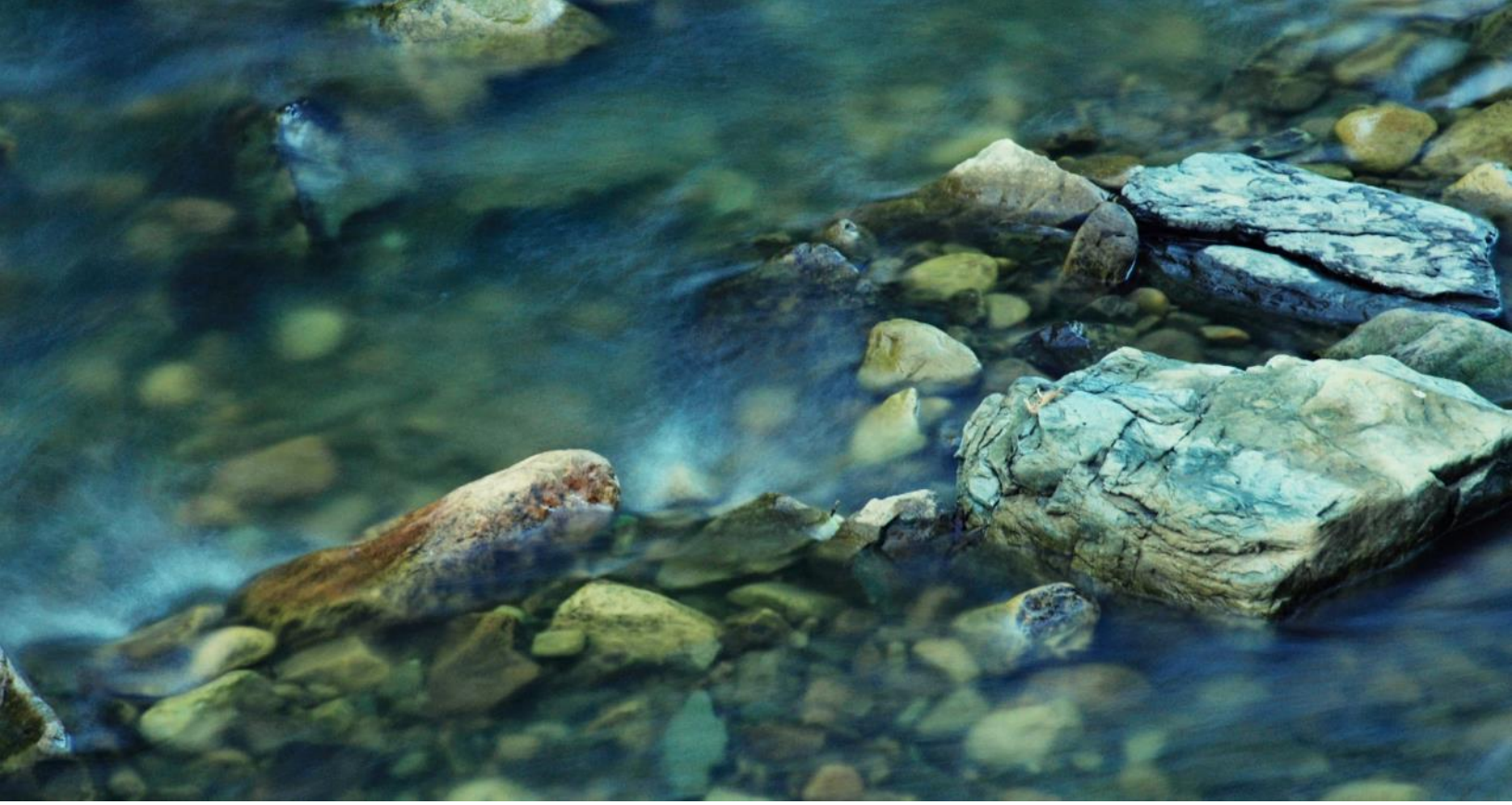

November 2019
Buena Vista Lagoon Enhancement Project

ANCHOR QEA

Preliminary Cost Estimate Update for Construction and Maintenance

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APPENDICES

ABBREVIATIONS

Enhancement Project	Buena Vista Lagoon Enhancement Project
Final EIR	*Buena Vista Lagoon Enhancement Project: Final Environmental Impact Report*
LA-5 ODMDS	Los Angeles Ocean Dredged Material Disposal Site
NGVD	National Geodetic Vertical Datum

1 Introduction

This document is an update of the cost estimate report prepared as an appendix to the *Buena Vista Lagoon Enhancement Project* [Enhancement Project]*: Final Environmental Impact Report* published in September 2017 (Final EIR; AECOM 2017). The purposes of the update are: 1) to present the cost estimate of one additional alternative, namely the Modified Saltwater Alternative, to the list of proposed alternatives for the Enhancement Project; and 2) to present the cost estimates prepared previously for four other Enhancement Project alternatives in 2019 dollars so that comparison of cost estimates can be conducted among all five alternatives. The five enhancement alternatives are listed as follows:

- Saltwater Alternative
- Modified Saltwater Alternative
- Freshwater Alternative
- Hybrid Alternative A (mix of saltwater and freshwater with channel in Weir Basin)
- Hybrid Alternative B (mix of saltwater and freshwater without channel in Weir Basin)

The costs associated with each enhancement alternative will be an important consideration in the ultimate selection of a preferred alternative. To help address the economic feasibility, construction cost estimates were prepared for each of the five enhancement alternatives based on preliminary design plans prepared for each enhancement alternative. In addition, maintenance cost estimates were prepared to provide information regarding the long-term costs associated with each enhancement alternative. The construction cost estimates are presented in Section 2, followed by the maintenance cost estimates in Section 3.

2 Construction Cost Estimate

2.1 Overview

Construction cost estimates were derived from estimated quantities and the unit costs associated with these quantities. Unit cost data used in the cost estimate were based on information from cost estimates and actual construction costs of similar projects within Southern California (e.g., Bolsa Chica Wetlands, San Diego Bay Western Salt Ponds Restoration, San Dieguito Lagoon Restoration), RSMeans (2013), Caltrans Cost Data Books, and Dredging Statistics Program of the U.S. Army Corps of Engineers (USACE 2014). To update the previous costs prepared in 2014 to 2019 dollar values, a construction cost index has been applied to the 2014 costs (ENR 2019).

The largest component of the construction cost associated with each alternative is the disposal of fine-grained sediment excavated during project construction. Two approaches for disposal of these sediments were investigated to develop the construction cost estimate. The first approach, referred to as "Approach 1: LA-5" would involve transporting fine-grained sediment by barge to the Los Angeles Ocean Dredged Material Disposal Site (LA-5 ODMDS) located off the coast of San Diego approximately 6 miles from Point Loma. The LA-5 ODMDS is an offshore site approved by the U.S. Environmental Protection Agency for the disposal of ocean dredged material. The second approach would involve the creation of an overdredge pit within the project site in a location devoid of beach-quality sand. The fine-grained sediments in the overdredge pit deemed unsuitable for beach or nearshore placement would essentially be swapped for the deeper, beach-quality sand, and then the beach-quality sand would be placed on nearby beaches or in nearshore waters where it would serve as beneficial use (beachfill). This approach is referred to as "Approach 2: Overdredge Pit." Considering two sediment disposal approaches for all five enhancement alternatives resulted in ten different construction cost estimate scenarios. The results of these ten construction cost estimate scenarios are presented below.

2.2 Construction Cost Estimate Background Information and Assumptions

The following background information and assumptions affect the construction cost estimates for the five enhancement alternatives and two disposal approaches. Previous geological investigations suggested that sediment underneath the current lagoon bottom is free of contaminants and falls into three categories: beach-quality sand, nearshore-quality fine sand, and fine-grained sediment. It was assumed that sediment that contains less than 20% fine-grained sediment could be placed on the beach at North Oceanside Beach and Carlsbad Beaches. It was assumed that sediment that contains between 20% and 30% fine-grained sediment can be placed in nearshore waters just off the coast of Oceanside where the beach-quality sediment would be transported to the beach via wave

action to provide a beneficial use (beachfill). Sediment which does not meet either of these criteria would be disposed of either at the LA-5 ODMDS or in an overdredge pit created within the lagoon.

The construction cost estimate includes the following strategies, conditions, and assumptions.

- Costs are in 2019 U.S. dollars with unit costs representing in-place costs, including contractor's overhead and profit. Costs derived from projects developed before 2019 were converted to 2019 costs using the cost indexes developed by the Engineering News Record (ENR 2019).
- The cost estimates do not include costs to improve bridges and overcrossings for the NTCD Railroad and I-5. Each of these corridors crosses the lagoon, but other entities are in charge of planned improvements to the structures. The costs of embankment protection for these structures are not included in the construction cost estimate.
- Cattails and other vegetation that are planned for removal would be disposed at the El Corazon Compost Facility located in Oceanside, San Diego County, approximately 4 miles from the Enhancement Project.
- Earthwork would be done by dredging, and it is assumed that dewatering would not be required since all sediment would either be beneficially reused as beachfill with direct beach placement or nearshore placement or disposed of via on-site placement in an overdredge pit or offshore at the LA-5 ODMDS.
- Earthwork quantities were estimated based on contours for the proposed enhancement alternatives prepared by Everest and Anchor QEA and contours for existing conditions prepared by Wootton Land Consultants (2005). Volume estimates were prepared with the aid of Autodesk Civil 3D terrain models.
- Costs do not include land acquisition, conservation easements, or post-construction monitoring.
- Mobilization and demobilization costs were based on 10% of the other construction costs for the lowest cost alternative given the same disposal approach.
- The following costs were estimated based on a percentage of other costs.
  - Contingency estimated at 25% of the construction cost.
  - Construction management estimated at 5% of the construction cost with contingency.
  - Environmental monitoring during construction estimated at 2% of the construction cost with contingency.
  - Final engineering/design estimated at 10% of the total construction cost.

2.3 Construction Cost Estimate Summary

The detailed construction breakdown for each enhancement alternative under each beneficial use/disposal approach is presented in Appendix 1. A summary of the total project construction costs by alternative and approach is shown in Table 1. The total project cost ranges from $50.2 million to

$88.2 million. In general, the construction cost for the Modified Saltwater Alternative is the highest, while that for the Freshwater Alternative is the lowest. The Overdredge Pit Approach lowers the project cost by $3.6 million to $7.5 million.

Table 1
Construction Cost Summary (in 2019 Dollars)

Alternative	Approach 1: LA-5	Approach 2: Overdredge Pit
Saltwater	$75,400,000	$70,400,000
Modified Saltwater	$88,200,000	$80,700,000
Freshwater	$53,700,000	$50,200,000
Hybrid A	$78,500,000	$72,100,000
Hybrid B	$77,400,000	$71,100,000

Under the Saltwater Alternative, Modified Saltwater Alternative, and Hybrid Alternatives, the existing 29-foot long Carlsbad Boulevard Bridge would be replaced with a bridge over the proposed 110-foot-wide channel. The width of the roadway would remain at 54 feet per discussions with City of Carlsbad staff but would be elevated from +9.7 feet National Geodetic Vertical Datum (NGVD) to +14.0 feet NGVD. Approaches extending approximately 300 feet north and south of the structure would be constructed to maintain sight lines for the proposed bridge. Bridge construction costs were prepared by AECOM, and these cost estimates have been incorporated into the detailed cost estimates in Appendix 1. Under the Freshwater Alternative, no channel expansion would occur and there would be no changes to the existing bridge structure.

Upon completion of the major earthwork elements of the construction effort, planting in specific proposed habitat types would be required to facilitate success. Only some habitats, such as vegetated habitats and saltwater dependent habitats, would require planting. Initial planting and plant maintenance needs for 5 years after construction have been included in the construction cost estimate. In calculating these costs, certain assumptions were made regarding the specific restoration tasks, required maintenance, and plant density involved in the enhancement of each habitat type under each alternative. The planting costs were prepared by AECOM, and this information has been incorporated into the detailed cost estimates in Appendix 1.

3 Maintenance Cost Estimate

3.1 Overview

Maintenance cost estimates were derived from estimated quantities of project features requiring maintenance and the unit costs associated with these quantities. Unit cost data used in the cost estimate were based on information from cost estimates and actual construction costs of similar projects within southern California (e.g., Bolsa Chica Wetlands, San Diego Bay Western Salt Ponds Restoration, San Dieguito Lagoon Restoration), RSMeans (2013), and Caltrans Cost Data Books. Costs derived from projects developed before 2019 were converted to 2019 costs using the cost indexes developed by the Engineering News Record (ENR 2019).

The Everest study (2014) has shown that under the Saltwater Alternative and two Hybrid Alternatives littoral sediment is likely to deposit within the inlet channel, Weir Basin, and, possibly, the Railroad Basin. The Modified Saltwater Alternative would be expected to have similar littoral sediment deposition. This deposition would likely accumulate over time until the inlet is effectively closed to tidal exchange. To maintain tidal exchange, a maintenance program would be required to remove the deposited littoral sediment from the inlet channel. In addition, it is expected that fluvial (river) sediment would deposit within the lagoon over time in a manner similar to, albeit slower than, historical sedimentation. It is possible that fluvial sedimentation might keep pace with sea level rise, in which case little to no maintenance would be required for fluvial sedimentation; however, given uncertainties in sea level rise and fluvial sedimentation it is prudent to plan for such sedimentation. Consequently, to maintain the habitat distribution in the future, a maintenance program could be required to remove the deposited fluvial sediment from the lagoon basins. Structural elements (e.g., channel guide) associated with each enhancement alternative would require maintenance in the future to maintain the function of these elements (e.g., channel slope protection). Other maintenance components could include trash removal, exotics removal, and predator control, but these components are not considered further as it is assumed such components would be provided by the California Department of Fish and Wildlife and nonprofit organizations. The cost estimate associated with these maintenance components is presented below for the five enhancement alternatives.

3.2 Maintenance Cost Estimate Background and Assumptions

The following background information and assumptions affect the maintenance cost estimates for the various enhancement alternatives:

- Costs are in 2019 U.S. dollars with unit costs representing in-place costs, including contractor's overhead and profit.
- The maintenance cost estimates do not include costs to maintain the bridges and overcrossings for Carlsbad Boulevard, NTCD Railroad, and I-5. Each of these corridors crosses

the lagoon, but other entities are in charge of maintenance for these infrastructure components.

- The littoral sediment volume was estimated from the study conducted for this project as documented in the *Enhancement Project Tidal Inlet Maintenance Memorandum* prepared by Everest (2014). It was estimated that the tidal inlet would require maintenance every 12 to 20 months, so annual maintenance was assumed for development of the maintenance cost estimates. Littoral sediment would be suitable for beach placement upcoast and/or downcoast from the inlet under the two Saltwater Alternatives and two Hybrid Alternatives. Littoral sediment would be excavated using conventional, land-based construction equipment that would access the area via the inlet channel.
- The fluvial sedimentation volume was estimated from an analysis of historical bathymetric data conducted by Everest to support the maintenance cost estimate. Fluvial sedimentation is caused by relatively small base flow and urban runoff flows that occur throughout the year as well as relatively large storm flows that occur primarily during the wet season from October through March. Most sediment delivery to the lagoon is associated with the storm flows; hence, most fluvial sedimentation is associated with storm flows that occur on an episodic basis. A range of fluvial sedimentation was developed to capture the episodic nature of fluvial sedimentation. For the Saltwater Alternative and Modified Saltwater Alternative, it was assumed that most of the fine-grained fluvial sediment would pass through the lagoon to the ocean so fluvial sedimentation would be negligible; hence, it was assumed that no fluvial sedimentation maintenance would be required for the two saltwater alternatives. For the Freshwater Alternative and two Hybrid Alternatives, a high and low range of fluvial sedimentation was identified, and these values were carried through to develop both high and low maintenance costs. High and low ranges were developed for other maintenance cost components to maintain consistency for this approach. It was assumed that maintenance of fluvial sediment would be required once every 25 years. It was assumed that the fluvial sediment would mostly be fine-grained sediment that would be dredged from the lagoon, dried on site, and hauled to a nearby landfill for disposal using standard dump trucks.
- Annual vegetation maintenance costs were based on unit costs ($ per acre) to conduct such maintenance from two sources applied over the proposed cattail maintenance area. The low cost estimate was based on a unit cost (updated to 2019 dollars) taken from a 1986 article titled "Efficacy and Cost of Aquatic Weed Control in Small Ponds" in the *Journal of American Water Resources Associates* (Shireman 1986). The high cost estimate was based on a unit cost (updated to 2019 dollars) taken from the University of California Division of Agriculture and Natural Resources (UCANR 2015).
- Annual miscellaneous maintenance costs for various structures (e.g., weir) were expressed as a percentage of the initial structure cost. Such structures may not require significant maintenance for several years in a row, only to be damaged by periodic storm events. The

structure maintenance costs are intended to represent an annualized cost for intermittent and/or long-term periodic maintenance and full replacement of damaged components. To develop this cost, it was assumed that maintenance of water control structures would be conducted every 10 years to develop a high cost estimate or every 20 years to develop a low cost estimate.

- Mobilization and demobilization costs were estimated at 10% of the other maintenance costs.

3.3 Maintenance Cost Estimate Summary

Detailed maintenance cost estimate information for each enhancement alternative is provided in Appendix 2. The ranges in total estimated annual maintenance costs for each enhancement alternative are presented in Table 2. The total annual maintenance cost ranges from about $181,000 to $873,000. The maintenance cost for the Saltwater Alternative has the lowest estimated cost, while the costs for the other alternatives are estimated at anywhere from about $4,000 to $679,000 higher than the cost for the Saltwater Alternative.

Table 2
Maintenance Cost Range Summary (in 2019 Dollars)

Alternative	Annual Cost Low End	Annual Cost High End
Saltwater	$181,000	$279,000
Modified Saltwater	$185,000	$295,000
Freshwater	$261,000	$585,000
Hybrid A	$437,000	$873,000
Hybrid B	$434,000	$860,000

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Appendix 1
Design and Construction Cost Estimate

Appendix 2
Annual Maintenance Cost Estimate