EXECUTIVE SUMMARY

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BACKGROUND

The All American Canal (AAC) and its Coachella Branch (CB) divert approximately 3.4 million acre-feet of water per year from the Colorado River for use in Imperial and Coachella Valleys and approximately 100,000 acre-feet of water per year is currently lost by seepage into the ground along unlined portions of the AAC and its CB. In order to conserve water, California State Senate Bill 1765 provides funding to line portions of the AAC and its CB and requested that a seepage study be conducted prior to lining the canals. A Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (Bureau of Reclamation, 1994) calls for lining a 23 mile section of the AAC to conserve approximately 67,700 acre-feet of water per year. A draft EIS/EIR (Bureau of Reclamation, 1993) calls for lining a 33.4 mile section of the CB to conserve approximately 25,680 acre-feet of water per year. The canal lining projects are projected to be completed in 2006.

The EIS/EIR for these projects indicates that the primary environmental consequences of the proposed lining projects are (1) the potential loss of wetlands habitat along the canals that have been induced by seepage and (2) the reduction of the fish population in the canals. Each project proposes mitigation plans to permit their implementation with no significant loss of environmental resources. This study determines the nature of subsurface and drainage canal water movements from the unlined AAC and CB canals to the Salton Sea and to existing adjacent wetlands, and quantifies the amount of water that may be lost to the Salton Sea and to those wetlands due to the proposed AAC and CB canal lining projects, taking into account the mitigation commitments already identified for each project.

DESCRIPTION OF STUDY AREA

The study area is located in Imperial and Mexicali Valleys and the East Mesa within the Salton Trough, a large sediment filled depression in the Colorado Desert of California. Elevations along the Imperial Valley floor run from near sea level at the Mexican-US border to 226 feet below Sea level at the Salton Sea shoreline in the northern Imperial Valley. Imperial Valley has a desert climate with temperature often exceeding 100°F in the summer and an average annual rainfall less than 3 inches. There has been extensive agricultural development in the area, and the AAC and CB import Colorado River water for

irrigation. Seepage from these canals recharges groundwater in the East Mesa and East Salton Sea, resulting in a shallow water table which supports pre-existing and developed wetlands in some areas along the canal and between the canals and the Salton Sea. Wetlands are dominated by an invasive exotic phreatophyte--salt cedar. Salt cedar has taken over approximately 50 percent of total wetland acreage along the AAC and 70 percent along the CB (Bureau of Reclamation 1993, 1994).

GROUNDWATER BASIN CHARACTERIZATION AND CONCEPTUAL MODEL

Groundwater in the study area occurs in water-bearing formations within East Mesa, the East Salton Sea, the Imperial Valley, and Mexicali Valley, which are bordered on the northwest by the Salton Sea, on the northeast by the Chocolate Mountains, on the southeast by the Cargo Muchaho Mountains and Pilot Knob, on the west by the San Jacinto fault, and on the south by the Colorado River. Groundwater is found in these areas within a 250-foot-thick shallow unconfined alluvial aquifer, a 130-foot-thick aquitard at intermediate depths, and a 350-foot-thick deeper semi-confined alluvial aquifer. Major sources of groundwater recharge include seepage from the unlined portions of the All American and Coachella Branch Canals and recharge during high flow years in the Colorado River in Mexico. Major sources of groundwater discharge include drainage into the New and Alamo Rivers and the Drain La Mesa, underflow into Mexicali Valley, and discharge to wetlands.

Aquifer transmissivity varies from low values of 100 ft^2/day in the lake sediments deposited in the center of the Salton Trough to high values of 40,000 ft^2/day in the sand and gravel sediments deposited in the East Mesa. Aquitard leakage rates are low, creating confined artesian conditions in areas between the East Mesa and the Alamo River. A water balance was estimated for the AAC seepage, and 83 percent of this seepage flowed into Mexico, 8 percent was discharged as evapotranspiration, and 9 percent flowed into East Mesa and Imperial Valley. A water balance was estimated for the East Salton Sea, and nearly all the CB seepage was found to discharge as evapotranspiration or as base flow into Salt Creek. In addition to canal water, a significant volume of geothermal water upwelling along range front faults was also found to discharge as evapotranspiration in the East Salton Sea.

NUMERICAL GROUNDWATER FLOW MODEL

The USGS groundwater model MODFLOW was used to develop a groundwater flow model of the study area. The model covers a 93 mile by 52 mile area of the East Salton Sea, East Mesa, and central Imperial Valley and includes three sub-horizontal layers representing the three regional hydrostratigraphic units of Imperial Valley: the shallow unconfined aquifer, the regional aquitard, and the deeper confined aquifer. The model was calibrated under steady-state conditions to the water levels and canal seepage rates in effect prior to the lining of the first 49 miles of the CB, and under transient conditions to the draining water table beneath the CB canal for the period following the lining the first 49 miles. The transient calibration of the lining of the first 49 miles also represents a validation of this model for predicting the effects of the AAC and CB lining projects.

The model was used to predict the effects of the AAC and CB canal lining projects on the seepage rates to the Salton Sea and adjacent wetlands during the period from 2006 to 2025. For the model predictions, canal seepage rates were reduced to reflect the lined canal leakage; water levels were modified at the southern boundary in Mexico to account for the canal lining effects on regional water levels; and wetland acreage and water application rates were modified according to pre-defined AAC and CB mitigation measures. The approach in mitigation was one of exchange and replacement of the invasive, low value salt cedar habitat for higher value screwbean mesquite, honey mesquite, and other native habitat. The model predictions include the change in seepage for the following components of groundwater discharge: evapotranspiration rates at the AAC Drop 3/Drop 4 wetlands complex; evapotranspiration rates at the CB wetlands; groundwater seepage rates into the Salton Sea; and groundwater discharge into the East Highline Canal, the New and Alamo Rivers, and the IID tile irrigation drain network.

The model predicts the amount of water that may be lost to the Salton Sea and salt cedar-dominated wetlands due to the proposed AAC and CB canal lining projects, taking into account the mitigation commitments, as shown in Tables E-1 and E-2. The Model predicts much lower reductions in wetland evapotranspiration in the CB lining project than originally projected in the draft CB EIR. Original EIR documentation projected immediate (within 10 years) reductions in evapotranspiration resulting in losses of 4,293 acres of wetlands. Of that 3,420 acres, 80 percent of the acreage would consist of pure stands of salt cedar. To mitigate for these losses, the Draft EIR called for revegetation with native vegetation such as California fan palms, honey mesquite, screwbean mesquite, cottonwood/willow, and riparian shrubs;

acquisition of riparian and marsh communities; and maintenance of flows in Salt Creek (up to 7,000 acre-feet was reserved, as needed, to provide for mitigation). When modeled, these mitigation commitments result in future surface and evapotranspiration demands which are less than current demands supplied by natural groundwater discharges. Recognizing that surface water will be a part of mitigation for lining the CB, model studies indicate that natural discharges from groundwater storage will be sufficient to sustain proposed mitigation measures well beyond the year 2026.

Table E-1

Adjacent Wetland Water Use,
Lined and Unlined Conditions in 2026

Wetland Complex	Wetland Type	Unlined Water Use* (af/yr)	Lined Water Use* (af/yr)		Change in Water Use* (af/yr)	
			High	Low	High	Low
AAC-Drop 3/4	marsh and desert riparian (9% marsh)	5,326	5,546	5,546	+220	+220
AAC-Drop 2/3 scattered	desert riparian	500	0	0	-500	-500
AAC-canal bank	marsh	120	0	0	-120	-120
Total AAC		5,946	5,546	5,546	-400	-400
Total CB	marsh and desert riparian (3.8% marsh)	37,941	24,643	14,218	-13,298	-23,723
Total AAC and CB		43,887	30,189	19,764	-13,698	-24,123

Note: *Model output values are rounded only to the nearest af/yr for convenience in verifying against model output files. Rounding to the nearest 1,000 af/yr is appropriate to indicate the degree of predictive accuracy.

Table E-2

Groundwater Discharge to Salton Sea and its Inflows,
Lined and Unlined Conditions in 2026

Surface Water Feature	Pathway to Salton Sea	Unlined Groundwater Discharge* (af/yr)	Lined Groundwater Discharge* (af/yr)		Change In Groundwater Discharge* (af/yr)	
			High	Low	High	Low
New River and Alamo River	Direct discharge of fraction not consumed by ET	63,324	63,315	63,210	-9	-114
IID Drains	Discharge via rivers of fraction not consumed by ET	21,769	20,798	9,227	-971	-12,542
Salton Sea (SS)	Direct discharge	24,320	22,605	14,112	-1,715	-10,208
Salt Creek	Direct discharge of fraction not consumed by ET	2,000	2,000	2,000	0	0
Total Water Discharge to SS	Direct discharge of fraction not consumed by ET	111,413	108,718	88,549	-2,695	-22,864

Note: *Model output values are rounded only to the nearest af/yr for convenience in verifying against model output files. Rounding to the nearest 1,000 af/yr is appropriate to indicate the degree of predictive accuracy.

The model predicts somewhat larger reductions in seepage to the AAC Drop 3/Drop 4 complex than projected in the AAC EIR. However, based upon the AAC mitigation commitments, this seepage reduction predicted by the model was assumed to be offset by diversion of 1,400 acre-feet per year from the AAC.

The impacts of these discharges varies depending on the pathway between the discharge point and the Salton Sea or wetlands. For example, groundwater seeping into surface waters that drain to the Salton Sea may be partially consumed by evapotranspiration during transport reducing the impact on the sea, while all groundwater seeping directly into the Salton Sea will impact the sea.

The decrease in water discharging to the East Highline Canal (EHC) is assumed not to be lost to the Salton Sea because the EHC water is applied as irrigation in Imperial Valley. All water lost to the New and Alamo Rivers and the IID irrigation tile drains is assumed to be lost to the Salton Sea to present a conservative, worst-case scenario.

WATER LOSSES TO SALTON SEA AND ADJACENT WETLANDS

Reviewing the model results, the most likely estimate for the amount of water that may be lost to the Salton Sea and to the adjacent wetlands due to the proposed canal lining projects and their proposed mitigation commitments is 10,000 acre-feet per year and 19,000 acre-feet per year, respectively, for a total of 29,000 acre-feet per year. The seepage losses to the Salton Sea are thought to be somewhat uncertain due to the large distance and travel time from the canals, and the reduction in seepage to the Salton Sea may range from 3,000 to 23,000 acre-feet per year. The estimates for the seepage losses to the wetlands are thought to be more certain due to the proximity of the wetlands to the canals, and the reduction in seepage to the wetlands may range from 14,000 to 24,000 acre-feet per year.

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