferdams and dewatering active work areas during weir replacement activities would help to prevent release and transport of disturbed sediment. Sediment would be dredged using a hydraulic cutterhead dredge, which would avoid/minimize the generation of turbidity at the location of the dredge. Maximum resuspension rates are generally less than 0.5 percent for a cutterhead dredge (Bridges et al. 2008). Through the implementation of BMPs (e.g., silt fence, fiber rolls, filtration devices, silt curtains) and construction methods (e.g., cofferdams, cutterhead dredge) mentioned above to minimize sedimentation/siltation, **construction activities associated with the Freshwater Alternative would not result in a substantial increase in erosion or siltation, and impacts would be less than significant (Criterion D).**

Although some turbidity within the lagoon would be expected during active construction (e.g., dredging, placement of dredged materials), the generation of turbidity would be minimized through the construction approach proposed for the project and BMPs implemented to control dispersal of spoils, as described above. Localized turbidity within the lagoon could also occur as a result of incidental material releases during the placement of fine material at the on-site overdredge pit, prior to stabilization and capping of the pit at the completion of construction. Nutrients could potentially become entrained back into the water column from suspended sediments within these areas of localized turbidity, temporarily increasing the potential for eutrophic conditions to develop within the lagoon; however, impacts are expected to be temporary and minimal. Other pollutants associated with suspended sediments, including metals and pesticides, are not anticipated to become entrained in the water column as a result of construction turbidity as only minimal turbidity is expected to occur in localized areas of the lagoon. **Therefore, removal of dredged sediments and/or placement at the on-site overdredge pit would not be expected to result in substantial adverse changes to water or sediment quality, toxicity, or bioaccumulation of contaminants, and impacts would be less than significant (Criterion C). However, because the lagoon is listed as a CWA Section 303(d) impaired waterbody for sedimentation/siltation, the potential temporary turbidity impacts generated by lagoon enhancement activities would be considered a potentially significant impact (Criterion B).**

The vertical (depth-related) extent of plumes within the lagoon depends on the initial displacement of bottom sediments, physical characteristics and settling velocities of the sediment particles and vertical mixing characteristics of the water column. For example, the vertical distribution of sand-sized particles disturbed by a cutterhead dredge may be confined to the near-bottom water layer once it is discharged from the dredge pipe, particularly when the bottom sediments consist of coarse-grained, rapid-settling particles and a natural density gradient is present in the water column that limits vertical mixing. In contrast, disturbed fine-grained sediments may remain suspended and distributed throughout the water column for long periods, particularly during winter (unstratified) conditions. The estimated plume distance on any given day would vary according to the grain size characteristics of the material, turbulence, current speed, and to what depth in the water column the particles are resuspended.

There is the potential for temporary sediment quality impacts to occur as a result of the release of pollutants (e.g., oil and grease, nutrients, metals) from dredging (disturbing) existing sediments and excavation for construction of structures (e.g., weir and Carlsbad Boulevard bridge). Based on the sediment chemistry results (SAIC 2008a) discussed in Section 3.4.1 above, the majority of pollutants analyzed were below their respective ERLs and no analytes were detected above their ERMs. The implementation of BMPs to protect water quality by controlling pollutant discharge from land-based construction areas (e.g., spill prevention and control, stockpile management, silt fence, hydraulic mulch) would minimize potential impacts to water quality during construction activities. In addition, pollutant release associated with localized temporary turbidity caused by dredging would be minimized through implementation of aquatic-based BMPs (e.g., flocculants, silt curtains, etc.), and vegetation would be removed from the water column to avoid potential increases in bacteria and nutrient levels from decaying organic material. By properly implementing BMPs specified in the Municipal Permit and an adequate project SWPPP that complies with the Construction General Permit, temporary construction activities would not be expected to impact water quality beyond existing conditions, with the exception of turbidity as a result of increased sedimentation/siltation.

In addition, with the required implementation of construction BMPs identified in the project SWPPP (e.g., spill prevention and control, solid waste management, housekeeping practices) aimed at preventing or minimizing pollutant discharge, temporary impacts to additional water quality parameters, including temperature, salinity, pH, metals, and pesticides, would not be anticipated to occur. As part of compliance with the Municipal Permit and the project SWPPP, water quality would be protected and monitoring would be conducted to verify that water quality standards are met and beneficial uses are protected. This would protect water quality because if the monitoring showed that water quality was outside of the required parameters, operational controls would be required or the material placement would be halted. **Therefore, under proper SWPPP and BMP implementation, construction of the Freshwater Alternative would not result in a violation of water quality standards or degradation of beneficial uses, and impacts would be less than significant, with the exception of increased sedimentation/siltation as discussed above (Criteria A and B).**

As a result of BMP implementation required in compliance with existing regulations (e.g., Construction General Permit, Municipal Permit) to control pollutant discharge, the use of a cutterhead dredge, and the localized temporary nature of disturbance, a violation of

water quality standards or a substantial increase in erosion or siltation would not occur; pollutants would not be generated or released to the environment that are in violation of applicable federal or state standards, hazardous to human health, or deleterious to biological communities; and removal of dredged sediments would not result in substantial changes to water or sediment quality. Impacts would be less than significant (Criteria A through D).

Construction of the Freshwater Alternative would result in less than significant temporary impacts from target pollutants generated or released to 303(d) waters (Criterion B), with the exception of the impact related to turbidity. As described above, potentially significant impacts could occur due to turbidity that could result in increased downstream sedimentation. However, these impacts would be localized and temporary, and overall water and sediment quality and circulation within the lagoon would be improved following construction.

<u>Permanent Impacts</u>

The Freshwater Alternative would provide little water quality improvement over existing conditions. Localized circulation would be slightly improved by removing vegetation and sediment in open water areas and infrastructure (i.e., weir) would be improved to minimize constrictions. However, overall water quality and residence times would not improve.

The Freshwater Alternative involves removing vegetation and excess sediment and constructing a new weir that would improve hydraulics and flood performance compared to existing conditions. Through the improved circulation gained by the removal of vegetation and sediment, the Freshwater Alternative would help to reduce the ongoing and currently anticipated future impacts from sedimentation/siltation blockage in the lagoon. The new, larger weir would enable the lagoon to drain more efficiently and improve flood control during large storm events. The proposed Boardwalk deck would be constructed of timber planks with spacing between and would require proper drainage designs per applicable regulations (i.e., Municipal Permit, HMP, LID BMPs) to eliminate or minimize increases in discharge flow rate, runoff volume, or sediment transport potential. The project would not be designed to alter inflow patterns. In addition, temporary staging areas would be uncompacted, revegetated, and restored to pre-construction conditions following construction activities.

As shown in Table 3.4-3, residence times during dry and wet weather conditions would increase over existing conditions under the Freshwater Alternative. Residence times are described as the average length of time during which water is in a given location. In water quality terms, typically a higher residence time results in lower water quality, while a lower residence time results in improved water quality. Residence times would be substantially higher than existing conditions in all four basins due to deeper basins and no tidal flushing. Under dry weather conditions, residence times under the Freshwater Alternative would range from 33 days in the I-5 Basin to 118 days in the Weir Basin, while under existing conditions, residence times range from 8 days (I-5 Basin) to 82 days (Weir Basin).

Table 3.4-3
Average Residence Time for Freshwater Alternative
(post-enhancement condition)

Alternatives	Basins	Residence Time (Days)	
		Dry Weather	Wet Weather
Freshwater	I-5	33	2
	Coast Highway	82	5
	Railroad	116	9
	Weir	118	9
Existing Conditions	I-5	8	1
	Coast Highway	36	3
	Railroad	75	4
	Weir	82	5

Source: Geomorph 2014; Appendix D

Under the Freshwater Alternative, salinity levels in all basins would be similar to existing conditions under dry and wet weather conditions (Everest 2015; Appendix M). Dry weather salinity would range from approximately 1–2 ppt during dry weather and less than 1 ppt during wet weather in all basins (Everest 2015; Appendix M).

Sedimentation/siltation within the lagoon likely would continue to occur from upstream fluvial inflow, erosion within the lagoon, or sediment entering from the coast during high tides. However, as discussed above, sediment entering the lagoon has decreased as the upstream watershed has been developed; therefore, siltation due to incoming runoff is not anticipated to increase relative to existing conditions, and removal of sediments is therefore expected to have a slight beneficial impact. Erosion along the lagoon channels would not be substantial due to scour protection improvements. Following construction, abovewater disturbed soil surfaces that could be susceptible to erosion within the lagoon would be stabilized by restoration planting and natural recruitment, and erosion would be short term and not substantial. Vegetation maintenance would occur under this alternative and is not anticipated to result in long-term impacts to erosion or sedimentation.

The Freshwater Alternative would provide little to no water quality improvement over existing conditions (Everest 2015). This alternative would slightly improve localized lagoon circulation with sediment and vegetation removal and by allowing pass-through of watershed sediments to the coast for beach replenishment during strong storm events when flows pass over the weir and erode the beach berm. Based on the *Buena Vista Lagoon Enhancement Project Bacteria and*

Nutrient Modeling (Everest 2015; Appendix M), bacteria concentrations would remain the same as existing conditions, with higher concentrations occurring during wet weather flows and lower concentrations during dry weather conditions. There would be no change in the frequency of bacteria exceedances under the Freshwater Alternative compared to existing conditions. DO concentrations would be similar to existing conditions in all basins during dry weather, but would be generally lower than existing conditions during wet weather. The frequency of non-compliance with the WQO (i.e., concentrations below 5 mg/L) would be similar to existing conditions under the Freshwater Alternative (Everest 2015). Total nitrogen would be similar to existing conditions during wet weather but slightly lower than existing conditions during dry weather in the Weir, Railroad and Coast Highway Basins; and total phosphorus concentrations would be lower than existing conditions (and less than 0.25 mg/L) in the Weir, Railroad and Coast Highway Basins during dry and wet weather and similar to existing conditions in the I-5 Basin (0.04 mg/L). The potential for pollutants to be generated or released to the environment in violation of applicable federal or state standards, or that would be hazardous to human health or deleterious to biological communities over the long term would not be increased over existing conditions. An increase in erosion or siltation would not occur and water quality standards would not be violated. **The Freshwater Alternative would not result in a discharges of pollutants that cause or contribute to a violation of water quality standards or degradation of beneficial uses (Criterion A) and would not generate/release pollutants that are in violation of applicable federal or state standards or hazardous to human health or biological communities, and impacts would be less than significant (Criterion B). Section 303(d) listed impairments (i.e., sedimentation/siltation, nutrients, bacteria) would not be increased over existing conditions and impacts would be less than significant (Criterion B). The Freshwater Alternative would not result in a substantial increase in erosion or siltation and impacts would be less than significant (Criterion D).**

Although temporary, localized turbidity within the lagoon would be expected during construction and maintenance activities, overall water and sediment quality following construction would not be reduced from existing conditions and permanent impacts to water and sediment quality would not be anticipated. Fluvial and tidal hydraulic modeling conducted for the Enhancement Project suggests that the velocity distributions across the lagoon would be relatively small except during large, infrequent storm events, which would help to minimize sedimentation and turbidity impacts and the potential release of contaminants (Appendix C). With the incorporation of appropriate BMPs to minimize sediment and turbidity (e.g., sediment- and erosion-control BMPs, such as fiber rolls and silt fences, and aquatic-based BMPs, such as silt curtains and filtration devices), impacts to water and sediment quality would not be anticipated. **Therefore, removal of dredged sediments would not be expected to result in substantial adverse changes to water or sediment quality, toxicity, or bioaccumulation of contaminants, and impacts would be less than significant (Criterion C).**

Long-term Benefits

The Freshwater Alternative would provide little to no water quality improvement over existing conditions. Localized circulation would increase with sediment and vegetation removal; however, residence times would increase compared to existing conditions. Long-term circulation may not persist because there is no long-term sediment removal, and only some continued vegetation removal is planned. Sedimentation within the lagoon likely would continue to occur due to fluvial flows.

Saltwater Alternative

Temporary Impacts

The Saltwater Alternative would require more vegetation removal (existing vegetation within dredging limits would be removed) and sediment removal for initial implementation than the Freshwater Alternative and would require periodic maintenance (every 12 to 20 months) to remove sediment from the inlet and lagoon basins, including the periodic removal of the flood shoal. Approximately 211,000 cy of vegetation and 781,000 cy of sediment would be removed during initial implementation, while approximately 27,000 cy of sediment would be removed from the inlet during maintenance activities (sediment removed during maintenance is anticipated to consist largely of coarse sediments, with limited adhered pollutants and would be suitable for beach placement on the North Carlsbad Beach placement site). The Saltwater Alternative would require replacement of the existing weir with an open tidal inlet, in addition to the construction of the Boardwalk and improvements to the Carlsbad Boulevard bridge.

Under the Saltwater Alternative, construction activities associated with the proposed dredging improvements have the potential to impact water quality through the release of pollutants in resident sediment, as well as other potential construction-related pollutants (e.g., sediment and adhered pollutants, soil stabilization residues, oil and grease, trash, and debris). Dredging and vegetation removal activities could result in increased turbidity and sedimentation and excess vegetative (organic) material in the water column. Upland soil disturbance from access roads or staging areas would expose soil to erosion from wind and water that could also result in sedimentation to receiving surface waters. Inlet and Boardwalk construction and bridge improvement activities could release pollutants such as oil and grease, concrete, asphalt, and metals, as well as sediment. However, as previously discussed, several construction methods compliant with the Construction General Permit and the Municipal Permit would minimize water quality impacts. A temporary cofferdam and dike would be used in active work areas during construction of the tidal inlet to prevent release and transport of pollutants (e.g., disturbed sediment) to ocean receiving waters. The project would be required to implement a dewatering plan during construction of the tidal inlet and BMPs (e.g., sediment basins, sediment traps, and dewatering tanks) would be implemented during dewatering to avoid pollutant discharge. Sediment would be dredged using a hydraulic cutterhead dredge to avoid/minimize the generation of turbidity at the location of the dredge and aquatic-based BMPs (e.g., silt curtains, flocculants), would be implemented during sediment removal to control turbidity and sedimentation within the water column. Under the Saltwater Alternative, erosion and sediment control would also be addressed in the project SWPPP to protect water quality, minimize erosion, prevent pollutant discharge, and avoid sediment transport during construction activities (e.g., bridge and Boardwalk construction). Erosion- and sediment-control BMPs anticipated for the project include fiber rolls, silt fences, gravel bag barriers, hydraulic mulch, soil binders, and stabilized access roads and construction entrances. Pile driving, concrete curing and finishing, and demolition adjacent to water BMPs would be implemented during weir removal/inlet construction and bridge improvement activities, as applicable. In addition, removal of the weir and then beach berm would be the final construction activity in the dredging process, which would allow sediment removal to progress without substantial flow-through from tidal exchange, minimize the distribution of suspended sediment from active dredging areas, and minimize turbidity in the recreational coastal zone. See Table 3.4-2 for typical BMPs that are anticipated to be used during construction activities. **Through the implementation of BMPs (e.g., silt fence, fiber rolls, filtration devices, silt curtains) and construction methods (e.g., cofferdams, cutterhead dredge) mentioned above to minimize sedimentation/siltation, construction activities associated with the Saltwater Alternative would not result in a substantial increase in erosion or siltation, and impacts would be less than significant (Criterion D).**

Although some turbidity within the lagoon would be expected during active construction (e.g., dredging, placement of dredged materials), the generation of turbidity would be minimized through the construction approach proposed for the project, as described above. Localized turbidity within the lagoon could occur during the placement of fine material at the on-site overdredge pit. Nutrients could potentially become entrained back into the water column from suspended sediments within these areas of localized turbidity, temporarily increasing the potential for eutrophic conditions to develop within the lagoon; however, impacts are expected to be temporary and minimal. **Therefore, removal of dredged sediments would not be expected to result in substantial adverse changes to water or sediment quality, toxicity, or bioaccumulation of contaminants, and impacts would be less than significant (Criterion C). However, because the lagoon is listed as a CWA Section 303(d) impaired waterbody for sedimentation/siltation, the potential temporary turbidity impacts generated by lagoon enhancement activities would be considered a potentially significant impact (Criterion B).**

Similar to the Freshwater Alternative, the implementation of BMPs to protect water quality by controlling pollutant discharge from land-based construction areas (e.g., spill prevention and control, stockpile management, silt fence, hydraulic mulch) would minimize potential impacts to water quality during construction activities (e.g., weir, Carlsbad Boulevard bridge, and Boardwalk construction). In addition, pollutant release associated with localized temporary turbidity caused by dredging would be minimized through implementation of aquatic-based BMPs (e.g., flocculants, silt curtains, etc.). By properly implementing BMPs specified in the Municipal Permit and an adequate project SWPPP that complies with the Construction General Permit, temporary construction activities would not be expected to impact water quality beyond existing conditions, with the exception of turbidity as a result of increased sedimentation/siltation as discussed above.

In addition, with the required implementation of construction BMPs (e.g., spill prevention and control, solid waste management, housekeeping practices) identified in the project SWPPP aimed at preventing or minimizing pollutant discharge, temporary impacts to additional water quality parameters, including temperature, salinity, pH, metals, and pesticides, would not be anticipated to occur. With proper BMP implementation (e.g., spill prevention and control, stockpile management, fiber rolls, silt curtain, filtration devices) in compliance with the Construction General and Municipal permits, pollutant discharges would be regulated, water quality would be protected, and monitoring would be conducted to verify that water quality standards are met and beneficial uses are protected. This would protect water quality because if the monitoring showed that water quality was outside of the required parameters, operational controls would be required or the material placement would be halted. Temporary construction activities would not be anticipated to significantly impact water or sediment quality. **Construction of the Saltwater Alternative would not result in a violation of water quality standards or degradation of beneficial uses (Criterion A) and would result in less than significant temporary impacts from pollutants generated or released to the environment in violation of applicable federal or state standards, or that would be hazardous to human health or deleterious to biological communities, with the exception of increased sedimentation/siltation as discussed above (Criterion B).**

<u>Permanent Impacts</u>

The Saltwater Alternative would provide long-term water quality improvement throughout the lagoon by permanently increasing the hydraulic efficiency of Buena Vista Lagoon over existing conditions by constructing a tidal inlet and creating and expanding channels to create better flow throughout the basins.

The Saltwater Alternative involves removing existing freshwater vegetation (within dredging limits) and excess sediment and replacing the existing weir with a tidal inlet that would allow tidal exchange and enhanced circulation and would improve water quality and flood performance compared to existing conditions. Through the improved circulation, flow regimes, and drainage patterns gained by the creation of a tidal inlet and improved channel network, the Saltwater Alternative would eliminate or reduce excessive sedimentation and would substantially help to reduce the ongoing and future impacts from sedimentation/siltation blockage in the lagoon. The open tidal inlet would promote enhanced tidal exchange deeper into the lagoon basins and shorten water residence times, enable the lagoon to drain incoming freshwater more efficiently, and improve flood control during large storm events.

As shown in Table 3.4-4, the Saltwater Alternative would substantially decrease existing water residence times in all four basins during dry and wet weather conditions. Under dry weather conditions, residence times under the Saltwater Alternative would range from 1 day in the Weir Basin and Railroad Basin to 3 days in the Coast Highway Basin and I-5 Basin, while under existing conditions, residence times range from 82 days (Weir Basin) to 8 days (I-5 Basin).

Table 3.4-4
Average Residence Time for Saltwater Alternative
(post-enhancement condition)

Alternatives	**Basins**	**Residence Time (Days)**	
		Dry Weather	**Wet Weather**
Saltwater	I-5	3	< 1
	Coast Highway	3	1
	Railroad	1	1
	Weir	1	1
Existing Conditions	I-5	8	1
	Coast Highway	36	3
	Railroad	75	4
	Weir	82	5

Source: Geomorph 2014; Appendix D

Under the Saltwater Alternative, salinity levels in basins with tidal influence (i.e., Weir, Railroad, and Coast Highway Basins) would be similar to salinity levels in the ocean (salinity greater than 30 ppt) under dry weather conditions with periodic drops during rain events (Geomorph 2014; Appendix D, and Everest 2015; Appendix M). Dry weather salinity would be approximately 31–32 ppt in the Weir, Railroad and Coast Highway Basins, and slightly lower (approximately 28 ppt) in the I-5 Basin (Everest 2015; Appendix M). During wet weather conditions, the I-5 Basin would become brackish, while the Coast Highway, Railroad, and Weir Basins would remain more saline but at lower levels than during dry weather.

The Saltwater Alternative would improve flood hydraulics in all basins when compared to existing conditions (Everest 2014; Appendix C), with correspondingly less sedimentation predicted to occur under the typical and 100-year flood scenarios. As sediment accumulation in the lagoon has decreased due to urbanization of the watershed, and with removal of existing sediment and long-term sediment removal under the Saltwater Alternative, sedimentation (as well as pollutants adhered to sediment) throughout the lagoon would decrease compared to existing conditions. Overall, water quality throughout the lagoon would be improved over existing conditions and residence times would be reduced, with increased circulation and tidal exchange and water quality standards and beneficial uses would continue to be protected.

Increases in impervious area (Boardwalk, Carlsbad Boulevard bridge abutment protection) would require compliance with regulatory requirements (Municipal Permit, SUSMP, HMP, LID BMPs) to control pollutants, increased flow rates, and durations and volumes of runoff, as well as added downstream sedimentation, resulting in no significant adverse changes in the amount of surface runoff or sedimentation entering the lagoon over existing conditions. The result would be a beneficial impact to water and sediment quality over existing conditions.

Siltation within the lagoon could occur from upstream fluvial inflow, erosion within the lagoon, or sediment entering from the coast during high tides. However, as discussed above, sediment entering the lagoon has decreased as the upstream watershed has been developed, so siltation due to incoming runoff would not be anticipated to increase over existing conditions under the Saltwater Alternative. Erosion along the lagoon channels would not be substantial due to stabilization and protection designed for channel areas predicted to be susceptible to scour. Following construction, abovewater exposed soil surfaces would be revegetated during the restoration planting and natural recruitment, thereby avoiding long-term erosion impacts. Sediment removal during periodic maintenance would be conducted using land-based construction equipment (e.g., backhoes, front loaders, scrapers, dump trucks) and would create similar periodic short-term water quality impacts in the lagoon and beach environments. The volume of removed sediment during maintenance would be approximately 27,000 cy. However, it is anticipated that larger grain-sized sediments would be removed, which would be expected to settle out relatively quickly, thereby minimizing water quality impacts related to sedimentation/turbidity. In addition, temporary staging areas would be uncompacted, revegetated, and restored to pre-construction conditions following construction activities.

The Saltwater Alternative would result in a beneficial impact to water quality by improving tidal exchange, lagoon circulation, and water residence times, and decreasing stagnation. This condition would be expected to reduce the potential for pollutants to be generated or released to the environment in violation of applicable federal or state standards, or that would be hazardous to human health or deleterious to biological communities over the long term. An increase in erosion or siltation would not occur and water quality standards would not be violated. Water quality would be protected and monitoring would be conducted to verify that water quality standards are met and beneficial uses are protected. Based on the *Buena Vista Lagoon Enhancement Project Bacteria and Nutrient Modeling* (Everest 2015; Appendix M), bacteria concentrations would be lower than existing conditions, with more significant decreases in the Weir and Railroad Basins. Wet and dry weather percent exceedances under the Saltwater Alternative compared to existing conditions are shown in Tables 3.4-5 and 3.4-6, respectively. In general, the Saltwater Alternative would result in a decrease in wet weather percent exceedances compared to existing conditions, especially for total coliform. Percent exceedances under dry weather conditions would be substantially lower than existing conditions in the Weir, Railroad, and Coast Highway Basins.

Table 3.4-5
Wet Weather Bacteria Exceedances for Saltwater Alternative

Alternative	Indicator Bacteria	Weir Basin	Railroad Basin	Coast Highway Basin	I-5 Basin
Existing Conditions	Enterococcus	93%	93%	97%	100%
	Fecal Coliform	93%	93%	93%	84%
	Total Coliform	93%	93%	90%	72%
Saltwater Alternative	Enterococcus	83%	86%	90%	100%
	Fecal Coliform	81%	81%	83%	81%
	Total Coliform	34%	48%	53%	62%

Source: Everest 2015; Appendix M

Table 3.4-6
Dry Weather Bacteria Exceedances for Saltwater Alternative

Alternative	Indicator Bacteria	Weir Basin	Railroad Basin	Coast Highway Basin	I-5 Basin
Existing Conditions	Enterococcus	89%	89%	97%	73%
	Fecal Coliform	61%	62%	65%	53%
	Total Coliform	13%	13%	11%	5%
Saltwater Alternative	Enterococcus	5%	6%	9%	72%
	Fecal Coliform	1%	4%	7%	35%
	Total Coliform	0%	0%	1%	1%

Source: Everest 2015; Appendix M

DO concentrations would be similar to and slightly higher than existing conditions during dry weather in the Weir, Railroad, and Coast Highway Basins (averaging approximately 7.9 mg/L), but lower than existing conditions during wet weather. The frequency of non-compliance (i.e., percent of time below the 5 mg/L WQO) would be reduced compared to existing conditions; frequency of non-compliance would be 0% in all basins (Everest 2015). Total nitrogen concentrations would be lower than existing conditions in the Weir, Railroad, and Coast Highway Basins; and total phosphorus concentrations would hover just above 0 mg/L in all basins, much less than existing conditions in the Weir, Railroad, and Coast Highway Basins (Everest 2015; Appendix M). **The Saltwater Alternative would not result in discharges of pollutants that cause or contribute to a violation of water quality standards or degradation of beneficial uses (Criterion A) and would not generate/release pollutants that are in violation of applicable federal or state standards, or hazardous to human health or biological communities. Impacts would be less than significant (Criterion B). Section 303(d) listed impairments (i.e., sedimentation/siltation, nutrients, bacteria) would not be increased over existing conditions and impacts would be less than significant (Criterion B). The Saltwater Alternative would not result in a substantial increase in erosion or siltation and impacts would be less than significant (Criterion D).**

Although some localized turbidity within the lagoon and ocean waters would be expected during periodic maintenance activities, the generation of turbidity would be temporary and overall water and sediment quality and circulation within the lagoon would be improved following each maintenance event. As stated above, it is anticipated that larger grain-sized sediments would be removed during maintenance, which would be expected to settle out relatively quickly, thereby minimizing water quality impacts related to sedimentation/turbidity. In addition, fluvial and tidal hydraulic modeling conducted for the Enhancement Project suggests that the velocity distributions across the lagoon would be relatively small except during large, infrequent storm events, which would help to minimize sedimentation and turbidity impacts and the potential release of contaminants (Geomorph 2014; Appendix D). With the incorporation of appropriate BMPs to minimize sediment and turbidity (e.g., sediment- and erosion-control BMPs, such as fiber rolls and silt fences, and aquatic-based BMPs, such as silt curtains and filtration devices) during maintenance events, impacts to water and sediment quality would not be anticipated. **Removal of dredged sediments would not be expected to result in substantial adverse changes to water or sediment quality, toxicity, or bioaccumulation of contaminants, and impacts would be less than significant (Criterion C).**

<u>Long-term Benefits</u>

Beneficial impacts to water and sediment quality would occur under the Saltwater Alternative as lagoon circulation, tidal exchange, and water residence times are improved and existing sedimentation and vegetation are reduced. Residence times would greatly improve over existing conditions and bacteria exceedances would decrease from existing conditions. Long-term circulation and tidal flushing would be expected to persist with long-term sediment removal from the inlet.

Hybrid Alternative

Temporary Impacts

The Hybrid Alternative would require slightly more sediment removal but less vegetation removal for initial implementation than the Saltwater Alternative and would require periodic annual maintenance (every 12 to 18 months) to remove sediment from the inlet and lagoon basins, similar to the Saltwater Alternative.

Approximately 148,500 cy of vegetation and 833,000 cy of sediment would be removed during initial implementation, while approximately 27,000 cy of sediment would be removed during maintenance activities. Similar to the Saltwater Alternative, the Hybrid Alternative would require replacement of the existing weir with an open tidal inlet, construction of the Boardwalk, and improvements to the Carlsbad Boulevard bridge. In addition, the Hybrid Alternative would include construction of a new weir in the channel under the I-5 bridge.

Construction activities associated with the Enhancement Project have the potential to impact water quality through the release of sediment-related pollutants and other construction-related pollutants. Dredging and vegetation removal activities could result in increased turbidity and sedimentation and excess vegetative (organic) material in the water column. Soil disturbance from access roads or staging areas could also result in sedimentation to receiving surface waters. Inlet, new weir, and Boardwalk construction and bridge improvement activities could release pollutants such as oil and grease, concrete, asphalt, and metals, as well as sediment. However, as previously discussed, several construction methods compliant with the Construction General Permit and the Municipal Permit would minimize water quality impacts. Pile driving, concrete curing and finishing, and demolition adjacent to water BMPs would be implemented during inlet and weir construction and bridge improvement activities, as applicable. A temporary cofferdam and dike would be used in active work areas during construction of the tidal inlet to prevent release and transport of disturbed sediment. The project would be required to implement a dewatering plan during construction of the tidal inlet and BMPs (e.g., sediment basins, sediment traps, and dewatering tanks) would be implemented during dewatering to avoid pollutant discharge. Sediment would be dredged using a hydraulic cutterhead dredge to avoid/minimize the generation of turbidity at the location of the dredge. Aquatic-based BMPs, such as silt curtains and flocculants, would be implemented during sediment removal to control turbidity and sedimentation within the water column. Similar to other alternatives, erosion and sediment control would also be addressed in the project SWPPP to protect water quality, minimize erosion, prevent pollutant discharge, and avoid sediment transport during construction. In addition, removal of the beach berm would be the final construction activity in the dredging process, which would allow sediment removal to progress without significant flow-through from tidal exchange, minimize the distribution of suspended sediment from active dredging areas, and avoid turbidity impacts in the recreational coastal zone. **Through the implementation of BMPs (e.g., silt fence, fiber rolls, filtration devices, silt curtains) and construction methods (e.g., cofferdams, cutterhead dredge) mentioned above to minimize sedimentation/siltation, construction activities associated with the Hybrid Alternative would not result in a substantial increase in erosion or siltation, and impacts would be less than significant (Criterion D).**

Although some turbidity within the lagoon would be expected during active construction (e.g., dredging, placement of dredged materials at the on-site overdredge pit), the generation of turbidity would be minimized through the construction approach proposed for the project, as described above. Localized turbidity could occur during the placement of fine material at the overdredge pit, and nutrients could potentially become entrained back into the water column from suspended sediments within these areas of localized turbidity, temporarily increasing the potential for eutrophic conditions to develop within the lagoon. However, impacts are expected to be temporary and minimal. **Therefore, removal of dredged sediments would not be expected to result in substantial adverse changes to water or sediment quality, toxicity, or bioaccumulation of contaminants, and impacts would be less than significant (Criterion C). However, because the lagoon is listed as a CWA Section 303d impaired waterbody for sedimentation/siltation, the potential temporary turbidity impacts generated by lagoon enhancement activities would be considered a potentially significant impact (Criterion B).**

Similar to the Saltwater Alternative, the implementation of BMPs (e.g., spill prevention and control, stockpile management, concrete curing, pile driving, silt fence, hydraulic mulch) to protect water quality by controlling pollutant discharge from land-based construction areas would minimize potential impacts to water quality during construction activities (e.g., inlet and weir construction, bridge improvements). In addition, pollutant release associated with localized temporary turbidity caused by dredging would be minimized through implementation of aquatic-based BMPs (e.g., flocculants, silt curtains, etc.). By properly implementing BMPs specified in the Municipal Permit and an adequate project SWPPP that complies with the Construction General Permit, temporary construction activities would not be expected to impact water quality beyond existing conditions, with the exception of turbidity as a result of increased sedimentation/siltation as discussed above.

In addition, with the required implementation of construction BMPs identified in the project SWPPP aimed at preventing or minimizing pollutant discharge, temporary impacts to additional water quality parameters, including temperature, salinity, pH, metals, and pesticides, would not be anticipated to occur. With proper BMP implementation (e.g., spill prevention and control, stockpile management, fiber rolls, silt curtain, filtration devices) in compliance with the Construction General and Municipal permits, pollutant discharges would be regulated, water quality would be protected, and monitoring would be conducted to verify that water quality standards are met and beneficial uses are protected. This would protect water quality because if the monitoring showed that water quality was outside of the required parameters, operational controls would be required or the material placement would be halted. Temporary construction activities would not be anticipated to significantly impact water or sediment quality. **Construction of the Hybrid Alternative would not result in a violation of water quality standards or degradation of beneficial uses (Criterion A) and would result in less than significant temporary impacts from pollutants generated or released to the environment in violation of applicable federal or state standards, or that would be hazardous to human health or deleterious to biological communities, with the exception of increased sedimentation/siltation discussed above (Criterion B).**

Permanent Impacts

The Hybrid Alternative would provide a long-term water quality improvement throughout the lagoon by permanently providing tidal exchange and increasing circulation. Similar to the Saltwater Alternative, the Hybrid Alternative would increase the hydraulic efficiency of Buena Vista Lagoon over existing conditions by constructing a tidal inlet and creating new and expanding existing channels to create better flow throughout the basins.

The Hybrid Alternative involves vegetation and sediment removal and replacing the existing weir with a tidal inlet that would allow tidal exchange and enhanced circulation, which would shorten residence times, and would improve water quality and flood performance compared to existing conditions. Through the improved circulation, flow regimes, and drainage patterns gained by the creation of a tidal inlet and improved channel network, the Hybrid Alternative would eliminate or reduce excessive sedimentation and would substantially help to reduce the ongoing and future impacts from sedimentation/siltation blockage in the lagoon. The open tidal inlet would promote enhanced tidal exchange deeper into the lagoon basins, enable the lagoon to drain incoming freshwater more efficiently, and improve flood control during large storm events.

As shown in Table 3.4-7, the Hybrid Alternative would also decrease existing water residence times but not to the same extent as the Saltwater Alternative. For the basins with tidal flushing (i.e., Weir, Railroad, and Coast Highway), residence times would be substantially less than those under existing conditions during dry weather conditions. For the I-5 Basin, residence times would increase over existing conditions and would be higher than those for the Saltwater Alternative. Residence times in each basin for the Hybrid Alternative, Option A and Option B, would be similar; the Weir Basin would have a slightly longer residence time under the Hybrid Alternative, Option A due to less flushing of the basin.

Table 3.4-7
Average Residence Time for Hybrid Alternative
(post-enhancement condition)

Alternatives	Basins	Residence Time (Days)	
		Dry Weather	Wet Weather
Hybrid Option A	I-5	23	2
	Coast Highway	18	3
	Railroad	1	1
	Weir	2	2
Hybrid Option B	I-5	22	2
	Coast Highway	17	3
	Railroad	1	1
	Weir	1	1
Existing Conditions	I-5	8	1
	Coast Highway	36	3
	Railroad	75	4
	Weir	82	5

Source: Geomorph 2014; Appendix D

Under Hybrid Option B (Option A was not modeled), the Weir, Railroad, and Coast Highway Basins would have a saltwater hydrologic regime and salinity levels would be similar to ocean levels and the Saltwater Alternative during dry weather conditions. The I-5 Basin would have a freshwater hydrologic regime and salinity levels would be similar to existing conditions and the Freshwater Alternative ranging from 1–2 ppt (Everest 2015; Appendix M). Salinity would drop to below 5 ppt during storm events in the Weir, Railroad, and Coast Highway Basins, and below 1 ppt in the I-5 Basin (Everest 2015; Appendix M).

In general, the Hybrid Alternative would improve flood hydraulics in all basins, with the exception of the I-5 Basin, when compared to existing conditions (Everest 2014; Appendix C), with correspondingly less sedimentation predicted to occur under the typical and 100-year flood scenarios. Overall, water quality throughout the lagoon would be improved over existing conditions and water quality standards and beneficial uses would continue to be protected. Increases in impervious area (Boardwalk, Carlsbad Boulevard bridge abutment protection) would require compliance with regulatory requirements (Municipal Permit, HMP, LID BMPs) to control pollutants as well as increases in flow rates, durations, and volumes of runoff, as well as added downstream sedimentation, resulting in no significant adverse changes in the amount of surface runoff or sedimentation entering the lagoon over existing conditions. The result would be a beneficial impact to water and sediment quality over existing conditions.

Siltation within the lagoon could occur from upstream fluvial inflow, erosion within the lagoon, or sediment entering from the coast during high tides. However, as discussed above, sediment entering the lagoon has decreased as the upstream watershed has been developed, so siltation due to incoming runoff would not be anticipated to increase over existing conditions under the Hybrid Alternative. Erosion along the lagoon channels would not be substantial due to stabilization and protection designed for channel areas predicted to be susceptible to scour. Following construction, abovewater exposed soil surfaces would be revegetated during the restoration planting and natural recruitment, thereby avoiding long-term erosion impacts. Sediment removal during periodic maintenance would be conducted using land-based construction equipment (e.g., backhoes, front loaders, scrapers, dump trucks) and would create similar periodic short-term water quality impacts in the lagoon and beach environments. The volume of removed sediment during maintenance would be approximately 27,000 cy. However, it is anticipated that larger grain-sized sediments would be removed, which would be expected to settle out relatively quickly, thereby minimizing water quality impacts related to sedimentation/turbidity. In addition, temporary staging areas would be uncompacted, revegetated, and restored to pre-construction conditions following construction activities.

The Hybrid Alternative would result in a beneficial impact to water quality by improving tidal exchange, lagoon circulation, and water residence times, and decreasing stagnation. This condition would be expected to reduce the potential for pollutants to be generated or released to the environment in violation of applicable federal or state standards, or that would be hazardous to human health or deleterious to biological communities over the long term. An increase in erosion or siltation would not occur and water quality standards would not be violated. Water quality would be protected and monitoring would be conducted to verify that water quality standards are met and beneficial uses are protected). Based on bacteria and nutrient modeling conducted by Everest (2015), bacteria concentrations in the Weir, Railroad, and Coast Highway Basins would be similar to those for the Saltwater Alternative and lower than existing conditions (concentrations in the I-5 Basin would be similar to existing conditions). Wet and dry weather percent exceedances under the Hybrid Option B Alternative compared to existing conditions are shown in Tables 3.4-8 and 3.4-9, respectively. In general, Hybrid Option B would result in a decrease in wet weather percent exceedances compared to existing conditions (similar to the Saltwater Alternative), except for the I-5 Basin. Percent exceedances under dry weather conditions would be substantially less than existing conditions in the Weir, Railroad and Coast Highway Basins, but higher in the I-5 Basin.

Table 3.4-8
Wet Weather Bacteria Exceedances for Hybrid Alternative, Option B

Alternative	Indicator Bacteria	Weir Basin	Railroad Basin	Coast Highway Basin	I-5 Basin
Existing Conditions	Enterococcus	93%	93%	97%	100%
	Fecal Coliform	93%	93%	93%	84%
	Total Coliform	93%	93%	90%	72%
Hybrid Alternative	Enterococcus	93%	93%	93%	100%
	Fecal Coliform	90%	90%	93%	95%
	Total Coliform	36%	45%	78%	83%

Source: Everest 2015; Appendix M

Table 3.4-9
Dry Weather Bacteria Exceedances for Hybrid Alternative, Option B

Alternative	Indicator Bacteria	Weir Basin	Railroad Basin	Coast Highway Basin	I-5 Basin
Existing Conditions	Enterococcus	89%	89%	97%	73%
	Fecal Coliform	61%	62%	65%	53%
	Total Coliform	13%	13%	11%	5%
Hybrid Alternative	Enterococcus	22%	25%	54%	96%
	Fecal Coliform	5%	7%	23%	73%
	Total Coliform	1%	1%	6%	12%

Source: Everest 2015; Appendix M

DO concentrations would be similar to the Saltwater Alternative (averaging approximately 7.9 mg/L). The frequency of non-compliance (i.e., percent of time below the 5 mg/L WQO) would be reduced in all basins compared to existing conditions, with the exception of the I-5 Basin (Everest 2015). Total nitrogen concentrations would be lower than existing conditions during dry weather in the Weir, Railroad, and Coast Highway Basins (total nitrogen in the I-5 Basin would be more similar to existing conditions); and total phosphorus concentrations would hover just above 0 mg/L in all basins, much less than existing conditions in the Weir, Railroad, and Coast Highway Basins (Everest 2015; Appendix M). **The Hybrid Alternative would not result in discharges of pollutants that cause or contribute to a violation of water quality standards**

or degradation of beneficial uses (Criterion A) and would not generate/release pollutants that are in violation of applicable federal or state standards, or hazardous to human health or biological communities. Impacts would be less than significant (Criterion B). Section 303(d) listed impairments (i.e., sedimentation/siltation, nutrients, bacteria) would not be increased over existing conditions and impacts would be less than significant (Criterion B). The Hybrid Alternative would not result in a substantial increase in erosion or siltation and impacts would be less than significant (Criterion D).

Although some localized turbidity within the lagoon and ocean waters would be expected during periodic maintenance activities, the generation of turbidity would be temporary and overall water and sediment quality and circulation within the lagoon would be improved following each maintenance event. Similar to the Saltwater Alternative, it is anticipated that larger grain-sized sediments would be removed during maintenance, which would be expected to settle out relatively quickly, thereby minimizing water quality impacts related to sedimentation/turbidity. In addition, fluvial and tidal hydraulic modeling conducted for the Enhancement Project suggests that the velocity distributions across the lagoon would be relatively small except during large, infrequent storm events, which would help to minimize sedimentation and turbidity impacts and the potential release of contaminants (Geomorph 2014; Appendix D). With the incorporation of appropriate BMPs to minimize sediment and turbidity (e.g., sediment- and erosion-control BMPs, such as fiber rolls and silt fences, and aquatic-based BMPs, such as silt curtains and filtration devices) during maintenance events, impacts to water and sediment quality would not be anticipated. **Removal of dredged sediments would not be expected to result in substantial adverse changes to water or sediment quality, toxicity, or bioaccumulation of contaminants, and impacts would be less than significant (Criterion C).**

Long-term Benefits

Beneficial impacts to water and sediment quality would occur under the Hybrid Alternative as circulation and tidal exchange are improved and existing sedimentation and vegetation are reduced. Residence times would greatly improve over existing conditions in the Weir, Railroad, and Coast Highway Basins, and bacteria exceedances would decrease from existing conditions, except in the I-5 Basin. Long-term circulation and tidal flushing would be expected to persist with long-term sediment and vegetation removal.

No Project Alternative

The No Project Alternative would enable existing degraded water quality conditions to continue to decline. The lagoon would continue to have restricted circulation due to the hydraulically inefficient channel system. Tidal flows would continue to be restricted due to the existing weir at the ocean outlet and narrow channels. No vegetation or sediment removal would occur and no improvements to infrastructure would occur to minimize constrictions at crossings to create better flow throughout the basins. As a result, poor lagoon circulation (i.e., tidal exchange) poor surface water drainage, and long residence times would continue if no Enhancement Project alternative is implemented. As vegetation expands into currently open water areas of the lagoon, it is anticipated that water circulation would further decrease, leading to increased residence times and additional water quality issues within the lagoon. The extent to which water quality would continue to degrade is speculative, and would depend on the rate and pattern of sedimentation and vegetation encroachment. This continued degradation compared to existing conditions and the proposed Enhancement Project alternatives would result in a **significant impact to water quality under the No Project Alternative (Criteria A through D).**

Materials Disposal/Reuse Study Area

<u>Littoral Zone Nourishment</u>

The construction approach would involve placement of material at the Oceanside onshore (beach) or nearshore site. Depending on the ultimate volume of beach-suitable sand identified through construction, material could also be placed at Carlsbad Beach. Material removed from the inlet during maintenance would also be placed at the Carlsbad Beach site. Based on preliminary sediment characterization studies (Everest and Battelle 2003; SAIC 2008a), the majority of sediments within Weir Basin and Railroad Basin have a sand content higher than 70 percent and would be suitable for onshore (beach) or nearshore placement. Sediments below 4 feet in the Coast Highway Basin would be suitable for beach or nearshore placement, but no sediments above 4 feet in the Coast Highway Basin and none of the sediment within the I-5 Basin would be suitable for beach or nearshore placement as the sand content is less than 70 percent.

Sediment testing shows that sediments in some areas of the lagoon contain contaminants (i.e., pesticides and metals). Sediment testing found low levels of DDE and metals in upper layers (0–3 feet) within each basin. These values were found to be above their respective ERL screening levels; however, no values were above ERM levels (SAIC 2008a; Table 3.4-1). This fine organic upper-layer material is not suitable for beach reuse and would require disposal in the on-site overdredge pit or the offshore disposal site, LA-5. The lower layer of sediment is primarily sand (greater than 70 percent) and would be suitable for reuse on beaches or for nearshore placement.

Material (depending on approach) would be placed at the Oceanside onshore or nearshore site during construction (see Table 2-8). Sediment suitable (>80 percent sand) for beneficial use as beach placement would be dredged and transported via pipeline to the beach. Sand would be discharged from the pipeline at the placement site in a slurry of water and sediment. To minimize impacts to nearshore water quality, a training dike would be constructed to form a settling basin where the slurry would be discharged (PDF-6). This would promote settling of sand out of the slurry and minimize turbidity of waters running off placement sites into the surf zone. The sand would then be spread along the beach using conventional construction equipment (e.g., bulldozers, scrapers, dump trucks, and graders). Because the deeper lagoon sediments targeted for beach replenishment consist of relatively clean sands with little contamination, runoff from the materials placement sites would not be expected to substantially degrade water quality or create a high oxygen demand in the surf zone. However, runoff waters may contain some suspended particles that did not settle out before the waters were released from behind the training dikes. Suspended sediments in the runoff may contribute to increased turbidity levels and discoloration of surface waters within the surf zone immediately adjacent to and downcurrent from the materials placement site.

Sediment that is marginally suitable (70 percent to 80 percent sand) for beneficial use would be dredged and transported via pipeline to the Oceanside nearshore area, where it would be discharged in water ranging in depth from approximately -20 feet NGVD29 to -30 feet NGVD29. Material discharged into the nearshore would be released close to the sea bottom to minimize surface turbidity.

When depositing material, some sediment fraction could remain suspended in the water column for various lengths of time depending on particle size and water movement. There would also be a degree of sediment resuspension in the water column of the deposition area, as well as the area of the seafloor where resident sediments would be physically disturbed and dislodged for a short period. However, it is anticipated that larger grain-sized sediments would be used for onshore or nearshore placement, which would be expected to settle out relatively quickly, thereby minimizing resuspension of sediments and the potential release of adhered pollutants into the water column. In addition, as stated above, upper layers of sediment containing low levels of contamination would not be suitable for beach reuse and would be disposed of at the on-site overdredge pit or the offshore disposal site, LA-5. Deeper lagoon sediments consisting of relatively clean sands with little contamination would be used for beach replenishment or nearshore placement.

The vertical (depth-related) extent of plumes depends on the initial displacement of bottom sediments, physical characteristics and settling velocities of the sediment particles, vertical mixing characteristics of the water column, and background suspended sediment concentrations/turbidity levels in nearshore waters. For example, the vertical distribution of sand-sized particles disturbed when disposed material strikes the bottom may be confined to the near-bottom water layer, particularly when the bottom sediments consist of coarse-grained, rapid-settling particles and a natural density gradient is present in the water column that limits vertical mixing. In contrast, disturbed fine-grained sediments may remain suspended and distributed throughout the water column for long periods, particularly during winter (unstratified) conditions. Similarly, plumes generated by placement activities can extend throughout the water column as particles settle at varying rates depending on particle size and depth-varying current speeds. However, it is anticipated that larger grain-sized sediments would be used for onshore or nearshore placement, which would be expected to settle out relatively quickly, thereby minimizing water quality impacts related to sedimentation/turbidity. Also, the background suspended sediment concentrations and turbidity levels of nearshore waters at the placement beaches are expected to reflect turbidity levels similar to levels expected in areas prone to wave and surf conditions; tidal and longshore current strengths and rip currents; and discharges from adjacent coastal rivers, lagoons, and storm drains.

Turbidity plumes associated with runoff from the placement sites would largely be confined to the surf zone area. However, in the presence of riptides or current jets from river or wetland discharges, some of the suspended sediments could be transported in an offshore direction and beyond the surf zone. Under these conditions, the plume would be transported and dispersed in a downcurrent direction, but likely at a lower speed due to reduced turbulence levels. Slower current speeds and reduced turbulence levels would also promote more rapid settling of suspended particles compared with those in the surf zone.

Estimates of plume dispersion distances from the Oceanside onshore and nearshore sites, under typical and maximum current conditions, are shown in Table 3.4-10. The estimated plume distances were calculated for a range in water depths, particle settling velocities, and current speeds.

Under typical current conditions, the plumes would generally extend 100 feet or less from the placement site. The plume transport distance would be expected to be less than 300 feet. Estimated plume distance on any given day is expected to vary according to the grain size characteristics of the material dredged, turbulence, current speed, and to what depth in the water column the particles are resuspended. Nevertheless, the estimated transport distances shown in Table 3.4-10 are considered reasonable conditions. Because the Oceanside materials placement sites are not in or adjacent to (i.e., within 3,100 feet) an ASBS, onshore or nearshore sand placement would not be expected to affect the natural water quality within an ASBS, even under maximum current conditions.

If turbidity levels exceed the permit limits, measures would be taken to ensure compliance with the permit. Corrective measures may include modification of pumping rates to the beach for

Table 3.4-10
Estimated Range and Average Turbidity Plumes for Materials Placement Sites

Materials Disposal/ Reuse Site	Depth (feet) MLLW	Range of Median Grain Size Diameters (mm)*	Range of Settling Velocities (feet/sec)	Estimated Downcurrent Plume Distance (feet) Range According to Depth and Current Speed — Knots (feet/sec): Typical 0.1 (0.17) to 0.9 (1.4)	Estimated Downcurrent Plume Distance (feet) Range According to Depth and Current Speed — Knots (feet/sec): Maximum 1.0 (1.5) to 2.0 (3.1)	Overall Mean Grain Size Diameter (mm)	Mean Settling Velocity (feet/sec)	Estimated Average Downcurrent Plume Distance (feet) Range According to Depth and Average Current Speed — Knots (feet/sec): Average 0.5 (0.85)
Oceanside, North Carlsbad	5–20	0.26–0.63	0.10–0.29	6–100	50–210	0.35–0.59	0.15–0.27	15–60

Source: Settling velocities based on Graf 1971 as cited in SANDAG 2011.
* Gravel-sized particles, which would rapidly settle, were not considered in the calculations.

onshore placement or reconfiguration of the training dikes to increase the residency time of the slurry waters as a way to manage the suspended sediment concentrations in the runoff waters.

Turbidity plumes associated with runoff from the Oceanside placement sites would persist for the duration of the periodic sand placement operations. However, particle settling, mixing, and dilution processes occurring in the naturally energetic surf zone area would rapidly reduce the plumes to background conditions once the placement operations were completed. Thus, a substantial increase in sedimentation over existing conditions would not be anticipated to occur. Further, given the similarities in grain size between lagoon sediments and sediments at placement sites, and the general absence of chemical contaminants in the lagoon sediments that are proposed for placement, the sand placement operations would not result in substantial changes or degradation of water or sediment quality at the materials placement sites. Consequently, the potential for significant toxicity to marine organisms or exposure of marine organisms to bioaccumulative materials would be negligible. This indicates little potential for biological effects (i.e., toxicity or contaminant bioaccumulation) or human health effects with sand placement operations. Thus, sand placement would not cause exceedances of water quality standards or discharge requirements. **Placement of material within the littoral zone would not violate ocean water quality standards, discharge requirements, or applicable federal or state standards; be hazardous to human health; be deleterious to biological communities; cause substantial adverse changes to water or sediment quality; cause toxicity or bioaccumulation of contaminants in aquatic biota; negatively affect wildlife habitat; or result in a substantial increase in sediment or siltation. Impacts would be less than significant (Criteria A through D).**

Offshore Disposal

Fine-grained material not suitable for reuse within the littoral zone could be generated by the project and would require disposal at the offshore disposal site, LA-5, if no overdredge pit is created and on-site disposal capacity is not available. This material would have a high proportion of fine-grained material, ranging from approximately 12 percent to 65 percent. The majority of the material would be from the I-5 Basin, as none of the sediment within the I-5 Basin would be suitable for beach or nearshore placement. Upper layers of sediment in the Railroad Basin (0–2 feet) and the Coast Highway Basin (0–4 feet) would also require disposal at LA-5.

Sediment testing showed that some areas within the upper layer of fine material have pesticide and metal levels that exceed their ERLs (Table 3.4-1); however, no levels exceeded ERM standards. Additional Tier 3 testing would be required prior to Corps and EPA approval of the proposed disposal. Tier 3 testing is generally more complex than Tiers 1 and 2 and would involve effects-based testing to determine the potential contamination from effluent, runoff, leachate, volatilization, and plant and animal uptake. Sediment samples would be expected to meet and exceed ocean disposal acceptance criteria (Everest and Battelle 2003). Should the materials be determined not suitable for disposal at this location, the material would be disposed of at an upland landfill.

Material for disposal at LA-5 would be piped from the dredge to a monobuoy offshore, where it would be transferred to a barge for transport to LA-5. During transfer of the material, excess water would be decanted from the barge and returned via pipe back to the lagoon to minimize ocean turbidity (PDF-10) by not allowing for the release of sediment-laced water. At LA-5, the barge would release the material within the boundaries of the disposal site. Since the material dredged from the lagoon would be discharged near the surface of the ocean (i.e., without the benefit of a vertical discharge pipe used for the more valuable beach sand spoils), the resulting plume would be expected to remain suspended in the water column for a much longer period of time (i.e., hours) than that for the deeper, heavier material that would be suitable for onshore/nearshore placement. The plume's travel distance and dilution would depend on ambient currents, wind, and wave action existing at the time of disposal.

Assuming an offshore water column current of 1 knot at LA-5 at the time of disposal, the plume would be visible for approximately 13 minutes and travel approximately 1,130 feet (Merkel & Associates 2014; Appendix F). Material disposed of at LA-5 would have to comply with the requirements set by the Corps and EPA (EPA 1987), and, as noted above, lagoon sediments would be expected to meet acceptance criteria and would be appropriate for disposal at LA-5 due to low levels of contamination. If approval is not obtained from the Corps and EPA for disposal at this location, the material would be disposed of at an upland landfill. **As a result, materials disposal for the Enhancement Project would not violate applicable federal or state standards; create hazardous human health conditions; cause deleterious effects to pelagic and benthic biological communities; or result in substantial adverse changes to water or sediment quality, or a substantial increase in sediment or siltation. Impacts would be less than significant (Criteria A through D).**

No Project Alternative

No materials disposal or placement would occur under the No Project Alternative. No changes to water quality would occur and **no impacts would result from the No Project Alternative (Criteria A through D).**

3.4.4 MITIGATION MEASURES

As shown in Table 2-10, the construction methods utilized by the project would minimize erosion and the release of pollutants into the environment, including use of a cutterhead dredge and the use of cofferdams, dikes, and dewatering, when applicable. However, the following mitigation measures are required for significant impacts resulting from turbidity during construction activities within the lagoon. Mitigation measures Water Quality-1 and Water Quality-2 would be required for implementation of any of the three lagoon enhancement alternatives during construction activities within the lagoon. With implementation of mitigation measures Water Quality-1 and 2, impacts would be reduced to less than significant.

Water Quality-1 Compliance with regulatory requirements intended to address turbidity impacts (e.g., Construction General Permit, Municipal Permit) shall be implemented to ensure impacts would be reduced to a less than significant level. Compliance with those permit conditions shall be monitored through the construction monitoring program and the contractor shall certify to the engineer of record that permit conditions have been completed.

Water Quality-2 Water levels shall be actively managed by using a temporary cofferdam, and/or dike, and/or dewatering in active work areas during weir replacement, and/or tidal inlet construction, and/or I-5 weir construction activities to minimize the impact of dredge-related turbidity. The contractor would ensure waters would be free of changes in turbidity that cause nuisance or adversely affect beneficial uses during construction activities.