Salton Sea Funding and Feasibility Review

Work Plan

TETRA TECH

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This document is prepared for public review and comment. Comments may be provided to:

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Comments will be reviewed by the Technical Coordination Team and incorporated into the work scope as appropriate. If substantive comments are received, a revised Work Plan may be produced and distributed.

Executive Summary

The overarching goal of this Work Plan is to develop an adaptive roadmap to reach a comprehensive solution to the Salton Sea's numerous environmental concerns. Multiple alternatives and approaches will be developed in the context of current funding opportunities and constraints while satisfying institutional and political requirements. New and updated alternatives will be developed with the best available science and analyzed based on financial, engineering and institutional/political criteria. This document should be considered dynamic; as contractors and specialists continue to join the restoration team to help complete various tasks, more specific details will be incorporated into those tasks or subtasks. The Work Plan may be updated as the project moves forward and as project needs arise. Stakeholders, including the public and any other interested parties, will have an important role throughout the life of this project and into the future. The program will include means to inform stakeholders as well as to receive feedback.

This Work Plan for the Salton Sea Funding and Feasibility Review describes the work to be performed and the general approach to be used to continue feasibility planning, design and environmental compliance for improving conditions at the Salton Sea, California. Even though the Sea was relatively stable in size and elevation over the last 40 years of the twentieth century, the dissolved salts present in the inflow water (about 3 tons per acre-foot) have been continuously accumulating in the water (except for the amount that precipitates and falls to the bottom). Declines in the inflow discharge have caused the Sea's water surface elevation to drop by about 5 feet over the past 10 years. Consequently, salt concentrations are rising even faster than before and are currently about 52 grams per liter (g/L). This is about 49% saltier than ocean water (USGS 2013). If no remedial actions are taken, the Sea will become increasingly saline within 15 years (over 60 g/L salt) and hypersaline (over 120 g/L) within 20 years, effectively eliminating the current fish habitat and an important food source for piscivorous birds (Pacific Institute 2006). Also, as the Sea recedes, there is potential for windblown dust emissions (mostly PM_{10}: particulate matter with an aerodynamic diameter of 10 micrometers or less), from the exposed dry lakebed (the playa). These particles are small enough to be inhaled and represent a potentially significant human health risk. Other concerns include highly eutrophic conditions and the creation and emission of ammonia and hydrogen sulfide in the lake, which have significant adverse wildlife and human health impacts (IID/Salton Sea Air Quality Management Team 2013).

The Work Plan includes development of a review of relevant and current data on the Sea. Future goals and objectives are divided into the following categories: planning and engineering, environmental, and financing and feasibility which includes evaluation of land development options and alternative renewable energy sources. Planning and engineering goals of the project include maintaining the Sea as a repository of agricultural drainage from the Imperial and Coachella Valleys, restoring opportunities for recreational uses and restoring a viable sport fishery. The main environmental goal of the project is to provide a safe, productive environment for resident and migratory birds and sensitive species, to manage eutrophic conditions such that the adverse human and wildlife impacts are minimized, and to

mitigate dust emissions resulting from proposed activities. Integrating economic development opportunities along the shoreline is another important goal, which would include creating opportunities of development of land and renewable energy.

The approach includes the formulation of **alternative scenarios** for the future of the Sea with one or more **restoration components**. The restoration components will be designed based on performance with respect to meeting multiple environmental objectives, capital and O&M costs, feasibility, and long-term sustainability. The effort will build upon current and past Federal, State and local studies, and new components are expected to be developed which meet the current conditions and potential funding realities. Components will be evaluated against their effectiveness to provide habitat and water quality improvements, control salinity and elevation, and their ability to mitigate potential dust problems. The restoration alternatives will necessarily meet the requirements of and include plans to implement dust mitigation measures as applicable. The conceptual planning and cost estimates for each restoration component and the complete alternatives will be described. The components will include a variety of engineering structural and environmental design features. The feasibility analysis will involve consideration of local geotechnical and soil conditions, availability of materials, and a variety of other engineering factors. Restoration components will incorporate salinity, water quality, and habitat improvements, and the integration of smaller local habitat improvement projects with large-scale engineering solutions.

A review of potential financing and funding options for the Salton Sea restoration activities will be discussed. This part of the work shall develop independent estimates of the renewable resource potential for the following resources in the Salton Valley: solar (photovoltaic and concentrating solar power), geothermal, solar thermal gradient ponds, and algae. The review will include a land use and resource assessment, a high-level market and power transmission analysis, a high-level business model, and an energy report. Other potential land development opportunities such as infrastructure financing districts will be considered for funding restoration activities.

Stakeholders, including the public and any other interested parties, will have an important role throughout the life of this project and into the future. The program will include means to inform stakeholders as well as to receive feedback. The Salton Sea Authority (the Authority) meetings are open to the public and are an appropriate forum to solicit public input. The Authority website and meetings will be the main avenue for the distribution of draft documents. Documents and data developed through this process will be made available for review and comment on the Authority website.

Imperial County and Imperial Irrigation District Sign Historic Memorandum of Understanding to Save the Salton Sea, October 24, 2013.

Acronyms and Abbreviations

Acronyms and abbreviations used in the Work Plan are listed below.

Authority	Salton Sea Authority
BLM	Bureau of Land Management
CAISO	California Independent System Operator
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CNRA	California Natural Resources Agency
CSP	Concentrating Solar Power
CVWD	Coachella Valley Water District
DOE	Department of Energy
DRECP	Desert Renewable Energy Conservation Plan
DWR	California Department of Water Resources
GIS	Geographic Information Systems
IID	Imperial Irrigation District
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
O&M	Operations & Management
OMER	Operation, maintenance, energy and repair
PUC	California Public Utilities Commission
PV	Photovoltaic
QSA	Quantification Settlement Agreement
R&D	Research & Development
RE	Renewable Energy
Reclamation	US Bureau of Reclamation
RFP	Request for Proposals
RFQ	Request for Qualifications
RPS	California Renewables Portfolio Standard
SCAQMD	South Coast Air Quality Management District
SCH	Species Conservation Habitat (Project)
TCT	Technical Coordination Team
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

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1.0 Introduction and Program Overview

This Work Plan provides an overview of the Salton Sea Funding and Feasibility Review Program. The goals and objectives of the program include planning and engineering, environmental, and financing and feasibility objectives. An overview of the Benchmarks identified in the State grant is discussed.

1.1 Introduction and Program Overview

This Work Plan outlines the work to be done and methods to be used to continue feasibility planning, design and environmental compliance for improving conditions at the Salton Sea, California. The Salton Sea is located in a closed portion of the Colorado River basin in Riverside and Imperial Counties in southern California, south of Indio and north of El Centro. The Sea is about 230 feet below mean sea level (msl) and has no natural outlet (USGS 2013). Land under the Sea is under a checkerboard of ownership consisting of: Federal (47%), Imperial Irrigation District (44%), tribal (5%), private (2%), State (1%) and Coachella Valley Water District (1%). The Salton Sea Basin is part of the Lower Colorado River Delta system. Lakes have historically existed in the basin as the course of the Colorado River shifted, most recently, several hundred years ago.

The current body of water formed in 1905 when a levee break along the Colorado River caused flows from the Colorado River to enter the basin for about 18 months. Since its formation in 1905, the Sea has been sustained predominantly by drainage flows from the nearly 600,000 acres of irrigated farmland in the Coachella and Imperial Valleys. The Sea also currently receives agricultural drainage, urban runoff, and wastewater flows from the Mexicali Valley and water from storm run-off (Salton Sea Authority 2006).

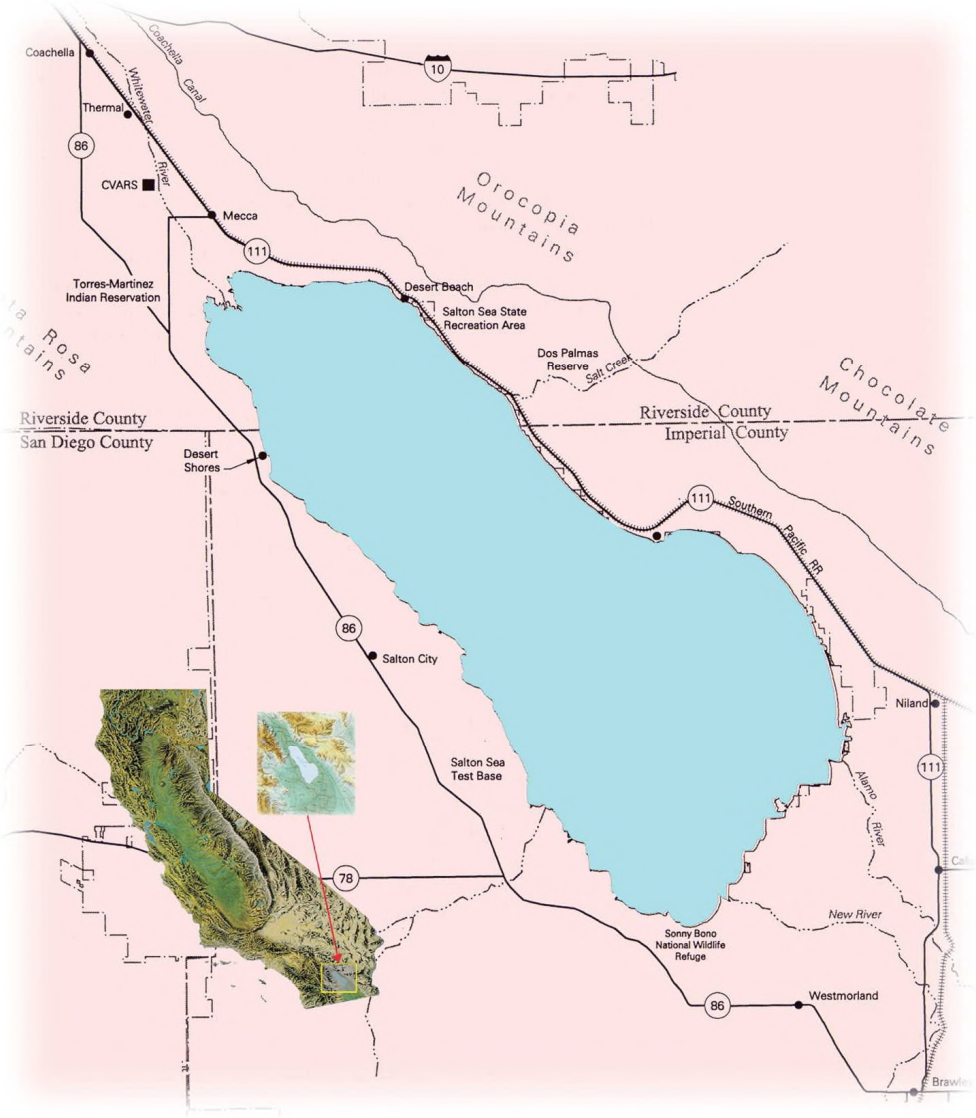


Figure 1: Map of Salton Sea

The Salton Sea was a major regional recreational destination in the 1950s and 60s, attracting more visitors annually than Yosemite National Park. Nascent seaside resort and residential communities, like Salton City, North Shores and Salton Sea Beach, sprung up along the Sea's 90-mile shoreline. While the Sea continues to remain a regional recreation resource for campers, fishing, boating, hunting, bird watching and passive activities, the Sea's increasing salinity and other water quality problems have curtailed recreational use in the area beginning in the early 1970s (Salton Sea Authority 2006).

The Sea and its adjacent areas have supported a diverse wildlife habitat for over 400 bird species. The Sea also serves as a critical link on the 5,000 mile international Pacific Flyway for bird migration (Shuford et al 2002).

Another important resource in the Salton Sea area is the geothermal energy field at its south end. This important source of green energy currently has geothermal energy plants with a combined generation capacity of about 300 MW. It has been estimated that the energy field can support up to 2,000 MW of baseload generation capacity. Part of the energy field is now under water, partially located in an area that has important shallow water habitat value (Salton Sea Authority 2006). However, geothermal production will become more practical when the shoreline recedes due to reduced inflows or engineered alterations. Specific plans will need to be developed to minimize conflicts between these two important assets.

Even though the Sea was relatively stable in size and elevation over the last 40 years of the twentieth century, the dissolved salts present in the inflow water (about 3 tons per acre-foot) have been continuously accumulating in the water (except for the amount that precipitates and falls to the bottom). Declines in the inflow discharge have caused the Sea's water surface elevation to drop by about 5 feet over the past 10 years. Consequently, salt concentrations are rising even faster than before and are currently about 52 grams per liter (g/L) (USGS 2013). This is about 49% saltier than ocean water. If no remedial actions are taken, the Sea will become so saline within 15 years (over 60 g/L salt) that the remaining fish that serve as a food source for piscivorous birds will be effectively eliminated. If the current inflow projections are correct, the Sea will evolve into a hypersaline water body (over 120 g/L salt) within 20 years, similar to Mono Lake in Inyo County. Some have suggested an even more rapid deterioration in habitat values (Pacific Institute, 2006). As inflows are reduced by water transfers and other factors as discussed below, the Sea will eventually become a semi-solid brine pool (over 200 g/L salt) surrounded by hard-surface salt flats similar to the Great Salt Lake in Utah and the Laguna Salada basin southwest of Mexicali.

In addition to high salinity, the Sea is also highly eutrophic, meaning that it has high levels of phosphorus and nitrogen compounds that result from agricultural drainage and municipal wastewater, a significant fraction of which, until 2007, was discharged without treatment into the New River from Mexicali south of the border. These nutrients stimulate algal growth which settles to the bottom of the sea, and upon decay, creates oxygen deficiencies in the water. The near

absence of oxygen in the deep bottom-water of the Sea leads to the formation and accumulation of substances such as hydrogen sulfide and ammonia that have unpleasant odors and can be toxic to fish in water and to humans when inhaled. When wind events overturn the Sea's natural stratification, these harmful gases rise to the surface and have caused sudden fish kills involving millions of fish. The Sea's eutrophic state also causes the unpleasant odors that permeate the residential areas surrounding the Sea (and occasionally as far away as Los Angeles and the San Fernando Valley) in certain months of the year (Salton Sea Authority 2006).

Projected inflow reductions in the upcoming years will shrink the Sea's wetted surface area and further concentrate salinity and possibly increase eutrophication problems. There are two primary reasons for the projected inflow reductions. First, the Quantification Settlement Agreement (QSA) was signed in October 2003 by Imperial Irrigation District (IID), Coachella Valley Water District (CVWD), other California Colorado River water users, the U.S. Department of Interior, and the California Department of Water Resources (DWR). Under this landmark agreement, about 300,000 AFY of Colorado River water (counting both contractual transfers and other reductions) that previously flowed into the Salton Sea will be supplied instead to other users outside the Salton Sea basin. Second, New River inflows from Mexico, now about 130,000 AFY, are estimated to decline as a result of plans by Mexicali to reclaim treated-effluent and farm-drainage flows (Salton Sea Authority 2006).

The overarching goal of this Work Plan is to develop an adaptive roadmap to reach a comprehensive solution to the Salton Sea's numerous environmental concerns. The alternatives and approaches will be developed in the context of current funding opportunities and constraints while satisfying institutional and political requirements. Alternatives will be developed with the best available science and analyzed based on financial, engineering and institutional/political criteria. This document should be considered dynamic; as contractors and specialists continue to join the restoration team to help complete various tasks, more specific details will be incorporated into those tasks or subtasks. The Work Plan may be updated as the project moves forward and as project needs arise. Stakeholders, including the public and any other interested parties, will have an important role throughout the life of this project and into the future. The program will include means to inform stakeholders as well as to receive feedback.

1.1.2 Benchmarks

This Work Plan represents Benchmark One of the grant between the State of California Natural Resources Agency and the Salton Sea Authority (the Authority), Agreement No. 0540 – SSA 1. The Final version of the Work Plan will be issued as a Public Draft, which will be posted to the Authority website (http://saltonsea.ca.gov/) along with correspondence information for comments. Interested stakeholders will have a specified amount of time to submit comments about the Work Plan, and the Work Plan may be revised accordingly. Any revisions or updates to the Work Plan will be made available on the Authority website.

Benchmark 1: Work Plan

This Work Plan represents Benchmark 1 of Grant Agreement No. 0540 – SSA 1 between the Natural Resources Agency and the Salton Sea Authority. The "Final" Work Plan for Benchmark 1 will be issued as a Public Draft and will be considered a living document subject to revision as the project proceeds.

The bulk of the project will be divided into the following six additional benchmarks:

- Benchmark two will consist of a Final Data Report following a review and update of existing environmental data.
- The third benchmark will consist of a review of alternatives with respect to existing conditions, including engineering data and an evaluation of restoration components.
- A set of conceptual plans for restoration components with cost estimates will be submitted as Benchmark Four.
- The fifth benchmark will be marked by the completion of an infrastructure development feasibility report.
- Benchmark six will involve economic analyses and funding feasibility with a major portion to be completed by the National Renewable Energy Laboratory (NREL).
- Benchmark seven will be comprised of the Final Report and the associated presentation of findings.

In addition to the seven benchmarks discussed above, a Project Management Task will involve program administration, oversight and legal review.

1.2 Goals and Objectives

The broad goal of this project is to develop an updated vision for the Salton Sea and surrounding region that matches funding realities with needs. The project has three specific goals for the Salton Sea and its surrounding area:

- Provide a healthy environment for residents around the Sea

- Work toward a Salton Sea and bordering habitat that sustains enough aquatic life to provide habitat for wildlife on the Pacific flyway
- Help revitalize the economy around the Salton Sea and in Imperial and Riverside Counties

Goals and objectives for the project can be divided into the following categories: planning and engineering, environmental, and financing and feasibility which includes evaluating land development options and alternative energy sources. The basic project goals along with the specific objectives for implementing the goals will continue to be re-assessed and re-evaluated as each phase of the Work Plan is implemented.

1.2.1 Formulate Alternative Future Scenarios for the Salton Sea

One of the key objectives of this project is to formulate alternative future scenarios for the Salton Sea. Existing condition data will be reviewed and updated to inform restoration options. Different options for achieving the goals and objectives of this Work Plan will be compiled and reviewed during Task 4.0. This review will evaluate individual restoration components as part of the solution. The components will be combined to formulate complete alternatives that describe future scenarios for Salton Sea restoration that are aligned with the goals and objectives discussed below. Alternatives will be formulated to match a range of funding scenarios that are expected to start with modest plans for habitat projects around the borders of the Sea to much larger, more comprehensive solutions. Workshops held during Tasks 2.0-6.0 will include TCT members and other agencies with relevant expertise.

1.2.2 Planning and Engineering

The primary planning and engineering objectives of the project will be to develop restoration components that can be used separately or in combination to further the goals stated above. The components to be investigated include:

- Identify methods for conveyance of water to remove salts from the Sea through pipelines or other methods
- Identify and evaluate sources of water to help maintain the Sea from various sources
- Evaluate structural methods to divide the Sea into partitions with varying salt levels.

A variety of planning and engineering investigations will be conducted to support these objectives. In addition to the broad project goals discussed above, the planning and engineering goals will include maintaining the Sea as a repository of agricultural drainage from the Imperial and Coachella Valleys, restoring opportunities for recreational uses, and restoring a viable sport fishery.

1.2.3 Environmental

The environmental objectives of the project will support the goal of providing improved water quality and a safe, productive environment for resident and migratory birds and sensitive species. An objective of this study is to identify a variety of environmental components that can be incorporated into the restoration plans. These components will be selected from all relevant environmental planning projects such as the State's Species Conservation Habitat Project, the IID Managed Marsh, the Tribal Wetlands, and any other similar projects. Data from these projects will evolve into a knowledge base for developing future restoration projects.

1.2.4 Financing and Feasibility

The objective of the financing and feasibility analysis is to identify any potential sources for funding restoration activities. Possible funding sources include fees from development of alternative energy sources and fees or taxes associated with land development around the Sea. The process for identifying funding sources from alternative energy sources include:

- Developing a cost estimate and determining the feasibility of each alternative energy source
- Confirming renewable resource production potential estimates
- Evaluating and updating information concerning renewable energy technologies, feasibility and markets
- Ensuring the careful location of the renewable energy projects so they do not preclude the various restoration strategies and minimize impacts to wildlife
- Developing an adequate electrical transmission system to carry the additional energy outside of the Salton Sea basin and facilitating changes to the procurement policies regarding must-take power purchase agreements

2.0 Review and Update Existing Condition Data Including Hydrology

The current environmental condition data at the Salton Sea will be compiled and evaluated. The evaluation will include consideration of ongoing water transfer mitigation, habitat restoration and funding options as different components. This task will include a compilation and review of existing data and the analysis of hydrologic conditions. The methods, models and data used for forecasting salinity and elevation are presented. The process of data management, producing the Draft Data Report and the Final Report is discussed.

Benchmark 2: Final Data Report

2.1 Data Compilation and Review

Sources of data from the Sea and surrounding region will be discussed and the existing water quality, hydrology, air quality, biological and lake elevation data will be compiled. Data sources to be queried include peer-reviewed publications, state and federal agencies (US Geological Survey and Bureau of Reclamation, Department of Water Resources, Regional Water Quality Control Boards, the California Department of Fish and Wildlife), the Coachella Valley and Imperial Valley Water Districts, and regional universities (University of Redlands, University of California at Riverside, Water Resource Institute at Cal State, and San Diego State University). To the extent possible data will be compiled in a geo-referenced format, such that the location of any measurement can be identified. The method that will be used for managing data into a master database will be described. Access to the database will be made available through the Authority website.

Deliverables

- Preliminary, draft and final version of a chapter summarizing the results of the data review and containing a list of the key data sources

- PowerPoint summary of data compilation and review
- Workshop presentation

2.2 Hydrology Analysis

A complete hydrologic analysis will be conducted, including forecasted hydrologic conditions under various scenarios. The hydrologic analysis will be based on past observations of major inflows into the Salton Sea at Whitewater, New and Alamo Rivers, as well as projections developed under different scenarios by the water districts in the region (Coachella Valley Water District and Imperial Irrigation District), and projections developed by DWR. The effect of climate change on agricultural runoff as a hydrologic input to the Sea is expected to be included in the potential scenarios.

Historically, the highly productive farmlands in the Imperial and Coachella Valleys have been irrigated with 3.3 million acre-feet/year (AFY) of Colorado River water. Because farming activity has remained relatively stable over the last 40 years of the twentieth century in the Coachella, Imperial and Mexicali Valleys, the quantity of drainage flows reaching the Sea was also relatively stable. During that period, inflows to the Sea averaged 1.35 million acre-feet per year (AFY) and remained within the range of 1.17 (-13%) to 1.59 (+18%) million AFY. Except for two hurricane flooding events in the late 1970s, the Sea has existed during that period as a picturesque 360-sq.-mile lake at a relatively stable elevation of –228 feet msl (+/-1.5 feet). Over the last ten years, the Sea has declined in elevation by about 5 feet as a result of reduced inflows on the order of 1.2 million AFY (USGS 2013). Although inflows have been much lower, recent inflows have been augmented by mitigation flows that were designated by the QSA. These mitigation flows will end in the next two to three years as the Sea faces a new challenge of more significant declines of inflow.

A collaborative effort between the Coachella Valley Water District, Imperial Irrigation District, the State and the Technical Coordination Team will allow for a robust set of scenarios projecting future inflows and the hydrologic and hydraulic impacts to the Sea. Data will be acquired from the USGS Salton Sea Office and other relevant sources. This hydrologic analysis will include a survey of recent efforts to evaluate inflows to the Salton Sea and update potential inflow scenarios as necessary. Changes in the relationship between irrigation water application and drain water volume and quality will be evaluated in current and future irrigation scenarios in the Imperial and Coachella Valleys. Estimates of changes in evaporation as a function of salinity will be updated using best available information. Other scenarios, including inflows from basins

outside the Coachella and Imperial Valleys, and outflows from the Sea to the Gulf of California will be considered as options to maintain the volume and water quality of the Sea.

Deliverables

- Preliminary and draft version of a chapter summarizing the results of hydrology analysis to be incorporated into the draft and final Data Report
- PowerPoint summary
- Public workshop presentation

2.3 Salinity and Elevation Forecasts

A water flow and mass balance approach will be used to evaluate changes in the area, elevation, and salinity in the Sea. A modified form of the Salton Sea Accounting Model under various scenarios will be detailed. New bathymetry data from the Sea, collected over the past decade, will be used to evaluate changes in elevation as the volume of water in the Sea changes. These projections will be performed over the 21st century.

Deliverables

- Preliminary and draft version of a chapter summarizing the results of salinity and elevation analysis to be incorporated into the draft and final Data Report
- PowerPoint summary
- Workshop presentation

2.4 Other Water Quality Conditions

The response of other water quality parameters in the Sea—primarily nitrogen, phosphorus, and selenium—to the changing volume and quality of inflows, and the nature of wind-driven mixing in the Sea will also be evaluated through a three-dimensional hydrodynamic model of Sea (developed and calibrated in past work for the Authority using the Environmental Fluid Dynamics Code or EFDC). As water availability for irrigation changes, and with changes in the treatment and reclamation of wastewater discharge from Mexicali, the quality of drainage water being discharged to the Sea will also change. The response of the Sea will be evaluated with a detailed water quality model that represents new loads as well as the recycling of internal loads, to fully understand how the eutrophication process will respond over time. Further, changes in the area or depth of the Sea will affect wind-driven and thermal mixing that allows aeration of deeper layers that releases gases built up during anoxic periods including

hydrogen sulfide and ammonia. Reduced mixing can potentially create more infrequent but also more extreme events of hydrogen sulfide and ammonia release. A proper understanding of the mixing processes under different lake configurations requires a three-dimensional modeling framework such as EFDC that is proposed to be applied here.

Deliverables

- Preliminary and draft version of a chapter summarizing the results of non-salinity water quality analyses to be incorporated into the draft and final Data Report
- PowerPoint summary
- Workshop presentation

2.5 Air Quality and Dust Emission Mitigation

As a result of the QSA, which includes a long-term transfer of up to 300,000 acre-feet of water annually from Imperial Irrigation District to the San Diego County Water Authority (SDCWA), Coachella Valley Water District (CVWD), and Metropolitan Water District of Southern California, the Salton Sea lakebed will be exposed at an accelerated rate. As the Sea recedes, there is potential for windblown dust emissions from the exposed dry lakebed (the playa). A significant portion of this windblown dust is PM_{10} (particulate matter with an aerodynamic diameter of 10 micrometers or less), which are approximately 1/7th the thickness of a human hair, are small enough to be inhaled, and represent a potential human health risk. Imperial County is designated as a serious non-attainment area for PM_{10} (i.e., the area does not attain federal and state air quality standards). As such, the potential for creating sources of PM_{10} is a public health concern (USGS 2013).

This task will begin with an inventory and evaluation of on-going dust mitigation planning efforts. Information from these plans and others regarding spatial variations in sediment characteristics and soil erodibility or temporal variations in factors contributing to the formation and erodibility of salt crusts will be reviewed and updated as part of the mitigation process. An analysis of how restoration efforts may affect dust mitigation will be included. Air quality effects including dust emissions under forecasted scenarios will be investigated.

Deliverables

- Preliminary and draft version of a chapter summarizing the results of air quality and dust emissions analysis to be incorporated into the draft and final Data Report

- PowerPoint summary
- Workshop presentation

2.6 Draft Data Report/Data Files

The data management strategy and the data compilation effort that will be documented in the Draft Data Report will be discussed. Specific format requirements for the data, and potential strategies and approaches for creating open platform, web-based public access to all relevant data and information will be considered. Potential platforms include Open EI, Data Basin, or other similarly focused structures.

Deliverables

- Preliminary and draft versions of the Data Report containing the chapters resulting from Tasks 2.1-2.5.
- PowerPoint summary of the draft data report
- Workshop presentation

2.7 Final Data Report/Data Files

The Technical Coordination Team (TCT) and other stakeholder comments will be incorporated into the Final Report. The master database created in previous tasks will be prepared and distributed.

Deliverables

- Written comments and/or questions from TCT and stakeholder parties and responses as appropriate.
- A Final Data Report to be incorporated into the preliminary and final Report as described in Task 7.0.
- Distribution or web-based access to database as discussed in Task 2.6.
- Final Data Report PowerPoint

3.0 Review Alternatives With Respect to Existing Conditions

The methods used to review proposed alternatives with respect to current environmental and economic conditions are discussed. The specific restoration components that may be used in combinations to develop more affordable alternatives in alignment with the overall goals of the review are presented. The task also includes the process of compiling engineering data and evaluating restoration components.

Benchmark 3: Review of Alternatives

3.1 Compile Engineering Data

Existing engineering data will be compiled, including geotechnical information from previous investigations and the latest engineering information and analyses prepared by the State for the Species Conservation Habitat (SCH) Project. Compiled data will be stored in a database and data gaps will be identified.

Deliverables

- Preliminary and draft versions of a summary of the compiled existing engineering data
- PowerPoint summary
- Public workshop presentation

3.2 Evaluate Restoration Components

Restoration components will include both updated components from previous studies and potential new components as technologies have evolved. The components of restoration alternatives from previous studies will be evaluated based on performance with respect to meeting different environmental objectives, capital and O&M costs, feasibility, and long-term sustainability. The effort will build upon current and past Federal, State and Local studies and the restoration plans developed in these studies. These include:

- The SCH Project
- The Salton Sea Water Marine Habitat Pilot Project (IID/Sephton Water Technologies)
- Salton Sea Incremental Habitat Plan (IID)
- Solar Technology Evaluation Pilot Project (IID/private sector)
- The Habitat Enhancement & Creation: GeoTube Project (Authority/Torres Martinez Tribe)
- The Red Hill Bay Project (U.S. Fish and Wildlife Service/IID)
- The CVWD Constructed Habitat Project
- The IID-SDCWA Water Transfer Mitigation Project
- The Brawley and CA Department of Fish & Wildlife Wetlands
- The Torrez-Martinez Wetlands Project
- The Reclamation Shallow Wetland Project at Niland
- The Imperial County Red Hill Marina Improvements
- The 1998 Reclamation Salton Sea Alternatives Final Pre-appraisal Report
- Previous alternatives generated by the Authority
- Alternatives proposed by the CA Department of Water Resources as part of the 2007 Final Programmatic Environmental Impact Report
- Any others that may be identified in the process of evaluating restoration components

In addition, new components are expected to be developed which meet the current conditions and potential funding realities. Components will be evaluated against their effectiveness to provide habitat and water quality improvements, control salinity and elevation and their ability to mitigate potential dust problems. All restoration alternatives will necessarily meet the requirements of and include plans to implement dust mitigation measures as applicable, which are listed in the Air Quality Mitigation Program for the Imperial Irrigation District Water Conservation and Transfer Project.

Deliverables

- Preliminary and draft versions of a summary of restoration components
- PowerPoint summary
- Public workshop presentation

4.0 Conceptual Plans and Cost Estimates

The conceptual planning for each restoration component and the methods for developing cost estimates for the components along with the complete alternatives are described. The components will include a variety of engineering structural and environmental design features. The feasibility analysis will involve consideration of local geotechnical and soil conditions, availability of materials, and a variety of other engineering factors. Institutional considerations will include national and international factors that influence implementation feasibility. Restoration components incorporate salinity, water quality, air quality, and habitat improvements, and the integration of smaller local habitat improvement projects with large-scale engineering solutions. Protocols for collaborating with the Technical Coordination Team (TCT) on restoration planning are discussed.

Benchmark 4: Conceptual Plans and Cost Estimates

4.1 Structural Engineering Features

A variety of structural features will be evaluated for technical and cost feasibility. As an example, strategies for the preparation and treatment of the structural foundation to mitigate weak soils of the project area will be evaluated based on engineering feasibility and cost per strategy. The various configurations and materials to be used in structural components will be determined by conducting static stability, seismic response, and other analyses.

Environmental and permitting implications for each component will be included as part of the analysis because CEQA/NEPA compliance and regulatory permitting issues associated with specific features may influence the feasibility or cost of implementation. The information from the State's SCH Project, Reclamation's 2007 engineering assessment of in-sea embankments and previous work by the Authority will be integrated into this feasibility analysis. In

addition, real-time data acquired from the State's SCH Project will be incorporated as it becomes available, including geotechnical data, soil conditions and the extent of land settling.

Conceptual plans for structural engineering features will be formulated following the review process. Cost estimates for each structural feature and the overall cost of each conceptual plan will be determined by conducting field investigations, computer modeling and other analytical processes. The cost analyses will include up front capital costs and present value calculations that integrate long-term operation, maintenance, energy, and monitoring costs. For some components, indexing will be used to update previous cost estimates to current levels.

Structural Engineering features may be divided in three categories as follows:

- **Outlet Conveyance Facilities**: Pipelines or channels that provide an outlet for salts and other constituents to be removed from the Sea.
- **Enhanced Inflow Conveyance Facilities**: Pipelines or channels that convey water into the Sea, including discharge lines from desalting facilities outside of the Salton Basin.
- **Partitioning Components**: In-Sea barriers of varying sizes that can be used to partition the Sea into area of higher and lower salinity or which can be used create enhanced habitat areas.

Each of these structural feature categories is discussed below.

Deliverables

- Preliminary and draft versions of a summary of the structural engineering conceptual plans with cost estimates
- PowerPoint summary of the draft data report
- Public workshop presentation

4.1.1 Outlet Conveyance Facilities

An updated version of the Salton Sea Accounting Model will be utilized to project Salton Sea inflow, outflow, depth, and water surface. The model will be used to determine the volume of water required to be pumped from the lake to maintain consistent salinity levels.

Discharge Location Assessment

Potential discharge locations for water from the Salton Sea will be investigated. The investigation will include assessment of total length of conveyance, area topography, and environmental impacts at the discharge site. The discharge locations to be considered are: the Gulf of California, Laguna Salada, and the Cienaga de Santa Clara. In addition, the investigation will include the option to pump salt water from the Sea and use it to assist with dust mitigation on playa that may be exposed as the Sea becomes smaller.

Concept Development - Water Conveyance Facilities

Three conceptual water conveyance systems will be developed. Each of the systems will be based on water being delivered from Salton Sea to one of three proposed discharge locations. Variable delivery flow rates will be analyzed with an expected discharge range of about 50,000 AFY to 150,000 AFY. Proposed tasks in developing the conceptual conveyance system include:

- **Intake Concept:** Determining the proposed location, depth and design of intake structure at the Salton Sea. Construction impacts to sea or shoreline activity or habitat will be considered in selecting a proposed intake location. Depth of the intake will account for anticipated maximum and minimum water surface level in the Salton Sea. Concept design development for the intake structure will include considerations to prevent the intake of fish and reduce the collection of solids in the drawn water using screens or baffling.
- **Conceptual Pipeline Alignment**: Identifying proposed start and end points of conveyance pipeline and studying topography and land use / aerial photos to determine conceptual pipeline alignments for each alternative.
- **Pipeline Sizing and Material Options**: Pipeline material recommendations will be made based on operating pressure, buried or above ground installation and construction cost.
- **Pipeline Valves and Appurtenances Recommendations**: Recommendations for isolation valves, air valves and blow-offs will be made based on the vertical alignment of the pipeline.
- **Pump Concept**: The pump stations will be sized for each of the three proposed flow rates. The pump concept will be developed utilizing the topography, conceptual pipeline alignments to determine the locations where pumping will be necessary, static lift required for the pumps at each location, as well as estimating the frictional loss in the associated piping. The pump concept will also take into consideration the type and

number of pumps, general mechanical layout concept, consideration of pump building or enclosures, redundancy, location relative to existing electrical service and backup power.

- **Outlet Concept**: utilizing mapping, aerial and water surface information for each proposed discharge water body an outlet concept will be developed. The outlet concept will consider back-pressure at the outlet to prevent air lock of the pipeline, and means of energy dissipation and/or air-gap at the outlet.

Information Review

Information will be gathered and reviewed as the initial step to concept development. Information to be received may consist but is not limited to aerial imagery, land use maps, agency atlas maps, and topographic data.

Technical Memorandum

A technical memorandum will be prepared summarizing each concept and providing graphics to effectively communicate design concepts. The memorandum will be developed for ease of incorporation into the final overall feasibility study. Anticipated graphics include:

- **Location Map**: Depicting Salton Sea, each discharge location, conceptual pipeline alignment(s), and conceptual pump locations. (1 sheets)
- **Pipeline Alignment**: Depicting the conceptual pipeline alignment per alternative in greater detail (3 sheets)
- **Intake Concept** (1 sheet)
- **Pump Concept**: Site plan, and mechanical typical layout per alternative (6 sheets)
- **Outlet Concept** (1 sheet)

Cost Estimate

A concept level cost estimate will be prepared for each alternative. The cost estimate will be formatted for incorporation into the overall feasibility study.

Deliverables

Information review, technical memorandum and cost estimate.

4.1.2 Enhanced Inflow Conveyance Facilities

Pipelines or channels that convey water into the Sea will be investigated, including discharge lines from desalting facilities outside of the Salton Basin. Several potential water supply sources to increase inflow to the Salton Sea will

be evaluated. The investigation will include assessment of total length of water conveyance, area topography, and potential environmental impacts. A least three potential water sources will be considered. It is expected that these will include: the Santa Ana Regional Interceptor (SARI) Pipeline, a potential brackish line from Tucson, Arizona being considered by the US Bureau of Reclamation (Reclamation), a potential brackish line for the construction of a water treatment facility along MWD facilities supplying water from the Colorado River and a two way conveyance between the Gulf of California and the Sea.

SARI Pipeline Assessment

The Santa Ana Regional Interceptor (SARI) pipeline is a brackish and non-reclaimable conveyance pipeline. It spans across San Bernardino County and Riverside County en route to Orange County. A review of available documents will be performed to determine the flow capacity, distance of conveyance, and water quality parameters that will influence the potential for the SARI pipeline water to serve as an inflow source to the Salton Sea.

Brackish Line from Tucson, Arizona

Another potential source of water for inflow to Salton Sea is a proposed brackish pipeline under consideration in the State of Arizona. Reclamation is considering the construction of a "brackish line," to remove leach water and/or brackish water from the State. The potential pipeline route would start near Tucson, pick up salt water drainage from various irrigation districts, and receive brackish drainage from Phoenix and Yuma. At Yuma, the flow could be treated in the existing reverse osmosis plant for environmental use, such as serving as inflow to the Salton Sea. Review of available documents will be performed to determine the flow capacity, distance of conveyance, and water quality parameters that will influence the potential for the Reclamation brackish water line to serve as an inflow source to the Salton Sea.

Brackish Solution from MWD – Colorado River Water

Another possible option is for a brackish water solution to come from a treatment plant to be constructed along MWD pipeline facilities conveying water from the Colorado River. Treatment would reduce the salinity of the raw Colorado River water prior to delivery throughout Southern California. The effluent would then be pumped and conveyed by pipeline from the treatment facility to the Salton Sea to serve as supplemental inflow. Review of available documents will be performed to determine the flow capacity, distance of conveyance, and water quality parameters that will influence the potential for a

brackish water source to be delivered from an MWD treatment plant water to the Salton Sea.

Two-way conveyance from the Gulf of CA

Previous Salton Sea planning efforts have identified a two-way pipeline built between the Salton Sea and the Gulf of California as a potential alternative. The feasibility review will update the option for two-way pipelines and/or channels between the Sea and the Gulf with new technical information and cost estimates.

Information Review

Various reports, technical studies and related information will be gathered and reviewed as the initial step to concept development. Information to be received may consist of but is not limited to reports, technical studies, aerial imagery, land use maps, agency atlas maps, and topographic data.

Concept Development - Water Conveyance Facilities

Three conceptual water conveyance systems will be developed. Each of the systems will be based on water being delivered to the Salton Sea from one of three proposed source pipelines. Proposed tasks in developing the conceptual conveyance system include:

- **Connection to Source**: Determining the proposed location and method of connection to receive water from each of the three identified potential sources. Concept design development will include consideration of potential points of connection, taking into consideration existing or proposed treatment facilities and distance from the Salton Sea in order to reduce infrastructure cost.
- **Conceptual Pipeline and Alignment**: Identifying proposed start and end points of conveyance pipeline and studying topography and land use / aerial photos to determine conceptual pipeline alignments for source of water. Pipeline material recommendations will be made based on operating pressure, buried or above ground installation and construction cost.
- **Pump Concept**: Pump stations will be sized for each of the three proposed flow rates. The pump concept will be developed utilizing the topography and conceptual pipeline alignments to determine the locations where pumping will be necessary, if static lift is required for the pumps at each location, as well as estimating the frictional loss in the associated piping.

Memorandum

A technical memorandum will be prepared summarizing each concept and providing graphics to communicate design concepts. The memorandum will be developed for ease of incorporation into the final overall feasibility study.

Deliverables

Information review, technical memorandum and cost estimate.

4.1.3 Partitioning Components

A mid-sea barrier is one proposed alternative for dividing the upper section (for habitat and freshwater recreational uses) and the lower section (salt sink). This scope will develop a matrix of alternatives by examining constructability of various structures in the lake.

Data Collection

In scoping this task, previous investigations and plans for restoration of the Salton Sea will be collected and the structural components will be evaluated. These previous investigations will include:

- Geotechnical investigations and conceptual embankment designs prepared by the Authority for their proposed plan;
- The alternatives developed for the State's Salton Sea Restoration PEIR;
- Conceptual embankment designs developed by the Reclamation as part of the Salton Sea Restoration planning process;
- Shallow water embankment designs used for the State's Species Conservation Habitat Project; and
- Shallow water embankment designs used in a variety of habitat projects around the Salton Sea.

Evaluation of Design Methods

A wide range of structural design methods for creating partitions within the Sea will be generated using experts in a variety of fields. This work will be done in a brainstorming environment without strict constraints on the alternatives generated. The design methods will then be filtered for basic projects requirements. Those designs not meeting the fundamental requirements will be eliminated. The remaining methods will be rated in a matrix fashion for a variety of criteria. The criteria can be given equal weight or some criteria can be more heavily weighted to correspond to the needs of the owner and other interested parties. The methods will then be evaluated with a simple system (generally exceeds, meets, or fails to meet the specific criteria). This simple

system is effective to reduce a significant number of designs to a few leading candidates for further development. By reducing the methods to a manageable number (two to four), further development can be focused to a more refined analysis including construction methodology and cost estimates.

This approach has been used effectively in the past on the Inner Harbor Navigation Canal (IHNC) surge protection barrier project in New Orleans. The surge barrier was designed and constructed as part of the Hurricane Protection program after Hurricane Katrina in 2005. A matrix approach was used to evaluate barriers and navigation gate types. The example shown in Table 1 is the evaluation matrix of twelve barrier wall types which were reduced to two alternatives based on this matrix evaluation in the IHNC project. The top contenders from this evaluation were the braced concrete pile wall and the 56 feet diameter caisson wall. The braced concrete pile wall was finally chosen for final design and construction.

Table 1: Evaluation Matrix for Barrier Walls from the IHNC Surge Barrier Project

Option	Alternative	Action / Decision	Schedule Achievement		Incorporation into Advance Measures	Cost			OMRR&R	4 R's Criteria				Expandability	Environmental Impact	Team Confidence				Navigation Impact
			Advance Measures	100-Year Level of Protection		Construction	O&M	Lifecycle		Resiliency	Redundancy	Repairability	Reliability			Design Complexity	Constructability	Local Construction Expertise	Local Material Availability	
Barrier Alternatives																				
L09	**Braced Concrete Pile Wall**	**Retain as primary solution. Provides robust system that can be constructed by local resources. Low O&M.**	G	E	E	M	L	M	L	E	G	G	G	G	L	M	G	E	E	L
L01	**Large (e.g., 56' diameter) Caisson**	**Retain as alternate solution. Provides robust system with low O&M.**	U	G	E	M	L	M	L	E	E	G	E	E	M	H	G	P	P	L
L02	Dumbell Caisson	Dropped – variant of L01. Can be re-evaluated if primary solution is not selected for further design.	U	G	E	M	L	M	L	E	E	G	E	E	M	H	G	P	P	L
L03	Open Cell Sheet Pile	Dropped - corrosion concerns with the sheet pile, high costs, and global stability concerns.	G	G	E	M	M	M	M	G	G	P	G	G	L	M	G	G	E	L
L04	Earthen Levee	Dropped – high cost for acquiring and placing the clay and high O&M cost for settlement. Also, resilience concerns from overtopping. Work will be significantly impacted by adverse weather.	P	U	E	H	H	H	H	P	P	E	G	G	H	L	G	E	P	L
L05	Pile-Supported Levee	Dropped - see L04. Savings from smaller levee footprint offset by higher cost for the piles.	P	U	E	H	H	H	H	P	P	E	G	P	H	L	G	E	P	L
L06	Jet Grout Wall	Dropped – high cost for jet grouting/deep soil mixing and concrete wall. Also, significant amount of site construction potentially impacted by adverse weather.	P	G	E	H	L	M	L	E	G	G	G	G	L	M	G	G	E	L
L07	New T -Wall	Dropped – high cost for robust T-wall with piles, slow installation, and significant amount of site construction potentially impacted by adverse weather	P	G	E	H	L	M	L	E	G	G	G	G	L	M	G	E	E	L
L08	Braced Steel Sheet Pile Wall	Dropped - corrosion concerns with the sheet pile.	G	E	E	M	M	M	M	G	G	P	G	G	L	M	G	E	E	L
L10	Earth Levee with Soil Mixing	Dropped - see L04. Savings from smaller levee footprint offset by higher cost for the deep soil mixing.	P	U	E	H	M	H	M	P	G	E	G	P	H	L	G	G	P	L
L11	Hybrid Box Levee with T-Wall	Dropped - difficult to attain Advance Measures; hybrid box cannot be cost-effectively built to an elevation to attain the Advance Measures so will still need T-wall. See L04 for soil placement and L07 for T-wall concerns	P	G	E	M	M	M	M	G	G	G	G	G	M	M	G	G	G	L
L12	Open Cell Sheet Pile with Earthen Levee	Dropped - see L03 and L04.	G	G	E	M	H	M	H	P	G	G	G	G	M	M	G	G	G	L

- Deeper water barriers with no significant load differential across the barrier (essentially zero head differential) for use in creating areas of higher and lower salinity; and
- Deep water barriers which can withstand a significant differential load.

All evaluations will include criteria for low maintenance, ability to build by local firms, design life, seismic performance, and future expansion. Productive and

efficient alternative analysis by the team is the key to efficiency and the method described is a proven first step towards a successful project.

Deliverables

A technical memorandum (memo) will be prepared presenting the matrices of design methods and summarizing the constructability criteria. The memo will include the matrices, a description of the evaluation process, concept designs, and cost estimates based on unit lengths of barriers at different water depths. The memo will be prepared in preliminary draft, draft and final formats. A workshop will be held during the evaluation process and PowerPoint presentations will be made at two meetings during the draft and final phases.

Figure 2: IHNC Surge Barrier Nears Completion

4.2 Salinity and Water Quality Improvements

Alternatives for water quality and salinity improvement will be developed from the components evaluated in Task 4.1. The analyses will be performed using the two modeling frameworks identified in Section 2.3, the updated Salton Sea

Accounting Model and an EFDC model of Salton Sea hydrodynamics and water quality.

Deliverables

- Preliminary and draft versions of a summary of key salinity and water quality improvement alternatives
- PowerPoint summary
- Workshop presentation

4.3 Air Quality and Dust Emission Mitigation

According to the analysis of dust emissions and air quality under various scenarios in Task 2.5, alternatives will necessarily contain measures to mitigate dust emissions. The mitigation measure employed to control dust emissions will depend on the alternative.

Deliverables

- Preliminary and draft versions of a summary of dust emission mitigations
- PowerPoint summary
- Workshop presentation

4.4 Habitat Improvements

A multi-phased plan for habitat improvement will be developed in coordination with the TCT. The plan will be developed to provide fish and wildlife habitat in different regions around the Sea, manage the various needs of water use, energy use, and water quality to ensure the long term sustainability of the newly created habitats. Site reviews and screenings, aerial imagery, site selection considerations and conceptual plan drawings will be used to create multiple habitat improvement alternatives. Many other habitat projects exist within the Salton Sea, and several other habitat improvements are in the planning stages, as discussed in Section 3.2. Successful habitat projects will be considered in the design of new habitat improvement plans. The multi-phased plan will allow for incremental and short-term funding sources to be exploited for immediate action instead of continued inaction due to a less likely or a long-term substantial funding source. Integrating smaller scale habitat projects with larger scale engineering options will also be evaluated.

Deliverables

- Preliminary and draft versions of a summary of the multi-phased habitat improvement plan

- PowerPoint summary
- Workshop presentation

4.5 Collaboration with the Technical Coordination Team

The participants in the Technical Coordination Team (TCT) are listed in the Point of Contacts section. The TCT will include representatives of the Authority, the State of California, the Bureau of Reclamation, the USGS Salton Sea Science Office, the Department of Water Resources, Coachella Valley Water District, Riverside County, Imperial Irrigation District, the Torrez Martinez Desert Cahuilla Indian Tribe, the CA Department of Fish and Wildlife, the Pacific Institute, and Tetra Tech Inc. Coordination with this Team will be important for moving this project forward. The Team will also assist in reviewing and finalizing the project goals and objectives and provide guidance throughout the life of the project. Three meetings of the TCT will be held throughout the Work Plan creation process in order to review the progress and provide valuable input. Regular meetings will be held during the Feasibility Study to incorporate input as necessary.

Deliverables

- TCT meeting agendas
- TCT meeting minutes

5.0 Infrastructure Financing Feasibility

The methods for evaluating the potential for real estate development as a viable funding source for Salton Sea restoration activities are described. This will include evaluating infrastructure funding alternatives, the production of a Draft Feasibility Report, followed by the Final Feasibility Report. In conjunction with the TCT, the private sector will formulate a financing feasibility study as discussed.

Benchmark 5: Real Estate Development Feasibility Report

5.1 Infrastructure Financing Feasibility Study

The scope of work for an Infrastructure Financing Feasibility Study is generally discussed below. It is expected that a Request for Qualifications (RFQ) will be developed in conjunction with the TCT and issued to private sector consultants in order to solicit methodologies and interest for developing infrastructure based financing.

The study will:

- Synthesize infrastructure financing opportunities and break them down to the lowest possible level, preferably independent of each other;
- Develop a high-level plan for opportunities, addressing potential financial, technical and political/institutional issues;
- Consider tax increment financing mechanisms associated with increased land values as potential revenue sources; and
- Include a real estate survey and an evaluation of various methods to create financing options.

The establishment of an Infrastructure Financing District may be considered to contribute funding for the restoration process through property tax revenues. The process will likely involve an industry forum to gather input from private investors and identify areas that need work to attract private interest.

Federal funding opportunities will be explored to complement private financing strategies and contribute to overall financial viability and early implementation

potential. A substantial federal funding commitment could encourage additional private investment via loan guarantees, special tax credits, and development grants.

Deliverables

- Request for Proposal to solicit private sector services to produce an infrastructure feasibility report in coordination with the TCT.
- Industry forum event
- Summary of results from the industry forum
- PowerPoint presentation summary

5.2 Draft Feasibility Report

The results of the previous task's feasibility study will be compiled in the Draft Feasibility Report that will identify potential infrastructure funding sources that could support phased approaches to fund components of restoration. The Report will contain the revenue generation potential, cost and timeline (early opportunities, short-term, long-term) of each alternative. The schedule for the completion of the draft feasibility report is shown in the timeline, Appendix A of the Work Plan.

Deliverables

- Draft infrastructure financing feasibility report
- PowerPoint presentation
- Workshop presentation

5.3 Final Feasibility Report

The Draft Feasibility Report will be finalized after it has received sufficient private consultant input and is reviewed by the TCT. The expected date of completion and review period is given in the timeline in Appendix A.

Deliverables

- Final infrastructure financing feasibility report
- Written comments and responses
- Final PowerPoint presentation

6.0 Financing and Funding Options from Renewable Energy Development

The review of all potential financing and funding options for the Salton Sea restoration activities is detailed. The review includes a land use and resource assessment, a high-level market and power transmission analysis, a high-level business model, an energy report with a briefing, all of which will be incorporated into the Funding and Finance Report. The scope for Tasks 6.1-6.7 discussed below were provided by the Department of Energy National Renewable Energy Laboratory (NREL).

Benchmark 6: Final Funding Report

6.1 Review IID/EES Report and Inventory Other Efforts

Imperial Irrigation District (IID) contracted with EES Consulting to prepare a study of potential renewable energy at the Salton Sea in early 2013. IID has made the draft report, Salton Sea Revenue Potential Study, (EES Report) available to NREL and the Authority. The report evaluates the geothermal, solar and thermal gradient pond resource potential (based on data supplied by IID and other publically available data), estimates renewable energy development costs, develop concept costs for development of the energy source and compare the cost effectiveness of Salton Sea resources with comparable resources in California. Based on those parameters the report forecasts the renewable energy margin available to fund Salton Sea restoration projects. The report also includes a high level analysis of potential revenue from mining resources (lithium, manganese and others).

Under Task 6.1, NREL shall review the data and conclusions of the IID/EES report and provide the Authority with written questions and comments. NREL will work with IID to obtain electronic copies of any relevant data used in the report. Also NREL will use the report as the starting point in refining/focusing the remaining tasks. NREL shall meet with various renewable energy stakeholders, energy transmission developers, energy project developers, land owners and others as

necessary to compile enough information to complete the remaining tasks. NREL shall also create an inventory of other relevant studies and analysis/planning efforts sponsored by the California Energy Commission (CEC), California Public Utilities Commission (CPUC), California Independent System Operator (CAISO), California Air Resource Board (CARB), California Natural Resources Agency (CNRA), federal agencies, NGOs and others.

Deliverable

- Written questions/comments on the EES study provided to the Authority.
- Compile inventory of relevant studies in an Excel spreadsheet.

6.2 Develop/Confirm Renewable Resource Potential Estimates

Based on the EES study described in Task 6.1, as well as using data inputs from other regional data sets, planning studies (e.g. the Desert Renewable Energy Conservation Plan (DRECP), the BLM West Chocolate Mountain studies, the BLM Solar Energy Program, Imperial and Riverside county renewable plans, IID, Reclamation and USGS) as well as NREL's internal resource maps and GIS layers, NREL shall develop independent estimates of the renewable resource potential for the following resources in the Salton Valley: solar (photovoltaic, PV and concentrating solar power, CSP), geothermal, solar thermal gradient ponds, and algae. The specific geographic extent of the resource assessment shall be jointly determined by NREL and relevant regional stakeholders.

NREL will work with local stakeholders, state and federal wildlife management agencies, the Western Governors Association Critical Habitat Assessment Tool (CHAT), the USGS Salton Sea Office, UC Riverside and other sources to identify potential areas that are suitable and not suitable for development. Various assumptions can be modeled in the GIS analysis.

NREL will work with the Authority to discuss format requirements for the data and develop potential approaches for creating open platform, web-based public access to all relevant data and information. Potential platforms include Open EI, Data Basin, or other similarly focused structures.

Deliverables

- Report section on renewable energy resource potential for the area of study for the resources listed above for 2-3 development/ environmental constraints scenarios;

- Copies of all relevant data and GIS layers compatible with University of Redlands Spatial Economic Analysis and Regional Planning databases;
- Recommendations on potential platforms and approaches for populating the data within an open access portal to facilitate additional studies by other organizations.

6.3 Technology Status Update

NREL shall document the current commercial status, costs and projections of technologies of interest to the Authority. Technologies to be analyzed include: algae production, solar thermal gradient ponds, geothermal power, and solar power (CSP, PV). The task will document technology readiness levels (TRLs), current and future capital and O&M costs, expected lifecycle costs, and current industry, university and government R&D priorities and focus areas. The results of this task will be used in later tasks including the market analysis for renewable electricity, desalinization analysis, assessing market opportunities to recover minerals from geothermal fluids, and in the Resource Planning Model analysis (potential future task). For PV and CSP, NREL shall document potential issues associated with operations related to dust, salt, and other issues specific to development in the Salton Sea immediate area.

Deliverable

Technology status update will be included in the draft and final reports and the briefing as discussed in Task 6.7.

6.4 Energy Market Analysis

Under this task, NREL shall conduct a more detailed renewable energy funding and marketing analysis. The objective is to provide projections of potential revenue streams from the renewable energy projects that could potentially be developed in the Salton Sea geographic area. The analytical emphasis will be on potential projects to be developed between 2015 and 2030. The following activities will be conducted through this task:

- Construct a reference case using the California Public Utility Commission's updated Renewable Portfolio Standards (RPS) Calculator. Renewable resources near the Salton Sea will be analyzed as a portfolio and compared against other resources in the supply curve constructed by the Calculator. The portfolio analysis will include new transmission and upgrades that would enable greater transfer capability from the Salton Sea area into CAISO.

  - As part of this effort, document renewable energy technology cost projections in California, the Salton Sea and other Western US states
- Construct sensitivity cases for 2020 and 2030 using alternative technology cost, capacity factor, capacity value, and integration cost assumptions developed under Task 4. The sensitivity case assumptions will replace the default assumptions used in the RPS Calculator, which will then be used to construct sensitivity case supply curves.
- Construct market price benchmarks based on the levelized all-in cost of new combined cycle gas turbines built in southern California in 2015, 2020, and 2030. Benchmarks will be calculated assuming natural gas prices of $2, $6, and $10 per mmBtu in 2014 dollars.
- Review and assess current/pending federal and California legislative efforts related to energy markets, greenhouse gas regulations, and projected impacts on Salton Sea renewable development. Review major studies and decisions on the effects of the San Onofre Generating Station (SONGS) shutdown, once through cooling, AB 32, possible IID participation in CAISO's regional energy imbalance market, and the PUC's energy storage targets.
- Review and document current utility integrated resource plans (IRPs). Utilities to be contacted include, Imperial Irrigation District (IID), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), Pacific Gas & Electric (PGE), Los Angeles Department of Water and Power (LADWP), Salt River Project (SRP), Arizona Public Service (APS) and Tucson Electric Power (TEP). Identify renewable energy and transmission development obstacles (i.e. permitting, competition, market need, financial, Federal/State policy, public opposition, etc.).
- Document current CAISO and utility transmission plans
- Analyze existing and new transmission capacity and access in the area that would be required to export the renewable energy to various markets.
- Investigate California's "in-kind" assistance options for renewable energy development in Salton Sea area
- Identify competitive advantages and competitive disadvantages of renewable resource development in the Salton Sea area vis-à-vis development in other Western states
- Verify/Refine analysis of possible annual revenue streams from renewable energy development only

- Conduct concept level analysis of how revenue streams might be used to fund remediation and restoration efforts.

Deliverable

Market summary chapter documenting the results of Task 6.4 will be included in the draft and final reports and the briefing as discussed in Task 6.7.

6.5 Desalinization Analysis

The potential for renewable-powered desalinization of water is very important and one that could affect not only the greater Salton Sea area, but could affect many of the larger Southern California imported water users. Sources of water in need of desalinization could range from agricultural discharge, high salinity river water, the Salton Sea itself, brackish groundwater, and ocean water from the Gulf. Combining desalinization with the baseload energy supply of geothermal could offer advantages (i.e. economic, restoration, creation of local energy demand, etc.) in developing local geothermal resources. Other resources may be viable as well including PV, CSP and solar gradient ponds and there are several ongoing commercial and R&D efforts on this topic.

High Level Analysis

NREL shall conduct a scoping level analysis to investigate and update existing data and information on the technical and economic potential use of several renewables (i.e. geothermal, PV, CSP, solar gradient pond) on a comparative basis to power potential desalinization processes in the Salton Sea region.

Task will include:

- Review of commercial renewable/desalinization plants and R&D projects in operation around the world. Document technical, energy requirement and economic performance of these plants
- Preliminary assessment of associated energy requirements (i.e. delivery, desalinization process, and return) from various sources of water supply and various desalinization plant sizes
- Determine the likely match of various technology power output profiles (PV, CSP, geothermal, solar gradient ponds) to desalinization energy demands
- Preliminary economic analysis of potential costs and revenues from desalinization efforts
- Identification of regulatory and environmental hurdles

- Initial assessment of how desalinization could match with restoration efforts

Deliverable

Summary chapter on the status of desalinization technologies and potential for renewable energy to provide power to desalinization plants. The chapter will be included in the draft and final reports and the briefing as discussed in Task 6.7.

6.6 Geothermal Fluid Mineral Recovery Market Analysis

One potential source of major funding for Salton Sea restoration efforts depends on the extraction viability, market prices, quantity, and purity of extracted metals (i.e. lithium, magnesium, zinc etc.). Preliminary estimates from the EES Consulting study (Salton Sea Revenue Potential Study, dated December 10, 2013) state that 'Mineral Recovery' is 36% of the overall potential revenue to Salton Sea restoration funding efforts. NREL shall verify and enhance the understanding of this potential major funding contributor through further investigation based on the following sub-tasks.

High Level Verification

NREL shall review data from EES Consulting, and augment with secondary market or proprietary knowledge/data from numerous stakeholders (i.e. developers, equipment manufacturers, DOE's geothermal program, USGS Salton Sea Office data and reports, University studies, etc.). The task will include:

- Independent analysis of EES and other data sources
- Verification of extraction technology and viability with NREL geothermal experts
- Discussion with mineral extraction pilot project participants at Hudson Ranch facility

High Level Market Verification Study

NREL will conduct a high level market overview of the production, demand and pricing.

- A summary of current/projected world production levels
- A summary of current/projected world demand levels
- Overview of quantities and amounts used in various renewable energy, energy storage, and electricity related technologies and synopsis of current industry growth prospects of each.

Deliverables

- Summary of current status of extraction technology.
- Summary market verification including mineral production levels, demand and growth prospects. The results of this task will be included in the draft and final reports and the briefing as discussed in Task 6.7.

6.7 Funding and Financing Reports and Briefings

NREL shall prepare a draft final report documenting the results of the study. The draft report will be provided to the Authority within 10 months of contract execution. NREL staff will conduct an in-person briefing of the draft results to the Authority and other interested parties.

The Authority and its suggested reviewers will provide NREL with comments on the draft report within two weeks of receiving the document. NREL will address comments as appropriate and prepare a final report for publication online. NREL will finalize the briefing and present the final results via a webinar.

Deliverables

- Draft final report submitted for comment and review;
- Briefing of the draft final report in person;
- Final report, to be published online;
- Final briefing and presentation via webinar.

6.8 Supplemental Financing Investigations

This task is reserved for supplemental funding and financing investigations for sources that may be identified over the course of the feasibility study. The detailed scope for this task will be developed at a future date.

7.0 Final Report and Presentation of Findings

The process of creating a Preliminary Report is stated, and details a plan of what can be done over the near term given expected funding profiles. In addition, a briefing package summarizing the findings will be created and presented to the TCT, the State, other interested agencies and the public.

Benchmark 7: Final Report and Presentation

7.1 Preliminary Report and Presentation

The Preliminary Report will be assembled using previous tasks and Benchmarks; it will provide specific actions that can be taken over the near-term given expected funding profiles. The final version of the preliminary report will be reviewed by the TCT. The final version will become the public draft Preliminary Report and it will be posted to the Authority website. In this way, comments will be solicited and addressed in the same manner as the Work Plan. The schedule for each period of review and date of completion is given in the Timeline.

Deliverables

- Draft Preliminary Report submitted for comment and review
- Preliminary Report submitted for comment and review
- PowerPoint presentation for briefing stakeholders

7.2 Final Report and Presentation

Comments will be incorporated from the Preliminary Report into the Final Report. The Final Report will again be reviewed by the TCT. A corresponding briefing package will be created in order to deliver the Final Presentation. The expected date of completion is shown in the Timeline.

Deliverables

- Written comments and/or questions with responses as appropriate
- Draft Final Funding and Feasibility Report
- Final Funding and Feasibility Report
- PowerPoint presentation for briefing package

8.0 Public and Stakeholder Involvement

Stakeholders, including the public and any other interested parties, have an important role throughout the life of this project and into the future. The program will include means to inform stakeholders as well as to receive feedback.

8.1 Public Involvement and Outreach Program

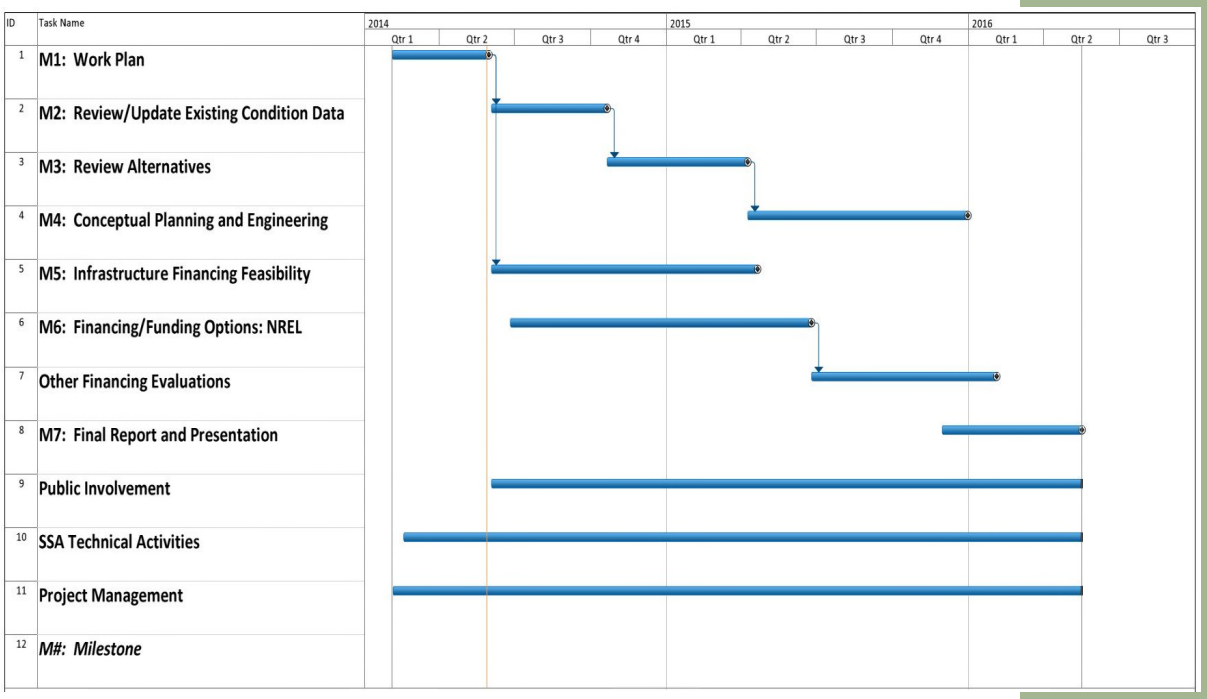
The public and other stakeholders will be involved in the process of creating the Work Plan and the Final Report by inviting comments based on draft versions of the documents. The Authority holds monthly meetings that are open to the public. The Authority's website and monthly meetings is an appropriate forum to solicit public input and will thus be the main channel for distributing draft documents and receiving feedback.

9.0 Timeline and Budget

A detailed budget and timeline for the entire project are presented. The schedule and budget are based on the original contract but are subject to alterations based on the refined needs of the project.

9.1 Timeline

The top level project schedule is shown below. An MS Project schedule for the entire project is under development and will be finalized during the initial phase of the project. The detailed schedule will show all proposed tasks and subtasks as well as TCT review periods and durations along with the critical path. Float will be included to allow for unexpected or unforeseen time factors and still allow completion of the project by the required end time of May 16, 2016.



9.2 Budget

A budget for the project is presented in the Appendix. The budget shows all proposed plan elements, divided by benchmarks and task-based deliverables. Each deliverable corresponds to an estimated cost and payment schedule. The payment schedule is based on the completion of the deliverables. Project Management costs will be reimbursed incrementally in conjunction with payment requests for completed Deliverables. Each task is directly related to the project and supported by detailed time documentation for in-house services. The budget is subject to revision but the grand total is not to exceed $2,000,000.

10.0 Program Administration, Oversight and Legal Review

The key program administration, oversight and legal review functions necessary to ensure the successful development of a reasonable set of findings are identified.

10.0 Program Administration, Oversight and Legal Review

The program will be administered by the Authority's staff and consultants. The program support functions will include general coordination and oversight of the project, coordination with other agencies and interested parties, and legal reviews. In addition, a large number of administrative support functions will be required including invoicing and financial management, email and other written communication, voice communication, meeting planning and logistics, and a variety of other support functions.

11.0 References and Points of Contact

References to be used throughout the course of the feasibility study and in the Work Plan are presented below. The list is intended to be representative and is not an exhaustive list of Salton Sea studies.

11.1 References

Air Quality Mitigation Program for the Imperial Irrigation District Water Conservation and Transfer Project, IID/Salton Sea Air Quality Management Team, 2013.

Hazard: The Future of the Salton Sea with No Restoration Project. Pacific Institute, 2006

Imperial Irrigation District Water Conservation and Transfer Project Draft Habitat Conservation Plan and Draft Environmental Impact Report/Environmental Impact Statement. Imperial Irrigation District and U.S. Bureau of Reclamation, 2002.

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Salton Sea Ecosystem Monitoring and Assessment Plan, Open File Report 2013-1133. Prepared for the California Department of Water Resources, Salton Sea Ecosystem Restoration Program, US Geological Survey, 2013.

Salton Sea Ecosystem Restoration Program Draft Programmatic Environmental Impact Report, California Resources Agency, 2006, available at: http://www.water.ca.gov/saltonsea/peir/draft/

Salton Sea Final Ecosystem Restoration Program: Programmatic Environmental Impact Report, Prepared for the Resources Agency by the Department of Water Resources and Department of Fish and Game, 2007 available at http://www.water.ca.gov/saltonsea/documents/final_eir.cfm.

Salton Sea Incremental Habitat Plan Draft. Imperial Irrigation District, 2013.

Salton Sea Project Draft Work Plan 4.0. Authority and US Bureau of Reclamation, 2001.

Salton Sea Species Conservation Habitat Project Draft Environmental Impact Statement/Environmental Impact Report. Prepared for the California Natural Resources Agency by CA Department of Water Resources and California Department of Fish and Game with assistance from Cardno ENTRIX, 2011.

Shuford, W.D., Warnock, Nils, Molina, K.C., and Sturm, K.K., 2002, The Salton Sea as critical habitat to migratory and resident waterbirds: Hydrobiologia, v. 473, p. 255–274.

11.2 Points of Contact

Name	Email
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Gary Wyatt, Imperial County	cgwyatt@co.imperial.ca.us

Appendix: Project Budget

Task #	Project Task	Budget
Benchmark 1 - Work Plan		
1.1	Draft Work Plan	40,000
1.2	Final Work Plan	10,000
	Benchmark 1 - Work Plan Total	50,000
Benchmark 2 - Review/Update Existing Condition Data Including Hydrology		
2.1	Data Compilation and Review	20,000
2.2	Hydrology Analysis	20,000
2.3	Salinity and Elevation Forecasts	20,000
2.4	Other Water Quality Conditions	20,000
2.5	Air Quality Conditions and Dust Emissions	25,000
2.6	Draft Data Report/Data Files	25,000
2.7	Final Data Report/Data Files	10,000
	SSA Technical Activities	10,000
	Benchmark 2 - Review/Update Existing Condition Data Total	150,000
Benchmark 3 - Review Alternatives with Respect to Existing Conditions		
3.1	Compile Engineering Data	33,000
3.2	Evaluate Restoration Components	77,000
	SSA Technical Activities	15,000
	Benchmark 3 - Review Alternatives Total	125,000
Benchmark 4 - Conceptual Plans for Restoration Components		
4.1	In-sea Embankments and Other Features	
4.1.1	Outlet Conveyance Facilities	85,000
4.1.2	Enhanced Inflow Conveyance Facilities	60,000
4.1.3	Partitioning Components	95,000
4.2	Salinity and Water Quality Improvements	70,000
4.3	Air Quality and Dust Emission Mitigation	35,000
4.4	Habitat Improvements	180,000
4.5	Technical Coordination Team Collaboration	100,000
	SSA Technical Activities	25,000
	Benchmark 4 - Conceptual Plans Total	650,000

Benchmark 5 -Infrastructure Financing Feasibility		
5.1	Infrastructure Financing Feasibility	150,000
5.2	Draft Feasibility Report	50,000
5.3	Final Feasibility Report	25,000
	SSA Technical Activities	40,000
	Benchmark 5 -Infrastructure Financing Feasibility Total	265,000
Benchmark 6 - Financing/Funding Options		
6.1a	NREL Stakeholder Engagement and Meetings	44,000
6.1b	Review IID/EES Report and Inventory Other Efforts	13,088
6.2	Develop/Confirm Renewable Resource Potential Estimates	23,584
6.3	Technology Status Update	36,531
6.4	Energy Market Analysis	63,594
6.5	Desalinization Analysis	14,775
6.6	Geothermal Fluid Mineral Recovery Market Analysis	37,653
6.7a	Draft and Final Reports and Briefings	59,561
6.7b	Coordination, Communication and Meetings	32,214
6.8	Other Financing Evaluations	135,000
	SSA Technical Activities	52,000
	Benchmark 6 - Financing/Funding Options Total	512,000
Benchmark 7 - Final Report and Presentation of Findings		
7.1	Preliminary Report and Presentation	95,000
7.2	Final Report and Presentation	45,000
	SSA Technical Activities	10,000
	Benchmark 7 - Final Report and Presentation Total	150,000
	Project Management	98,000
Grand Total		**$ 2,000,000**