

5.5.1 Brine Line to the Salton Sea



Introduction

In support of the One Water One Watershed (OWOW) 2.0 Plan, the Bureau of Reclamation (Reclamation) conducted an appraisal-level analysis of the connection of the Inland Empire Brine Line (Brine Line), formerly known as the Santa Ana Regional Interceptor (SARI), to the Salton Sea. It is one of several salt management alternatives involving brine delivery that the Santa Ana Watershed Project Authority (SAWPA) examined within the basin. One alternative option explores direct brine discharge to the Sea. Reclamation's appraisal analysis of the Brine Line are found in a four-volume set of technical memoranda that address the SARI history; engineering, brine and flow data; various options and strategies; projected cost information; and recommendations. Those points are captured in Reclamation's *Inland Empire Interceptor Appraisal: Technical Manuals 1-4* and the associated *Executive Summary*, attached as OWOW 2.0 **Appendix D1-D5**.

The Brine Line was constructed to help manage the basin's water quality by exporting highly saline waters from the Inland Empire to a wastewater plant in Orange County for ocean discharge. Like nearly all watersheds in arid climates, salt management is essential for water resource managers to ensure populations and ecosystems continue to thrive.

SAWPA's Brine Line, an important tool in managing inland groundwater basins, has allowed businesses with industrial processes that produce brine to move into and expand in the Inland Empire. Orange County also benefits from the Brine Line through the removal of salinity from the Santa Ana River, providing a reliable level of protection for its water quality and reducing the area's dependence upon imported water.

A study entitled Santa Ana Watershed Salinity Management Program (Salinity Management Program) was completed in 2010, by a team of consultants led by Camp, Dresser & McKee Smith (CDM Smith), which addressed the Brine Line capacity limitations. The Salinity Management Program identified and evaluated several alternatives for managing flows in the Brine Line system.

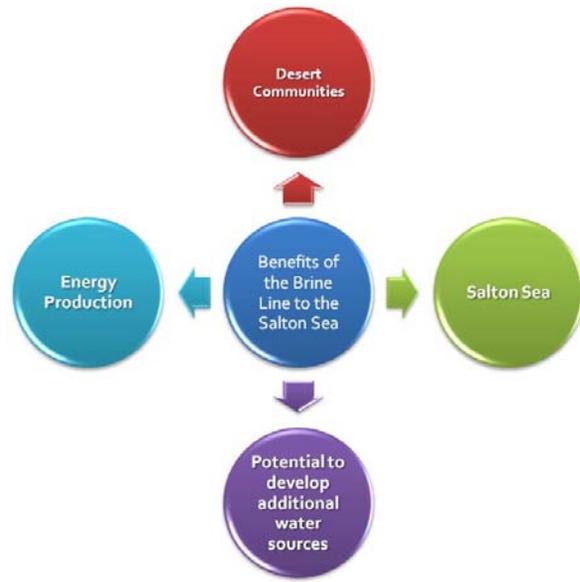
Some alternatives have been considered for improved salt management involving the Brine Line within the Santa Ana River Watershed (SARW). The first was a Brine Line flow reduction through a centralized treatment facility. Here the brine would undergo biological treatment, followed by chemical softening, then high recovery reverse osmosis treatment and disinfection concludes the process. The treated water is then available for use while the reject water continues downstream for further treatment and discharge to the ocean. A variation of this option would be to further treat and concentrate brine at individual desalters or facilities, but the benefits of scale for a single facility would be lost. Another salt management alternative includes providing incentives to commercial users to encourage use of the existing Brine Line. Brine disposal can be maximized and the cost can be minimized by directly discharging brine to the ocean. Currently, brine in the Brine Line is several times less salty than ocean water and with sufficient pretreatment at the source stream the brine could be discharged directly to the ocean without any negative impact to the environment, avoiding downstream treatment costs. Pretreatment is only required of system users with high BOD/TSS waste, but the cost of pretreatment may provide an incentive for the highest valued use of the Brine Line, salt disposal. In addition, the permit requirements for direct ocean discharge are onerous and time-consuming, so making use of the existing brine line is advantageous to these industries.

The final salt management alternative assumes all the flows in the Brine Line would be collected just below Prado Dam, the lowest elevation in the upper watershed, and that a separate pipeline would be constructed to transport that flow directly to the Salton Sea. The Salton Sea, California's largest inland lake, is a shallow, highly saline basin with no outfall to external water bodies. It is 14,000 parts per million saltier than ocean water.

After delivery of the Santa Ana Watershed Salinity Management Program report by CDM Smith, SAWPA staff prepared a report entitled *Inland Empire Brine Line Disposal Option Concept Investigation* (SAWPA Investigation) in which four alternative conceptual designs for the Brine Line to the Salton Sea alternative were developed and evaluated. Such a pipeline could accommodate additional saline flows which would be treated to some extent prior to discharge into the Salton Sea. A list of potential benefits including bringing in 30-40 thousand acre -feet of water every year to the Salton Sea were identified that would significantly assist in the following:

- Dilute salt concentrations
- Help stabilize lake levels
- Enhance water reliability
- Protect fish and wildlife that are dependent on the Salton Sea ecosystem

- Restore the long-term stable aquatic and shoreline habitat for fish and wildlife that depend on the Sea
- Mitigate air quality impacts from exposed playas
- Maintain the Salton Sea as a vital link along the Pacific Flyway
- Minimize noxious odors and other water and air quality problems
- Enhance economic development opportunities that will provide sustainable financial improvements
- Improve the economic quality of life for communities around the Salton Sea
- Improve aquifer water quality
- Increase water production



Reclamation’s engineering analysis and recommendations are attached as a separate report, which is an **Appendix D5** in OWOW 2.0. Based on that analysis, SAWPA remains hopeful that as new partnerships are developed with potential brine customers throughout the Basin and other parts of the state, the viability of this salt management alternative will become a truly system-wide solution. An economic analysis was recommended to help examine the potential for this proposed undertaking.

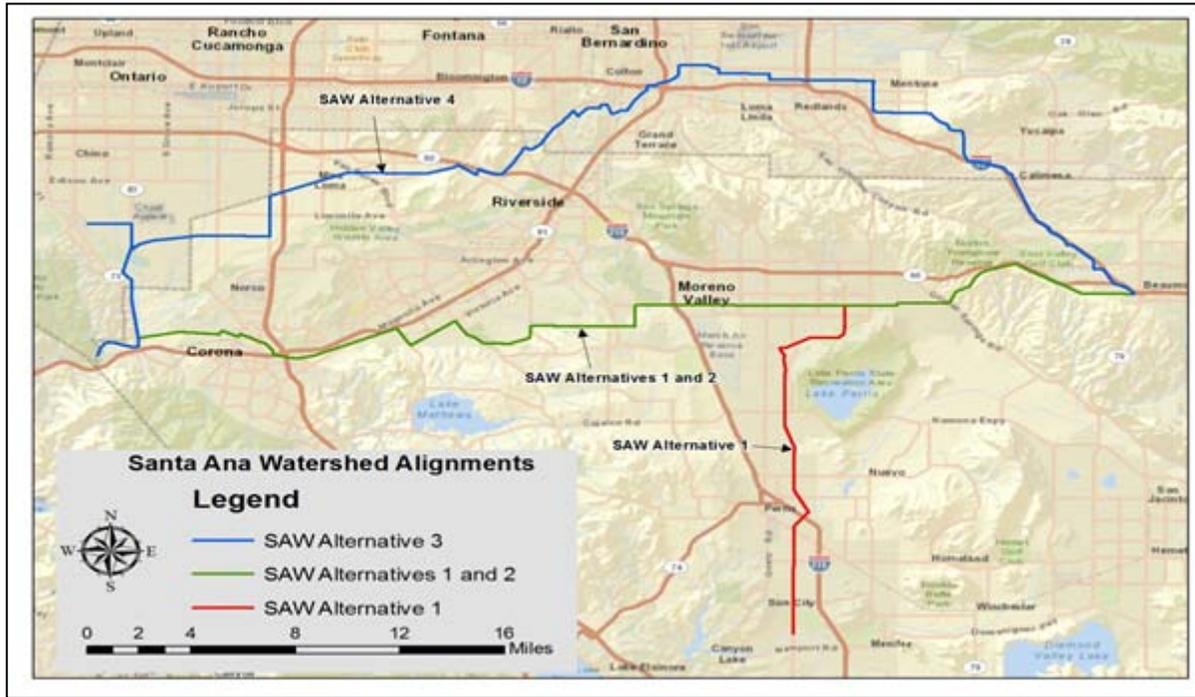
Appraisal Analysis Objectives

As mentioned above, the Brine Line to the Salton Sea alternative was the subject of the Appraisal Analysis and is identified as the Inland Empire Interceptor (IEI).

The purpose of this Appraisal Analysis is to help determine whether more detailed investigations of the proposed IEI are justified. Under Reclamation criteria set forth in *Reclamation Manual, Directives and Standards, FAC 09-01: Cost Estimating* (Reclamation Manual), appraisal analyses “are intended to be used as an aid in selecting the most economical plan by comparing alternative features”. Several alternative conceptual designs for the proposed IEI will be developed and evaluated in this Appraisal Analysis for the purpose of comparison.

Three of the four alternative conceptual designs for the portion of the proposed IEI in the Santa Ana Watershed addressed in the SAWPA Investigation described above were considered in this Appraisal Analysis.

Figure 5.5.1-1 Santa Ana Watershed Alignments for the Proposed IEI



Additionally, two alternative alignments were developed and evaluated in this Appraisal Analysis for the portion in the San Geronio Pass and Coachella Valley. The route of the proposed IEI through the San Geronio Pass and Coachella Valley areas in eastern Riverside County represents an opportunity for SAWPA to expand the Brine Line service area.

Figure 5.5.1-2 Coachella Valley Alignments for the Proposed IEI

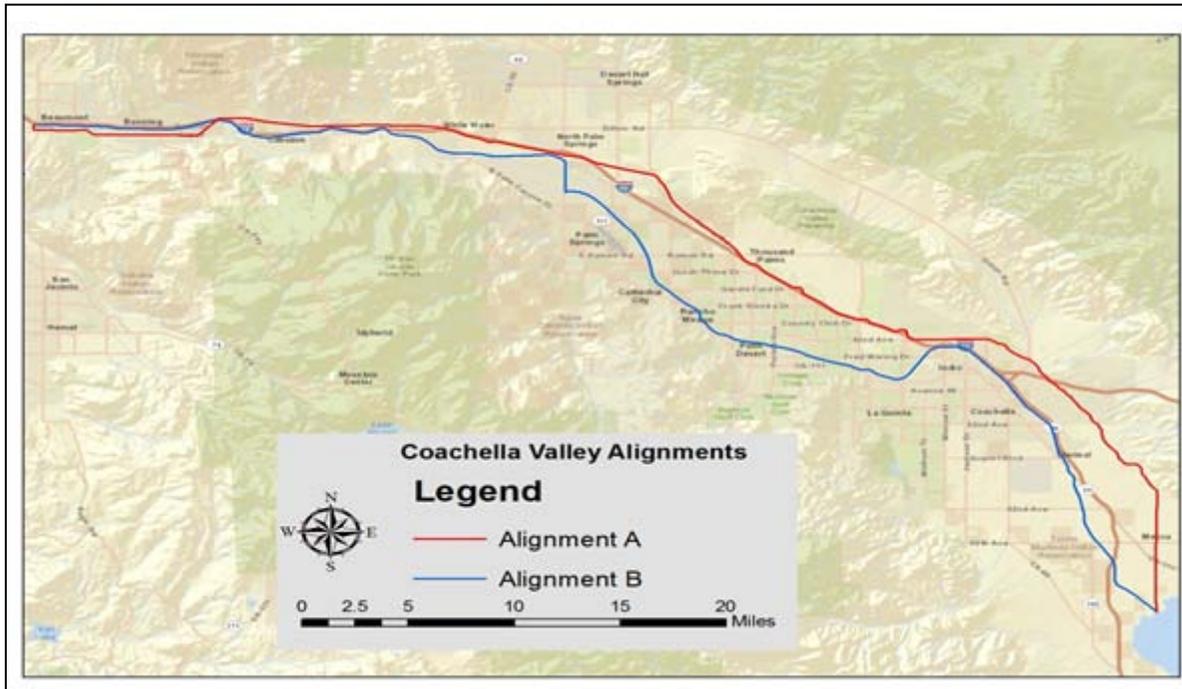
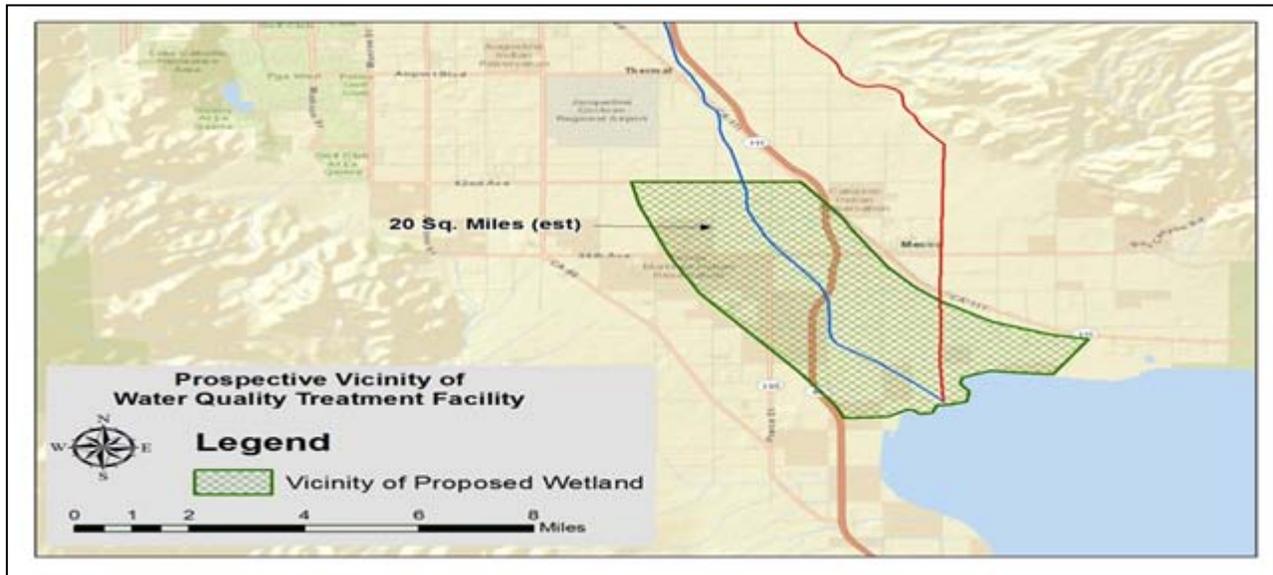


Figure 5.5.1-3 Water Quality Treatment Facility Location for Proposed IEI



Feasibility Analysis and Benefit-Cost Analysis

As discussed above, the purpose of an Appraisal Analysis is to help determine whether more detailed investigations of a proposed project are justified, the criteria for which are set forth in the Reclamation Manual. The *Reclamation Manual* also describes criteria for “a project Feasibility Study and Feasibility-level cost estimate, which are intended to support funding authorization for new construction” and “cannot be conducted without authorization and appropriation of funds by the Congress”.

Also, as a Federal agency, Reclamation must perform benefit-cost analyses (BCA) for proposed water resources projects at the appropriate stage of project planning. The main set of guidelines for a BCA is the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, U. S. Water Resources Council, 1983 (P&Gs). For Reclamation projects, BCAs are typically performed at the Feasibility level of study.

The purpose of a BCA is to compare the benefits of a proposed project to its costs. The total costs of the project are subtracted from the total benefits to measure net benefits. If the net benefits are positive (benefits exceed costs), then the project could be considered economically justified. Conversely, if net benefits are negative (costs exceed benefits), then the project would not be economically justified. When multiple alternatives are being considered for a project, the alternative with the greatest positive net benefit would be preferred from an economic perspective.

A BCA is comprised of four “accounts” identified as the National Economic Development (NED) account, the Regional Economic Development (RED) account, the Environmental Quality (EQ) account, and the Social Effects (OSE) account. The NED and RED accounts are used to evaluate the economic effects of proposed alternative plans.

A RED analysis focuses on economic impacts to the region in which the project is located. The RED analysis recognizes the NED benefits accruing to the local region plus the transfers of income into the region.

A NED analysis focuses on economic impacts to the entire Nation. The *P&Gs* require Reclamation to analyze the NED effects so as not to favor one area of the country over another. Economic justification is determined solely by the benefit-cost analysis and must be demonstrated on the basis of NED benefits exceeding NED costs.

Conclusions and Recommendations

The results of the present worth analyses of the estimated costs for the proposed IEI are presented in Technical Memorandum No.4 (TM4). A simple comparison of those results with the present worth analyses for the other Options presented in the Salinity Management Program indicates that the costs of the proposed IEI are greater than the costs of other Options. However, certain aspects of the proposed IEI distinguish this Option 4 from the other options considered in the Salinity Management Program, and further investigation and analysis of the proposed IEI warrants consideration.

Significant opportunities are available for refinement of the conceptual designs for the proposed IEI presented in this Appraisal Analysis. Further investigation and analysis of these opportunities could help refine the estimated costs, reduce the multiplier applied to estimated costs for contingencies, and evaluate the benefits associated with the project. These refinements could lead to a more favorable present worth comparison of the proposed IEI with the other Options.

Opportunities to refine the scope, conceptual designs, estimated costs, and benefits associated with the proposed IEI are identified and discussed in TM4. In general, these Opportunities represent the Conclusions of this Appraisal Analysis. Suggested Optimization Strategies for the proposed IEI are also identified and discussed in TM4. These suggested Optimization Strategies describe recommended next steps (or Recommendations) for further investigation and analysis of the proposed IEI.

As discussed above, a Feasibility level of study “cannot be conducted without authorization and appropriation of funds by the Congress” and represents a substantial commitment to a project. These recommendations are suggested as interim stages of investigation and analysis of the proposed IEI. A Feasibility study and benefit-cost analysis of the proposed IEI would be warranted only if these additional investigations and analyses produce favorable results.

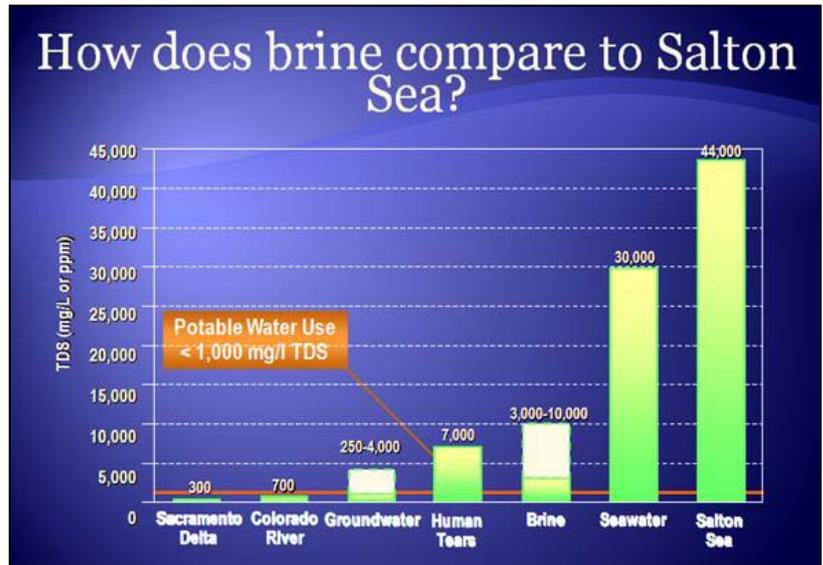
Conclusions

The Conclusions from this Appraisal Analysis are summarized as follows:

- C1. Economic Development: The economic development potential associated with the proposed IEI is significant and unique to this option. If implemented, the proposed IEI would make brine management infrastructure available to prospective employers located in the San Gorgonio Pass and Coachella Valley areas.
- C2. Net Impact: The proposed IEI would impact the Salton Sea in various ways, some of which may be considered beneficial and others negative. Further investigation and analysis of these aspects would help determine design criteria for associated components of the proposed IEI.
- C3. Salton Sea Restoration: Delays to implementation of a restoration plan for the Salton Sea have contributed to uncertainties regarding salinity and water quality aspects of the proposed IEI. Improved understanding of progress toward restoration of the Sea would help determine appropriate project design criteria for the affected components of the proposed IEI.
- C4. Basin Plan: Uncertainties regarding Salton Sea salinity and water quality regulatory requirements contribute to uncertainties regarding planning and design of associated components of the proposed IEI and the associated costs.
- C5. Stakeholder Partnering: The standards established in the Basin Plan for salinity and water quality in the Salton Sea are a deterrent to potential new sources of water supply to the Sea.

Community and stakeholder support would enhance the likelihood of adoption of changes to those standards.

C6. Salton Sea Salinity: The salts in the IEI flows would add to the existing rate of accumulation of salts in the Sea. Whether those salts would cause total dissolved solids (TDS) concentrations in the Sea to increase will depend on such factors as the magnitude of the Salton Sea water budget imbalance over time and progress toward implementation of a Salton Sea restoration plan.



C7. Salton Sea Water Quality: Similar to salinity, whether the total suspended solids (TSS) and biochemical

oxygen demand (BOD) in the IEI flows would cause an adverse impact on the water quality in the Salton Sea will depend on such factors as the magnitude of the Salton Sea water budget imbalance over time and progress toward implementation of a Salton Sea restoration plan. The estimated cost of the proposed Water Quality Treatment Facility (TF) represents a substantial portion of the total estimated costs for the project, which calls for careful scrutiny of the design criteria for this facility.

C8. Brine Pretreatment and Treatment Strategies: The proposed TF could function in place of the Brine Pretreatment and Treatment Strategies presented in the Salinity Management Program, or it could function as part of a hybrid design in combination with a Strategy from the Salinity Management Program.

C9. Management of Surplus Energy: The large estimated costs of the proposed IEI Turbine Generator Stations and associated electric transmission facilities indicate that the time period necessary to recover that investment in would be long. The estimated cost of the proposed IEI could likely be significantly reduced by using an alternative approach to remove surplus energy from flows in the system.

C10. Other Opportunities: Examples of other opportunities to refine, reduce and/or eliminate estimated costs identified in this Appraisal Analysis include but are not limited to the following:

- Synthetic Membrane Liner - The synthetic membrane liner under the TF is the largest single component of the estimated cost of that facility; use of an alternative approach to soil permeability could likely significantly reduce that cost.
- Tunneling – Tunneling in lieu of direct bury of the proposed pipeline through the Badlands west of the City of Beaumont along the Gas Main Alignment may reduce impacts associated with construction of the project.
- Phasing - Phasing of certain project components could allow some project costs to be deferred.

Recommendations

The results of this Appraisal Analysis and the Conclusions listed above suggest appropriate recommended next steps for further investigation and analysis of the proposed IEI to refine the scope, conceptual designs, estimated costs and anticipated benefits of the proposed IEI. These recommendations are summarized as follows:

- R1. Economic Impact Analysis: In response to Conclusion C1 (Economic Development), perform an economic impact analysis for the proposed IEI to quantify the economic development and other benefits of the proposed IEI.
- R2. Salton Sea Water Budget: In response to Conclusions C2, C3, C6 and C7, develop water budgets for the Salton Sea and for the planned Salton Sea restoration, or update available existing water budgets.
- R3. Salton Sea Salinity and Water Quality Models: In response to Conclusions C2, C3, C6 and C7, develop models for salinity and water quality in the Salton Sea and for the planned Salton Sea restoration, or update available existing models.
- R4. IEI Influence on Salton Sea Salinity: In response to Conclusions C2, C3 and C6, use the water budgets and the salinity models for the Salton Sea to evaluate the impact of proposed IEI flows on TDS concentrations in the Salton Sea, to evaluate the influence of those impacts on the IEI design, and to refine estimated costs for the proposed IEI.
- R5. IEI Influence on Salton Sea Water Quality: In response to Conclusions C2, C3 and C7, use the water budgets and the water quality models for the Salton Sea to evaluate the impact of the proposed IEI flows on TSS and BOD concentrations in the Salton Sea, to evaluate the influence of those impacts on the IEI design, and to refine estimated costs for associated components of the proposed IEI.
- R6. Salton Sea Restoration Influence on IEI Design: In response to Conclusion C2, C3, C6 and C7, use the water budgets and the salinity and water quality models for the Salton Sea restoration to evaluate the impact of the proposed IEI flows on the planned restoration, to evaluate the influence of the planned restoration on the IEI design, and to refine estimated costs for the proposed IEI.
- R7. Basin Plan Amendment Process: In response to Conclusion C4 (Basin Plan), evaluate the process and technical requirements for a Basin Plan Amendment to modify Salton Sea salinity and water quality regulatory requirements for the proposed IEI.
- R8. Identify, Investigate & Initiate Partnerships: In response to Conclusion C5 (Stakeholder Partnering), seek opportunities to partner with other Salton Sea stakeholders in support of regulatory changes to encourage new sources of water supply to the Salton Sea in support of restoration efforts. This effort may include:

- Establish a dialogue with other organizations serving the San Geronio Pass, Coachella Valley areas, and/or other areas adjacent to the Salton Sea,
- Investigate community support for changes to the regulatory approach to Salton Sea salinity and water quality standards to encourage new sources of water supply for the Salton Sea, and
- Develop specific proposals for suggested regulatory changes and identify benefits. Communicate the suggested regulatory changes and associated benefits to the community.

R9. Hybrid Strategies for Brine Treatment: In response to Conclusion C8 (Brine Pretreatment and Treatment Strategies), identify and evaluate alternative strategies for treatment of the IEI flows, which may include hybrid designs incorporating Salinity Management Program brine pretreatment strategies in combination with alternative configurations of the wastewater treatment ponds and/or constructed wetlands that comprise the TF considered in this Appraisal Analysis.

R10. Alternative Designs for Surplus Energy: In response to Conclusion C9 (Management of Surplus Energy), develop and evaluate alternative strategies for management of surplus energy in IEI flows such as low-head in-line turbine generators and pressure reducing valves.

R11. Alternative Liner Materials: In response to Conclusion C10 (Other Opportunities), investigate alternatives to the proposed synthetic membrane liner under the TF, including site-specific soil investigations to determine actual soil permeability to facilitate investigation of alternatives such as soil treatment using clay and suitability of a “leaky wetland”.

R12. Tunneling: In response to Conclusion C10 (Other Opportunities), investigate the constructability of and the impacts associated with direct-bury of the proposed pipeline through the Badlands west of the City of Beaumont along the Gas Main Alignment and the feasibility of tunneling in lieu of direct bury in that area.

R13. Phasing of Improvements: In response to Conclusion C10 (Other Opportunities), investigate opportunities for phasing of selected project components (e.g. use of dual pipelines in Coachella Valley) to defer costs until warranted by system flows, including a Present Worth analysis of the phased project costs.

Summary

The Conclusions (Opportunities) and the associated Recommendations (Optimization Strategies) identified above are summarized in **Table 5.5.1-1**. Priority rankings are assigned the table to those recommendations, which are loosely based on the potential influence on the estimated project costs and/or the value of anticipated benefits.

Table 5.5.1-1 Summary of Conclusions and Recommendations

CONCLUSIONS (OPPORTUNITIES)	PRIORITY	RECOMMENDATIONS (OPTIMIZATION STRATEGIES)												
		R1 - Economic Impact Analysis	R2 - Salton Sea Water Budget	R3 - Salton Sea Salinity & Water Quality Model	R4 - IEI Influence on Salton Sea Salinity	R5 - IEI Influence on Salton Sea Water Quality	R6 - Influence of Salton Sea on IEI Design	R7 - Basin Plan Amendment Process	R8 - Identify, Investigate, & Initiate Partnerships	R9 - Hybrid Strategies for Brine Treatment	R10 - Alternative Designs for Surplus Energy	R11 - Alternative Liner Materials	R12 - Tunneling in Lieu of Direct Bury	R13 - Phasing of Improvements
C1 - Economic Development	1	X												
C2 - Net Impact	2		X	X	X	X	X							
C3 - Salton Sea Restoration	2		X	X	X	X	X							
C4 - Basin Plan	3							X						
C5 - Stakeholder Partnering	4								X					
C6 - Salton Sea Salinity	2		X	X	X		X							
C7 - Salton Sea Water Quality	2		X	X		X	X							
C8 - Brine Pretreatment and Treatment	5									X				
C9 - Management of Surplus Energy	6										X			
C10 - Other Opportunities	7											X	X	X