Salton Sea Independent Review Panel Fatal Flaw Report

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Evaluation of Water Importation Concepts for Long-Term Salton Sea Restoration

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Disclaimer

The views and opinions expressed in this Report and its appendices, including any interpretation of objectives or obligations of the state of California with regard to Salton Sea restoration, are solely those of the Independent Review Panel. They do not represent the official policy or position of the state of California.

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Acronyms and Abbreviations

AFY	acre-feet per year
GHG	greenhouse gas
IBWC	International Boundary & Water Commission
mg/L	milligrams per liter
MAFY	million acre-feet per year
MW	megawatts
NASA	National Aeronautics and Space Administration
Panel	Independent Review Panel
QSA	Quantification Settlement Agreement
RO	Reverse osmosis
RFI	Request for Information
SB 100	California Senate Bill 100. Officially titled "The 100 Percent Clean Energy Act of 2018".
SSAM	Salton Sea Accounting Model
SSMP	Salton Sea Management Program
TM	Technical Memorandum
UC Santa Cruz	University of California, Santa Cruz
UNESCO	United Nations Educational, Scientific, and Cultural Organization
US	United States of America

1.0 Introduction

This report is a product of the Independent Review Panel's (Panel) evaluation of long-term water importation solutions to problems facing the Salton Sea, located in southern California. The Panel was convened under Agreement #4600014042 between the State of California's Salton Sea Management Program (SSMP) and the University of California, Santa Cruz (UC Santa Cruz) (Brent Haddad, Ph.D., PI). This is the Panel's second report.

1.1 Purpose of the Report

On two occasions (2017 and 2021), the SSMP and Panel issued public Requests for Information (RFI) asking for water-importation-based approaches to restore the Salton Sea. A total of 18 concepts were received. They are being reviewed by the Panel with the assistance of a research and analysis support team. The review process includes the following steps:

- Screening of the 18 responses for compliance with RFI requirements (Screening Report).
- A fatal flaw analysis of the remaining submissions (this report).
- Detailed feasibility studies compiled in a Feasibility Report.
- A Summary Report describing the review process, outcomes of the screening and feasibility analyses, and possible next steps.

The Screening Report removed five responses from consideration due to non-conformance with the RFI. This Fatal Flaw Report serves as the first substantive review of the remaining 13 responses.

The Panel was tasked with independently defining a set of fatal flaws. It did so based on Panel members' expertise and the Panel's research on the region. Because the process of defining fatal flaws occurred after the submission of responses to the RFI, submitters were not informed in advance what the fatal flaw criteria would be. All responses passed through an initial fatal flaw review, and each respondent was given an opportunity to address any fatal flaw identified by the Panel. Ten respondents provided additional material. Following review of the additional material, responses that still possess one or more of the fatal flaws listed below will not be considered further by the Panel. Those that are free of fatal flaws will be further considered for Feasibility.

Many of the responses contain elements that would support the restoration of the Salton Sea, some of which the Panel finds compelling. In the Summary Report suggestions for possible next steps the Panel may include strong elements from responses that did not meet all of the fatal flaw criteria, with acknowledgement.

1.2 Overall Review Process

The Panel is proceeding in its review of the RFI responses in two stages: screening and feasibility. The screening process itself is divided into two steps, an initial screening of submissions for compliance with the RFI, and an examination of submissions for fatal flaws. The ensuing Feasibility Report will examine selected concepts emerging from the fatal flaw review in more detail. The Panel will provide a final Summary Report which will include the Panel's suggestions for next steps.

2.0 RFI Responses

On December 8, 2017, the SSMP issued an RFI for Salton Sea Water Importation Projects. Following the establishment of the Panel, a nearly identical RFI was issued by the Panel (August 13, 2021) to solicit additional responses and to allow the initial respondents to update their submissions. Eighteen responses were received in total: 11 responses in 2017, including updates, and seven additional responses in 2021. Response materials are available on the SSMP website via: https://saltonsea.ca.gov/planning/.

Five responses were removed in the screening process for failure to conform to the parameters set forth in the RFI. The remaining 13 responses are summarized in Table 2-1. Each response was assigned a number for ease of reference.

Table 2-1: RFI Responses

Response Number	Response Title	Prime Respondent
R2	Tres Mares Restoration: Salton Sea, Laguna Salada & Sea of Cortez[1]	AGESS, Inc.
R4	Salton Sea Water Importation Project	Cordoba Corporation
R5	Bi-National Canal for Salton Sea Restoration and Colorado River Augmentation	GEI Consultants, Inc. and Michael Clinton Consulting, LLC
R6	Harnessing Energy and Water in the Salton Sea	Geothermal Worldwide, Inc.
R7	Wi. Ňy-Wey Maātap: The Living Stone Canal	Quadrant, LLC
R8	Sea to Sea Canal Project	Sea to Sea Canal Company
R9	Water Import Salt Extraction Revenue	Sephton Water Technology, Inc.
R10	Super Salton Trough Interconnection Project	New Water Group, LLC
R12	The Salton Sea: The Best Days are Ahead of Us	E2Eden, LLC

Response Number	Response Title	Prime Respondent
R13	The Sustainable Solution for Remediation and Restoration of the Salton Sea	Global Premier Development, Inc. and Salton Power, Inc.
R14	Salton Sea Management Plan: Recycled Water Importation	Online Land Planning, LLC
R15	Transalton Project: Transoceanic proposal for massive fresh water imports to the Salton Sea and the lower Colorado River basin from South Mexico rivers	Transoceanic, LLC - USA
R16	Water Importation to the Salton Sea	Water Train, Inc.

[1] Originally submitted as Tres Lagunas Restoration: Salton Sea, Laguna Salada & Sea of Cortez

3.0 Fatal Flaw Analysis

This section details the fatal flaw analysis process.

3.1 Development of Fatal Flaw Criteria

A fatal flaw constitutes at least one of the following:

- A performance outcome well short of the necessary long-term conditions needed to minimize air quality problems from exposed playa and address ecological health in the region.
- Possible negative effects of constructing and operating the project that are severe enough to prevent its acceptance.

The state of California asked the Panel to consider 10 topics in its fatal flaw analysis (Table 3-1), plus any additional topics identified by the Panel.

Table 3-1: State of California requested topics for Water Importation fatal flaw analysis

No.	Topics for Fatal Flaw Analysis
1	Water source identification.
2	Concept design and engineering; including energy sources, conveyance and pumping facilities and intake structures.
3	Construction considerations for the proposed structure or system.
4	Long-term operations of the proposed structure or system.
5	Water treatment facilities.
6	Water and land use.
7	Flood control and climate change impacts.
8	Environmental parameters such as: water quality, air quality, hydrology, hydraulics, ecological impacts, biology, restoration, and endangered species.
9	International, Federal, State, and Local environmental laws, regulatory compliance, and permitting.
10	Stakeholder strategy and coordination (International, Federal, State, Local).

The Panel refined the topics by stating them in the form of fatal flaws that could be evaluated for all the submissions.

Transitioning from the State's list of topics to the Panel's fatal flaw criteria occurred first by reviewing each submission to understand the range of strategies proposed and their potential impacts. The Panel then examined the State's commitments to the region, the region's ecological and public health conditions, and what minimum safety and reliability requirements should be considered for large engineering projects.

Toward the end of its analysis, the Panel re-reviewed all the fatal flaws for consistency of application and to consider whether the criteria were overly stringent. A change that emerged from this review related to how Salton Sea salinity levels would be projected over time (criterion 3b). The Panel chose to introduce a measure of uncertainty to its long-range modeling so as to incorporate potential variability in long-term average Salton Sea base inflows. As a result, a greater number of submissions met criterion 3 for the reduction of salinity and exposed playa. Furthermore, the Panel re-reviewed three responses (R2, R8, and R14) that failed only one fatal flaw criterion. This review confirmed the Panel's initial decision.

In reviewing the 10 topics provided by the State, the Panel decided not to adopt the topic of "Stakeholder strategy and coordination" as a fatal flaw. The Panel could not arrive at a measurable fatal flaw with respect to public outreach, and it was determined that stakeholder engagement could be altered and/or expanded for any submission if needed. More details on how the fatal flaw criteria address the State's list of topics are provided in Technical Memo (TM) 2.7 in Appendix A.

3.2 Fatal Flaw Criteria

Failure of a respondent's submission to pass the fatal flaw analysis does not constitute a judgment on the ability of the respondent to carry out the project or on the broad merits of the technologies.

Table 3-2: Fatal Flaw Criteria

No.	Fatal Flaw Criteria
1	The submission is technically sound and utilizes established, non-speculative technologies.
2	The submission will not create significant risk of catastrophic flooding.
3	The submission is consistent with the objectives of the Salton Sea Restoration Act.
3a	The submission results in improved air quality (1) through reduction of exposed playa to levels consistent with those prior to 2018, or (2) through reduction of dust emissions by employing other mechanisms over an equivalent area.
3b	The submission's stated salinity goals should not exceed 70,000 mg/L, which is above identified salinity tolerance ranges for Protected Species and Species of Importance.

No.	Fatal Flaw Criteria
4	No extraction or infrastructure being proposed will cause significant ecological impacts to the Biosphere Reserve and Ramsar wetlands of international importance located within the Upper Gulf of California and Lower Colorado River Delta.
5	Solutions must be viable for the project duration (until 2078).

The Panel selected these criteria for the following reasons:

1. ***The submission is technically sound and utilizes established, non-speculative technologies.***

The Panel encourages new and innovative solutions. However, they should be in the form of new combinations and uses of proven technologies. Technologies that have minimal or no performance record present too much risk to the timely completion of a project of this immediacy, magnitude, and importance. One example of a systematic approach to evaluating technology is the Technology Readiness Levels, first developed by NASA and used widely in water resources engineering and treatment. The Levels range from Level 1: basic principles observed and reported, to Level 9: actual system proven through use (Mankins 1995). The technologies used for this project should be equivalent to Level 9 – actual systems proven through use.

2. ***The submission will not create significant risk of catastrophic flooding.***

A water importation project for the long-term restoration of the Salton Sea would involve the transport of water on the scale of hundreds of thousands to millions of acre-feet per year. Uncontrolled release of large volumes of water in the event of infrastructure failure could have devastating consequences. No project should introduce a significant risk of catastrophic flooding due to infrastructure failure that may be triggered by earthquakes, fire, mismanagement, vandalism, or other causes.

The surface elevation of the Salton Sea is more than 200 feet below sea level. Many of its surrounding towns, from Indio to Calexico, and associated farmland in the Salton Sea basin, are also at or below sea level. Uncontrolled release of water into the Salton Sea basin could result in a catastrophic loss of life and/or damage to land, property, and ecosystems.

3. ***The submission is consistent with the objectives of the Salton Sea Restoration Act.***

    3a. The submission results in improved air quality (1) through reduction of exposed playa to levels consistent with those prior to 2018, or (2) through reduction of dust emissions by employing other mechanisms over an equivalent area.

3b. The submission's stated salinity goals, confirmed by modeling projections, should not exceed 70,000 mg/L, which is above identified Protected Species and Species of Importance salinity tolerance ranges.

The Salton Sea Restoration Act sets the State's restoration objectives to minimize air and water quality problems and to restore long-term stable aquatic and shoreline habitat that supports a self-sustaining aquatic community and native birds that use the Salton Sea as stopover habitat during migration. To pass this criterion, the response must demonstrate a strong likelihood of meeting the State's objectives. The Panel selected 2018 as the reference year for playa exposure because mitigation flows related to the QSA ended in 2017. The Panel selected 70,000 mg/L as a maximum acceptable salinity and fatal flaw tipping point because it is the salinity level at which the in-sea food webs that support avian wildlife are likely to collapse.

4. No extraction or infrastructure being proposed will cause significant ecological impacts to the Biosphere Reserve and Ramsar wetlands of international importance located within the Upper Gulf of California and Lower Colorado River Delta.

The Biosphere Reserve of the Upper Gulf of California and Colorado River Delta, a UNESCO World Heritage Site, is defined as the Upper Gulf of California, the Colorado River Delta (marine portion), and associated islands and coastal protected areas. Three other protected ecological sites overlap, or are adjacent to, the Biosphere Reserve, one being the Humedales del Delta del Río Colorado, a Ramsar wetland of international importance (Ramsar 2001; Ramsar 2008). Given the present and potential value of these areas for biodiversity, and its associated ecosystem services, substantial and long-lasting ecological impacts would be deemed unacceptable losses by international and national conservation organizations (e.g., the United Nations and Ramsar Convention [Conference of the Contracting Parties]) and local nature-based industries, and would likely require extensive review and analysis by Mexican regulatory agencies. Therefore, responses that may result in substantial and irreversible ecological impacts on the Biosphere or wetlands of importance during construction or operation will not pass this fatal flaw.

5. Solutions must be viable for the project duration (until 2078).

The charge of the Panel is to assess the feasibility of water importation as a long-term strategy to restore the Salton Sea. Consistent with the Quantitative Settlement Agreement (QSA), the period defined by the Salton Sea Ecosystem Restoration Program and Final Programmatic Environmental Impact Report extends from 2003 to 2078. Factors considered for viability include reliability of the water source, ability to obtain in a timely manner and extend necessary rights and permits, ability to maintain or replace infrastructure, and prevention of negative secondary effects. Concepts that have a shorter period of beneficial impact are subject to this fatal flaw.

3.3 Methodology of Applying the Fatal Flaw Criteria to Submissions

The Panel developed methodologies for each criterion intended to yield clear pass/fail outcomes. Detailed methodology for each criterion is provided in Appendix B in Technical Memoranda (TMs) 11.1 through 11.5.

When evaluating submissions in terms of the fatal flaw criteria, the following resources were used: written submissions; the 30-minute presentations that many respondents gave to the Panel in October 2021; maps from the submissions as well as other maps identified by the Panel; answers provided by the respondents to Panel queries; scientific literature and other publicly available information; comments from the general public; responses addressing fatal flaws identified in the first review; and the Panel's independent judgment when it was possible and straightforward to fill a gap in materials presented. The Panel did not consider additional information presented by respondents in other venues such as conferences, summits, newspaper articles, or websites. In order to treat all submissions equitably, the Panel evaluated the materials provided by the respondents as submitted and did not introduce possible alternatives or changes that could make them more favorable under certain fatal flaw criteria.

Following the completion of the initial fatal flaw review, each submitter was sent an explanation of the findings of the Panel (via email on June 17, 2022, Appendix C) and invited to re-submit responses by July 1, 2022. The report was finalized after a review of the revised submissions.

To assist in the analysis of the water and salt balances likely to result from each submission, the Salton Sea Accounting Model (SSAM) was used. The SSAM is a spreadsheet model originally developed by the US Bureau of Reclamation in the 1990s and updated by an environmental consulting firm, Tetra Tech, to include current Salton Sea data (Tetra Tech 2021). The model provides a tool to equitably compare responses based on the impact of their projected water imports on water surface elevation, exposed playa, and salinity. Environmental factors such as evaporation rates, precipitation, and existing inflows (i.e., via rivers and drainage) were applied equally to all responses. Information derived from each response—including water import volumes, imported water salinity, water extraction for desalination, and timeline of implementation—were input into the SSAM, generating data to compare against fatal flaw criteria requirements.

The Panel recognizes that baseline flows into the Salton Sea can vary from year to year. In addition, the SSAM depends on projections of future evaporation rates, precipitation rates, and water inputs through existing inflows. We therefore incorporated additional reasonable uncertainty into the modeling. The SSAM was used in evaluating sub-criteria 3a and 3b.

3.4 Additional Critical Topics

The Panel identified additional topics that are critical to project success but could not be distilled into measurable fatal flaw criteria. They are listed below.

3.4.1 Implementation Timing

The Panel recognizes the environmental and human impacts of declining sea surface levels and the expansion of exposed playa. The Panel has heard the local community voice the urgency of the problem and the need for the state of California to swiftly address the changes occurring at the Sea. The timing of project implementation is critical to the feasibility of water importation projects.

While the Panel agreed that the likelihood of a project never obtaining necessary permits was sufficient to be a fatal flaw, it did not select a "fatal" cut-off time for a slow or delayed permitting process. Instead, it considers timing of permitting—and therefore of implementation and beneficial results—to be a project characteristic. The desirability of a project decreases, however, as the likelihood of delayed implementation increases. A project that reduces salinity, for example, will reach the maximum salinity goal later in time if it is delayed, thus maintaining stress on the ecosystem and its dependent species for a longer duration. Although important to consider as a critical characteristic of a project, possible delayed implementation was not considered to be a fatal flaw.

3.4.2 Energy and Carbon Footprint

The state of California is making concerted efforts to address climate change risks by reducing greenhouse gas (GHG) emissions, and it has enacted policies that will move the state toward a carbon neutral energy future. As part of this effort, the State has enacted legislation (SB 100) that would ensure "eligible renewable energy resources and zero-carbon resources supply 100 percent of all retail sales of electricity to California end-use customers and 100 percent of electricity procured to serve all state agencies by December 31, 2045." Governor Newsom has requested that this process be accelerated to meet a new target of 2035.

Provisions within SB 100 direct all state agencies to "ensure actions taken in furtherance of these purposes achieve [SB 100's] specified objectives." In the context of Salton Sea restoration efforts, the Independent Review Panel notes that the large-scale conveyance of water, desalination, and other components presented in the submissions typically require a significant amount of energy (hundreds to thousands of megawatts [MW]) and energy transmission capacity. In addition, the Panel recognizes that climate change is likely to exacerbate the public health and environmental challenges facing the Salton Sea region. Accordingly, a water importation project should demonstrate the ability to comply with the intent of SB 100 by remaining carbon neutral (e.g., using renewable energy for ongoing operations) during the life of the project.

While the Panel believes compliance with the intent of SB 100 to be extremely important, it chose not to make shortfalls in carbon neutrality a fatal flaw. This requirement was not listed in either of the RFIs and any of the submissions could conceivably achieve carbon neutrality through the purchase of carbon offsets or the construction of additional wind, solar, or other

renewable energy sources to power the project. Instead, energy consumption and carbon footprint are considered characteristics of the submissions to be analyzed and compared.

3.4.3 Binational Benefits

Several responses utilize the Sea of Cortez as the source for water import. Since the Water Treaty of 1944 between the US and Mexico, there have only been five large scale projects addressing water supply or water quality at the US-Mexico border.[1] Any project crossing the border will require management through the International Boundary and Water Commission process.

The construction and maintenance of significant infrastructure in Mexico is more likely to be permitted if the project demonstrates benefits to the local communities, tribes, and governments in Mexico and therefore better adheres to social justice principals. The Panel is not in a position to quantify what binational benefits, or level of benefits, would be required for project success. Additionally, the cost share of the project must be reflective of the project benefits for each country.

3.4.4 Cost

The costs of many of the submissions range in the billions of dollars. While the Panel recognizes that the cost of a project could exceed available allocated resources, it was not able to determine a cut-off point that could serve as a fatal flaw. It is, of course, evident that the immediate public health and environmental crises at the Salton Sea will require significant investment in both the near and long term.

3.4.5 Stranded Assets

A stranded asset is a functional piece of equipment or entire system that ceases to be utilized at full capacity. Problems related to stranded assets include lack of revenue from operating the system to pay capital and maintenance costs, an unnecessarily large construction footprint, and inefficient operation of a remaining system that is sized incorrectly for its ongoing use.

Several submissions include the import of large volumes (millions of acre-feet) of water in a relatively short timeframe (five years or less) to restore historical water surface elevations at the Salton Sea, followed by a decrease in flow for the project duration. These projects would require infrastructure costing billions of dollars, which would likely be paid off over decades through bond financing. Sizing pumping, conveyance and treatment facilities for an initial high-flow rate, then significantly lowering the flow during longer-term operations, could result in significant stranded infrastructure assets. Minimizing the amount of stranded assets will reduce project

[1] Falcon Dam on the Rio Grande; Armistad Dam on the Rio Grande; Channelization of the Tijuana River; International Wastewater Treatment Plant for Tijuana/San Diego; Binational Study for Desalination at the Sea of Cortez (feasibility study).

costs, reduce the amount of unused equipment during post-recovery project operation, and increase the efficiency of the project. The Panel considers this to be a critical topic but not a fatal flaw because a project that creates stranded assets can nevertheless achieve the long-term goals of improving public and environmental health in the region.

4.0 Application of Fatal Flaw Criteria

Each of the 13 responses was evaluated utilizing the five fatal flaw criteria described above (Table 3-2). Twelve of the 13 responses were found to be deficient in at least one criterion after the initial review. All respondents were given an opportunity to address the fatal flaws and ten out of twelve provided resubmissions. Resubmissions were reviewed for all five fatal flaw criteria. An additional 2 submissions passed all criteria based on their resubmissions. Details of the fatal flaw analysis are documented in Appendix B (TMs 11.1 through11.5).

The results are shown in Table 4-1, with red dots denoting not passing and green dots denoting passing. Responses R4, R9, and R10 passed all of the criteria. The following sections provide additional details on this determination.

Table 4-1: Results of Fatal Flaw Criteria Application

Criterion	Response												
	R2	R4	R5	R6	R7	R8	R9	R10	R12	R13	R14	R15	R16
1	●	●	●	●	●	●	●	●	●	●	●	●	●
2	●	●	●	●	●	●	●	●	●	●	●	●	●
3	●	●	●	●	●	●	●	●	●	●	●	●	●
4	●	●	●	●	●	●	●	●	●	●	●	●	●
5	●	●	●	●	●	●	●	●	●	●	●	●	●

A summary of why the responses failed given criteria is provided below. Full details on the rationale behind why a response passed or failed each criterion are provided in Appendix B (TMs 11.1 through 11.5).

4.1 Evaluation of Responses for Fatal Flaws

4.1.1 Response R2

Response R2 was submitted in 2018 in response to the original RFI and updated in the 2021 RFI process. Following the initial fatal flaw analysis, a resubmission of R2 was received and reviewed. R2 was found to be deficient in Criterion 4.

Criterion 4

This response includes using 30 miles of the Coyote Canal from the Sea of Cortez to Laguna Salada. The path passes through both the Biosphere and the Ramsar wetland site and would permanently alter flooding regimes within the Ramsar wetlands.

4.1.2 Response R5

Response R5 was submitted in 2018 in response to the original RFI. Following the initial fatal flaw analysis, no resubmission was received. R5 was found to be deficient in Criteria 1, 4, and 5.

Criterion 1

This response utilizes a proprietary desalination technology that does not constitute an actual system proven through use.

Criterion 4

This response withdraws water from the core zone of the Biosphere Reserve and includes dredging of 130 miles of canal within the Biosphere Reserve and Humedales del Delta del Río Colorado.

Criterion 5

This response is unlikely to receive the required environmental permits for construction of infrastructure. The generation of hundreds of millions of tons of salt per year poses significant operation and maintenance concerns.

4.1.3 Response R6

Response R6 was submitted in 2018 in response to the original RFI and updated in the 2021 RFI process. Following the initial fatal flaw analysis, a resubmission of R6 was received and reviewed. R6 was found to be deficient in Criteria 1 and 5.

Criterion 1

This response utilizes multiple technologies that do not constitute actual systems proven through use. Additionally, components of the submission, including extremely high pipeline velocities, are outside of industry standards and are not considered technically sound.

Criterion 5

This response utilizes technologies that have not been demonstrated to have operational and maintenance requirements that will allow the system to operate reliably through 2078.

4.1.4 Response R7

Response R7 was submitted in 2018 in response to the original RFI. Following the initial fatal flaw analysis, a resubmission of R7 was received and reviewed. R7 was found to be deficient in Criteria 1, 3, 4, and 5.

Criterion 1

This response has insufficient information to determine the adequacy of the design and proposed technologies for the canal intake, conveyance, upstream and downstream storage facilities, and hydroelectric power plant.

Criterion 3

This response would result in the Salton Sea salinity remaining outside of the target salinity range for the preservation of protected species.

Criterion 4

This response includes dredging of a canal in the Biosphere Reserve and Ramsar wetland site, Humedales del Delta del Río Colorado.

Criterion 5

This response involves extensive withdrawal of groundwater, including from within the Biosphere Reserve. Long-term extraction of 0.5 MAFY is expected to have significant impacts on local groundwater supplies. No salt management technology or strategy is proposed, posing operations and maintenance concerns.

4.1.5 Response R8

Response R8 was submitted in 2018 in response to the original RFI. Following the initial fatal flaw analysis, a resubmission of R8 was received and reviewed. R8 was found to be deficient in Criterion 4.

Criterion 4

This response utilizes 95 miles of canals in Mexico, including Coyote Canal through Laguna Salada, that lie within the Biosphere Reserve buffer zone and Ramsar wetlands, Humedales del Delta del Río Colorado, and Sistema de Humedales Remanentes del Delta del Río Colorado.

4.1.6 Response R12

Response R12 was submitted in 2021 in response to the updated RFI. Following the initial fatal flaw analysis, a resubmission of R12 was received and reviewed. R12 was found to be deficient in Criteria 1 and 5.

Criterion 1

The response includes an infiltration gallery to withdraw ocean water for blending with Salton Sea water prior to discharge into the Pacific Ocean. The velocity proposed for the intake far exceeds industry-recommended velocity.

Criterion 5

This response is unlikely to receive the required environmental permits under existing regulatory processes and precedents. The resubmission included the intake of billions of gallons of ocean water to dilute millions to billions of gallons of hypersaline water from the Salton Sea prior to discharge into California coastal waters.

4.1.7 Response R13

Response R13 was submitted in 2021 in response to the updated RFI. Following the initial fatal flaw analysis, a resubmission of R13 was received and reviewed. R13 was found to be deficient in Criteria 1, 2, and 5. This response contains proprietary information. Details of the deficiencies have been communicated to the respondent directly.

4.1.8 Response R14

Response R14 was submitted in 2021 in response to the updated RFI. Following the initial fatal flaw analysis, a resubmission of R14 was received and reviewed. R14 was found to be deficient in Criterion 5.

Criterion 5

The response utilizes treated wastewater from coastal California, which cannot be considered a reliable resource, as ongoing local water recycling efforts continue to reduce the amount of water that would be available for use in the project.

4.1.9 Response R15

Response R15 was submitted in 2021 in response to the updated RFI. Following the initial fatal flaw analysis, a resubmission of R15 was received and reviewed. R15 was found to be deficient in Criteria 1 and 5.

Criterion 1

This response utilizes a conveyance technology that does not constitute an established system proven through use.

Criterion 5

The long-term viability of the conveyance technology has not been demonstrated.

4.1.10 Response R16

Response R16 was submitted in 2021 in response to the updated RFI. Following the initial fatal flaw analysis, no resubmission was received. R16 was found to be deficient in Criteria 1, 3, and 5.

Criterion 1

This response was found to not be technically sound due to the inability to convey enough water to the Salton Sea to meet the project goals.

Criterion 3

This response would not provide enough water to meet salinity goals or sufficiently reduce playa exposure.

Criterion 5

This response utilizes spring water from three unnamed states in the eastern United States. Viability of this water source until 2078 is unlikely.

5.0 Summary

This analysis treats each submission as a complete and separate importation program. Due to the complexity of the importation challenge, nearly all submissions were combinations of different processes and procedures. A fatal flaw to one aspect of the submission affected the entire submission, meaning that, as a whole, it would not proceed to further analysis by the Panel.

5.1 Results of the Fatal Flaw Analysis

Three submissions, R4, R9, and R10, met all fatal flaw criteria upon review. The responses have the following components:

Table 5-1: Components of responses passing the fatal flaw criteria

Component	R4	R9	R10
Water Source	Sea of Cortez	Sea of Cortez	Sea of Cortez
Intake	Submerged	Tidal, sand filtered	Subsurface
Desalination	RO	RO	RO
Brine Management	Outfall	Salt recovery for sale; salinity gradient solar ponds	Outfall
Conveyance	Pipeline	Pipeline and Canal	Pipeline
Delivery Point	Salton Sea	Salton Sea (R9A) Salton Sea via Mexicali (R9B) Mexicali, in exchange for Colorado River Water (R9C)	Salton Sea; option for desalinated water delivery to Mexico
Remediation Desalination at Salton Sea	RO; pumping of hypersaline water	RO	TBD as part of a salinity management plan
Salt Management	Evaporation Ponds; Deep well injection	Salt recovery for sale; salinity gradient solar ponds	TBD; brine line to ocean outfall

Notes: RO= reverse osmosis
TBD= to be determined

Submissions R2, R8, and R14 failed to pass only one fatal flaw criterion. The Panel revisited these submissions to determine if the single fatal flaw was conclusive to eliminate the submission from further evaluation. R2 and R8 entail flooding the Laguna Salada with salt water. This action clearly does not pass criterion 4, as described further below. R14 involves the import of coastal recycled water, which the Panel deemed as not sustainable over the project

span, as described further below. The Panel confirmed its fatal flaw decision and no changes were made based on the Panel's re-review of R2, R8, and R14.

5.2 Key Findings

In the review of the resubmissions for fatal flaws, the Panel generated the key findings described below.

5.2.1 Potential Water Import Sources

5.2.1.1 Sea of Cortez

The Sea of Cortez is proposed as the water source for seven of the submissions (R2, R4, R5, R6, R8, R9, and R10). Importation from the Sea of Cortez has the benefit of lower pumping elevation requirements. Although not reviewed as a part of the RFI responses, it could potentially be easier to site desalination facilities along the north-eastern side of the Sea of Cortez, including bypassing sensitive marine sanctuaries and protected wetlands, and leveraging existing permitting and policy progress made through the IBWC Binational Study of Water Desalination Opportunities in the Sea of Cortez. Challenges of the Sea of Cortez as a water source include a longer conveyance distance than concepts sourced from the Pacific Ocean, potential need for new power generation facilities to support a desalination facility, infrastructure outside US jurisdiction (a possible risk for project completion and ongoing operations), and environmental impacts in the Sea of Cortez. Because the regulatory climate in Mexico may allow the extraction of water from the Sea of Cortez for desalination and disposal of brine, the Sea was considered a viable water source for ongoing feasibility analysis. Yet any cross-boundary water project should adhere to environmental and social justice principles, and thus we suggest that any desalination efforts at the Sea of Cortez adhere to similar environmental impact analyses applied within the United States.

5.2.1.2 Pacific Ocean

Three submissions (R6, R12, and R13) included importation of water from the Pacific Ocean. Advantages of importation from the Pacific Ocean include a shorter distance than from the Sea of Cortez and infrastructure located within the United States. However, the Panel found the Pacific Ocean to currently not be viable as a source of water for the Salton Sea due, in part, to the regulatory climate facing water projects along the southern California coast. In particular, the Panel viewed the May 2022 decision by the California Coastal Commission to deny a permit for construction of a new desalination facility in Huntington Beach (citing among other concerns the ecological impacts of both the water extraction and the discharge of brine) as a good gauge of what is currently possible. The political and regulatory climate may change in the future to allow the extraction of California Pacific coastal water and discharge of brine along the southern California coast, especially as a changing climate results in prolonged droughts in the region. However, current regulatory permitting realities in California preclude the feasibility of meeting the immediate need for a strategy for long-term restoration of the Salton Sea. Additional challenges of importation from the Pacific Ocean include higher energy costs due to

the increased pumping elevation, high capital costs to construct a conveyance tunnel, and the difficulty of finding an appropriate site for desalination and pumping facilities in the highly developed coastal California area.

In addition to the Pacific Ocean as a water source, the Panel considered reclaimed water from coastal water reclamation facilities that would be transferred following treatment to the Salton Sea via pipeline or tunnel, as suggested in one submission. While a significant volume of treated wastewater is currently discharged into the Pacific Ocean, utilities along the California coast and throughout the state are moving rapidly to increase water reclamation for non-potable and potable reuse within metropolitan areas near where wastewater is generated. The Panel supports water reclamation as a reliable, low salinity, drought-proof water source available to local water portfolios. Due to rising local demand, the Panel does not believe that sufficient volumes of reclaimed water will be available for importation to the Salton Sea to make a substantial contribution to its restoration over the long term.

5.2.1.3 Colorado River

Another source considered by the Panel is the Colorado River. With average annual flows decreasing in the river and storage reservoirs reaching historic low levels, obtaining additional water from the Colorado River will pose a significant but not insurmountable challenge now and into the future. Opportunities to conserve and transfer water through existing water rights, including amending existing water transfer agreements, should be explored, but are not expected to provide flows at the volumes proposed in the reviewed responses for water importation concepts. Potential for exchanges with Mexico of Colorado River water intended for use in Mexico for desalinated water originating in the Sea of Cortez merit further investigation.

Fresh water from other sources outside of the Colorado River is not considered viable due to the cost of conveyance and other challenges.

5.2.2 Use of Emerging Technologies

Technologies that have minimal or no performance record present too much risk to the timely completion of a project of this immediacy, magnitude, and importance. However, the Panel strongly supports the continued research and development of new technologies to address the pressing issues of the Salton Sea. Advances in technologies for desalination, salt management, renewable energy production, water conveyance, and playa remediation could play a critical role in the long-term efforts at the Salton Sea once demonstrated to be viable. The Panel recommends that substantial grant funding be made available to advance such technologies.

5.2.3 Status of the Biosphere Reserve and Ramsar Wetlands

Respondents indicated that support exists in Mexico for development within designated Ramsar Wetlands and/or portions of the Biosphere Reserve. Both areas are designated as ecologically important areas with international governing bodies providing oversight. While future changes to the designations of these areas are possible, it is a major obstacle to permitting in the present as construction that affects these protected ecosystems requires international

negotiations, public input, and analysis on resulting ecological impacts. The Panel believes that such a delay would not enable the timely implementation of a project to restore the Salton Sea.

5.2.4 Expedited Permitting

Some strategies presented by respondents rely on special permitting considerations by either the Governor of California or officials in Mexico. While certain officials have the ability to expedite permitting processes or direct policies towards water allocation and use, the Panel does not deem it reliable to rely on special consideration or approval under extraordinary circumstances. Reliance on executive actions with minimal precedent could result in extensive litigation that would delay the project longer than if conventional pathways were taken.

6.0 Next Steps

The next report of the Panel will be a feasibility analysis of selected importation concepts that passed the fatal flaw analysis. The feasibility analysis will provide a more detailed examination of costs, benefits, and other requirements and impacts of the water importation concepts.

The Panel recognizes many strong aspects to submissions that also have fatal flaws. The Panel will review positive aspects of submissions containing fatal flaws in their recommendation of pathways to the long-term restoration of the Salton Sea. Based on this review, and in combination with importation concepts that were not submitted but came to the attention of the Panel, suggestions for possible importation approaches may be presented in the Panel's upcoming reports. The source of any approach drawn from submissions will be recognized. Because the Panel will disband upon completion and submission of its Summary Report, it will not participate in the promotion or implementation of any submission or composite importation approach.

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Appendices

Appendix A: Technical Memorandum 2.7 - Comparison of Independent Review Panel Fatal Flaw Criteria with Topics Listed in UC Santa Cruz – Department of Water Resources Contract

Technical Memorandum (TM) #2.7

Prepared by: Brent M. Haddad, Charlie Chesney, UC Santa Cruz

Reviewed by: Jean Debroux, Kennedy Jenks

Subject Area: Screening and Evaluation Approach

Topic: Reconciling fatal flaw topics with criteria generated by the Independent Review Panel

This Technical Memorandum (TM) was prepared as part of the Salton Sea Water Importation Proposal Review to provide information to support and reflect the Independent Review Panel's evaluation of submitted ideas to restore the Salton Sea by water importation and provide the Salton Sea Management Program (SSMP) with approaches that are feasible.

The purpose of this TM is to demonstrate how suggested fatal flaw topics can be located in the fatal flaw criteria generated by the Independent Review Panel.

1.0 Defining "fatal flaw" and moving from categories of interest to specific criteria

The 2021 Agreement (#4600014042) between California's Department of Water Resources and the Regents of the University of California (UC Santa Cruz) tasks the Independent Review Panel to develop fatal flaw criteria and apply them to the importation concepts submitted in the 2018 and 2021 Requests for Information.

The Panel considers a fatal flaw to constitute one or both of the following:

- A performance outcome well short of the long-term conditions needed to minimize air quality problems from exposed playa and address ecological health in the region.
- Possible negative effects of building and operating the project that are severe enough to prevent its acceptance.

Negative effects could result from unintended but foreseeable negative outcomes, or severe adverse consequences of an otherwise properly implemented project.

Failure of a response to pass the fatal flaw analysis does not constitute a judgment on the ability of the respondent to perform the submitted project, or the merits of the technologies and participants.

2.0 The ten suggested topics for fatal flaw criteria

The 2021 Agreement lists ten topics that should be included in a fatal flaw analysis of water importation concepts. The list is provided below:

a. Water source identification.

b. Concept design and engineering; including energy sources, conveyance and pumping facilities and intake structures.

c. Construction considerations for the proposed structure or system.

d. Long-term operations of the proposed structure or system.

e. Water treatment facilities.

f. Water and land use.

g. Flood control and climate change impacts.

h. Environmental parameters such as: water quality, air quality, hydrology, hydraulics, ecological impacts, biology, restoration, and endangered species.

i. International, Federal, State, and Local environmental laws, regulatory compliance, and permitting.

j. Stakeholder strategy and coordination (International, Federal, State, Local).

In conversations with Salton Sea Management Program leaders, it was clarified that these ten considerations are a starting-point, a “should” list, and the Independent Review Panel could add to and adapt this list as it saw necessary.

3.0 The Independent Review Panel’s criteria

When transitioning from topics to specific fatal flaws, the Panel determined that an ideal fatal flaw criterion should:

- directly address the topic; and
- result in a clear distinction between which responses pass and which fail.

Before generating its criteria, the Panel studied the importation responses and background materials on the Salton Sea region. It reviewed the suggested topics from the Agreement. It then visited the Salton Sea region, including nearly all sites proposed for major infrastructure both north and south of the border, and held public input meetings. It then developed the following list of fatal flaw criteria:

1. The submission is technically sound and utilizes established, non-speculative technologies.
2. The submission will not create significant risk of catastrophic flooding.
3. The submission is consistent with the objectives of the Salton Sea Restoration Act.

    3a. The submission results in improved air quality (1) through reduction of exposed playa to levels consistent with those prior to 2018, or (2) through reduction of dust emissions by employing other mechanisms over an equivalent area.

    3b. The submission's stated salinity goals, confirmed by modeled projections, should not exceed 70,000 mg/L, which is above identified salinity tolerance ranges for Protected Species and Species of Importance.

4. No extraction or infrastructure being proposed will cause significant ecological impacts to the Biosphere Reserve and Ramsar wetlands of international importance located within the Upper Gulf of California and Lower Colorado River Delta.
5. Solutions must be viable for the project duration (until 2078).

4.0 Connecting the suggested topics with the Panel's criteria

The criteria, sub-criteria, and means of testing are found in the Fatal Flaw Report and Appendix B.

Table 1 lists the five Panel criteria on the horizontal axis and suggested topics on the vertical axis. Green dots indicate where suggested topics are included in fatal flaw criteria.

Table 1: Comparison of Agreement Suggestions and Fatal Flaw Criteria developed by the Panel

Suggested Topics	Panel Criteria				
	1	2	3	4	5
Water source		●	●	●	●
Concept design	●	●	●	●	●
Construction	●	●			●
Long-term operations	●	●	●		●
Treatment facilities	●				●
Water/Land use			●	●	●
Flood control/climate		●		●	●
Environmental parameters	●	●	●	●	●
Regulatory and Permitting			●	●	●
Stakeholder strategy					

All but one of the suggested topics (*Stakeholder strategy and coordination [International, Federal, State, Local])* are captured in the Panel's criteria. Other suggested topics appear at least twice, ranging from focal points of criteria to related issues. For example, the topic of *Regulation and Permitting* appears three times, related to meeting air quality and environmental objectives (criterion 3), avoiding environmental damage to critical habitat areas (criterion 4), and maintaining project benefits over the long term (criterion 5).

The Panel was unable to capture *Stakeholder strategy and coordination (International, Federal, State, Local*) in a fatal flaw criterion. After discussion the Panel felt that any of the submissions could develop a stakeholder strategy and coordination plan needed to implement the project. Therefore, a stakeholder-strategy fatal flaw criterion was not produced.

Appendix B: Technical Memoranda 11.1 through 11.5 – Fatal Flaw Evaluation Outcomes

Technical Memorandum (TM) #11.1

Prepared by: Rominder Suri, Philip H. Burgi, Independent Review Panel; Stephen Timko, Kennedy Jenks

Reviewed by: Independent Review Panel; Jean Debroux, Kennedy Jenks

Subject Area: Fatal Flaw Evaluation Outcomes

Topic: Fatal Flaw Criterion #1: Technically Sound Approach, Established Technologies

This Technical Memorandum (TM) was prepared as part of the Salton Sea Water Importation Proposal Review to provide information to support and reflect the Independent Review Panel's evaluation of submitted ideas to restore the Salton Sea by water importation and to provide the Salton Sea Management Program (SSMP) with approaches that are feasible.

The purpose of this TM is to document the process for evaluating Fatal Flaw Criterion 1 regarding the use of technically sound approaches and established technologies. Rationale for the criterion, methodology of application, and results are presented.

In arriving at decisions of whether a submission meets this criterion, a two-step process was followed. Initial submissions were reviewed by the Panel. If a fatal flaw was identified, the submitter was contacted and given an opportunity to correct the flaw. These responses were then evaluated, and a final decision made on whether the fatal flaw criterion was met. Review of both the initial submissions and resubmissions are included in the TM to document the two-step review process.

1.0 Fatal Flaw Criterion

Fatal flaw Criterion 1 states:

The submission is technically sound and utilizes established, non-speculative technologies.

Submissions must be technically sound to pass the fatal flaw analysis. This judgement pertains to concept design and engineering considerations that include, but are not limited to, intake structures, pumping and conveyance, energy sources, salt management strategies, constructability, and long-term operations.

In addition, water importation must be based on established, proven technologies.

Failure of a submission to meet this criterion does not constitute a judgment by the Panel on the proposed technology, the technology's manufacturer/provider, or the respondent. Rather, the Panel is concerned about the amount of time it would take to establish the technical viability of emerging technologies in light of the immediate needs in the region, as well as the additional risks of developing/scaling up emerging technologies to the capacity needed to address the region's problems.

This criterion represents a fatal flaw because technologies that have minimal or no performance record present too much risk to the timely completion of a project of this immediacy, magnitude, and importance. Responses that are not deemed to be technically sound are inherently infeasible and will not be reviewed in the feasibility analysis.

1.1 Methodology

The design and engineering concepts presented in each RFI response were reviewed. While the ideas presented are conceptual in nature, omissions of key project components will result in a failure to meet this criterion. Failure to address issues such as conveyance or salt management will lead to failing the criterion.

Each RFI response was evaluated for its use of proven technology. While innovative approaches are encouraged, it is important that the technology proposed is able to reliably meet the objectives of restoring the Salton Sea, including ensuring salinity control and reducing air pollution. Responses were evaluated for their selection and use of technology for importation, storage, desalination, and energy generation (if applicable). Ancillary technologies included in RFI responses for other beneficial uses were not evaluated as a part of this criterion. Established technologies are defined as those with operating infrastructure/facilities on the scale required for the project and/or that have demonstrated the ability to be scaled up to the required size. For example, reverse osmosis (RO) is an established desalination technology that has been used in water treatment for decades. An RFI response that proposes a desalination facility utilizing RO that is larger than current facilities will still pass this criterion because the scalability of RO has been demonstrated. Reliance on technologies that have not been demonstrated at scale or have not demonstrated scalability will not be considered as passing this fatal flaw criterion.

1.2 Results

Each response that passed the screening process was evaluated with regard to the fatal flaw criterion. RFI responses are provided in Attachment A for reference.

1.2.1 Response R2

1.2.1.1 Initial Submission

Response R2 includes transportation of water from the Sea of Cortez to Laguna Salada via tidal action in a series of canals. Canals would be constructed via dredging. A check dam would be built to maintain water levels in Laguna Salada. Water would then be conveyed to the Salton Sea basin via a pump station and pipeline. Energy would be recovered in the pipeline via hydroelectric turbine, although details surrounding turbine selection are not provided.

Response R2 utilizes a system of berms to divide the Salton Sea into areas of varying salinity. Berm construction would be accomplished with barge-mounted dredging equipment. Fish screens would be used at inlets that allow lower salinity water to be flushed into higher salinity zones.

A hydrogeological assessment is proposed to support the development of groundwater wells for agricultural production and dust mitigation, with drainage contributing flow to the Salton Sea.

The technologies included in Response R2 have been utilized in other engineering projects globally and are considered established technologies. Response R2 therefore meets the criterion.

Features in the response that provide additional benefits beyond water importation were not evaluated as a part of this criterion, including the plastic processing facility, phytoremediation and phytomining, and localized climate impacts.

1.2.1.2 Resubmission

Resubmission of R2 modified the conveyance strategy to include pumping seawater through pipelines rather than dredged canals. Other technologies and approaches were unchanged from the initial submission. The response therefore meets the criterion.

1.2.2 Response R4

1.2.2.1 Initial Submission

Response R4 proposes pumping water from the Sea of Cortez to the Salton Sea. The concept involves submerged intakes with screens at the Sea of Cortez, with a pump station with debris removal and vertical turbine pumps. Water would be lifted through a pipeline to 200 feet above sea level near the US-Mexico border before descending to the Salton Sea via pipeline.

The response acknowledges the need for salt removal to maintain a proper level of salinity in the Salton Sea. The response does not propose a single solution, but rather presents multiple options that can be implemented individually or in combination:

- Saline water pumped from the Salton Sea to evaporation ponds
- Desalination via RO with brine disposal via deep well injection

The response does not specify a location for potential desalination facilities, but states that water could be pumped from the Salton Sea to be desalinated or that water from the Sea of Cortez could be desalinated prior to importation.

The technologies presented in R4 are established technologies. Not all details are provided with regard to salt management, but there are no indications that the concept is not technically sound.

Response R4 therefore meets the criterion.

1.2.2.2 Resubmission
No resubmission of R4 was required.

1.2.3 Response R5
1.2.3.1 Initial Submission
Response R5 includes water importation from the Sea of Cortez to the Salton Sea, followed by desalination of water from the Salton Sea. Water would be conveyed from the Sea of Cortez to the northern end of Laguna Salada via a system of new canals equipped with tidal flap gates. A pump station would transport water through a pipeline and a four-mile-long tunnel to cross the US-Mexico border and be conveyed to a new reservoir behind a new 30-foot-high dam. Water would then flow through a hydroelectric facility and be discharged into the Salton Sea.

The response details a desalination facility at the Salton Sea that would remove salt from the lake and provide fresh water to local customers via the Coachella Canal. The proposed desalination facility utilizes proprietary distillation technology. Limited details were provided on the proprietary technology, hindering the ability of the Panel to review its similarity to established technologies. The response indicates that the desalination facility would be zero liquid discharge, with the byproducts being fresh water and various solid salts and minerals. Solids would be removed via rail car, either for disposal or market sale. While various zero liquid discharge technologies have been demonstrated on a pilot scale, these technologies have not been implemented on the scale required for this project.

Response R5 therefore does not meet the criterion.

1.2.3.2 Resubmission
No resubmission of R5 was provided.

1.2.4 Response R6

1.2.4.1 Initial Submission

Response R6 focuses on importing water from either the Pacific Ocean or the Sea of Cortez. No details are provided on the intake structures. Pumping facilities to convey the proposed 1.1 to 2.3 million AFY to the Salton Sea include submerged in-line pumps at the intake, with multiple in-line pumps incorporated in the pipelines to convey water over the highest elevation required. The response lists the velocity through the five 48" diameter pipelines as 8.2 yards per second, or 24.6 ft/s. Best engineering practices recommend a pipeline velocity range of 4 to 15 ft/s depending on pipe material, while 5 ft/s is typically used to reduce pumping energy requirements (Nayyar 2000, C.22). After achieving the maximum elevation, the response suggests a reduction from five pipes to a single 48" diameter pipeline, achieving pipeline velocities of up to 83.5 yards per second or 250 ft/s, 25 times the recommended maximum pipeline velocity. This could result in cavitation damage as well as very high frictional losses thus reducing any benefit from in-line turbines. The pipeline component of the response therefore cannot be considered technically sound.

The response includes energy recovery via "in-line-generators." Similar technologies have been utilized for energy recovery in water conveyance systems. The use of a "thermo-optical solar system" (TOSS) is proposed to utilize the top of the pipelines as a foundation for solar energy generation. However, the respondent acknowledges that the thermo-optical solar system has not been tested to date and is therefore not considered an established technology.

Response R6 includes dividing the Salton Sea into multiple segments utilizing dikes. Fresh water production is proposed by condensing steam that is produced during geothermal energy production via Self Contained In-Ground Geothermal Generator (SCI-GGG) and Self Contained In-Ground Heat Exchanger (SCI-GHE) systems for electricity generation. The Panel is not aware that these technologies have been used to produce large volumes of desalinated water.

Technologies presented in this response for geothermal energy production, lithium recovery, groundwater extraction, and other recreational benefits were not reviewed as a part of this criterion.

Key components in Response R6's importation of water and energy generation do not meet the requirements of the criterion.

1.2.4.2 Resubmission

The resubmission of R6 clarified that potable water production would occur via the SCI-GHE and/or TOSS systems. New pipeline velocities were proposed, but were still above the recommended pipeline velocities. The respondent acknowledged that the technologies presented are not established:

"I am aware that the Panel is not aware that these technologies have been used because they have not been yet but, I am hoping that the Panel will realize the creativity, simplicity, and potential of such a concept that would benefit the project of restoration of the Salton Sea."

While the Panel supports the development of innovative technologies and concepts, technologies that have minimal or no performance record present too much risk to the timely completion of an infrastructure project of this magnitude, immediacy, and importance. The resubmission therefore did not adequately address the fatal flaw and does not meet the requirements of the criterion.

1.2.5 Response R7

1.2.5.1 Initial Submission

Response R7 focuses on infrastructure on the Mexico side of the border. A canal system would be utilized to bring water to the northern end of the Laguna Salada. The response lists the potential for construction of a tunnel to deliver water to a hydroelectric power plant on the US side of the border. The response includes an overflow emergency discharge system, but no details are provided. A brackish water RO desalination plant and geothermal desalination plant are proposed, but no details are provided.

This proposal has insufficient information to determine the adequacy of the design and proposed technologies for the canal intake, conveyance, upstream and downstream storage facilities, and hydroelectric powerplant.

Response R7 therefore does not meet this criterion.

1.2.5.2 Resubmission

Resubmission of R7 clarified that water would be delivered by lining the existing Coyote Canal with concrete, conveyance to a geomembrane-lined control lagoon, and crossing the border via a tunnel. Final delivery to the Salton Sea would be either via an existing or new canal.

The resubmission did not mention the initially proposed hydroelectric power plant, brackish water RO desalination plant, or geothermal desalination plant. Without information surrounding these details, the response does not meet the criterion.

1.2.6 Response R8

1.2.6.1 Initial Submission

Response R8 proposes conveying seawater from the Sea of Cortez to the Salton Sea via canal. The concept involves siphons to lift the water to a maximum elevation of 30 feet above sea level prior to flowing into the Salton Sea basin. Along the proposed canal alignment, water must be lifted to over 200 feet above sea level before flowing down to the Salton Sea. It is unclear

how the proposed siphon system, with stated use of zero pumping, could provide the lift required to convey over 2,000 ft^3/s of water to the Salton Sea.

Response R8 therefore is found to be not technically sound and does not meet this criterion.

1.2.6.2 Resubmission

The resubmission of R8 included options for the use of a lift station or tunnel to achieve the required elevation gain in lieu of a siphon system. The response addressed the previous concern and passes the criterion.

1.2.7 Response R9

1.2.7.1 Initial Submission

Response R9 has three importation alternatives (R9A, R9B, and R9C). R9A involves the transfer of water from the Sea of Cortez to the Salton Sea, followed by desalination. R9B is similar to R9A but locates the desalination facilities in Mexico. R9C involves purchasing Colorado River water and transporting the water to the Salton Sea basin, followed by desalination.

Responses R9A and R9B utilize sand filtration to pre-treat water from the Sea of Cortez prior to conveying the water north. The proposed conveyance consists of lift stations and open channel, lined canals. R9A includes the option for pumping through pipelines as needed to cross the elevation at the US-Mexico border. Hydro-turbines would be utilized to recover energy between the border and the Salton Sea. R9B includes additional canals to transport water desalinated in Mexico across the border and to the Salton Sea. R9C involves the purchase of Colorado River water and conveyance to the Salton Sea via existing canals.

All three alternatives utilize the same desalination technologies. The core technology for desalination is a Vertical Tube Evaporator (VTE) Multi-Effect Distillation (MED) plant. MED is an established desalination technology with a high energy demand and is primarily utilized in Middle Eastern countries where fuel costs are low and there is a prevalence of co-generation facilities producing water and power (Voutchkov 2016). The VTE MED process builds off of the standard MED configuration and has been developed by the respondent specifically for use at the Salton Sea. The technology utilizes novel process configurations, scale control methods, and materials of construction. To date, this technology has only been piloted at the Salton Sea. Information provided by the respondent indicates the initial pilot test units were installed in 2004 and consist of two 5,000 gallon per day units. A demonstration facility is under construction, utilizing an evaporator rated for 50,000 gallons per day capacity, but producing a maximum anticipated flow of 21,000 gallons per day (Sephton Water Technology 2013). Pilot testing data on 1 to 2 “effects” in the VTE MED process has been utilized to provide estimates on performance of facilities using stacks of 5-effect units up to 60 total effects. The response includes construction of 24 facilities with 20 MGD capacity each for R9A, 30 total facilities (24 in Mexico and six at the Salton Sea) in R9B, and six facilities in R9C. Based on the information

provided, it is unclear if this technology can be scaled up as proposed within the project timeframe.

Other technologies included in the proposed treatment process include ultrafiltration, nanofiltration, solar evaporation ponds, and salinity gradient solar ponds, all of which are established technologies. Vacuum salt refining plants are proposed, and while vacuum salt processing is an established process, the response indicates the salt refining plants will utilize the VTE MED technology.

Response R9 does not meet the criterion due to its reliance on the emerging VTE MED technology for a project of this immediacy and scale.

1.2.7.2 Resubmission

The resubmission of R9 substituted the emerging desalination technology with reverse osmosis.

The resubmission includes the use of solar panel arrays to power the proposed desalination facilities. Excess power generated during the day would be stored via pumped storage hydropower for use at night and as needed. Both of these strategies constitute established technologies.

Response R9 passes the criterion.

1.2.8 Response R10

1.2.8.1 Initial Submission

Response R10 involves pumping water from the Sea of Cortez to the Salton Sea. The importation system includes coastal wellfields that would extract seawater through shallow wells to provide pre-filtration. Water would be pumped through a pipeline to the Salton Sea. The response includes construction of expandable desalination facilities that utilize RO. RO brine would be disposed of via an outfall in the Sea of Cortez. Geothermal energy would be used for water processing.

Response R10 utilizes established technologies and therefore meets this criterion.

1.2.8.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.9 Response R12

1.2.9.1 Initial Submission

Response R12 proposes constructing a gravity-fed tunnel from the Pacific Ocean to the Salton Sea. The respondents indicate that the project would utilize “recent innovative cost and

technological breakthroughs," that would result in a 20- to 200- fold decrease in cost compared to conventional tunneling technologies. The concept would utilize up to seven tunnels total, with the first tunnel labeled as a proof of concept. The respondents have not previously demonstrated this tunneling technology but would rely on tunnel-boring vendors. While the details provided are minimal, large-scale water tunnels have been constructed previously:

- Delaware Aqueduct, New York, United States: 85 miles
- Päijänne Water Tunnel, Finland: 74.6 miles
- Dahuofang Water Tunnel, China: 53.0 miles
- Orange–Fish River Tunnel, South Africa: 51.4 miles

Additional technologies include hydroelectric turbines for energy recovery and pumps to send brine from the Salton Sea back to the Pacific Ocean. Specific technologies are not referenced but, conceptually, R12 meets this criterion.

1.2.9.2 Resubmission

Resubmission of R12 included a brine dilution option to reduce the concentration of brine being discharged into the coastal Pacific Ocean. To provide the diluent ocean water, 15,480 MGD of ocean water would be pumped through a 1.37-acre infiltration gallery. The resubmission calculated the infiltration gallery size based on a flow velocity of 0.4 ft/s (no reference provided). This is 100 to 1000 times the recommended intake flow velocities for infiltration galleries. Literature values range from 0.03 gpm/ft^2 (operating desalination facility in Fukuoka, Japan) to 0.3 gpm/ft^2, corresponding to 0.00007 to 0.0007 ft/s (Mackey 2011, ISTAP 2014). The response therefore does not meet the criterion.

Response R12 does not pass this criterion.

1.2.10 Response R13

1.2.10.1 Initial Submission

Response R13 was submitted in 2021 in response to the updated RFI. R13 was found to be deficient in Criterion 1. This response contains proprietary information. Details of the deficiencies have been communicated to the respondent directly.

Response R13 does not pass this criterion.

1.2.10.2 Resubmission

Resubmission of R13 was received and reviewed. R13 was found to be deficient in Criterion 1. This response contains proprietary information. Details of the deficiencies have been communicated to the respondent directly.

Response R13 does not pass this criterion.

1.2.11 Response R14

1.2.11.1 Initial Submission

Response R14 proposes creating an underwater pipeline from an existing wastewater treatment plant outfall (expandable to include outfalls from six total facilities) to the San Onofre Nuclear Generating Station, tying into the existing cooling water pump station, and then pumping treated wastewater via pipeline from the California coast to the Salton Sea. The pipeline includes in-line turbines for energy recovery. Similar technology is presently being used in Portland, Oregon water supply lines. Solar farms are also proposed to offset pumping energy, although sizing and location information is not provided.

Once delivered to the Salton Sea basin, the water would be treated via a polishing facility. This treatment and polishing facility will remove nutrients and recover resources from wastewater through the "addition of chemical coagulants and/or polyelectrolytes." While specific technologies are not mentioned, water reclamation facilities are common in the industry, and can be designed to utilize established technologies.

Therefore, Response R14 meets the criterion for using technically sound and proven design concepts.

1.2.11.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.12 Response R15

1.2.12.1 Initial Submission

Response R15 proposes transporting fresh water from a river in southern Mexico to the Sea of Cortez via submersible storage containers. Water would then be pumped from the submersibles to the Salton Sea for restoration purposes. There is no desalination aspect presented in the response. The technology surrounding the design, construction, and operation of the submersibles on the scale proposed for the Salton Sea has not been implemented previously.

Response R15 therefore does not meet the criterion.

1.2.12.2 Resubmission

The resubmission of R15 did not adequately address the fatal flaw by identifying technologies with proven performance records to accommodate timely completion of a project of this immediacy, magnitude, and importance. The response therefore does not meet the requirements of the criterion.

1.2.13 Response R16

1.2.13.1 Initial Submission

Response R16 involves the transport of fresh water via trains to fill the Salton Sea. There is no desalination aspect to this project. The use of trains to transport water has been previously implemented in the United States and internationally, although typically for short durations to address drought conditions or emergencies. Each train of up to 110 cars can hold up to 2.5 million gallons, or 7.7 acre-feet of water. To restore water levels in the Salton Sea, modeling with SSAM suggests that 325,000 to 825,000 acre-feet per year would be required for five years depending on the final water elevation, with an average of 319,000 to 528,000 acre-feet per year required to maintain the final elevation for the project duration. This would require one train's worth of water to be delivered every 5-12 minutes to fill the lake, and every 8-13 minutes to maintain lake levels. The response lists the time to unload one train as 8 hours. The volume of water required for this idea cannot be provided by this concept.

Response R16 therefore does not meet the criterion.

1.2.13.2 Resubmission

No resubmission of R16 was provided.

2.0 Summary

The 13 RFI responses that passed through the screening process were evaluated against Fatal Flaw Criterion 1:

The submission is technically sound and utilizes established, non-speculative technologies.

After review, the following responses did not meet the requirements of the criterion:

- R5
- R6
- R7
- R12
- R13
- R15
- R16

The following responses did meet the criterion:

- R2
- R4
- R8
- R9
- R10
- R14

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Attachment A

Response Number	Response Title	Prime Respondent
R2	Tres Lagunas Restoration: Salton Sea, Laguna Salada & Sea of Cortez	AGESS, Inc.
R4	Salton Sea Water Importation Project	Cordoba Corporation
R5	Bi-National Canal for Salton Sea Restoration and Colorado River Augmentation	GEI Consultants, Inc. and Michael Clinton Consulting, LLC
R6	Harnessing Energy and Water in the Salton Sea	Geothermal Worldwide, Inc.
R7	Wi. Ňy-Wey Maātap: The Living Stone Canal	Quadrant, LLC
R8	Sea to Sea Canal Project	Sea to Sea Canal Company
R9	Water Import Salt Extraction Revenue	Sephton Water Technology, Inc.
R10	Super Salton Trough Interconnection Project	New Water Group, LLC
R12	The Salton Sea: The Best Days are Ahead of Us	E2Eden, LLC
R13	The Sustainable Solution for Remediation and Restoration of the Salton Sea	Global Premier Development, Inc. and Salton Power, Inc.
R14	Salton Sea Management Plan: Recycled Water Importation	Online Land Planning, LLC
R15	Transalton Project: Transoceanic proposal for massive fresh water imports to the Salton Sea and the lower Colorado River basin from South Mexico rivers	Transoceanic, LLC- USA
R16	Water Importation to the Salton Sea	Water Train, Inc.

Technical Memorandum (TM) #11.2

Prepared by: Philip H. Burgi, Robert Glennon, Independent Review Panel; Stephen Timko, Kennedy Jenks

Reviewed by: Independent Review Panel; Jean Debroux, Kennedy Jenks

Subject Area: Fatal Flaw Evaluation Outcomes

Topic: Fatal Flaw Criterion #2: Catastrophic Flooding Review

This Technical Memorandum (TM) was prepared as part of the Salton Sea Water Importation Proposal Review to provide information to support and reflect the Independent Review Panel's evaluation of submitted ideas to restore the Salton Sea by water importation and to provide the Salton Sea Management Program (SSMP) with approaches that are feasible.

The purpose of this TM is to document the process for evaluating Fatal Flaw Criterion 2 regarding catastrophic flooding. Rationale for the criterion, information on how the criterion was applied, and results are presented.

In the event that a RFI response did not include sufficient information for the Panel to make a determination with regard to the significant risk of catastrophic flooding, the Panel made reasonable assumptions when possible, based on established scientific and engineering best practices. However, the burden is on the respondent to provide sufficient information for the Panel to evaluate feasibility, and the Panel reserved the right to remove a response from consideration due to insufficient information provided.

In arriving at decisions of whether a submission meets this criterion, a two-step process was followed. Initial submissions were reviewed by the Panel. If a fatal flaw was identified, the submitter was contacted and given an opportunity to correct the flaw. These responses were then evaluated and a final decision made on whether the fatal flaw criterion was met. Review of both the initial submissions and resubmissions are included in the TM to document the two-step review process.

1.0 Fatal Flaw Criterion

Fatal Flaw Criterion 2 states:

The submission will not create significant risk of catastrophic flooding.

A water importation project for long-term restoration of the Salton Sea would involve the transport of water on the scale of hundreds of thousands to millions of acre-feet per year.

Uncontrolled release of large volumes of water in the event of infrastructure failure could have devastating consequences. No project should introduce a significant risk of catastrophic flooding due to infrastructure failure that may be triggered by earthquakes, fire, mismanagement, vandalism, or other causes.

The surface elevation of the Salton Sea is more than 200 feet below sea level. Many of its surrounding towns, from Indio to Calexico, and associated farmland in the Salton Sea basin are also at or below sea level. Uncontrolled release of water into the Salton Sea basin could result in a catastrophic loss of life and/or damage to land, property, and ecology. Similarly, importation of water from the source, whether the Sea of Cortez or the Pacific Ocean, to the Salton Sea basin should be designed and constructed to prevent catastrophic flooding from occurring in the areas outside of the basin.

The goals of the long-term restoration of the Salton Sea include minimizing air and water quality problems and restoring the ecology of the Salton Sea. Introducing a significant risk of catastrophic flooding is contrary to the goals of the project and therefore constitutes a fatal flaw.

1.1 Methodology

Each RFI response was evaluated for its potential to introduce significant risk of catastrophic flooding. While failure of any water infrastructure may result in localized flooding, this criterion specifically refers to catastrophic flooding, here defined as the uncontrolled release of hundreds of thousands of acre-feet of water that would result in loss of life, injury, significant damage to structures and infrastructure, damage to wildlife, loss of services, and road closures resulting from flood damage, fallen trees, and debris.

RFI responses were evaluated for their design of water conveyance and storage systems. Systems that require pumping water from the source to a higher elevation before gravity feeding to the Salton Sea will not be considered as having a risk of catastrophic flooding because, in the event of system failure, pumping could be stopped and the flow of water ended. Responses that utilize direct connections with the California coast, the Sea of Cortez, reservoirs, dams, and/or tunnels that hydraulically connect large bodies of water to the Salton Sea basin will be reviewed for the ability to provide sufficient safeguards to eliminate the risk of catastrophic flooding due to infrastructure failure.

1.2 Results

Each RFI response that passed through the screening process was evaluated with regard to the fatal flaw criterion. RFI responses are provided in Attachment A for reference.

1.2.1 Response R2

1.2.1.1 Initial Submission

Response R2 includes transportation of water from the Sea of Cortez to Laguna Salada via tidal action in a series of canals. Canals would be constructed via dredging. A check dam would be built to maintain water levels in Laguna Salada. Water would then be conveyed to the Salton Sea basin via a pump station and pipeline. Energy would be recovered in the pipeline via hydroelectric turbine.

In the event of failure of the check dam, a large volume of water (not stated in the response) would be released into the canals. While this flow of water may damage the project infrastructure and potentially the local highway infrastructure, the area is unpopulated and impacts to human life and property would be minimal.

In the event of failure of infrastructure on the US side of the border, pumping could be stopped at Laguna Salada, stopping the flow of water and preventing catastrophic flooding in the Salton Sea basin. Hence, R2 did not have a fatal flaw of significant risk for catastrophic flooding.

1.2.1.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.2 Response R4

1.2.2.1 Initial Submission

The concept presented in response R4 involves pumping water from the Sea of Cortez (elevation 0 ft) to a maximum elevation of 200 feet above sea level before descending to the Salton Sea. In the event of infrastructure failure, pumping could be halted, stopping the flow of water and preventing catastrophic flooding. Hence, R4 did not have a fatal flaw of significant risk for catastrophic flooding.

1.2.2.2 Resubmission

No resubmission of R4 was required.

1.2.3 Response R5

1.2.3.1 Initial Submission

Response R5 proposes utilizing a canal to bring water from the Sea of Cortez to Laguna Salada via tidal action. At the end of the first canal (near San Felipe Highway), a pump station would lift the water 95 feet to a second canal located on the east side of the Laguna Salada before flowing to a four-mile tunnel. The tunnel would discharge into a new 77,000 acre-feet reservoir formed by a new West Mesa Dam.

In the event of infrastructure failure, the pump station could be turned off, stopping the flow of water from the Sea of Cortez to the Salton Sea basin. The proposed 30 ft-high dam is located southwest of the Salton Sea outside of Westmoreland. The area is primarily agricultural, with farmland, reservoirs, irrigational canals, and road infrastructure that may be damaged in the event of dam failure. However, the dam must meet the design, operation, and maintenance requirements of the California State dam safety oversight regulations. Such dams are required to provide adequate spillway overflow to prevent dam overtopping, a low-level outlet to drain the reservoir for emergency evacuation and/or inspection. Adherence to these safety regulations eliminates the risks of catastrophic flooding.

Response R5 therefore passes the criterion.

1.2.3.2 Resubmission

No resubmission of R5 was provided.

1.2.4 Response R6

1.2.4.1 Initial Submission

Response R6 focuses on importing water from either the Pacific Ocean or the Sea of Cortez. Pumping facilities to convey the proposed 1.1 to 2.3 million AFY to the Salton Sea include submerged in-line pumps at the intake, with multiple in-line pumps incorporated in the pipelines to convey water over the highest elevation required. In the event of infrastructure failure, pumping could be halted, stopping the flow of water and preventing catastrophic flooding. Response R6 therefore passes the criterion.

1.2.4.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.5 Response R7

1.2.5.1 Initial Submission

Response R7 focuses on infrastructure on the Mexico side of the border. A canal system would be utilized to bring water to the northern end of the Laguna Salada. The response lists the potential for construction of a tunnel to deliver water to a hydroelectric power plant on the US side of the border. The response includes an overflow emergency discharge system, but no details are provided. Based on the information provided, including the use of a hydroelectric power plant, it is assumed that pumping would be utilized, and therefore that flow could be controlled in the event of infrastructure failure. Response R7 therefore passes the criterion.

1.2.5.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.6 Response R8

1.2.6.1 Initial Submission

Response R8 proposes conveying seawater from the Sea of Cortez to the Salton Sea via canal. The concept involves syphons to lift the water to a maximum elevation of 30 feet above sea level prior to flowing into the Salton Sea basin. R8 specifically lists ten emergency canal gates along the length of the canal to stop and/or divert flow, along with four sea-lock gates to stop water inflow. Although not stated, syphon breaking valves could be installed to stop the flow of water to the Salton Sea basin in a flow emergency. Response R8 therefore passes the criterion.

1.2.6.2 Resubmission

The resubmission included the use of a pump station or tunnel instead of siphons to convey water across the US-Mexico border. In the event of infrastructure failure, a pump station could be turned off, stopping the flow of water from the Sea of Cortez to the Salton Sea basin. Although no specifics are given, a fail-safe water gate could safely control flow into a tunnel. With the ability to safely stop the flow into the Salton Sea basin, response R8 passes the criterion.

1.2.7 Response R9

1.2.7.1 Initial Submission

Response R9 has three importation alternatives (R9A, R9B, and R9C). R9A relies on pumping water from the Sea of Cortez to the Salton Sea basin. R9B relies on pumping water from the Sea of Cortez to Cerro Prieto, Mexico, followed by desalinated water being delivered to the Salton Sea basin via canal. In the event of infrastructure failure, pumping could be halted (R9A and R9B) and/or desalinated water discharge halted (R9B), stopping the flow of water and preventing catastrophic flooding.

R9C involves purchasing Colorado River water from existing water rights holders and transporting the water to the Salton Sea basin via existing canal infrastructure. While infrastructure failure resulting from flooding of the Colorado River is responsible for the most recent filling of the basin and formation of the Salton Sea, R9C would not introduce additional risks of infrastructure failure leading to catastrophic flooding, as the conveyance infrastructure is existing, and risk of its failure applies to all scenarios.

The three alternatives presented in response R9 passes the criterion.

1.2.7.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.8 Response R10

1.2.8.1 Initial Submission

The concept presented in response R10 involves pumping water from the Sea of Cortez to the Salton Sea basin. In the event of infrastructure failure, pumping could be halted, stopping the flow of water and preventing catastrophic flooding. Response R10 therefore passes the criterion.

1.2.8.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.9 Response R12

1.2.9.1 Initial Submission

Response R12 involves construction of a gravity tunnel from the Pacific Ocean to the Salton Sea basin. The direct hydraulic connection of the Pacific Ocean to the Salton Sea basin introduces the risk of catastrophic flooding in the event of infrastructure failure. However, this proposal has a concept of a sea-level intake as the flow enters the tunnel. Although no specifics are given, a fail-safe water gate at sea level could safely control flow into the tunnel. With the ability to safely stop the flow into the Salton Sea basin, response R12 passes the criterion.

1.2.9.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.10 Response R13

1.2.10.1 Initial Submission

Response R13 was submitted in 2021 in response to the updated RFI. R13 was found to be deficient in Criterion 2. This response contains proprietary information. Details of the deficiencies have been communicated to the respondent directly.

Response R13 does not pass this criterion.

1.2.10.2 Resubmission

Resubmission of R13 was received and reviewed. R13 was found to be deficient in Criterion 2. This response contains proprietary information. Details of the deficiencies have been communicated to the respondent directly.

Response R13 does not pass this criterion.

1.2.11 Response R14

1.2.11.1 Initial Submission

Response R14 proposes the pumping of treated wastewater from the California coast to the Salton Sea. This involves pumping the water over the Peninsular Range to over 3,000 feet of elevation. In the event of infrastructure failure, pumping could be halted, stopping the flow of water and preventing catastrophic flooding. Response R14 therefore passes the criterion.

1.2.11.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.12 Response R15

1.2.12.1 Initial Submission

Response R15 proposes transporting fresh water from a river in southern Mexico to the northern end of the Sea of Cortez via submersible storage vessels. Water would then be pumped from the submersibles to a number of stakeholders including the Salton Sea for restoration purposes. While pipeline/canal alignments or configurations are not presented in the response, it is assumed based on the topography that pumping will be required to deliver water into the Salton Sea basin. In the event of infrastructure failure, pumping could be halted, stopping the flow of water and preventing catastrophic flooding. Response R15 therefore passes the criterion.

1.2.12.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.13 Response R16

1.2.13.1 Initial Submission

Response R16 involves the transport of fresh water via train. In the event of derailment or other infrastructure failure, localized flooding may occur, but there is no risk of catastrophic flooding. Response R16 therefore passes the criterion.

1.2.13.2 Resubmission

No resubmission of R16 was provided.

2.0 Summary

The 15 RFI responses that passed through the screening process were evaluated against Fatal Flaw Criterion 2:

The submission will not create significant risk of catastrophic flooding.

After review, response R13 failed to meet the requirements of the criterion. Response R13 will not be considered in the feasibility analysis portion of the evaluation.

Attachment A

Response Number	Response Title	Prime Respondent
R2	Tres Lagunas Restoration: Salton Sea, Laguna Salada & Sea of Cortez	AGESS, Inc.
R4	Salton Sea Water Importation Project	Cordoba Corporation
R5	Bi-National Canal for Salton Sea Restoration and Colorado River Augmentation	GEI Consultants, Inc. and Michael Clinton Consulting, LLC
R6	Harnessing Energy and Water in the Salton Sea	Geothermal Worldwide, Inc.
R7	Wi. Ňy-Wey Maātap: The Living Stone Canal	Quadrant, LLC
R8	Sea to Sea Canal Project	Sea to Sea Canal Company
R9	Water Import Salt Extraction Revenue	Sephton Water Technology, Inc.
R10	Super Salton Trough Interconnection Project	New Water Group, LLC
R12	The Salton Sea: The Best Days are Ahead of Us	E2Eden, LLC
R13	The Sustainable Solution for Remediation and Restoration of the Salton Sea	Global Premier Development, Inc. and Salton Power, Inc.
R14	Salton Sea Management Plan: Recycled Water Importation	Online Land Planning, LLC
R15	Transalton Project: Transoceanic proposal for massive fresh water imports to the Salton Sea and the lower Colorado River basin from South Mexico rivers	Transoceanic, LLC- USA
R16	Water Importation to the Salton Sea	Water Train, Inc.

Technical Memorandum (TM) #11.3

Prepared by: Sharon D. Kenny, Julie Lockwood, Adina Paytan, Independent Review Panel; Daniel Hastings, Charlie Chesney, UC Santa Cruz

Reviewed by: Independent Review Panel

Subject Area: Fatal Flaw Evaluation Outcomes

Topic: Fatal Flaw Criterion #3: Meeting the QSA Requirements

This Technical Memorandum (TM) was prepared as part of the Salton Sea Water Importation Proposal Review to provide information to support and reflect the Independent Review Panel's evaluation of submitted ideas to restore the Salton Sea by water importation and to provide the Salton Sea Management Program (SSMP) with approaches that are feasible.

The purpose of this TM is to document the process for evaluating Fatal Flaw Criterion 3 regarding whether or not a response is likely to meet the State's obligations under the 2003 Quantification Settlement Agreement (QSA). Rationale for the criterion, methodology of application, and results are presented.

In arriving at decisions of whether a submission meets this criterion, a two-step process was followed taken. Initial submissions were reviewed by the Panel. If a fatal flaw was identified, the submitter was contacted and given an opportunity to correct the flaw. These responses were then evaluated and a final decision made on whether the fatal flaw criterion was met. Review of both the initial submissions and resubmissions are included in the TM to document the two-step review process.

1.0 Fatal Flaw Criterion

Fatal Flaw Criterion 3 states:

The submission is consistent with the objectives of the Salton Sea Restoration Act.

The Salton Sea Restoration Act sets the State's restoration objectives to minimize air and water quality problems and to restore long-term stable aquatic and shoreline habitat that supports a self-sustaining aquatic community and native birds that use the Salton Sea as stopover habitat during migration. To pass this criterion, the response must demonstrate a strong likelihood of meeting the State's objectives. Criterion 3 has two sub-criteria, 3a and 3b.

3a. The submission results in improved air quality (1) through reduction of exposed playa to levels consistent with those prior to 2018 or (2) through reduction of dust emissions by employing other mechanisms over an equivalent area.

Exposed playa is defined here as the area that was inundated by the Salton Sea prior to 2018, when mitigation inflows to the Salton Sea stopped as a part of the QSA, and is now above the water line (Figure 1). This is an area of over 5,000 acres that extends from 237 feet below sea level to the current water level at -239 feet (USGS, 2022).

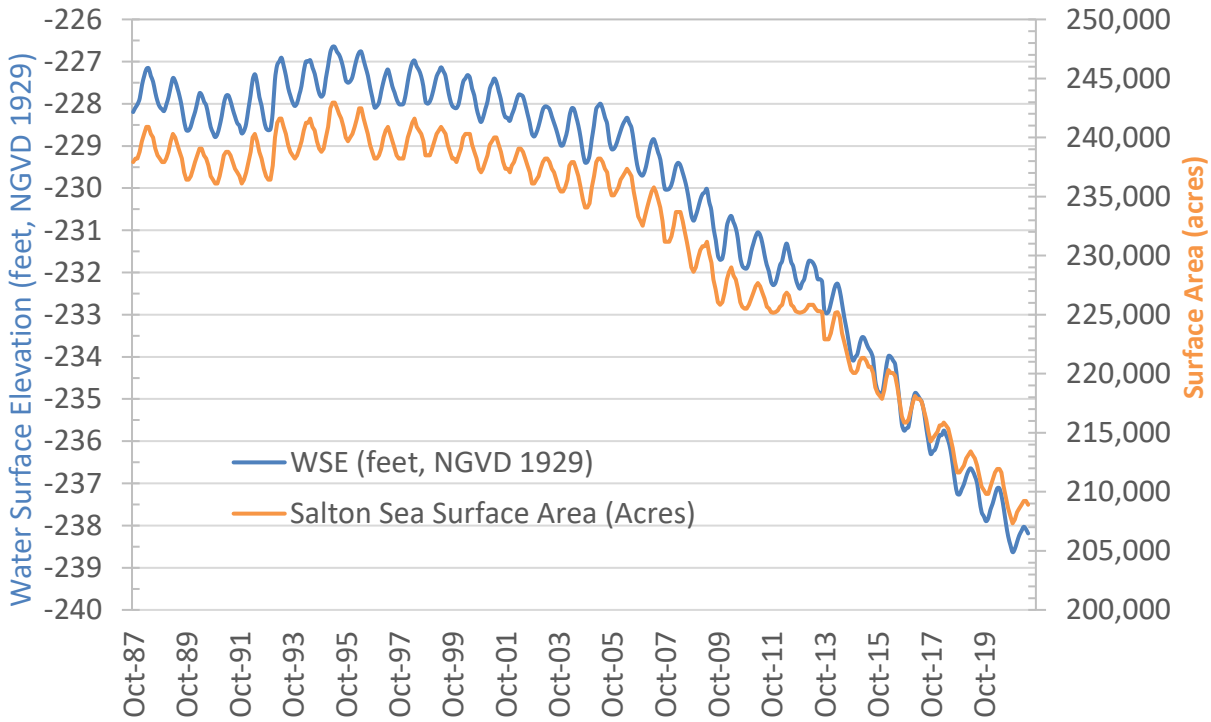

Figure 1: Salton Sea historical water level and surface area 1987-2021

Some areas of the playa are highly emissive and other areas have a salt crust resistant to emissions. High wind events, which often occur in this desert landscape, readily aerosolize dust from the emissive areas, increasing the concentration of particulate matter (PM) in the air (King et al. 2011; IDD 2016; Buck et al. 2011). Particulate matter is an air pollutant regulated under the Clean Air Act (CAA), which requires the EPA to set National Ambient Air Quality Standards (NAAQS) for PM10, particulate matter 10 micrometers or less in diameter, and for PM2.5, particulate matter 2.5 micrometers and smaller. The NAAQS for PM pollution defines the maximum amount of PM that can be present in outdoor air without harming human health. Areas where air pollution levels persistently exceed the air quality standards are designated "nonattainment." Imperial County has been consistently classified as a nonattainment area for PM2.5 under NAAQS since 2009 (EPA, 2022).

Air quality is one of the chief environmental concerns of residents in this region. Both PM2.5 and PM10 can be inhaled, with some depositing throughout the airways, though PM2.5 is more likely to travel into and deposit on the surface of the deeper parts of the lungs. Numerous scientific studies have associated PM2.5 exposure to a variety of health problems, including reduced lung function in children, acute and chronic bronchitis, asthma attacks, and premature mortality (CARB 2022; Johnson et al. 2019). The incidence of asthma in Imperial County is more than double the national average. Although numerous other sources of air pollution are found in the region, including particulate matter mobilized from the surrounding desert, agricultural burning, and unpaved roads (Frie et al. 2019; IID 2021), it is likely that respiratory health has been in decline in part due to wind-borne particulate matter from emissive areas of the playa exposed as the shoreline recedes.

Studies of the composition of ambient particulate matter at the Salton Sea emphasize the importance of playa as a source of PM in the region (Frie et al. 2017). More research is needed into the composition of playa dust, especially with regards to pesticides and herbicides from agricultural runoff that have been found in lake sediment (Lyons and Hung 2016; Bahreini et al. 2021). If these contaminants are present in playa dust, the dust could pose further negative effects on health.

Hydrogen sulfide emissions are an additional threat to public health in this region. Eutrophication of the Salton Sea causes excessive algae and bacteria growth, which then consumes dissolved oxygen in the water creating anoxic conditions and, in the presence of sulfate, the production of hydrogen sulfide. Hydrogen sulfide accumulates in the anoxic water and, during high wind days, water column mixing can cause hydrogen sulfide to come to the surface and become airborne. Hydrogen sulfide that escapes into the air causes negative respiratory impacts as well as an unpleasant rotten egg smell. Hydrogen sulfide emissions in the Salton Sea area have been found at times to exceed the state safety standards of 30 parts per billion per hour (Lyons and Hung 2021). While the Panel notes that reduction of hydrogen sulfide emissions should be addressed in the region, the submitted responses have not been evaluated for hydrogen sulfide reduction due to the complexity of quantifying hydrogen sulfide emissions. However, the Panel believes that any project implemented to improve the Salton Sea should include measures to eliminate this problem.

Responses must result in a reduction of exposed playa and/or utilize dust control measures; responses that do not alleviate dust emissions would be unacceptable. Specifically, exposed playa area should be reduced to levels consistent with the level prior to 2018, when mitigation inflows to the Salton Sea stopped as a part of the QSA. To achieve this reduction in the exposed playa area, Salton Sea water level should be equivalent to the water level prior to 2018, corresponding to a water level of –237 feet (Figure 1). If playa exposure exceeds this 2018 benchmark, dust control measures must be employed to reduce the emissivity of acreage

equivalent to the remaining exposed playa. As a part of the SSMP 10 Year Plan, dust mitigation in approximately 30,000 acres of playa is planned by 2028. Responses that do not meet the water level of -237 feet may be credited up to 30,000 acres of dust mitigation by SSMP planned activities.

The Panel recognizes that air quality is a major concern in the region, which has been consistently classified as a nonattainment area for PM2.5 under NAAQS since 2009. While the relative contribution of exposed playa to PM2.5 in the region and subsequent degradation of air quality has not been determined, the Panel believes that covering or remediating exposed playa beyond the 2018 benchmark could be an important component of successful long-term restoration. Increased remediation beyond the fatal flaw benchmark will be discussed in the Feasibility Report as a comparative criterion.

3b. The submission's stated salinity goals, confirmed by modeling projections, should not exceed 70,000 mg/L, which is above identified salinity tolerance ranges for Protected Species and Species of Importance.

The Salton Sea Restoration Act states that the state of California intends to restore and protect aquatic and shoreline habitat of the Salton Sea ecosystem and provide long-term conservation of the fish and wildlife that depend on this habitat. Article 1 of the Salton Sea Restoration Act (Fish and Game Code §§ 2930-2933) sets the objective to restore and permanently protect the Salton Sea ecosystem, specifically the "...long-term stable aquatic and shoreline habitat for the historic levels and diversity of fish and wildlife." Article 2 (Fish and Game Code §§ 2940-2945) states that in restoring the Salton Sea, the State intends to conserve and restore the Salton Sea ecosystem and protect water quality to provide long-term habitat for fish and birds that rely on the ecosystem and as an avian stopover on the Pacific Flyway.

Several native species have legal protection status in the Salton Sea region, among them the desert pupfish, American White Pelican, and Yuma Ridgway rail. Any project to restore the Salton Sea therefore must result in salinity ranges consistent with the long-term persistence of these species and the food webs on which they depend. Responses that exceed the maximum salinity needed to preserve these species will be considered as having a fatal flaw. Based on the salinity tolerance ranges of the desert pupfish, American White Pelican, Yuma Ridgway rail—as well as brine shrimp, pile worm, and barnacle, all keystone species for the Salton Sea's food web—the maximum salinity is determined to be 70,000 mg/L (Kuhl and Oglesby 1979; Simpson and Hurlbert 1989; Nougué et al. 2015).

The Panel does not recommend a minimum salinity target. While a decrease in salinity to below 40,000 mg/L may negatively impact brine shrimp populations, it is likely that the base of the food web would be supplemented with other invertebrate species that currently exist in less saline portions of the Salton Sea and its tributaries, as occurred previously at the Salton Sea.

The Panel recognizes that the state has a goal of 40,000 mg/L for the Salton Sea. The Panel's 70,000 mg/L is its estimation of a maximum acceptable salinity to serve as a fatal flaw tipping point, not a desired salinity goal.

Salinity goals as defined in each response refer to the salinity that will be achieved during and following the proposed actions as stated in each response (e.g., the salinity that species will be exposed to during implementation and after the project is complete). Responses must result in a Salton Sea water salinity level that maintains and supports the food web and legally protected native species, otherwise, it will be considered as having a fatal flaw.

1.1 Methodology

Responses have been evaluated according to the two sub-criteria listed above using the following methods.

a. Playa exposure is directly related to the water surface elevation in the Salton Sea based on its bathymetry. In addition to reviewing the stated water surface elevation goals listed in each submission, the Panel modeled water levels over time and the corresponding exposed playa using the Salton Sea Accounting Model (SSAM).

The SSAM is a spreadsheet model originally developed by the US Bureau of Reclamation in the 1990s and updated by an environmental consulting firm, Tetra Tech, to include more recent Salton Sea data. The model provides a tool to equitably compare responses' projected water surface elevation, exposed playa, and salinity. The Panel projected water levels and salinity as a deterministic outcome of the input parameters of SSAM. All input parameters in SSAM are based on historical information for the Salton Sea, and thus all projections assume that the value of these parameters remains consistent into the future. These parameters, such as evaporation rates, precipitation, and base flows (i.e., via rivers and drainage) were applied equally to all responses, and thus SSAM projections provide a mechanism to judge all responses on an independent and fair basis. Information derived from each response—including water import volumes, imported water salinity, and water extraction for desalination—was input into SSAM, generating Figures 2 and 3. Modeling of all responses' water importation assumed a start date of 2030 for comparative purposes. Inputs and assumptions for the SSAM model are provided in Attachment A.

The US Bureau of Reclamation conducted a sensitivity analysis on SSAM modeled projections, showing minor to moderate sensitivity of projected outcomes to the value of input parameters. The one input parameter that showed high sensitivity was average annual inflow (base flow). In recognition of this model sensitivity, the Panel applied a reasonable uncertainty factor when using the SSAM. The Panel projected model outcomes with a +/- 10% change in base flows to evaluate final water surface elevation, exposed playa, and salinity (discussed below) based on

import and extraction volumes stated within the responses and the requirements of the criterion (a and b).

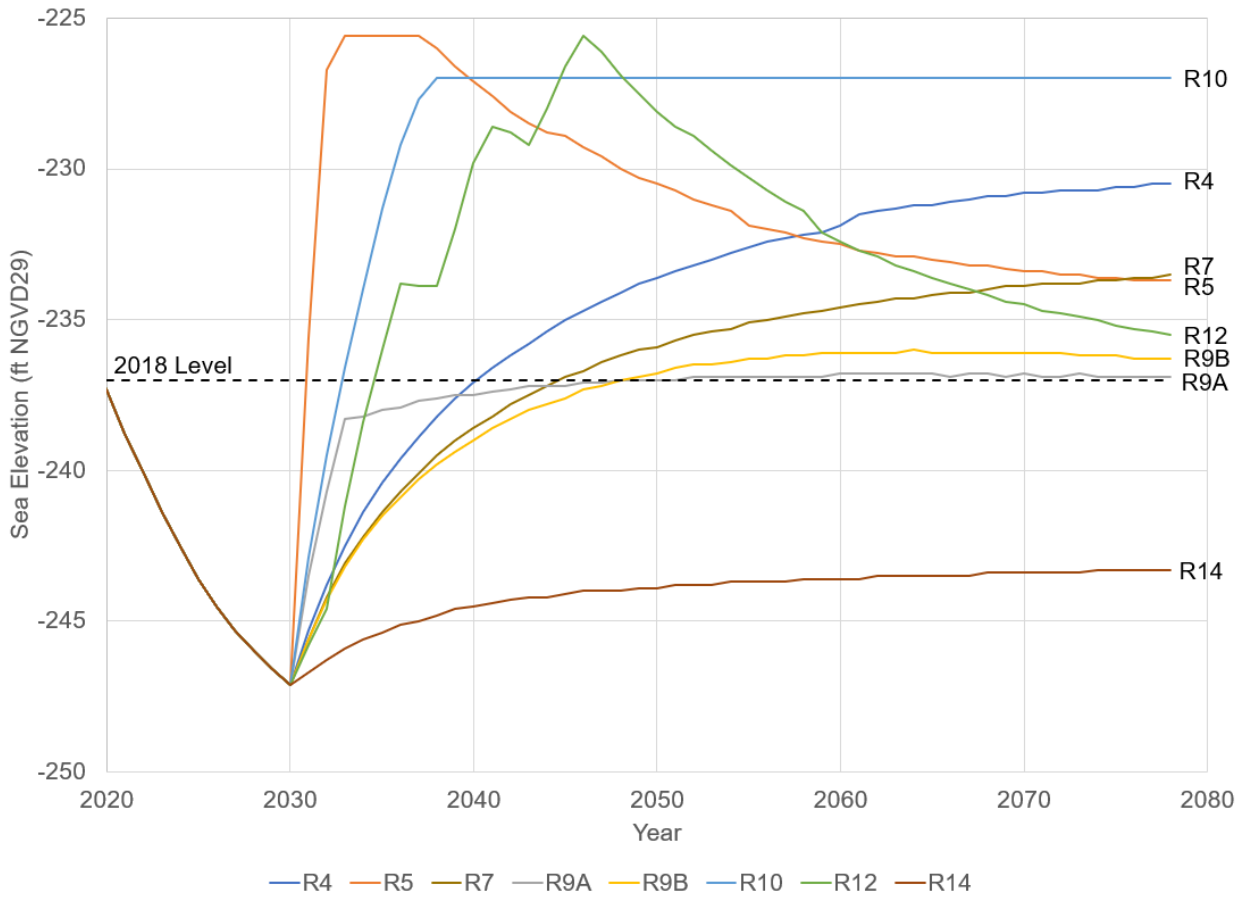

Figure 2. Water level changes over time modeled for initial responses with sufficient information for SSAM modeling, assuming a water importation inflow start date of 2030. 2018 water surface elevation is depicted by the dashed line.

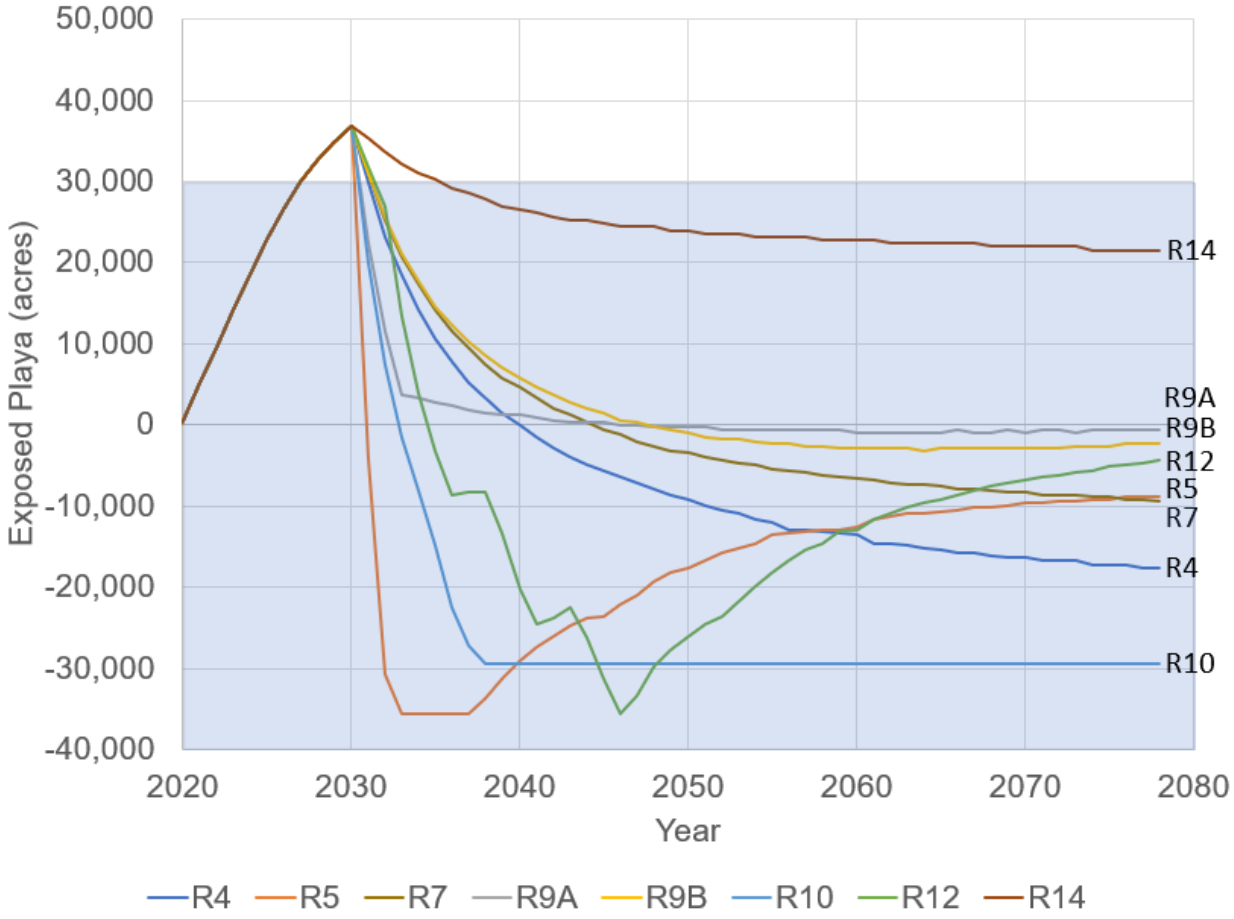

Figure 3: Modeled exposed playa relative to elevation -237 feet for responses with sufficient information for SSAM modeling. Target playa exposure highlighted in blue shaded area, and extends to 30,000 acres to account for planned dust mitigation under the SSMP 10 Year Plan.

When incorporating uncertainty in the average annual baseflow, no additional responses to those shown in Figures 2 and 3 maintained the target elevation and subsequent reduction in playa exposure for the project duration.

b. Salinity of the Salton Sea was projected for each response with SSAM as described above. Not all responses could be modeled due to lack of information related to water inflows, salinity of imported water, water extraction from the Salton Sea for desalination, use of multiple salinity zones within the Salton Sea, or lake elevations outside of the bounds of the model.

In order to pass the criterion, each response must satisfy the following:

i. The response results in a water salinity across the current and proposed sea footprint below 70,000 mg/L as modeled using SSAM.

ii. The response must not increase water salinity past 170,000 mg/L (the maximum salinity that supports brine shrimp reproduction) at any point after initiation as measured using SSAM.

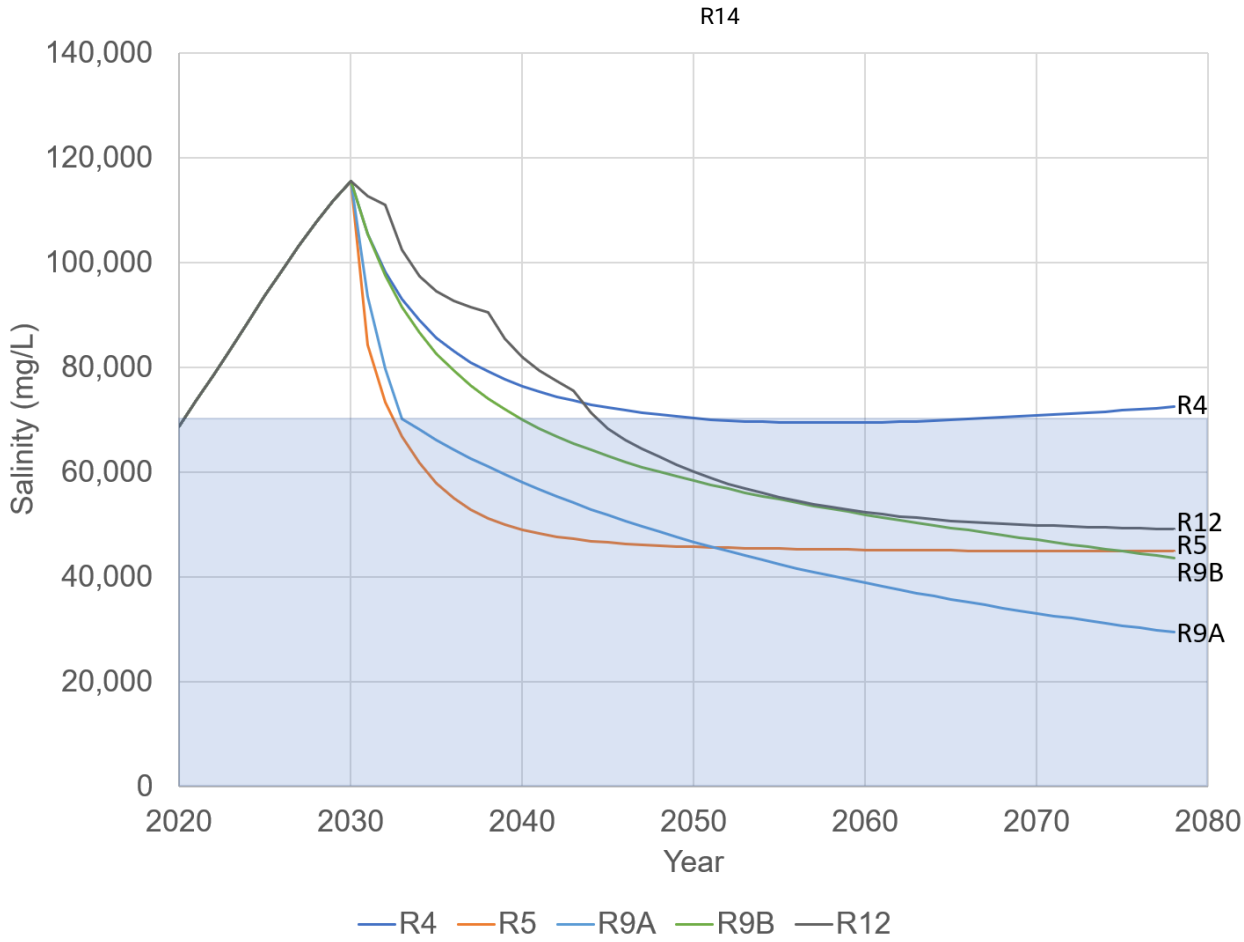

Figure 4. Projected Salton Sea water salinity over time for responses with sufficient information for SSAM modeling, assuming a water import start date of 2030. The critical salinity tolerance range needed to sustain fish and wildlife of the Salton Sea ecosystem is depicted in blue shaded area.

When accounting for uncertainty in the baseflows to the Salton Sea, one response (R4) may reach the target salinity range. Figure 5 illustrates the reduced salinity with increased baseflows.

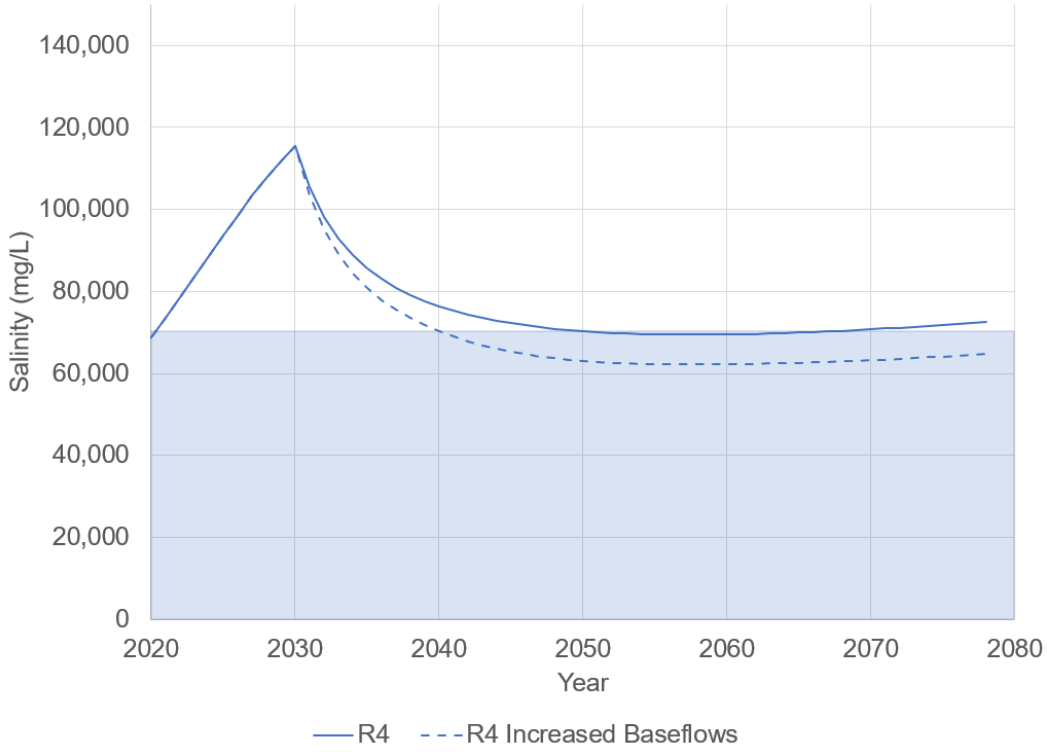

Figure 5. Projected Salton Sea water salinity over time modeled for R4 using SSAM, assuming a water importation start date of 2030 under baseline (solid line) and increased baseflows (dashed line) to the Salton Sea. The critical salinity tolerance range needed to sustain fish and wildlife of the Salton Sea ecosystem is depicted in blue shaded area.

1.2 Results

Each RFI response that passed the screening process was evaluated with regard to the fatal flaw criterion defined above. RFI responses are listed in Attachment B for reference.

1.2.1 Response R2

1.2.1.1 Initial Submission

a. Response R2 would reduce airborne particulate matter via water addition, but it does not state a goal water level or area of playa to be covered. It mentions that water addition would restore the Salton Sea's historical shoreline, but no further information is given (e.g., the exact year of the waterline they would like to replicate). The targeted volume of water to be imported, 2 million AFY, is expected to bring the Salton Sea level to -230 feet or higher, hence, it would likely meet the criteria.

This submission demonstrates a strong likelihood of meeting the state's objectives although it does not explicitly discuss dust reduction.

b. This response lists different salinities based on distinct zones within the Salton Sea area. The lowest salinity is 6,000 mg/L and the highest salinity is 350,000 mg/L. With the exception of the Salt Sink (up to 350,000 mg/L), all of the zones fall within the accepted salinity range. Based on Article 1 of the Salton Sea Restoration Act, and because all eight alternatives presented in the 2006 PEIR include separating the Salton Sea by salinity level, response R2's plan to have distinct salinity zones is acceptable. While the SSAM can model the use of a salt sink, it cannot model multiple salinity zones as proposed in R2. Accordingly, this response meets the salinity requirement and meets the criterion.

R2 meets criterion 3.

1.2.1.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.2 Response R4

1.2.2.1 Initial Submission

a. Response R4 does not include a proposed final water surface elevation of the Salton Sea. Modeling with SSAM resulted in water surface elevations reaching the target of -237 feet 10 years after water import begins. Accordingly, this response meets the requirements for reduction of exposed playa and passes the criterion.

b. The stated salinity goal of 110,000 mg/L falls outside of the acceptable salinity range. This goal corresponds to the base scenario in the response that does not include desalination of imported water. However, R4 contains ample information about how desalination could be incorporated. Modeling of the parameters in response R4 under the baseline scenario resulted in a reduction in salinity from 110,000 mg/L in 2029 to 68,000 mg/L in 2056, followed by an increase in salinity to 72,000 mg/L in 2078. While the modeled salinity reaches the stated goal, the salinity remains in the target range for only 14 years. When incorporating uncertainty in the baseline inflows to the Salton Sea, however, the salinity falls below the 70,000 mg/L maximum. Due to the uncertainty of baseflows through 2078, the Panel chose to allow response R4 to pass sub-criterion 3b.

R4 meets criterion 3.

1.2.2.2 Resubmission

No resubmission of R4 was required.

1.2.3 Response R5

1.2.3.1 Initial Submission

a. Response R5 states dust mitigation will be achieved through covering the exposed playa to a water level of -225 feet. This effort would cover all the exposed playa. Note, however, that a final surface water elevation of -225 feet may result in flooding. Modeled elevations with the parameters from R5 indeed initially reach -225 feet but drop as low as -234 feet through the project duration under baseline flow conditions. This elevation drop is due to the large volume of water extracted for desalination (2 MAFY), which is then sold to local water districts. The water surface elevation remains within the acceptable range. The response therefore meets the criterion.

b. The response states that salinity will initially decrease to 50,000 mg/L and continue to decrease to a steady state of about 39,000 mg/L. Modeling the parameters presented in response R5 with SSAM resulted in a final salinity of approximately 44,900 mg/l in 2078. Part of the response includes blending distilled water with Colorado River water for irrigation within the IID system. This blending would likely result in reduced salinity in the drainage waters and in the New and Alamo Rivers, however, this reduction is difficult to quantify due to the large percentage of the salt load coming from the soils and not the Colorado River water directly. A reduction in salinity of the basin inflow by 1/3 resulted in a final Salton Sea salinity of 44,400 mg/L in 2078. This result is due to the impact of salt from the water imported from the Sea of Cortez, which is over 30 times greater than the amount of salt added to the Salton Sea due to in-basin flows. Accordingly, this response meets the salinity requirements and passes the criterion.

R5 meets criterion 3.

1.2.3.2 Resubmission

No resubmission of R5 was provided.

1.2.4 Response R6

1.2.4.1 Initial Submission

a. Response R6 would address dust mitigation by raising the water level of the sea to approximately -230 feet. The response includes multiple beneficial uses of desalinated water, but it does not include target flows for extraction and, therefore, could not be modeled with SSAM. The response therefore meets the criterion for reduction of exposed playa.

b. The stated salinity goal of 35,000 mg/L is within the acceptable salinity range. Given the lack of information about the desalination process and corresponding water requirements in response R6, salinity could not be modeled using SSAM. The stated salinity goal meets the salinity requirements and passes the criterion.

R6 meets criterion 3.

1.2.4.2 Resubmission
No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.5 Response R7
1.2.5.1 Initial Submission
a. Response R7 would fill the sea to an unspecified level. This response would not implement additional dust suppression measures. Modeling of the 0.5 MAFY imported flow resulted in a slow increase in surface elevation from -245 feet in 2030 to -234 feet in 2078, within the required range. The response therefore passes the criterion.

b. No salinity goal is stated in the response. Additionally, while the imported water is defined as being "TDS-conditioned," a final salinity is stated as being determined at a later date. Regardless of influent TDS, without salt extraction at the Salton Sea, the salinity will continue to increase over time. Hence, this response does not meet the criterion.

R7 fails criterion 3 due to the likelihood that it will not be able to meet the salinity requirements.

1.2.5.2 Resubmission
The resubmission did not include any changes to the imported water volume, and therefore passes criterion a.

The resubmission states that the project would "condition the water using salinity ponds where we will recover the salt as a byproduct." It is unclear if this conditioning would occur on the imported water or at the Salton Sea, or how these ponds would operate to bring the Salton Sea within the target salinity range. The response therefore does not meet criterion b.

The resubmission does not meet criterion 3 due to the likelihood that it will not be able to meet the salinity requirements.

1.2.6 Response R8
1.2.6.1 Initial Submission
a. Response R8 states that it would fill the sea to -220 feet and reduce exposed playa by 50,000 to 100,000 acres. The -220 feet water level would cover all exposed playa but may cause flooding. The SSAM model is limited to elevations between -265 and -226 feet. Therefore, the final elevation cannot be modeled with SSAM. Accordingly, this response meets the requirements for reduction of exposed playa and passes the criterion.

b. The stated salinity goal of 45,000 mg/L falls within the acceptable salinity range. While SSAM cannot accurately model the salinity, the mass of salt imported (44 million to 95 million tons per year) exceeds the mass of salt removed via desalination (27 million to 47 million tons per year). Therefore, the salinity would continue to increase in the Salton Sea after the initial dilution with salt water from the Sea of Cortez and could not be stabilized within the acceptable salinity range. Accordingly, due to the long-term increase in salinity, the response does not pass this criterion.

R8 fails criterion 3 due to an increase in salinity at the Salton Sea above the acceptable salinity requirement.

1.2.6.2 Resubmission

The resubmission of R8 clarified that the target water surface elevation would be set by the state of California and would be set at a level which would avoid flooding. The initial submission and resubmission pass sub-criterion a.

The resubmission of R8 includes increased removal of salt from the Salton Sea via desalination, listed as 68 million tons of salt but pending the selection of a water surface elevation and desalination technology. The resubmission therefore would likely meet the stated salinity goal of 45,000 mg/L.

R8 therefore passes criterion 3.

1.2.7 Response R9

1.2.7.1 Initial Submission

Response 9 includes three alternatives (R9A, R9B, and R9C), each of which was evaluated individually.

a. Response R9 addresses dust mitigation by filling the sea to “close to the pre-QSA elevation.” It states that it would additionally mitigate dust through the construction of salinity gradient solar ponds on existing playa, which would cover “thousands of acres.” Modeling of response R9A resulted in a maximum water surface elevation of -234 feet, with a subsequent reduction to -243 ft. Even when incorporating uncertainty into the baseline inflows, the final water surface elevation did not reach the acceptable range. Response R9A therefore fails the criterion.

Modeling of response R9B resulted in a stabilized elevation of -236 feet. The final water surface elevation reaches the acceptable range. The response therefore meets the criterion.

Response R9C does not state specific water volumes to be imported, and elevation cannot be modeled. Based upon the stated water elevation (2003 levels), this response meets the requirements for reduction of exposed playa and passes the criterion.

b. R9A: The stated salinity goal after 5 years of operation is 50,000 mg/L. The response states salinity will continue to decline, but no final salinity is stated. Modeling of Response R9A resulted in the salinity reaching the acceptable range and decreasing to a final salinity of 37,000 mg/L in 2078. Hence, R9A meets the criterion.

R9B: The stated salinity goal after 10 years of operation is 50,000 mg/L, which was expected to continue to decrease to an unstated final salinity with distillation. Modeling of Response R9B showed salinity reaching the acceptable range and decreasing to a final salinity of 44,000 mg/L in 2078. R9B therefore meets the criterion.

R9C: The stated salinity goal after 10 years of operation is 50,000 mg/L, which was expected to continue decrease to an unstated final salinity with the introduction of Colorado River water and proposed desalination. Response R9C does not state specific water volumes to be imported, so salinity cannot be modeled and verified with SSAM. The response meets the criterion as the stated salinity goal is within the target range.

R9A fails criterion 3 due to insufficient reduction in exposed playa. R9B and R9C meet criterion 3.

1.2.7.2 Resubmission

Resubmission of R9 included updated calculations of extraction of water from the Salton Sea and subsequent return flows of desalinated water under scenario R9A. Modeling in SSAM resulted in a water surface elevation of –234 feet, meeting the requirements for reduction in playa exposure.

R9A, R9B, and R9C therefore pass criterion 3.

1.2.8 Response R10

1.2.8.1 Initial Submission

a. Response R10 would address dust mitigation by filling the sea to -227 feet, satisfying the requirement for reduction of exposed playa. The response stated a starting flow of 1 MAFY, with reduction after the target elevation is reached. While the response indicates three years of flow at 1 MAFY would be required, SSAM modeling showed seven years is required before reducing the flow to maintain the target elevation. The response meets the criterion to reduce exposed playa.

b. The response does not state a salinity goal, but Figure 4 shows salinity increasing above 70,000 mg/L with implementation of the project. Desalination of the imported water was proposed with a 25 MGD plant, expandable to 100 MGD; however, the timeline for implementation was not provided in the response. Assuming 100 MGD of desalination on the imported water, the salinity at the Salton Sea increases above the 70,000 mg/L goal. The

response does mention an opportunity to drain hypersaline water or segregate the lake into multiple salinity zones, but no details were provided on this approach. Accordingly, due to the long-term increase in salinity, the response does not meet the criterion.

R10 fails criterion 3 due to the long-term increase in salinity outside of the target range.

1.2.8.2 Resubmission

Resubmission of R10 included a narrative description of potential salinity management strategies to achieve the target of below 70,000 mg/L. With specific technologies and approaches not provided, the salinity could not be modeled in SSAM. However, the stated salinity goal meets the salinity requirements and therefore passes the criterion.

R10 therefore passes criterion 3.

1.2.9 Response R12

1.2.9.1 Initial Submission

a. Response R12 aims to reduce toxic dust through filling the sea to a level of -230 feet. This effort was suggested as resulting in a reduction of exposed playa that would meet the requirement. Modeling in SSAM showed that under baseline conditions, the maximum surface elevation of -226 feet would decrease over time to -236 feet due to the large volume of water required to be pumped back to the ocean to regulate salinity. Even with the decrease in water surface elevation, the elevation remains within the acceptable range. The response therefore meets the criterion.

b. The stated salinity goal of 53,570 mg/L after 55 years falls within the acceptable salinity range. SSAM modeling showed salinity reaching the acceptable range 16 years after construction, and staying in the target zone thereafter, with a final salinity of 49,000 mg/L in 2078. The response therefore meets the criterion.

R12 meets the criterion.

1.2.9.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.10 Response R13

1.2.10.1 Initial Submission

Response R13 was submitted in 2021 in response to the updated RFI. R13 was found to be deficient in Criterion 3. This response contains proprietary information. Details of the deficiencies have been communicated to the respondent directly.

Response R13 does not pass this criterion.

1.2.10.2 Resubmission

Resubmission of R13 was received and reviewed. The resubmission addressed the concerns related to Criterion 3.

Response R13 meets the criterion.

1.2.11 Response R14

1.2.11.1 Initial Submission

a. Response R14 has a proposed water level of -243 feet. This level is approximately five feet lower than the current water level and would result in additional exposed playa. Modeling of the parameters in the response within SSAM resulted in a water surface elevation between -249 feet and -250 feet. Accordingly, this response does not meet the requirements and does not pass this criterion.

b. No salinity goal is stated within this response. With no salinity information provided on the source water, the Panel assumed the imported water to have a salinity of 100 mg/L. With no salt extraction from the Salton Sea and a very small water import of 0.13 MAFY, modeling of the salinity showed a steady increase from 115,000 mg/L at the project onset to 160,000 mg/L by 2078. The response therefore does not meet the criterion.

R14 fails criterion 3 due to insufficient reduction in exposed playa and increase in salinity outside of the target range.

1.2.11.2 Resubmission

Resubmission of R14 included an option to increase the total imported water by 150 MGD, bringing the total imported water flow to approximately 300,000 AFY. Modeling with SSAM projected the water surface elevation stabilizing at -243 ft under baseline conditions and -240 ft with increased baseflows, leaving 11,000 to 21,000 acres of playa exposed. The response indicates partnership with planned dust mitigation measures (30,000 acres), which would be sufficient to address the playa exposure resulting from the final water surface elevation. R14 meets the criterion.

The resubmission includes an option to pump out hypersaline water from the Salton Sea to reduce the overall salinity. While details are not provided, a pump out strategy could result in salinity within the target range. The so-called “pump-out/pump-in” alternative has been evaluated previously as a means of salinity control (USBR 1998, ch. 5). R14 passes the sub-criterion.

R14 meets criterion 3.

1.2.12 Response R15

1.2.12.1 Initial Submission

a. Response R15 does not explicitly mention dust mitigation. If implemented, this response states a stabilized water elevation of -245 feet, a lower sea level than the present. Modeling of the 250,000 AFY input supported a stabilized elevation of -245 feet. Accordingly, this response does not meet the requirements and does not pass this criterion.

b. No salinity goal is stated in the response. With no salinity information provided in the source water, the Panel assumed the imported water to have a salinity of 100 mg/L. With no salt extraction from the Salton Sea, modeling of the salinity showed a steady increase from 114,000 mg/L in the first ten years of the project to 130,000 mg/L by 2078. The response therefore did not meet this criterion.

R15 fails criterion 3 due to insufficient reduction in exposed playa and increase in salinity outside of the target range.

1.2.12.2 Resubmission

Resubmission of R15 indicated that a larger portion of the proposed 7.3 MAFY of total imported fresh water could be allocated to the Salton Sea to raise the water surface elevation to desired levels, covering the exposed playa. The resubmission additionally states that salinity of the Salton Sea could be reduced by pumping brine back to the submersible vessels located at the Sea of Cortez and transported out of the Sea of Cortez for disposal. While flow data is not provided in the resubmission, the range of potential flows suggests that response may be able to satisfy both reduction in exposed playa and salinity requirements. R15 therefore passes the criterion.

1.2.13 Response R16

1.2.13.1 Initial Submission

a. Response R16 does not explicitly mention dust mitigation, and it does not give an estimate of the amount of playa that would be covered or a new sea elevation. The volume requirement to restore the water surface elevations cannot be provided via the proposed conveyance strategy (see TM 11.1). For this reason, the response does not meet the criterion.

b. No salinity goal is stated in the response. Salinity could not be modeled as detailed flow information is not provided. A stated minimum delivery of 14,000 AFY of water is proposed, corresponding to five trains of water per day, each of which takes eight hours to unload. Additional water delivery may present severe challenges. The stated flow is insufficient to maintain salinity within the accepted range. The response therefore does not meet the criterion.

R16 fails criterion 3 due to insufficient reduction in exposed playa and increase in salinity outside of the target range.

1.2.13.2 Resubmission

No resubmission of R16 was provided.

2.0 Summary

The 13 RFI responses that passed through the screening process were evaluated against Fatal Flaw Criterion 3. After review, the following responses did not meet the requirements of the criterion:

- R7
- R16

The following responses did meet this criterion:

- R2
- R4
- R5
- R6
- R8
- R9
- R10
- R12
- R13
- R14
- R15

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Attachment A

SSAM Model Inputs

The following assumptions were utilized for all model runs:

Table A-1: Model input values utilized in all SSAM models

Parameter	Value	Source	Notes
Inflow	717,000 AFY	Tetra Tech, 2016	Inflow adjusted for 2030 to 2078 Default values maintained for 2000-2029
Base Evaporation	69.0 in	Default	
Precipitation	2.5 in	Default	

Table A-2: Model inputs for each Response

Response	Net Import Volume (AFY)	Net Import Salt (tons/yr)	Net Export Volume (AFY)	Net Export Salt (tons/yr)	Notes
R2	-	-	-	-	SSAM cannot accommodate the multiple salinity zones, no model produced
R4	568,000	27,000,000 2,710,000	180,000 18,000	24,413,000 2,440,000	Modeled assuming the proposed desalination of 90% of imported water
R5	2,500,000	118,700,000	2,000,000	120,000- 199,000	Response states completion of Phase 2 (desal facilities) 3 years after water importation begins
R6	-	-	-	-	Could not be modeled due to lack of information on flows to beneficial water uses
R7	500,000	-	-	-	No salinity information provided
R8	-	-	-	-	Final Salton Sea elevation outside of the bounds of the model

Response	Net Import Volume (AFY)	Net Import Salt (tons/yr)	Net Export Volume (AFY)	Net Export Salt (tons/yr)	Notes
R9A	900,000 500,000	122,000 67,800	28,000-206,000	6,000,000-18,000,000	Inflow reduced after 3 years; water and salt export per spreadsheet provided in response
R9B	500,000	67,800	3,000-37,000	6,500,000-9,900,000	Water and salt export per spreadsheet provided in response
R9C	-	-	-	-	Water volumes not provided, could not be modeled
R10	1,000,000 - 325,000	47,500,000-15,400,000	0	0	Water volumes reduced after 7 years; salinity removal not detailed
R12	463,000-1,850,000	22,000,000-88,000,000	463,000-1,390,000	58,000,000-93,000,000	Assumes construction of one tunnel at a time, 2 years to construct inflow tunnel, four years to construct outflow tunnel
R13	3,400,000-3,100,000	161,000,000-149,000,000	-	-	Two years of elevated flows to fill Salton Sea; multiple salinity zones not modeled
R14	134,000 – 300,000	18,000-41,000	0	0	Assumes inflow salinity of 100 mg/L TDS; salinity removal not detailed
R15	-	-	-	-	Water volumes not provided, salinity removal not detailed, could not be modeled
R16	-	-	-	-	Only minimum flow provided; no salinity information

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Attachment B

Response Number	Response Title	Prime Respondent
R2	Tres Lagunas Restoration: Salton Sea, Laguna Salada & Sea of Cortez	AGESS, Inc.
R4	Salton Sea Water Importation Project	Cordoba Corporation
R5	Bi-National Canal for Salton Sea Restoration and Colorado River Augmentation	GEI Consultants, Inc. and Michael Clinton Consulting, LLC
R6	Harnessing Energy and Water in the Salton Sea	Geothermal Worldwide, Inc.
R7	Wi. Ňy-Wey Maātap: The Living Stone Canal	Quadrant, LLC
R8	Sea to Sea Canal Project	Sea to Sea Canal Company
R9	Water Import Salt Extraction Revenue	Sephton Water Technology, Inc.
R10	Super Salton Trough Interconnection Project	New Water Group, LLC
R12	The Salton Sea: The Best Days are Ahead of Us	E2Eden, LLC
R13	The Sustainable Solution for Remediation and Restoration of the Salton Sea	Global Premier Development, Inc. and Salton Power, Inc.
R14	Salton Sea Management Plan: Recycled Water Importation	Online Land Planning, LLC
R15	Transalton Project: Transoceanic proposal for massive fresh water imports to the Salton Sea and the lower Colorado River basin from South Mexico rivers	Transoceanic, LLC- USA
R16	Water Importation to the Salton Sea	Water Train, Inc.

Technical Memorandum (TM) #11.4

Prepared by: Julie Lockwood, Adina Paytan, Independent Review Panel; Charlie Chesney, UC Santa Cruz

Reviewed by: Independent Review Panel

Subject Area: Fatal Flaw Evaluation Outcomes

Topic: Fatal Flaw Criterion #4: Ecological Changes in the Biosphere Reserve

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This Technical Memorandum (TM) was prepared as part of the Salton Sea Water Importation Proposal Review to provide information to support and reflect the Independent Review Panel's evaluation of submitted ideas to restore the Salton Sea by water importation and to provide the Salton Sea Management Program (SSMP) with approaches that are feasible.

The purpose of this TM is to document the process for evaluating Fatal Flaw Criterion 4 regarding whether the water extraction processes or infrastructure being proposed will cause significant ecological impacts to the Biosphere Reserves and Ramsar wetlands of international importance located within the Upper Gulf of California and Lower Colorado River Delta. Rationale for the criterion, methodology of application, and results are presented.

In arriving at decisions of whether a submission meets this criterion, a two-step process was followed. Initial submissions were reviewed by the Panel. If a fatal flaw was identified, the submitter was contacted and given an opportunity to correct the flaw. These responses were then evaluated and a final decision made on whether the fatal flaw criterion was met. Review of both the initial submissions and resubmissions are included in the TM to document the two-step review process.

1.0 Fatal Flaw Criterion

Fatal Flaw Criterion 4 states:

No extraction or infrastructure being proposed will cause significant ecological impacts to the Biosphere Reserve and Ramsar wetlands of international importance located within the Upper Gulf of California and Lower Colorado River Delta.

The Biosphere Reserve of the Upper Gulf of California and Colorado River Delta, a UNESCO World Heritage Site, is defined as the Upper Gulf of California–Colorado River Delta (marine portion) and associated islands and coastal protected areas. The core zone of the Biosphere

Reserve spans 165,172 hectares (408,148 acres), 86,638 hectares (214,087 acres) of which are marine waters (WHC-UNESCO, n.d.; Comision Nacional de Areas Naturales Protegidas Map). The buffer zone surrounds the core zone and spans 773,438 hectares (1,911,207 acres), a third of which is terrestrial, and the marine portion stretches across the Sea of Cortez from north of San Felipe to north of Puerto Peñasco (WHC-UNESCO n.d.; IUCN, UNEP-WCMC 2011; Comision Nacional de Areas Naturales Protegidas Map). The International Union for Conservation of Nature (IUCN) lists the Upper Gulf of California–Colorado River Delta as a Delta Biosphere Reserve: VI Managed Resource Protected Area, meaning sustainable use can occur alongside conservation, but no large-scale industrial use can take place (IUCN n.d.).

Three other protected ecological sites overlap, or are adjacent to, the Biosphere Reserve. The Humedales del Delta del Río Colorado is a Ramsar Wetland of International Importance (Ramsar, 2001), spanning 250,000 hectares (617,763 acres). While Ramsar is not legally binding, Mexico must continue to conserve the wetland to maintain Ramsar status. Thus, all proposed activity in a Ramsar designated wetland must undergo an ecological evaluation, making a denial of permits for activities likely if ecological impacts are possible (Koester 1989). The Humedales del Delta del Río Colorado wetland houses several rare, threatened, and endemic plant species, and provides migratory stopover habitat for birds using the Pacific Flyway (Ramsar 2001). Sistema de Humedales Remanentes del Delta del Río Colorado is also a Ramsar Wetland of International Importance spanning 127,614 hectares (315,341 acres). This site encompasses all wetlands north of Humedales del Delta del Río Colorado up to the US border, including all of Laguna Salada (Ramsar 2008). This wetland is a key migratory stopover site for migratory birds along the Pacific Flyway. It also serves to recharge local freshwater aquifers and prevent flooding, both of which are critical functions to the communities that live in the area (Ramsar 2008). Finally, the Colorado River Delta Reserve (Reserva de la Biosfera Alto Golfo de California y Delta de Rio Colorado) overlaps the Biosphere Reserve and is designated as a Cómision Nacional de Áreas Naturales Protegidas Biosphere Reserve by the Mexican government. It covers 934,756 hectares (2,309,832 acres), 60% of which is marine (Federal Attorney for Environmental Protection 2019), and includes a buffer zone that encompasses another 773,438 hectares (1,911,207 acres). The southern region of this reserve stretches across the Sea of Cortez from north of San Felipe to north of Puerto Peñasco, while the northern region includes the Colorado River Delta. This reserve provides critical habitat to 50 endangered species protected under SEMARNAT, including the vaquita dolphin, totoaba fish, and Yuma Clapper Rail (UNESCO 2018; Procuraduria Federal de Protecion al Ambienta 2019). Vaquita, in particular, are of concern as they are endemic to this area and all populations are legally protected by NOM-059-ECOL-2001, which states that any action within its habitat must “not alter the necessary conditions for the subsistence, development and evolution” of the species (CEC 2003).

Extraction is defined here as the intentional or accidental removal of water, soil, or aquatic and terrestrial plants and animals during the construction, operation, or maintenance of the response's water importation plan.

Infrastructure refers to any new structure or alteration to the aquatic or terrestrial environment including, but not limited to, wells, roads, docks, canals, pipelines, buildings, power lines and power generation facilities, and water intake or outflow facilities.

We define ecological impacts as those that result in protected species population decline, or that alter ecological functions (1) to the point where they will not recover in the absence of direct intervention (e.g., mitigation or restoration) or (2) such that they are permanently altered. We set the criteria for significant ecological impacts as those that will likely result in long-term alterations of biodiversity. Relevant examples include contributions to species extinction, persistent changes in ecosystem functions, such as elevated nutrient and saltwater input and reduction in freshwater hydrological recharge, and permanent or persistent alterations of natural disturbance regimes, such as flooding frequency, depth, and spatial extent. Given the ecological value of the core and buffer areas around these reserves and wetlands of international importance, substantial and long-lasting ecological impacts would be deemed unacceptable losses by international conservation organizations (e.g., the United Nations and Ramsar Convention) and would likely be prohibited by Mexican regulatory agencies. Therefore, responses that may result in substantial and irreversible ecological impacts to the biosphere or wetlands of international importance during construction or operation are subject to this fatal flaw.

1.1 Methodology

Each response's water intake location, infrastructure, and conveyance line were added to the ArcGIS map using files obtained directly from response authors or by generating spatial files based on maps and figures submitted with the response. Locations shared at any point in the response are included in this analysis, including those submitted in the written response in 2017 and 2021 as well as routes shared during a presentation and when responding to Panel questions. The boundaries of the biosphere and Ramsar wetlands were added to the ArcGIS map. Responses that pass through the Biosphere or Ramsar wetlands were noted, as was the nature of the activities proposed in these sites.

Criterion 4 has two sub-criteria, 1 and 2:

1. No withdrawal of water from within the core zone of the Biosphere Reserve.
2. No creation of canals or other water conveyances that permanently alter flooding regimes or increase salinity within Ramsar wetlands.

1.2 Results

Each response that passed through the screening process was evaluated with regard to the fatal flaw criterion. RFI responses are provided in Attachment A for reference.

1.2.1 Response R2

1.2.1.1 Initial Submission

Response locations: Response R2's conveyance line and/or infrastructure overlaps with the Biosphere Reserve, Humedales del Delta del Río Colorado, and the Sistema de Humedales Remanentes del Delta del Río Colorado.

Sub-criterion 1: Response R2 withdraws water from a tributary about 23 miles north of San Felipe. This location is towards the southern end of the Biosphere buffer zone, and is not within a Ramsar wetland.

Sub-criterion 2: Response R2 suggests flooding 30 miles of the Coyote Canal from the Sea of Cortez to Laguna Salada with seawater. The path passes through both the Biosphere buffer zone, the Humedales del Delta del Rio Colorado, and the Sistema de Humedales Remanentes del Delta del Rio Colorado Ramsar wetlands.

Response R2 does not meet this criterion.

1.2.1.2 Resubmission

Sub-criterion 1: The updated response withdraws water from outside of the Biosphere Reserve.

Sub-criterion 2: The alternatives in this document still call for the flooding of the Laguna Salada with sea water, which is an alteration of the salinity and flooding pattern of this RAMSAR designated wetland. The Laguna Salada is naturally filled from rainwater. The respondents argue that the lagoon has been altered since its RAMSAR designation by earthquakes and changes in the salinity of the groundwater. Whether or not this is true, the RAMSAR designation is a major obstacle to permitting and the panel believes that such a delay would not enable the state to address this pressing problem in a timely manner. For this reason, the response fails sub-criterion 2.

1.2.2 Response R4

1.2.2.1 Initial Submission

Sub-criterion 1: R4 includes three proposed pipeline alignments, each of which withdraw water from within the Biosphere core zone and passes through the northern section of Sistema de Humedales Remanentes del Delta del Rio Colorado and enters a small segment of the south-eastern region of the Biosphere core zone and Humedales del Delta del Rio Colorado.

However, an alternative alignment was proposed in the 2018 response and was presented to the Panel as an alternative to the preferred alignment. The alternative alignment withdraws water from outside of the Biosphere core zone.

Sub-criterion 2: Each of the proposed alignments uses pipelines for water conveyance.

R4 meets the criterion utilizing the alternative alignment that does not withdraw water from the Biosphere core zone. Other presented alignments that withdraw water from the core zone do not meet the criterion.

1.2.2.2 Resubmission

No resubmission of R4 was required.

1.2.3 Response R5

1.2.3.1 Initial Submission

Response locations: Response R5 overlaps with the Biosphere Reserve and Humedales del Delta del Río Colorado.

Sub-criterion 1: Response R5 withdraws water from the northernmost point of the Biosphere Reserve core zone.

Sub-criterion 2: Response R5 includes dredging of 130 miles of canal within the Biosphere Reserve and Humedales del Delta del Río Colorado.

Response R5 does not meet this criterion.

1.2.3.2 Resubmission

No resubmission of R5 was provided.

1.2.4 Response R6

1.2.4.1 Initial Submission

Route 1

Response locations: Response R6 - Route 1 overlaps with the Biosphere Reserve, Humedales del Delta del Río Colorado, and Sistema de Humedales Remanentes del Delta del Río Colorado.

Sub-criterion 1: Response R6 - Route 1 pulls water from about 11 miles north of San Felipe. This is within the southern region of the Biosphere Reserve, but within the buffer and not core of the reserve.

Sub-criterion 2: Response R6 - Route 1 uses pipelines as water conveyance.

Response R6 - Route 1 meets this criterion.

Route 2

Response locations: Response R6 - Route 2 does not pass through the Biosphere Reserve or Ramsar wetlands and is therefore not subject to Criteria 1 or 2.

Response R6 - Route 2 meets this criterion.

1.2.4.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.5 Response R7

1.2.5.1 Initial Submission

Response locations: Response R7 overlaps the Biosphere Reserve and Humedales del Delta del Río Colorado. The response does not show a specific water conveyance line.

Sub-criterion 1: Response R7 withdraws water from a network of groundwater wells in southern Mexicali. One region falls within the northern section of the Biosphere buffer zone, but not the core.

Sub-criterion 2: Response R7 includes dredging of a canal in the Biosphere Reserve and Ramsar wetland Humedales del Delta del Río Colorado.

Response R7 does not meet this criterion.

1.2.5.2 Resubmission

Resubmission of R7 clarified that water would be delivered by lining the existing Coyote Canal with concrete and conveyance to a geomembrane-lined control lagoon. These measures do not meet the requirements of sub-criterion 2.

Response R7 therefore does not meet the criterion.

1.2.6 Response R8

1.2.6.1 Initial Submission

Response location: Response R8 overlaps with the Biosphere Reserve, Humedales del Delta del Río Colorado, and Sistema de Humedales Remanentes del Delta del Río Colorado.

Sub-criterion 1: Response R8 withdraws water from the northernmost section of the Biosphere Reserve buffer zone, but not the core.

Sub-criterion 2: Response R8 utilizes 95 miles of canals in Mexico, including Coyote Canal through Laguna Salada that lies within Ramsar wetlands Humedales del Delta del Río Colorado and Sistema de Humedales Remanentes del Delta del Río Colorado.

Response R8 does not meet this criterion.

1.2.6.2 Resubmission

Sub-criterion 1: The response proposes withdrawing water from wells outside of the biosphere where seawater has infiltrated the groundwater in contrast to the previous version which would use tidal flows in the Coyote Canal.

Sub-criterion 2: Response R8 utilizes the Coyote Canal and would either flood or build additional canal length in the Laguna Salada which lies within the Sistema de Humedales Remanentes del Delta del Río Colorado RAMSAR site. The Laguna Salada is typically filled by rainwater on the rare occasions that it floods. Flooding this area would change the salinity and typical flows in this area. Construction of additional canal length would also require a lengthy environmental review process.

Response R8 does not meet this criterion.

1.2.7 Response R9

1.2.7.1 Initial Submission

Response R9A

Response locations: Response R9A overlaps with the Biosphere Reserve, Humedales del Delta del Río Colorado, and Sistema de Humedales Remanentes del Delta del Río Colorado.

Sub-criterion 1: Response R9A withdraws water from outside of the Biosphere Reserve core zone.

Sub-criterion 2: Response R9A utilizes dredged canals including Coyote Canal and passes through Laguna Salada. This canal lies within Ramsar wetlands Humedales del Delta del Río Colorado and Sistema de Humedales Remanentes del Delta del Río Colorado.

Response R9A does not meet this criterion.

Response R9B

Response locations: Response R9B overlaps with the Biosphere Reserve, Humedales del Delta del Río Colorado, and Sistema de Humedales Remanentes del Delta del Río Colorado.

Sub-criterion 1: Response R9B withdraws water from outside of the Biosphere Reserve core zone.

Sub-criterion 2: Response R9B proposes dredging canals including the Coyote Canal through Ramsar wetlands, Humedales del Delta del Río Colorado and Sistema de Humedales Remanentes del Delta del Río Colorado.

Response R9B does not meet this criterion.

Response R9C

Response locations: Response R9C does not pass through the Biosphere Reserve and/or Ramsar wetlands and is therefore not subject to sub-criteria 1 or 2.

Response R9C meets this criterion.

1.2.7.2 Resubmission

Resubmission of R9 subconcepts relocated canal and pipeline alignments to be outside of the Biosphere Reserve, Humedales del Delta del Río Colorado, and Sistema de Humedales Remanentes del Delta del Río Colorado.

Response R9 subconcepts R9A, R9B, and R9C pass the criterion.

1.2.8 Response R10

1.2.8.1 Initial Submission

Response locations: Response R10 overlaps with the Biosphere Reserve and Sistema de Humedales Remanentes del Delta del Río Colorado.

Sub-criterion 1: Response R10 withdraws water from coastal wellfields north and south of San Felipe. The northern wellfield is within the southern region of the Biosphere Reserve, but from buffer areas and not core.

Sub-criterion 2: Response R10 uses pipelines for water conveyance that do not pass through the Biosphere Reserve and/or Ramsar wetlands.

Response R10 meets this criterion.

1.2.8.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.9 Response R12

1.2.9.1 Initial Submission

Response locations: Response R12 does not pass through the Biosphere Reserve and/or Ramsar wetlands and is therefore not subject to sub-criteria 1 or 2.

Response R12 meets this criterion.

1.2.9.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.10 Response R13

1.2.10.1 Initial Submission

Response R13 was submitted in 2021 in response to the updated RFI. R13 passes Criteria 4. This response contains proprietary information, details have been communicated to the respondent directly.

Response R13 meets this criterion.

1.2.10.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.11 Response R14

1.2.11.1 Initial Submission

Response locations: Response R14 does not pass through the Biosphere Reserve and/or Ramsar wetlands and is therefore not subject to sub-criteria 1 or 2.

Response R14 meets this criterion.

1.2.11.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.12 Response R15

1.2.12.1 Initial Submission

Response locations: Response R15 overlaps with the Biosphere Reserve, and Humedales del Delta del Río Colorado.

Sub-criterion 1: Response R15 withdraws water from the Balas River in Southern Mexico.

Sub-criterion 2: Response R15 presents a series of alternative water conveyances, some of which involve canal dredging or other alterations that likely result in ecological impacts via changes in flooding regimes and increases in water salinity.

Response R15 does not meet this criterion.

1.2.12.2 Resubmission

The resubmission of R15 clarified that the conveyance of imported water would occur in pipelines from San Felipe north along Highway 5, avoiding infrastructure that would permanently alter flooding regimes or increase salinity within Ramsar wetlands. The response therefore meets the criterion.

1.2.13 Response R16

1.2.13.1 Initial Submission

Response locations: Response R16 does not pass through the Biosphere Reserve and/or Ramsar wetlands and is therefore not subject to sub-criteria 1 or 2.

Response R16 meets this criterion.

1.2.13.2 Resubmission

No resubmission of R16 was provided.

2.0 Summary

The 15 RFI responses that passed through the screening process were evaluated against Fatal Flaw Criterion 4:

No extraction or infrastructure being proposed will cause significant ecological impacts to the Biosphere Reserves and Ramsar wetlands of international importance located within the Upper Gulf of California & Lower Colorado River Delta.

After review, the following responses did not meet the requirements of the criterion:

- R2
- R5
- R7
- R8

The following responses did meet the requirements of the criterion:

- R4
- R6
- R9
- R10
- R12
- R13
- R14

- R15
- R16

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Attachment A

Response Number	Response Title	Prime Respondent
R2	Tres Lagunas Restoration: Salton Sea, Laguna Salada & Sea of Cortez	AGESS, Inc.
R4	Salton Sea Water Importation Project	Cordoba Corporation
R5	Bi-National Canal for Salton Sea Restoration and Colorado River Augmentation	GEI Consultants, Inc. and Michael Clinton Consulting, LLC
R6	Harnessing Energy and Water in the Salton Sea	Geothermal Worldwide, Inc.
R7	Wi. Ñy-Wey Maātap: The Living Stone Canal	Quadrant, LLC
R8	Sea to Sea Canal Project	Sea to Sea Canal Company
R9	Water Import Salt Extraction Revenue	Sephton Water Technology, Inc.
R10	Super Salton Trough Interconnection Project	New Water Group, LLC
R12	The Salton Sea: The Best Days are Ahead of Us	E2Eden, LLC
R13	The Sustainable Solution for Remediation and Restoration of the Salton Sea	Global Premier Development, Inc. and Salton Power, Inc.
R14	Salton Sea Management Plan: Recycled Water Importation	Online Land Planning, LLC
R15	Transalton Project: Transoceanic proposal for massive fresh water imports to the Salton Sea and the lower Colorado River basin from South Mexico rivers	Transoceanic, LLC- USA
R16	Water Importation to the Salton Sea	Water Train, Inc.

Technical Memorandum (TM) #11.5

Prepared by: Sharon Kenny, Robert Raucher, Rominder Suri, Independent Review Panel;

Brent Haddad, UC Santa Cruz; Stephen Timko, Kennedy Jenks

Reviewed by: Independent Review Panel

Subject Area: Fatal Flaw Evaluation Outcomes

Topic: Fatal Flaw Criterion #5: Project Viability to 2078

This Technical Memorandum (TM) was prepared as part of the Salton Sea Water Importation Proposal Review to provide information to support and reflect the Independent Review Panel's evaluation of submitted ideas to restore the Salton Sea by water importation and to provide the Salton Sea Management Program (SSMP) with approaches that are feasible.

The purpose of this TM is to document the process for evaluating Fatal Flaw Criterion 5 regarding whether the responses are likely to be viable over the long term. Rationale for the criterion, methodology of application, and results are presented.

In arriving at decisions of whether a submission meets this criterion, a two-step process was followed. Initial submissions were reviewed by the Panel. If a fatal flaw was identified, the submitter was contacted and given an opportunity to correct the flaw. These responses were then evaluated and a final decision made on whether the fatal flaw criterion was met. Review of both the initial submissions and resubmissions are included in the TM to document the two-step review process.

1.0 Fatal Flaw Criterion

Fatal Flaw Criterion 5 states:

Solutions must be viable for the project duration (until 2078).

The charge of the Panel is to assess the feasibility of water importation as a long-term strategy for restoration of the Salton Sea. To be consistent with the Quantification Settlement Agreement (QSA), the period as defined by the Salton Sea Ecosystem Restoration Program and Final Programmatic Environmental Impact Report extends from 2003 to 2078. Concepts that have a shorter period of beneficial impact are subject to this fatal flaw.

Why is this a fatal flaw?

Concepts with beneficial impacts that do not last over the long term, or are extensively delayed at the outset, are fatally flawed. The Salton Sea region is experiencing extreme environmental stress and public health problems, the solutions to which have already been long delayed. The State is committed to solving these problems, and while some reasonable ramp-up times for large-scale projects are understandable, projects that are either unlikely to ever yield beneficial results, or, even if completed, would be overly delayed, are considered to be fatally flawed. This is especially important for water import infrastructure projects such as pipelines, canals and tunnels that do not provide benefits until they are completed.

It is also possible that a project could, over time, cause direct or indirect damage to adjacent natural systems it relies on, harmful enough to disqualify the approach according to this criterion. A project or set of projects that would not supply the needed flow of water through 2078 would not meet the obligation of the State over that time period. Similarly, a project that precludes options to supply water in the future is problematic because it will reduce the range of options available for follow-on projects if needed before 2078.

The Salton Sea Restoration Act sets the State's objectives for Salton Sea restoration. The Panel's charge includes evaluating projects for their ability to meet the State's long-term objectives. Though a project may be deemed not to meet this criterion, it is possible that certain aspects of the projects could provide important benefits to the region during their time frame of viability. The Panel may consider aspects of these projects if it develops a composite recommendation.

1.1 Methodology

Responses are evaluated according to the following four sub-criteria, using the following methods.

1. Is the water source reliable through 2078? The water source of each submission and competing demands for it is evaluated for long-term viability.
2. Can necessary water rights, property rights, access rights, and other needed rights, as well as regulatory permits, be acquired for the project and extended until 2078? This is assessed by reviewing responses for rights and permit-acquisition plans. The permitting plans are examined both in light of what was submitted as well as the Panel's analysis of the project's potential impacts. For example, responses that withdraw water from or dredge within the core zone of the Upper Gulf of California Biosphere Reserve (Biosphere) are not likely to be awarded permits and have water rights approved.
3. Can engineered systems and geologic support systems be reasonably maintained or replaced through 2078? Engineered and geological aspects of the submissions are

examined for possible irreversible degradation or unreasonable effort required to replace outdated infrastructure.

4. Does implementing the project create secondary effects such that the harm outweighs the benefits, or does it have severe negative impacts focused on vulnerable regions or communities over the life of the project? Examples of secondary effects include:
    a. Accumulation of brine and salt from seawater desalination. Brine that accumulates over time on land could harm soil fertility, damage water quality in aquifers, or, if mobilized by wind, cause respiratory problems;
    b. Economic/housing dislocation due to rising land values and taxes;
    c. Loss of surface water and/or groundwater security due to reallocation to alternative uses;
    d. Increasing pollution resulting from new industrial activity.

Possible secondary impacts are considered for each submission, giving careful attention to vulnerable groups and areas, such as tribal lands, lower-income areas, and non-English-speaking areas. Both the US and Mexican sides of the border are considered.

Other criteria relevant to long-term submission viability are addressed elsewhere in the Panel's evaluation, including:

5. Responses should also minimize air quality problems and provide environmental improvements to the region sufficient to meet the State's objectives until 2078. This is addressed in Criterion 3.

Failure to pass any sub-criterion means the response does not pass the overall criterion. All sub-criteria are equally vital.

1.2 Results

Each response that passed through the screening process was evaluated with regard to the fatal flaw criterion. RFI responses are provided in Attachment A for reference.

1.2.1 Response R2

1.2.1.1 Initial Submission

1. The main water source is the Sea of Cortez. The water source is considered reliable through 2078. Supplemental fresh water for agricultural use is proposed via the development of new groundwater well fields. The response indicates a hydrogeological study will be performed. The Panel assumes that the eventual withdrawal locations and strategy will be sustainable through 2078.

2. R2 withdraws water from outside of the core zone of the Biosphere, thus water rights may be granted by the Conagua, Mexico's National Water Commission, and is less likely to be stalled

by local stakeholders. R2 will likely need to obtain a right-of-way permit from the Cocopah Tribe as the conveyance route appears to pass through Cocopah Tribe land. Because water will cross the US-Mexico border, R2 requires an International Boundary and Water Commission (IBWC) Minute, and presidential and environmental permits in both Mexico and the US. While complex and time-consuming, the permitting requirements can be met.

3. No challenges related to the maintenance or replacement of infrastructure were identified.

4. R2 utilizes a portion of the Salton Sea for saltwater accumulation, thus reducing the potential impact of salt accumulation on land. It does not appear to result in secondary housing, water insecurity, or industrial pollution risks and therefore passes this sub-criterion.

R2 passes this criterion.

1.2.1.2 Resubmission

No changes to the submission impacted the application of the criterion. The response therefore passes the criterion.

1.2.2 Response R4

1.2.2.1 Initial Submission

1. The water source is the Sea of Cortez. The water source is considered reliable through 2078.

2. R4 includes three proposed pipeline alignments, each of which withdraw water from within the Biosphere core zone and will likely not receive permitting or water rights from Conagua. In addition, the project will likely see pushback from local stakeholders, including fishers, those who rely on tourism, and environmental groups, which may stall the project's approval. Therefore, the proposed alignments do not pass this sub-criterion.

However, an alternative alignment was proposed in the 2018 response and was presented to the Panel as an alternative to the preferred alignment. The alternative alignment withdraws water from outside of the Biosphere core zone and is thus more likely to obtain environmental permits and water rights from Conagua. This alignment will also likely see less resistance from local and environmental stakeholders. The alignment will likely need to obtain a right-of-way permit from the Cocopah Tribe as the conveyance route appears to pass through Cocopah Tribe land. Because water will cross the US-Mexico border, R4 requires an International Boundary and Water Commission (IBWC) Minute, and presidential and environmental permits in both Mexico and the US. While complex and time-consuming, the permitting requirements can be met.

3. No challenges related to the maintenance or replacement of infrastructure were identified.

4. Three options for disposal of brine from desalination are offered: deep well injection, creation of saline zones in the Salton Sea, and the return of saline water to the Sea of Cortez.

None of these results in excessive salts accumulating on land. The options also do not appear to result in secondary housing, water insecurity, or industrial pollution risks and therefore pass this sub-criterion.

R4 passes the criterion utilizing the alternative alignment that does not withdraw water from the Biosphere core zone. Other presented alignments that withdraw water from the core zone do not pass the criterion.

1.2.2.2 Resubmission

No resubmission of R4 was required.

1.2.3 Response R5

1.2.3.1 Initial Submission

1. The water source is the Sea of Cortez. The water source is considered reliable through 2078.

2. R5 withdraws water from within the Biosphere core zone and thus will likely not obtain environmental permits or water rights from Conagua. In addition, the project will likely see pushback from local stakeholders, including fishers, those who rely on tourism, and environmental groups, which may stall the project's approval. Therefore, R5 does not pass this sub-criterion.

3. The response states it will remove 60 million tons of salt per year from the Salton Sea, which will be delivered to the railroad on a three-mile conveyor. The Salton Sea Accounting Model (SSAM), which models inflows, evaporation, surface elevation, and salinity, estimates that if two million AFY of water is extracted from the Salton Sea for desalination, as suggested in the response R5, it will generate 120 million to 200 million tons of salt. Assuming 60 million tons of salt per year at 25 cubic feet per ton, approximately seven trains per day—each comprised of 110 standard 50 feet long, 5,238 cubic-foot capacity cars—would be required to move this salt. Moving this high volume of salt is considered infeasible and presents long term operations and maintenance concerns. The response therefore does not meet the sub-criterion.

4. Salts are generated by a distillation process involving waters of the New and Alamo Rivers and the Sea of Cortez. Salts are delivered to railcars for introduction to markets and to unspecified disposal sites. The amount of salt generated could reach 120-200 million tons per year. By way of comparison, total salt production for all uses in the US is in the range of 40-45 million tons per year. The absence of a plan for disposing of salt in this magnitude means it does not meet this sub-criterion. The approach does not appear to result in secondary housing, water insecurity, or industrial pollution risks. Long-term risk associated with accumulation of salt residual from desalination constitutes a fatal flaw.

R5 does not meet this criterion.

1.2.3.2 Resubmission

No resubmission of R5 was provided.

1.2.4 Response R6

1.2.4.1 Initial Submission

1. Two water sources are proposed: the Pacific Ocean and the Sea of Cortez. The Sea of Cortez is considered a reliable water source. The precedent of existing water intakes from the Pacific Ocean in California suggests that, if the extraction can be permitted, it will likely be reliable for the project duration.

2. The alignment that utilizes the Sea of Cortez withdraws water from the Biosphere buffer zone, which is distinct from the Biosphere core zone, and will likely obtain water rights from Conagua and environmental permits and will also likely see less resistance from local and environmental stakeholders. This alignment would need to obtain a right of way from the Cocopah Tribe as the conveyance pathway appears to pass through Cocopah Tribe land. Because water will cross the US-Mexico border, the alignment requires an International Boundary and Water Commission (IBWC) Minute, and presidential and environmental permits in both Mexico and the US. While complex and time-consuming, the permitting requirements can be met.

The alternative alignment in R6 withdraws water from the Pacific Ocean and thus does not require any permitting, water rights, rights of way within Mexico, IBWC Minute, nor presidential permit. This alignment would be subject to NEPA and CEQA within California and must obtain permits to extract water from the Pacific Ocean. The alignment passes through some protected areas in California and may see delays in permitting and from stakeholder pushback but could ultimately receive necessary permits.

3. The response utilizes non-established technologies (TM 11.1). Without the years of operational and maintenance data available for established technologies, the Panel cannot make a determination on whether or not the systems can be reasonably maintained or replaced. The response therefore fails the sub-criterion because it does not demonstrate that the proposed system can be reliably operated for the project duration.

4. Response R6 disposes of brine either in geothermal reservoirs or by return pipelines to the ocean, thereby not creating a land-based salt hazard. The options also do not appear to result in secondary housing, water insecurity, or industrial pollution risks and therefore pass this sub-criterion.

R6 does not meet the criterion because it has not been demonstrated that the proposed technologies have reasonable operational and maintenance requirements so that the system could be operated reliably through 2078.

1.2.4.2 Resubmission

The resubmission notes that the mechanical elements are reasonable extensions of existing technologies. The Panel, however, sought technologies with a proven record of operation. The response therefore does not sufficiently address the operations and maintenance concerns to determine that the project could operate reliably through 2078. R6 therefore does not meet this criterion.

1.2.5 Response R7

1.2.5.1 Initial Submission

1. R7 withdraws groundwater from a network of wells in Mexicali. Long-term extraction of the volumes required for restoration of the Salton Sea (hundreds of thousands of acre-feet per year) is not considered sustainable for the project duration, as it will likely cause overdraft of the aquifer and saltwater intrusion. It therefore does not pass this sub-criterion.

2. One R7 groundwater withdrawal site is located within the Biosphere core zone and will thus likely not obtain water rights from Conagua or environmental permits. Additionally, it is likely that stakeholder resistance from local fishers, those who rely on tourism, farmers who rely on groundwater, and environmental groups interested in the Biosphere and wetlands will stall the permitting process. For these reasons, R7 does not pass this sub-criterion.

3. Insufficient information is provided on the engineered systems to determine if there are issues with the operations and maintenance of the proposed infrastructure.

4. R7 includes a desalination component associated with the canal system; however, a strategy for managing saline brine/salt accumulation from the desalination step is not enumerated. Sufficient information on the volume of salt production is not provided. This approach does not appear to result in secondary housing, water insecurity, or industrial pollution risks. The lack of a strategy for salt management means that R7 does not pass this sub-criterion.

R7 does not meet this criterion.

1.2.5.2 Resubmission

The resubmission does not address sub-criterion 1 concerning the flow capacity of the wellfields and the concern that the groundwater will be overdrafted and ocean water will infiltrate the wellfield. The resubmission addresses sub-criterion 2 by noting the existence of legal documents permitting development of the water right-of-way. The engineering systems are not addressed, as raised in sub-criterion 3. With respect to sub-criterion 4, the resubmission does not address salt management. Overall, the resubmission does not meet this criterion.

1.2.6 Response R8

1.2.6.1 Initial Submission

1. The water source is the Sea of Cortez. The water source is considered reliable through 2078.

2. R8 withdraws water from within the Biosphere core zone and thus will likely not obtain environmental permits or water rights from Conagua. In addition, stakeholder resistance from local fishers, those who rely on tourism, and environmental groups would likely stall the project. Therefore, R8 does not pass this sub-criterion.

3. No challenges related to the maintenance or replacement of infrastructure were identified.

4. During the early stage of the project, as the Salton Sea refills, 40 million tons per year of salt will be produced. R8 proposes to sell 3 million tons on salt markets and use 37 million tons in salt ponds located in the shallower southern region of the Salton Sea to generate power. Lower quantities of salt will be generated once the Sea is refilled and inflows reduced. Because this approach includes creating a high-salinity sink within the Salton Sea, it is similar to other dual-salinity approaches. This approach does not appear to result in secondary housing or water insecurity risks, and therefore passes this sub-criterion.

R8 does not meet this criterion.

1.2.6.2 Resubmission

The resubmission notes that capturing tidal flows in the biosphere reserve should be studied for its potential environmental impacts, but that the team is prepared to consider using seawater wells instead of tidal flows as intakes. Development of 300 to 500 wells is proposed, which would require significant operations and maintenance effort. This latter approach is not described but could meet the sub-criterion if established outside the Biosphere core zone. It therefore meets this criterion.

1.2.7 Response R9

1.2.7.1 Initial Submission

1. The water source for R9A and R9B is the Sea of Cortez. The water source is considered reliable through 2078. R9C utilizes Colorado River water via purchasing of unused water rights. While water rights may be purchased in the short term, the increased demands on the Colorado River coupled with historic drought and low reservoir levels make the purchase of excess rights an unreliable source through 2078. R9C therefore does not meet this criterion.

2. R9A and R9B both withdraw water from outside of the core zone of the Biosphere and will likely obtain water rights and environmental permits from Conagua, and will also likely see less resistance from local and environmental stakeholders. R9A and R9B would need to obtain a right-of-way permit from the Cocopah Tribe if the final conveyance route passes through Cocopah Tribe land. Because water will cross the US-Mexico border, R9A and R9B require an

International Boundary and Water Commission (IBWC) Minute, and presidential and environmental permits in both Mexico and the US. While complex and time-consuming, the permitting requirements can be met.

R9C purchases water rights from lower Colorado River tribes and uses the All-American Canal to deliver water. Therefore, it is not subject to water rights, rights of way and environmental permits in Mexico, nor is it required to obtain a presidential permit or an IBWC Minute. R9C will need to pass through the NEPA/CEQA process. It is highly unlikely that dormant tribal water rights could be purchased and utilized because that would create a new water demand on the already-stressed Colorado River. There would need to be an equivalent, measurable reduction in tribal water consumption equivalent to the volume of water transferred to the Salton Sea. While unlikely, this approach cannot be dismissed as fatally flawed.

3. R9A and R9B do not present technological challenges that worsen over time. R9C relies on existing infrastructure that is likely to be maintained through 2078 and therefore passes this sub-criterion.

4. This approach separates salts from inflow waters. Some of the salts are refined for market sale and others are sent to high-salinity sinks on the Salton Sea playa to produce energy in solar ponds. Because this approach amounts to creating a high-salinity sink within the Salton Sea, it is similar to other dual-salinity approaches. This approach does not appear to result in secondary housing or water insecurity risks, and therefore passes this sub-criterion.

R9A and R9B pass this criterion, while R9C does not.

1.2.7.2 Resubmission

No changes to the submission of R9A or R9B impacted the application of the criterion. R9A and R9B therefore pass the criterion.

The resubmission of R9 included a revised water transfer strategy for R9C. A new desalination plant would be funded and constructed by the US, providing Mexico with 500,000 AFY of desalinated water. In exchange, the US would receive an equivalent 500,000 AFY of Colorado River water from Mexico's 1.5 MAFY allotment. While the Panel supports the concept of an exchange of desalinated water for Colorado River water, there is concern surrounding the magnitude of the exchange. Colorado River water rarely reaches the Sea of Cortez, but reducing the flow in the Colorado River below Imperial Dam by 1/3 could result in environmental impacts in the Biosphere Reserve, and possibly have social and economic impacts elsewhere in the region. Ongoing discussions about historically low levels in Lakes Mead and Powell are likely to result in significant reductions in diversions in the Lower Basin. Reductions, whether as part of Drought Contingency Plans (DCPs) or as mandates from the US Bureau of Reclamation, may further reduce flows in the Colorado River from Imperial Dam to its terminus in the Biosphere

Reserve. However, given the lack of publicly available information about how Mexico utilizes its existing 1.5 MAFY allotment and how the proposed 500,000 AFY of desalinated water would be distributed, which could mitigate the instream losses, the Panel cannot definitively say that the concept is fatally flawed.

R9C therefore meets the criterion.

1.2.8 Response R10

1.2.8.1 Initial Submission

1. The water source is the Sea of Cortez via subsurface intakes. If the hydrogeology of the area is favorable for slant or horizontal well construction and the aquifer is hydraulically connected to the Sea, the source can be considered sustainable.

2. R10 withdraws water from outside of the Biosphere. If constructed in an area of favorable hydrogeology, subsurface intakes can have reduced environmental impacts compared to open water intakes (Mackey et al. 2011). Because water will cross the US-Mexico border, R10 requires an International Boundary and Water Commission (IBWC) Minute, and presidential and environmental permits in both Mexico and the US. While complex and time-consuming, the permitting requirements can be met.

3. Operations and maintenance of subsurface intakes can be challenging and costly. Subsurface intakes for desalination of ocean water are typically preferred for facilities with relatively low flow rates (<10 MGD). In the planning phases of the Huntington Beach desalination facility, nine subsurface intakes were evaluated, with seven deemed infeasible in phase 1 of the study and the two others deemed infeasible in phase 2. The intakes comparable to those proposed in R10 were eliminated due to operational concerns from the production size, impacts to freshwater aquifers, and geologic concerns (ISTAP 2014). The two designs evaluated in phase 2 were both infiltration galleries and ranged in capital cost from $1,936M to $2,347M, with $42M to $58M annual operations costs (2015 dollars) (ISTAP 2015). A separate study by the WateReuse Foundation estimated the lifespan of a seawater intake well to be 10-20 years due to reduction in water capacity caused by plugging of the wells (WateReuse 2011).

Due to the potential for high operational demands to repair or replace wells and the potential impacts to local aquifers, R10 does not meet the criterion.

4. This project returns brine from desalination to the Sea of Cortez; therefore, it does not create a land-based salt management issue. A properly placed and extensive brine dispersion field could reduce the damage of the return brine flows to an acceptable level. This approach does not appear to result in secondary housing or water insecurity risks, and therefore passes this sub-criterion.

R10 does not meet this criterion.

1.2.8.2 Resubmission

The resubmission of R10 included clarification of the intake types, design parameters, and operations and maintenance strategies associated with the proposed subsurface intakes. The intakes would be located appropriately so as to not impact local beneficial use aquifers. The resubmission sufficiently addressed the Panel's concerns.

R10 passes the criterion.

1.2.9 Response R12

1.2.9.1 Initial Submission

1. The proposed water source is the Pacific Ocean. The precedent of water intakes from the Pacific Ocean in California suggests that, if the extraction can be permitted, it will likely be reliable for the project duration.

2. R12 withdraws water from the Pacific Ocean and does not withdraw water from Mexico. It is therefore not subject to permitting, rights of way and water rights in Mexico, nor will it require a presidential permit or an IBWC Minute. R12 will be subject to NEPA and CEQA within California and must obtain permits to extract water from and discharge water to the Pacific Ocean. R12 does pass through some protected areas in California and may see delays in permitting and stakeholder resistance from environmental organizations, land- and homeowners near Pacific coast construction areas, and organizations representing fishers and other users of coastal resources.

In order to reduce the salinity of the Salton Sea, R12 includes tunnels to pump hypersaline water from the Salton Sea back to the Pacific Ocean. The initial discharge would be approximately 344 MGD of water that is approximately 3 times the salinity of the ocean. As more tunnels are constructed and the salinity of the Salton Sea decreases, flows will increase to over 1,000 MGD, and water salinity will decline to no more than 40% greater salinity than the ocean. Given the regulatory environment surrounding extraction and discharge along the Pacific coast, it is very unlikely that the discharge of this volume of hypersaline water would be permitted.

While the water extraction portion of R12 would be likely to face extensive delays through permitting and potential litigation, the extraction may still be permitted. However, discharge of hypersaline water at flows of 344 MGD to 1,000 MGD is unlikely to be permitted. R12 therefore does not meet this sub-criterion.

3. The use of tunnels through a seismically active area is of concern. Passing through a fault line raises the possibility of tunnel collapse or damage to flow management infrastructure. However, it is likely the infrastructure will last through 2078, so R12 meets this sub-criterion.

4. Digging a tunnel will require the disposal of the alluvium and rock displaced. While environmentally problematic and requiring careful planning, this could be carried out. This

approach exchanges Salton Sea water with Pacific Ocean water and therefore does not create a land-based salt disposal challenge. This approach also does not appear to result in secondary housing or water insecurity risks, and therefore passes this sub-criterion.

R12 does not pass this criterion due to the unlikelihood of permitting the discharge of hypersaline water to the Pacific Coast.

1.2.9.2 Resubmission

The resubmission describes and illustrates a coastal mixing and dispersion system in which seawater is drawn from the ocean and mixed with the saline outflow to achieve a reasonable target salinity slightly higher than ocean salinity, and then dispersed offshore in a large-scale brine mixing field.

In the planning phases of the proposed Huntington Beach desalination facility, the two intake designs evaluated in phase 2 were both infiltration galleries, similar to what is proposed in the R12 resubmission, and ranged in capital cost from $1,936M to $2,347M, with $42M to $58M annual operations costs (2015 dollars) (ISTAP 2015). The system proposed in R12 is approximately 140 times larger than the 106 MGD proposed for the Huntington Beach desalination facility. The challenges in construction and maintenance of the dilution system as well as the requirement to pump ten billion gallons of water or more per day constitute a fatal flaw.

The resubmission anticipates the permitting challenges for a coastal facility of the magnitude envisioned (drawing as much as 15 billion gallons per day) and suggests that the overall importance of the project would lead to special state-level exemptions granted from normal permitting processes. The Panel agrees that permitting by exemption is the only reasonable permitting approach. However, the project should not rely on an expectation of permitting exemptions to proceed, especially in as timely a manner as is desired to address the immediate needs. It therefore does not pass this criterion.

1.2.10 Response R13

1.2.10.1 Initial Submission

Response R13 was submitted in 2021 in response to the updated RFI. R13 was found to be deficient in Criterion 5. This response contains proprietary information. Details of the deficiencies have been communicated to the respondent directly.

R13 does not pass this criterion.

1.2.10.2 Resubmission

Upon resubmission, R13 still does not pass this criterion. Details have been communicated to the respondent directly.

1.2.11 Response R14

1.2.11.1 Initial Submission

1. The proposed water source is treated effluent from wastewater treatment plants on the California coastline. As documented in TM 11.3, the proposed water flow in response R14 is insufficient to maintain water surface elevations in the Salton Sea at acceptable levels. TM 3.2 estimated the water requirements to fill and maintain the water surface elevation at -230 feet as up to 825,000 AFY and 528,000 AFY, respectively. This flow represents approximately 80% and 50% percent, respectively, of the 914 MGD of available treated wastewater presented in the response. The growing interest in recycling water for potable and non-potable uses coupled with increased drought and decreased imported water supply, suggests that the use of coastal treated wastewater is not a sustainable source of water for the Salton Sea for the project duration, and does not meet the sub-criterion.

2. R14 relies on water from a wastewater treatment plant in California and does not enter Mexico. It therefore does not require permitting, right-of-way, or water rights in Mexico, nor does it need to obtain a presidential permit or IBWC Minute. R14 will require NEPA and CEQA. R14 meets this sub-criterion.

3. No challenges related to the maintenance or replacement of infrastructure were identified.

4. This approach uses urban wastewater from the San Diego area as source water to replenish the Salton Sea. The water is pumped via pipeline to a treatment facility roughly 20 miles from the Salton Sea, improved, and then delivered to the Sea. Disposing of the solid and brine byproducts from the treatment steps appears to be manageable. This approach also does not produce a major salt disposal challenge. This approach does not appear to result in secondary housing or water insecurity risks, and therefore passes this sub-criterion.

R14 does not meet this criterion.

1.2.11.2 Resubmission

The resubmission notes that discussions with regional water authorities managing water reclamation and reuse have expressed a willingness to sell reclaimed water for use at the Salton Sea. For example, one-third of the production of San Diego's Point Loma wastewater treatment plant has been "theoretically protected" for use at the Salton Sea, and it would be possible to supplement San Diego water with Huntington Beach water if San Diego water is insufficient. The resubmission further argues that it is a matter of state priority setting as to whether reclaimed water will be used along the coast or piped inland to address Salton Sea issues, and the state has good reason to prioritize the Salton Sea basin. The resubmission also notes that recent population declines in the San Diego area could result in reduced demand for reclaimed water.

The Panel still considers the security of long-term reclaimed water supply to be a fatal flaw. California's south coast urban regions have the financial means to pay for their own recycled water infrastructure and operations. The value of reclaimed water as a reliable, local water supply is now widely recognized, especially as severe drought conditions continue to persist that threaten existing supplies, and as potable reuse is gaining regulatory and public acceptance. Water agencies throughout the region are planning and implementing numerous new or expanded water reuse projects. While a coastal wastewater-based supply might be reliably available for Salton Sea restoration for short-term use while local/regional reuse infrastructure is built, a project transferring as much as 300,000 AFY (>250 MGD) annually for at least half a century is not reasonable in light of ongoing coastal water system vulnerability and clear evidence of plans for expanded within-region reuse. R14 therefore does not meet this criterion.

1.2.12 Response R15

1.2.12.1 Initial Submission

1. The proposed water source is fresh water from a river in southern Mexico, collected off-shore. The source water is likely to remain available throughout the project period.

2. R15 withdraws water from the Balas River and passes through the Biosphere core zone. It is unlikely that environmental permits will be approved to construct infrastructure within the core zone. It is also likely that stakeholder pushback from fishers, those who rely on tourism, and environmental groups could delay permitting. Thus, R15 is unlikely to obtain permits.

3. The water transport vessels utilized in R15 have not been previously constructed or implemented. There is therefore insufficient information to evaluate the operations and maintenance requirements of this response. There is an example of a 100-mile test of a 3-acre-foot floating bladder of fresh water in 1996 between Port Angeles and Seattle, Washington. The concept was long promoted by entrepreneur Terry Sprague, but not pursued further. There are major differences in technologies (floating bladders vs. submersibles) and scale (3-acre-feet test in 1996 vs. 7,600 acre-feet per submersible). The lack of evidence of long-term viability of the technology means it does not pass this sub-criterion.

4. Because freshwater is being delivered, this approach does not create an onshore salt management challenge. This approach also does not appear to result in secondary housing or water insecurity risks, and therefore passes this criterion. The onshore infrastructure needed to build and repair submersibles could create some environmental impacts, which would be manageable. This approach meets this sub-criterion.

R15 does not meet this criterion.

1.2.12.2 Resubmission

The resubmission notes that the project does not pass through the Biosphere core zone. Also, the opportunity of large, new supplies of fresh water flowing to NW Mexico as a result of this approach will accelerate the Mexican permitting process. Further, the elements of submersible water-supply technology (bladders, concrete superstructures) are all established technologies even though the combination is novel.

Although the map submitted originally shows the offloading and pipeline infrastructure to be located in the Biosphere reserve, it is possible to locate them outside. Based on the resubmission's claim, it now passes sub-criterion 2.

However, without a record of performance on which a judgment about technology reliability can be made, the risk of pursuing this technology as a long-term strategy is too high. The resubmission therefore still does not pass sub-criterion 3. Overall, R15 does not meet this criterion.

1.2.13 Response R16

1.2.13.1 Initial Submission

1. The proposed water source is spring water from three unnamed states in the Eastern US.

Response R16 estimates it could provide "approximately 8 years of service." However, to be sustainable, a proposal must be capable of providing water through the year 2078. This incapacity is a fatal flaw.

From a hydrological perspective, the Panel cannot assume that the unnamed aquifers have the capacity to provide sufficient water through 2078 due to the possibility of over drafting.

2. The submission mentions that it has rights to water from three Eastern states. It does not mention the names of the states but notes it can obtain the permits necessary to export sufficient water. The submission notes that the water source would be spring water. Spring water is a highly valued, scarce, and contested commodity. The likelihood is high that any proposal to export the quantity of water required to fulfill the needs of the Salton Sea for salinity control and public health would encounter fierce resistance from local water users and environmental organizations.

3. No challenges related to the maintenance or replacement of infrastructure were identified.

4. This approach draws 14,000 AFY from mid-western aquifers with a 120-year history of artesian (naturally flowing) springs. (Note: the submission uses the term artisan, which we assume means artesian.) This accounts for only 3% of the company's water reserves, which span 320 million acres over three states. Note that no three states in the Eastern US in combination approach 320 million acres in size. Although the specific aquifers are not listed, it

is possible that some could sustainably produce 14,000 AFY. This approach also does not appear to result in secondary housing or water insecurity risks, and therefore meets this sub-criterion.

R16 does not meet the criterion.

1.2.13.2 Resubmission

No resubmission of R16 was provided.

2.0 Summary

After review, the following responses did not meet the requirements of the criterion:

- R5
- R6
- R7
- R12
- R13
- R14
- R15
- R16

The following responses did meet this criterion:

- R2
- R4
- R8
- R9
- R10

References

Independent Scientific Technical Advisory Panel (ISTAP). 2015. *Phase 1 Report: Technical Feasibility of Subsurface Intake Designs for the Proposed Poseidon Water Desalination Facility at Huntington Beach, California*. San Francisco: California Coastal Commission and Poseidon Resources (Surfside) LLC. http://doi.org/10.13140/RG.2.1.2392.8166.

Independent Scientific Technical Advisory Panel (ISTAP). 2014. *Phase 2 Report: Feasibility of Subsurface Intake Designs for the Proposed Poseidon Water Desalination Facility at Huntington Beach, California*. San Francisco: California Coastal Commission and Poseidon Resources (Surfside) LLC. http://doi.org/10.13140/RG.2.1.3230.6643.

Mackey, Erin D., Nicki Pozos, Wendie James, and Tom Seacord. 2011. *Assessing Seawater Intake Systems for Desalination Plants*. Denver: Water Research Foundation.

WateReuse Association Desalination Committee. 2011. *Overview of Desalination Plant Intake Alternatives: White Paper*. Alexandria: WateReuse Association.

Attachment A

Response Number	Response Title	Prime Respondent
R2	Tres Lagunas Restoration: Salton Sea, Laguna Salada & Sea of Cortez	AGESS, Inc.
R4	Salton Sea Water Importation Project	Cordoba Corporation
R5	Bi-National Canal for Salton Sea Restoration and Colorado River Augmentation	GEI Consultants, Inc. and Michael Clinton Consulting, LLC
R6	Harnessing Energy and Water in the Salton Sea	Geothermal Worldwide, Inc.
R7	Wi. Ňy-Wey Maātap: The Living Stone Canal	Quadrant, LLC
R8	Sea to Sea Canal Project	Sea to Sea Canal Company
R9	Water Import Salt Extraction Revenue	Sephton Water Technology, Inc.
R10	Super Salton Trough Interconnection Project	New Water Group, LLC
R12	The Salton Sea: The Best Days are Ahead of Us	E2Eden, LLC
R13	The Sustainable Solution for Remediation and Restoration of the Salton Sea	Global Premier Development, Inc. and Salton Power, Inc.
R14	Salton Sea Management Plan: Recycled Water Importation	Online Land Planning, LLC
R15	Transalton Project: Transoceanic proposal for massive fresh water imports to the Salton Sea and the lower Colorado River basin from South Mexico rivers	Transoceanic, LLC- USA
R16	Water Importation to the Salton Sea	Water Train, Inc.

Appendix C: Fatal Flaw Revision Invitation and follow-up Email Templates

Date: June 17th, 2022
Subject: Fatal Flaws-Revision Invitation

Dear [Team Lead Name],

The Independent Review Panel has completed the second stage of the review process and has identified which concepts have fatal flaws. You are receiving this correspondence because your submission has [number] fatal flaw(s). The attachment will describe the fatal flaw(s) the Panel identified related to your team's concept.

We invite you to revise your submission to address the fatal flaws if you so choose. To meet the Panel's overall project deadlines, you have until **July 1st, 2022 7:00pm (pst**) to submit materials that address your fatal flaws. If you do not meet this deadline additional material will not be accepted. Please be aware that the Panel will only consider information specific to addressing the fatal flaws identified for the concept you have submitted. The Panel will not accept concepts that are fundamentally or significantly different from the original concept submitted.

If you do submit additional materials they will again be subject to the Fatal Flaw review. The additional materials should be in the form of a separate document describing only the changes to your previous submissions, not an edited version of your previous submissions.

You are not required to submit additional materials. If you do not submit additional materials, your full project concept will not proceed to the next stage of evaluation and will only be reviewed for beneficial elements that could be included in a potential long-range importation plan.

On behalf of the Panel, I want to thank you for your submission and ongoing participation and interest in its water importation review process.

Sincerely,
Azucena
--
Azucena Beltrán
Project Coordinator
Salton Sea Long-Term Restoration Review
University of California, Santa Cruz

June 22nd, 2022
Subject: Fatal Flaw Criteria List

Dear [Team Lead Name],

There has been a request from one of the participating teams to provide all of the fatal flaw criteria, which we are now providing to all recipients. The fatal flaw criteria are listed below.

No.	Fatal Flaw Criteria
1	The submission is technically sound and utilizes established, non-speculative technologies.
2	The submission will not create significant risk of catastrophic flooding.
3	The submission is consistent with the objectives of the Salton Sea Restoration Act.
3a	The submission results in improved air quality (1) through reduction of exposed playa to levels consistent with those prior to 2018, or (2) reduces dust emissions by employing other mechanisms over an equivalent area.
3b	The submission's stated salinity goals, confirmed by modeling projections, should not exceed 70,000 mg/L, which is above identified salinity tolerance ranges for Protected Species and Species of Importance.
4	No extraction or infrastructure being proposed will cause significant ecological impacts to the Biosphere Reserve and Ramsar wetlands of international importance located within the Upper Gulf of California and Lower Colorado River Delta.
5	Solutions must be viable for the project duration (until 2078).

The Fatal Flaw report will be released in July.

We look forward to seeing your additional materials. Let me know if you have any other questions.

Sincerely,
Azucena
--
Azucena Beltrán
Project Coordinator
Salton Sea Long-Term Restoration Review
University of California, Santa Cruz

June 23rd, 2022
Subject: Fatal Flaw 5 Sub-Criterion

Dear [Team Lead Name],

Additionally, we are attaching the Panel's sub-criteria for Fatal Flaw #5 to assist you in your revisions. The sub-criteria are:

1. Is the water source reliable through 2078? The water source of each submission and competing demands for it is evaluated for long-term viability.
2. Can necessary water rights, property rights, access rights, and other needed rights, as well as regulatory permits, be acquired for the project and extended until 2078? This is assessed by reviewing responses for rights and permit-acquisition plans. The permitting plans are examined both in light of what was submitted as well as the Panel's analysis of the project's potential impacts. For example, responses that withdraw water from or dredge within the core zone of the Upper Gulf of California Biosphere Reserve (Biosphere) are not likely to be awarded permits and have water rights approved.
3. Can engineered systems and geologic support systems be reasonably maintained or replaced through 2078? Engineered and geological aspects of the submissions are examined for possible irreversible degradation or unreasonable effort required to replace outdated infrastructure.
4. Does implementing the project create secondary effects such that the harm outweighs the benefits, or does it have severe negative impacts focused on vulnerable regions or communities over the life of the project? Examples of secondary effects include:
    a. Accumulation of brine and salt from seawater desalination. Brine that accumulates over time on land could harm soil fertility, damage water quality in aquifers, or, if mobilized by wind, cause respiratory problems;
    b. Economic/housing dislocation due to rising land values and taxes;
    c. Loss of surface water and/or groundwater security due to relocation to alternative uses;
    d. Increasing pollution resulting from new industrial activity.

Sincerely,
Azucena
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Azucena Beltrán
Project Coordinator
Salton Sea Long-Term Restoration Review
University of California, Santa Cruz