SALTON SEA WATER IMPORTATION SUBMITTAL REVIEW

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Technical Memorandum (TM) #10.1

Prepared for: Independent Advisory Panel

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Subject Area: Evaluation Outcomes

Topic: Salton Sea Hydrology, Elevation, and Surface Area

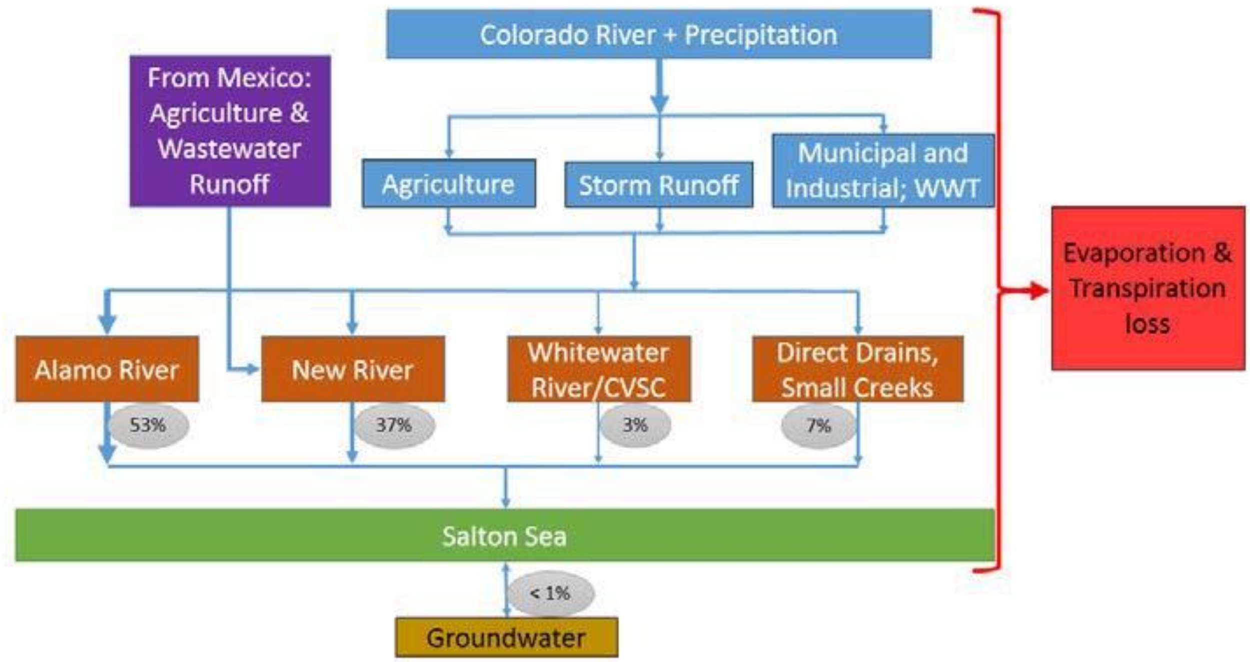
This Technical Memorandum (TM) was prepared as part of the Salton Sea Water Importation Proposal Review to provide information to support and reflect the Independent Review Panel's evaluation of submitted ideas to restore the Salton Sea by water importation and provide the Salton Sea Management Program (SSMP) with approaches that are feasible. Parts of this TM may be used in the Panel's Screening Report, Fatal Flaw Report, Feasibility Report, and/or Summary Report (Reports). In the event that any discrepancies are found between the Reports and this TM, the Reports shall take precedence.

1.0 Salton Sea Hydrology

The Salton Sea hydrology is controlled by complex interactions between agricultural management practices, hydrology, urban use, evaporation, surface water-groundwater interactions and water policy. The conceptual diagram in Figure 1 shows simplified hydrological pathways to and from the Salton Sea. Grey circles show the relevant percent contribution of the total inflow from each source in 2013, based on the Salton Sea Funding and Feasibility Action Plan Benchmark Studies (Tetra Tech, 2015 and 2016). Figure 2 illustrates the Salton Sea watershed and the location of key sampling locations for river inflows and Salton Sea data.

Lands within Imperial Irrigation District (IID) are located around the southern portion of the Salton Sea and lands within Coachella Valley Water District (CVWD) and Torres Martinez Desert Indian Reservation are located around the northern portion of the Salton Sea. IID and CVWD use and divert water rights water on the Colorado River for agricultural and municipal water users. The CVWD and the Torres Martinez Desert Indian Reservation uses groundwater. CVWD also uses recycled municipal water supplies; and IID captures and reuses agricultural drainage and return water flows to reduce water demands on freshwater sources. Agricultural drainage and return water from these entities flow to the Salton Sea. During droughts, water rights water availability declines for IID and CVVWD; and therefore, the agricultural flows into the Salton Sea also declines.

Figure 1: Salton Sea Hydrogeological Pathways



Source: Salton Sea Benchmark 2 Report: Review and Update Existing Condition Data (Tetra Tech, May 2016)

Inflow to the Salton Sea has decreased since the turn of the century primarily due to two reasons (Tetra Tech, 2016):

1. The **Quantification Settlement Agreement (QSA)**, signed in October 2003 by IID and CVWD, other California Colorado River water users, the U.S. Department of Interior, and the California Department of Water Resources (DWR). Under this landmark agreement, about 300,000 acre feet/year (AFY) of Colorado River water (counting both contractual transfers and other reductions) that previously flowed into the Salton Sea will be supplied instead to other users outside the Salton Sea basin for 75 years (through 2078).

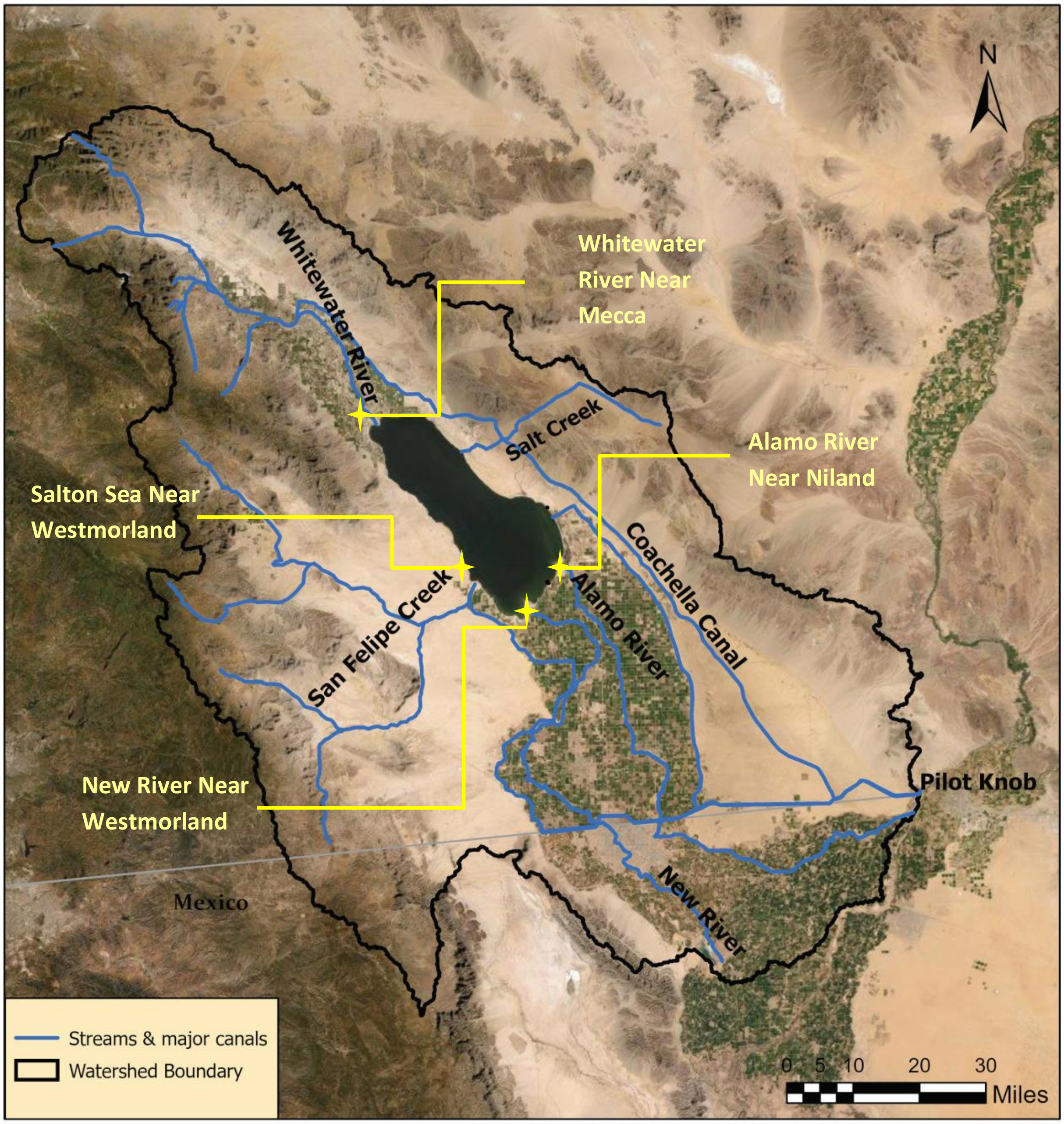
   The QSA and associated provisions in the California Fish and Game Code (Sections 2081.7 (c)(1) and (c)(2)) provided for up to 800,000 acre-feet of water conserved by IID was conveyed into the Salton Sea from 2003 through 2018 to mitigate a portion of the adverse impacts caused by the transfer of water from IID by not increasing the rate of Salton Sea water surface elevation decline and salinity increases that would have occurred without the QSA over the first 15 years of the QSA implementation.

Following adoptions of the QSA, the California Fish and Game Code (Section 2930 *et.seq.*) was amended to require preparation of a restoration study and an environmental impact report (EIR). A Final Programmatic EIR (FPEIR), including the restoration plan, was prepared and published in 2007 (DWR and DFG, 2007).

2. **Mexican efforts to reclaim treated-effluent and farm-drainage flows**, which has and will continue to reduce New River inflows from Mexico.

As the Salton Sea volume decreases due to this hydrologic imbalance, the water level lowers, concentrating water quality constituents like salts in the Salton Sea, decreasing the wetted surface area and subsequently exposing more of the shoreline soils, or playa, at a faster rate, which may have air quality effects. Historic and current salinity and the impacts on ecology and community are discussed in TM 4.1 Salinity and TM 8.1 Salton Sea Ecology. Air quality, odors and potential impacts on public health is discussed in TM 9.1 Public Health.

Figure 2: Salton Sea Watershed and Major Sampling Locations

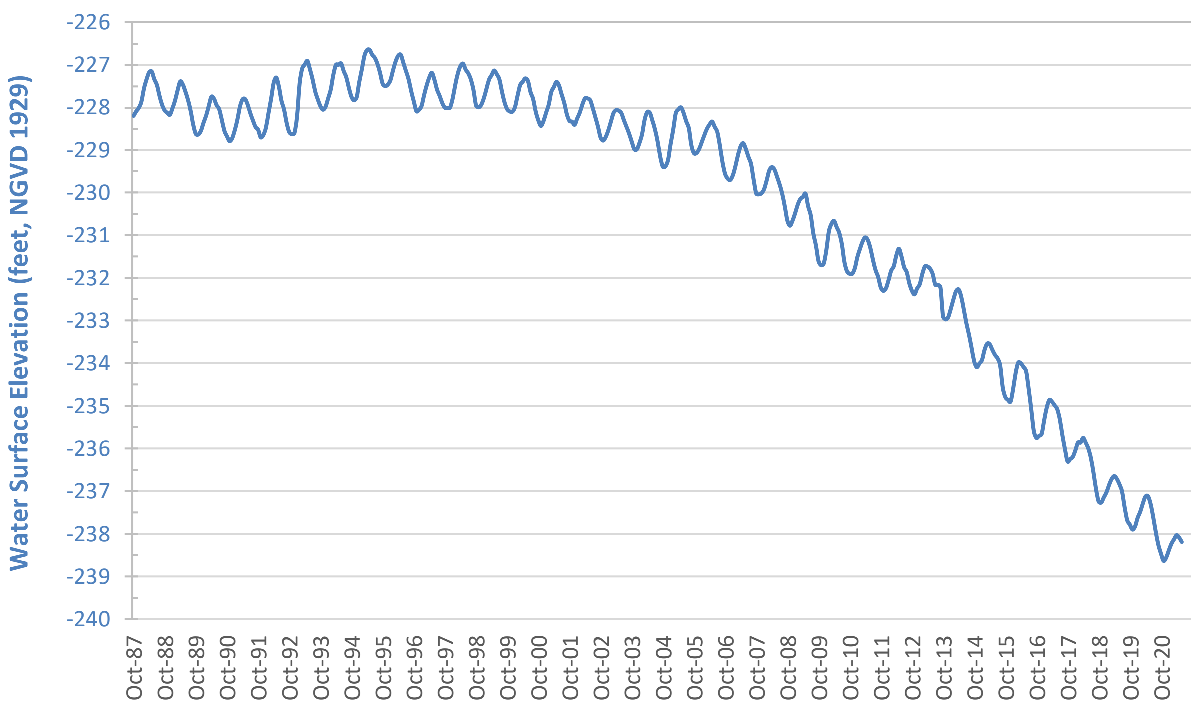


Source: Modified from Crisis at the Salton Sea (UC Riverside, 2021)

2.0 Elevation of the Salton Sea

Daily water surface elevation data for the Salton Sea is measured by the United States Geological Survey (USGS) at the Salton Sea station near Westmorland, CA (#10254005), shown on Figure 2. Historical lake levels from 1987 to 2021 are presented in Figure 3, showing a peak in elevation in 1995, with declining elevations, thereafter, resulting in a 12-foot drop in elevation over the past 15 years. The downward trend in the Salton Sea surface elevation is related to a long-term decrease of inflows due to drought and diminishing flows from Mexico into the New River and from Coachella Valley into the Whitewater River (Tetra Tech, 2016).

Figure 3: Salton Sea Historical Water Surface Elevation and Surface Area (1987 to 2021)



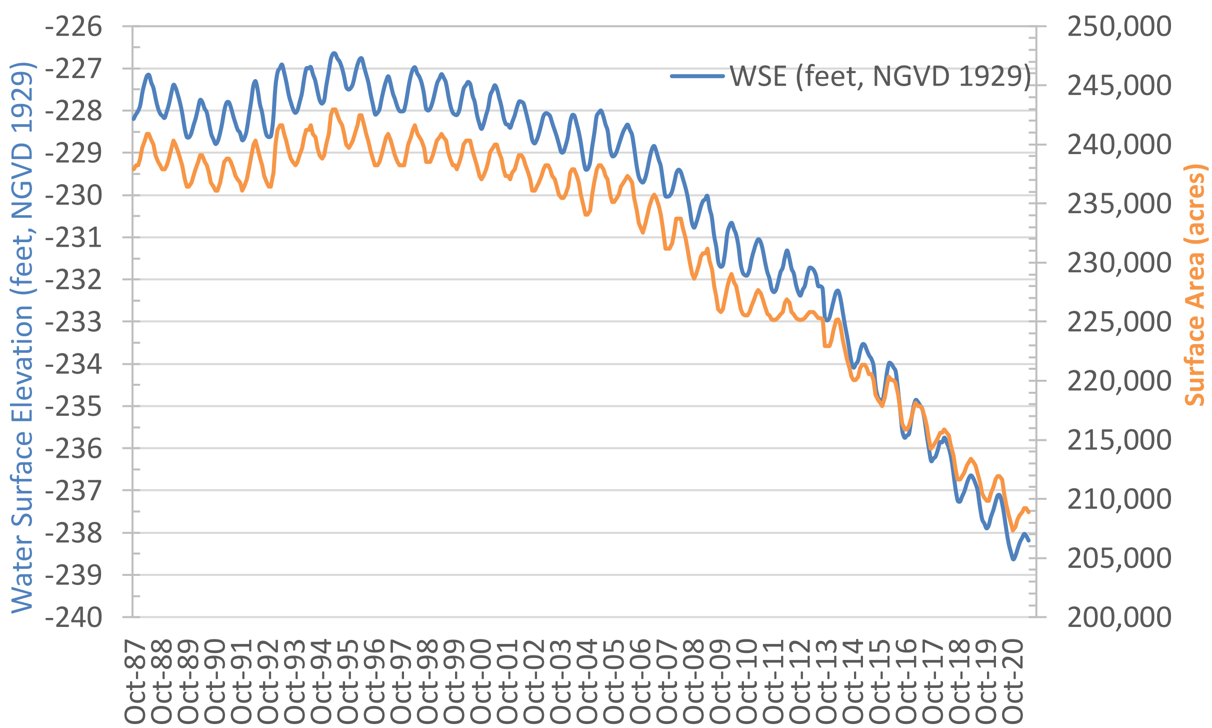
Source: Water Surface Elevation (USGS 10254005 SALTON SEA NR WESTMORLAND CA)

Projected increases in global average temperature and the resulting reduction in snowpack in the Rocky Mountains are expected to decrease Colorado River inflows in the future, increase evaporation and decrease precipitation, all of which will likely continue to result in decreasing water surface elevations in the Salton Sea.

3.0 Salton Sea Surface Area

As a consequence of decreasing inflows and declining water surfaced elevations, the surface area of the Salton Sea is shrinking, exposing the shoreline soils or playa, producing dust rich in metals and pesticides. Windblown dust may have air quality effects to nearby and distant communities. The Salton Sea Accounting Model, initially developed by the US Bureau of Reclamation (USBR) in 2003 and updated over the years, simulated lake wetted surface area based on 1995 and 1999 surveys of underwater topography and levee data. The relationship between water surface elevation data and the wetted surface area was used to simulate historical surface area, as shown in Figure 4.

Figure 4: Salton Sea Historical Water Surface Elevation and Calculated Surface Area



Source: Water Surface Elevation (USGS 10254005 SALTON SEA NR WESTMORLAND CA)
Surface Area (interpolated from Salton Sea Accounting Model)

4.0 Salton Sea Water Surface Elevation (WSE) Considerations from Prior Projects

Over the past 40 years, more than 20 studies and investigations with several hundreds of alternatives have been completed to address the environmental problems at the Salton Sea. Individual study objectives have differed, but the main focus has generally been on controlling salinity and water surface elevation of the Salton Sea to support fish and wildlife and the associated recreation and community goals (DWR and DFG, 2007). The desired Sea elevation has varied greatly depending on the Salton Sea restoration concept, facilities being considered and the organization defining the desired level.

The **Salton Sea Authority (SSA)**, a Joint Powers Authority (JPA) focused on revitalizing the Salton Sea in consultation and cooperation with state and federal governments, aimed for a stable water surface elevation of **-230 feet mean sea level (ft)** for the North Salt Water Lake and **-228 ft** for the Southern Estuary Lake as part of the **SSA Preferred Alternative** (SSA, 2006). The SSA Preferred Alternative included a brine sink within an internal barrier to allow for discharge of salts and maintaining salinity and elevation control in the outer Sea. The sink elevation was envisioned to decrease over time and then stabilize around **-250 ft.**

California Department of Water Resources (DWR) identified a project with a long-term marine sea elevation of **-230 ft** and brine/sedimentation and habitat areas ranging from **-282 to -232 ft** as part of the **DWR Preferred Alternative** (DWR and DFG, 2007). The DWR Preferred Alternative assumed the Salton Sea elevation would quickly stabilize at **-230 ft** by the mid-2030's while the sink elevation would gradually decrease over time.

These alternatives, and other restoration concepts, are evaluated in the Salton Sea Ecosystem Restoration Program **Final Programmatic Environmental Impact Report (Final PEIR)** Report (DWR and DFG, 2007), including the Draft Programmatic Environmental Impact Report (Draft PEIR) for the Salton Sea Ecosystem Restoration, which included the following restoration concepts:

1. Whole Sea Concepts
2. Partial Sea Concepts
3. Shallow Saline Habitat Concepts
4. Saltwater Disposal Concepts

The **Whole Sea Concepts** are most relevant to the *Salton Sea Water Importation Evaluation,* as these concepts address imported water to the Salton Sea to maintain a stable water surface elevation throughout the Salton Seabed, with areas of deep water and estuarine conditions at the confluences with the rivers, creeks, and drains. Imported water from the Gulf of California, Pacific Ocean, Colorado River and recycled water from neighboring counties were considered in the Draft PEIR (DWR and DFG, 2007).

The following sections provide additional details about the no action alternative inflow assumptions (as defined in the Final PEIR), maximum shoreline elevation for the preferred alternatives and the Salton Sea elevation triggers for air quality mitigation.

The water importation submissions being reviewed as part of this effort propose a variety of Salton Sea elevation goals, as summarized in the Project Fact Sheets included in the Panel Orientation Meeting #1 package. ***The intent of this summary is to provide the Panel with background information to aide in the identification of Sea elevation screening criteria to compare proposal concepts.***

4.1 No Action Alternative Inflow Assumptions

The Salton Sea inflow assumptions must be considered to understand the existing conditions and the No Action Alternative water surface elevations. Furthermore, it is important to recognize that inflow assumptions are anticipated to change for future conditions with climate change with reduced precipitation (or more extreme rainfall events), increased evaporation (due to higher temperatures) and reduced flows from the Colorado River watershed (due to decreased availability of irrigation water that results in agricultural drainage flows).

As discussed in Section 1, increased reuse of wastewater flows in Mexico will further reduce future Salton Sea inflow as plans to reuse treated effluent for power generation cooling water and irrigation at new resorts in Baja will result in decreased discharges to the rivers that terminate at the Salton Sea. Also, the amount of agricultural drainage flows has been declining because the Regional Water Quality Control Board implemented water quality criteria that resulted in capture and reuse of the drainage flows, which subsequently improved overall agricultural water supply availability.

Given this context, the inflow assumptions to the Salton Sea can be summarized as follows:

- **Existing Conditions in 2007 DWR Final PEIR (DWR and DFG, 2007)** – average inflow over 75-years is estimated to be 1,300,000 acre feet per year (AFY), without final transfers to San Diego County Water Authority (SDCWA).
- **No Action Alternative in 2007 DWR Draft PEIR (DWR and DFG, 2007) –** average inflow over 75 years is estimated to be 922,000 AFY, difference from existing conditions is due to climate change, final transfers to SDCWA, and increased capture and reuse of agricultural drainage flows.
- **No Action Alternative in Salton Sea Benchmark Reports** (Tetra Tech, 2016)– average inflow over 75 years is estimated to be 717,000 AFY, difference from 2007 No Action Alternative appears to be primarily due to climate change model results.

4.2 Shoreline Elevation for Preferred Alternatives

In the 2007 DWR FPEIR, it states that for the Proposed Project, the shoreline water surface elevation (WSE) needs to be at least -228 ft to -230 ft to allow connectivity to the existing shoreline land uses and facilities, including boat docks and canals that flow into the Salton Sea to allow boats to continue to access the Salton Sea from the canals). This elevation range also would allow for gravity flow from the New River, Alamo River and IID canals into the Salton Sea. Historically, IID has pumped agricultural drainage into the Salton Sea when WSEs were higher than -228 feet. WSE higher than -228 ft would also flood some land uses, especially at the northern and eastern shorelines.

For reference, the 2007 FPEIR Existing Conditions included a WSE of -228 ft in 2004 and the No Action Alternative conditions for 2078 (at the end of the QSA approved operational periods) included a WSE of -248 ft without climate change considerations and -260 ft with variable climate change considerations.

The Salton Sea Benchmark Report (Tetra Tech, 2016) noted that the WSE should range from -228 ft to -230 ft to avoid conflicts of interest with existing land use. Also, under this concept, the higher elevation in the South Lake (-228 ft) would drive circulation to the lower elevation in the North Lake (-230 ft). This document also noted that the 2015 Existing Conditions WSE at -233.7 ft and defined the "Baseline" No Action Alternative in 2077 WSE at -252 ft. As shown in Figure 3, the current Salton Sea WSE is at -239 ft as of Sept 2021, according to the USGS gage.

4.3 Salton Sea Elevation Triggers for Air Quality Mitigation

Though difficult to quantify, measurement and modeling studies suggest that ongoing declines in lake volume will contribute to lower air quality for residents throughout the basin and beyond. The transport, composition, and health impacts of air pollutants originating from the Salton Sea and its exposed lakebed though not fully understood in its magnitude, is impacting the health and well-being of local communities (UC Riverside, 2021). The WSE of the Salton Sea is directly tied to the declining wetted area of the Salton Sea and subsequently the exposure of dried lakebed, or playa, which results in the release of airborne dust fluxes, which impact air quality. DWR was ordered by the State Water Resources Control Board to mitigate dust emissions by implementing a variety of dust control measures to meet ambient air quality standards.

As described in the Final PEIR (DWR and DFG, 2007) and Section 1.0 of this document, implementation of the QSA was considered under the Existing Conditions and No Action Alternative. Under the QSA, mitigation water was released until 2018 by IID to avoid water elevations below 235 ft by 2018. The WSE was projected to decline by 2078 to -235 feet without the QSA or restoration projects (CVWD et. al., 2002 and 2003). Therefore, Air Quality Mitigation Plans considered in the Final PEIR (DWR and DFG, 2007) considered impacts due to the QSA and restoration plans and associated mitigation measures for exposed land as the Salton Sea declines below -235 ft. Most of the land ownership between -228 ft and -235 ft is by the Federal Government and IID and within lands of the Torres Martinez Desert Cahuilla Indian Reservation.

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