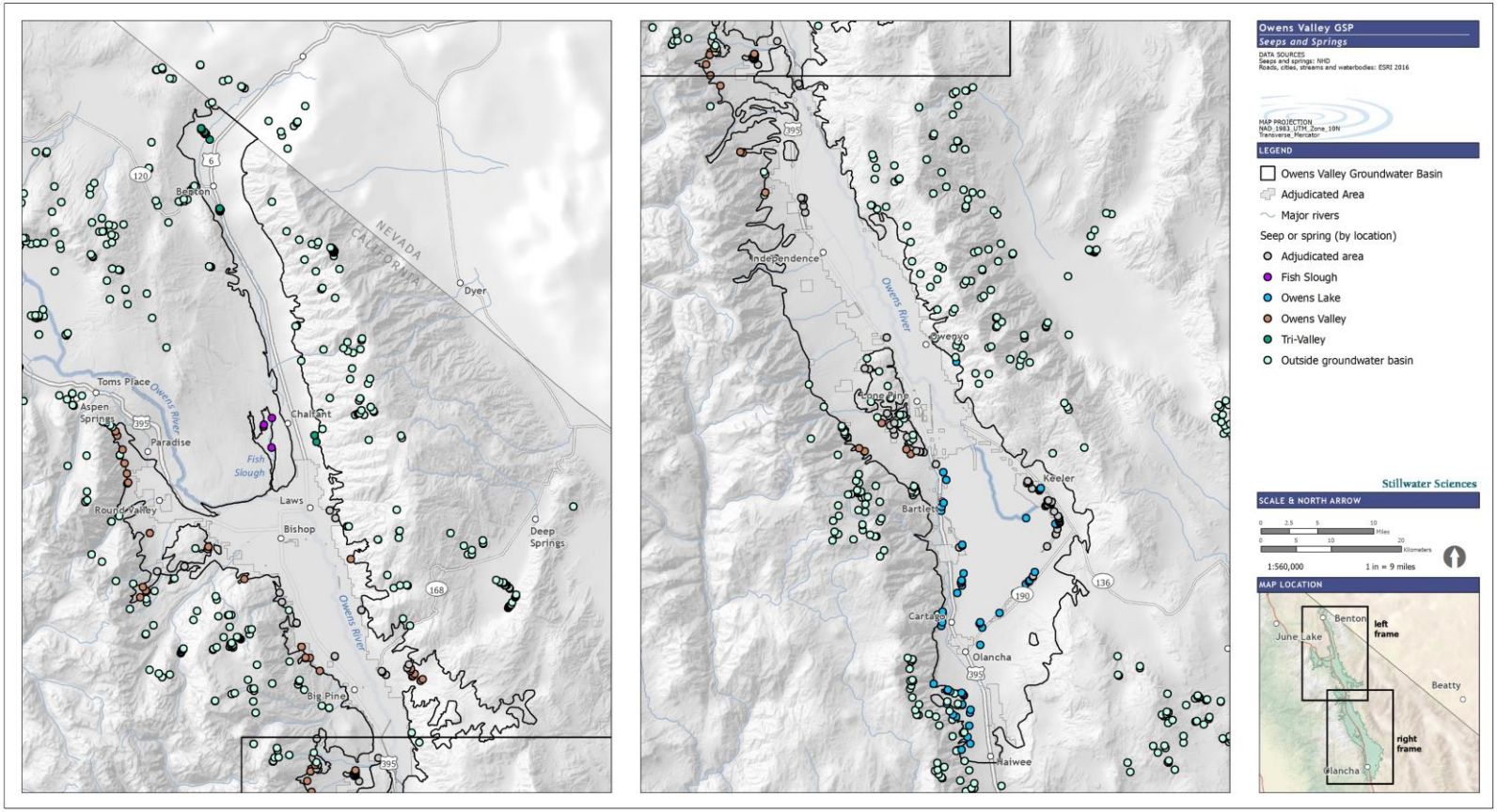


Figure 2-24. Seeps and Springs in the Owens Valley Groundwater Basin and vicinity.

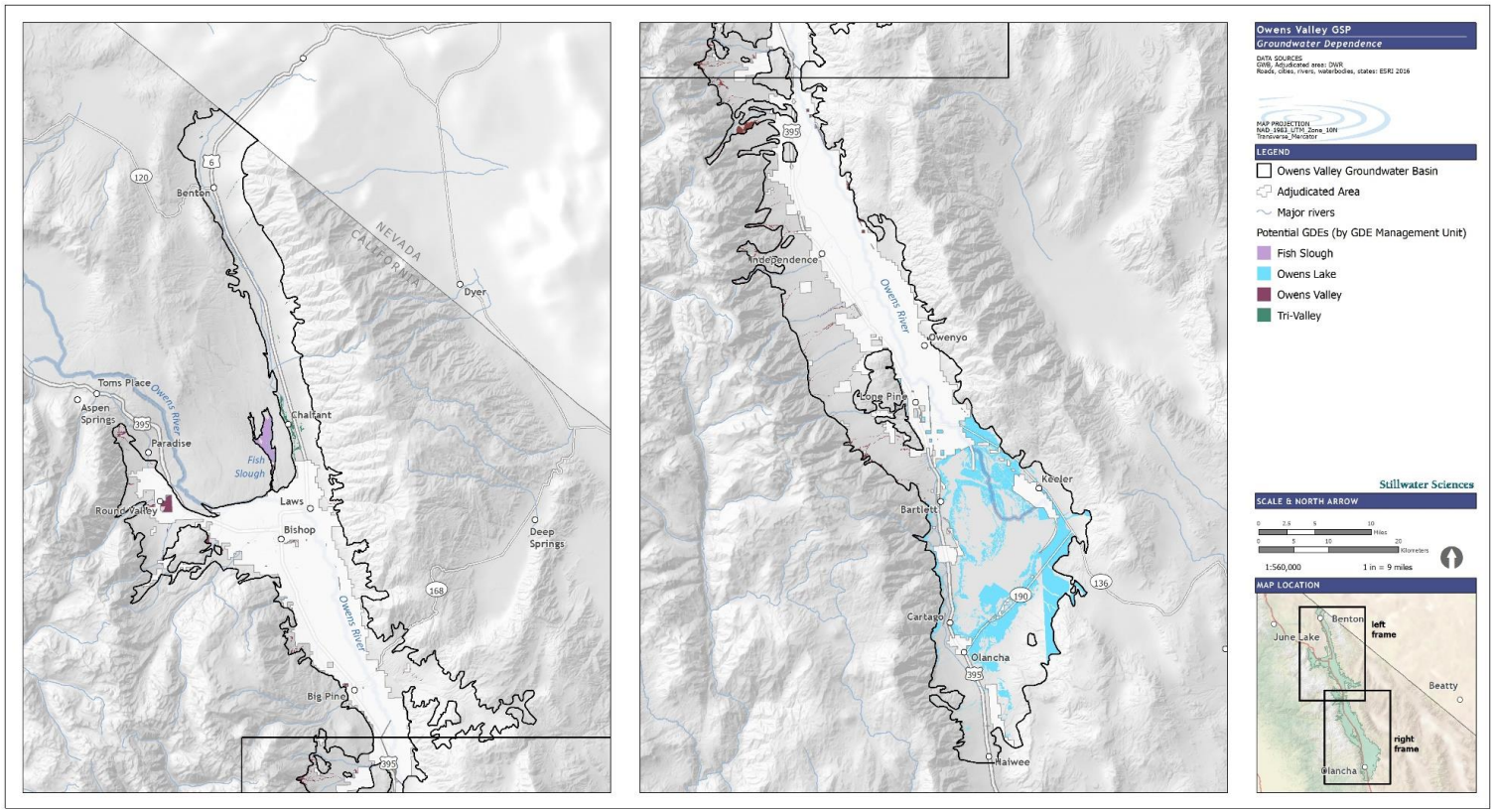


Figure 2-25. Final GDE map including vegetation polygons kept and removed by ICWD. The kept polygons represent GDE communities consistently mapped within the adjudicated as well as extensive areas on Owens Lake that are dust control measures.

GDEs: Potential GDE units in the Owens groundwater basin were identified using the California Department of Water Resources' (DWR) indicators of groundwater dependent ecosystems (iGDE) database (Klausemeyer et al., 2018). The database is published online and referred to as the Natural Communities Commonly Associated with Groundwater dataset (DWR, 2020b) which includes vegetation and wetland natural communities. The iGDE database was reviewed in a geographic information system (GIS) and used to generate a preliminary map that served as the primary basis for identification of potential GDEs. This dataset is a combination of publicly available data and uses the following sources to identify potential GDEs in the Owens groundwater basin:

- Vegetation Classification and Mapping Program (VegCAMP), California Department of Fish and Wildlife
  - Central Mojave Vegetation Database (United States Geologic Survey [USGS] 2002)
  - Fish Slough (California Department of Fish and Wildlife [CDFW] 2014)
  - Manzanar National Historic Site (United States National Park Service, 2012)
- Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) – United States Department of Agriculture - Forest Service (USDA 2014)
- Fire and Resource Assessment Program (FRAP) – California Department of Forestry and Fire Protection (CAL FIRE, 2015)
- National Wetlands Inventory - Version 2.0 (NWI v2.0), U.S. Fish and Wildlife Service (USFWS 2018)
- National Hydrography Dataset (NHD) – Springs and seeps, (USGS 2016)

In addition to the sources identified by the iGDE database listed above, the final GDE map includes vegetation data from the following sources:

- Vegetation Mapping and Classification of the Jawbone Canyon Region and Owens Valley (Menke et al. 2020)
- Delineation of Waters of the United States for the Owens Lake Playa (Jones and Stokes and GBUAPCD, 1996).

Additional information on vegetation community composition, aerial imagery, depth to groundwater from local wells (where available), plant and species distributions in the area, plant species rooting depths, and local observations from Inyo County Water Department biologists (ICWD, 2020) were also relied upon to prepare the GDE map. These data were reviewed and

augmented with additional vegetation mapping datasets to produce a final map of potential GDE units (Figure 2-25).

Rohde et al. (2018) recommended that maps of likely GDEs to prepare a GSP be compared with local groundwater elevations to determine where groundwater is within the rooting depth of potential phreatophytic species, and assigning GDE status to vegetation communities if water table depth is within 30 feet of the ground surface, or where interconnected surface waters are observed. This is not possible in the GSP area where groundwater data were more sparse. Instead the final GDE map incorporated a combination of local expertise of biologists at the ICWD and literature on groundwater dependence of plant communities in the Owens Valley. The extensive history of studies of GDEs in the valley to manage LADWP's groundwater pumping had previously established the typical DTW ranges for plant communities that are unavailable in other basins. ICWD has extensive data linking groundwater depth and species occurrence (e.g., Manning 1997; Elmore et al., 2003) as well as measurements of evapotranspiration (ET) using measurements of stomatal conductance (Steinwand et al., 2001) and eddy covariance (Steinwand et al., 2006). These ET measurements can be compared with measurements of local rainfall to determine the portion of the plant water needs that are supplied by groundwater. As a result, ICWD has a detailed local understanding of what plant species and vegetation communities are likely to be phreatophytic and those that are likely not connected to groundwater. The preliminary map was reviewed by ICWD to help determine which polygons included by the iGDE database and map (DWR, 2020b) are likely to be dominated by phreatophytic species in the Owens Valley. Polygon boundaries on the iGDE map were not redrawn. The ICWD analysis was used wherever the final assessment was based on CalVeg, FRAP, or VegCAMP (Mojave VegCAMP or Fish Slough). See Appendix 9 for a complete description of the methods.

The final map of potential GDE locations is shown in Figure 2-25 for each Management Area or subbasin, and overall acreages summarized in Table 2-8. Several improvements to the map in Figure 2-25 should be completed during implementation of this GSP before the five year assessment or if there is a change in prioritization of the Basin. The ICWD review of iGDE mapped polygons was primarily based on local knowledge and ground truth of whether the species and plant communities at the locations typically would require water in excess of precipitation. Discrimination of the water source tapped by the vegetation or adjusting polygon boundaries in the field was beyond the scope of this evaluation. As a result, areas of higher

Table 2-8. Extent of GDEs by management area and subbasin.

Management area	Owens Valley	Owens Lake	Tri-Valley	Fish Slough	Total
Total Area (acres)	184,788	170,491	71,839	2,943	430,061
GDE extent (acres)	6,115	46,129	1,033	2,191	55,468
Percent of area composed of GDEs (%)	3.3	27.1	1.4	74.4	12.9

vegetation cover on tributaries are reflected in the potential GDE map, but as described above, these narrow bands of vegetation are likely dependent on surface water runon and infiltration and not a shallow water table.

The iGDE map captured extensive areas on Owens Lake that are part of the water-based dust control measures. It was difficult to segregate the iGDE polygon boundary between spring and seeps that border the lake and the shallow flood or managed vegetation dust control measures located more toward the center of the lake. That boundary will be more precisely mapped using information prepared in the next GSP update. Also, areas of low cover phreatophytes occurring in dunes surrounding the lake were not captured in the iGDE map. Mapping and studies of the groundwater dependence of those areas is an ongoing study part of the OLGDP. The GSP and GDE map will be updated as new data or refinements based on additional ground truth are available or if the Basin is reprioritized. The remainder of the map polygons outside the lakebed and tributaries in Figure 2-25 likely represent plant communities that are consistently mapped within the adjudicated area as GDE. The details of the relationship between groundwater levels and vegetation health or susceptibility to the declining water levels in the vicinity of Tri-Valley and Fish Slough is hampered by identified data gaps in groundwater monitoring or modeling. Management Actions and Projects to address those data gaps are included in Section 4.

Threatened and endangered species, and critical habitat: The Owens Valley Basin is ecologically diverse and includes numerous species and habitat that are groundwater dependent. Thirty-six special-status terrestrial and aquatic wildlife species were identified as indirectly or directly groundwater dependent (Appendix 9). Species endemic to Owens Valley that are likely to be found within one or more of the management areas include: Owens pupfish (*Cyprinodon*

radiosus), Owens tui chub (*Siphateles bicolor snyderi*), Owens speckled dace (*Rhinichthys osculus ssp*), Owens Valley vole (*Microtus californicus vallicola*), and Owens Valley springsnail (*Pyrgulopsis owensensis*). Appendix 9 provides additional information on special-status terrestrial and aquatic animal species that may occur in the Basin including regulatory status, habitat associations, and likelihood to occur in management areas. In addition, 25 special-status plant species were documented within the Owens Valley Basin, 18 of which are identified as certain or likely to be dependent on groundwater.

Owens Valley, Owens Lake, and Fish Slough management areas overlap with USFWS-designated critical habitat for four federally listed species: Fish Slough milk-vetch (*Astragalus lentiginosus* var. *piscinensis*), Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*), Sierra Nevada yellow-legged frog (*Rana sierrae*), and yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (USFWS 2005, USFWS 2008, USFWS 2016, USFWS 2020). The acreage of critical habitat for each species within the Owens Valley, Owens Lake, Tri-Valley, management areas is summarized in Appendix 9.

Habitat management and special-status species recovery plans have been implemented in the Owens Valley Basin and include protections for special-status species and associated habitats. These plans include *Owens Basin Wetland and Aquatic Species Recovery Plan Inyo and Mono Counties, California* (USFWS 1998), *Owens Lake Habitat Management Plan* (LADWP, 2010), *Owens Valley Land Management Plan* (LADWP and Ecosystem Sciences, 2010), and the *LADWP Habitat Conservation Plan* (LADWP, 2015). No provision of this GSP conflicts with those plans.

GDE Value and Conditions: Hydrologic and ecological value and condition of the GDEs in Figure 2-25 within each Management Area or subbasin were characterized and assigned a relative rank to summarize the results of the this analysis (high, medium, low, see Rohde et al. 2018). Fish Slough is a designated ACEC with substantially different ecology than the primarily agricultural land use of the Benton, Hammil, and Chalfant valleys and was evaluated separately from those valleys. The evaluation of ecological conditions relied primarily on remote sensing data related to vegetation vigor or wetness as well as other monitoring data (Appendix 9). The evaluation also included an assessment of the vulnerability to changes in groundwater discharge or levels that could substantially alter their distribution, species composition, and/or health. Historical impacts to GDEs that have already occurred in the GSP area were documented in the available

datasets and therefore could not be tabulated separately in the results. The results of the ecological evaluation are shown in Table 2-9.

The Tri-Valley Management Area was determined to have low ecological value because: (1) it supports a relatively small number of special-status species and ecological communities, (2) contains no designated critical habitat for federally listed species, (3) supports few species that are directly dependent on groundwater (two mollusks), and (4) includes few species or ecological communities that are vulnerable to changes in groundwater conditions. Additional groundwater and vegetation mapping and monitoring is necessary to assess the susceptibility of the GDE in Tri-Valley to pumping management.

The Fish Slough subbasin was determined to have high ecological value because: (1) it supports a moderate number of special-status species and ecological communities, (2) contains designated critical habitat for the federally listed and highly endemic Fish Slough milk-vetch, (3) supports two fish and two mollusk species that are directly dependent on groundwater, and (4) includes several species and ecological communities that are highly or moderately vulnerable to changes in groundwater conditions.

The Owens Valley Management Area was determined to have high ecological value because: (1) it supports a relatively large number of special-status species and ecological communities, (2) contains a relatively large amount of designated critical habitat for four federally listed species, (3) supports two amphibians and three mollusk species that are directly dependent on groundwater, and (4) includes species and ecological communities that are highly or moderately vulnerable to changes in groundwater conditions.

Table 2-9. Ecological Condition rank for each management area or subbasin.

Management area	Owens Valley	Owens Lake	Tri-Valley	Fish Slough
Ecological Value	High	High	Low	High
Ecological Condition	Fair	Undetermined†	Fair	Fair
Susceptibility to GW changes	Moderate	Undetermined	Low	High

†: Difficult to determine using methods adopted for the GSP analysis. Historically there has been low amounts of groundwater pumping in the Owens Lake Management Area. PoThe Owens Lake tential pumping effects on GDEs are the subject of LADWP's ongoing studies.

Management Area was determined to have high ecological value because: (1) it supports a relatively large number of special-status species and ecological communities, (2) supports one amphibian, two fish, and one mollusk species that are directly dependent on groundwater, and (3) includes species and ecological communities that are highly or moderately vulnerable to changes in groundwater conditions.

The ecological condition of the GDEs were similarly ranked based on a variety of vegetation and other monitoring data (Appendix 9). The results are shown in Table 2-9. Ranks describing the susceptibility to groundwater changes were also included based on categories developed by Rohde et al. (2018) based hydrologic data, climate predictions, and remote sensing measures of aggregate GDE changes in each management area or subbasin since the baseline time (since 1985). See Appendix 9 for a detailed description of these categories and supporting data.

The health of GDEs has been monitored extensively in the adjudicated area of the Basin by ICWD using similar remote sensing of vegetation coupled with targeted field verification. Applying a similar approach to GDEs where they occur outside the adjudicated area would allow the OVGA to efficiently monitor GDEs. This was not a SGMA requirement but was included as a possible Management Action (Section 4). If necessary, the GSP can be updated to include additional monitoring as it becomes available.

2.2.3 Water Budget Information (Reg. § 354.18)

The water budget information contained in this section is a summary of the findings presented in Appendix 10 containing the Water Budget Technical Memorandum. For more details, the reader is referred to the appendix.

This basin is highly dependent on groundwater supplies for potable supplies, but overdraft conditions have NOT been identified for the overall basin. In recognition of the varying hydrogeologic conditions in the basin, the OVGA has identified three management areas (see Section 2.2.4): Tri-Valley, Owens Valley, and Owens Lake (Figure 2-26). When considering water budget components, it is worth restating a few notable basin characteristics from Section 2.2.1. The Owens groundwater basin is a closed basin and no natural surface or groundwater flow exits the basin other than aqueduct water exported by LADWP. The majority of the basin consists of publicly owned land that is not available for development, limiting past and future

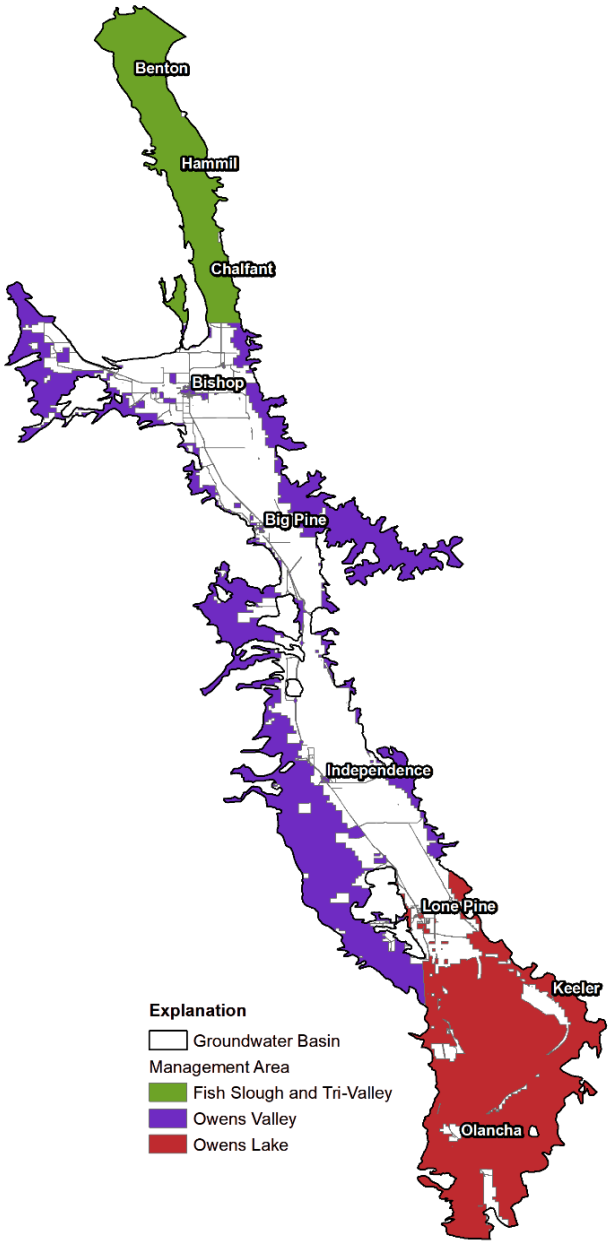


Figure 2-26. Owens Valley Management Areas. White area in the center of the Basin are lands not subject to SGMA.

growth. The majority of groundwater extraction occurs in the adjudicated portion of the basin, which is managed according to the LTWA. A second but smaller concentration of pumping is in the Tri-Valley area.

LADWP has developed and updated or maintained several groundwater models for the Owens Basin which in aggregate cover the Owens Valley and Owens Lake Management areas. These models represent the most rigorous synthesis of the hydrologic conditions in their domain, but unfortunately these models were not publicly available, and the OVGA was not able to obtain copies of the models via cooperation. Efforts to obtain these models or at least the steady-state model output files continue. Lack of active groundwater models for the basin is identified as a data gap and the specific OVGA actions to address this data gap are identified in Section 4.3 and 4.3 of this GSP.

In lieu of water budget outputs from these recent groundwater models and due to a lack of model coverage in the Tri-Valley management area, this GSP uses best available information to estimate water budget inflows and outflows. The basic water balance equation is that inflows (including precipitation, surface and ground water inflows) minus outflows (including evapotranspiration, groundwater extraction, surface and groundwater discharge) equal change in storage (changes in the volume of storage will be tracked using groundwater levels as a surrogate). Efforts to estimate the water balance components included synthesizing and evaluating existing hydrologic studies containing water budget components, conducting additional land-system modeling using the USGS Basin Characterization Model (BCM) for assessment of the historical (1986-2016), current (2006-2016), and future water budget inflow components including simulated impacts of climate change,

2.2.3.1 Previous Investigations

Harrington (2016) completed the most recent evaluation of the water budget for the basin. He reviewed previous studies to estimate the water budget for the entire Owens Valley groundwater basin and also for the Tri-Valley, Owens Valley, and Owens Lake areas to assess regional differences in the Basin. The Owens Valley and Owens Lake areas are intensively monitored by LADWP and recharge and discharge components of the water balance are better understood than in other portions of the Basin. Notable prior groundwater modeling efforts summarized by Harrington (2016) included: USGS modelling for the Owens Valley area

Table 2-10. Owens Valley Groundwater Basin Water Budget (adapted from Harrington, 2016).

Management Area	Recharge (AFY)	Discharge (AFY)	
		Pumping	ET, springs seeps, water course baseflow
Tri-Valley region	17,000-43,000	16,200-19,600	5,000[1]
Owens Valley	183,800	98,000[2]	84,000
Owens Lake	29,500-55,000	2300[3]	51,400
Subtotal	230,300-281,800	116,500-119,900	141,400
Total	219,700-271,200[4]	256, 900-260,300	

1: 4,400 AFY groundwater discharge at Fish Slough plus 600 AFY discharge in Chalfant Valley
2: 78,000 AFY pumping by LADWP plus 10,000 AFY by non-LADWP pumpers, plus 10,000 AFY from flowing wells
3: Includes 2,000 AFY for irrigation and 300 AFY for water bottling plant
4: 10,600 AFY was subtracted to account for overlap with Owens Valley (Danskin, 1998) and Owens Lake (MWH, 2011a-c) study areas.

(Danskin, 1998); Camp, Dresser, McKee (CDM 2000) modeling on behalf of LADWP for the Owens Lake Management Area with additional review and analysis conducted by MWH America's (MWH, 2013); and MHA Environmental Consulting (MHA 2001) modelling of the Tri-Valley area.

Harrington (2016) also prepared original estimates for some water balance components that were poorly or not quantified by previous studies. In each of the subareas the greatest uncertainty in the water balance were inflows from recharge and runoff. The groundwater extraction outflow component for the Tri-Valley Management area was also uncertain due to lack of monitoring data and was estimated based on irrigated acreage totals obtained from remote sensing/GIS analysis and approximate water duty for alfalfa. The pumping total in Tri-

Valley also includes the estimated domestic pumping use based on the approximate water duty and number of households.

Table 2.10 presents the Harrington (2016) water budget. These values were developed using values representing long-term averages and should be considered representative of an "average" water-year or steady-state conditions during recent decades. A range of the change in volume of water storage in the Basin can be computed from Table 2.10 by subtracting minimum discharge values (outflows) from minimum recharge values (inflows). For the Tri-Valley regions this range in average annual storage volume is between -4,200 AFY (loss in storage reflected in the declining groundwater levels) and +18,400 AFY (gain in storage which should be reflected by rising water levels). For the Owens Valley the average annual storage volume is +1,800 AFY suggesting it is approximately in balance. For the Owens Lake area the range in average annual storage volume is between -24,200 AFY and +1,300 AFY.

There is a significant range of values presented in Table 2-10 for the Owens Lake and Tri-Valley management areas reflecting the range in estimates used in previous studies. For the Owens Lake area, the water budget values derived from CDM (2000) steady state groundwater model have inflows at 57,433 AFY versus outflows of 57,561 AFY. Additionally, recharge estimates from the most recent Owens Lake modelling efforts (MWH 2013, Table 3-7) are between 44,000-67,500 AFY. These modelling reports indicate that the high end of Table 2-10 recharge values (55,000 AFY) is a more likely estimate of groundwater inflows in the lake area. Owens Lake area groundwater levels fluctuate with weather cycles, but the mean is approximately stable over the long term consistent with close balance between inflows and outflows.

For the Tri-Valley area, the large range of storage volumes reflects the large knowledge gaps in the management area. As described below, both the USGS BCM modelling and groundwater level trends were analyzed to assess potential change in storage volumes and the likelihood of sustainable conditions in this management area.

2.2.3.2 BCM – Land System Water Budget

The Basin Characterization Model (BCM) developed by USGS (Flint, et al 2013) was used in this GSP to derive independent recharge and runoff values for the basin from the land-surface system. DWR (2020c) suggests using the BCM for basins or areas which lack numerical groundwater models. The BCM uses climate inputs, precipitation, and air temperature as well as

data on soil properties and the permeability of underlying bedrock to quantify potential excess water that may become a source for groundwater recharge or surface water runoff. The BCM is not a groundwater flow model and does not include groundwater pumping or the subsurface movement of groundwater. It is used in this GSP to comply with DWR's GSP recommendations to provide an estimate of basin-scale runoff and recharge components of the water budget, and to model potential changes related to future climate scenarios.

Results from the BCM land system modeling are presented in Table 2-11 including a summary of the current (2006-2016) land-system water budget for Owens basin and the three management areas (Figure 2-26). A more detailed presentation of BCM output values, including breakdown of individual inflow/outflow components, from 1986-2016 are presented in tabular and graphical form in Appendix 10 but is summarized below.

The entire Owens watershed is spatially divided into the headwater basin which contributes to groundwater recharge and the alluvial Owens Valley Groundwater Basin delineated in DWR Bulletin 118. The headwater areas are primarily high-altitude mountainous areas (e.g. Sierra, White, Inyo ranges) and are where most of the runoff and recharge to the alluvial groundwater basin originates. The water budget for this spatial area is referred to as the Contributing Area (CA). Water budget outputs from the BCM overlying the alluvial Owens Valley Groundwater Basin are also computed and referred to as the Groundwater Basin (GWB). These two values when summed are estimates for the entire the watershed. Additionally, BCM results were sub-divided into the Owens Valley, Owens Lake, and Tri-Valley/Fish Slough areas with corresponding values computed for the upland/watershed CA and the portion of the management area (MA) within the groundwater basin's boundary.

Table 2-11. Summary of Current Land System Water Budget.

Average (1000s TAFY)	Precipitation	Evapotranspiration	Runoff	Recharge	Vadose Zone Storage
Owens Basin CA	1622	689	410	234	289
Owens GWB	333	224	4	20	85
Basin-wide Total	**1955**	**913**	**414**	**254**	**374**
Owens Valley CA	1225	489	356	188	192
Owens Valley MA	141	85	3	16	36
Owens Valley Total	**1366**	**574**	**359**	**204**	**228**
Tri-Valley CA	211	111	25	22	54
Tri-Valley MA	37	24	0	1	12
Tri Valley Fish Slough Total	**248**	**135**	**25**	**23**	**66**
Owens Lake CA	212	106	32	25	49
Owens Lake MA	85	66	0	1	18
Owens Lake Total	297	172	32	26	67

CA = Contributing Area; MA = Management Area; GWB = Ground Water Basin

2.2.3.3 *Sustainability in Owens Basin*

Comparing the discharge estimates to the likely recharge estimates can estimate a potential water balance or overdraft condition. Comparing the range in recharge from Harrington (2016) with the BCM estimate for each management area is useful to narrow the most likely range for recharge values, but this is not a perfect one-to-one comparison due to differences in methods. When combined with measured long-term trends in groundwater elevation, it is possible to infer if the Basin or individual management area water budget is in balance..

For the Tri Valley management area, the BCM estimated the total recharge approximately the same as the lower range of Harrington (2016) recharge (23,000 AFY), and when compared to the totals of pumping and natural discharge (ET, springs seeps, discharge, surface water outflow), it is likely that this management area is approximately balanced (+1,800 to -1,600). The estimate that suggests an overdraft exists (-1,600 AFY) would be consistent with the long-term groundwater elevation declines observed in Benton, Hammill, Chalfant, and Fish Slough monitoring wells. A separate and rough method that relies on the lateral extent of the shallow alluvial aquifer, typical yield values (volume of water for a given aquifer volume) for alluvial sediments, and the amount of observed groundwater level declines suggests that the area has experienced average annual overdraft of up to -7,600 AFY over the past three decades. The result of this alternate method is greater overdraft than suggested by the water balance method (up to -1,600 AFY).

Analysis prepared by this GSP narrowed the range of estimates of the water balance for Tri-Valley, but lack of agreement among the various methods to assess the water balance reflects a significant data and knowledge gap that must be addressed. Identifying an overdraft exists (e.g. diagnosing chronically lowering water levels) is insufficient information to begin managing pumping to correct the overdraft. Future projects to better quantify the overdraft and develop models are necessary to inform any groundwater management plan developed for that portion of the Basin

For the Owens Valley management area, the BCM estimate of recharge (204,000 AFY) agrees well with Harrington (2016) estimate and is slightly more than the combined discharge components. Long-term (decadal) monitoring data confirm this management area is likely in balance as a whole with groundwater levels decreasing during extended drought or pumping,

but recovering during periods of above average recharge and lower pumping (dynamic steady state).

For the Owens Lake management area, the BCM values (26,000 AFY) are at the lower end of Harrington (2016) recharge estimate and much below the combined pumping and natural discharge estimates. However, long-term monitoring data show the management area is not experiencing groundwater level declines suggesting that the area is in dynamic steady state. A likely cause for this discrepancy between BCM inflows and water level data is that the BCM recharge estimates only natural processes and do not account for LADWP management activities which include the amount of surface water applied to the lake by LADWP for the purpose of dust mitigation (averaging approximately 60,000 AFY for 2006-2015). The BCM recharge values may not account for the amount of down-valley groundwater flow entering the Owens Lake Management Area.

Previous investigations of the water balance, supplemented with the BCM refinement of recharge estimates in Tri-Valley, indicates that the Owens Valley and Owens Lake Management Areas are not in overdraft is consistent with the water level monitoring showing nearly steady state conditions. However, based on monitoring well data and a comparison of recharge and discharge, the Tri Valley management area appears to be in overdraft.

2.2.3.4 Future Water Balance

DWR future climate change factors for the Owens basin suggest that temperatures will increase by approximately 2.6° F by mid-century and precipitation will increase by 0.3%. The USGS completed future climate runs using the BCM model for a subset of climate model inputs, CCSM4; CNRM-CM5; GFDL-CM3; MIROC5. For the purpose of this GSP, the CCSM4 scenario 8.5 was selected for the Owens Basin to evaluate future water budgets because this scenario showed a similar range in temperature changes as suggested by DWR.

As described in Appendix 10 and summarized in Table 2-12, the BCM modeling of future climatic conditions for the Owens River Basin and watershed includes a 6% increase in precipitation, but this excess is lost to increased evapotranspiration (19% increase). Overall, the amount of recharge is expected to increase by a modest 3% (7,000 AFY by 2045) due to climate change, but surface water runoff decreases by 6% (27,000 AFY by 2045). This results in a net 2.6% decline in inflows to the overall Basin water balance.

Table 2-12. Future Water Budget for Land Surface System-Entire Owens Basin.

Average (1000 AFY)	Precipitation	Evapotranspiration	Runoff	Recharge
Historical	2091	1047	473	275
Future	2214	1250	446	282
Difference	123	203	-27	7
Change(%)	6%	19%	-6%	3%

The BCM estimates climate change effects on ET, the largest outflow component of the water budget, and runoff and recharge, the primary inflow components. To isolate the effects from climate change, the other outflow components of the water budget were assumed by the model to generally remain stable in the future. This assumption is reasonable given continued management of the adjudicated portion of the basin under the LTWA and lack of private land constraining growth and additional groundwater uses.

For comparison, LADWP conducted studies in 2011 and 2020 utilizing global climate models to evaluate the effect of climate change on the Sierra Nevada (LADWP, 2020). The studies were conducted to forecast the effects of climate change on the LADWP water supply reliability. The studies aggregated the results of 16 models in 2011 and 20 models in the 2020 study for the greenhouse gas emission scenario RCP 8.5. This scenario essentially assumes no concerted effort to reduce emissions will be implemented. By 2045, LADWP's modelling study estimated an approximately 3°F temperature increase and essentially no change in precipitation (the mean change from the 20 model results was just above zero). LADWP's predicted temperature and precipitation changes are comparable to DWR climate change factors. LADWP also predicted that runoff will decline 0.165% annually or about 7,770 AFY by 2045. LADWP (2020) projected that over the next 25 years, average deliveries from the Los Angeles Aqueduct (LA Aqueduct) to the City would decline from the 1985-2014 median of 192,000 acre-feet per year to 184,200 acre-feet per year by 2045 due to climate change. Other studies in the literature suggest the timing of runoff may also be altered by climate change which could influence the management

of surface water used for recharge in the future. It is not known how this will affect the groundwater balance.

Given the model uncertainty and different methods, the BCM and LADWP runoff predictions are comparable, with the LADWP models predicting less reduction in runoff due to climate change (approximately 8,000 ac-ft vs. 27,000 ac-ft in the BCM). It is important to note that the portion of the watershed in the two modelling exercises were different. LADWP did not assess runoff in the Tri-Valley management areas, but both models included the Sierra Nevada portion of the contributing area where the bulk of runoff occurs.

2.2.3.5 *Description of surface water supply used or available for use for groundwater recharge or in-lieu use*

Surface water rights for nearly all Owens River tributary streams are owned by City of Los Angeles. Smaller holders of water rights exist but the sum of private water rights as a portion of the runoff into the Basin is negligible compared to LADWP water rights. The Los Angeles City Charter City prevents LADWP from selling or transferring water rights without a vote of City Council which is considered unlikely during the implementation of this GSP. In large runoff years, LADWP typically diverts surface water into numerous recharge basins on the valley floor and across alluvial fans for the purpose of groundwater recharge. The Owens Basin is a closed basin, and no surplus surface water or groundwater naturally exits the basin.

Surface water used for irrigation in Tri-Valley area (Benton, Hammil, and Chalfant) is predominantly associated with pre-1914 water rights. Except in extreme instances following storms, surface runoff remains in the Tri-Valley area. Any water associated with these large storms leaving the Tri-Valley area recharges the northern Laws area of the Owens Valley. More typically, runoff from the White Mountains is either diverted for irrigation or infiltrates in the creeks on the alluvial fans to recharge groundwater. A portion of the runoff and surface water used for irrigation also supports local recharge.

2.2.4 Management Areas (Reg. § 354.20)

The varying combinations of topography, geology, and climate over the large area of the Owens Valley groundwater basin has resulted in hydrogeologic conditions varying spatially, generally from north to south. These can be broadly grouped into three categories representing the hydrogeologic conditions. The spatial distribution of these categories are used in the GSP to

Table 2-13. Acreage and proportion of the Basin of the three Management Areas.

Management Area	Area (acres)	% of total
Owens Valley	184,788	43.0
Owens Lake	170,491	39.6
Tri-Valley	74,782	17.4
Total	430,061	100

divide the basin into separate management areas (Figure 2-26) which allow for development of unique SMCs that take into account hydrogeologic conditions present in the area (Table 2-13). The management areas from north to south are:

- Tri-Valley management area including the Fish Slough subbasin
- Owens Valley management area
- Owens Lake management area

In accordance with the JPA, Article II, Section 4.3, the OVGA formally voted to create management areas on August 12, 2021. The sections below provide the rationale for separating the basin into the three management areas. See Appendix 3 for more detailed information about monitoring networks, available datasets and identified data gaps for each management area.

2.2.4.1 Tri-Valley Management Area

The Fish Slough subbasin, located to the north of Bishop and to the west of Chalfant Valley in the volcanic tablelands, is a federally-designated Area of Critical Environmental Concern (ACEC) due to the presence of rare plants and animals. Although little precipitation falls directly on the Fish Slough subbasin, habitat is supported by groundwater discharged to springs and seeps along faults. While the amounts of groundwater discharging into Fish Slough are poorly quantified, existing evidence suggests a large portion comes from the Tri-Valley area (Jayko & Fatooh, 2010; Zdon et al., 2019).

The Fish Slough and Tri-Valley management area is the least understood portion of the basin. There have been few hydrogeologic studies conducted in the area and monitoring networks are

limited. Hydrologically, the Tri-Valley Management Area is distinct because it has few surface-water features and sources recharge primarily from the White Mountains instead of the Sierra. It is geologically distinct from the Owens Valley Management Area to the south containing alluvium derived primarily from sedimentary and metamorphic rock and the rhyolitic Bishop Tuff as opposed to primarily granitic-derived alluvium, interlayered basalt flows and presences of thick clay layers. The Tri-Valley portion of the area is considered to have a single aquifer. A portion of this aquifer is believed to extend under the Bishop Tuff towards Fish Slough where it becomes confined. The southeastern portion of the management area contains a prominent subsurface bedrock high that is coincident with a significant change in hydraulic gradient. This stratigraphy combined with preferential flow along faults/fractures that extend from Hammil Valley south to Fish Slough are believed to result in hydrogeologic connection between Tri-Valley and Fish Slough. Observed chronic declines in groundwater elevations in the Tri-Valley Management Area do not occur in the adjacent Owens Valley Management Area, indicating that groundwater management effects on water levels are largely confined to the Tri-Valley Management Area. Recent geochemical studies comparing Tri-Valley, Fish Slough and northern Owens Valley groundwater also suggest a link between northern Fish Slough and Tri-Valley groundwater. Two calibrated groundwater models with domains along the southern end of the management area suggest that flow exiting the southern boundary of Tri-Valley is relatively small and a very minor portion of the inflows to the Owens Valley.

As noted, observed chronic declines in groundwater elevations in the Tri-Valley Management Area do not occur in the other two management areas. This is consistent with the conceptual model developed for the basin. Future management actions would seek to stabilize groundwater levels in the Tri-Valley Management Area and therefore arrest any declines to the small groundwater flux across the management area boundary. Similarly, maintaining water levels in the Owens Valley and Owens Lake Management Areas should preserve the existing water balance and down valley flow supporting conditions near the lake.

2.2.4.2 Owens Valley Management Area

The Owens Valley Management Area is fragmented geographically due to LADWP lands in the valley being considered adjudicated under the SGMA. However, this management area is hydrogeologically distinct because the majority of it overlies the alluvial fans along the margins of the valley where development is limited and not expected to change due to lack of private land ownership. In addition, LADWP pumping operations outside of the GSP area could have a

significant impact to the hydrologic system within the Basin, whereas there is relatively little LADWP pumping in the other two management areas. LADWP has created an extensive monitoring network in this portion of the basin, although most wells are located on lands adjacent to the Owens Valley management area and are commonly down gradient of the GSP area. The majority of groundwater leaving the Owens Valley Management Area flows onto LADWP lands before entering the Owens Lake Management Area to the south. The significantly larger volume of groundwater pumped on LADWP lands means effects of management actions within the Owens Valley Management Area are expected to be negligible compared with LADWP operations unless new pumping projects are proposed.

2.2.4.3 Owens Lake Management Area

The Owens Lake management area's aquifer system geology is less heterogeneous compared to the other two management areas, and exhibits a more layer-cake geology due to the depositional environment of the Pleistocene Owens Lake. Thick lacustrine clay layers separate distinct aquifers and act as confining beds. These clay layers provide the geologic conditions necessary for subsidence to occur, which are largely absent from the other two management areas. The other two management areas also have generally high water quality, while the Owens Lake Management Area has poor water quality resulting from natural evaporative concentration at the terminus of the closed basin under the lakebed. Monitoring network density for this area is generally high, both horizontally and vertically in the aquifer system. The management goal for Owens Lake is to maintain current conditions, which will not impact the other two management areas defined in the basin.

3. Sustainable Management Criteria

SGMA defines sustainable Groundwater Management as the *"…the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results"* (CWC 10721 (v)). SGMA includes four sustainable management criteria (SMC) components that the GSP is required to define: a sustainability goal, undesirable results, minimum thresholds, and measurable objectives. These four components are described in this section specifically for the three management areas or for the entire Basin where applicable.

SGMA listed six sustainability indicators pertaining to groundwater conditions occurring throughout the basin that can represent undesirable results (CWC Section 10721): chronic lowering of groundwater levels, reduction in groundwater storage, depletion of interconnected surface water, seawater intrusion, degraded water quality, land subsidence. Measurable objectives and minimum thresholds for five of these indicators are discussed in this section. The Basin is not located near the ocean and therefore not susceptible to undesirable results from seawater intrusion. No SMC were established for this indicator, and it is not discussed further in this section.

3.1 Sustainability Goal (Reg. § 354.24)

The Basin is currently ranked by DWR as a low priority basin. The prioritization of the Basin, including the Fish Slough subbasin, relied on existing data and considered the following factors (CWC Section 10933(b)):

1. The population overlying the basin or subbasin.
2. The rate of current and projected growth of the population overlying the basin or subbasin.
3. The number of public supply wells that draw from the basin or subbasin.
4. The total number of wells that draw from the basin or subbasin.
5. The irrigated acreage overlying the basin or subbasin.
6. The degree to which persons overlying the basin or subbasin rely on groundwater

as their primary source of water.

7. Any documented impacts on the groundwater within the basin or subbasin, including overdraft, subsidence, saline intrusion, and other water quality degradation.

8. Any other information determined to be relevant by the department, including adverse impacts on local habitat and local stream flows.

Following the adoption of SGMA, the Basin was originally ranked as medium priority, and steps were taken by local agencies to create the OVGA to act as the exclusive GSA for the Basin and prepare a GSP. The status of the Basin was reassessed following a basin boundary adjustment. In the April 2019 draft assessment, the DWR reconsidered the number of points assigned for out-of-basin transfers by LADWP which automatically placed the Basin in the high priority category. The primary objection of the OVGA was that the scoring procedure included a factor not listed in the above criteria and was inequitable because, under SGMA, the OVGA has no control over LADWP water resource management. Without the added score for LADWP export, the Basin would have been ranked as low priority. In the final December 2019 report, the DWR removed the out-of-basin transfer points and added points to account for information DWR previously lacked showing declining water levels in a portion of the Basin. The final score placed the Basin in the low priority category.

The sustainability goal of the OVGA is to monitor and manage the Basin by implementing a groundwater monitoring network and database and by adopting management actions that fairly consider the needs of and protect the groundwater resources for all beneficial users in the Basin. The OVGA is committed to ensuring the sustainability of the Basin is maintained and to preventing undesirable results by establishing SMC including minimum thresholds and management objectives described in this GSP. The OVGA opposes groundwater export from the Eastern Sierra that would result in negative consequences to groundwater sustainability, the environment, local economy, and residents.

The OVGA recognizes that different hydrologic characteristics, land, and water management and concerns exist within the Basin and has established separate management areas in this GSP (Section 2.2.4). Developing SMC particular to each management area was necessary to protect the resources and beneficial uses and users of groundwater specific to each area. Within each management area, information from the basin setting (Section 2) was used to establish the

sustainability goal and measures. Recent trends in water levels in the Owens Valley and Owens Lake Management Areas are stable over time, and the proposed SMC were established based on maintaining water levels within historical ranges. For the Tri-Valley Management Area, the OVGA relied on previous studies of hydrology and geology and the history of monitoring information from existing monitoring wells and spring flows. Water levels and Fish Slough spring flows have been steadily declining in this management area, and the proposed SMC were established to prevent impacts to private wells by stabilizing the water table at 2015 elevations by 2042. Spring flow SMC were based on recommended flows to manage threatened ecosystems downstream of the springs based on the expertise of agencies with land management responsibility in Fish Slough. Pumping induced subsidence and water quality are presently not a serious problem in the Basin. Sustainability measures are included in this GSP to monitor those indicators and intervene to prevent undesirable results from occurring.

3.1.1 Sustainability Measures

The OVGA is proposing a limited number of projects and management actions that will improve characterization and monitoring in the Basin and if necessary manage demands and supplies to achieve the sustainability goal. These projects are briefly summarized in this section and described in greater detail in Section 4.

1) Monitoring Network and Database: This measure is applicable to all management areas. The OVGA will monitor groundwater resources as prescribed in this GSP, assess changes in the groundwater basin using best available models and data, and report annually and as needed to the OVGA Board and public on groundwater uses and conditions in the Basin. Monitoring data will be maintained in a publicly accessible form. In addition, the OVGA has selected representative monitoring locations in each management area to track conditions to compare with established sustainability criteria. These criteria are described in detail in Section 3.5 below.

2) If necessary, the OVGA may implement groundwater management policies, regulations, projects, or studies consistent with the authorities granted under SGMA. The OVGA will develop such measures to devise or modify management practices when needed to achieve or maintain the sustainability goal within management areas. Actions to address data gaps, and maintain an up-to-date database are included in Section 4.

3) The Tri-Valley Management Area exhibits declining water levels and spring flow in Fish Slough; however, lack of a groundwater model to evaluate and assess pumping effects prevents

the identification of immediate management measures. This GSP includes a plan for additional studies predicated on acquiring outside funding to prepare a numerical groundwater model.

4) Ensure local resident and stakeholder voices, including Federal and State recognized tribes, are heard through effective public engagement that invites deliberation, collaboration, and action on groundwater management issues of common importance as the GSP is implemented. The OVGA is committed to work with land use agencies in the Basin to promote land use practices and water demand goals that sustain water resources.

The OVGA recognizes that sustainable groundwater conditions in the Basin are critical to support, preserve, and enhance the economic viability, social well-being, environmental health, and culture of all beneficial users and uses including tribal, domestic, municipal, agricultural, environmental, and industrial users.

The Sustainability Goal will be achieved within 20 years of Plan implementation by setting criteria to maintain water levels and applicable water quality standards, continuing monitoring, and adopting regulations as necessary. Where concerns over lowering water levels are observed, the OVGA proposes to conduct studies to determine and quantify the pumping effects from other possible causes and, if necessary, develop a pumping plan to prevent significant and unreasonable effects (Section 3.4).

3.2 Undesirable Results (Reg. § 354.26)

There are currently no documented undesirable results for the indicators throughout the Basin reflecting the overall sustainable conditions. As described in the Basin Setting (Section 2.2.2), three sustainability indicators exhibit documented trends toward undesirable results in the Tri-Valley Management Area: declining water levels, reduced groundwater storage, and declines in interconnected surface water. Undesirable results therefore were defined based on groundwater conditions that could lead to potentially significant and unreasonable effects in each of the three management areas.

3.2.1 Tri-Valley Management Area

Undesirable results for the relevant sustainability indicators for the Tri-Valley Management Area are presented in Table 3-1 and described below.

Table 3-1. Undesirable results identified for the Tri-Valley Management Area.

Sustainability Indicator	Undesirable Results
Chronic Lowering of GW elevation	Increased pumping costs Drying out shallow domestic wells Loss of existing monitoring wells Reduced groundwater discharge to Fish Slough
Reduction in GW Storage	Decreased ability to maintain status quo pumping during extended drought periods
Depletion of Interconnected SW	Reduction of groundwater discharged to the surface resulting in impairment of GDEs
Land Subsidence	General infrastructure damage
Degraded WQ	Increased treatment costs, Loss of potable water supplies

Cause of groundwater conditions which may lead to undesirable results: Potential Undesirable Results of concern in the Tri-Valley Management Area would primarily be related to lowering water levels that could result in potential impacts to production wells (increased pumping costs), drying out of shallow domestic or monitoring wells, and reduced groundwater discharge to GDEs, in particular the springs located in Fish Slough. Based on available geologic, hydrologic, and geochemical evidence, pumping in the management area in excess of recharge is the cause of lowering water levels. The magnitude of overdraft and the pumping effect on spring flow, however, are poorly quantified (Table 2-10 and Section 2.2.3). The susceptibility of domestic and monitoring wells to lowering water levels was assessed in this GSP and is described below and in Appendix 11.

For the type of aquifer system in the Tri-Valley Management Area, lowering of water levels corresponds with reductions in storage. The steady water table decline is concerning, but it is unlikely that sustainable yield or available groundwater storage will be exceeded or that a decreased ability to maintain status quo pumping during droughts will occur during GSP implementation due to the thickness of the aquifer compared to the lesser groundwater level declines.

Severe pumping overdraft resulting in land subsidence (which does not presently exist) could cause general infrastructure damage or migration of lower quality deeper groundwater requiring treatment or loss of potable water, but these are unlikely to occur at the current rate of groundwater level decline.

Criteria used to define undesirable results: Because the sustainability goal is to prevent undesirable results from occurring in the future, criteria to define them in this GSP were necessarily based on the analysis of future monitoring results or reporting by residents. Water level, spring flow, water quality and subsidence monitoring data collected during GSP implementation will be assessed to compare with SMC included in this GSP. Future projects to address data gaps that limit the understanding of the Tri-Valley Management Area may alter the SMC used to define undesirable results in a future update of this GSP. Potential management actions and projects are included to develop and implement suitable measures to stabilize water level declines and spring flows.

An analysis to estimate the potential for impacts to domestic wells was completed to assist in defining undesirable results for chronically declining water levels in the Benton, Hammil, and Chalfant valleys. The well vulnerability analysis (Appendix 11) was based on the most pertinent factors (e.g. height of water column above pump setting or well bottom) to evaluate the possibility that significant and unreasonable effects to domestic wells may occur. Data for all factors necessary to complete the analysis were seldom available for each specific domestic well. This analysis was essential to assess the potential severity of unreasonable effects to arise in domestic wells, and thus relied on several assumptions regarding typical well construction to complete. The assumptions, though necessary and reasonable, limit the confidence in the conclusions beyond determining that whether the number of vulnerable wells is few or many, and whether significant and unreasonable effects are eminent or possible much later in the planning horizon of this GSP. This data gap regarding conditions in domestic wells may be addressed through the proposed Management Actions or by inspection of domestic wells upon request by the well owner to acquire data and complete a well-specific assessment (Section 4 below).

Potential effects on the beneficial uses and users of groundwater: The primary beneficial uses and users in the Tri-Valley management area include agricultural pumpers; domestic *de minimis* users; shallow GDE in the Benton, Hammil, and Chalfant valleys; and spring flow and associated GDEs in Fish Slough. Impacts to domestic wells directly caused by lowering of groundwater

levels and related changes in storage would include increased electrical costs and shortened pump life, costs to lower or replace a pump, and costs to deepen or replace a well. These added costs for a homeowner range from a few tens of dollars per year to potentially tens of thousands for drilling a new well.

Reduction of spring flow in Fish Slough would directly impact several protected species, critical habitat, and GDEs (Section 2.2.2.5). Land subsidence may cause impacts to general infrastructure including damage to improvements on private property, public roadways, or utilities. Degraded water quality could make groundwater unsuitable for the predominant beneficial uses for agriculture or domestic use.

3.2.2 Owens Valley Management Area

Undesirable results for the relevant sustainability indicators for the Owens Valley Management Area are presented in Table 3-2 and described below.

Cause of groundwater condition which may lead to undesirable results: Potential undesirable results of concern in the Owens Valley Management Area include lowering water levels causing impacts to production wells (increased pumping costs), drying out of shallow domestic or monitoring wells and impaired GDE.

Table 3-2. Undesirable results identified for the Owens Valley Management Area.

Sustainability Indicator	Undesirable Results
GW elevation	Increased pumping costs Drying out shallow domestic wells Loss of existing monitoring wells
GW Storage Reduction	Decreased ability to maintain status quo pumping during extended drought periods
SW Depletion	Reduction of groundwater discharged to the surface resulting in impairment of GDEs
Land Subsidence	General infrastructure damage
Degraded WQ	Increased treatment costs, Loss of potable water supplies

Presently water levels are stable in the GSP area in this management area. The potential exists for changes in pumping management or installation of new wells in the adjudicated area affecting the remainder of the management area. Similarly, wells newly installed in the few areas of privately owned lands could alter the local water table conditions.

Given the nature of the aquifer system, lowering of water levels corresponds with reductions in storage. The stable water table trends at present are not concerning, and it is unlikely that sustainable yield or available groundwater storage will be exceeded or that a decreased ability to maintain status quo pumping during droughts will occur during the GSP implementation.

Severe pumping overdraft that could cause land subsidence (which does not presently exist) could cause l general infrastructure damage or migration of lower quality deep groundwater requiring treatment or loss of potable water, but these are unlikely to occur.

Criteria used to define undesirable results: Because the goal is largely to prevent undesirable results from occurring in the future if Basin conditions change, criteria to define them in this GSP were necessarily based on the analysis of future monitoring results. Water levels, spring flow, water quality, and subsidence monitoring data collected during GSP implementation will be assessed annually to compare with SMC included in this GSP.

Potential effects on the beneficial uses and users of groundwater: The primary beneficial uses and users in the Owens Valley management area include community service districts, municipal or mutual water company water providers, domestic *de minimis* users, and shallow GDE. Impacts to domestic wells directly caused by lowering of groundwater levels and related changes in storage would include increased electricity costs, costs to adjust pump placement in a well, or to deepen or replace a well. Land subsidence may cause impacts to general infrastructure and would include damage to improvements on private property, public roadways or utilities. Degraded water quality could make groundwater unsuitable for the predominant beneficial uses for agriculture or domestic use.

3.2.3 Owens Lake Management Area

Undesirable results for the relevant sustainability indicators for the Owens Lake Management Area are presented in Table 3-3 and described below.

Table 3-3. Undesirable results identified for the Owens Lake Management Area.

Sustainability Indicator	Undesirable Results
GW elevation	Increased pumping costs Drying out shallow domestic wells Loss of existing monitoring wells
GW Storage Reduction	Decreased ability to maintain status quo pumping during extended drought periods
SW Depletion	Reduction of groundwater discharged to the surface resulting in impairment of GDEs
Land Subsidence	General infrastructure damage Damage to conveyance infrastructure
Degraded WQ	Increased treatment costs, Loss of potable water supplies

Cause of groundwater condition which may lead to undesirable results: Potential undesirable results of concern in the Owens Lake Management Area related to lowering water levels include potential impacts to production wells (increased pumping costs), drying out of shallow domestic or monitoring wells, and impaired GDEs. Presently water level trends are stable in the GSP area portion of this management area. The potential exists for future changes in pumping management in the adjudicated area, on privately owned lands, or under Owens Lake managed by the State Lands Commission to affect the remainder of the management area.

Given the nature of the aquifer system, lowering of water levels corresponds with reductions in storage except for the immediate vicinity of Owens Lake where multiple stacked deeper aquifers are present. Lower aquifers that may be tapped in the future by LADWP to supply dust control measures will be monitored to track the potential for reduction in storage. The steady water table trend at present is not concerning, and it is unlikely that sustainable yield or available groundwater storage will be exceeded or that a decreased ability to maintain status quo pumping during droughts will occur during the GSP implementation based on current pumping amounts.

Pumping could cause land subsidence resulting in infrastructure damage or migration of lower quality groundwater near or under Owens Lake requiring treatment or loss of potable water. No

problems with subsidence or migration of saline groundwater caused by pumping exist presently, and the potential for these impacts to occur depends on future development of groundwater pumping projects in the management area. **The primary subsidence threat is future pumping under the lakebed from deeper confined aquifers.**

Criteria used to define undesirable results: This GSP was prepared primarily to prevent potential undesirable results from occurring in the Basin. For that situation, criteria to define undesirable results are necessarily based on the analysis of future monitoring results or reporting by residents. Water level, spring flow, water quality, and subsidence monitoring data collected during the GSP implementation will be assessed to compare with SMC included in this GSP.

P*otential effects on the beneficial uses and users of groundwater:* The primary beneficial uses and users in the Owens Lake management area include agricultural or commercial pumpers, community service districts or mutual water companies, domestic *de minimis* users, and GDE. Impacts to domestic wells directly caused by lowering of groundwater levels and related changes in storage would include increased electrical costs, costs to adjust pump placement in a well, or to deepen or replace a well. Land subsidence may cause impacts to general infrastructure would include damage to improvements on private property, public roadways or utilities or infrastructure for dust control measures on the lakebed. Degraded water quality could make groundwater unsuitable for the predominant beneficial uses for agriculture, municipal, or domestic use.

3.3 Minimum Thresholds (Reg. § 354.28)

A Minimum Threshold is defined as "*a numeric value for each sustainability indicator used to define undesirable results*" (Reg. § 351 (t)). A value for each sustainability indicator denoting undesirable results (Section 3.2) must be included in the GSP and consider the beneficial uses and users of groundwater and other interests within the Basin. The sections below describe the rationale behind the development of the minimum thresholds for the relevant sustainability indicators for management areas in the Basin. Hydrographs of all representative monitoring locations showing the Minimum Thresholds and Management Objectives are included in Appendix 12.

3.3.1 Tri-Valley Management Area

3.3.1.1 Groundwater Level Declines and Groundwater Storage Reductions

Groundwater level declines and storage reductions are closely correlated in unconfined aquifer systems like that in the Tri-Valley Management Area. The minimum thresholds for both indicators are based on water levels and trends at representative monitoring wells (Section 3.5 below).

Three undesirable results to pumpers caused by lowering of water levels were included in the GSP for the Tri-Valley Management Area; increased pumping costs, drying out shallow domestic wells, and loss of existing monitoring wells. Drying of shallow domestic wells was determined to be the most urgent and significant undesirable result from chronic declines in groundwater levels in the Benton, Hammil, and Chalfant valleys. This event would entail the maximum expense to the well owner with costs typically of tens of thousands of dollars. The GSP designated these impacts to domestic well owners as significant and unreasonable.

A well vulnerability assessment was performed for 189 domestic wells in the management area using the limited amount and types of publicly available data (Appendix 11). This is a large sample set, but the total number of domestic wells in the three valleys is not accurately known. The analysis suggested that water levels in approximately 8 (4%) wells potentially are deep enough to prevent the wells from producing presently, but all 8 of these wells are over 50 years old. Because no wells in the Tri-Valley area have been reported going dry (two well owners reported replacing wells in the outreach survey but the reason was not certain), it is possible that these older wells are no longer the primary water supply for the property. If the present rate of water level declines of 0.5-2.0 ft/yr (Section 2.2.2) persist and are representative for all areas within the three valleys, approximately 11 (6%) wells could experience problems by 2025 and 16 (8%) by 2040 (both values include the 8 wells that may currently be dry). There is significant uncertainty in the domestic well vulnerability assessment due to the assumptions required, but few domestic wells appear to be at immediate risk of going dry due to declining water levels, and the number remains small if declines continue for 5 years (Appendix 11). The number of vulnerable wells increases within the planning horizon if the declines are not arrested. After 2007 impacts to domestic well owners could be significant and unreasonable or if less severe impacts to wells (e.g. pump repair or increased electical cost) are also considered undesirable..

Table 3-4. Tri-Valley management area minimum thresholds for groundwater level declines and groundwater storage reductions at representative monitoring points. Values rounded to the nearest foot.

Representative Monitoring Well	Minimum Threshold Elevation (ft amsl)	Minimum Threshold Depth to Water (ft RP)
BT-MW1	5,301	134
Hammil 2	4,401	183
CH-MW2	4,204	76
FS-2	4,214	6
FS-3D	4,179	16
T397	4,199	31

The minimum threshold water levels at the representative monitoring wells assume continued steady water table declines at the average rate (Appendix 3) projected to May 2030 (eight years after GSP adoption) and Table 3-4. At this level, it is expected that between 3 to 8 domestic wells may be at risk of refurbishment or replacement. This number of wells being negatively affected by declining water levels is considered significant and unreasonable. Management actions and projects are included in this GSP to prevent this undesirable result from occurring by stabilizing water levels at levels above the minimum threshold (Sections 3.4 and 4).

Because the water levels in Fish Slough and Tri-Valley have similar long term declining trends (albeit at different rates), a similar extrapolation to estimate 2030 water levels based on rate of water table decline was used to set minimum thresholds in representative monitoring wells in Fish Slough (FS-2, FS3-D, and T397). The minimum thresholds for wells in Fish Slough represent less than 1.5 feet of additional decline.

3.3.1.2 Land Subsidence

A minimum threshold of 0.3 ft (3.6 inches) of subsidence measured by InSAR has been proposed as less than significant and reasonable. This value is greater than the vertical resolution of the InSAR instrument and the historic range of variation (approximately 1.6 inches) observed in the permanent GSP stations reflecting elevation changes caused by factors other than subsidence

and reflects the limited potential for subsidence based on current geologic understanding of the management area's subsurface materials.

3.3.1.3 Interconnected Surface-Water Depletions

The primary interconnected surface water depletions of concern in this management area are springs and associated GDE in Fish Slough. Fish Slough Northeast Spring is the primary spring at risk of drying up, and of the three largest spring vents in Fish Slough, its water chemistry was most similar to the Tri-Valley groundwater chemistry (Zdon, et al., 2019). The spring supports threatened and endangered species and associated critical habitat. LADWP monitors and CDFW manages the flow downstream of the spring for the benefit of the listed species and habitat. An average flow rate of 0.1 cfs from the Fish Slough Northeast Spring (SW3208) is being used as the minimum threshold for the interconnected surface-water depletion sustainability indicator. When flows approach the minimum threshold, field scientists at CDFW saw degradation of habitat representing an undesireable result of impairment of GDE. (Alisa Ellsworth, CDFW personal communication).

3.3.1.4 Water Quality Degradation

Recognizing that the OVGA is not a public water supplier nor does SGMA grant regulatory authority over groundwater quality to GSAs, minimum thresholds for groundwater quality included in this GSP are those set by existing or future regulations (e.g., statewide drinking water standards). This approach reflects the fact that elevated solute concentrations in the basin are either naturally occurring or that sources of poor water quality are localized and already regulated by State agencies.

3.3.2 Owens Valley Management Area

3.3.2.1 Groundwater Level Declines, Groundwater Storage Reductions, and Interconnected Surface Water Depletions

In the Owens Lake Management Area, the GSP pathway to comply with SGMA is to prevent undesirable results before they occur. This is consistent with SGMA and the OVGA desire to remain a low priority basin and preserves the existing beneficial uses and property interests (GSP Regulation 354(b)(4)). Minimum groundwater elevations observed during the 2012-2016 drought were used to establish the minimum thresholds for groundwater level declines and groundwater storage reductions and surface water depletions. If no data were available for a

Table 3-5. Owens Valley management area minimum thresholds groundwater level declines and groundwater storage reductions at representative monitoring points. Values rounded to the nearest foot.

Representative Monitoring Well	Minimum Threshold Elevation (ft amsl)	Minimum Threshold Depth to Water (ft RP)
ICWCSD 4	4,249	37
T001	3,867	630
T362	4,047	49
T364	3,898	25
T384	4,165	18
T389	4,216	20
T391	4,296	15
T480	3,994	11
T513	4,113	12
T574	4,067	20
T750	4,357	55
T751	4,373	39
T808	3,834	25
T809	3,823	19
T869	3,983	289
T871	3,850	120
T872	3,946	475
T873	4,954	89
V016GB	3,880	27
V151	3,827	67
V299	3,909	101
WCCSD 2	6,020	233
WCCSD 4	6,263	132

representative monitoring well during this time, the minimum groundwater elevation observed since January 1, 2000, was used. These values are presented in Table 3-5. No significant and unreasonable impacts within the management area were reported during this time period.

Therefore, maintaining water level elevations at or above those recorded during that time is not anticipated to result in significant and unreasonable impacts in the future. Potential surface water depletions in the management area are limited to the few acres of GDE that may be dependent on the shallow water table. Maintaining the steady water level trend should prevent impairment of GDEs caused by pumping from the GSP area.

3.3.2.2 Land Subsidence

A minimum threshold of 0.3 ft (3.6 inches) of subsidence measured by InSAR has been proposed as less than significant and reasonable. This value is greater than the vertical resolution of the InSAR instrument and historic range of variation (approximately 1.6 inches) observed in the permanent GSP stations reflecting elevation changes caused by factors other than subsidence. This threshold reflects the limited potential for subsidence based on current geologic understanding of the management area's subsurface materials.

3.3.2.3 Water Quality Degradation

Recognizing that the OVGA is not a public water supplier nor does SGMA grant regulatory authority over groundwater quality to GSAs, minimum thresholds for groundwater quality adopted by the OVGA are those set by existing or future regulations (e.g., statewide drinking water standards). This reflects the fact that elevated solute concentrations in the basin are either naturally occurring or sources are localized and already regulated by another agency.

3.3.3 Owens Lake Management Area

3.3.3.1 Groundwater Level Declines and Groundwater Storage Reductions

In the Owens Lake Management Area, the GSP pathway to comply with SGMA is to prevent undesirable results before they occur. This is consistent with SGMA and the OVGA desire to remain a low priority basin. This preserves the existing beneficial uses and property interests (GSP Regulation 354(b)(4)). Minimum groundwater elevations observed during the 2012-2016 drought were used to establish the minimum thresholds for groundwater level declines and groundwater storage reductions. If no data were available in a representative monitoring well

Table 3-6. Owens Lake management area measurable objectives for groundwater level declines and groundwater storage reductions at representative monitoring points. Values rounded to the nearest foot.

Aquifer Unit	Representative Monitoring Well	Minimum Threshold Elevation (ft amsl)	Minimum Threshold Depth to Water (ft RP)
1	DVF South Upper	3,636	30
1	T901	3,607	-34
1	T904	3,626	5
1	T910	3,607	-26
2	DVF South Middle	3,639	27
2	Fault Test T3	3,620	-30
2	Fault Test T5	3,617	-27
2	Keeler-Swansea Lower	3,618	-9
2	River Site Lower	3,594	-4
3	DVF South Lower	3,640	26
3	OL92-2	3,605	-47
3	SFIP MW	3,511	54
3	T917	3,704	-25
4	DVF North MW	3,643	28
5	T899	3,617	-44
5	T902	3,631	0
5	T908	3,625	-43
5	T916	3,704	-25
Owens Lake Shallow	DELTA W(3)_10	3,562	5
Owens Lake Shallow	I10(7)_4	3,568	4
Unknown	KCSD	3,612	42
Unknown	O6(5)_4	3,567	5
Unknown	Rio Tinto[a]	--	--
Unknown	T348	3,630	12

Unknown	T588	3,685	23
Unknown	T858	3,666	13
Unknown	T860	3,708	30
Unknown	T920	3,600	213
Unknown	T922[a]	--	--
Unknown	T924	3,590	143
Unknown	T925[a]	--	--
Unknown	T929[a]	--	--

a. Newly established representative monitoring point or data not currently available. Measurable objective will be established in future GSP updates.

during this time, the minimum groundwater elevation observed since January 1, 2000, was used. These values are presented in Table 3-6. No significant and unreasonable impacts within the management area were reported during this time period. Therefore, maintaining water level elevations at or above those recorded during that time is not anticipated to result in significant and unreasonable impacts in the future.

3.3.3.2 Land Subsidence

A minimum threshold of 0.3 ft (3.6 inches) of subsidence measured by InSAR has been proposed as less than significant and reasonable. This value is greater than the vertical resolution of the InSAR instrument and the historic range of variation observed in the permanent GSP stations reflecting elevation changes caused by factors other than subsidence . As noted earlier, additional subsidence monitoring with associated minimum thresholds would be appropriate if LADWP proceeds with its OLGDP.

3.3.3.3 Interconnected Surface-Water Depletions

Minimum groundwater elevations observed during the 2012-2016 drought were used to establish the minimum thresholds for interconnected surface-water depletion. If no data were available during this time, the minimum groundwater elevation observed in the well since January 1, 2000, was adopted. These values are presented in Table 3-6. No significant and unreasonable impacts within the management area were reported during this time period.

Therefore, maintaining water level elevations at or above those recorded during that time is not anticipated to result in significant and unreasonable impacts in the future.

Minimum thresholds based on a reduction in head gradient measured near springs and flowing artesian wells, both vertically and horizontally, may be included in a future GSP update. Further analysis and data collection are required to develop these thresholds which are part of the ongoing collaborative LADWP OLGDP.

3.3.3.4 Water Quality Degradation

Recognizing that the OVGA is not a public water supplier nor does SGMA grant regulatory authority over groundwater quality to GSAs, minimum thresholds for groundwater quality adopted by the OVGA are those set by existing or future regulations (e.g., statewide drinking water standards). This reflects the fact that elevated solute concentrations in the basin are either naturally occurring or sources are localized and already regulated by another agency. If it is necessary to establish criteria to detect the migration of saline water, the GSP could be amended to include additional water quality monitoring or triggers to prevent exceedance of regulatory standards.

3.4 Measurable Objectives (Reg. § 354.30)

The sections below describe the rationale behind development of the measurable objectives for the five sustainability indicators for the Basin management areas. Due to observed declines in groundwater levels, both interim milestones and 20-year measurable objectives are presented for the Tri-Valley Management Area. The Owens Valley and Owens Lake Management Areas are considered to be in a dynamic steady state condition. Interim milestones for measurable objectives in those management areas are identical to the 20-year value. Due to generally stable water levels, application of the GSP proposed management actions and projects in the Owens Valley and Owens Lake Management Area would maintain conditions and would not cause undesirable results in the Tri-Valley Management Area. Stabilizing water levels and spring flow declines in the Tri-Valley Management Area would potentially increase groundwater flow and spring discharge into the Owens Valley Management Area and, therefore, not cause undesirable results in Owens Valley area. Hydrographs of all representative monitoring locations showing the Minimum Thresholds and Management Objectives are included in Appendix 12.

Table 3-7. Fish Slough and Tri-Valley management area measurable objectives for groundwater level declines and groundwater storage reductions at representative monitoring points. Values rounded to the nearest foot.

Representative Monitoring Point	Groundwater Elevation (ft amsl)				Depth to Water (ft RP)
	5-year Interim Milestone	10-year Interim Milestone	15-year Interim Milestone	20-year Measurable Objective	20-year Measurable Objective
BT-MW1	5,303	5,303	5,306	5,309	126
Hammil 2[a]	--	--	--	--	--
CH-MW2	4,207	4,207	4,209	4,211	69
FS-2	4,215	4,215	4,216	4,217	3
FS-3D[a]	--	--	--	--	--
T397	4,199	4,199	4,200	4,201	29

a: Newly established representative monitoring point. Measurable objectives will be established in future GSP updates.

3.4.1 Tri-Valley Management Area

3.4.1.1 Groundwater Level Declines and Groundwater Storage Reductions

Groundwater elevations present when SGMA was enacted on January 1, 2015, were selected as the 20-year measurable objective for undesirable results that could occur in the Tri-Valley

Management Area from chronic groundwater level declines and groundwater storage reductions (Table 3-7). If undesirable results before 2015 are present (e.g. water levels in Tri-Valley declining since the 1980's), the GSP must set measureable objectives to maintain or improve upon conditions occurring in 2015 (DWR, 2017). The GSP may but is not required to address undesirable conditions that occurred before January 1, 2015 (SGMA 10727.2(b4)).

The 20-year measurable objectives and interim milestones for water levels of representative monitoring wells in the Tri-Valley Management Area are shown in Table 3-7. Interim milestones reflect the anticipated continued declines and eventual stabilization and recovery in

groundwater levels to the 20-year measurable objective. Continued declines are projected for the next five years (2027, 5-year milestone) while potential management actions are evaluated, and a numerical hydrologic model of the area is developed. Following the initial five years of decline, this GSP anticipates five years of stabilizing groundwater levels as projects and management actions begin to come online (10-year milestone). The next ten years involves recovering water levels to the 20-year measurable objective value, set at January 1, 2015, water levels.

A recognized data gap in this management area is insufficient water level monitoring to assess spatial variabilty of conditions within the valleys. In future GSP updates, the management objectives may be revised at the present locations or new management objectives established for additional representative monitoring points. Since there have been no reported significant and unreasonable results directly related to decreased water levels in Benton, Hammil, or Chalfant valleys as of the date of this Plan, setting long-term sustainability goals at January 1, 2015, water level elevations (higher than current levels) provides a reasonable margin of safety.

Current water levels are below the management objective. Achieving the 20-year measurable objective to correct declining water levels requires either increasing recharge into the aquifer or decreasing pumping. While increasing recharge is typically preferred, it is not a realistic option for the Tri-Valley management area due to the limited availability of water available for import and nearly all runoff in the area already recharging groundwater. Reducing demand is the most likely option for arresting the chronic groundwater declines and groundwater storage reductions. This can take many forms such as improving irrigation efficiencies, retiring less productive agricultural lands, changing crop types, or deficit irrigation. Development of any of these strategies necessarily follows steps in this GSP to address data gaps and groundwater modelling capability in this management area and probably requires acquisition of outside funding. For example, uncertainty in the water budget and the lack of a numerical groundwater flow model for the area prevents an accurate assessment of how much groundwater pumping in Tri-Valley would need to be reduced or recharge increased to achieve the measurable objectives. More accurate characterization of the groundwater deficit is a priority project in this GSP.

3.4.1.2 Land Subsidence

The measurable objective for land subsidence in the Tri-Valley Management Area has been set to less than 0.07 ft (0.84 inches), the vertical resolution of the remotely sensed inteferometric synthetic-aperture radar (InSAR) data provided by DWR (TRE Altamira, 2021; Towill, 2021). This value for the objective was chosen because no subsidence has been observed in the management area despite long-term water level declines and the necessary geologic conditions are not considered to be present (see Appendix 8).

3.4.1.3 Interconnected Surface-Water Depletions

Interconnected groundwater and surface-water point discharge in the Tri-Valley Management Area is primarily present in Fish Slough, where groundwater is discharged via springs and seeps and a small area of GDE in Tri-Valley. A flow rate of 0.5 cfs at the northeast spring (SW3208) was selected as the 20-year measurable objective (Table 3-8). This was selected based on the flow rate recommended by the CDFW for maintaining a healthy environment for the Owens Pupfish and Fish Slough Milk Vetch (Alisa Ellsworth, CDFW, personal communication). CDFW is the custodial agency responsible for managing the outflow from the spring to support endangered species habitat and associated wetlands.

Similar to the projected path for water level declines and storage reduction, spring flows are projected to decrease over the next five years while more data are collected and models are developed to better inform management actions. Spring flows are projected to stabilize over the following five years (10-year interim milestone) as projects and management actions begin to come online. The next 10 years involves recovering spring flows measured at the northeast spring (SW3208) to the 20-year measurable objective value of 0.5 cfs.

Table 3-8. Tri-Valley management area measurable objectives for interconnected surface-water depletions at representative monitoring points.

Representative Monitoring Point	Northeast Spring Flow Rate (cfs)			
	5-year Interim Milestone	10-year Interim Milestone	15-year Interim Milestone	20-year Measurable Objective
SW3208	0.1	0.1	0.3	0.5

The current hydrogeologic conceptual model for the basin sources a portion of groundwater discharge into Fish Slough from Tri-Valleys. Therefore, achieving the measurable objective for spring flow will likely require increasing the flow gradient from Tri-Valley into Fish Slough, which translates to increasing water levels in the valleys. Potential management actions for achieving this are discussed above in Section 3.2.1.1 and in Section 4.

Potential surface water depletions in the Tri Valley itself are limited to the few acres of GDE that may be dependent on shallow water table. Stabilizing water level trends from Benton to Chalfant should prevent impairment of GDE caused by pumping. Additional refinement of the mapping of these areas is warranted to assess their susceptibility to water level changes.

3.4.1.4 Water Quality Degradation

Groundwater quality in the Tri-Valley Management Area is generally good, with only a single well exceeding the secondary drinking water standard of 500 mg/L for total dissolved solids (see Figure 2-21 and Appendix 3). This well is located on a landfill site that is already regulated by the California State Water Resources Control Board.

Recognizing that the OVGA is not a public water supplier nor does SGMA grant regulatory authority over groundwater quality to GSAs, the water quality degradation sustainability indicator has been interpreted to mean that projects and management actions undertaken by the OVGA cannot result in additional degradation of water quality within the groundwater basin. Potential project and management actions in the Tri-Valley Management Area will likely be focused on demand reduction and are not expected to adversely impact water quality.

Constituents of concern identified in the Tri-Valley Management Area by stakeholders are arsenic, chloride, nitrate, total dissolved solids, and sodium. Measurable objectives for these constituents have been set to the average observed concentration since January 1, 2000 (Table 3-9). In general, observed solute concentrations in the management area are naturally occurring. Elevated values from landfill monitoring wells are believed to be localized and an artifact of limited water quality data for the Tri-Valley management area. Water quality impacts from landfill leachate are already regulated by the State Water Resources Control Board under the Porter-Cologne Water Quality Control Act. The OVGA will report water quality conditions, and

Table 3-9. Average concentrations set as the Measureable Objectives for constituents of concern in the Tri-Valley Management Area.

Representative Monitoring Point	Average Concentration since January 1, 2000				
	As (ug/L)	Cl (mg/L)	NO_3 (mg/L as N)	TDS (mg/L)	Na (mg/L)
BT-MW1	2.4	2.0	1.1	227	--
CH-MW3	2.8	25.1	0.6	565	--
OV-03	2.2	8.8	0.1	301	44.9
OV-31	3.4	1.8	0.2	151	21.3

will alert and coordinate with responsible agencies as needed if water quality conditions appear to decline in the future.

3.4.2 Owens Valley Management Area

3.4.2.1 Groundwater Level Declines and Groundwater Storage Reductions

In the Owens Lake Management Area, the GSP pathway to comply with SGMA is to prevent undesirable results before they occur. This is consistent with SGMA and the OVGA desire to remain a low priority basin and preserves the existing beneficial uses and property interests (GSP Regulation 354(b)(4)). Measurable objectives for groundwater level declines and groundwater storage reductions for the Owens Valley management area were selected using averages of groundwater elevations measured between 2001 and 2010 (Table 3-10). For wells constructed after 2010, or for which no data were available from 2001 to 2010, the measurable objective was set to the average groundwater elevation for the most recent 10 years for which data were available. No significant and unreasonable impacts from groundwater level declines or groundwater storage reductions were reported within the management area since 2001.

Interim milestones and long-term measurable objectives are set to the same value because the management area is in a dynamic steady state condition. Water level elevations typically reflect weather conditions, with levels generally increasing during wet years and decreasing during dry

Table 3-10. Owens Valley management area measurable objectives for groundwater level declines and groundwater storage reductions at representative monitoring points. Values rounded to the nearest foot.

Representative Monitoring Well	Measurable Objective Elevation (ft amsl)	Measurable Objective Depth to Water (ft RP)
ICWCSD 4	4,254	32
T001	3,880	617
T362	4,072	24
T364	3,903	20
T384	4,168	15
T389	4,224	12
T391	4,303	8
T480	3,995	10
T513	4,117	8
T574	4,071	16
T750	4,360	52
T751	4,379	33
T808	3,846	13
T809	3,829	13
T869	3,985	287
T871	3,852	118
T872	3,955	466
T873	4,963	80
V016GB	3,882	25
V151	3,834	60
V299	3,914	96
WCCSD 2	6,023	230
WCCSD 4	6,274	121

years. Operations within the management area are currently sustainable. As long as groundwater demand does not significantly increase, which is not anticipated, then maintaining the status quo will keep the management area in a sustainable condition.

3.4.2.2 Land Subsidence

The measurable objective for land subsidence in the Owens Valley management area has been set to less than 0.07 ft (0.84 inches) measured by remotely sensed interferometric synthetic-aperture radar (InSAR). This is equal to the vertical resolution of the InSAR data provided by DWR (TRE Altamira, 2021; Towill, 2020). It was chosen because no subsidence has been observed in the management area, and the necessary geologic conditions required for subsidence are not considered to be present (see Appendix 8).

3.4.2.3 Interconnected Surface-Water Depletions

Potential surface water depletions in the management area are limited to the few acres of GDE that may be dependent on shallow water table. Maintaining the steady water level trends should prevent impairment of GDE caused by pumping from the GSP area. Additional refinement of the mapping of these areas is warranted to assess their susceptibility to water level changes.

3.4.2.4 Water Quality Degradation

Groundwater quality in the Owens Valley management area is generally good, with none of the representative wells exceeding any of the primary or secondary MCLs (see Figures 4-20 through 4-23 in Appendix 3). Recognizing that the OVGA is not a public water supplier nor does SGMA grant regulatory authority over groundwater quality to GSAs, the water quality degradation sustainability indicator has been interpreted to mean that projects and management actions undertaken by the OVGA cannot result in additional degradation of water quality within the groundwater basin. Since the Owens Valley management area is currently in a dynamic steady state condition it therefore does not require project and management actions for water quality at this time.

Constituents of concern identified in the Owens Valley management area by stakeholders are arsenic, chloride, nitrate, total dissolved solids, and sodium. Measurable objectives for these constituents have been set to the average observed concentration since January 1, 2000 (Table

Table 3-11. Average concentrations set as the Measureable Objectives for constituents of concern in the Owens Valley management area.

Representative Monitoring Point	Average Concentration since January 1, 2000				
	As (ug/L)	Cl (mg/L)	NO_3 (mg/L as N)	TDS (mg/L)	Na (mg/L)
1400010-003	--	4.4	0.7	78.3	8.7
1400019-001	--	--	0.5	70	16
1400516-001	--	--	0.7	--	5.9
1410004-002	--	6.1	0.8	165.3	13.1
COB 2	5.2	3.4	0.5	127.1	10.6
COB 4	1.5	2.6	0.4	76.5	5.6
OV-06	3.5	3.3	--	159.7	15.7
OV-08	1.8	3.2	1	145.4	18.2
OV-10	0.2	0.7	0.1	74.9	5.4
OV-12	1.5	0.9	0.2	60.6	5.1
OV-13	0.5	9.6	0.4	123	22.1
OV-24	0.5	4.8	0.5	145.1	9.8
OV-29	3.5	3.8	0.4	244.9	23.3
OV-36	0.8	17.9	0.1	295.7	34.4
W384	0.6	10.3	0.2	134.8	21.1

3-11). In general, observed solute concentrations in the management area are naturally occurring. Localized water quality impacts occur primarily from leaking underground storage tanks (USTs) and are already regulated by the State Water Resources Control Board under the Porter-Cologne Water Quality Control Act. The OVGA will report water quality conditions, and will alert and coordinate with responsible agencies as needed if water quality conditions appear to decline in the future.

3.4.3 Owens Lake Management Area

3.4.3.1 Groundwater Level Declines and Groundwater Storage Reductions

In the Owens Lake Management Area, the GSP pathway to comply with SGMA is to prevent undesirable results before they occur. This is consistent with SGMA and the OVGA desire to remain a low priority basin and preserves the existing beneficial uses and property interests (GSP Regulation 354(b)(4)). Measurable objectives for groundwater level declines and groundwater storage reductions for the Owens Lake management area were selected using averages of groundwater elevations measured between 2001 and 2010 (Table 3-12). For wells constructed after 2010, or those having no data from 2001 to 2010, the measurable objective was set to the average groundwater elevation for the most recent 10 years for which data were available. No significant and unreasonable impacts due to groundwater level declines or groundwater storage reductions have been reported in the management area.

Groundwater levels in the Owens Lake management area are extremely consistent and vary little (Figures 2-20, and Appendix 3). Observations typically vary less than 5 ft within a well, with larger water level changes explained by short term pumping tests performed nearby. The limited natural variation in groundwater levels and groundwater storage in the Owens Lake management area, combined with the absence of reported impacts historically, indicate the selected measurable objective values will keep the Owens Lake management area in a sustainable condition.

Interim milestones and long-term measurable objectives are set at the same value because the management area is in a dynamic steady state condition. Water level elevations typically reflect water-year type conditions, with levels generally increasing during wet years and decreasing during dry years. Operations within the management area are currently sustainable. As long as groundwater demand does not significantly increase or groundwater inflows do not significantly decrease, then maintaining current pumping volumes will keep the management area in a sustainable condition.

3.4.3.2 Land Subsidence

The Owens Lake management area is the only portion of the groundwater basin covered by the GSP where geologic conditions necessary for subsidence are considered present. Measurable objectives have been set for both groundwater elevations and observed subsidence measured using GPS, InSAR, and extensometers. No subsidence in the Owens Lake management area has

Table 3-12. Owens Lake management area measureable objectives for groundwater level declines and groundwater storage reductions at representative monitoring points. Values rounded to the nearest foot.

Aquifer Unit	Representative Monitoring Well	Measureable Objective Elevation (ft amsl)	Measureable Objective Depth to Water (ft RP)
1	DVF South Upper	3,641	25
1	T901	3,610	-37
1	T904	3,629	2
1	T910	3,608	-27
2	DVF South Middle	3,643	23
2	Fault Test T3	3,623	-33
2	Fault Test T5	3,623	-33
2	Keeler-Swansea Lower	3,618	-9
2	River Site Lower	3,633	-43
3	DVF South Lower	3,643	23
3	OL92-2	3,607	-49
3	SFIP MW	3,613	-48
3	T917	3,705	-26
4	DVF North MW	3,645	26
5	T899	3,618	-45
5	T902	3,632	-1
5	T908	3,627	-45
5	T916	3,704	-25
Owens Lake	DELTA W(3)_10	3,563	4
Owens Lake	I10(7)_4	3,570	2
Unknow	KCSD	3,613	41
Unknow	O6(5)_4	3,569	3
Unknow	Rio Tinto[a]	--	--
Unknow	T348	3,633	9
Unknow	T588	3,693	15

Unknow	T858	3,670	9
Unknow	T860	3,711	27
Unknow	T920	3,601	212
Unknow	T922[a]	--	--
Unknow	T924	3,592	141
Unknow	T925[a]	--	--
Unknow	T929[a]	--	--

a. Newly established representative monitoring point or data not currently available. Measureable objective will be established in future GSP updates.

been observed, and therefore measurable objectives for subsidence are defined by the vertical resolution of the available measurements.

The same measurable objectives used for the groundwater level decline and groundwater storage reduction (Table 3-7) sustainability indicators are also applied to subsidence. Subsidence is strongly correlated with changes in groundwater elevations. Typically, as long as groundwater elevations remain above the lowest observed value, then subsidence will be prevented. The established measurable objectives for groundwater level decline and groundwater storage reduction are conservative from a subsidence perspective, as the average value of groundwater elevations for a given period is always greater than the minimum observed value.

Continuous Global Positioning (CGPS) stations generally have the smallest vertical resolution of the subsidence observations being used. Vertical resolution of CGPS data is station dependent. The more data collected by the station the more accurate the vertical resolution, so older stations tend to have greater vertical resolution compared to newly installed stations. A review of USGS CGPS stations completed in bedrock that have been in operation for over a decade around Owens Lake show a consistent vertical resolution of +/-0.1 ft. The LADWP operates the only GPS monitoring network on the playa (see Figure 4-3 in Appendix 8), but data from this network were not available for inclusion in the GSP. If these data are available in the future, they can be incorporated into future 5-year updates. Vertical resolution of extensometer data is also station dependent, but typically on the order of a thousandth of a foot (Michelle Sneed, personal communication). No extensometers have been installed in the Owens Lake

management area as of the date of this report, but two locations have been proposed in the northern and eastern portions of the management area (see Figure 6-1 in Appendix 8).

Currently the only available data of observed subsidence is from InSAR. The measurable objective for land subsidence in the Owens Lake management area has been set to less than 0.07 ft (0.84 inches). This is equal to the vertical resolution of the InSAR data provided by DWR (TRE Altamira, 2021; Towill, 2020).

3.4.3.3 Interconnected Surface-Water Depletions

The majority of surface-water that would naturally enter the Owens Lake management area is diverted to the Los Angeles Aqueduct for export out of the basin. The combination of limited surface-water inflows and the presence of thick clay layers at the surface results in effectively little exchange of water between streams and the groundwater system in the Owens Lake management area. However, groundwater is discharged to the surface along faults and by flowing artesian wells that form springs and small wetlands that provide vital habitat for species in the area. Groundwater is discharged where groundwater flowing toward the lake encounters finer textured lake sediments or encounters fault zones, and flow is deflected to the land surface to form seeps.

The diffuse nature of many of these springs/seeps and the very flat topography of the area make it extremely difficult to measure spring discharge accurately. The use of vertical and horizontal groundwater elevation gradients between nested wells have been proposed as long-term monitoring criteria to provide early warning of potential changes in discharge, but further analysis and data collection are required to develop such gradient-based SMC. It is anticipated these will be included in the 5-year updates to the GSP if necessary to manage pumping conducted under the lakebed. Until gradient-based criteria are established, groundwater elevations are used as a proxy for measurable objectives.

The same measurable objectives used for the groundwater level decline, groundwater storage reduction, and subsidence (Table 3-7) sustainability indicators are also applied to interconnected surface-water depletions. No significant and unreasonable impacts to groundwater dependent ecosystems on the playa caused by pumping have been observed during either of the two averaging periods used. Therefore, maintaining current groundwater elevations should keep the

vertical hydraulic gradients that feed the springs and flowing artesian wells that provide vital habitat for species in the area.

3.4.3.4 Water Quality Degradation

Groundwater quality in the Owens Lake management area is generally very poor under the lakebed. However, higher quality groundwater exists primarily in the north, west and southern perimeter and outside the lakebed. Recognizing that the OVGA is not a public water supplier nor does SGMA grant regulatory authority over groundwater quality to GSAs, the water quality degradation sustainability indicator has been interpreted to mean that projects and management actions undertaken by the OVGA cannot result in degradation of water quality within the groundwater basin. Because the Owens Lake management area is currently in a dynamic steady state condition, it therefore does not require project and management actions at this time. Should groundwater conditions, water banking, or pumping in the management area change, the need for additional OVGA monitoring to detect water quality degradation before regulatory thresholds might be reached may be necessary in this portion of the Basin and could be included in an amended GSP.

Constituents of concern identified in the Owens Lake management area are arsenic, chloride, nitrate, total dissolved solids, and sodium. Measurable objectives for these constituents have been set to the average observed concentration since January 1, 2000 (Table 3-13). Observed

solute concentrations in the management area are naturally occurring. Localized water quality impacts occur primarily from leaking underground storage tanks (USTs) and are already regulated by the State Water Resources Control Board under the Porter-Cologne Water Quality Control Act. The OVGA will report water quality conditions and will alert and coordinate with responsible agencies as needed if water quality conditions appear to decline in the future.

3.5 Monitoring Network

A detailed description of current and historical monitoring in the Basin can be found in Appendix 3: Monitoring Plan and Data Gaps Analysis. The representative monitoring locations and graphs of historical data are included there. The sections below briefly summarize the current monitoring network. Historical groundwater level, quality, extraction, surface water gauging, and meteorological data have been uploaded to the publicly available OVGA database.

Table 3-13. Average concentrations set as the Measureable Objectives for constituents of concern in the Owens Lake management area.

Aquifer Unit	Representative Monitoring Point	Average Concentration since January 1, 2000				
		As (ug/L)	Cl (mg/L)	NO_3 (mg/L as N)	TDS (mg/L)	Na (mg/L)
1	DVF North	6.6	11.1	--	304.9	58.5
1	Keeler-Swansea	3.3	228.9	--	1,722.5	461.9
1	River	11.5	69.4	--	670.8	166
2	DVF North	2	88.6	--	738.1	80.4
2	Keeler-Swansea	4.5	245.2	--	1,903.2	409.8
2	River Site	--	97.6	--	861.9	110
3	DVF North	19.9	155.6	--	1,081.3	124.5
3	OL92-2	33	3,958.6	0.1	14,014	5,431.4
4	DVF North MW	11	206.5	--	1476	149.1
4	Star Trek	11	139.4	--	2223	696.6
5	Fault Test T1	7.2	84.1	--	902.4	123.9
Unknown	1400511-001	--	--	0.4	95	4
Unknown	KCSD	53	103.8	0.1	864.1	157.4
Unknown	W344	0.6	7	0.3	123.3	13.8

The OVGA anticipates updating this database on a regular basis (annually or more frequently) as additional data (post-2020) are made available by the various reporting agencies.

3.5.1 Description of Monitoring Network (Reg. § 354.34)

The objective for the monitoring network is to monitor Basin conditions to maintain sustainable groundwater conditions, detect negative trends towards minimum thresholds and assess progress towards reaching or sustaining measurable objectives. The proposed monitoring

network is extensive, with sufficient number of locations and monitoring frequency to track changes in groundwater levels, water quality, depletions of interconnected surface water, and subsidence over time.

Multiple entities have established monitoring programs in the Basin and have provided data to the OVGA. The data are housed in an interactive and publicly accessible database which can be viewed at owens.gladata.com. Brief descriptions of existing water resource management and monitoring programs are included in Section 2.12; data sources are described fully in Appendix 3.

The largest and most frequently measured monitoring well network in the Eastern Sierra is maintained by LADWP and the Inyo County Water Department. Data from a total of 880 wells with recent (January 1, 2010, and later) water level observations have been acquired by the OVGA. Most of the data are from LADWP monitoring programs. The vast majority of these wells are located on LADWP lands, but there are more than 126 wells with recent water level data identified on GSP lands. Additional monitoring entities or programs include local water suppliers such as CSDs and municipalities, monitoring related to CalEPA regulatory programs (landfills, USTs, etc.), GAMA or CASEGM (see Section 2.12), and monitoring related to CEQA/NEPA permitted actions. In addition, the OVGA may conduct on-site monitoring as needed to fill data gaps, but the level of effort necessary will be small compared to the quantity of data acquired from the extensive set of existing monitoring programs.

In addition to groundwater monitoring, LADWP also has an extensive network of surface water gauges on canals, ditches, creeks and streams located from the perimeter of the basin (base of mountains) and on the valley floor to the Owens Lake. The surface gauging stations have automated data loggers typically recording flow at 15-minute intervals with data totaled and available online or downloaded at monthly intervals. Inyo County receives monthly surface water flow totals, annual runoff measurements, and recharge forecasts from LADWP for the Owens Valley and Owens Lake management areas in the Basin. These measurements and forecasts are based on the stream gauging and meteorological data (precipitation, snow pillows, snow courses, etc.) collected throughout the Sierra from Mono Basin to Olancha/Cartago and at numerous locations across the Owens Valley floor. These data have been added to the OVGA database.

Monitoring data frequency varies by entity. LADWP typically collects monthly or bimonthly measurements. Water levels at landfills in the Basin are collected on a quarterly basis. Municipalities appear to collect water level data on a quarterly to annual basis. Most of the data appear to be collected manually. There is no evidence of a groundwater level telemetry system operational in the Basin except some surface water measurements are reported in real time by LADWP. Pressure transducers that collect several daily observations at regular intervals are deployed, primarily by LADWP, throughout the Basin in areas of interest; for example, a transducer network is currently deployed (as of summer 2020) in the southern portion of Fish Slough and adjacent portion of the Owens Valley to collect data at one-hour intervals. Another network was deployed in the Owens Lake area from about the mid-1990s to early 2010. The ICWD typically conducts monitoring monthly or annually. More frequent site visits or deployment of a small number of continuous recorders are implemented for projects in specific areas.

From the extensive set of monitoring locations in the database, representative locations for the water level monitoring network were selected using criteria including recent data availability and reliable monitoring, spatial location, proximity to areas of interest (e.g. GSP area or groundwater production locations), and length and monitoring frequency of the historical data record. The rationale for the subset of representative monitoring locations is discussed in greater detail in Section 3.5.3 below.

Due to the generally high quality of water in the Owens Valley, no formal network has been established to measure and monitor groundwater quality in the basin. Monitoring is typically done on a well-specific basis according to the California Regulations Related to Drinking Water, or a site-specific basis according to the California State Water Resources Control Board in response to localized groundwater contamination (e.g. leaking UST). As a result, most groundwater quality observations acquired by the OVGA and housed in the database are clustered around population centers in the Basin. A total of 115 wells in the Basin have had at least three analytical results for the constituents of concern arsenic (As), chloride (Cl), sodium (Na), nitrate (NO_3), or total dissolved solids (TDS) since January 1, 2010, with 82 of these wells located within the GSP area.

With the notable exception of the Tri-Valley area, the majority of the significant groundwater extraction wells (LADWP, large CSDs, City of Bishop, and smaller population centers like Laws,

Big Pine and Lone Pine) in the Basin are metered with monthly or annual totals included in the monitoring network/database. Lack of metered pumping data for the Tri-Valley area is discussed as a data gap in Section 3.5.4. Also, steps the OVGA will undertake to acquire the necessary data to maintain the database are described in Section 4.

The combination of generally stable groundwater levels and/or general lack of susceptible subsurface materials with high potential for subsidence, has led to little historical, dedicated subsidence monitoring. Changes in the Owens Valley surface elevations are more often associated with seismic events. However, as described in Appendix 8, the Owens Valley monitoring network includes InSAR data from DWR's publicly available data set (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub). Figures 5-1 and 5-2 from Appendix 8 display the locations and data from the InSAR set. Continuous Monitoring GPS data was also examined for this GSP preparation to substantiate the InSAR data set and to confirm the lack of historical subsidence, but existing sites are not located in alluvium. This program is not currently slated to be part of the monitoring network. If necessary, subsidence monitoring may be revised to more accurately detect surface elevation changes if pumping projects under or around the Owens Lake are implemented.

3.5.1.1 Description of the Monitoring Network Capabilities

The historical record of hydrographic data acquired thus far varies by location, but often ranges from several years to several decades. The majority of the Basin monitoring network locations have at least quarterly, and usually monthly or more, frequent monitoring of surface water and groundwater, which is sufficient to detect both seasonal and multi-year trends. Typical seasonal and intra-annual changes include: 1) rising groundwater levels during the winter from recharge and when phreatophytic vegetation is senescent; 2) rising surface water levels in spring from runoff associated with winter snowmelt; 3) summer declines in both surface and groundwater levels from decreasing runoff and increasing evapotranspiration and pumping demand; and 4) minimum flows and groundwater levels generally in the fall. Multi-year trends are typically related to drought or wet periods because pumping has been relatively constant for several decades. Comparing recently collected measurements with the extensive record of historical data for ongoing and anticipated trends in hydrologic conditions will permit the OVGA to distinguish seasonal, annual or weather events like multi-year droughts from increased pumping stress. Continued data collection is a requirement of the various agencies (described in Section

2.1.2), and the OVGA anticipates maintaining the hydrologic data in the database during the GSP implementation period largely by acquiring data collected by other agencies.

Key areas of interconnected surface water include the springs in Fish Slough and the perimeter of Owens Lake. In these areas, several groundwater monitoring wells in the network are located in the vicinity of surface water gauging stations. The relationship between interconnected surface water and groundwater discharge can be effectively monitored by comparing changes in groundwater head in a nearby monitoring well to spring discharge in surface water gauge. The historical relationship between groundwater levels and spring flow in Fish Slough is evident. Similar relationships are expected to be developed in the Owens Lake area as more data are collected as part of the ongoing Owens Lake Groundwater Development Project and incorporated into the OVGA database.

As noted in Sections 3.2 and 3.3, the spatial coverage and frequency of data collection in the monitoring network allows qualitative and often quantitative (e.g. ICWD, 2021 annual report) assessment of whether water trends will maintain water levels above minimum thresholds or if levels are progressing towards measurable objectives. Surface water and groundwater levels changes can be summarized on annual time-steps for integration into water budgets and/or modelling efforts. Precipitation, runoff, extraction, and water export values generated by the monitoring network can also be totaled for use in modeling efforts (see Section 2.0 Water Budget). Impacts to beneficial users or significant changes in groundwater conditions can be monitored using wells located upgradient and downgradient from the use of interest. Although data gaps have been identified, primarily in the Tri-Valley area, the GSP includes management actions to address those gaps using public outreach efforts, inter-agency cooperation, or by pursuing grants for studies and projects (see Section 4).

3.5.1.2 Monitoring Network Applicability to Specific Sustainability Indicators

Chronic Lowering of Groundwater Levels, Reduction in Storage or flow directions: As described in Section 2.2.2.2, water level monitoring is related to groundwater storage and is sufficient to assess whether undesirable effects from change in storage is occurring. The monitoring network in the Basin is comprised of groundwater monitoring wells completed in both the water-table aquifer and deeper zones. The majority of monitoring wells have deep enough screen intervals that even during the severe 2012-2016 drought the wells did not go dry preventing loss of water

level (or water quality) data. The representative monitoring wells have multi-decadal history and provide a solid basis for later comparison of trends and SMCs (even in Tri-Valley) to project changes in groundwater levels to avoid chronic declines in groundwater levels. Chronic lowering of groundwater levels in the Owens Valley and Owens Lake management areas have not been observed and are unlikely. Similarly, unreasonable changes in groundwater storage are also unlikely. In the Tri-Valley management areas, a chronic decline in groundwater levels has been detected by the existing monitoring network, ranging from 0 to 2 feet of decline per year for multiple decades. The OVGA will explore the opportunity to expand the monitoring system in the Tri-Valley management area by cooperating with other agencies that may conduct monitoring (e.g. TVGMD or CDFW) or through acquisition of water levels in domestic wells to close additional data gaps in this management area. The scope of the latter effort will be dependent on voluntary cooperation by residents, but the OVGA is not dependent on implementing additional monitoring to detect and quantify a chronic decline in groundwater levels.

The monitoring network allows for the assessment of hydraulic gradients across all three management areas. The network includes monitoring wells at various depths and in each of the major hydrostratigraphic units. Groundwater generally flows north to south and west to east in the Basin. A groundwater flow path from Tri-Valley to Fish Slough is also hypothesized. Flow paths related to changes in groundwater gradient are unlikely to undergo significant change, but would be detected by the network given the numerous of monitoring locations covering upgradient and downgradient portions of the Basin and in the major aquifers.

Degraded Groundwater Quality: The OVGA will continue to acquire water quality data reported for other purposes and publicly available data collected for specific studies in the Basin. The distribution and number of monitoring locations allows groundwater elevation monitoring to supplement and assess the need for additional groundwater quality monitoring. For example, if new pumping stress in the Owens Lake management area led to a significant change in gradient and associated flow path which could cause migration of deeper, saline water, the network's deep and shallow monitoring wells would detect those changes. This provides the OVGA advance warning to implement additional monitoring or management recommendations to prevent degraded water quality. In the Tri-Valley and Owens Valley management areas, water quality is high, especially in the primarily undeveloped areas at the Basin margins near the recharge sources. The potential for degraded water quality is low due to this lack of

development and related sources of contamination. The network is capable of monitoring changes in water quality in these areas by acquiring publicly reported water quality data and studies.

Land Subsidence: As noted in Sections 2.2 and 3.2.3.2, most of the Basin has low susceptibility to subsidence because the combination of chronic groundwater declines and wide-spread susceptible subsurface materials do not exist (Table 7.2, Appendix 8). No historical subsidence has been noted despite numerous droughts and fluctuations in water levels. Based on the low potential for subsidence and the generally sustainable management in the Basin, the existing InSAR data supplied by DWR along with the monitoring of groundwater level changes are adequate for the Tri Valley and Owens Valley management areas.

In the Owens Lake management area, thick subsurface clay layers along with the proposed LADWP OLGDP could potentially lead to subsidence. The management area is rated as having a moderate susceptibility for subsidence (Table 7.2, Appendix 8). If the proposed LADWP groundwater development program proceeds, then the monitoring network will need to be increased and made correspondingly more accurate. As part of the OLGDP, LADWP has proposed to monitor surveyed ground surface locations and install two extensometer locations. As a participant on the Owens Lake Groundwater Working Group the OVGA could insist that survey points, extensometer, or tiltmeter monitoring be instituted, and could add these new locations to the GSP. The combination of groundwater level and subsidence monitoring with the existing ground surface (surveyed/InSAR data) and potential future site-specific monitoring will detect potential subsidence in vulnerable areas on the lakebed.

Depletions of Interconnected Surface/Ground Water: Where relevant, direct measurements of spring discharge will continue at existing stations and be updated in the database. In addition, where groundwater discharge to the surface is primarily related to the amount of upward groundwater gradient, groundwater elevation measurements are an effective proxy for determining impacts to interconnected surface/groundwater. This is especially true at locations where groundwater changes can be compared to surface water flow changes. For example, the relationship between declining groundwater level at Fish Slough in monitoring well T397 is correlated with declining surface water discharge from the neighboring Fish Slough Northeast Spring measured at SW3208 gauge. Examining hydraulic head differences in well clusters consisting of adjacent monitoring wells with differing vertical screen intervals is an additional

way to monitor groundwater and surface water connections and to assess changes in vertical hydraulic gradient. Numerous monitoring well clusters exist in the monitoring network in all three management areas, particularly in the Fish Slough and Owens Lake areas where the majority of interconnected waters exist within the Basin. By comparing historical and future hydraulic vertical gradients using cluster wells, the monitoring network will detect decreases in upward groundwater flow that could lead to decreases in groundwater discharge to surface waters.

In areas of GDE, evapotranspiration and vegetation cover is related to water table depth and groundwater elevation monitoring (Elmore et al., 2003 & 2006). Monitoring water levels is a sufficient proxy to indicate potential for reductions in groundwater discharge caused by groundwater management.

Monitoring Network and Management Area Considerations: The Tri-Valley Management Area contains the least amount monitoring data to describe the long-term groundwater level declines and consistent pumping stress. As noted in section 3.5.4, the OVGA will attempt to address this monitoring gap using a variety of methods. A 2021 survey sent to Tri-Valley residents has yielded several potential domestic well owners willing to allow OVGA staff to monitor groundwater levels in their wells. OVGA has attempted extensive outreach with Tri-Valley Groundwater Management District agricultural pumpers in an attempt to ascertain annual pumping amounts and is exploring acquiring data from indirect methods to estimate agricultural pumping based on remote sensing. The OVGA is exploring grant opportunities and the potential for cooperative agreements with state and federal agencies with land jurisdiction in the Basin to fund additional water level monitoring.

The Owens Valley Management Area contains the greatest density, highest frequency, and longest record of historical monitoring due to LADWP's surface and groundwater extraction activities. The robust monitoring network available for this management area near population centers and near LADWP wellfields is evident in the online database and is more than sufficient to assess conditions and trends. The exception to this monitoring density and frequency is in the northwestern corner locally referred to as Round Valley. This area currently has low pumping stress and ample surface water diversions. It currently has little potential for future development or extraction. Based on these circumstances and the observed stable groundwater levels, the more limited monitoring in Round Valley (primarily from Wheeler Crest CSD and LADWP monitoring) is deemed sufficient but could be improved under this GSP (Section 4, Project #3).

Although there is currently little pumping stress in the Owens Lake Management Area, potential projects in development could change conditions. As described in Sections 2.1.2, 2.1.3 and 3.2.3, LADWP is developing a groundwater development program to pump saline groundwater from confined aquifers under the Owens Dry Lake. There are several regulatory programs that could apply to any eventual groundwater development including SGMA though none (except compliance with CEQA) are certain. As part of the planning efforts, LADWP has installed and continues to upgrade an extensive system of surface water, groundwater, extraction, ground surface, meteorological and vegetation monitoring equipment. The OVGA anticipates that additional monitoring locations will be added to the OVGA monitoring network and database as more data becomes available as the project development proceeds.

The robust set of representative monitoring wells selected for the Owens Lake Management Area anticipates potential future pumping under the lakebed. The proposed monitoring network includes wells completed in multiple confined aquifers beneath the lake and cluster wells with differing vertical screen intervals in the unconfined aquifer that supports GDEs along the lake perimeter, in seep and spring areas, and upslope on alluvial fans. LADWP has also installed a subsidence monitoring network (see Appendix 8) and anticipates installing extensometers at two locations in deeper lake-area wells. The monitoring network can be used for baseline/background data and will be used to prevent significant and unreasonable effects caused by deviations from historical groundwater levels if LADWP's project or another unforeseen project is implemented.

3.5.2 Monitoring Protocols for Data Collection and Monitoring (Reg. § 352.2)

This section will briefly review the monitoring protocols necessary to implement the GSP. Detailed descriptions are contained in Appendix 4, Sampling and Analysis Protocol (SAP). The SAP was prepared in accordance with DWR SGMA inspired Best Management Practices (BMP), in particular BMP #1 - *Monitoring Protocols, Standards, and Sites* (DWR, 2016b). Technical guidance documents considered in preparation of the SAP include, but are not limited to, the following documents:

- Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4 (U.S. Environmental Protection Agency [EPA], 2006)
- Requirements for Quality Assurance Project Plans, EPA QA/R-5 (USEPA, 2001)

- National Field Manual for the Collection of Water-Quality Data (USGS, individual Chapters published as separate documents)
- Groundwater technical procedures of the USGS: U.S. Geological Survey Techniques and Methods 1–A1 (USGS, 2011)

Links to complete documents cited in the SAP are included in the References Section and available online.

3.5.3 Representative Monitoring (Reg. § 354.36)

Due to the large size of the Basin and varying hydrologic conditions and pumping stresses, the OVGA decided to split the Basin into three Management Areas (Section 2.2.4). Within each management area, representative monitoring wells have been selected from the larger, comprehensive monitoring network that reflect the prevailing hydrologic conditions and react to changes in water balance components such as recharge and pumping. This GSP includes 86 representative monitoring sites to monitor conditions and SMC for the relevant sustainability indicators at these locations to periodically evaluate the sustainability of the Basin. The sites include groundwater monitoring wells, surface water flows at Fish Slough springs, and sites for remotely sensed ground elevation measurements. Locations and description of the representative sites are contained in Section 3.5.1 and Appendix 3. Data from wells other than the representative monitoring sites will continue to be acquired for the monitoring network and will be used to evaluate the adequacy of the representative sites when the GSP is updated. Subsidence Monitoring using InSAR measurements at representative locations is described in Section 2.2.2.4 and Appendix 3.

Minimum Thresholds and Measurable Objectives have been established at representative monitoring wells as detailed in Sections 3.2 and 3.3, respectively. The representative wells have an extensive historical data record with semi-annual or more frequent groundwater observations over many years along with well construction information and geologic information. Most wells are part of ongoing monitoring programs from OVGA members and future data availability should not be a limitation. All representative wells are in good physical condition. The wells are spatially dispersed in all management areas, and most are constructed in the uppermost water table aquifer. Some wells are completed in deeper confined or semi-confined aquifers, primarily in Fish Slough and Owens Lake Management Area.

In most portions of the Basin multiple monitoring candidate locations exist, and additional criteria were developed to select the representative wells to ensure the selected wells reflected general water level conditions in the area. Criteria included: proximity to either recharge area or extraction stress (creeks, ditches, reservoirs and actively pumped wells); subsurface characteristics and proximity to any structural heterogeneities (faults, alluvial/volcanic contacts, etc.); proximity to more sensitive resources (domestic wells, GDEs, etc.); upgradient or down-gradient wells for water quality assessment. Hydrographic data and well logs were examined for all nearby wells to select wells that accurately reflected regional groundwater patterns. The prevailing selection strategy was to select wells that were in good hydrologic communication with the surrounding region and that were located near enough to recharge/pumping zones to reflect seasonal and annual changes. Wells unduly influenced by local recharge sources such as temporary water spreading for recharge or consistent surface water seepage or adjacent to larger supply wells that may turn on/off on daily or weekly time frames were not selected.

3.5.4 Assessment and Improvement of Monitoring Network (Reg. § 354.38)

Identification and description of data gaps is described in detail in Appendix 3. As noted in Section 3.5.4 and Appendix 3, during the initial 5-year implementation of the GSP, the OVGA plans to address data gaps in the Basin. The OVGA may add new monitoring points to the current representative monitoring wells if suitable monitoring become available. Additionally if, as a part of ongoing monitoring or if groundwater conditions change or are expected to change, the GSP will be updated to add or alter monitoring locations, methods, or frequency. Management Actions and Projects #1, #2, and #3 described in Section 4 were included in the GSP address high priority data gaps will include annual review and evaluation of the monitoring network as part of the database maintenance.

4. Projects and Management Actions to Achieve Sustainability Goal (Reg. § 354.44)

Groundwater Sustainability Plans must include *"a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin"* (Reg. § 354.44). As established above, the Basin is currently ranked low priority. The OVGA has chosen to

develop this GSP to ensure groundwater conditions in the Basin are maintained or improved where applicable. An additional consideration in developing this list of Management Actions and Projects was to not place an undue financial or regulatory burden on local residents recognizing that compliance with SGMA is voluntary for the OVGA (See Fund1 in guiding principles, Section 1.2). Given the Basin conditions and low priority status, the management actions and projects discussed in this section will be implemented at the discretion of the OVGA.

Four proposed Management Actions and Projects are summarized in Table 4-1 and discussed individually below. Design specifics for projects, implementation plans, or OVGA regulations will be prepared as applicable after adoption of this GSP and will be made available for public review and comment before Board decisions to implement an action. As this GSP is implemented, if the management actions or projects cannot be implemented due to lack of funding, the OVGA will determine whether to pursue outside funds or impose fees to implement the project if it is necessary to maintain sustainability of the Basin or GSA viability. Decisions regarding imposition of fees will be consistent with the OVGA Guiding Principles (CEP and Section 1.2)

4.1 Proposed Management Action #1: Well Registration and Reporting Ordinance

The purpose of this proposed management action is to address a data gap regarding well locations and pumping amounts in the Basin. Several water providers or commercial pumpers did not respond to requests to provide data voluntarily to the OVGA to include in the GSP. In some portions of the Basin the data gap is considered high priority, for example no pumping information was provided for the Tri-Valley Management Area (Appendix 3). The proposed ordinance will describe methods for measurement of pumping (e.g. flow meters on wells) or procedures for estimation of pumping rates and volumes using power consumption data. In addition, the list of domestic wells in the Basin is probably incomplete. Registration of *de minimis* pumpers is permitted by SGMA, and the ordinance may include a one-time voluntary report to acquire information on well location, well construction characteristics, water levels, and approximate production amounts. This basic information is already required by local and State regulations as part of well permitting and well completion reports. The ordinance will contain procedures, timing, and methods to register a well and submit needed information which will be reviewed for quality control and entered in the OVGA database.

Circumstances under which projects or management actions shall be implemented and criteria that would trigger implementation and termination: The OVGA shall determine the timing of when to consider a Well Registration and Reporting Ordinance following adoption of the GSP; however, this program will be a necessary to complete and maintain a current database of pumping locations and amounts. Termination of this program would be at the discretion of the OVGA. Data relevant to activities and monitoring in the adjudicated portion of the Basin will be exempt from the ordinance, but subject to the data sharing requirements of the LTWA (Section 2).

Permitting and regulatory process: Preparation of a Well Registration and Reporting Ordinance would be exempt from environmental regulations or permitting. The OVGA will follow all public noticing and review requirements when preparing and adopting the ordinance.

Justification and Benefits: SGMA requires GSAs to maintain a database of hydrologic and hydrographic data (§354.40). Substantial effort and state funds have been expended to compile historical data into the OVGA database, yet data gaps remain (Appendix 3). This ordinance is necessary to address multiple data gaps identified as high to low priority (e.g. well location, construction, production). Expected benefits of this management action will be a more accurate and complete database and ready access to groundwater information to all beneficial users in the Basin. If it becomes necessary for the OVGA to regulate pumping amounts or well spacing to prevent well interference or other impacts to private wells, a complete registration of all pumpers is necessary.

Implementation: The OVGA retains discretion whether to implement this management action depending on funding, staffing, and need. If the Well Registration and Reporting Ordinance is adopted, OVGA staff or contractors will establish a contact list of well owners, develop mail and on-line reporting forms and procedures including establishing a location on the website OVGA.us to submit the required information. Pumpers in the Basin will be given ample opportunity and time to prepare the requested well and pumping information. Initially, well registration and reporting potentially could be required of all well owners, but ongoing reporting of pumping would only be required for agricultural, commercial, or municipal pumpers, and CSD/mutual water companies but not *de minimis* users. Staff will inspect data received and update the OVGA database approximately annually. Specifics regarding timing and level of detail of the reported data will be described in the ordinance.

Legal authority: The OVGA members created a JPA in accordance with California Government Code Section 6509 to jointly exercise their powers as the exclusive GSA for the Basin and for the purpose of preparing this GSP. Descriptions of the powers are contained in Article II, Section 2 of the JPA included in Appendix 1. The JPA will remain in effect until terminated by unanimous consent of active members or when there are fewer than two members remaining in the OVGA.

SGMA grants GSAs the powers and authorities to *"perform any act necessary or proper..."* including adopting *"..rules, regulations, ordinances, and resolutions..."* necessary for SGMA implementation (CWC 10725.2(b)). Registration of groundwater extraction facilities and reporting is permitted by SGMA (CWC 10725.6 and 10725.8). Acquisition of groundwater pumping and well information is necessary to manage groundwater in accordance with SGMA.

Procedures for providing noticing to the public: In addition to applicable noticing and public hearings to adopt an ordinance, the OVGA will post all notices on its website and notify individuals on its interested party contact list before adoption in accordance with CWC 10725.2(c).

Cost: The OVGA will incur staff, administrative, and noticing costs to prepare and adopt the Well Registration and Reporting Ordinance. Costs are estimated to be $14,370. Costs to receive, catalog, enter data, and perform all program functions are estimated to be $360 annually. The low estimated costs reflects the nearly complete extraction dataset for the Basin already obtained by the OVGA.

4.2 Proposed Management Action #2: Well Permit Review Ordinance

The purpose of this proposed management action is to acquire information necessary to maintain an up-to-date database of pumping wells in the Basin. Additionally, the ordinance would allow the OVGA to determine if regulation of new wells under SGMA is applicable and necessary to ensure sustainable conditions are maintained. The proposed ordinance will require well construction permit applications submitted to Inyo or Mono Counties be provided to the OVGA for review. Final approval authority of the well construction permits remains with the Counties. The Ordinance will include criteria the OVGA will apply to determine the need to regulate pumping from a new, reactivated, or replacement well. The scope of the permit review will be tailored as necessary to determine the need for groundwater management based on the

potential for a well described in a permit to exceed a minimum threshold, prevent attaining a measurable objective, or to create other significant and unreasonable effects (e.g. well interference, surface water depletion). The Ordinance will describe the conditions the OVGA may place on well construction, location, capacity, or extraction to ensure sustainable groundwater conditions are maintained in the Basin. Small capacity wells for *de minimis* extractors are exempt from most SGMA provisions including regulation of pumping. Permits for such wells will be reviewed primarily to acquire information to update the database and ensure the use and production of the well is correctly cataloged as *de minimis*.

Circumstances under which projects or management actions shall be implemented and criteria that would trigger implementation and termination: The OVGA shall determine the timing of when to consider a Well Permit Review and Ordinance following adoption of the GSP; however, this program will be necessary to maintain a current database of pumping locations and amounts and determine the need for groundwater regulation of new wells. Termination of the program would be at the discretion of the OVGA.

Permitting and regulatory process: Preparation of a Well Permit Review Ordinance would be exempt from environmental regulations or permitting. The OVGA will follow all public noticing and review requirements when preparing and adopting the ordinance.

Justification and Benefits: SGMA requires GSAs to maintain a database of hydrologic and hydrographic data (§354.40). Substantial effort and state funds have been expended to compile historical data into the OVGA database, and this ordinance is necessary to maintain an accurate and up-to-date database and determine the need for groundwater regulation. The database provides to groundwater information to all beneficial users in the Basin in a readily accessible format.

Implementation: The OVGA retains discretion whether to implement this management action depending on funding, staffing, and need. If the project proceeds, the Ordinance will describe the procedure for Inyo and Mono County departments responsible for approving well permits to provide the permits to the OVGA for review. The Ordinance will specify the procedures the OVGA will employ to complete its well permit review, including deadlines to complete and notification of the applicant and surrounding properties. If additional conditions on a well location, construction, or operation are warranted, the Ordinance will contain procedures to modify the permit or to appeal the decision.

Legal authority: The OVGA members created a JPA in accordance with California Government Code Section 6509 to jointly exercise their powers as the exclusive GSA for the Basin and for the purpose of preparing this GSP. Descriptions of the powers are contained in Article II, Section 2 of the JPA included in Appendix 1. The JPA will remain in effect until terminated by unanimous consent of active members or when there are fewer than two members remaining in the OVGA.

SGMA grants GSAs the powers and authorities to *"perform any act necessary or proper..."* including adopting *"...rules, regulations, ordinances, and resolutions..."* necessary for SGMA implementation (CWC 10725.2(b)). Acquisition of groundwater pumping and well information is necessary to manage groundwater in accordance with SGMA. Registration of groundwater extraction facility and reporting is permitted by SGMA (CWC 10725.6 and 10725.8) as is regulation of pumping (CWC 10726.4).

Procedures for providing noticing to the public: In addition to applicable noticing and hearing requirements to adopt an ordinance, the OVGA will post all notices on its website OVGA.us and notify individuals on its interested party contact list before adoption. Procedures for communication and any necessary agreements between County Departments responsible for well permits, permit applicants, and the OVGA will be included in the Ordinance.

Cost: The OVGA will incur staff, administrative, and noticing costs to prepare and adopt the Well Permit Review Ordinance. Hydrology staff or contractors may be retained to complete the permit review. Costs are estimated to be $7,920. Annual costs to receive, review, analyze potential pumping effects are estimated to be $1,740 based on the recent history of well permit applications submitted to Inyo and Mono Counties. The low cost of this of this project reflects the relatively low number of well permit applications in the Basin, approximately 40 each year.

4.3 Proposed Management Action #3: Increase groundwater level monitoring network

The purpose of this proposed management action is to address a data gap regarding the paucity of water level measurements primarily in the Tri-Valley Management Area. The current water level monitoring network in the Benton and Hammil Valleys and to a lesser extent Chalfant Valley is insufficient for detailed mapping of groundwater elevations. Without better quantification of groundwater elevations across the valleys, a domestic well vulnerability assessment is difficult and reliant on several (though reasonable) assumptions. This data gap

added uncertainty in developing SMCs and in the assessment of whether or where groundwater conditions may cause unreasonable effects. The limited data acquired by the OVGA, show water levels have been slowly but consistently declining in the Tri-Valley area for decades. Filling this data gap is recommended as high priority, and collecting water level data from existing wells is the most expedient and cost-effective solution. In addition, water level data for Round Valley in the Owens Valley Management Area and south of Olancha in the Owens Lake Management Area are sparse and might be expanded by monitoring private wells if volunteer owners are identified. Pumping stress in these parts of the Basin is much lower and thus filling those data gaps is a lower priority. This management action will consist of two components, a voluntary program of monitoring existing privately-owned wells and a potential program to install additional, dedicated monitoring wells.

Circumstances under which projects or management actions shall be implemented and criteria that would trigger implementation and termination: Following adoption of the GSP, the OVGA will determine whether to implement this management action. First, the OVGA must ascertain whether well owners are willing to participate in a voluntary monitoring program. The program will require the OVGA enter into land access agreements with willing well owners. The time required to finalize access agreements or what conditions a well owner may request are not known. Access for the OVGA to conduct monitoring would be voluntary and could be terminated by the well owner at any time. Discontinuing the overall water level monitoring program would be the discretion of the OVGA.

Construction of new dedicated monitoring wells by the OVGA is contingent on acquiring funding and developing land access/lease agreements with landowners at suitable locations in the Basin.

Permitting and regulatory process: Instituting a private well monitoring program would be exempt from environmental regulations or permitting. Fieldwork will be conducted by qualified, and certified staff or contractors and will comply with all applicable regulations, standards, and monitoring protocols to prevent contamination or damage to private property.

Installation of new monitoring wells will comply with CEQA and applicable permitting and regulations pertaining to well installation. Monitoring wells will be constructed in accordance with current State regulations.

Justification and Benefits: Substantial effort and state funds have been expended to compile historical data into the OVGA database, yet data gaps remain (Appendix 3). Expanding monitoring in the Tri-Valley portion of the Basin is necessary to address multiple high priority data gaps for well information (e.g. location, construction) and for characterization of water levels. Similar efforts in other portions of the Basin may be beneficial but are not as high priority. Expected benefits of this management action are a more accurate and complete characterization and description of groundwater conditions and trends. The data will be housed in the OVGA database and readily accessible to all beneficial users in the Basin.

Implementation: Responding to a mailed survey sent by the OVGA to the Tri-Valley Management Area residents, several well owners in the Tri-Valley Management area expressed interest in participating in a water level monitoring program. To increase the number of candidate locations, the OVGA will add a form to its website to allow well owners to volunteer for the program or request monitoring of their well. The OVGA must inspect each well to determine if it is suitable for monitoring and would provide reliable and useful information. Based on that inspection, the OVGA would select which wells to include in the program and begin negotiating access agreements. Monitoring frequency would be a condition in access agreements, but should be at least annually or semi-annually. Monitoring may be conducted by the OVGA or in cooperation with another agency such as the TVGMD. The program could also include monitoring of existing or new wells owned by state or local agencies under a cooperative arrangement with the OVGA or TVGMD.

If the private well monitoring program is insufficient to fully address the data gap, the OVGA may seek funding to install wells owned by the Authority. Implementation of this program is contingent on acquiring funding and developing land access/lease agreements with landowners at suitable locations in the Management Area.

Legal authority: The OVGA members created a JPA in accordance with California Government Code Section 6509 to jointly exercise their powers as the exclusive GSA for the Basin and for the purpose of preparing this GSP. Descriptions of the powers are contained in Article II, Section 2 of the JPA included in Appendix 1. The JPA will remain in effect until terminated by unanimous consent of active members or when there are fewer than two members remaining in the OVGA.

SGMA grants GSAs the powers and authorities to *"perform any act necessary or proper..."* including adopting *"...rules, regulations, ordinances, and resolutions..."* necessary for SGMA

implementation (CWC 10725.2(b)). The OVGA is permitted to enter into agreements with a private party to assist in or facilitate the implementation of a GSP (CWC 10726.5). Similarly, the OVGA may acquire by purchase or lease real property and construct improvements (i.e. monitoring wells) to carry out the purposes of the GSP (CWC 10726.2). Expanding the number of groundwater level monitoring locations either by agreement with private parties or construction of monitoring wells is currently considered necessary to manage groundwater in accordance with SGMA.

Procedures for providing noticing to the public: The OVGA will publicize all requests for well owners to volunteer for the monitoring program and modify the website (https://ovga.us/) to facilitate requests to the OVGA for monitoring. The TVGMD will be notified and kept apprised of the development and implementation of the monitoring program.

Cost: The OVGA will incur staff, administrative, and noticing costs to inspect candidate well and prepare land access agreements. The cost of the inspections and conducting the monitoring depends on the number of wells but has been estimated at $26,730 with ongoing costs of $10,050 assuming approximately 20 additional monitoring locations may be visited semi-annually. The scope of the project and costs will be determined by the OVGA considering available funding. If it determines additional wells dedicated to monitoring are necessary, the OVGA could incur staff costs to procure outside funding and potential lease costs with landowners where new monitoring wells are sited. Costs for well construction are contingent on acquisition of funding.

4.4 Proposed Project #4: Tri-Valley Groundwater Model Development

Water levels in the Tri-Valley Management Area have been steadily declining approximately 0.5-2 ft/year for 20-30 years (depending on location and data record). Spring discharge into Fish Slough, an Area of Critical Environmental Concern, likewise has steadily decreased over the last 30 years. Available geologic and hydraulic evidence suggests there is hydrologic connection between the Tri-Valley and Fish Slough areas, and that the declining water levels in Tri-Valley are associated with reduced spring discharge at Fish slough. If these trends continue, spring discharge is expected to cease completely at some locations within the next few years, which will severely degrade or eliminate a significant portion of remaining habitat for the endangered

Owens pupfish and threatened Fish Slough milk-vetch which are dependent on spring flow and water management.

CWC Section 106 states that it is *"the established policy of this State that the use of water for domestic purposes is the highest use of water and that the next highest use is for irrigation."* It is not feasible or reasonable for the residents and agricultural producers in the Tri-Valley communities to make immediate or drastic reductions in pumping without economic and social hardship or without potentially impacting air quality (see Fund 1 guiding principle in Section 1.2). More importantly, insufficient information exists for the OVGA (or another agency) to design a program to manage pumping to ensure the SMC for water levels in the valleys and spring flow are achieved.

Despite the importance of spring discharge in Fish Slough for maintaining habitat and declining discharge rates over multiple decades, its water source is currently inferred indirectly from geologic and hydrologic data. Based on general geochemistry, stable isotopes, and tritium, Zdon et al., (2019) concluded Fish Slough springs were sourced by a combination of water from Tri-Valley to the east, or the shared recharge areas for Adobe Valley and the Volcanic Tablelands to the north and northwest. The geochemistry of source water varied spatially within Fish Slough, suggesting it is located at a convergence of regional groundwater flow paths. The authors did not quantify the proportion each source area contributed to a particular spring or seep discharge.

As part of the development of this GSP, the OVGA has improved the understanding of several of the water balance components for the Tri-Valley management area, in particular developing two land surface models to estimate groundwater recharge (Appendices 10 and 11). The OVGA proposes to build upon these recent advances in knowledge of source area and water balance by developing a regional hydrogeologic groundwater model to simulate groundwater levels, flow and spring discharge within Fish Slough and the Tri-Valley management area. Expected benefits from the model include: 1) compiling all relevant hydrogeologic information into a single repository, 2) increasing regional geologic understanding by developing a 3D geologic model, 3) quantifying the amount of recharge and flow paths from specific areas, and 4) providing an indispensable tool for predicting anticipated effects of proposed management actions to address declining spring flow and water levels in the management area.

Circumstances under which projects or management actions shall be implemented and criteria that would trigger implementation and termination: Presently neither the OVGA nor its member agencies possess sufficient funding to complete the groundwater model development. The Tri-Valley area includes a Disadvantaged Community and imposition of fees to fund the project is not preferred. Grant funding is actively being sought through the Inyo-Mono Integrated Regional Management Group (IMIRMG) for a portion of the required budget. Requested funds total $150,000 with up to an additional $150,000 anticipated as matching funds or in-kind contribution to complete the project. Initiation of the project is contingent on obtaining the necessary funding.

Permitting and regulatory process: This is a data compilation and groundwater modeling project. There will be no public noticing requirements, permitting, or regulatory process for this project.

Justification and Benefits: The lack of a numerical groundwater flow model was identified as a high priority data and knowledge gap. The capability to manage groundwater pumping is dependent on an ability to predict the impacts of recharge and pumping on the aquifer system. The GSP has documented the gaps in the monitoring network and water balance and contains proposed steps to address them. Many of the datasets required to develop the proposed numerical groundwater flow model have already been compiled and processed as part of this GSP preparation. Increased understanding of the hydrogeologic system, and data collected as part of the modeling effort, could in turn inform subsequent GSP updates. The model could also be used to help determine specific GSP criteria such as sustainable yield, measurable objectives, and minimum thresholds for the Tri-Valley area, which is data poor compared to the rest of the Owens Valley Groundwater Basin. All measurable objectives for this Management Area are expected to benefit from the project.

Additional data alone will be insufficient to determine how pumping should be managed to stabilize water levels or spring flow above minimum thresholds or to recover water levels to the measurable objectives. Greater understanding of the regional hydrogeologic flow system is vital to determine causality and to develop solutions to arrest or reverse the declines in water levels and spring flow discharge observed within Fish Slough. Numerical groundwater flow models can provide this by integrating the multiple sources of data, information, and knowledge available for the area into a single system. It would be inappropriate and infeasible to impose regulations on pumping that could cause economic and social hardship or degrade the agricultural landscape and air quality based on incomplete knowledge. This project is necessary

for the OVGA, Tri-Valley residents, and concerned public to have confidence that potential pumping management measures will accomplish the intended positive effects to the groundwater system and avoid causing other undesirable results or impacts to residents.

Implementation: Implementation of the project requires acquisition of outside funds. If funds are acquired, the OVGA will enter into the necessary grant agreements to expend the funds. The work will incur staff time, but a contractor with expertise in groundwater modelling will likely be selected to complete the study. If this project is undertaken, OVGA should conduct a groundwater management public education campaign concurrent with model development to help Tri-Valley residents understand the current groundwater conditions, the purpose for the project, methods adopted for the work, and inform residents how they can assist in the model development process. The intent for this outreach component would be to directly involve and inform residents on decisions that could affect their environment or livelihoods consistent with OVGA Strategy #6 and General Principle #1 (Section 1.2). The outreach should include discussions at regularly scheduled TVGMD meetings as well as public meetings hosted by the OVGA in each of the communities.

Legal authority: The OVGA members created a JPA in accordance with California Government Code Section 6509 to jointly exercise their powers as the exclusive GSA for the Basin and for the purpose of preparing this GSP. Descriptions of the powers are contained in Article II, Section 2 of the JPA included in Appendix 1. The JPA will remain in effect until terminated by unanimous consent of active members or when there are fewer than two members remaining in the OVGA.

SGMA grants GSAs the powers and authorities to *"perform any act necessary or proper..."* including adopting *"...rules, regulations, ordinances, and resolutions..."* necessary for SGMA implementation (CWC 10725.2(b)) including groundwater investigations (CWC 10725.4(b)). Developing a groundwater model for the Tri-Valley Management Area is necessary to manage groundwater in accordance with SGMA.

Procedures for providing noticing to the public: This is a data compilation and groundwater modeling project. There will be no public noticing requirements, permitting, or regulatory process for this project. The TVGMD will be informed of all applications for funds and progress on the project if it proceeds.

4.5 Additional OVGA Activities

4.5.1 Owens Lake Groundwater Development Project

In this GSP the OVGA has designated the southern portion of the Basin including Owens Lake as a separate management area. The geology of Owens Lake Management area is distinct from the rest of the Basin, and it has areas of naturally occurring poor water quality due to evaporative concentration at the terminus of a closed basin. The current pumping stress in the Management Area is imperfectly quantified but is known to be relatively low compared to the rest of the Basin. The Well Registration and Reporting Ordinance and database updates should address the recognized data gaps. Water level conditions are stable, and the overall management goal for the Owens Lake Management Area is to maintain current conditions in areas of sensitive vegetation and near existing beneficial uses of groundwater.

LADWP is proceeding with plans to develop saline groundwater from aquifers beneath the lakebed to replace potable water from the Los Angeles aqueduct presently used for dust control (dust control regulation or management is not subject to SGMA or this GSP). The OLGDP has identified the sensitive resources potentially affected by the project, most of which overlap with SGMA sustainability indicators, e.g. water levels, surface water capture (springs), water quality, and subsidence. Details of the potential pumping project including the monitoring methods and locations or management triggers are not yet finalized. A fundamental principal of the OLGDP, however, is to include an adaptive management strategy to evaluate monitoring results, and based on the observations, adjust pumping, monitoring, or management triggers, or take other actions to avoid impacts to sensitive resources. Such a strategy could be accommodated in future GSP updates.

The OVGA cannot compel state agencies to comply with the GSP and the application of SGMA and this GSP to the OLGDP is the discretion of the CSLC. Lands managed pursuant to the LTWA are exempt from SGMA (CWC §10720.8), but except for some areas on the edge of the lake, most of the OLGDP is not on LADWP-owned lands. There is an outstanding dispute resolution proceeding between Inyo County and LADWP over whether the LTWA applies to Owens Lake with LADWP contending that the LTWA doesn't apply and Inyo County contending that it does. This dispute was not resolved and was put on hold without prejudice while the OLGDP proceeded. Unless managed pursuant to LTWA, Owens Lake pumping might be subject to regulation by this GSP.

The lakebed is owned and managed by the California State Lands Commission (CSLC), and LADWP operations on State Lands are conducted under a CSLC lease. State agencies are required to *"…consider the policies of [SGMA], and any groundwater sustainability plans adopted pursuant to [SGMA], when revising or adopting policies, regulations, or criteria, or when issuing orders or determinations, where pertinent"* (CWC §10720.9). SGMA *"…does not authorize a local agency to impose any requirement on the state or any agency, department, or officer of the state. State agencies and departments shall work cooperatively with a local agency on a voluntary basis."* (CWC §10726.8(d)). The CSLC could make compliance with an adopted GSP part of their future lease requirements. Given the various sources of uncertainty regarding oversight for the OLGDP, this GSP was prepared assuming it could apply to the lakebed.

LADWP established the Owens Lake Groundwater Working Group of stakeholders as part of the OLGDP while the research is conducted on the lake to develop a management plan and associated CEQA analysis for the project. An idea to create a multi-agency entity to oversee adaptive management and provisions of a CEQA monitoring and mitigation plan has been proposed, but the regulatory framework has not been finalized. This GSP proposes that the OVGA actively participate in the working group and coordinate with state and local agencies with land management responsibilities to ensure this management area is managed sustainably to avoid undesirable results. If desired, the OVGA may establish an advisory committee for the Owens Lake Management Area (JPA Article I.5, Appendix 1) to assist the Board.

4.5.2 Provide assistance acquiring state or federal funding

It is anticipated that as the GSP is implemented, the OVGA will require or desire additional grant funding to conduct activities described in the plan. The OVGA is a signatory to the IRWMP, and staff from the group are experienced and well positioned to identify grant opportunities that may be applicable to the OVGA or its members. The Inyo-Mono Integrated Regional Water Management Program has helped obtain funding and technical expertise for small water systems in the two counties. Many of these systems depend on groundwater, and some are within the area covered by this GSP. For example, the two water systems for Big Pine, one serving the Paiute Tribe and the other serving the town via its Community Services District, each rely on a single production well. Although these systems have emergency backup wells, the tribe and the CSD have discussed an intertie to make the water supplies more reliable in case of a serious failure or other problem. A feasibility study (California Rural Water Association & Inyo-

Mono IRWMP, 2020) was conducted to evaluate the options, potential difficulties, estimated costs for an emergency connection between the two water systems. In another example, the Keeler Community Services District obtains its water from a single well. This water contains naturally-occurring high levels of arsenic (about ten times the state's Maximum Contaminant Level) and manganese. A feasibility study (California Rural Water Association & Inyo-Mono IRWMP, 2021) to evaluate Keeler's water system and examine different treatment options was recently completed.

The OVGA will support the IRWMP to provide assistance identifying and acquiring state or federal funding for projects for monitoring, studies, outreach, or potential measures to improve groundwater use efficiency or conservation. The Board will consider contracting with the IRWMP to manage grants awarded to the OVGA. Details regarding specific services that may be provided to the OVGA or compensation have not been determined and will be defined in subsequent agreements between the agencies.

4.5.3 GDE monitoring project

Several improvements to the final GDE map in Figure 2-25 should be completed during implementation of this GSP before the five year assessment or if there is a change in prioritization of the Basin. Funds were not available to conduct fieldwork to groundtruth all parts the iGDE map or the final GDE map (after ICWD staff review). The GDE map refinement should include updates to reflect more accurate mapping of springs and seeps and vegetated dune areas near Owens Lake. In addition, the GSP consultants recommended a remote sensing project should be implemented for future monitoring (see Appendix 9). This was also a suggestion from public commenters at OVGA Board meetings (see Table 2-6a) during presentation of the GDE work projects for the draft GSP. The consultants recommended a vegetation monitoring program could adopt the methods currently utilized by the ICWD in the adjudicated portion of the Basin.

The ICWD routinely acquires spatially averaged spectral data and indices derived from Landsat data for many areas of irrigated land and GDEs in the Owens Valley. Scientists at the ICWD process and extract Landsat satellite imagery for the entire archive of Landsat 5, 7, and 8 data. Processing of the raw satellite data includes methods to account for variations in the satellite sensors over time, radiometric and atmospheric corrections (see Huntingtion et al., 2016), and

filtering scenes for quality control (e.g. cloudy scenes). Datasets consist of a 36-year time series for several spectral indices related to greenness or wetness of the landscape (e.g. NDVI, EVI, NDWI). Summary statistics (e.g. minimum, maximum, average) for specific periods during the growing season are calculated to allow year to year comparison of the remote sensing data with ground measurements of vegetation cover conducted by the LADWP and ICWD. Most analyses rely on the widely used Normalized Difference Vegetation Index (NDVI) as the measure of vegetation vigor. NDVI was the index most strongly correlated with vegetation cover measured in the field by the Inyo/Los Angeles Technical Group. The OVGA should consider implementing a similar remote sensing program if the Basin ranking is changed to medium or high priority in the future.

4.5.4 Develop a pumping program to stabilize water levels in Tri-Valley Management Area

Declining water levels in the Tri-Valley Management Area have been documented as discussed above (Section 2 and Appendix 3). For a largely unconfined aquifer system, this suggests overdraft is occurring, but the presence or amount of overdraft is not readily apparent in the water balance (Section 2.2.3). The ambiguity is partially due large data gaps in the management area which should be addressed by Management Actions described above to require additional data reporting and for groundwater model development. If an overdraft condition is confirmed and measures to improve efficiency or land use practices are not effective or not implemented, the OVGA will take steps to develop a pumping plan to ensure sustainable conditions are achieved and undesirable results prevented while minimizing impacts to beneficial water users. GSAs have the authority to control groundwater extractions (CWC §10726.4(a)). This potential management action is dependent on development of a numerical groundwater model to adequately inform OVGA decision makers. Specifics regarding potential management actions that may be implemented are not possible at the time this GSP was prepared and will be included in future GSP updates.

Table 4.1 Summary of Management Actions for each Management Area including timeline and events that initiate the actions. The Management Actions are also organized the applicable sustainability indicator.

Tri-Valley Management Area						
Sustainability Indicator	Goal	Management Action or Project	Required Action	Timeline	Triggers	Notes
Lowering of Water Levels, Reduction in Storage	Stabilize Declining Water Levels	Set SMC minimum threshold at the anticipated groundwater elevation in 2030 and measurable objective at the level measured in January 2015.	Include in approved GSP	Short	N/A	
		Establish supply well registration and reporting	Well Registration and Reporting Ordinance	Short	GSP adoption	Information is necessary to fill data gap and to maintain the OVGA database
		Review new permits for water supply wells. Regulate production if necessary to ensure water levels remain within SMC	Well Permit Review Ordinance (de minimis excluded)	Short	GSP adoption	Information necessary to maintain OVGA database. Hydrology staff or contractor required.
		Increase groundwater level monitoring network	Land access agreements for monitoring	Short	GSP adoption	Information is necessary to fill data gap. Dependent on

Tri-Valley Management Area						
Sustainability Indicator	Goal	Management Action or Project	Required Action	Timeline	Triggers	Notes
			existing wells or new monitoring well installation			grant funding for new monitoring wells. Hydrology staff or contractor required
		Develop groundwater model for Tri-Valley/Fish Slough management area	Grant agreement	Short or Long	Grant Funding Awarded SMC Minimum Threshold hit	Dependent on grant funding. Necessary to fill data gap
		Provide assistance acquiring state or federal funding for projects to improve groundwater use efficiency or conservation	Resolution	Medium	Grant Funding Opportunity	Conducted by or in cooperation with TVGMD and Inyo-Mono IRWMP
		If efficiency gains have not addressed the declining water levels, based on the model and monitoring, develop a pumping program to stabilize water levels by 2030 and attain the measurable objective by	GSP amendment	Long	SMC Minimum Threshold hit Completed Groundwater Model	Dependent on groundwater model completion and could require an additional 1-2 years to prepare

Tri-Valley Management Area						
Sustainability Indicator	Goal	Management Action or Project	Required Action	Timeline	Triggers	Notes
		2042				
Surface Water Depletion	Stabilize Fish Slough Spring Discharge	Set SMC minimum threshold at 0.1 cfs and measurable objective at 0.5 cfs for Fish Slough Northeast spring	Include in approved GSP	Short	N/A	
		Cooperate with agencies having jurisdiction in the Fish Slough sub-basin to acquire grant or other funding for studies and projects.	Provide letters of support	Short	Board Direction	Necessary to address data gap.
		Develop groundwater model for Tri-Valley/Fish Slough management area	Grant agreement, letters of support for grant applicants	Short or Long	SMC Minimum Threshold hit Grant Funding Awarded	Dependent on grant funding. Necessary to fill data gap
		If a pumping effect is determined from monitoring or the model, develop a pumping program or other contingency measures (e.g. wells) to stabilize pumping effect on the spring at the	GSP amendment	Long	Completed groundwater model	

Tri-Valley Management Area						
Sustainability Indicator	Goal	Management Action or Project	Required Action	Timeline	Triggers	Notes
		SMC management objective				
		If a pumping effect is determined, seek or support grant opportunities for agricultural water use efficiency or multi-benefit land repurposing	Grant Agreement or letters of support for grant applicants	Long	Board Direction	Conducted by or in cooperation with TVGMD and IRWMP
		Identify recharge sources supporting GDEs in Tri-Valley and support land management that enhances or maintains recharge	Letters of Support Land Access Agreement for monitoring	Long	Completed groundwater model Expanded water level monitoring	Additional monitoring equipment (e.g. flow gauges or monitoring wells) or imagery would require funding
Subsidence	Prevent subsidence	Set SMC minimum threshold of 0.3 ft and measurable objective based on average water level and 0 ft of subsidence	Include in approved GSP	Short	N/A	
		Monitor water levels. Monitor ground elevation utilizing publicly available	None	Short	Board Direction	Hydrology staff or contractor required to analyze data and report

Tri-Valley Management Area						
Sustainability Indicator	Goal	Management Action or Project	Required Action	Timeline	Triggers	Notes
		remote sensing methods				findings
Water Quality	Track Water Quality	Continue data acquisition from ongoing monitoring programs or studies	None	Short	GSP adoption	Staff time to maintain database

Owens Valley Management Area						
Sustainability Indicator	Goal	Management Action or Project	Required Action	Timeline	Triggers	Notes
Lowering of Water Levels, Reduction in Storage. Surface Water Depletion	Maintain Water Levels	Set SMC minimum threshold in the GSP at lowest GW elevation during 2012-2016 drought and management objective at the average elevation from 2001-2010	Include in approved GSP	Short	N/A	
		Establish supply well registration and reporting	Well Registration and Reporting Ordinance	Short	GSP adoption	Information is necessary to fill data gap and to maintain database
		Review new permits for water supply wells Regulate production if necessary to ensure water levels remain within SMC	Well Permit Review Ordinance (de minimis excluded).	Short	GSP adoption	Information necessary to maintain database. Hydrology staff or contractor required.
		Acquire or develop groundwater model for the Owens Valley management area	TBD	Medium	Board Direction Grant Funding Awarded	

Owens Valley Management Area						
Sustainability Indicator	Goal	Management Action or Project	Required Action	Timeline	Triggers	Notes
		Provide assistance acquiring state or federal funding for projects to improve groundwater use efficiency or conservation	Resolution	Medium	Grant Funding Opportunity	Conducted in cooperation with Inyo-Mono IRWMP
Subsidence	Prevent subsidence	Set SMC minimum threshold of 0.3 ft and measurable objective based on average water level and 0 ft of subsidence	Include in approved GSP	Short	N/A	
		Monitor water levels and for changes in ground elevation utilizing publicly available remote sensing methods	None	Short	Board Direction	Hydrology staff or contractor required to analyze data and report findings
Water Quality	Track Water Quality	Continue data acquisition from ongoing monitoring programs or studies	None	Short	GSP adoption	Staff time to maintain database

Owens Lake Management Area						
Sustainability Indicator	Goal	Management Action	Possible Board Action	Timeline	Triggers	Notes
Lowering Water Levels, Surface Water Depletion	Maintain Water Levels	Set SMC minimum threshold in the GSP at lowest GW elevation during 2012-2016 drought and management objective at the average elevation from 2001-2010.	Include in approved GSP	Short	N/A	
		Establish supply well registration and reporting	Well Registration and Reporting Ordinance	Short	GSP adoption	Information is necessary to fill data gap and to maintain the OVGA database
		Review new permits for water supply wells Regulate production if necessary to ensure water levels remain within SMC	Well Permit Review Ordinance (de minimis excluded).	Short	GSP adoption	Information needed. to maintain OVGA database. Hydrology staff or contractor required.
		Acquire or develop groundwater model for the Owens Lake management area		Medium	Board Direction	
		Participate in the Owens Lake Groundwater	MOU, GSP Amendment to	Short and	Ongoing	Hydrology staff or contractor required.

Owens Lake Management Area						
Sustainability Indicator	Goal	Management Action	Possible Board Action	Timeline	Triggers	Notes
		Working Group and the proposed (but not defined) regulatory entity to oversee the Master Project EIR and HMMMP provisions	include SMC for GDE/springs for the Master Project	Long	Master Project implemented	Costs or fees associated with oversight could be negotiated with project proponent
Subsidence	Prevent subsidence	Monitor water levels and changes in ground elevation utilizing publicly available remote sensing methods		Short	GSP adoption	For portion of management area outside the lakebed
		Participate in the proposed regulatory entity to oversee the LADWP Master Project EIR and HMMMP provisions	MOU, GSP Amendment to include SMC for subsidence for the Master Project	Long	Master Project implemented	
Water Quality	Track Water Quality	Continue data acquisition from ongoing monitoring programs or studies	None	Short	GSP adoption	Staff time to maintain database
		Participate in the Owens Lake Groundwater Working Group and the	MOU, GSP Amendment to include SMC for	Short and Long	Ongoing Master Project	Hydrology staff or contractor required. Costs or fees

Owens Lake Management Area						
Sustainability Indicator	Goal	Management Action	Possible Board Action	Timeline	Triggers	Notes
		proposed (but not defined) regulatory entity to oversee the Master Project EIR and HMMMP provisions	water quality triggers for the Master Project		implemented	associated with oversight could be negotiated with project proponent

5. Plan Implementation

5.1 Estimate of GSP Implementation Costs (Reg. § 354.6)

Implementation of all or parts of this GSP is at the discretion of the OVGA as long as the Basin remains ranked as low priority. Agencies can request to terminate membership in the OVGA following adoption of the GSP in accordance with the JPA (Article VI section 1.1; Appendix 1). It was not possible to anticipate future OVGA membership or how it may exercise its discretion regarding implementation of projects at the time this GSP was prepared. This budget assumed the OVGA may decide to designate members responsible for each Management Area once the membership questions are settled. To assist the OVGA, future cost estimates to implement this GSP were developed for administrative functions as well as for each Project. Costs to implement tasks specific to each Management Area were also developed.

Several assumptions were necessary to estimate GSP implementation costs. The OVGA adopted a budget for FY 2021-2022 in April 2021 (Table 5-1), and that budget will be applicable for the six months after the GSP is submitted in January 2022. Annual administration and other ongoing costs to maintain the OVGA database were estimated. Costs to implement individual Management Actions were assumed to occur in FY 2022-23 (the OVGA may initiate these tasks sooner in which case the annual budget would revised). Staff and contractor hourly rates included in the estimated budget are approximate and will be finalized when the future OVGA staffing model is determined.

The estimated cost to implement the GSP is approximately $436,665. The single largest cost is the development of a groundwater model for the Tri-Valley and Fish Slough portion of the Basin. The model is prerequisite to development of land or pumping management to address groundwater concerns and is contingent on acquisition of grant funding. The initial year of the GSP (FY 2022-23) includes three Management Actions and total costs are estimated to be $81,270. Ongoing annual costs thereafter are estimated to be $44,620. A breakdown of costs to implement this GSP that are applicable to the entire Basin are presented as are costs for specific tasks in each Management area (Table 5-2). Primary costs consist of staff services with smaller added expense for basic equipment purchases (for monitoring). The assistance of contractors is included for some tasks, primarily monitoring in Tri-Valley Management Area. Additional

assumptions for administration include two annual meetings of the OVGA Board, preparation of an annual report for the Board and DWR and budget, staff for routine OVGA/SGMA business, website maintenance, and incidental costs to maintain an active GSA (insurance, fiscal services, general operating expenses). Costs for each Management Action or Project are presented in Table 5-3. Costs for projects contingent on completion of modelling or that are expected to be initiated after the 5 year periodic evaluation (Table 4-1) were not estimated.

5.2 Schedule for Implementation

Implementation of the GSP for the low priority basin is discretionary and contingent on final disposition of the Board membership following submission of the GSP or acquisition of grants, neither of which cannot be determined at the time this GSP was prepared. A schedule is not included, however, Management Actions #,1, #,2, #3 (potentially) and other activities to provide assistance acquiring state or federal funding and participation in the OLGDP could be completed in 2022-2023.

5.3 Annual Reporting (Reg. § 356.2)

The OVGA JPA (Article III section 3.1.7) requires the Executive Manager prepare and submit an annual report, including a proposed budget, to the OVGA Board of Directors before April 1 of each year. The report will document groundwater conditions and progress implementing Management Actions in this GSP and will comply with CWC §10728 requirements for annual reporting. The report will include: groundwater elevation data, annual groundwater extraction data, surface water used for groundwater recharge , total water use, and change in groundwater storage. The report may suggest the OVGA consider revisions to the GSP based on groundwater conditions or new information gained through implementation of monitoring or the Management Actions.

5.4 Periodic Evaluations

Every five years after adopting the GSP, the OVGA will evaluate sustainability of the groundwater conditions throughout the Basin. The report will evaluate conditions relative to SMC and interim milestones at representative monitoring sites. The status of the monitoring network will be reviewed and discuss whether previous data gaps have been addressed or new gaps have been identified. A summary of the implementation of GSP projects and management actions,

including an updated implementation schedule and summary of the benefits from implementation will be included. Amendments to the GSP will be described as well as any revisions to the monitoring program. Although not anticipated, legal actions arising from the GSP and any enforcement actions will be described. Presentation of the five year evaluation will coincide with the OVGA annual report, and it will be submitted to DWR, if required.

Table 5-1. OVGA FY 2021-22 adopted budget.

Revenues	
Interest from treasury	$4,000
Other Agencies (member contributions)	$0
Grant Funding	
(a) Grant Administration	$18,750
(b) Stakeholder Engagement Plan	$0
(c) GSP Development	$130,792
Total Revenue	**$153,542**
Expenditures	
Fiscal Services	
Insurance	$2,500
Reserve Fund	$13,290
Subtotal	**$15,790**
Staff Services	
Agency: Inyo, Executive Manager	
(a) Staff services	$33,970
(b) Grant Administration	$13,000
Agency: Inyo, Legal	$18,000
Agency: Inyo, Fiscal Agent/Financial Services	$4,000
Agency: Mono, Administrative & Legal	$33,000
Agency: Bishop, Administrative	$5,500
Subtotal	**$107,470**
Professional Services	
Website Development	$0
Outside Audit	$4,850
DBS&A	$7,500
Subtotal	**$12,350**
Miscellaneous Expenses	
Internal Copy Charges	$1,500
Advertising	$3,000
Office, Space & Site Rental	$1,500
General Operating	$500
Subtotal	**$6,500**
Total Expenditures	**$142,110**
Anticipated carry over balance	**$11,432**

Table 5-2. OVGA GSP implementation costs for the Basin and for each Management Area.

OVGA Operation	Administration and Basin Wide Projects	Tri-Valley	Owens Valley	Owens Lake	Total
FY 2022-23	$45,260	$20,640	$8,545	$6,825	$81,270
Ongoing annual cost	$25,070	$11,760	$4,645	$3,145	$44,620
Groundwater Model		$310,775			$310,775
Total	$70,330	$343,175	$13,190	$9,970	$436,665

Table 5-3. GSP Management Actions and Project costs.

Management Action	FY 2022-23	Ongoing Annual Cost
Well Registration and Reporting Ordinance	$14,370	$360
Well Permit Review Ordinance	$7,920	$1,740
Increase groundwater level monitoring network	$26,730	$10,050
Groundwater Model	$310,775	$0
Grant Assistance or multi-agency cooperation	$5,840	$5,840
Total	$365,635	$17,990

6. References (Reg. § 354.4)

Ca. Dept. of Forestry and Fire Protection. (2015). CAL FIRE Fire and Resource Assessment Program (FRAP) FVEG [ESRI File Geodatabase]. Sacramento, CA. Accessed October 2016.

Ca. Dept. of Forestry and Fire Protection. (2020). CAL FIRE Land Ownership geodatabase. https://frap.fire.ca.gov/mapping/gis-data/ Accessed

Ca Dept. of Fish and Wildlife, CDFW. (2014). Fish Slough Digital vegetation map managed through the California Vegetation Classification and Mapping Program (VegCAMP). Accessed January 2016.

Ca. Dept. of Water Resources. (2016a). Preparation Checklist for GSP Submittal Guidance Document.

Ca. Dept. of Water Resources. (2016b). BMP 1: Best Management Practices for the Sustainable Management of Groundwater Monitoring Protocols, Standards, and Sites, December 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-1-Monitoring-Protocols-Standards-and-Sites_ay_19.pdf

Ca. Dept. of Water Resources. (2016c). Land use viewer, map of farmed lands. https://gis.water.ca.gov/app/CADWRLandUseViewer/

Ca. Dept. of Water Resources. (2016d). BMP 5: Best Management Practices for Modeling, December 2016.

Ca. Dept. of Water Resources. (2017). BMP 6: Best Management Practices for the Sustainable Management Criteria, draft November 2017.

Ca. Dept. of Water Resources. (2018). Guidance Document for Groundwater Sustainability Plan, Stakeholder Communication and Engagement.

Ca. Dept. of Water Resources. (2020a). California's Groundwater, Bulletin 118. California Department of Water Resources. http://water.ca.gov/groundwater/bulletin118.cfm. Accessed December 2016

Ca. Dept. of Water Resources. (2020b). Natural Communities Commonly Associated with Groundwater Dataset Viewer. https://gis.water.ca.gov/app/NCDatasetViewer/#. Accessed November 2020.

Ca. Dept. of Water Resources. (2020c). Draft Handbook for Water Budget Development.

City of Bishop (2008). City of Bishop Water Master Plan. https://www.cityofbishop.com/Document%20Center/Department/Public%20works/Water/WaterMasterPlan2008.pdf

City of Bishop (2011). General Plan for the City of Bishop, , https://www.cityofbishop.com/departments/planning/general_plan.php

Crowley, J. L., B. Schoene, and S.A. Bowring. (2007). U-Pb dating of zircon in the Bishop Tuff at the millennial scale. Geology, 35(12), 1123–1126. https://doi.org/10.1130/G24017A.1

County of Mono (2015). Regional Transportation Plan and General Plan Update, Draft EIR SCH#2014061029. https://monocounty.ca.gov/sites/default/files/fileattachments/planning_division/page/8022/2_draft_eir_with_appendices_7.31.15.pdf

Danskin, W. R. (1988). Preliminary Evaluation of the Hydrogeologic System in Owens Valley, California. U.S. Geological Survey Water-Resources Investigations Report 88-4003.

Danskin, W. R. (1998). Evaluation of the Hydrologic System and Selected Water-Management Alternatives in the Owens Valley, California. U.S. Geological Survey Water-Supply Paper 2370-H. In Hydrology and Soil-Water-Plant Relations in Owens Valley, California.

Danskin, W. R. (2000). Plant Communities. In J. Smith (Ed.), Sierra East, Edge of the Great Basin. University of California Press.

Davis, F. W., Stoms, D. M., Hollander, A. D., Thomas, K. A., Stine, P. A., Odion, D., Borchert, M. I., Thorne, J. H., Gray, M. V., Walker, R. E., Warner, K., & Graae, J. (1998). The California Gap Analysis Project - Final Report. University of California, Santa Barbara, CA.

Elmore, A.J., J.F. Mustard, and S.J. Manning. (2003). Regional patterns of community response to changes in water: Owens Valley, California. Ecol. Appl. 12:443-460.

Elmore, A.J., S.J. Manning, J.F. Mustard, and J.M. Craine. (2006). Decline in alkali meadow vegetation cover in California: the effects of groundwater extraction and drought. J. Appl. Ecol. 43:770-779.

Flint, L.E., A.L. Flint, and M.A. Stern. (2013). The basin characterization model – a regional water balance software package. U.S. Geological Survey Techniques and Methods 6-H1, 85 p.

Jones and Stokes and Great Basin Unified Air Pollution Control District. (1996). Delineation of Waters of the United States for the Owens Lake Playa. Prepared for the U.S. Army Corps of Engineers. Data provided by Grace Holder, Great Basin Unified Air Pollution Control District.

Green Book for the LongTerm Groundwater Management Plan for the Owens Valley and Inyo County (1990). Technical Appendix to the Inyo/Los Angeles LongTerm Groundwater Management Agreement, prepared by Inyo County and the Los Angeles Department of Water and Power.

Harrington, R. (2007). Development of a Groundwater Flow Model for the Bishop/Laws Area: Final Report for Local Groundwater Assistance, Grant Agreement No. 4600004129 (54 p.).

Harrington, R.H. (2016), Hydrogeologic Conceptual Model for the Owners Valley Groundwater Basin (6-12), Inyo and Mono Counties. Prepared for submittal to the California Department of Water Resources. Prepared by Inyo County Water Department, Independence, CA

Hollett, K. J., Danskin, W. R., McCaffrey, W. F., & Walti, C. L. (1991). Geology and Water Resources of Owens Valley, California. U.S. Geological Survey Water-Supply Paper 2370-B. In Hydrology and Soil-Water-Plant Relations in Owens Valley, California.

Huntington, J., K. McGuire, C. Morton, K. Snyder, S. Peterson, T. Erickson, R. Niswonger, R. Carroll, G. Smith, and R. Allen. 2016. Assessing the role of climate change and resource management on groundwater dependent ecosystem changes in arid environments with the Landsat archive. Remote Sensing of Env. 185:186-197.

Inyo County and City of Bishop. (2017). Multi Jurisdictional Hazard Mitigation Plan, Final Draft (FEMA approved). https://www.inyocounty.us/services/emergency-services/multi-jurisdictional-hazard-mitigation-plan (page 29).

ICWD. (2020). Shapefile of kept and removed vegetation polygons from the DWR Natural Communities Commonly Associated With Groundwater Database. Shapefile provided by Aaron Steinwand.

Jayko, A. S., & Fatooh, J. (2010). Fish Slough, a geologic and hydrologic summary, Inyo and Mono Counties, California. U.S. Geological Survey Administrative Report.

Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, and A. Lyons. 2018. Mapping indicators of groundwater dependent ecosystems in California. https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

Langridge, R.B.,S. Sepaniak, & E. Conrad. (2016). An evaluation of California's special act groundwater districts. Report for the State Water Resources Control Board. 183p. https://escholarship.org/uc/item/3cr8k66v

Los Angeles Department of Water and Power. (2010). Owens Lake Habitat Management Plan. March 2010.

Los Angeles Department of Water and Power. (2020). LADWP Urban Water Management Plan. LADWP 2020 UWMP_Web.pdf.

Los Angeles Department of Water and Power. (2015). Habitat Conservation Plan for Los Angeles Department of Water and Power's operations, maintenance, and management activities on its land in Mono and Inyo Counties, California. DRAFT August 2015.

Los Angeles Department of Water and Power and County of Inyo. (1991). Agreement Between the County of Inyo and the City of Los Angeles and its Department of Water and Power on a Long Term Groundwater Management Plan for Owens Valley and Inyo County, Stipulation and Order for Judgement, Inyo County Superior Court, Case no. 1. 95pp.

Los Angeles Department of Water and Power and Ecosystem Sciences. (2010). Owens Valley Land Management Plan. 426pp.

Manning, S.J. (1997). Plant communities of LADWP land in the Owens Valley: an exploratory analysis of baseline conditions. Inyo County Water Department report, Inyo County Water Department, Bishop, California.

Menke, J., A. Hepburn, D. Johnson, E. Reyes, A. Glass, J. Evens, S. Winitsky, K. Sikes. (2020). (in progress). Vegetation Mapping and Classification of the Jawbone Canyon Region and Owens Valley. Report to Bureau of Land Management. Aerial Information Systems, Redlands, California.

MHA. (2001). Task 1 Report: Preliminary Data Collection and Hydrologic Models for the USFilter Tri-Valley Surplus Groundwater Program, Mono County, California (p. 261).

Mono County and the Town of Mammoth Lakes (2019). Multi-jurisdictional Hazard Mitigation Plan (including the Mono County Community Wildfire Protection Plan), Final. https://www.monosheriff.org/sites/default/files/fileattachments/planning_division/page/9617/mono_county_mjhmp_final_052919_w-appdx.pdf (page 3-3).

Montgomery Watson Harza. (2003). Confining Layer Characteristics Cooperative Study: Final Report.

Montgomery Watson Harza. (2010). TM: Evaluation of Geophysical Data - Phase I (September 2010). Appendix Q of Final Report on the Owens Lake Groundwater Evaluation Project (2013).

Montgomery Watson Harza. (2011a). Report: Updated Conceptual Model (November 2011). Appendix H of Final Report on the Owens Lake Groundwater Evaluation Project (2013).

Montgomery Watson Harza. (2011b). TM: Evaluation of Geophysical Data - Phase II (June 2011). Appendix R of Final Report on the Owens Lake Groundwater Evaluation Project (2013).

Montgomery Watson Harza. (2011c). TM: Preliminary Updated Conceptual Model (January 2011). Appendix C of Final Report on the Owens Lake Groundwater Evaluation Project (2013).

Montgomery Watson Harza. (2013). Final Report on the Owens Lake Groundwater Evaluation Project.

Neponset Geophysical Corporation (1999) Tiltmeter Evaluation Project River Site Wells, Owens Lake, Inyo County, California, prepared for the Great Basin Unified Pollution Control District.

Pakiser, L. C., Kane, M. F., & Jackson, W. H. (1964). Structural Geology and Volcanism of Owens Valley Region, California - A Geophysical Study. U.S. Geological Survey Professional Paper 438.

Phillip Williams and Associates. (1980). The Hydrology of the Benton, Hammil, and Chalfant Valleys, Mono County, California, Final Report (p. 45).

PRISM Climate Group. (n.d.). Oregon State University, http://prism.oregonstate.edu, retrieved 22 April 2020.

Rohde, M. M., S. Matsumoto, J. Howard, S. Liu, L. Riege, and E. J. Remson. 2018. Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans. The Nature Conservancy, San Francisco, California.

Saint-Amand, P., Mathews, L. A., Gaines, C., and Roger, R. (1986). Dust Storms From Owens and Mono Valleys, California. NWC-TP-6731, Naval Weapons Center, China Lake, CA.

Slemmons, D. B., Vittori, E., Jayko, A. S., Carver, G. A., and Bacon, S. N. (2008). Quaternary fault and lineament map of Owens Valley, Inyo County, eastern California. Geological Society of America map and chart series MCH096, scale 1:73,500.

Soil Survey Staff. (2002). Soil survey of Benton-Owens Valley area, California, parts of Inyo and Mono Counties, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database. Available online at https://sdmdataaccess.sc.egov.usda.gov. Accessed [04/27/2020].

Steinwand, A.L., Harrington, R.F. and Groeneveld, D.P. (2001). Transpiration coefficients for three Great Basin shrubs. Journal of Arid Environments, 49:555–567.

Steinwand, A.L., Harrington, R.F. and Or, D. (2006). Water balance for Great Basin phreatophytes derived from eddy covariance, soil water, and water table measurements. Journal of Hydrology, 329:595–605.

Stevens, C. H., Stone, P., & Blakely, R. J. (2013). Structural Evolution of the East Sierra Valley System (Owens Valley and Vicinity), California: A Geologic and Geophysical Synthesis. *Geosciences*, *3*(2), 176-15.

Towill, Inc., (2020). InSAR Data Accuracy for California Groundwater Basins CGPS Data Comparative Analysis January 2015 to September 2019. https://data.cnra.ca.gov/dataset/tre- altamira-insar-subsidence/resource/a1949b59-2435-4e5d-bb29-7a8d432454f5.

TRE Altamira Inc. (2021). InSAR datasets DWR's SGMA Map Viewer (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub)

U.S. Dept. of Agriculture Forest Service. (2014). Existing Vegetation Great Basin, 1999–2009, v1 [ESRI File Geodatabase]. MeClellan, CA. Accessed June 2016.

U.S. Environmental Protection Agency. (2001). EPA requirements for quality assurance project plans, EPA QA/R-5. EPA/240/B-01/003. March 2001. https://www.epa.gov/sites/production/files/2016-06/documents/r5-final_0.pdf

U.S. Environmental Protection Agency. (2006). Guidance on systematic planning using the data quality objectives process, EPA QA/G-4. EPA/240/B-06/001. February 2006. https://www.epa.gov/sites/production/files/2015-06/documents/g4-final.pdf

U.S. Fish and Wildlife Service. (1998). Owens Basin Wetland and Aquatic Species Recovery Plan, Inyo and Mono Counties. Portland, Oregon.

U.S. Fish and Wildlife Service. (2005). Endangered and threatened wildlife and plants; designation of critical habitat for *Astragalus lentiginosus var. piscinensis* (Fish Slough Milk-Vetch). Federal Register 70 (10), No. 110. 33774–33795.

U.S. Fish and Wildlife Service. (2008). Endangered and threatened wildlife and plants; designation of critical habitat for the Sierra Nevada Bighorn Sheep (*Ovis canadensis sierrae*) and Taxonomic Revision; Final Rule. Federal Register 73 45534–45604.

U.S. Fish and Wildlife Service. (2016). Endangered and threatened wildlife and plants; designation of critical habitat for the Sierra Nevada yellow-legged frog, the Northern District Population Segment of the mountain yellow-legged frog, and the Yosemite toad; final rule. Federal Register 81 9046–59119.

U.S. Fish and Wildlife Service. (2018). National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands/

U.S. Fish and Wildlife Service. (2020). Endangered and threatened wildlife and plants; Revised designation of critical habitat for the Western Distinct (sic.) pollution segment of the Yellow billed cuckoo. Federal Register 85 11458-11594.

U.S. Geological Survey. (2002). Central Mojave vegetation database. Digital vegetation map managed through the California Vegetation Classification and Mapping Program (VegCAMP). Prepared by USGS, Western Ecological Research Center. Accessed January 2016.

U.S. Geological Survey. (2011) Groundwater technical procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1–A1. Compiled by Cunningham, W.L., and Schalk, C.W. https://pubs.usgs.gov/tm/1a1/pdf/tm1-a1.pdf

U.S. Geological Survey. (2016). National hydrography dataset, high resolution, v220. Washington D.C. Retrieved from ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/HighResolution/NHDH_CA_931v220.zip.

U.S. Geological Survey. (2018) General introduction for the "National Field Manual for the Collection of Water Quality Data" (ver. 1.1, June 2018): U.S. Geological Survey Techniques and Methods, book 9, chap. A0, 4 p., https://doi.org/10.3133/tm9A0. [Supersedes USGS Techniques and Methods, book 9, chap. A0, version 1.0.]

U.S. Geological Survey. (2019). National Hydrography Dataset. available online at https://viewer.nationalmap.gov/basic/, accessed May 20, 2020.

U.S. National Park Service. 2012. Geospatial Vegetation Information for the Manzanar National Historical Site Vegetation Inventory Project. Accessed January 2016.

Zdon, A., Rainville, K., Buckmaster, N., Parmenter, S., & Love, A. H. (2019). Identification of Source Water Mixing in the Fish Slough Spring Complex, Mono County, California, USA. *Hydrology*, 6(1), 26.

JOINT EXERCISE OF POWERS AGREEMENT

between the

BIG PINE COMMUNITY SERVICE DISTRICT

CITY OF BISHOP

COUNTY OF INYO

COUNTY OF MONO

EASTERN SIERRA COMMUNITY SERVICE DISTRICT

INDIAN CREEK-WESTRIDGE COMMUNITY SERVICE DISTRICT

KEELER COMMUNITY SERVICE DISTRICT

SIERRA HIGHLANDS COMMUNITY SERVICE DISTRICT

STARLITE COMMUNITY SERVICE DISTRICT

TRI-VALLEY WATER MANAGEMENT DISTRICT

and the

WHEELER CREST COMMUNITY SERVICE DISTRICT

creating the

OWENS VALLEY GROUNDWATER AUTHORITY

OWENS VALLEY GROUNDWATER AUTHORITY
JOINT POWERS AGREEMENT

This Joint Exercise of Powers Agreement ("**Agreement**") forming the Owens Valley Groundwater Authority is made and entered into this 1st day of August, 2017, ("Effective Date"), by and among the public agencies listed on the attached Exhibit "A" executing this Agreement (collectively referred to as the "Members" and individually "Member") for the purpose of forming a Groundwater Sustainability Agency ("GSA") and achieving groundwater sustainability in the Owens Valley Groundwater Basin.

WHEREAS, California enacted a series of laws collectively referred to as the Sustainable Groundwater Management Act, found in Part 2.74 of Division 6 of the California Water Code ("SGMA"); and

WHEREAS, the SGMA requires each California groundwater basin or sub-basin be managed by a Groundwater Sustainability Agency ("GSA"), or multiple GSAs, and that such management be implemented pursuant to an approved Groundwater Sustainability Plan(s) ("GSP"); and

WHEREAS, the SGMA, at Water Code § 10723.6(a), authorizes certain local agencies, as defined, to form a GSA via joint powers agreement; and

WHEREAS, Government Code § 6500 et seq. (hereinafter referred to as the "Act") authorizes municipalities and counties to jointly exercise any power common to them all; and

WHEREAS, each of the Members are local agencies, authorized to form a GSA via joint powers agreement, with jurisdictional boundaries covering portions of the Owens Valley Groundwater Basin (Basin No. 6-12 in the Department of Water Resources Bulletin 118 Update 2016, henceforth the "Basin"); and

WHEREAS, the Members desire to create the Owens Valley Groundwater Authority pursuant to the Act as authorized by the SGMA in order to jointly exercise their powers as a GSA for the purpose of creating a GSP to be implemented within their combined jurisdictional boundaries in the Basin; and

WHEREAS, subsequent to forming the GSA via this Agreement, the Members intend to engage with other agencies and entities that are not eligible to form a GSA, ("Associates" or "Interested Parties") to allow them to participate in the GSA as contemplated by SGMA and by this Agreement; and

WHEREAS, the Members intend the GSA created through the Authority to engage with any other GSA(s) formed within the Basin in order to either coordinate the creation of a single GSP, or to coordinate their respective GSPs as required by the SGMA; and

WHEREAS, the Members intend that the GSP created through this GSA, if possible, be coordinated with any groundwater management plan of other agencies that have lands overlying SGMA-exempt areas within the Basin; and

WHEREAS, through this Agreement the Members intend take advantage of economies of scale to obtain the most cost-effective consulting, technical and professional services for the development and implementation of a GSP.

NOW, THEREFORE, IT IS MUTUALLY AGREED by the Members, as follows:

ARTICLE I

CREATION AND OPERATION OF THE OWENS VALLEY GROUNDWATER AUTHORITY

1 **CREATION OF THE AUTHORITY**:

Upon adoption of this Agreement by two or more Members, pursuant to the Act and as authorized by the SGMA, there is hereby created a joint powers authority known as the Owens Valley Groundwater Authority ("Authority"). The Authority shall be, to the extent provided by law, a public entity separate from the Members of this Agreement.

Within thirty (30) days of the adoption of this Agreement by two or more Members, the Authority shall prepare the notice required by Government Code Section 6503.5, file it with the Secretary of State, and pay any fees for such filing that the Secretary of State may charge. In addition, the Board of Directors of the Authority shall file the statements required by and in accordance with Government Code Section 53051.

2 **TERM:** This Agreement shall become operative on the Effective Date provided that at least two of the Members listed in Exhibit A have executed this Agreement by said date.

This Agreement shall remain in effect until terminated by the unanimous written consent of all then active Members or when there are less than two Members remaining in the Authority; provided, however, that this Agreement shall remain in effect during the term of any contractual obligation or indebtedness of the Authority that was previously approved by the Board of Directors.

3 MEMBERSHIP:

3.1 MEMBERS. The Members of the Authority shall be the public agencies listed on the attached Exhibit "A" that have executed this Agreement by August 1, 2017, so long as their Membership has not been withdrawn or terminated pursuant to the provisions Article VI of this Agreement. If an eligible agency listed in Exhibit A has not executed this Agreement by August 1, 2017, they will lose their right to join through execution of this Agreement and their membership will be subject to the process for inclusion of new Members set forth in Section 3.2 below.

3.2 NEW MEMBERS.

The Board may approve an application for a new Member to join the Authority through a majority of the votes of the Board so long as: 1) the new Member is a local agency that is qualified to join the Authority as a GSA forming party under the provisions of SGMA and the Act; and, 2) the new Member agrees to or has met any other conditions that the Board may establish from time to time.

Once an application is deemed complete by the Board of Directors, the governing bodies for each of the Members shall be sent the application for their consideration and possible approval. For a new Member to be admitted the application must be unanimously approved by the Members acting through their governing bodies.

Upon a new Member joining the Authority pursuant to this section, said new Member and the Authority shall take all steps necessary to revise the Owens Valley GSA boundaries to incorporate any new areas of the Basin into the GSA's jurisdiction in a manner consistent with that contemplated by Article II Section 3.2 of this Agreement.

3.3 ASSOCIATES & INTERESTED PARTIES.

The participating Associates and Interested Parties shall be those entities participating in the GSA pursuant to Article V below.

4 GOVERNING BOARD:

4.1 BOARD DIRECTORS. The Authority shall be administered by a governing board. The governing board shall be called the "Board of Directors of the Authority," (hereafter referred to as the "Board of Directors"). The Board of Directors shall consist of members appointed as follows:

4.1.1 Member Appointments: Each Member's governing body shall appoint one Primary Director and one Alternate Director (sometimes individually referred to herein as a "Director"). The Alternate Director shall serve and assume the rights and duties of the Primary

Director when the Primary Director is unable to attend a Board of Directors meeting. The Primary and Alternate Directors for all Members shall be elected members of their governing bodies. Directors shall serve at the pleasure of the governing body appointing them and they may be removed at any time, with or without cause, in the sole discretion of their governing body. Each Director shall hold office until their successor is selected by their governing body and the Authority has been notified of the succession.

4.1.2 Associate & Interested Party Appointments: Associates and Interested Parties shall make appointments as set forth in **Article V** of this Agreement.

5 BOARD MEETINGS AND ACTIONS: All meetings of the Board of Directors shall be public meetings noticed, held, and conducted in accordance with the provisions of the Ralph M. Brown Act (California Government Code sections 54950, et seq.). The Board of Directors may use teleconferencing in connection with any meeting in conformance with, and to the extent authorized by, applicable law. The Board of Directors may further establish rules of conduct for its meetings provided that said rules do not conflict with the Ralph M. Brown Act or other applicable law.

5.1 INITIAL MEETING. The initial meeting of the Board of Directors shall be held at a location overlying the Basin within forty five days (45) days of the Effective Date of this Agreement. At the initial meeting the Board of Directors shall establish a principal office for the Authority, which shall be located at a place overlying the Basin. The Board of Directors may change the principal office from time to time as it sees fit so long as that principal office remains at a location overlying the Basin.

5.2 REGULAR MEETING SCHEDULE. The Board of Directors shall establish a regular meeting time and place at the initial meeting of the Board. The Board of Directors may vote to change the regular meeting time and place provided that the new location remains at a place overlying the Basin and within the jurisdictional boundaries of the Authority.

5.3 SPECIAL MEETINGS. Special meetings of the Board of Directors shall be conducted pursuant to California Government Code section 54956 and they may be called by the Chairperson, or by the concurrence of any two Primary Directors appointed by the Members.

5.4 ADVISORY COMMITTEES. The Board of Directors may from time to time establish advisory committees for the purpose of making recommendations to the Board of Directors on the various activities of the Authority. The establishment and dissolution of any committee and its duties shall require a majority of the votes of the Board of Directors and the activities of the committee shall be subject to the provisions of the Ralph M. Brown Act (California Government Code sections 54950, et seq.). Committees shall exist for the term specified in the action creating the committee. A Committee may use teleconferencing in connection with any meeting in conformance with, and to the extent authorized by, applicable law. The Board of Directors may further establish rules of conduct for Committees of the Board

meetings provided that said rules do not conflict with the Ralph M. Brown Act or other applicable law.

5.5 QUORUM. A quorum of the Board of Directors shall consist of majority of the Directors. Notwithstanding the above, the Authority shall not conduct business at a meeting in the absence of a majority of Directors appointed by the Members participating in such a meeting, beyond the adjournment of a meeting by the remaining Board Members. A Director shall be deemed present for the determination of a quorum if the Director is present at the meeting in person or if he/she participates in the meeting remotely as may be permitted by the Ralph M. Brown Act. Action taken by the Board of Directors shall require the affirmative vote of a majority of the voting shares on the Board of Directors, unless otherwise provided by this Agreement.

5.6 FISCAL YEAR: The fiscal year of the Authority shall be from July 1 through June 30 unless otherwise changed by Resolution of the Board of Directors.

5.7 BYLAWS, POLICY AND PROCEDURE MANUAL: Within the first six (6) months of the Authority's existence, the Board of Directors shall establish Bylaws and a Policy and Procedure Manual to govern the day-to-day operations of the Authority, in a manner consistent with applicable law and this Agreement. Each Director and their respective governing bodies shall receive a copy of the Bylaws and the Policy and Procedure Manual. Thereafter, the Board Directors may amend or repeal any bylaw, regulation, or policy and procedure, and may adopt additional bylaws, regulations, or policies and procedures that are consistent with applicable law and this Agreement. The Executive Manager shall send to each Director and to all of their respective appointing authorities all Bylaw amendments promptly after adoption by the Board of Directors.

5.8 ADOPTION OF ANNUAL BUDGET: Except as provided for in Article II Section 4.1, the Board of Directors shall adopt the annual budget of the Authority on or before May 1, by a majority of the votes of the Directors appointed by the Members and Associates.

5.9 ANNUAL REPORT: By April 1 of each year, the Authority shall prepare an annual report of its operation, in a form determined by the Board of Directors.

//

//

//

//

//

ARTICLE II

PURPOSE, POWERS AND DUTIES

1 **PURPOSE**: The purpose of this Agreement in creating the Authority is to provide for the joint exercise of powers common to the Members, including those additional powers granted by SGMA, to, among other things, cooperatively carry out the requirements of the SGMA, including, but not limited to, serving as the GSA for the Basin within the jurisdictional boundaries of the Authority-formed GSA and developing, adopting and implementing a GSP that achieves groundwater sustainability in the Basin.

2 **POWERS**: In accordance with California Government Code section 6509, the Authority's powers shall be subject to the restrictions upon the manner of exercising such powers pertaining to the County of Inyo.

2.1 In order to carry out its purpose, the Authority shall possess the ability to exercise those powers granted by the Act and by the SGMA. Additionally, the Authority shall possess the ability to exercise the common powers of its Members related to the purposes of the Authority, including but not limited to the following:

2.1.1 To become the GSA for the Basin pursuant to the SGMA and in a manner consistent with Section 3.3 below;

2.1.2 To develop, adopt, and implement a GSP for the Basin pursuant to SGMA;

2.1.3 To provide all services necessary to operate the GSA and implement the GSP;

2.1.4 To adopt rules, regulations, policies, bylaws and procedures governing the operation of the Authority and the adoption and implementation of the GSP;

2.1.5 To contract for the services of engineers, attorneys, planners, financial consultants, employees, agents and representatives, and/or to directly employ or appoint any such persons as it deems appropriate;

2.1.6 To collect and monitor all data related and beneficial to the development, adoption and implementation of the GSP for the Basin;

2.1.7 To issue revenue bonds or other appropriate public or private debt and incur debts, liabilities or obligations in connection with the operation, maintenance, administration and management of any facilities required to carry out these purposes;

2.1.8 To levy assessments, charges and fees as provided in SGMA;

2.1.9 To regulate and monitor groundwater extractions as permitted by SGMA, provided that this provision does not extend to a Member's or Associate's operation of its system to distribute water once extracted or otherwise obtained, unless and to the extent required by other laws;

2.1.10 To establish and administer water banking programs for the benefit of the Basin;

2.1.11 To establish and administer water recycling, recapturing or purifying programs for the benefit of the Basin;

2.1.12 To distribute water in exchange for the cessation or reduction of groundwater extractions;

2.1.13 To spread, sink, and inject water into the Basin;

2.1.14 To store, transport, recapture, recycle, purify, treat, or otherwise manage and control water for the beneficial use of persons and property within the Basin;

2.1.15 For the common benefit of the Basin, to store water within and outside of the Basin, to appropriate water and acquire water rights, to import water, and to conserve, or cause the conservation of, water within or outside of the Basin;

2.1.16 To cooperate, act in conjunction and contract with the United States, the State of California, or any agency thereof, counties, municipalities, public and private corporations of any kind (including without limitation, investor-owned utilities), and individuals, or any of them, for any and all purposes necessary or convenient for the full exercise of the powers of the Authority;

2.1.17 To accumulate operating and reserve funds and invest the same as allowed by law for the purposes of the Authority;

2.1.18 To apply for and accept grants, contributions, donations and loans under any federal, state or local programs for assistance in developing or implementing any of its projects or programs in connection with any project undertaken in the Authority's name for the purposes of the Authority;

2.1.19 To acquire by negotiation or condemnation or any other lawful authority, lease, purchase, construct, hold, manage, maintain, operate and dispose of any buildings, property, water rights, works or improvements within and without the respective boundaries of the Members necessary to accomplish the purposes described herein;

2.1.20 To invest funds pursuant to California Government Code section 6509.5 or other applicable State Law;

2.1.21 To sue and be sued in its own name;

2.1.22 Any power necessary or incidental to the foregoing powers in the manner and according to the procedures provided for under the law applicable to the Members to this Agreement;

2.1.23 Any additional powers conferred under SGMA or the Act or under applicable law, insofar as such powers are needed to accomplish the purposes of SGMA, including all powers granted to the Authority under Article 4 of the Act which are in addition to the common powers of the Members, including the power to issue bonds or otherwise incur debts, liabilities or obligations to the extent authorized by the Act or any other applicable provision of law and to pledge any property or revenues of the rights thereto as security for such bonds and other indebtedness.

2.2 WATER RIGHTS AND ADDITIONAL CONSIDERATIONS.

As set forth in California Water Code section 10723.2, and any future amendments to SGMA, the GSA shall consider the interests of all beneficial uses and users of groundwater in the Basin, as well as those responsible for implementing the GSP. Additionally, as set forth in California Water Code section 10720.5(a), and any future amendments to SGMA, any GSP adopted pursuant to this Agreement shall be consistent with Section 2 of Article X of the California Constitution and nothing in this Agreement modifies the rights or priorities to use or store groundwater consistent with Section 2 of Article X of the California Constitution, with the exception that no extraction of groundwater between January 1, 2015 and the date the GSP is adopted may be used as evidence of, or to establish or defend against, any claim of prescription. Likewise, as set forth in California Water Code section 10720.5(b), and any future amendments to SGMA, nothing in this Agreement or any GSP adopted pursuant to this Agreement determines or alters surface water rights or groundwater rights under common law or any provision of law that determines or grants water rights.

2.3 PRESERVATION OF POLICE POWERS.

Nothing set forth in this Agreement shall be deemed to modify or otherwise limit a county's or city's police powers in any way or its authority to regulate groundwater under existing law or any amendment thereto.

3 NOTICES OF ADOPTION AND GSA RECISION AND FORMATION: The Authority and its Members shall have the following specific duties:

3.1 NOTICE TO MEMBERS. Within forty-eight hours after adoption of this Agreement by the governing board of a Member, said Member shall notify all other Members of said adoption of this Agreement.

3.2 NOTICE TO DWR BY AUTHORITY. As required by SGMA, the Authority shall file a notice with DWR of its intent to be the GSA for the portions of the Basin covered by the combined jurisdictional boundaries of all Members, excluding any portion of the Basin covered by a valid notice from another, non-Member local public agency if the failure to exclude would result in overlapping applications as contemplated by Water Code Section 10723.8(c). Notwithstanding the foregoing, the Authority may elect to include overlapping areas in a subsequent amended notice filed with DWR so long as that application does not substantially impair the ability of the Authority to fulfill its purpose while the application is pending.

3.3 NOTICE TO DWR BY MEMBERS. Within thirty (30) days of a public hearing held by the Authority pursuant to Water Code Section 10723.(b) where the Authority decides to become a GSA within the Basin, any Member that previously notified the California Department of Water Resources (DWR) of its intent to be a GSA in the Basin ("Original Notice") pursuant to Water Code Section 10728.3 shall formally notify DWR, in writing, of its intent to withdraw or rescind such notification in order to allow the Authority to become the exclusive GSA for the area of the Basin covered by that Original Notice ("Rescission Notice"). Said Rescission Notice shall be expressly contingent upon the Authority becoming the exclusive GSA for the areas of the Basin covered by the Original Notice.

4 GSP BUDGET, ADOPTION, AND MANAGEMENT AREAS:

4.1 GSP DEVELOPMENT BUDGET. Notwithstanding any provision herein to the contrary, within six months of the formation of the Authority, the Inyo County Water Department shall, with input from any Members and as it otherwise deems appropriate, develop the Authority's initial budget for development of the GSP over a multi-year period (i.e. until the GSP is approved for implementation) within the requirements of the SGMA (hereinafter referred to as the "GSP Development Budget"). The GSP Development Budget shall function as a forecasting tool for the Members to guide them in their respective Funding Contribution decisions as discussed in Article IV below.

Upon notice from the Inyo County Water Department that the GSP Development Budget is complete and ready for approval, the Authority shall place the matter on the next possible Board meeting agenda. The Board of Directors shall adopt the GSP Development Budget as submitted by the Inyo County Water Department. In other words, approval of the GSP Development Budget shall be a ministerial act of the Board of Directors, provided, however, that it may be modified by the Board at a subsequent meeting(s) by a majority of the votes of the Directors appointed by the Members and Associates.

4.2 GSP ADOPTION, MODIFICATION, OR ALTERATION. The Board of Directors shall adopt a GSP for the area within the GSA formed by the Authority. The Board of Directors may modify or alter the GSP as necessary or appropriate.

4.3 GSP MANAGEMENT AREAS. To the extent permitted under SGMA, the GSP may provide for discrete areas within the GSA boundary in which the GSP is implemented and managed by at least one Member and/or Associate (a "GSP Management Area"). GSP Management Areas shall be created based on hydrological conditions (e.g. identifiable and logical sub-basins) that may or may not correspond to geopolitical boundaries. It is unlikely that a GSP Management Area will be restricted to any specific jurisdictional boundaries of a GSA Member and/or Associate. The creation of a GSP Management Area requires a majority of the votes of the Directors appointed by the Members and Associates. While Management Areas may provide for different requirements than other areas within the GSP, such requirements shall not conflict with the GSP. Unless otherwise agreed to by the Members, significant additional costs beyond the typical baseline costs for development and/or implementation of the GSP to the Basin as a whole that are attributable to the GSA activities within a GSP Management Area shall be borne by the Member(s), Associate(s), and Interested Party(s) that undertake(s) management of the GSP Management Area. Such entities that undertake management of a GSP Management Area shall determine how to allocate such additional costs amongst themselves.

ARTICLE III

OFFICERS AND STAFFING

1 CHAIR AND VICE-CHAIR: The Board of Directors shall annually elect a Chair and Vice-Chair from among the Members. The Chairperson shall preside at all meetings of the Board, while the Vice-Chairperson shall perform the duties of the Chairperson in the absence or disability of the Chairperson. The Chairperson and Vice-Chairperson shall exercise and perform such other powers and duties as may be assigned by the Board.

2 TREASURER AND AUDITOR CONTROLLER: The County of Inyo shall serve as the Fiscal Agent and Treasurer for the Authority unless otherwise directed by a majority of the votes of the Board of Directors. The Fiscal Agent shall be responsible for all money of the Authority from whatever source, shall be the depositary and have custody of the money of the Authority, and shall provide all duties and functions of the Treasurer for the Authority as set forth in Government Code Sections 6505, 6505.5, and all other applicable provisions of federal, state and local laws, ordinances, regulations, and this Agreement. All funds of the Authority shall be strictly and separately accounted for and regular reports shall be rendered of all receipts and disbursements during the Fiscal Year as designated by the Board. The cost for such services shall be actual costs, including reasonable overhead.

//

3 **EXECUTIVE MANAGER**: The Board of Directors shall appoint an Executive Manager. The Executive Manager shall serve at the pleasure of or upon the terms prescribed by the Board of Directors. The Executive Manager so appointed may be an employee of a Member, an employee of the Authority, or an independent contractor. The cost for such services shall be actual costs, including reasonable overhead, as determined by a written agreement with the Authority therefor.

3.1 EXECUTIVE MANAGER POWERS and DUTIES. Subject to any rules and regulations provided by the Board, the powers and duties of the Executive Manager are:

3.1.1 Consistent with Article II Section 4.1, to lead and coordinate the development of a GSP for the Authority and to be responsible to the Board of Directors for proper administration of all affairs of the Authority.

3.1.2 To appoint, assign, direct, supervise, and, subject to the personnel rules adopted by the Board of Directors, discipline or remove Authority employees.

3.1.3 To supervise and direct the preparation of the annual operating and capital improvement budgets for the Board of Directors and be responsible for their administration after adoption by the Board of Directors.

3.1.4 To formulate and present to the Board of Directors plans for facilities and/or services within the Authority and the means to finance them.

3.1.5 To supervise the planning, acquisition, construction, maintenance, and operation of the facilities and/or services of the Authority.

3.1.6 To attend all meetings of the Board of Directors and act as the secretary of the Board. To cause to be kept minutes of all meetings of the Board of Directors and to cause a copy of the minutes to be forwarded to each member of the Board of Directors and to the member entities, prior to the next regular meeting of the Board of Directors.

3.1.7 On or before April 1 of each year, to cause to be prepared and submitted to the Board of Directors and each of the Members a proposed budget for the upcoming fiscal year the annual report and the GSA's annual report.

3.1.8 To execute transfers within major budget units, in concurrence with the Treasurer Auditor-Controller of the Authority, as long as the total expenditures of each major budget unit remain unchanged.

3.1.9 To purchase or lease items, fixed assets, or services within the levels authorized in the Bylaws.

3.1.10 To perform such other duties as the Board of Directors may require in carrying out the policies and directives of the Board of Directors.

ARTICLE IV

MEMBER FUNDING AND VOTING

1 FUNDING CONTRIBUTION:

While funding of the Authority is expected to be shared equally between the Members, Members shall not be required to make a funding commitment prior to entering into this Agreement. Any funding contribution provided through sources other than Members shall reduce the contribution of the Members, pro-rated to their funding commitment for said budgets. All Members shall have an equal ability to provide funding toward the Authority's budgets.

1.1 MEMBER FUNDING OF THE GSP DEVELOPMENT BUDGET.

The Authority shall cause to be placed on the agenda of the Board meeting immediately following the meeting at which the GSP Development Budget is adopted (as required by Article II Section 4.1 above,) the matter of each Member's financial contribution commitment toward funding the multi-year GSP Development Budget. Said meeting shall be referred to herein as the "GSPDB Funding Meeting." Each Member shall make a legally binding commitment of its financial contribution toward the multi-year GSP Development Budget at the GSPDB Funding Meeting. The funding commitment made at the GSPDB Funding Meeting shall set the Member's maximum financial contribution to the GSP Development Budget. Members may continue this item to a later meeting so long as the continuance does not substantially impair the ability of the Authority to fulfill its purpose while the matter is pending.

The GSP Development Budget is expected to be reviewed and adjusted annually during the development of the GSP. Should the GSP Development Budget be subsequently modified by a majority of the votes of the Directors appointed by the Members and Associates in a manner that does not result in an increase to the dollar amount greater than the originally adopted GSP Development Budget, all funding commitments may be adjusted in a manner that maintains the Member's funding commitment as a percentage of the total GSP Development Budget. Should the GSP Development Budget be so modified in a manner that results in an increase to the dollar amount greater than the originally adopted GSP Development Budget, the Authority shall hold another GSPDB Funding Meeting at which the Directors appointed by Members shall determine how, if at all, a Member's and/or Associate's maximum contribution will increase. A Member unwilling or unable to fund its proportional share of the increase shall have its votes adjusted accordingly based on the formula in Article IV Section 2.1.3.

Members shall be classified as a "Funding Member," a "Partial-Funding Member," "Non-Funding Member" or an "Extra-Funding Member" as set forth immediately below.

1.1.1 Funding Member: Any Members that commit to funding **1/[total number of Members]** of the GSP Development Budget shall be classified as a Funding Member. For example, if there are four Members at the time of the GSPDB Funding Meeting, then a Funding Member would commit itself to funding **1/4** of the GSP Development Budget.

1.1.2 Partial-Funding Member: Any Member that commits to funding some amount less than **1/[total number of Members]**, but more than zero, shall be classified as a Partial-Funding Member.

1.1.3 Non-Funding Member: Any Members that do not commit to funding any portion of the GSP Development Budget shall be classified as a Non-Funding Member.

1.1.4 Extra-Funding Member: Any Members that commit to funding greater than **1/[total number of Members]** of the GSP Development Budget shall be classified as an Extra-Funding Member.

1.2 MEMBER FUNDING LEVELS FOR ANNUAL BUDGETS. After the GSP is developed, the Authority will adopt Annual Budgets to implement the GSP and/or otherwise fund its operations. Any costs incurred in the operation of the GSA prior to adoption of the GSP shall be accounted for in the GSP Development Budget. The matter of each Member's funding contribution commitment toward funding of all non-GSP Development Budget annual budgets shall be placed on the agenda of the Board meeting immediately following the meeting at which the respective annual budget is adopted by the Board. Said meetings shall be referred to herein as the "Annual Budget Funding Meetings." Each Member shall make a legally binding commitment of its funding contribution toward said annual budgets at the Annual Budget Funding Meetings. Members shall then be (re-)classified in a manner consistent with the process set forth in Section 1.1 above.

1.3 EQUAL FUNDING OPPORTUNITY. For the purpose of determining voting shares, if, after all Members make their respective funding commitments, the decision by a Member or Members to be a Partial-Funding Member or Non-Funding Member, results in funding commitments being less than the outstanding amount of funding needed cover expenses in the GSP Development Budget (the "Funding Shortfall"), any Member making a binding commitment to be a Funding Member will have the equal opportunity to become an Extra-Funding Member by making an additional binding funding commitment toward the Funding Shortfall. This process of providing additional funding by Funding Members who choose to become Extra-Funding Members shall continue until the Funding Shortfall is reduced to zero (0) through additional binding contributions. In this manner, all Members who become Funding Members will have an equal opportunity to become Extra-Funding Members with equal standing in terms of voting shares.

//

//

2 **VOTES**: The affirmative vote of a majority of the Board voting share shall be required for the approval of any Board action.

2.1 MEMBER VOTE SHARES. Each Member shall have the specific number of votes during said budget cycles as follows:

2.1.1 Funding Members shall each have four (4) votes.

2.1.2 Non-Funding Members shall each have two (2) votes.

2.1.3 Partial-Funding Members and Extra-Funding Members shall each have the following vote share:

$$V = 2 + 2MC/B$$

- V is the number of votes a Member has;
- M is the number of Members;
- C is the Members monetary contribution toward the total budget; and
- B is the total budget.

2.2 ASSOCIATE & INTERESTED PARTIES VOTE SHARES. Associates and Interested Parties shall have the specific number of votes during all budget cycles as provided for in Article V, provided, however, that in no event shall Members collectively have less than 70% of the total voting share of the Authority. Should the votes allocated to Associates and Interested Parties result in the Members receiving less than 70% of the total voting share of the Authority, the Members shall be allocated the number of additional votes that will equate to an aggregate 70% of the voting share of the Authority. Said additional votes shall be distributed to the Members consistent with their funding status.

//

//

//

//

//

//

ARTICLE V

ASSOCIATES AND INTERESTED PARTIES

1 ASSOCIATES:

1.1 APPLICATION TO BECOME AN ASSOCIATE. It is the Authority's intention to include certain entities, to the extent allowed by law and approved by the Authority's Directors appointed by its Members, in the sustainable management of groundwater within the Basin. To that end, only Directors appointed by the Members may vote to approve an application from an entity requesting to participate as an Associate in the GSA and/or GSP as permitted by the Act, SGMA, this Agreement, and any by-laws adopted by the Authority. The application shall be on a form developed by the Authority and shall include substantially the same types of information required as if the entity was filing to become a GSA. In the event an application is deemed incomplete, the Authority shall notify the entity in writing of such determination and describe the information or materials which must be provided and the deadline for their provision. The final terms governing the Authority's granting Associate status shall be consistent with the express requirements of this Agreement and subject to approval by the Directors appointed by the Members.

1.2 GENERAL REQUIREMENTS.

1.2.1 Eligibility. Generally speaking, Associate Board seats and corresponding voting powers are intended to be made available to federally recognized tribes within the Basin, a Federal Agency, the Los Angeles Department of Water and Power, and a limited number of mutual water companies representing themselves independently or in association with other mutual water companies. To be eligible to become an Associate of the Authority, the applicant must be eligible to "participate" in the GSA and/or GSP under SGMA and the Act. No Associate shall be another GSA, or part of another GSA by agreement, within the Basin.

1.2.2 Inclusion of new areas within the GSA. To the extent an entity applying for Associate membership owns and/or controls any areas of the Basin that are not within the Authority's GSA boundary and/or are exempt from the SGMA, the entity must have the authority, and shall agree, to subject any such areas to the Authority's jurisdiction, including, but not limited to, implementation of any GSP requirements, and funding the Authority's costs to implement the GSP within such areas, unless otherwise agreed to by a majority of the Members. Such areas may be designated as a Management Area pursuant to Article II Section 4.3.

1.3 SPECIAL REQUIREMENTS. The following special requirements are in addition to any general requirements:

1.3.1 Tribal Participation. Tribes may be eligible to participate as authorized by Water Code Section 10720.3(c). To be eligible to participate as an Associate of the Authority a tribe must be federally recognized and have sovereign lands within the Basin.

1.3.2 Federal Agency Participation. While there are multiple Federal Agencies potentially eligible to become an Associate, there shall be a maximum of one Associate Board seat available for those Federal Agencies collectively. If the Federal Agencies are unable to agree on which agency among them is best suited to be an Associate of the Authority those agencies shall file competing applications to become the federal Associate of the Authority.

1.3.3 LADWP. The Los Angeles Department of Water and Power's participation in the GSA as an Associate shall be conditioned on its providing a minimum level of ongoing funding toward the Authority's budgets as determined by a majority of the votes of the Directors appointed by Members, and providing information deemed relevant to the preparation and implementation of the GSP. The GSP shall only otherwise apply to LADWP water management activities to the extent the City of Los Angeles and Inyo County agree that the GSP requirements do not directly conflict with the Water Agreement.

1.3.4 Mutual Water Companies. While there are multiple mutual water companies and/or corporations regulated by the PUC (collectively referred to as "mutual water companies") potentially eligible to be an Associate, there shall be a maximum of three available Associate seats for those mutual water companies collectively. If the mutual water companies are unable to agree on which company(s) among them are best suited to be an Associate, those mutual water companies, or groups thereof, shall file competing applications to become an Associate of the Authority. Any such participation in the GSA as an Associate shall be conditioned on their providing a minimum level of ongoing funding toward the Authority's budgets as determined by a majority of the votes of the Directors appointed by Members.

1.3.5 Additional conditions. Additional conditions required for Associates may be established by a majority of the votes of the Directors appointed by the Members.

1.4 ASSOCIATE BOARD APPOINTMENTS AND VOTES.

1.4.1 In General. All Associates shall appoint one Primary Director and one Alternate Director (sometimes referred to herein as a "Director") to the Board of Directors. The Alternate Director shall serve and assume the rights and duties of the Primary Director when the Primary Director is unable to attend a Board of Directors meeting. Directors shall serve at the pleasure of the governing body appointing them and may be removed at any time, with or without cause, in the sole discretion of the Associate's governing body or equivalent thereof. Each Director shall hold office until his/her successor is selected by the Associate and the Authority has been notified of the succession in writing. Votes shall be allocated to Associates and available as follows:

1.4.2 Tribes. Each tribal Associate shall have two (2) votes.

1.4.3 Federal Agency Votes. The Federal Agency Associate shall have two (2) votes.

1.4.4 LADWP. The LADWP Associate shall have four (4) votes.

1.4.5 Mutual Water Companies. Each mutual water company Associate shall have two (2) votes.

2 INTERESTED PARTIES:

2.1 IN GENERAL. The Authority intends to allow other entities that are ineligible to become an Associate, or whose applications to become an Associate have been denied, or that choose not to be an Associate, to participate as an Interested Party as provided for by SGMA section 10727.8 and this Agreement. Those eligible to become an Interested Party are listed on Exhibit B to this Agreement, and shall not also be an Associate, or part of a group already represented on the Authority by an Associate. The Authority shall provide for four (4) seats on its Board of Directors held by representatives of Interested Parties. The (4) four Interested Parties' Director seats shall be selected by the Directors appointed by the Members. Each Director appointed as an Interested Party Director shall have one vote, except as otherwise specified herein.

2.2 APPLICATION TO BECOME AN INTERESTED PARTY. The application shall be on a form developed by the Authority. The application shall include substantially the same types of information required as if the entity was filing to become a GSA or as otherwise relevant to the applicant's interest in the Basin. In the event an application is deemed incomplete, the Authority shall notify the entity or individual in writing of such determination and describe the information or materials which must be provided and the deadline for their provision. The final terms governing the Authority's granting Interested Party status shall be consistent with the express requirements of this Agreement and subject to approval by a majority of the votes of Directors appointed by the Members and Associates.

//

//

//

//

//

//

//

//

ARTICLE VI

MISCELLANEOUS PROVISIONS

1 WITHDRAWAL & TERMINATION:

1.1 WITHDRAWAL OF A MEMBER. A Member may not withdraw from this Agreement after conclusion of the GSPDB Funding Meeting until the GSP is approved for implementation. After the GSP is approved for implementation, any Member may withdraw from this Agreement upon written notice given (3) three months prior to the adoption of the next annual budget. Any such withdrawal shall not become effective until the later of the end of the fiscal year within which the withdrawal notice was provided or when a replacement GSP has been adopted and implemented for any areas that would otherwise become unmanaged by virtue of the Member's withdrawal. The withdrawal of one or more Members shall not terminate this Agreement or result in the dissolution of the Authority. This Agreement shall remain in full force and effect among the remaining members, following the withdrawal of any Member, and the Authority shall remain in operation provided that there are at least two Members remaining in this Agreement.

1.2 WITHDRAWAL OF ASSOCIATE. Any Associate may withdraw from this Agreement upon three months' written notice, effective the following fiscal year.

1.3 WITHDRAWAL OF INTERESTED PARTY. Any Interested Party may withdraw from participation one months' written notice.

1.4 DISPOSITION OF ASSETS UPON WITHDRAWAL. Any asset received or otherwise acquired by the Authority shall remain the Authority's asset upon withdrawal of any Member, Associate or Interested Party.

1.5 TERMINATION OF PARTICIPATION. The Directors appointed by Members may vote to terminate the formal participation of any Associate or Interested Party in their sole discretion. A majority of the Members may also terminate any other Member for cause including, but not limited to, the failure to meet its obligations as set forth in this Agreement or as otherwise may be required. In the event of a termination, this Agreement shall continue in full force and effect among the remaining members as set forth immediately below.

1.6 ONGOING OBLIGATIONS. Any withdrawal or termination of a Member, Associate, or Interested Party shall not relieve it of its financial obligations (including, but not limited to, indemnity obligations, capital costs, debt obligations, CalPERS unfunded Liability, or any net operations and maintenance costs resulting from such withdrawal) arising under this Agreement prior to the effective date of the withdrawal or termination.

2 OBLIGATIONS AND AUTHORITY: The debts, liabilities and obligations of the Authority shall not be the debts, liabilities and obligations of any of the Members.

3 **LIABILITY OF THE PARTIES**: No debt, liability, or obligation of any one Member, Associate, or Interested Party shall constitute the debt, liability, or obligation of any of the other Member, Associate, or Interested Party. The Authority created hereunder shall indemnify and hold harmless the Members, Associates, and Interested Parties, and their agents, officers and employees from and against any damages, costs, or liabilities arising out of the acts or omissions of the Authority, or its officers, agents, and employees. Where Authority employees are also employees of a Member, Associate, or Interested Party, the Authority shall indemnify and hold harmless that employing entity for any damages, costs, or liabilities arising out of the acts or omissions of the employing entity's agents, officers or employees when those persons act on behalf of or at the direction of the Authority. The Authority shall maintain insurance coverage (including workers compensation coverage) adequate to fulfill its responsibilities under this section.

4 **DISSOLUTION**. The Authority may be dissolved at any time upon the unanimous vote of the Directors appointed by the Members and approval of the Members' governing boards. However, the Authority shall not be dissolved until all debts and liabilities of the Authority have been eliminated. Upon dissolution of the Authority, each Member shall receive its proportionate share of any remaining assets after all Authority liabilities and obligations have been paid in full. The distribution of remaining assets may be made "in kind" or assets may be sold and the proceeds thereof distributed to the Members. This distribution shall occur within a reasonable time after dissolution. No former member which previously withdrew or was terminated shall be entitled to a distribution upon dissolution.

5 **DESIGNATION OF SUCCESOR OR ASSIGNS**: This Agreement shall be binding upon and shall inure to the benefit of any successors to or assigns of the Members. Any successor or assignee of a Member must be eligible to form a GSA as set forth by the SGMA at Water Code § 10723.6(a), must incur all responsibilities of the original Member under this Agreement and must be approved by a majority of the Board of Directors.

6 **SUCCESSOR ENTITY**: If the Authority shall be succeeded by a new and separate entity or public entity deemed by the Board of Directors to be a "successor entity," that entity or entities shall receive title to all property held by the Authority pursuant to this Agreement.

7 **NO SUCCESSOR ENTITY**: Upon termination of the Authority, with no successor entity, all assets and funds, including the proceeds of the sale of property, in the possession of the Authority after payment and/or satisfaction of all lawfully incurred

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 **AMENDMENTS**: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 **SEVERABILITY**: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

EXHIBIT A
POTENTIAL MEMBERS

1. BIG PINE CSD
2. CITY OF BISHOP
3. COUNTY OF INYO
4. COUNTY OF MONO
5. EASTERN SIERRA CSD
6. INDIAN CREEK-WESTRIDGE CSD
7. LONE PINE CSD
8. KEELER CSD
9. SIERRA HIGHLANDS CSD
10. SIERRA NORTH CSD
11. STARLITE CSD
12. TRI-VALLEY WATER MANAGEMENT DISTRICT
13. WHEELER CREST CSD

EXHIBIT B

POTENTIALLY ELIGIBLE INTERESTED PARTIES

1. Agricultural Businesses
2. Disadvantaged Communities Not Already Represented
3. Domestic Well Owner Groups
4. Environmental Organizations
5. Environmental Users
6. Federal Agencies
7. Mutual Water Companies
8. Non-Agricultural Businesses with private wells
9. Public Water Systems
10. State Agencies
11. Tribes
12. Others as set forth in SGMA section 10727.8

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 **AMENDMENTS**: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 **SEVERABILITY**: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 AMENDMENTS: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 SEVERABILITY: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 **AMENDMENTS**: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 **SEVERABILITY**: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 **AMENDMENTS**: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 **SEVERABILITY**: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 **AMENDMENTS**: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 **SEVERABILITY**: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
Rus Elder President 7-11-2017 INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 **AMENDMENTS**: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 **SEVERABILITY**: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, **as of the day and year first above written.**

BIG PINE CSD	Sherry S Cosgrove 8/15/17 KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 **AMENDMENTS**: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 **SEVERABILITY**: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 AMENDMENTS: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 SEVERABILITY: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	Richard Mons Chair TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD
LONE PINE CSD	

obligations of the Authority, shall be returned to the members in proportion to their contribution in a manner consistent with Section 1.4 above.

8 **AMENDMENTS**: This Agreement may only be amended by a written amendment approved by the governing bodies of all Members.

9 **SEVERABILITY**: If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

IN WITNESS WHEREOF, the parties hereto have cause this Agreement to be executed and attested by the proper officers, who are duly authorized, as of the day and year first above written.

BIG PINE CSD	KEELER CSD
CITY OF BISHOP	SIERRA HIGHLANDS CSD
COUNTY OF INYO	SIERRA NORTH CSD
COUNTY OF MONO	STARLITE CSD
EASTERN SIERRA CSD	TRI-VALLEY WATER MANAGEMENT DISTRICT
INDIAN CREEK-WESTRIDGE CSD	WHEELER CREST CSD (CHAIRMAN)
LONE PINE CSD	

TABLE OF CONTENTS

Paul N. Bruce, County Counsel
Gregory L. James, Special Counsel
Antonio Rossmann, Special Counsel
Office of the County Counsel
County of Inyo
Independence, CA 93526
(619) 878-2411

Edward A. Schlotman
Assistant City Attorney of
City of Los Angeles
P.O. Box 111, Beaudry 1848
Los Angeles, CA 90051
(213) 481-6370

SUPERIOR COURT OF CALIFORNIA

COUNTY OF INYO

* * * *

CITY OF LOS ANGELES; DEPARTMENT OF WATER AND POWER OF THE CITY OF LOS ANGELES, Plaintiffs, vs. BOARD OF SUPERVISORS OF THE COUNTY OF INYO; THE COUNTY OF INYO; JOHN K. SMITH, COUNTY ADMINISTRATIVE OFFICER; INYO COUNTY WATER COMMISSION; AND DOES 1 THROUGH 50, Defendants.	CASE NO. 12908 STIPULATION AND ORDER FOR JUDGMENT

It is hereby ordered by this Court, and stipulated by and between Plaintiff, CITY OF LOS ANGELES (Los Angeles) and DEPARTMENT OF WATER AND POWER OF THE CITY OF LOS ANGELES (Department) by and through JAMES K. HAHN, City Attorney; EDWARD C. FARRELL, Chief Assistant City Attorney for Water and Power; by EDWARD A. SCHLOTMAN, Assistant City Attorney; and defendants COUNTY OF INYO (County) by and through PAUL N. BRUCE, County Counsel; GREGORY L. JAMES, Special Counsel; and ANTONIO ROSSMANN, Special Counsel; as follows:

SECTION I

History and Preliminary Statement

In 1913, the City of Los Angeles completed an aqueduct from Owens Valley to the City. The aqueduct had a capacity of 480 cubic feet per second (cfs). In 1970, a second aqueduct with a capacity of 300 cfs was completed and began operating, bringing the total capacity of the aqueduct system to about 780 cfs. Los Angeles' operations to supply the second aqueduct, including the pumping of groundwater in Owens Valley led to litigation by Inyo County against Los Angeles.

In a suit filed in 1972, Inyo County claimed that increased groundwater pumping was harming the environment of Owens Valley and that the practice should be analyzed in an Environmental Impact Report (EIR) in accordance with the provisions of the California Environmental Quality Act (CEQA). In 1973, the Court of Appeal for the Third Appellate District ruled that Los Angeles must prepare an EIR (32 Cal. App. 3d 795). Since 1973, Los Angeles has prepared two EIR's, one in 1976 and another in 1979, but the Appellate Court found both to be legally inadequate.

In 1980, the Inyo County Board of Supervisors drafted, and the Inyo County voters passed, a groundwater ordinance to regulate groundwater pumping in the Valley through a groundwater management plan. The plan was to be implemented by a groundwater pumping permit procedure. The ordinance created a County Water Department and a County Water Commission.

As a result of litigation commenced against the County by the City of Los Angeles and its Department, the

County was directed in May 1981, by order of this Court in case number 12883, not to implement the Ordinance until a legally sufficient environmental impact report had been prepared and adopted by the County. A Final EIR was prepared, but the Final EIR was not adopted by the County.

In July 1983, as a result of litigation commenced by the City of Los Angeles and the Department, this Court in case number 12908 ruled said Ordinance unconstitutional, invalid, and preempted by law, and that the implementation of the Ordinance should be enjoined. Pursuant to stipulation of the parties, entry of an injunction and final judgment have not been entered by this Court.

In 1983, following the Superior Court's decision invalidating Inyo County's groundwater ordinance, Inyo County and Los Angeles began an attempt to develop a groundwater management plan that would settle the litigation between the parties. In April 1984, the governing bodies of Inyo County and Los Angeles approved a five (5) year interim agreement. In this interim agreement, the two parties agreed to:

- settle then existing property tax litigation between Inyo County and Los Angeles;
- temporarily suspend Inyo County's appeal of the Court's decision invalidating its groundwater ordinance;
- temporarily suspend litigation on Inyo County's environmental suit and Court-imposed pumping restrictions by substituting jointly developed annual pumping programs;
- lease Owens Valley town water systems to Inyo County, which would result in a reduction in water

rates;

- o conduct cooperative studies, together with impartial third parties, including the United States Geological Survey (USGS);
- o implement certain enhancement/mitigation projects;
- o provide financial assistance to Inyo County from Los Angeles to cover costs of various studies and the County's water-related activities;
- o negotiate a long term groundwater management plan;
- o resume the CEQA litigation and litigation over the groundwater ordinance's validity if the parties did not develop and adopt a long term joint groundwater management plan for Owens Valley.

In December 1984, the Court of Appeal modified the Writ of Mandate that it had originally issued in 1973, to approve the five-year agreement of the parties. The Court specifically explained that the modification did not imply that a joint long term groundwater management plan would be a new project. The project would remain as it was -- a program increasing the average rate of groundwater pumping and use (both for export and in-valley use), above a baseline rate reasonably representing the average of groundwater pumping and use (both for export and in-valley use) preceding the operation of the second aqueduct. However, the Court did allow that the command of its Writ to prepare an EIR could be met if the EIR were to be presented in conjunction with a joint long term groundwater management plan. In January 1985, this Court approved the interim agreement.

In May 1988, as a result of a joint application by Inyo County and the Department, a sixteen (16) month exten-

sion by the Court (from February 1989 to June 30, 1990) was granted to the Department for the purpose of completing studies necessary for development of a joint long term groundwater management plan and EIR. In June 1990, Los Angeles and Inyo County requested a further twelve (12) month extension to September 30, 1991. In July 1990, the Court also granted this extension. In August 1991, the Court granted a further extension to October 21, 1991.

Since 1984, certain studies budgeted at approximately five million dollars ($5,000,000.00) have been undertaken by Inyo County, Los Angeles, and USGS to learn more about the relationship between groundwater pumping and its impact on native vegetation. As part of these studies, Inyo County and the Department developed extensive information on the geohydrology, water budget, soils, and vegetation of Owens Valley. USGS compiled and analyzed the information and summarized its independent findings in a series of technical reports. These USGS reports, together with other cooperative study materials, became the technical foundation for the joint long term groundwater management plan that has been developed by the parties.

Under the joint five-year interim agreement, the two parties cooperatively developed and implemented numerous projects. These enhancement/mitigation projects range in scope from the revegetation and irrigation of certain areas to enhancement of wildlife habitats and recreation areas.

After two years of negotiations, Inyo County and Los Angeles reached a preliminary agreement on a joint long term groundwater management plan on August 1, 1989. The joint long term management plan is set forth in this Stipulation and

Order. An EIR, as required of Los Angeles by the Court of Appeal's Writ was presented to that Court in conjunction with the joint long term groundwater management plan. The EIR has been approved by that Court and its Writ of Mandate has been discharged.

SECTION II

AGREEMENT BETWEEN THE COUNTY OF INYO AND THE CITY OF LOS ANGELES AND ITS DEPARTMENT OF WATER AND POWER ON A LONG TERM GROUNDWATER MANAGEMENT PLAN FOR OWENS VALLEY AND INYO COUNTY

GOALS AND PRINCIPLES FOR GROUNDWATER MANAGEMENT

The goals and principles of this Stipulation and Order shall apply primarily within Owens Valley, but shall be applied as appropriate to activities of the Department within Inyo County.

The Inyo County/Los Angeles Standing Committee and the Inyo/Los Angeles Technical Group formed pursuant to a Memorandum of Understanding between the parties, dated September 2, 1982, will continue in existence to represent the parties in implementing these goals and principles.

As agreed by the parties, the Department representatives on the Standing Committee shall include at least one (1) member of the Los Angeles City Council, the Administrative Officer of the City of Los Angeles, two (2) members of the Board of Water and Power Commissioners, and three (3) staff members. The County representatives on the Standing Committee shall be at least one (1) member of the Inyo County Board of Supervisors, two (2) Inyo County Water Commissioners, and three (3) staff members. The Technical Group shall be comprised of not more than five (5) representatives selected by the County and five (5) by the Department.

Neither the Technical Group nor the Standing Committee shall make any determination or recommendation as called for in this Stipulation and Order, the Green Book, or the EIR without first obtaining agreement among the Department's representatives and the County's representatives. Regardless of the number of representatives from either party in attendance at a Standing Committee or Technical Group meeting, Inyo County shall have only one (1) vote, and Los Angeles shall have only one (1) vote.

I. MANAGEMENT AREAS

A. Each well field area has been included in a designated management area. The boundaries of each management area have been established so as to contain all vegetation that could be impacted as a result of groundwater pumping from the well field area during "worst case" conditions (multiple dry years along with heavy pumping). Each management area contains several monitoring sites. Each Department well in a management area is linked to a monitoring site for management purposes.

B. The vegetation and groundwater conditions within the management areas will be carefully monitored by the Technical Group to assure that the goals and principles of this groundwater management plan are met.

C. If a new well is constructed outside of a designated management area, or if, outside of a designated management area, groundwater pumping is found through monitoring or other means, to cause or to have the potential to cause a significant decrease or change in vegetation or a significant effect on the environment, or if the Department commences water gathering activities outside of the

Owens Valley, the Technical Group shall expand the management area as necessary, or shall designate a new management area along with appropriate monitoring requirements. The appropriate vegetation classifications for management shall be established by the Technical Group within the new area and each new management area shall be managed in accordance with these goals and principles.

D. It is recognized that vegetation composition and density varies for reasons other than groundwater pumping, from period to period, depending upon weather, precipitation, surface water spreading, and other factors.

II. MANAGEMENT MAPS

Color coded management maps have been prepared (reduced copies attached as Exhibit A) which show Owens Valley vegetation classified by management type, management areas, monitoring sites, and wells. The Department's vegetation inventories that were conducted between 1984 and 1987, were used in compiling these maps. Approximately 227,000 acres of vegetation on the valley floor have been classified as follows:

A. Type A Classification. This classification is comprised of vegetation communities with evapotranspiration approximately equal to average annual precipitation. This classification is shown as white on the management maps and includes approximately 150,347 acres.

B. Type B Classification. This classification is comprised of scrub dominated communities, including rabbitbrush and Nevada saltbush communities with evapotranspiration greater than precipitation. This classification is shown

as yellow on the management maps and includes approximately 10,390 acres.

C. Type C Classification. This classification is comprised of grasslands/meadow vegetation communities with evapotranspiration greater than precipitation. The communities comprising this classification exist because of high groundwater conditions, natural surface water drainage, and/or surface water management practices in the area, i.e., conveyance facilities, wet year water spreading, etc. This classification is shown as green on the management maps and includes approximately 42,013 acres.

D. Type D Classification. This classification is comprised of riparian/marshland vegetation communities with evapotranspiration greater than precipitation. The communities comprising this classification exist because of high groundwater conditions, natural surface water drainage, and/or surface water management practices in the area, i.e., conveyance facilities, wet year spreading, etc. This classification is shown as red on the management maps and includes approximately 5,580 acres.

E. Type E Classification. This classification is comprised of areas where water is provided to City-owned lands for alfalfa production, pasture, recreation uses, wildlife habitats, livestock, and enhancement/mitigation projects. This classification is shown as blue on the management maps and includes approximately 18,830 acres.

/ / / / / / / / / / / /

/ / / / / / / / / / / /

/ / / / / / / / / / / /

/ / / / / / / / / / / /

III. MANAGEMENT STRATEGY

A. OVERALL GOAL

The overall goal of managing the water resources within Inyo County is to avoid certain described decreases and changes in vegetation and to cause no significant effect on the environment which cannot be acceptably mitigated while providing a reliable supply of water for export to Los Angeles and for use in Inyo County.

B. GROUNDWATER MINING

The goal is to avoid long term groundwater mining from aquifers of Inyo County. This goal will be met by managing annual groundwater pumping so that the total pumping from any well field area over a 20 year period (the then current year plus the 19 previous years) does not exceed the total recharge to the same well field area over the same 20 year period. The Technical Group may increase the annual pumping from a well field area above this amount if a recharge program for that area is implemented or for other relevant reasons that are consistent with these goals and principles. The average annual recharge to each well field area over the 20 year period shall be determined by the Technical Group using information developed by the United States Geological Survey (USGS) and other relevant information, including an analysis of water levels in each well field area.

C. DEFINITIONS

Unless otherwise specifically defined in these goals and principles, the terms "mitigation" and "feasible" are to be defined as under the California Environ-

mental Quality Act ("CEQA") as of July 1, 1989. The definition of these terms as set forth in CEQA and the Guidelines for Implementation of CEQA on July 1, 1989 are:

Mitigation:

1. Avoiding the impact altogether by not taking a certain action or parts of an action,
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation,
3. Rectifying the impact by repairing, rehabilitating, or restoring the impacted environment,
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action,
5. Compensating for the impact by replacing or providing substitute resources or environments.

(Guidelines for Implementation of the California Environmental Quality Act - Section 15370)

Feasible:

1. "Feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

(California Environmental Quality Act - California Public Resource Code - Section 21061.1)

D. MONITORING

Vegetation monitoring sites and water table monitoring wells have been and shall be established inside and outside each management area and Owens Valley town as determined feasible and necessary by the Techni-

cal Group. The type of monitoring that will be conducted at each site and at each monitoring well will vary as determined necessary by the Technical Group. Monitoring could include, but is not limited to, measurement of retained soil water, water levels in deep and shallow wells, analysis of vegetation, and the use of photographic monitoring. All monitoring, analysis and interpretation of results shall be done by the Technical Group. The Department shall fund the installation of the necessary monitoring sites and monitoring wells. The Department shall perform such maintenance on the monitoring wells as is necessary. The Department and the County shall jointly maintain the vegetation monitoring sites.

E. GREEN BOOK

The location of each management area, vegetation monitoring site, and each monitoring well, the wells linked to each vegetation monitoring site, the method for locating additional monitoring sites and monitoring wells, the type of monitoring to be conducted at each site, the standardized procedures for analysis and interpretation of monitoring results, including the determination of available soil water and the amount of soil water required by vegetation, are set forth in a technical document called a "Green Book." The "Green Book" is attached as a technical appendix to this Stipulation and Order and to the EIR.

F. MITIGATION

In addition to the mitigation measures described below, any significant effect on the environment of Inyo County attributable to groundwater pumping or to

Department surface water management practices, shall be mitigated as soon as a reasonable and feasible mitigation plan is developed. Implementation of this plan shall be commenced within twelve (12) months of a determination by the Technical Group or by dispute resolution that a significant effect on the environment has occurred.

G. PRIVATE WELLS

New wells will be sited and groundwater pumping shall be managed to avoid causing significant adverse effects on water quality or water levels in non-Department-owned wells in the Owens Valley that are attributable to groundwater pumping by the Department. Any such significant adverse effects shall be promptly mitigated by the Department. The determination of significant adverse effects shall be made by the Technical Group as provided in section IV.B below. Although this provision is intended to protect owners of wells who are not parties to this Stipulation and Order from impacts attributable to groundwater pumping by the Department, this provision is not a limitation of the legal rights of such non-parties or the parties, nor does it create a binding administrative remedy that must be pursued and exhausted prior to the exercise of any legal right by such a non-party.

H. INDIAN LANDS

These goals and principles and the other provisions of this Stipulation and Order will not alter in any way the Department's existing commitments to supply water to Indian lands in the Owens Valley, or cause a significant adverse effect on such lands.

I. RARE AND ENDANGERED SPECIES

Groundwater pumping and surface water management practices will be managed in a manner that is consistent with state and federal laws pertaining to rare and endangered species.

J. BISHOP CREEK WATER ASSOCIATION

These goals and principles and the other provisions of this Stipulation and Order shall not alter in any way the powers and duties of the Bishop Creek Water Association.

IV. VEGETATION MANAGEMENT GOALS AND PRINCIPLES

The management goals and principles for each vegetation management type are described below.

A. VEGETATION MANAGEMENT

Type A Vegetation Classification

This zone, composed of vegetation with a calculated evapotranspiration rate approximately equal to precipitation, is not affected by groundwater pumping or by changes in surface water management practices since such vegetation survives on available precipitation.

Type B, C, and D Vegetation Classifications

The goal is to manage groundwater pumping and surface water management practices so as to avoid causing significant decreases in live vegetation cover, and to avoid causing a significant amount of vegetation comprising either the Type B, C, or D classification to change to vegetation in a classification type which precedes it alphabetically (for example, Type D changing to either Type C, B, or A vegetation).

Methods that will be used to achieve this goal include an extensive monitoring program, discretion vested in the Technical Group and/or Standing Committee to take appropriate action, provisions for automatic turning off of wells (see section V), provisions for determining whether significant decreases or changes in vegetation have occurred (see section IV.B), provisions for mitigation, and provisions for dispute resolution.

Type B, C, and D classifications are each comprised of several vegetation communities defined in the "Land Classification and Natural Community Descriptions for the Owens Valley" (1987). It is recognized that a change in vegetation from one of these communities to another, as long as the change is not to a community that would fall outside the same classification will not be considered significant. A decrease in live salt cedar cover in the Type D classification generally will not be considered significant.

Notwithstanding the fact that wells may have been turned off due to insufficient soil moisture, any decreases or changes in vegetation that are determined to be significant by the Technical Group shall be mitigated as soon as a reasonable and feasible mitigation plan is developed by the Technical Group and implemented by the Department. In developing this mitigation plan, the Technical Group shall consider the potential environmental and water supply effects of any proposed plan.

/ / / / / / / / / / / /

/ / / / / / / / / / / /

/ / / / / / / / / / / /

Implementation of this plan shall be commenced by the Department within twelve (12) months of a determination by the Technical Group or by dispute resolution that a significant decrease or change has occurred.

A mitigation plan developed by the Technical Group could include restoring perennial vegetation cover in an area where there has been a significant decrease in live perennial vegetation cover, and/or restoring vegetation in an affected area to a vegetation community that falls within the classification shown on the relevant vegetation management map as soon as it can be reasonably restored. Mitigation activities could include, but are not limited to, surface water application or reduction in groundwater pumping (if groundwater pumping has not already been terminated in the affected area in accordance with the provisions of section V).

The Department shall continue to operate canals in accordance with its practices from 1970 (past practices have included taking canals out of service for maintenance and for operational purposes). However, any permanent change in canal operations, compared to past practices, shall be subject to prior Standing Committee approval. The Department will continue to determine and implement maintenance activities to control aquatic weeds and ditch bank vegetation in order to maintain canals in a clean and efficient manner.

Type E Vegetation Classification

(Lands supplied with water.) These lands will be supplied with water and will be managed to avoid causing significant decreases and changes in vegetation

from vegetation conditions which existed on such lands during the 1981-82 runoff year. Significant decreases and changes in vegetation will be determined as set forth in the management goals for Type B, C, and D vegetation; however, conversion of cultivated land by the Department or its lessee to other irrigated uses shall not be considered a significant decrease or change. Another primary goal is to avoid significant decreases in recreational uses and wildlife habitats that in the past have been dependent on water supplied by the Department.

The Department shall continue to provide water for Los Angeles-owned lands in Inyo County in an amount sufficient so that the water related uses of such lands that were made during the 1981-82 runoff year can continue to be made. The Department shall continue to provide water to Los Angeles-owned lands in the Olancha/Cartago area such that the lands that have received water in the past will continue to receive water. Additionally, the Department shall provide water to any enhancement/mitigation projects added since 1981-1982, unless the Inyo County Board of Supervisors and the Department agree to reduce or eliminate such water supply.

It is recognized that successive dry years could result in insufficient water to meet all needs. During periods of dry year water shortages, the Technical Group will evaluate existing conditions. A program providing for reasonable reductions in irrigation water supply for Los Angeles-owned lands in the Owens Valley and for enhancement/mitigation projects may be implement-

Reduce water to E/M in dry years.

ed if such a program is approved by the Inyo County Board of Supervisors and the Department, acting through the Standing Committee.

B. DETERMINATION OF "SIGNIFICANT" AND "SIGNIFICANT EFFECT ON THE ENVIRONMENT"

In determining (1) whether a decrease in live vegetation cover is "significant," or (2) whether a change in vegetation from one vegetation classification to another is "significant," or (3) whether a "significant effect on the environment" has occurred, it is recognized that it is infeasible to develop definitions of these terms for use in all areas and under all conditions. Therefore, a determination of what is a significant decrease or change in vegetation and of what is a significant effect on the environment will be made by a case by case analysis.

The first step in this case by case analysis is to determine whether the decrease or change can be measurably demonstrated. If so, it must then be determined by the Technical Group if the decrease or change, or if a potential significant effect on the environment, is or is not attributable to groundwater pumping and/or to surface water management practices.

Decreases and changes in vegetation and other environmental effects shall be considered "attributable to groundwater pumping, or to a change in surface water management practices," if the decrease, change, or effect would not have occurred but for groundwater pumping and/or a change in past surface water management practices. This shall be determined by an analysis of all

relevant factors, including a comparison of the affected area with an area of similar vegetation, soils, rainfall, and other relevant conditions where such a decrease, change, or effect has not occurred, or has not occurred to the same degree.

If the decrease, change, or effect is determined to be attributable to groundwater pumping or to changes in past surface water management practices, the Technical Group then shall determine whether the decrease, change, or effect is significant. In making this determination, the factors to be considered by the Technical Group shall include, but are not limited to:

- The size, location, and use of the affected area;
- The degree of the decrease, change or effect within the affected area;
- The permanency of the decrease, change, or effect;
- Whether the decrease, change, or effect causes a violation of air quality standards;
- Whether the decrease, change, or effect affects human health;
- Available factual and scientific data;
- Whether effects of the decrease, change, or effect are limited, but the incremental effects are substantial when viewed in connection with decreases or changes in other areas that are attributable to groundwater pumping or to changes in surface water management practices by the Department;
- Enhancement and mitigation projects that have been implemented by the Department.

\ \ \ \ \ \ \ \ \

V. GROUNDWATER PUMPING PROGRAM

A. WATER BALANCE PROJECTIONS

By the first of each month the Technical Group shall project the "water balance" for each monitoring site. These monthly projections will be made unless the Technical Group determines that monthly projections are unnecessary because of high soil water conditions. In making these water balance projections, the Technical Group shall compare the estimated amount of soil moisture available to vegetation with the estimated required water needs of the vegetation for the growing season (or appropriate portion thereof) at each monitoring site. These projections shall be made in accordance with procedures contained in the Green Book.

The growing season used when water balance projections are made between January 1st and September 1st, shall be the growing season (or appropriate portion thereof) during that calendar year, and no precipitation shall be included in such water balance projections. The growing season used when water balance projections are made between September 1st through December 31st shall be the growing season during the following calendar year. One-half of the average annual precipitation at the monitoring site between October 1st and September 30th shall be included in the October 1st water balance projection. This will be reduced to 40 percent of the annual average precipitation if the average of the actual runoff for the previous runoff year and the forecasted runoff for the then current runoff year is less than 70 percent of average, and to 30 percent of the average

annual precipitation if the average of the actual runoff for the two previous runoff years and the forecasted runoff for the then current runoff year is less than 75 percent of average. No precipitation shall be included in the November 1st and December 1st water balance projections.

B. WELL TURN OFF PROVISIONS

If as of July 1st or October 1st, the projected amount of available soil water at a monitoring site is less than the estimated water needs of the vegetation for the growing season (or appropriate portion thereof), the Department's wells linked to that monitoring site shall be immediately turned off. In addition to this provision requiring the automatic turn off of wells, the Technical Group and/or the Standing Committee may at any time turn off such wells as deemed necessary, or take such other action as appropriate, to achieve the goals of this Stipulation and Order.

C. WELL TURN ON PROVISIONS

In the event that wells are turned off in any area as a result of the provisions of paragraph B, the Technical Group shall periodically evaluate existing vegetation conditions in that area and determine whether any wells could be turned on. Only those wells whose operation will not contribute to the causation of a significant decrease or change in vegetation could be turned on. Wells that have been turned off could also be turned on if the Technical Group determines that the implementation of mitigation warrants such action.

If the Technical Group does not agree to turn

on wells in an area, the Department shall leave such wells off until the soil water in the area of the monitoring site has recovered to the estimated water needs of the vegetation as of the time the wells were turned off. Once the soil water in the area of the monitoring site has recovered to the level where the amount available to vegetation is equal to the estimated water needs of the vegetation as of the time that the wells were turned off (as determined by the monthly water balance projections), the Department may turn on the wells that are linked to that monitoring site. The Technical Group, based upon an evaluation of the existing vegetation conditions and other relevant factors, may revise the required level of soil water recovery in a monitoring site area if such a revision is consistent with these goals and principles.

These provisions do not prohibit the Department from unilaterally implementing such mitigation consistent with these goals and principles as may be necessary to cause an increase in the soil water in the area of a monitoring site prior to, or after the occurrence of a projected soil water deficit. This means that a well that has been turned off, may be turned on to supply water for mitigation in the area of the monitoring site to which it is linked. The area of the monitoring site within which the soil water must recover to the required level will be determined by the Technical Group.

A disagreement over whether wells are to be turned on will be subject to dispute resolution. Certain town supply wells, irrigation supply wells, fish hatchery supply wells, enhancement/mitigation project

supply wells, and other wells not affecting areas with groundwater dependent vegetation may be designated by the Technical Group as exempt from automatic turn-off.

D. ANNUAL OPERATIONS PLAN

By April 20th of each year, the Department shall prepare and submit to the Inyo County Technical Group a proposed operations plan and pumping program for the twelve (12) month period beginning on April 1st. (In the event of two consecutive dry years when actual and forecasted Owens Valley runoff for the April to September period is below normal and averages less than 75 percent of normal, the Department shall prepare a proposed plan for the six (6) month period beginning on April 1st and October 1st, and submit such plans by April 20th and October 20th.) The proposed plan and pumping program and any subsequent modifications to it shall be consistent with these goals and principles.

1. A proposed plan shall include, but is not limited to, the following:

   - Owens Valley Runoff estimate (annual)
   - Projected groundwater production by well field (monthly)
   - Projected total aqueduct reservoir storage levels (monthly)
   - Projected aqueduct deliveries to Los Angeles (monthly)
   - Projected water uses in the Owens Valley (monthly)
   - Water balance projections at each monitoring site

2. The County through its Technical Group representatives shall review the Department's proposed plan of operations and provide comments to the Department within ten (10) days of receipt of the plan.

3. The Department shall meet with the County's Technical Group representatives within ten (10) days of the receipt of the County's comments, and attempt to resolve concerns of the County relating to the proposed pumping program.

4. The Department shall determine appropriate revisions to the plan, provide the revised plan to the County within ten (10) days after the meeting, and implement the plan.

5. The April 1st pumping program may be modified by the Department during the period covered by the plan to meet changing conditions. The Department shall notify the County's Technical Group representatives in advance of any planned significant modifications. The County shall have the opportunity to comment on any such modifications.

6. Information and records pertaining to the Department's operations and runoff conditions shall be reported to the County's Technical Group representatives throughout the year.

VI. NEW WELLS AND PRODUCTION CAPACITY

The Department's current groundwater pumping capacity may be increased to provide increased operational flexibility and to facilitate rotational pumping. The Department may replace existing wells and construct new wells in areas where

hydrogeologic conditions are favorable, and where the operation of that well will not cause a change in vegetation that would be inconsistent with these goals and principles.

Prior to the Department's construction of new wells, the location of each well shall be jointly evaluated by the Technical Group as to the potential impact of its operation on the valley's vegetation and environment. The evaluation shall include the drilling of one or more test holes, if needed, to develop information on the hydrogeologic conditions at the site, an inventory and classification of vegetation that could be affected by the operation of the well, and the assessment of any other potential significant effects on the environment.

Each new well will generally reflect optimum design parameters considering location, economics, and current practice in the industry. The Department will schedule and contract for construction of the well.

An aquifer test of up to seventy-two (72) hours duration shall be conducted on each new well. One existing or new monitoring well with appropriate perforations is necessary for the aquifer test. The Technical Group shall determine the location of this monitoring well and the need for any additional monitoring wells and the length of the aquifer test.

All data generated from the well construction process shall promptly be made available to the County. The County shall make application for and obtain any well construction permits required by the County or any subdivision thereof.

It is recognized that this new well program may result in a change in the areas that would be affected by pumping from existing wells. Therefore, additional monitoring

of groundwater tables and vegetation shall be implemented as necessary outside of existing management areas and monitoring requirements shall be altered or created as necessary. The Technical Group shall designate a management area and monitoring site requirements for each new well. The siting and the operation of the well shall be consistent with these goals and principles.

Only one well initially shall be constructed and operated in any new area. No additional well(s) shall be installed in the area until the initial well has been operated for at least six (6) months at full intended operational capacity in order to gain information on the area and to minimize the potential for adverse impacts.

During this initial period of operation, the Technical group shall monitor water levels and vegetation conditions in accordance with a jointly developed monitoring program. Additional wells may be installed by the Department in the area if operation of the initial well indicates no impacts that would be inconsistent with these goals and principles. Monitoring wells shall be installed as necessary to evaluate any potential effects of the operation of the new well or wells on wells not owned by the Department.

A current program of replacing twelve (12) production wells with perforations only in a lower zone may be continued. (Six (6) replacement wells have been drilled and six (6) wells are scheduled to be drilled during the 1990-91 fiscal year.)

Any production wells that are to be permanently removed from service shall be converted into properly sealed monitoring wells or shall be abandoned in accordance with

state water well standards. The sealing of a monitoring well shall be designed to prevent cross flow between aquifers.

The EIR describes the impacts of the construction and operation of fifteen (15) new wells. The construction and operation of any new wells not described in the EIR will be the subject of a subsequent CEQA review.

The Technical Group may agree that some existing wells that now supply enhancement/mitigation projects be converted to Department production wells. Wells that are the only source of supply for an enhancement/mitigation project shall not be converted. Water for the enhancement/mitigation project formerly supplied by a converted well will be supplied as necessary from Department production wells. Any enhancement/mitigation well converted to a production well could later be reverted to an enhancement/mitigation well if agreed to by the Technical Group.

VII. GROUNDWATER PUMPING ON THE BISHOP CONE

A. Any groundwater pumping by the Department on the "Bishop Cone" (Cone) shall be in strict adherence to the provisions of the Stipulation and Order filed on the 26th day of August, 1940, in Inyo County Superior Court in the case of Hillside Water Company, a corporation, et al. vs. The City of Los Angeles, a Municipal Corporation, et al., ("Hillside Decree").

Before the Department may increase groundwater pumping above present levels, or construct any new wells on the Cone, the Technical Group must agree on a method for determining the exact amount of water annually used on Los Angeles-owned lands on the Cone. The agreed upon method shall be based on a jointly conducted audit

of such water uses.

The Department's annual groundwater extractions from the Cone shall be limited to an amount not greater than the total amount of water used on Los Angeles-owned lands on the Cone during that year. Annual groundwater extractions by the Department shall be the total of all groundwater pumped by the Department on the Cone, plus the amount of artesian water that flowed out of the casing of uncapped wells on the Cone during the year. Water used on Los Angeles-owned lands on the Cone, shall be the quantity of water supplied to such lands, including conveyance losses, less any return flow to the aqueduct system.

B. The overall management goals and principles and the specific goals and principles for each vegetation classification of this Stipulation and Order apply to vegetation on the Cone.

VIII. GROUNDWATER RECHARGE FACILITIES

It is recognized that development of new groundwater storage, and the implementation and operation of feasible groundwater banking and recharge facilities in the Owens Valley and in the Rose Valley that will not cause significant effects on the environment may be beneficial. The development of any such facilities in the Owens Valley and in Rose Valley are subject to agreement of the Inyo County Board of Supervisors and the Department, acting through the Standing Committee. The Inyo County Board of Supervisors shall not unreasonably refuse to agree to a feasible groundwater banking facility that will not cause significant decrease or change in vegetation or a significant effect on the environment. The

EIR describes the implementation of selected groundwater recharge facilities. The operation of such facilities shall be consistent with these goals and principles. The development of any future groundwater recharge and extraction facilities not covered by the EIR will be the subject of a subsequent "CEQA" review.

IX. COOPERATIVE STUDIES

It is recognized that additional cooperative studies related to the effects of groundwater pumping on the environment of the Owens Valley are necessary. The reasonable costs of studies implemented under the Stipulation and Order or the Green Book shall be funded by the Department. If necessary, such funding will be in addition to funds provided under section XIV below.

PROJECTS AND OTHER PROVISIONS

X. ENHANCEMENT/MITIGATION PROJECTS

All existing enhancement/mitigation projects will continue unless the Inyo County Board of Supervisors and the Department, acting through the Standing Committee agree to modify or discontinue a project. Periodic evaluations of the projects shall be made by the Technical Group. Subject to the provisions of section VI, enhancement/mitigation projects shall continue to be supplied by enhancement/mitigation wells as necessary. New enhancement projects will be implemented if such projects are approved by the Inyo County Board of Supervisors and the Department, acting through the Standing Committee.

XI. TOWN WATER SYSTEMS

Los Angeles shall transfer ownership of the water systems in the towns of Lone Pine, Independence, and Laws to

the County or to another Owens Valley public entity or entities. The transfer of ownership will be for a price of one dollar ($1.00) per water system. The method of transfer will be a lease purchase agreement wherein the transfer of the ownership of each system will be complete at the end of five (5) years from the date of entry of this Stipulation and Order.

Prior to the transfer of the water systems, the County and the Department will jointly select and will have an independent engineering firm inspect each of the systems for compliance with all applicable requirements (including water quality) of the California Department of Health Services and other agencies, and perform a structural assessment of the Independence Reservoir including its ability to withstand seismic events. The costs of this inspection shall be funded by the Department. Prior to the transfer of the systems, the Department will make any repairs or alterations necessary to bring each distribution system into compliance with all such applicable requirements.

During the five (5) year lease period, Los Angeles shall be responsible for the operation and maintenance of the wells, pumps, reservoirs and chlorination equipment supplying the water systems of the three towns. Treated water shall be supplied by the Department as needed to each of the three town water systems at no cost up to the annual amounts set forth below:

System	Amount in Acre Feet
Lone Pine	550
Independence	450
Laws	50

The County (or other public entity operating the water system) shall pay the Department for water used in excess of these totals in an amount that would reflect the actual incremental cost to the Department of operating and maintaining the wells and reservoirs to provide the excess amount.

Also during the five (5) year lease period, the Department will improve the Independence town reservoir, if needed, to provide a facility with an expected service life of at least fifteen (15) years with routine maintenance and that meets all applicable Department of Health Services requirements. Further, the Department, at its option, shall either upgrade the reservoir as needed to meet seismic requirements as agreed upon by the Inyo County Board of Supervisors and the Department, or shall fully repair any damage to the reservoir caused by earthquake during a fifteen (15) year period following the transfer of the water system. The Lone Pine reservoir shall be replaced by the Department with a new reservoir with a five hundred thousand (500,000) gallon capacity. (Once a replacement well and the new reservoir are in service, groundwater shall no longer be exported via the Los Angeles aqueduct from the wells supplying the Lone Pine Water System.)

During the five (5) year lease period, the County or the public entity or entities shall set the water rates for the three town water systems, operate and maintain all components of the water systems (except the wells, pumps, chlorination equipment, and reservoirs), begin the transition for operating and maintaining the chlorination equipment, handle all billing and related matters, and establish a capital

reserve fund for replacement of components of the systems in the event of emergency or deterioration.

At the end of the five (5) year lease period, the County or other public entity or entities shall assume total ownership and operation of each town water system, except that the Department shall continue to own and operate the wells. The Department shall supply untreated water to each water system at no cost up to the annual amounts described above. The County (or other public entity) operating each water system shall pay the Department for water used in excess of these totals in an amount that reflects the actual incremental costs of supplying water in excess of these totals.

It is recognized that Los Angeles has leased the town water system in Big Pine to the Big Pine Community Services District. It also is recognized that the lease requires certain considerations favorable to the District in the event of a permanent transfer of the town water systems in the other Owens Valley towns as part of an overall settlement of litigation. In view of this, the same benefits and opportunities will be provided to the Big Pine water system as are available to the three other Owens Valley water systems. This includes providing untreated water to the system without charge up to five hundred (500) acre feet per year.

XII. LOWER OWENS RIVER

The parties, together with the California Department of Fish and Game will complete a management plan that is now in preparation for the Lower Owens River by June 1, 1992. The County and the Department shall actively seek to secure funding for the construction and operation of the Lower Owens River Project from the State of California and from other

funding sources. Construction of the project shall be commenced by the Department within three (3) years after Court approval of this Stipulation and Order unless otherwise agreed by the Inyo County Board of Supervisors and the Department. Prior to implementation, the project will be the subject of a CEQA review separate from the EIR which describes this Stipulation and Order.

The project plan will include the construction of a pumpback station from the river near Keeler Bridge to the Los Angeles aqueduct. The pumpback system will be capable of pumping up to fifty cubic feet per second (50 cfs) from the river to the aqueduct. Due to seasonal fluctuation in the flow of the river, the average annual pumping in any year will not exceed approximately thirty-five cubic feet per second (35 cfs). The plan will also provide that water releases would be made to the river above Blackrock Gate on the Los Angeles aqueduct (but below the aqueduct intake), that the existence of off-river lakes and ponds now supplied by the existing project will be continued, and for a water release from the pumpback station to supply the southern end of the river and the Delta. It is recognized that the release to the southern end of the river and the Delta may be constrained by the legal requirements concerning the Department's release of water to Owens Lake.

In addition to the above, the management plan will provide for, but not be limited to, the following:

- The water flow and schedules needed to maintain a healthy and productive warm water fishery in the lower Owens River and in the off-river lakes and ponds.
- The specific water diversion and release points to

supply the project.

- The locations of ponds and pools in and adjacent to the Lower Owens River, and the proposed methods to manage these to produce and maintain a viable fishery.
- The requirements for channel maintenance.
- The plans for fish stocking.
- The plans for tule and other plant control in the river and the off stream ponds and lakes.

The Department shall construct, operate, and maintain the pumpback system. The total cost of the construction of the pumpback system, new release structures, channel modifications, and other necessary work for initial operation of the project is estimated by the Department to be approximately seven and one-half million dollars ($7,500,000.00). The Department shall fund the initial construction costs of the project and the State of California, the County or other sources shall contribute fifty percent of actual costs up to three million seven hundred fifty thousand dollars ($3,750,000.00) to the Department. The Department shall pay for the annual cost of operating the pumpback system less any funds received from other non-County sources. Once the project has been constructed and completed, the Department and the County would jointly operate and fund the non-pumpback portions of the project.

In the event that Inyo County is required to fund any portion (up to $3.75 million) of the costs of constructing the Owens River pumpback system, Los Angeles shall loan Inyo County the amount of the County's share of such costs. The County shall repay such loan without interest and shall make annual payments in the amount of three hundred thousand dol-

lars ($300,000.00) until the loan is fully repaid.

XIII. HAIWEE RESERVOIRS

The Department shall conduct and finance seismic studies required by the California State Department of Water Resources to determine if South Haiwee Dam can be safely operated at reduced storage levels. If such operations are allowed, the Department and the County shall develop a recreation plan for South Haiwee reservoir, and the Department shall open this facility to public recreation pursuant to the plan. The recreation plan will be implemented and operated by the County or by a concessionaire.

In the event that the continued operation of South Haiwee is not allowed, the parties shall jointly develop a recreation plan for North Haiwee Reservoir and such plan will be implemented if it is feasible to do so. Any plan must take into consideration Los Angeles' operating and security needs. The plan must also take into consideration the fluctuations of water levels and the requirements for water treatment.

XIV. FINANCIAL ASSISTANCE

A. SALT CEDAR CONTROL

The Department shall provide funding to the County for an initial three (3) year salt cedar control effort and for an annual maintenance and control effort in the Owens Valley area. This effort shall be conducted by Inyo County. The salt cedar control effort will be commenced as soon as feasible following entry of this Stipulation and Order.

The initial salt cedar control effort will be focused on those acres on the valley floor identified in

the Technical Group's "Salt Cedar Control Study Report" as having a high density of salt cedar composition. The following is the priority for implementation of control:

1. Lower Owens River Channel
2. Tinemaha Reservoir and Owens Valley north of Tinemaha Reservoir
3. Perennial Streams, Canals, and Ditches
4. Springs and Seep Areas
5. High Water Table Meadows
6. Spreading Areas that Normally Receive Water
7. Spreading Areas that Receive Water Only in Very High Runoff Years

The annual control program will be based on the same control priorities as described above. The funding of the initial three (3) year program shall be three hundred fifty thousand dollars ($350,000.00) for the first year and two hundred thousand dollars ($200,000.00) for the second and third years. A three hundred fifty thousand dollar ($350,000.00) payment shall be made by the Department to the County within sixty (60) days of entry of this Stipulation and Order. Thereafter, the second and the third year payments shall be made by twelve (12) months and twenty-four (24) months after the first payment, respectively.

The first annual maintenance and control effort payment shall be made to the County by July 10th following the making of the last payment of the initial three (3) year program. This payment shall be in the amount of fifty thousand dollars ($50,000.00). Thereafter, each annual payment shall be made by July 10th, and the

amount of each payment shall be the previous year's payment adjusted upward or downward each year in accordance with the Los Angeles - Anaheim - Riverside All Urban Consumers Price Index or its successor. The maximum adjustment shall not exceed five (5) percent in any year. The annual payment shall be placed in trust by the County and will be used only for the purposes of salt cedar control. If, at anytime, one hundred fifty thousand dollars ($150,000.00) or more is accumulated in the trust, the Department shall not be required to make an additional payment until such time as the funds in the trust are less than fifty thousand dollars ($50,000.00) on June 30th of any year. The annual funding for salt cedar would continue unless the Inyo County Board of Supervisors and the Department, through the Standing Committee, agree that the salt cedar control program is to be reduced in scale or terminated. It is recognized that even with an initial and an annual control effort, salt cedar may not be fully controlled in the Owens Valley.

B. PARK REHABILITATION, DEVELOPMENT, AND MAINTENANCE

The Department shall provide funding as provided herein to the County for rehabilitation of existing County parks and campgrounds, development of new County campgrounds, parks, and recreational facilities and programs, and for the annual operation and maintenance of existing and new facilities and programs. These facilities are now, and will be, located on lands owned by the City of Los Angeles.

During the ten (10) years following entry of

this Stipulation and Order, the County will rehabilitate certain existing parks and campgrounds and develop certain new parks, campgrounds, recreational facilities and programs. These facilities will be developed in accordance with a master plan now being prepared by the County, or in accordance with any future plans developed by the County.

Among the first facilities considered for rehabilitation will be the Pleasant Valley Campground, the Baker Creek Campground, Dehy Park, and Diaz Lake. Among the first new facilities and programs considered for development will be certain campgrounds along the Owens River from Pleasant Valley Reservoir to the Owens River Delta, and a recreational use and management plan for that reach of the Owens River. The construction of new facilities and any significant changes in existing facilities will be subject to a CEQA review.

During this ten (10) year period, the Department shall provide up to two million dollars ($2,000,000.00) to the County for the above purposes. The amount of funds provided in any year shall be based upon the work to be undertaken on such activities by the County during that year. The funds provided may only be used by the County for the purposes described in the above text.

To financially assist the County in the operation and maintenance of existing and new parks, recreational facilities and programs operated by the County on lands owned by the City of Los Angeles, the Department shall make an annual payment to the County. The initial

payment shall be made within sixty (60) days of entry of this Stipulation and Order. If the entry of this Stipulation and Order occurs during the month of July, the payment would be one hundred thousand dollars ($100,000.00). If entry of this Stipulation and Order occurs between August 1st and June 30th, the payment shall be the sum of one hundred thousand dollars ($100,000.00) prorated. The proration shall be based upon the month of the July-June fiscal year when entry of this Stipulation and Order occurs. For example, if entry of this Stipulation and Order occurs in either January or June, the payment would be five twelfths of one hundred thousand dollars (5/12 of $100,000.00), or one twelfth of one hundred thousand dollars (1/12 of $100,000.00), respectively.

After the initial payment, an annual payment shall be made by July 10th of each year, and the amount of the payment for the first full fiscal year following final approval shall be one hundred thousand dollars ($100,000.00). Each year thereafter, the amount of the annual payment shall be the previous year's payment adjusted upward or downward each year in accordance with the Los Angeles - Anaheim - Riverside All Urban Consumers Price Index or its successor. The maximum adjustment shall not exceed five (5) percent in any year. The annual funding shall be placed in trust by the County and shall be used only for the purposes of operation and maintenance of existing and new parks, recreational facilities and programs. If at anytime three hundred thousand dollars ($300,000.00) or more were to be accumu-

lated in the trust, the Department shall not be required to make an additional annual payment until such time as the funds in the trust are less than one hundred thousand dollars ($100,000.00) as of June 30th of any year. This annual funding shall continue unless the Inyo County Board of Supervisors and the Department agree that the operation and maintenance program is to be reduced in scale or terminated.

C. WATER AND ENVIRONMENTAL ACTIVITIES

The Department shall assist the County in funding water and environmentally related activities by making an annual payment to the County. The first payment shall be made within sixty (60) days of approval of this Stipulation and Order by both the County and Los Angeles. The amount of the first payment shall be the sum of eight hundred twenty thousand five hundred eighty dollars ($820,580.00) minus the amount of any previous payments made by the Department to the County for these activities during the 1991-92 fiscal year.

After the initial payment, an annual payment shall be made by July 10th of each subsequent year. The amount of the first such payment shall be eight hundred twenty thousand five hundred eighty dollars ($820,580.00) adjusted upward or downward in accordance with the Los Angeles - Anaheim - Riverside All Urban Consumers Price Index or its successor. Each year thereafter, the amount of the annual payment shall be the amount of the previous year's payment adjusted in accordance with said consumer's price index. The maximum adjustment shall not exceed five (5) percent in any year. Annual funding

shall be placed in trust by the County and shall be used only for purposes of operation and maintenance of water and environmentally related activities. If at anytime one million five hundred thousand dollars ($1,500,000.00) or more is accumulated in the trust, the Department shall not be required to make an additional annual payment until the funds in the trust are less than eight hundred twenty thousand five hundred eighty dollars ($820,580.00) as of June 30th of any year.

This annual funding will be discontinued as of the date of a final decision by a court to disapprove this Stipulation and Order. This annual funding shall continue unless the Inyo County Board of Supervisors and the Department agree that the program is to be reduced in scale or terminated.

D. GENERAL FINANCIAL ASSISTANCE TO THE COUNTY

To assist the County in providing services to its citizens, the Department shall make an annual contribution to the County. The first contribution shall be made within sixty (60) days of approval of this Stipulation and Order by both the County and Los Angeles. The amount of the first payment shall be the sum of one million two hundred twenty-one thousand six hundred eighty-five dollars ($1,221,685.00) minus the amount of any previous contributions made by the Department to the County for these services during the 1991-92 fiscal year.

After the initial contribution, an annual contribution payment shall be made by July 10th of each subsequent year. The amount of the first annual contribution payment shall be one million two hundred twenty-

one thousand six hundred eighty-five dollars ($1,221,685.00) adjusted in accordance with the formula for assessment of Los Angeles-owned property as set forth in present Article XIII, Section 11 of the California Constitution. Each year thereafter, the amount of the annual contribution payment shall be the amount of the previous year's payment adjusted in accordance with said formula.

In the event that Los Angeles' existing geothermal leases in the Coso Geothermal area of Inyo County are developed in such a manner that the County receives possessory interest taxes on such leases, such taxes received by the County shall be credited to the Department for up to one-half of the total annual general financial contribution to the County. Such credit shall only be made if the possessory interest taxes received are not subject to a claim for refund, legal challenges, or to refund for other reasons.

These annual contribution payments will be discontinued as of the date of a final decision by a court to disapprove this Stipulation and Order.

E. BIG PINE DITCH SYSTEM

The Department shall provide up to one hundred thousand dollars ($100,000.00) for reconstruction and upgrading of the ditch system and for construction of additional ditches to supply additional properties in the town of Big Pine. The ditch system must be planned, constructed, operated, and maintained by a Big Pine entity or organization separate from the Department or the County, except for existing ditches on Los Angeles-

owned land which will continue to be maintained by the Department. This entity or organization must obtain all necessary rights of way prior to construction.

The Department shall make a flow of up to six (6) cfs available to supply the ditch system with water. This is in addition to water now diverted for use by Big Pine Water Association members. Water to replace any water used by this project will come from a new well, which will be constructed by the Department west of Big Pine. This well may also supply water to the Big Pine Water System.

The stockholders of the Big Pine Water Association must approve the use of existing ditches. The Department (a stockholder) shall not unreasonably refuse such approval, or unreasonably refuse the right to use or modify existing ditches on Los Angeles-owned property. Water rights of all stockholders must be protected and current water delivery rates maintained.

Provisions will be made to insure that the project funds will only be made available to an appropriate entity or organization and only will be made available as construction of the Big Pine ditch system or other approved projects progresses. Any costs of constructing the ditch system in excess of one hundred thousand dollars ($100,000.00), must be secured prior to commencement of funding of the construction of the ditch system. Project funds would only be made available if substantial construction of the ditch system is commenced within two (2) years of the entry of this Stipulation and Order. If such construction is not commenced within this

two year period, unless otherwise agreed by the Inyo County Board of Supervisors and the Department, through the Standing Committee, the funds shall be used for a project other than a ditch system. If less than $100,000 is expended on the ditch system, or if no ditch system is constructed, the unexpended difference may be used by the Big Pine entity or organization on other projects in Big Pine that have been approved in advance by the Department and the Inyo County Board of Supervisors, acting through the Standing Committee.

F. PARK AND ENVIRONMENTAL ASSISTANCE TO CITY OF BISHOP

To financially assist the City of Bishop in the operation and maintenance of its park and other environmentally related activities, the Department shall make an annual payment to the City of Bishop. The first annual payment shall be made within sixty (60) days of entry of this Stipulation and Order. If entry of this Stipulation and Order occurs in the month of July, the payment will be one hundred twenty-five thousand dollars ($125,000.00). If entry of this Stipulation and Order occurs between August 1st and June 30th, the payment shall be the sum of one hundred twenty-five thousand dollars ($125,000.00) prorated as set forth in paragraph B above. Thereafter, the annual payment shall be made by July 10th of each year, and the amount of each payment shall be the previous year's payment adjusted upward or downward each year in accordance with the Los Angeles - Anaheim - Riverside All Urban Consumers Price Index or its successor. The maximum adjustment will not exceed five (5) percent in any year. Except as

provided below, Inyo County shall make an annual payment to the City of Bishop in an amount equal to the payment made by the Department during that year; provided however, in any given year this obligation of the County shall be completely satisfied by its payment to the City of Bishop pursuant to Inyo County Code Section 3.40.010 et seq. (transaction and use tax) regardless of the amount of such payment.

XV. RELEASE OF CITY OWNED LANDS

A. INYO COUNTY

Inyo County, in order to provide for the future orderly development of towns within the County, has requested Los Angeles to offer for sale seventy-five (75) acres of Los Angeles-owned land within the general areas designated by the boundaries noted on the maps attached as Exhibit B. In order to cooperate with the County's request, Los Angeles agrees to offer for sale, either at public auction or to the County for public purposes, said seventy-five (75) acres, consistent with the requirements of the Los Angeles City Charter for the sale of real property. To ensure that any sales of the seventy-five (75) acres furthers the County efforts for the orderly development of the towns within Inyo County, the parties further agree to jointly confer on the location of, and the schedule for, the sale of each parcel pursuant to this paragraph. As part of such orderly development, the parties further agree that prior to the sale of any such parcels, there must be available a public water system to serve such property after its sale.

Because the location of the proposed sale of

the seventy-five (75) acres is sufficiently determined in this Stipulation and Order, by its approval of this document, Los Angeles City Council grants approval, as required by the Los Angeles City Charter, for the Board of Water and Power Commissioners to subsequently engage in the actual sale of individual parcels. The terms of each sale will be subject to approval by the Los Angeles City Council.

The area of any property that is undeveloped as of the date of entry of this Stipulation and Order, located within the designated release areas, and sold by Los Angeles after entry of this Stipulation and Order will be credited against the seventy-five (75) acre total. Each such sale is subject to a CEQA review.

B. CITY OF BISHOP

In addition to the sales described above, Los Angeles will sell at public auction, or sell directly to the City of Bishop or the Bishop Community Redevelopment Agency, properties within the Bishop City limits totaling twenty-six (26) acres of surplus Los Angeles-owned land. Such sales are subject to the Los Angeles City Charter. The location of each property and the schedule for sale must be agreed upon by the City of Bishop and Los Angeles. Each parcel sold must be located within general areas designated by boundaries on the attached map. Authorization to sell up to twenty-six (26) acres of surplus properties within designated release areas is granted by the Los Angeles City Council by its approval of this Stipulation and Order. By this approval, the Department's Board of Water and Power Commissioners is

authorized to act on behalf of the City in approving and conducting such sales. However, the terms of each sale will be subject to approval by the Los Angeles City Council. Each sale is subject to a CEQA review. Nothing in these concepts precludes the City of Los Angeles and the City of Bishop from reaching an agreement for the sale of all or part of the twenty-six (26) acres prior to entry of this Stipulation and Order. Any land so sold will be credited against the twenty-six (26) acre total.

C. ADDITIONAL SALES

In addition to the above described sales, upon request of the Inyo County Board of Supervisors or the Bishop City Council, Los Angeles shall negotiate in good faith for the sale at public auction of additional surplus Los Angeles-owned land in or near valley towns for specific identified needs. Any such sales shall occur subsequent to those described above. A precondition of a sale would be that a public water system must be available to serve each property after its sale. Each such sale would be subject to a CEQA review. It is recognized that such sales at public auction may take considerable time, and that such sales require approval of the Department's Board and the Los Angeles City Council, and must be in compliance with the Los Angeles City Charter. Decisions on this matter by the Department's Board of Commissioners and the Los Angeles City Council shall not be subject to dispute resolution.

D. LANDS FOR PUBLIC PURPOSES

Los Angeles shall negotiate in good faith for the sale or lease to the County of any Los Angeles-owned

land requested by the County for use as a public park or for other public purposes. Any sale of land shall be at fair market value and any land sold must be within or adjacent to valley towns.

E. WITHDRAWN LANDS

Because of the above provisions for land releases, Inyo County will support passage of withdrawn land legislation pertaining to federally owned lands in Inyo County. Such legislation is to be in substantially the same form as the draft of such legislation discussed by the parties in the fall of 1987, except that the proposed legislation will be modified to allow lands in Rose Valley which might be used in conjunction with a groundwater storage program to remain in withdrawn status. The County will support such legislation even though the status of such withdrawn lands is under review by the Federal Bureau of Land Management as part of the new Bishop Resources Area Management Plan.

XVI. LEGISLATIVE COORDINATION

Except as provided below, the County and Los Angeles shall refrain from seeking or supporting any legislation, administrative regulation, or litigation that would weaken or strengthen local or state authority to regulate groundwater or that would affect any provision of this Stipulation and Order.

A. Neither the County nor Los Angeles may sponsor, take a support position, or seek to amend any legislation or administrative regulation or initiate any litigation that would directly affect any provision of this Stipulation and Order or that would weaken or strengthen local

authority to regulate groundwater unless such sponsorship, support, amended position or litigation is first approved by the other party.

B. Neither the County nor Los Angeles may take a position in opposition to any legislation or administrative regulation that could directly affect any provision of this Stipulation and Order or that would weaken or strengthen local authority to regulate groundwater without first notifying the other party and attempting to reach concurrence on the proposed course of action. Failure to reach agreement on the proposed course of action will not preclude either party from opposing such legislation.

XVII. EXCHANGE OF INFORMATION AND ACCESS

The County and the Department shall make any data or information in its possession that reasonably pertains to purposes of this Stipulation and Order available to the other party on reasonable notice. The County and the Department recognize that such a free exchange of data and information is essential to the purposes of this Stipulation and Order.

The County and the Department shall provide to the other party reasonable access to its wells, water conveyance, metering devices, control structures, etc. for the purpose of such independent monitoring and inspection as is necessary to carry out the implementation of this Stipulation and Order.

XVIII. HEALTH AND SAFETY CODE PROJECTS

Any project implemented pursuant to California Health and Safety Code section 42316 is not a part of this Stipulation and Order.

XIX. LEASE CHARGES

Los Angeles or its Department shall have the right

to seek and use funding from a lessee if a new enhancement/mitigation project is developed on lands leased by the lessee from Los Angeles and the project will increase the value of the lease. Such funding may be obtained through normal Department ranch leasing practices.

Except as provided above, lease charges and/or charges for water supplied by Los Angeles and its Department to its Owens Valley lessees may not be increased or decreased, or altered in any way, as a result of any provision of this Stipulation and Order. This provision is not to be construed as preventing rent increases which the City may determine to implement in the ordinary course of business following its usually applicable practices and principles in the determination of the need for rent increases, capitalization of improvements, or land reclassification.

XX. HOLD HARMLESS

The County and the Department and the City of Los Angeles shall keep and hold each other free and harmless from any and all cost, liability, damage, or expense including cost of suit or expense for legal service claimed by anyone by reason of injury or damage to person or properties sustained in or on or about any enhancement/mitigation project, mitigation measure, or monitoring site as proximate result of acts or omissions of a party, its agents, servants or employees, or arising out of any condition of the property occupied by an enhancement/mitigation project, mitigation measure or monitoring site or arising out of the operation of the parties upon, about or above the property occupied by an enhancement/mitigation project, mitigation measure or monitoring site.

Except as may be provided above, this provision does

not, and shall not be construed to require the County of Inyo, its employees, agents, or consultants to keep and hold harmless the City of Los Angeles, its Department, or any of their employees, agents, or consultants, from any cost, liability or damage, or other relief claimed or sought by anyone, or any organization or entity, that arises out of the Department's water gathering activities in Owens Valley, including its groundwater pumping and its surface water management, or that arises out of the management of its lands by the City of Los Angeles.

XXI. NO EFFECT ON NON-PARTY LEGAL RIGHTS

This Stipulation and Order is not a limitation of the legal rights of any person, organization, or entity that is not a party to this Stipulation and Order, nor does it create a binding administrative remedy that must be pursued and exhausted prior to the exercise of any legal right by such non-parties to this Stipulation and Order.

XXII. NO EFFECT ON EXISTING WATER RIGHTS

Any water right of either the County or of Los Angeles or of any other person existing prior to the entry of this Stipulation and Order will not be adversely affected, directly or indirectly, by this Stipulation and Order. No water right of any kind, including but not limited to prescriptive water rights, nor any claim thereto, shall arise or be created in favor of or against any party or other person, directly or indirectly, as a result of this Stipulation and Order.

XXIII. FUTURE AQUEDUCT CAPACITY

Los Angeles and its Department shall not construct a third aqueduct to carry water from Inyo County or enlarge

the capacity of the two existing aqueducts above the maximum flow in each aqueduct that occurred before July 1, 1989. The maximum flow for each aqueduct is set forth in the Department's Daily Flow Records.

XXIV. ACKNOWLEDGMENT OF WATER SUPPLY UNCERTAINTIES

Los Angeles and the County acknowledge that there are certain risks in maintaining current and projected water supplies to Los Angeles. These foreseeable risks are a possible reduction in diversions by Los Angeles from the Mono Basin, contamination of the San Fernando Valley Groundwater Basin, uncertainty in the amount of water exports from the Sacramento/San Joaquin Delta, a reduction in now available Colorado River supplies to Southern California and reasonably foreseeable population growth in Los Angeles and California. Such foreseeable risks shall not be a basis for a future request to a court to terminate this Stipulation and Order absent agreement by the Inyo County Board of Supervisors, the Department, and the City of Los Angeles.

XXV. MODIFICATIONS

If, as a result of information gained from ongoing research or cooperative studies, or for other reasons as may be necessary to better achieve the goals of this Stipulation and Order, or for purposes of improving the monitoring and evaluation activities, the Department and the Inyo County Board of Supervisors, by agreement, may modify: 1) any provision of the Green Book, including its provisions for monitoring sites, the type of monitoring, and the interpretation of monitoring results; 2) the Management Areas (section I); 3) the Management Maps (section II); and 4) the soil moisture "triggering mechanism" for turning off wells (sections V.A, B,

and C), including a substitution of an entirely new "triggering mechanism." A disagreement over such a modification shall be subject to dispute resolution. The remaining provisions of this Stipulation and Order, other than those identified above, may be modified by agreement between the Department and the Inyo County Board of Supervisors, and approval of such modification by the Court. Approval by the Court shall be upon written noticed motion. Notice shall be given in accordance with California Civil Procedure Section 1005, and published in Los Angeles and Inyo counties in accordance with Government Code Section 6062a.

XXVI. DISPUTE RESOLUTION

A. SUBJECT MATTER

Subjects of dispute resolution include, but are not limited to:

1. Whether a decrease or change in vegetation or a potential significant effect on the environment is attributable to groundwater pumping or a change in surface water management practices.
2. Whether a significant decrease or change in vegetation or a significant effect on the environment has occurred.
3. A reclassification of vegetation inside or outside a management area.
4. The location of monitoring sites or monitoring wells, the type of monitoring to be conducted at a site, or the interpretation of monitoring results.
5. A change in the contents of the "Green Book."
6. The need for mitigation or type of mitigation.

7. The linkage of wells to monitoring sites and the area of the monitoring site where soil water must recover.

8. A disagreement over whether or not the "triggering mechanism" based on soil moisture should be modified or changed to a different triggering concept.

9. Whether a well turned off under the provisions of section V should be turned on.

10. Consistency of a proposed pumping program with the goals and principals of this Stipulation and Order.

11. Disagreements over additional cooperative studies.

12. Whether water quality or water levels in a well not owned by the Department has been significantly adversely affected by groundwater pumping by the Department.

13. Any other matter covered by or arising out of the Stipulation and Order or the Green Book.

B. TECHNICAL GROUP AND STANDING COMMITTEE

Disputes between the parties arising out of this Stipulation and Order or the Green Book shall be submitted to the Technical Group and the Standing Committee for resolution as follows:

1. Technical Group Requirements

Within fourteen (14) calendar days of the receipt of a written request from either party, the Technical Group shall convene for the purpose of attempting to resolve a disagreement over a matter which is to be decided by the Technical Group, or upon which the Technical Group is required to make a

recommendation to the Standing Committee. If the Technical Group agrees on a resolution, that agreement shall be submitted to the Standing Committee for consideration and implementation if concurred with by the Standing Committee. In the event that the Technical Group is unable to resolve a matter, or is unable to make a unanimous recommendation to the Standing Committee, the Technical Group shall make a written report to the Standing Committee explaining the areas of agreement, if any, the subject or subjects of disagreement, and each party's argument in favor of its position along with supporting data and background. This report shall be made within seven (7) calendar days after the Technical Group meeting, unless the Technical Group by unanimous vote, agrees to a longer time period.

2. Standing Committee Requirements

Within fourteen (14) calendar days of the receipt of such a written report of disagreement from the Technical Group, the Standing Committee shall convene concerning the subject of the report. Additionally, within fourteen (14) days of receipt of a written request from either party, the Standing Committee shall convene for the purpose of hearing any matter which is to be determined by the Standing Committee, or a disagreement between the parties.

C. MEDIATION/TEMPORARY ARBITRATION

If the Standing Committee is unable to resolve a dispute or claim within twenty-one (21) days of the receipt of a Technical Group report or a written request

to meet, either party may submit the disputes or claims for mediation/temporary arbitration. Such a submittal shall be made by so notifying the Standing Committee in writing.

Mediation/temporary arbitration shall be conducted by three (3) mediators unless a single mediator is agreed upon by the Standing Committee. One (1) mediator shall be selected by Inyo County and one (1) mediator shall be selected by the Department. The two (2) mediators selected by the parties shall select a third mediator.

In the event of mediation, each party will pay their own costs and one-half of the costs of the mediation. If, by the forty-fifth (45th) day after a party has invoked mediation, there is no mediated resolution, the mediators shall present written findings to the Standing Committee. These findings shall be submitted to the Standing Committee not later than the sixtieth (60th) day after mediation was invoked by a party. Unless otherwise agreed by the Standing Committee, the County and the Department shall immediately implement and follow the findings of the mediators. Any recommendation or finding of the mediators must be based upon the "goals" and "principles" and other provisions of this Stipulation and Order, the Green Book, or the EIR.

D. SUPERIOR COURT JUDGE

If a dispute or claim has not been resolved through mediation/temporary arbitration, a party may submit that dispute or claim for resolution to the Superior Court Judge then assigned to Inyo County Superior

Court Case No. 12908, by filing with the Judge, and serving upon the other party, a memorandum which sets forth the disagreement, the party's contentions, its argument in favor of its position, and any supporting evidence and points and authorities. The memorandum shall be filed and served within fifteen (15) calendar days after the issuance of written findings by the mediators unless both parties agree in writing to a longer time period. The other party may file a responsive memorandum that sets forth its view of the disagreement, its contentions, its arguments in favor of its position, and any supporting evidence and points and authorities. Such a memorandum shall be filed and served upon the other party within fifteen (15) days of the service of the initiating papers.

Not later than fifteen (15) calendar days after service of any responsive memorandum, or of the date for serving such a memorandum if none is filed, the parties shall file with the Judge a joint memorandum setting forth all the relevant factual and legal issues upon which they agree, and all the factual and legal issues to be resolved, together with any additional supporting or rebutting evidence and any additional points and authorities. The Judge will set the matter for hearing, ordinarily within fifteen (15) calendar days after the date of filing the joint memorandum. The Judge shall endeavor to issue a decision on the unresolved factual and legal issues as soon as possible, ordinarily within twenty (20) days after the hearing.

Failure of a party to file the initiating

memorandum with the Court within fifteen (15) calendar days, precludes a submission of the particular dispute or claim to the Judge.

In the event that the present Superior Court Judge presiding over Inyo County Superior Court Case No. 12908 ceases to act, the Chair of the Judicial Counsel shall be requested to assign a successor judge from a neutral County. The parties shall have the right of challenge pursuant to the California Code of Civil Procedure. The parties will at the time of the request attempt to nominate to the Chair of the Judicial Council a neutral judge or judges to serve as the successor judge.

E. EFFECT OF COURT RESOLUTION

The decision of the Judge shall be binding on the parties. No appeal of the Judge's decision may be made, except as provided in California Code of Civil Procedure, section 1284, and sections 1285 through 1294.2, provided that the time limit to serve and file a petition to confirm pursuant to section 1288 shall be reduced to one hundred eighty (180) days.

XXVII. INYO SUPERIOR COURT CASE NO. 12883

Nothing in this Stipulation and Order shall affect Inyo County Superior Court Case No. 12883 (the EIR case brought by Los Angeles concerning Inyo County's Groundwater Ordinance).

XXVIII. INYO SUPERIOR COURT CASE NO. 12908

A final order in Inyo County Superior Court Case No. 12908 on this Court's ruling on Inyo County's Groundwater Ordinance shall not be entered or filed. Additionally, during

the term of this Stipulation and Order, the County, its agents, servants, officers and employees, and all other persons acting in concert with the County, are enjoined from applying, implementing, or enforcing in any manner whatsoever, the County of Inyo Owens Valley Groundwater Management Ordinance, enrolled as Chapter 7.01 of the Inyo County Code, and Inyo County Ordinance No. 395; provided however, that the Inyo County Water Department and Inyo County Water Commission may remain in existence to carry out the provisions of this Stipulation and Order. Further, during the term of this Stipulation and Order, the County will not seek any appellate review of the ruling, decision, or injunction of this Court in Inyo County Superior Court Case Number 12908.

XXIX. ENTRY OF JUDGMENT

Judgment implementing this Stipulation may be entered in accordance herewith without further notice to the parties.

XXX. PARAGRAPH HEADINGS

The paragraph titles herein are for convenience only and do not define, limit, or construe the contents of such paragraphs.

XXXI. NOTICES

Any notices hereunder from the County to the City and its Department shall be in writing and may be personally delivered or sent by certified mail to the following addresses:

Assistant General Manager - Water
Los Angeles Department of Water and Power
P.O. Box 111, Room 1455
Los Angeles, California 90051

Northern District Engineer
Los Angeles Department of Water and Power
300 Mandich Street
Bishop, California 93514

The City and its Department may change said address by notice in writing to the County.

Any notices hereunder from the City and its Department to the County shall be in writing and may be personally delivered or sent by certified mail to the following addresses:

County Administrator
County of Inyo
Post Office Drawer N
Independence, California 93526

Director
Inyo County Water Department
163 May Street
Bishop, California 93514

The County may change said address by notice in writing to the City and its Department. Notice shall be considered given either (a) when delivered to the recipient, or (b) on the date shown on the return receipt when deposited.

Dated: OCT 18 1991

PAUL N. BRUCE, County Counsel
GREGORY L. JAMES, Special Counsel
ANTONIO ROSSMANN, Special Counsel

By Paul N. Bruce
PAUL N. BRUCE

Gregory L. James
GREGORY L. JAMES

Antonio Rossmann
ANTONIO ROSSMANN

Attorneys for Defendants
County of Inyo

Robert H. Campbell
Chairman, Inyo County
Board of Supervisors

Keith Bright
Inyo County
Board of Supervisors

Dated: OCT 18 1991

JAMES K. HAHN, City Attorney
EDWARD C. FARRELL, Chief
Assistant City Attorney
EDWARD A. SCHLOTMAN
Assistant City Attorney

By
EDWARD A. SCHLOTMAN

Attorneys for Plaintiffs
City of Los Angeles and
Department of Water and
Power of the City of
Los Angeles

Tom Bradley
Tom Bradley, Mayor
City of Los Angeles

John Ferraro
John Ferraro
President, City Council
City of Los Angeles

Joan Milke Flores
Joan Milke Flores
Councilwoman
City of Los Angeles

Harry Holgate
Chairman, Inyo County
Water Commission

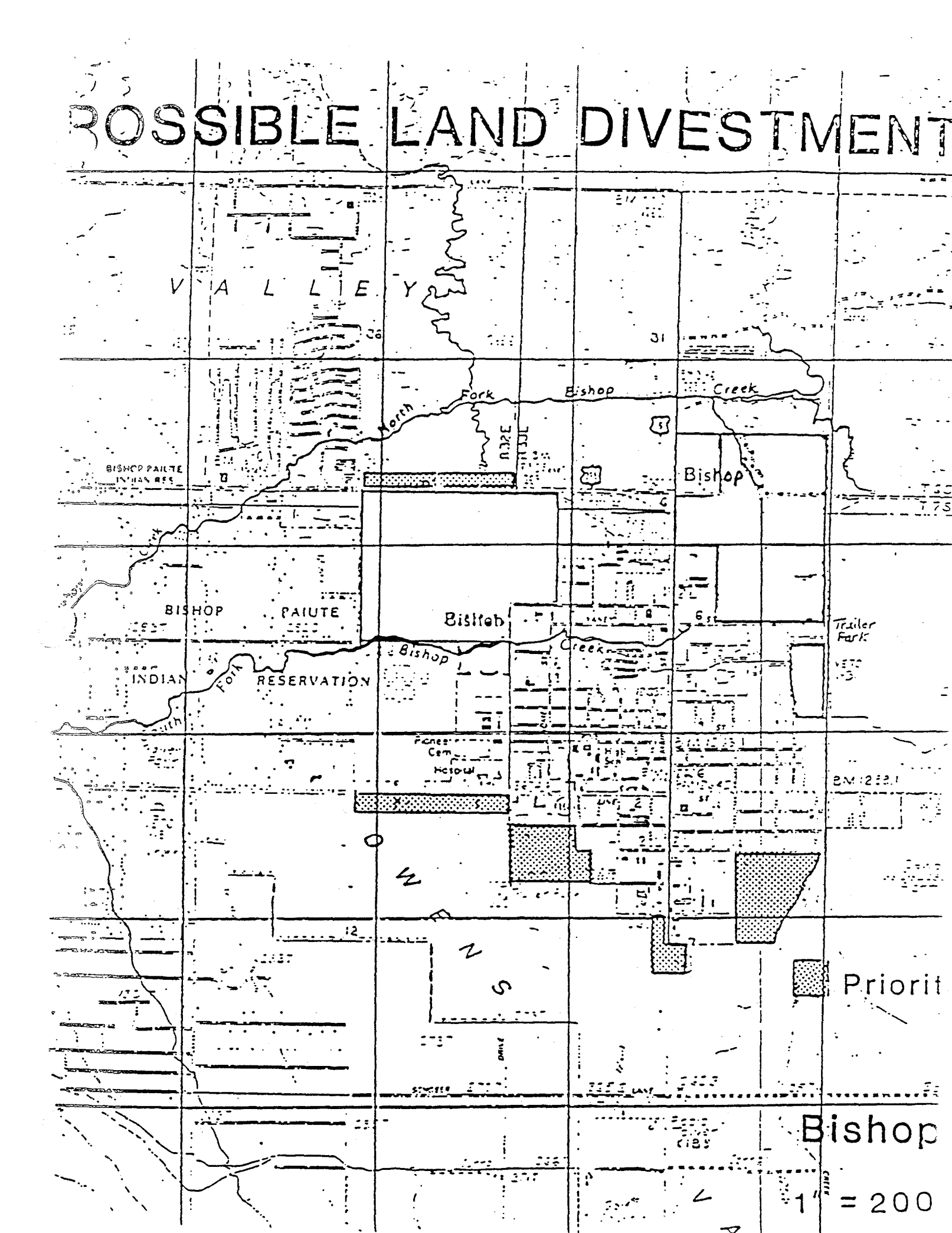
Michael Gage
President, Los Angeles
Board of Water & Power Cmsn.

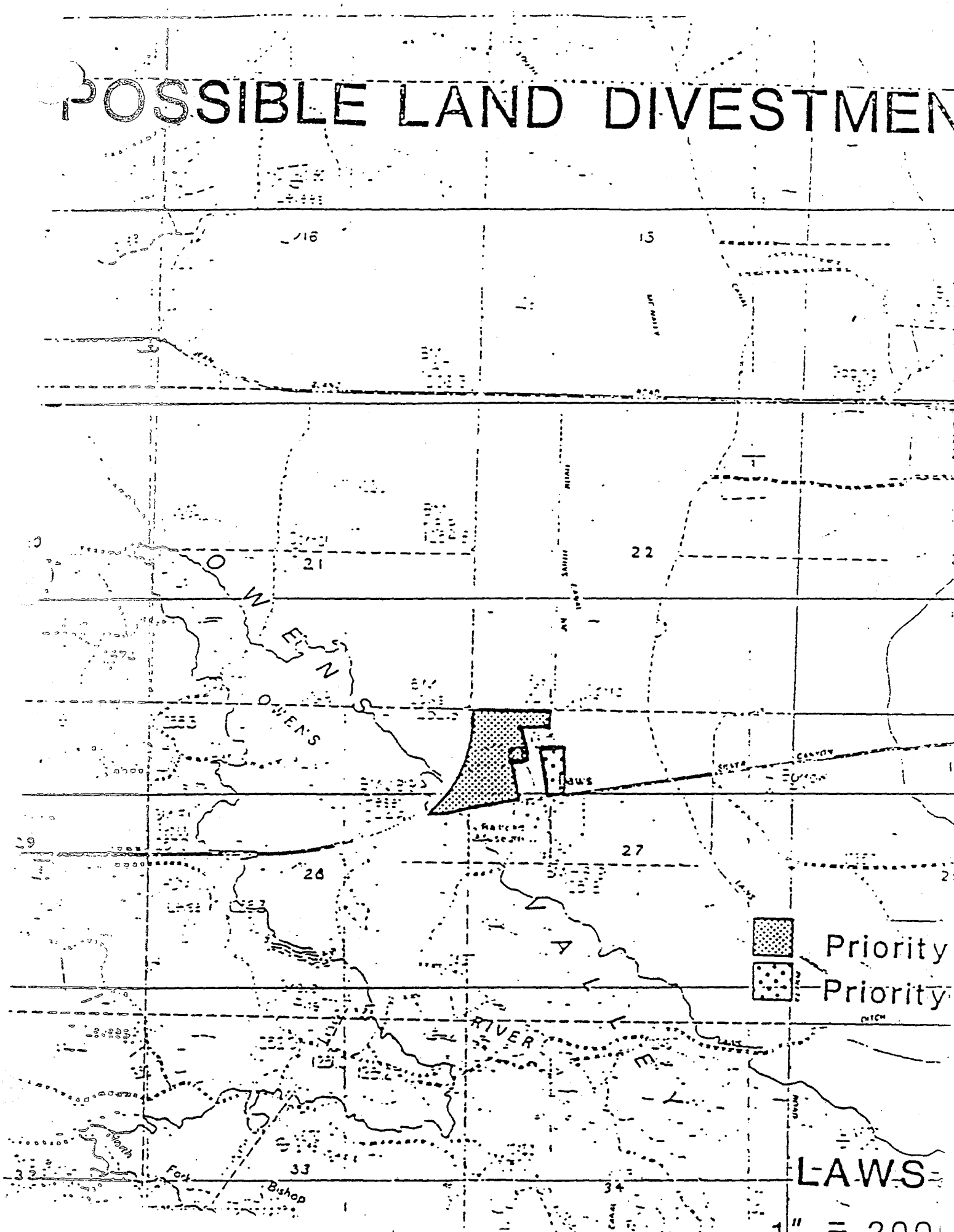
Ray Gray
Vice Chairman, Inyo County
Water Commission

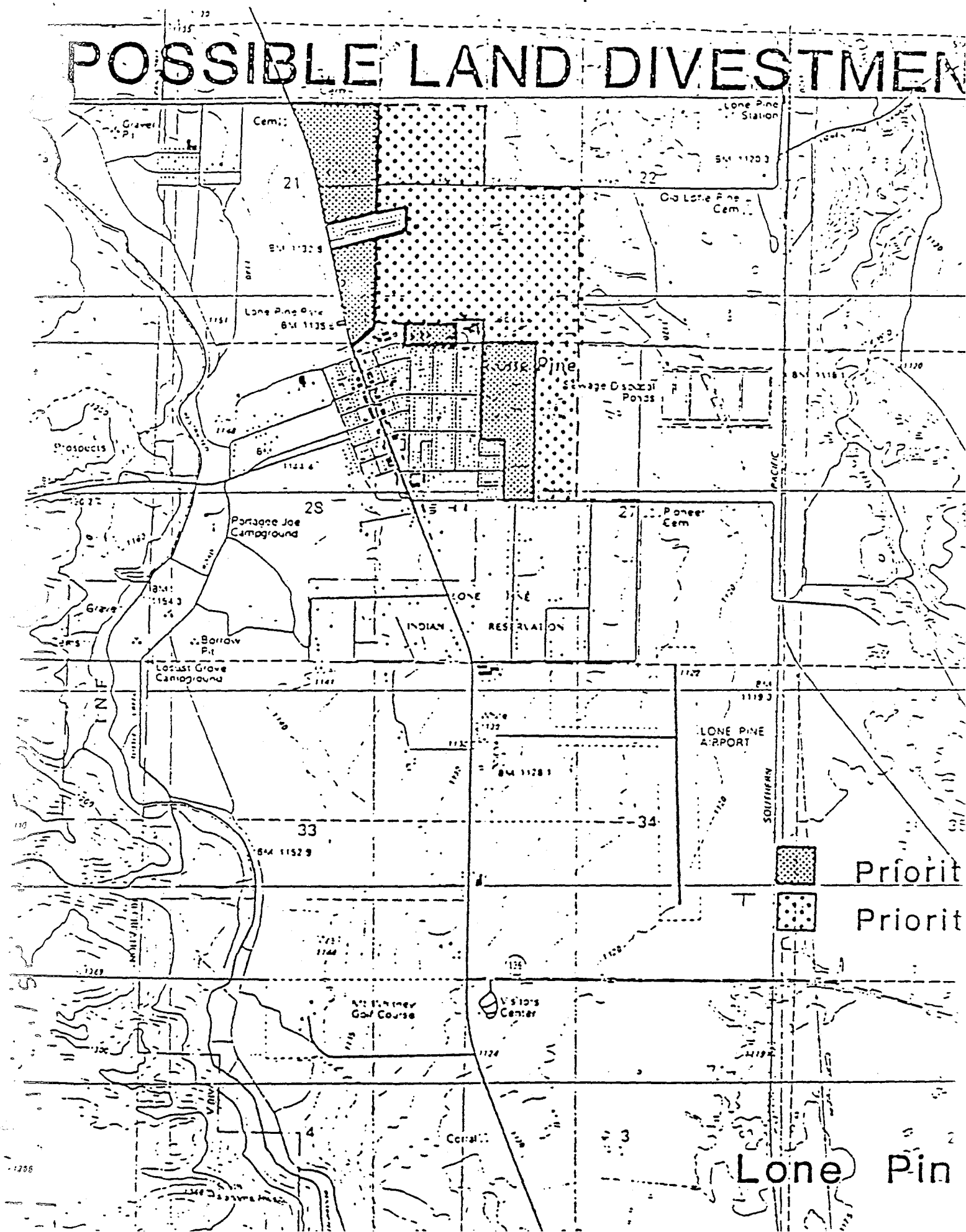
Rick Caruso
Chairman, Standing Committee
Vice President, Los Angeles
Board of Water & Power Cmsn.

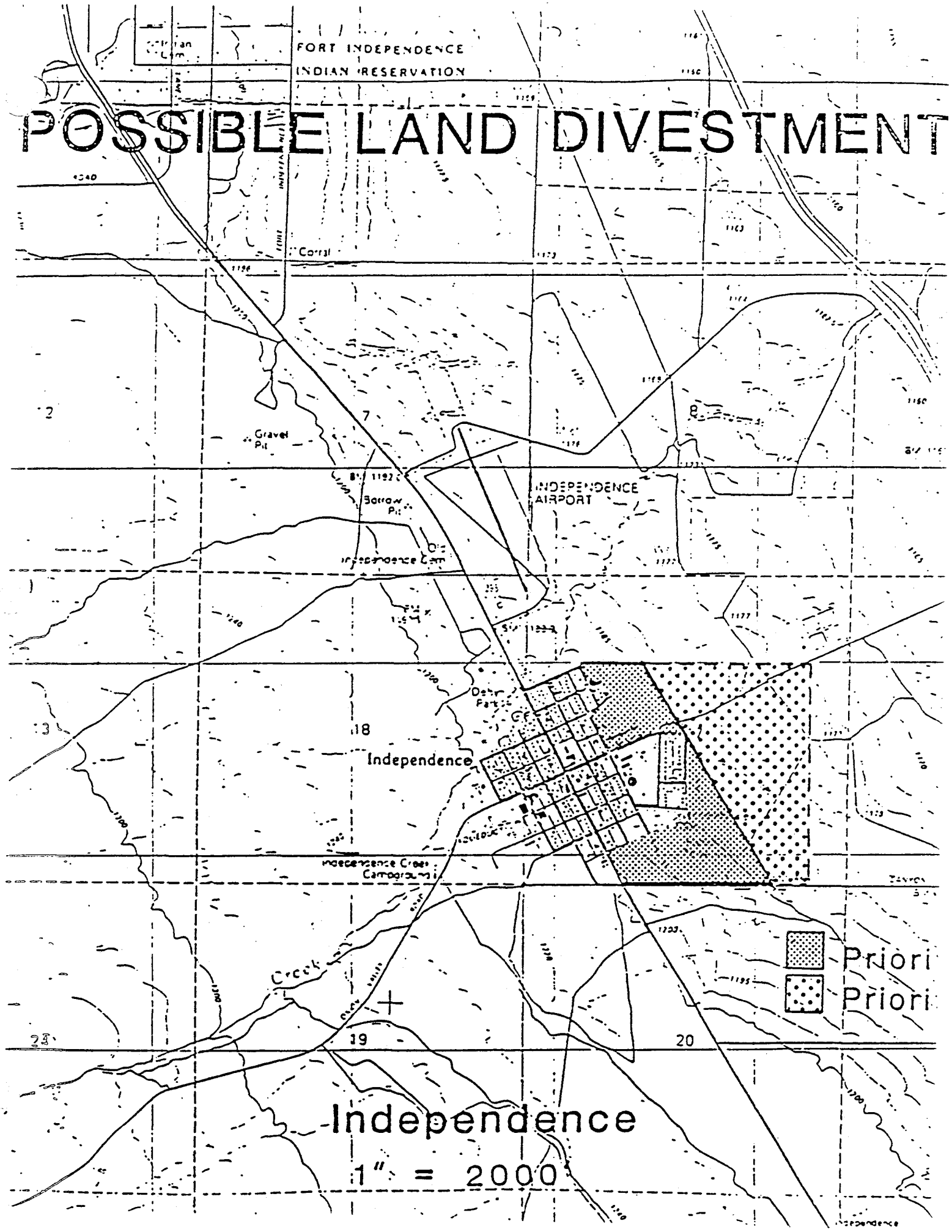
The within instrument approved by the Council of the City of Los Angeles at its meeting of
OCT 18 1991
ELIAS MARTINEZ, City Clerk
By Elaine Stone
Deputy

Said Agreement is No.
of Contracts: C-83803

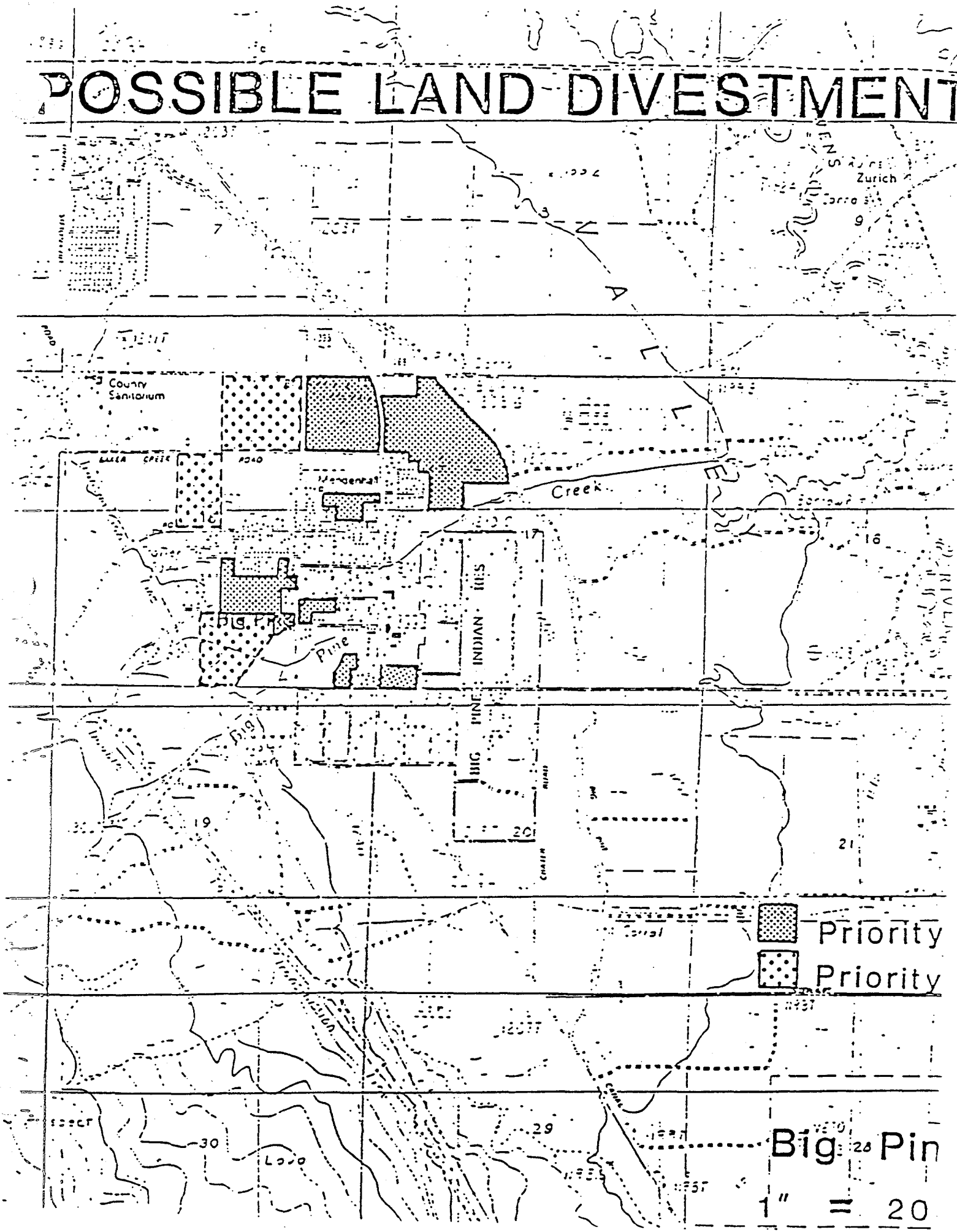

ROSSIBLE LAND DIVESTMENT
V A L L E Y
Bishop Creek
North Fork
Bishop
BISHOP PAIUTE INDIAN RES
BISHOP PAIUTE
INDIAN RESERVATION
Bishop
Creek
Trailer Park
Priorit
Bishop
1" = 200

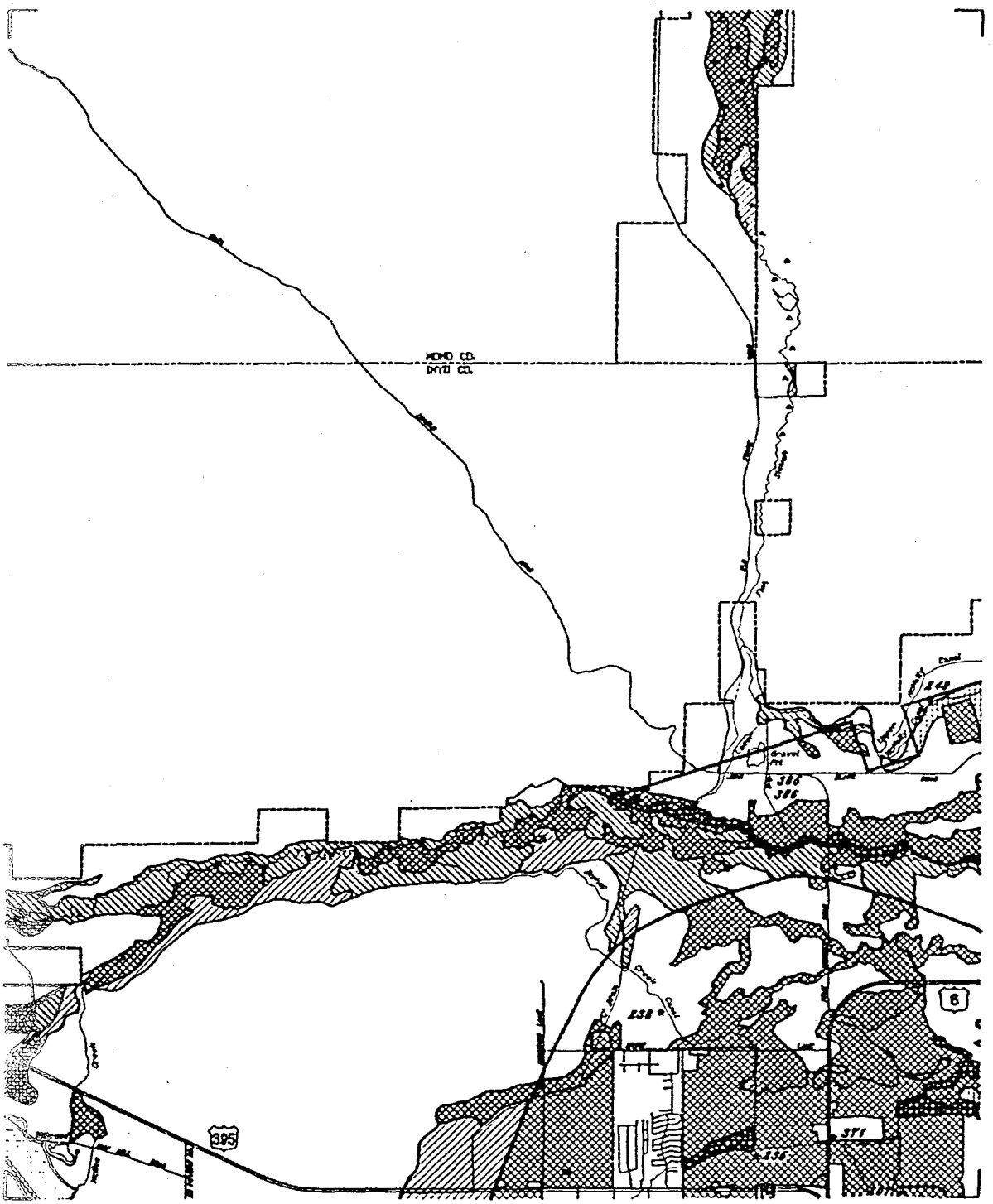

POSSIBLE LAND DIVESTMEN
16
15
21
22
OWENS
OWENS
LAWS
27
26
Priority
Priority
RIVER
33
34
Fork
Bishop
LAWS


POSSIBLE LAND DIVESTMEN
Lone Pine Station
Old Lone Pine Cem.
Lone Pine
Sewage Disposal Ponds
Prospects
Portagee Joe Campground
Pioneer Cem
INDIAN RESERVATION
Borrow Pit
Lastest Grove Campground
LONE PINE AIRPORT
Visitors Center
Priorit
Priorit
Lone Pin
21
22
27
33
34
3
4
2S


POSSIBLE LAND DIVESTMENT
FORT INDEPENDENCE
INDIAN RESERVATION
Corral
Gravel Pit
Borrow Pit
INDEPENDENCE AIRPORT
Independence Cem
Dump
Independence
Independence Creek Campground
Creek
Priori
Priori
2
7
8
18
19
20
21
Independence
1" = 2000

POSSIBLE LAND DIVESTMENT





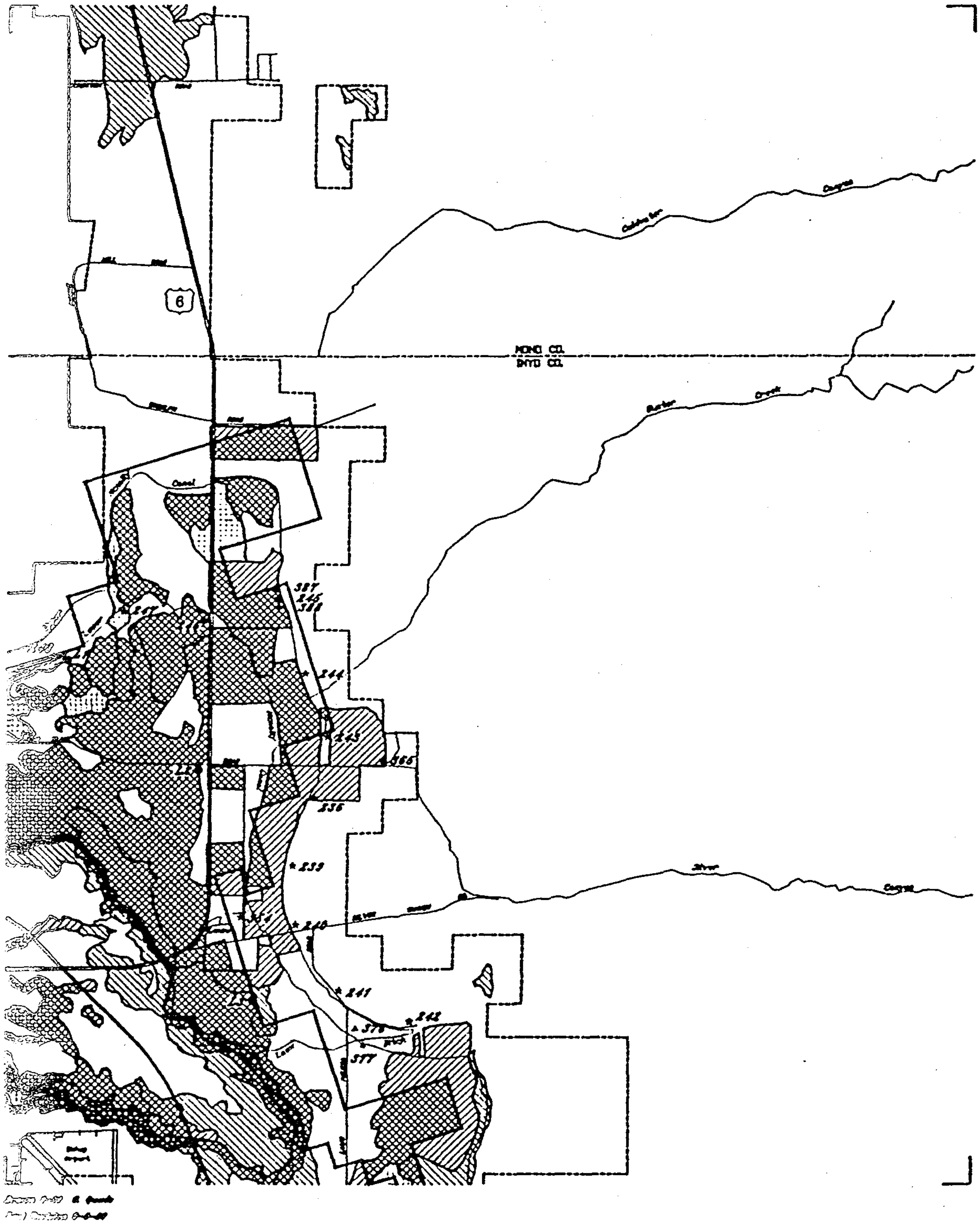
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	2000 Ac.	7457 Ac.	9457
TYPE B CLASSIFICATION	65 Ac.	128 Ac.	193
TYPE C CLASSIFICATION	1257 Ac.	1082 Ac.	2339
TYPE D CLASSIFICATION	130 Ac.	831 Ac.	1961
TYPE E CLASSIFICATION	1343 Ac.	600 Ac.	1943
TOTALS	4836 Ac.	9738 Ac.	14573

★ PUMPING WELL
▲ RAW PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE BARRY
—— LADWP PROPERTY LINE

FISH SLOUGH, CALIF.
(413-82)

VEGETATION AND WELLFIELD MANAGEMENT AREA



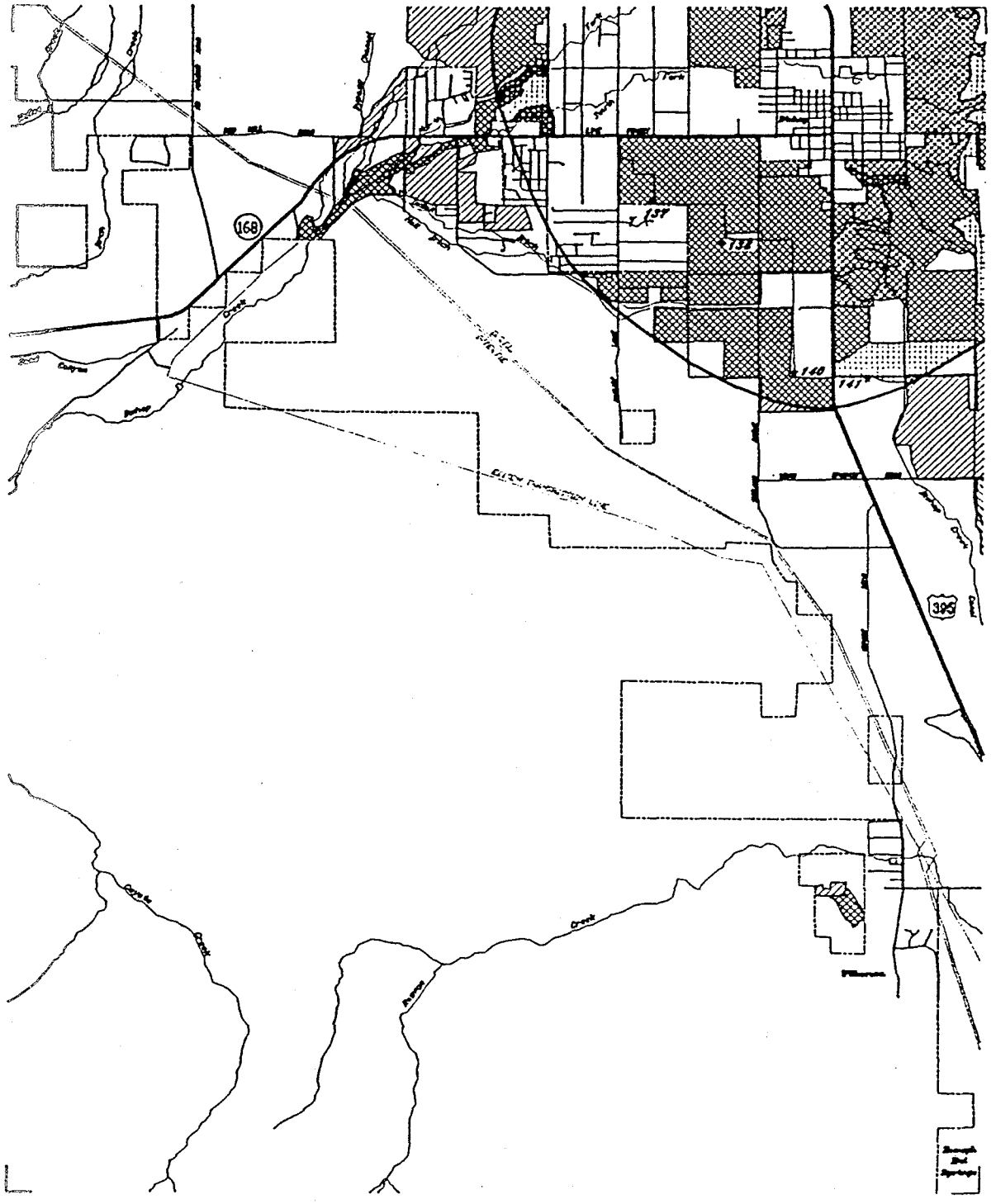
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET		WATER TABLE CHANGE LESS THAN 10 FEET		TOTAL ACREAGE
TYPE A CLASSIFICATION	▭	2289 Ac.	▭	5374 Ac.	7663
TYPE B CLASSIFICATION	▭	132 Ac.	▭	111 Ac.	243
TYPE C CLASSIFICATION	▦	1406 Ac.	▨	1062 Ac.	2468
TYPE D CLASSIFICATION	▦	296 Ac.	▦	98 Ac.	394
TYPE E CLASSIFICATION	▦	1398 Ac.	▨	782 Ac.	2180
TOTALS		5521 Ac.		7427 Ac.	12948

★ PUMPING WELL
▲ RAW PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE BNDRY.
—— LADWP PROPERTY LINE

LAWS, CALIF.
(413-1E)

VEGETATION AND WELLFIELD MANAGEMENT AREA



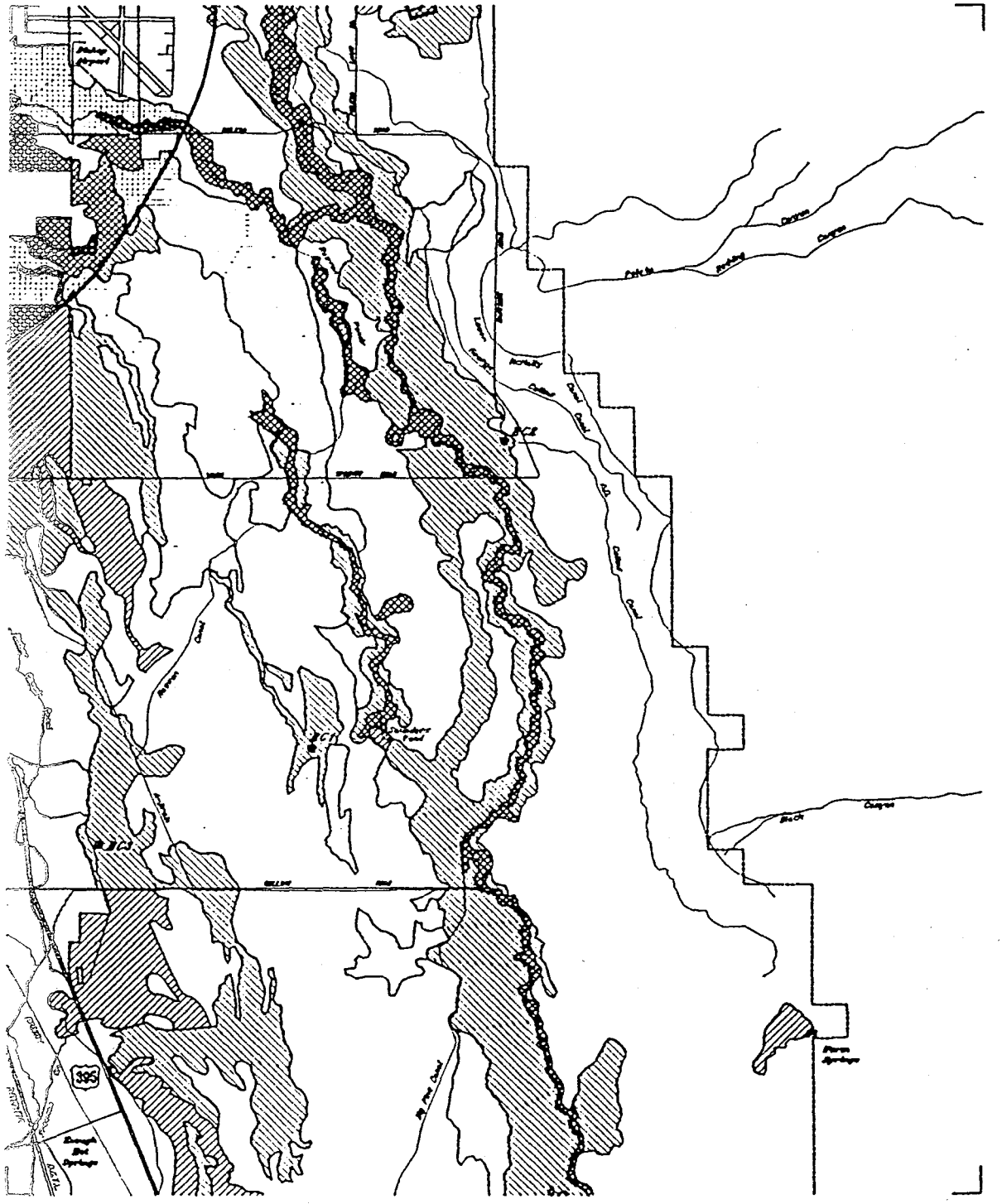
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET		WATER TABLE CHANGE LESS THAN 10 FEET		TOTAL ACREAGE
TYPE A CLASSIFICATION	2454 Ac.		8149 Ac.		10603
TYPE B CLASSIFICATION	252 Ac.		67 Ac.		319
TYPE C CLASSIFICATION	611 Ac.		12 Ac.		623
TYPE D CLASSIFICATION	63 Ac.		153 Ac.		216
TYPE E CLASSIFICATION	1860 Ac.		704 Ac.		2564
TOTALS	5340 Ac.		9085 Ac.		14425

★ PUMPING WELL
▲ R&M PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE ENDBY.
----- LADWP PROPERTY LINE

BISHOP, CALIF.
(413-3E)

VEGETATION AND WELLFIELD MANAGEMENT AREA



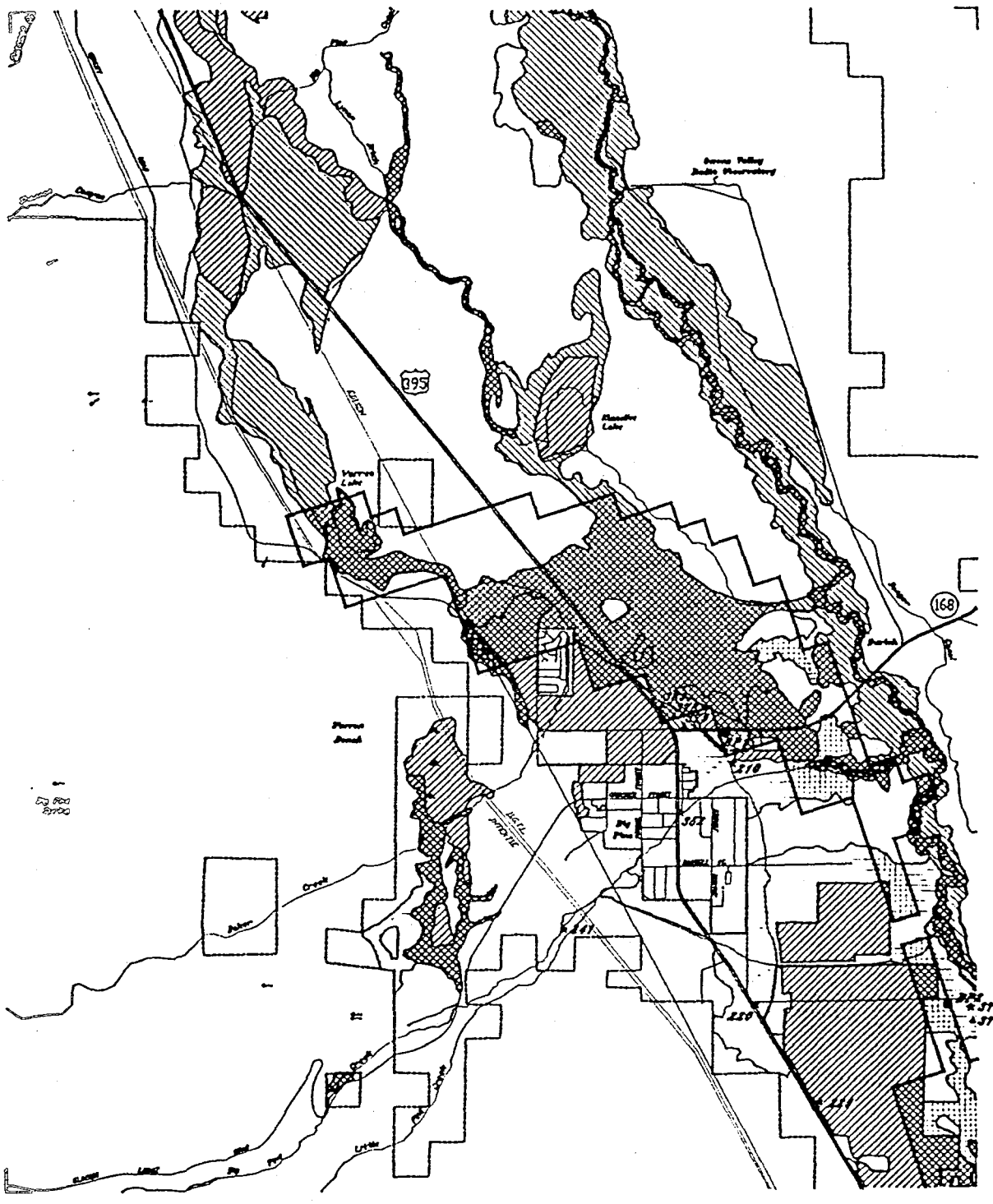
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	720 Ac.	14482 Ac.	16202
TYPE B CLASSIFICATION	414 Ac.	2492 Ac.	2906
TYPE C CLASSIFICATION	160 Ac.	6038 Ac.	6198
TYPE D CLASSIFICATION	36 Ac.	764 Ac.	798
TYPE E CLASSIFICATION	174 Ac.	1133 Ac.	1307
TOTALS	1611 Ac.	23809 Ac.	26410

- ★ PUMPING WELL
- ▲ R&M PUMPING WELL
- ● VEGETATION MONITOR SITE
- —— WATER TABLE CHANGE BNDRY.
- —— LLBVP PROPERTY LINE

POLETA CANYON, CALIF.
(413-4E)

VEGETATION AND WELLFIELD MANAGEMENT AREA



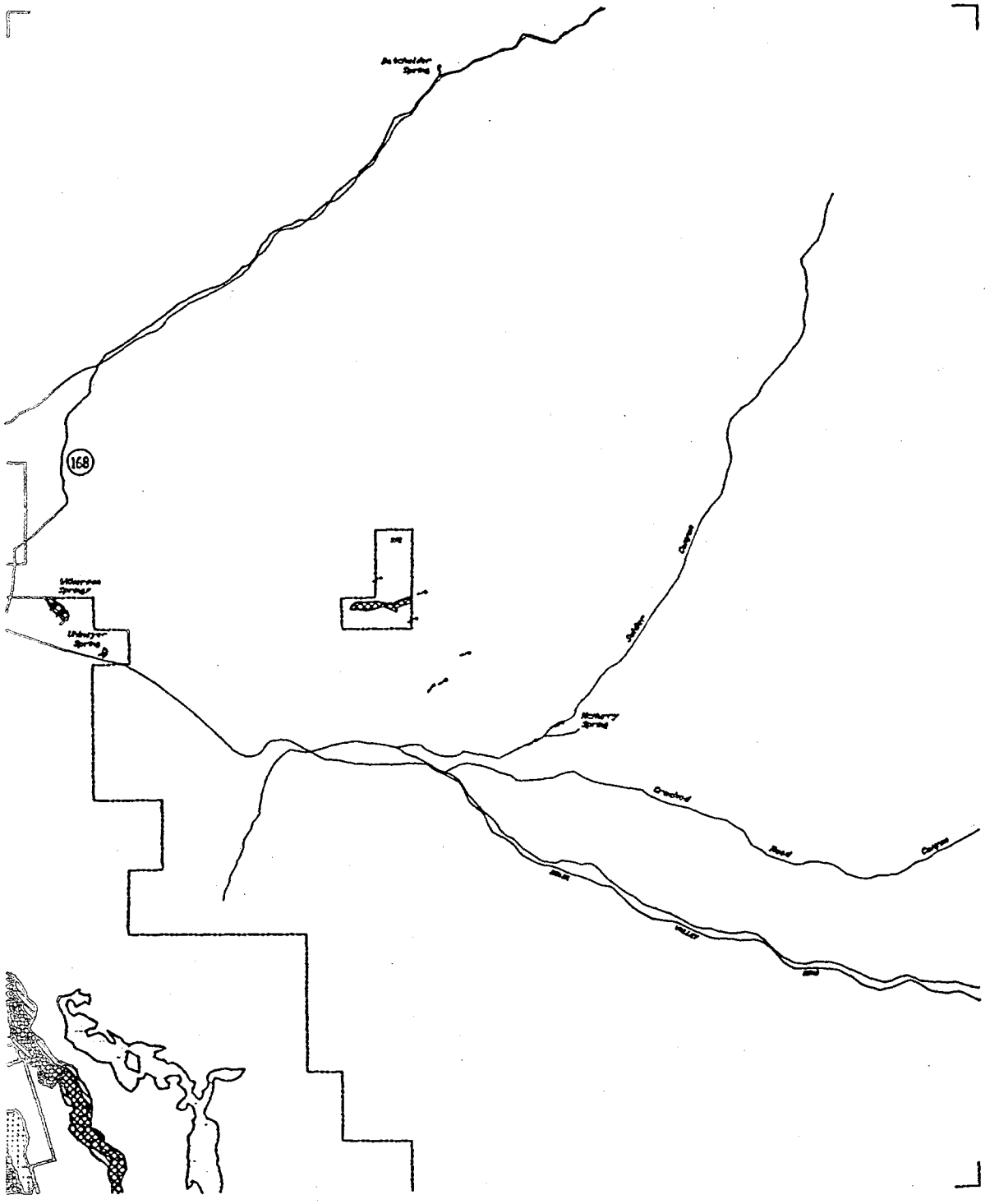
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	1259 Ac.	13683 Ac.	14942
TYPE B CLASSIFICATION	164 Ac.	1351 Ac.	1515
TYPE C CLASSIFICATION	1088 Ac.	3138 Ac.	4226
TYPE D CLASSIFICATION	64 Ac.	695 Ac.	759
TYPE E CLASSIFICATION	616 Ac.	5145 Ac.	5761
TOTALS	3172 Ac.	20922 Ac.	24094

★ PUMPING WELL
▲ R&M PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE BNDRY.
—— LADWP PROPERTY LINE

BIG PINE, CALIF.
(395-1E)

VEGETATION AND WELLFIELD MANAGEMENT AREA



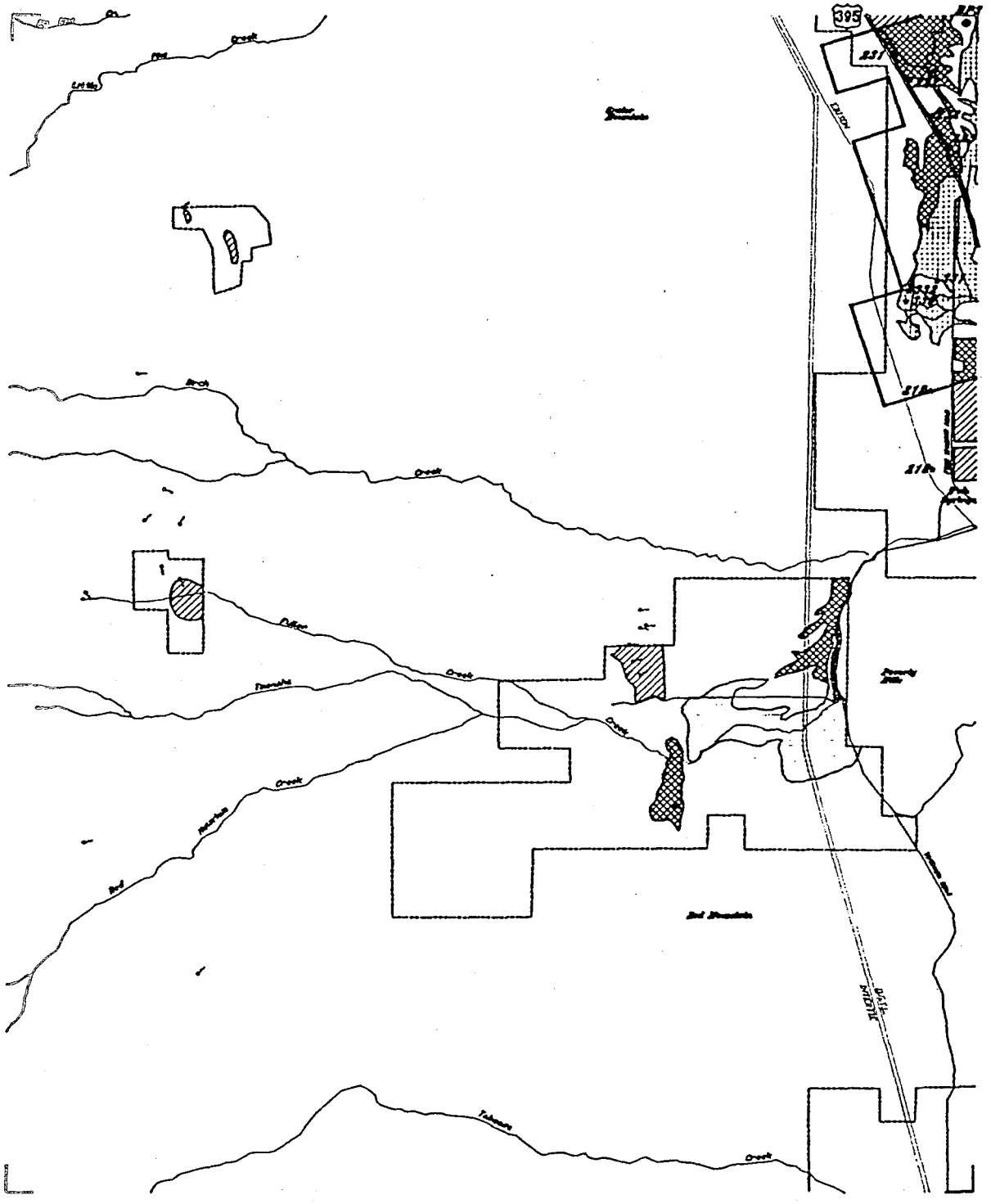
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	63 Ac.	3785 Ac.	3848
TYPE B CLASSIFICATION	48 Ac.	232 Ac.	280
TYPE C CLASSIFICATION	8 Ac.	64 Ac.	72
TYPE D CLASSIFICATION		143 Ac.	143
TYPE E CLASSIFICATION			
TOTALS	119 Ac.	4224 Ac.	4343

★ PUMPING WELL
▲ R&M PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE BNDRY.
—— LADWP PROPERTY LINE

UHLMEYER SPRING, CALIF.
(332-2E)

VEGETATION AND WELLFIELD MANAGEMENT AREA



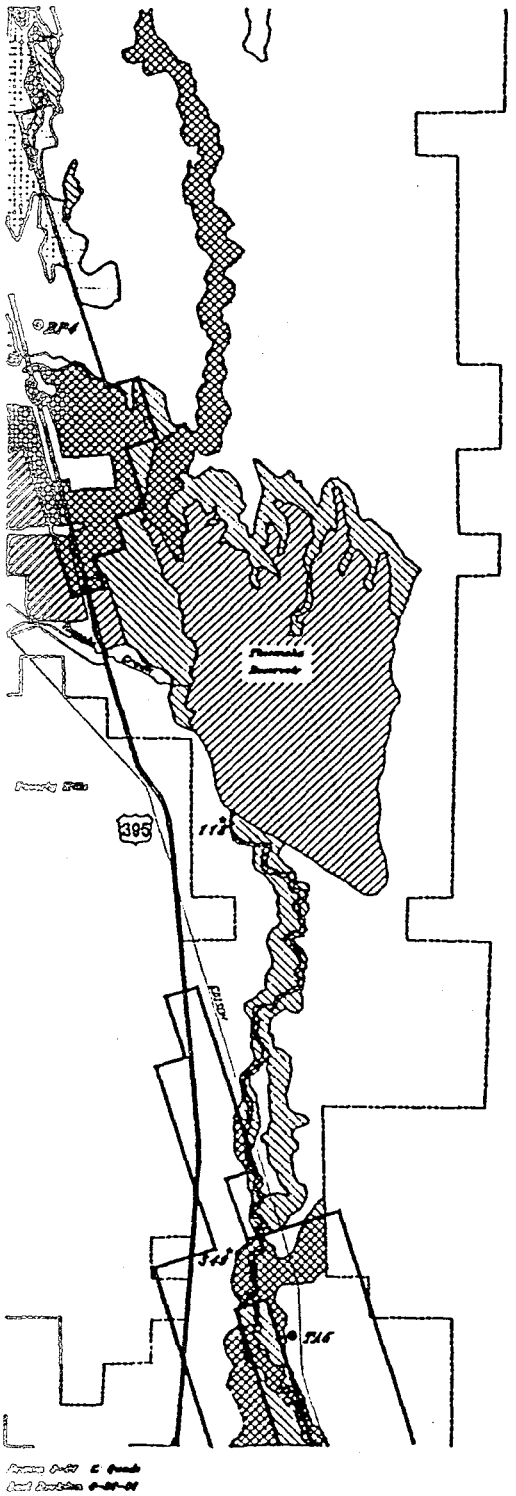
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	684 Ac.	4496 Ac.	6974
TYPE B CLASSIFICATION	286 Ac.	384 Ac.	670
TYPE C CLASSIFICATION	171 Ac.	24 Ac.	195
TYPE D CLASSIFICATION		163 Ac.	163
TYPE E CLASSIFICATION	97 Ac.	199 Ac.	296
TOTALS	1148 Ac.	5260 Ac.	6498

- ★ PUMPING WELL
- ▲ RAW PUMPING WELL
- ● VEGETATION MONITOR SITE
- WATER TABLE CHANGE ENDAT.
- LADWP PROPERTY LINE

FISH SPRINGS, CALIF.
(393-42)

VEGETATION AND WELLFIELD MANAGEMENT AREA



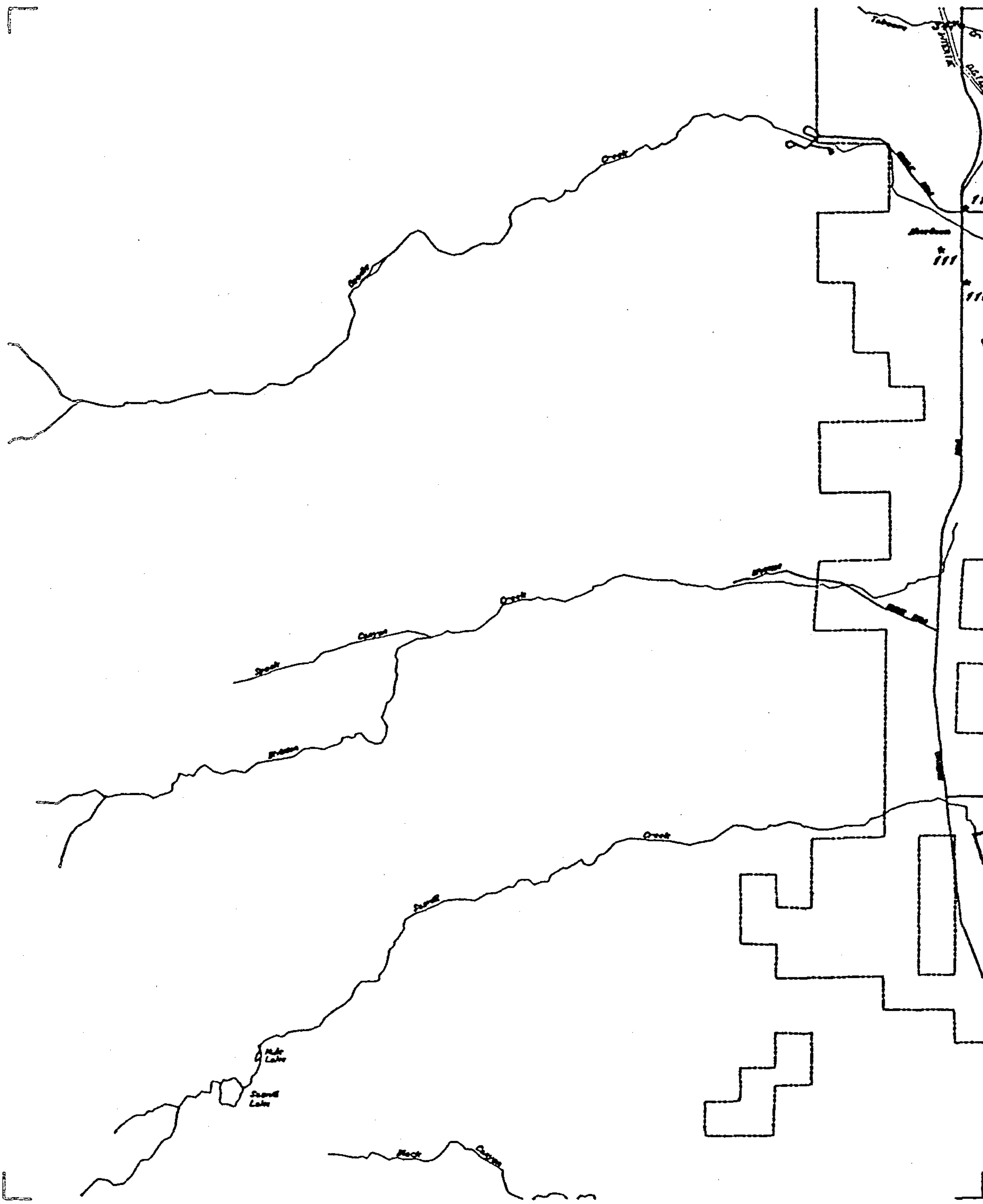
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	1124 Ac.	6756 Ac.	7880
TYPE B CLASSIFICATION	110 Ac.	215 Ac.	325
TYPE C CLASSIFICATION	608 Ac.	886 Ac.	1493
TYPE D CLASSIFICATION	13 Ac.	465 Ac.	478
TYPE E CLASSIFICATION	78 Ac.	1681 Ac.	1759
TOTALS	1833 Ac.	9972 Ac.	11805

★ PUMPING WELL
▲ R&M PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE BNDRY.
—— LADWP PROPERTY LINE

PINEMAHA RESERVOIR, CALIF.
(393-SE)

VEGETATION AND WELLFIELD MANAGEMENT AREA



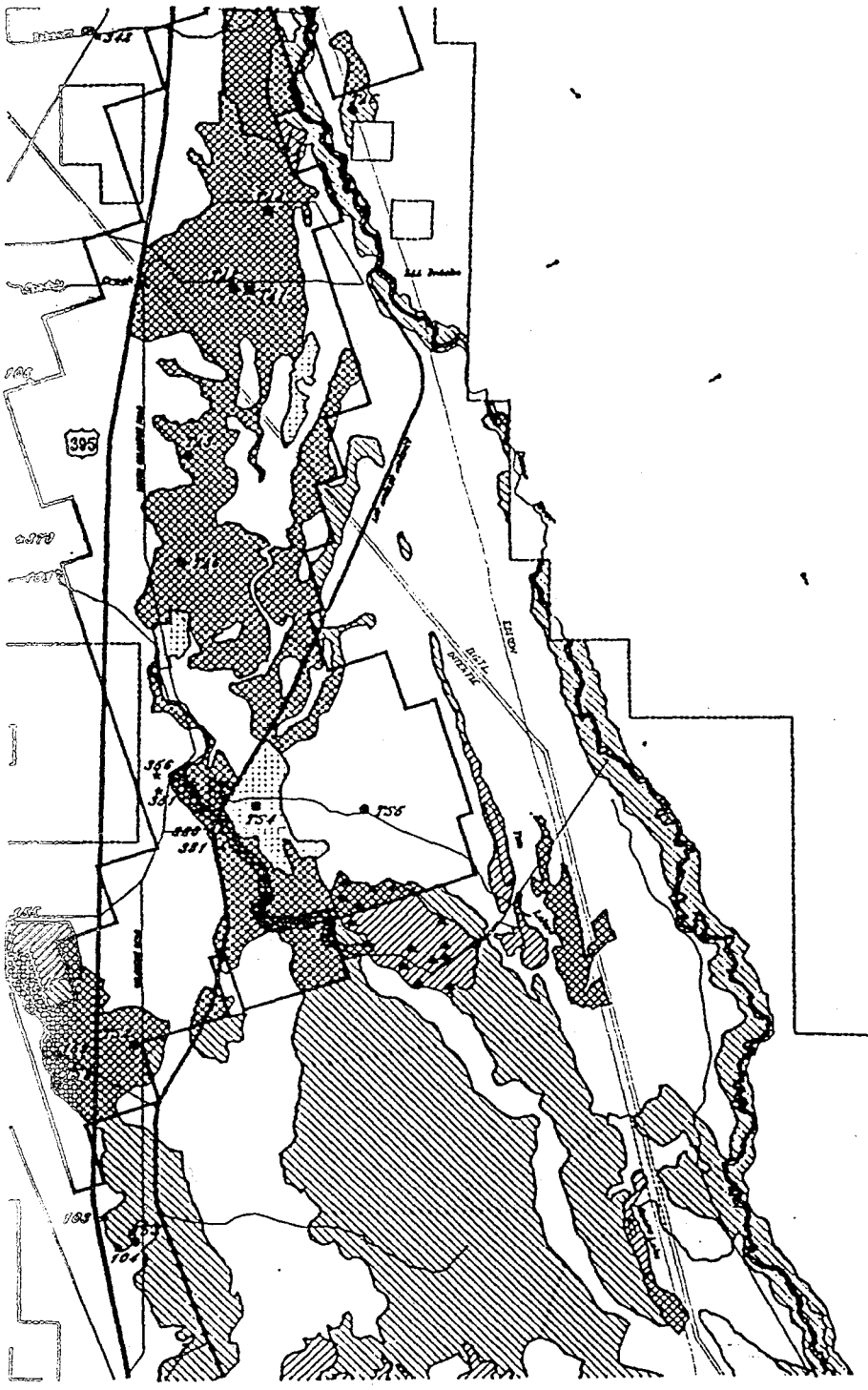
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	11 Ac.	4506 Ac.	4517
TYPE B CLASSIFICATION			
TYPE C CLASSIFICATION			
TYPE D CLASSIFICATION			
TYPE E CLASSIFICATION			
TOTALS	11 Ac.	4506 Ac.	4517

- ★ PUMPING WELL
- ▲ E&M PUMPING WELL
- ● VEGETATION MONITOR SITE
- —— WATER TABLE CHANGE BNDRY.
- —·— LADWP PROPERTY LINE

ABERDEEN, CALIF.
(373-1R)

VEGETATION AND WELLFIELD MANAGEMENT AREA



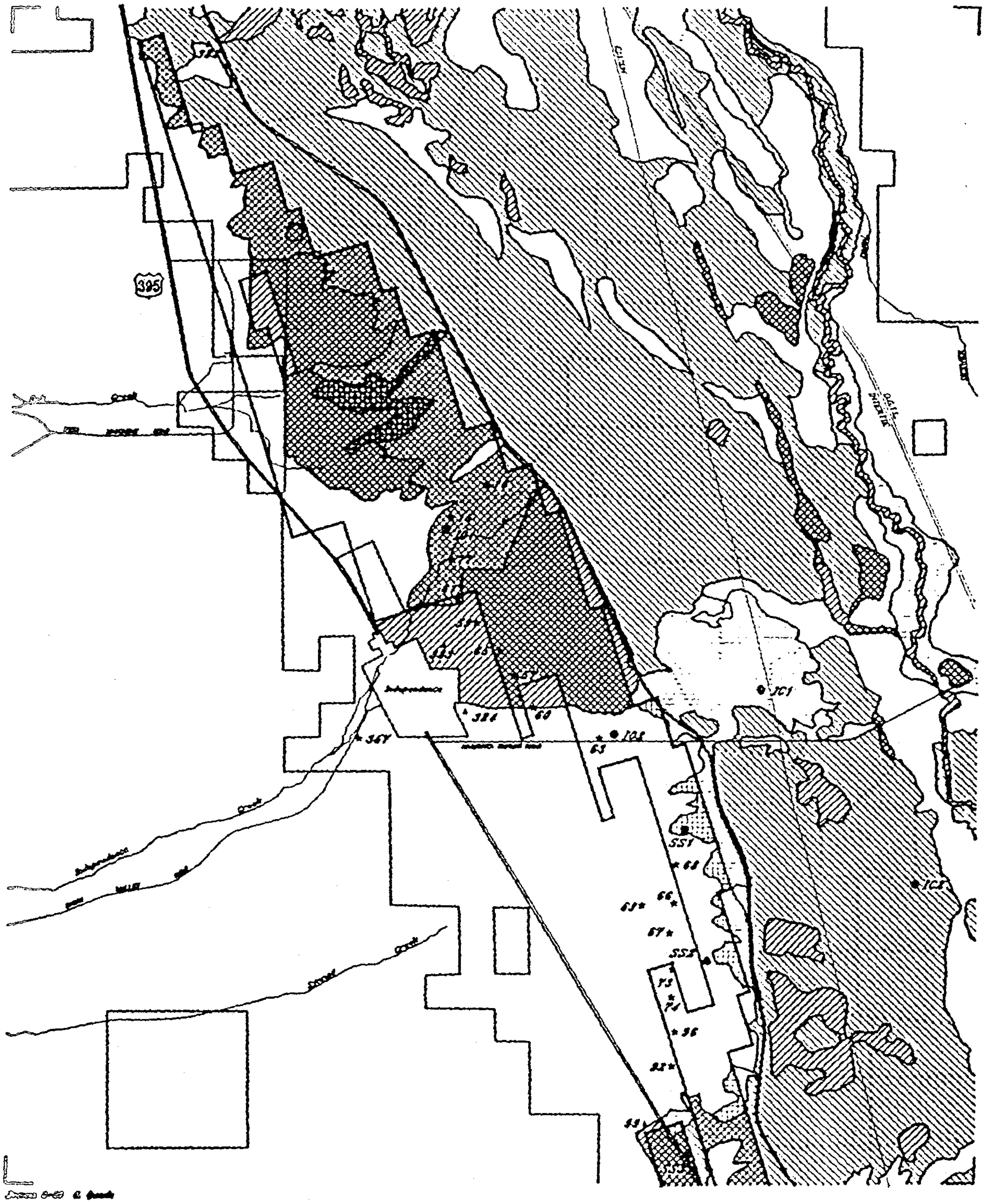
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	3953 Ac.	9960 Ac.	13913
TYPE B CLASSIFICATION	222 Ac.	188 Ac.	410
TYPE C CLASSIFICATION	2259 Ac.	4592 Ac.	6851
TYPE D CLASSIFICATION	93 Ac.	247 Ac.	340
TYPE E CLASSIFICATION	236 Ac.	655 Ac.	891
TOTALS	6763 Ac.	15642 Ac.	22406

- PUMPING WELL
- RAW PUMPING WELL
- VEGETATION MONITOR SITE
- WATER TABLE CHANGE BNDRY.
- LADWP PROPERTY LINE

BLACKROCK, CALIF.
(372-AE)

VEGETATION AND WELLFIELD MANAGEMENT AREA



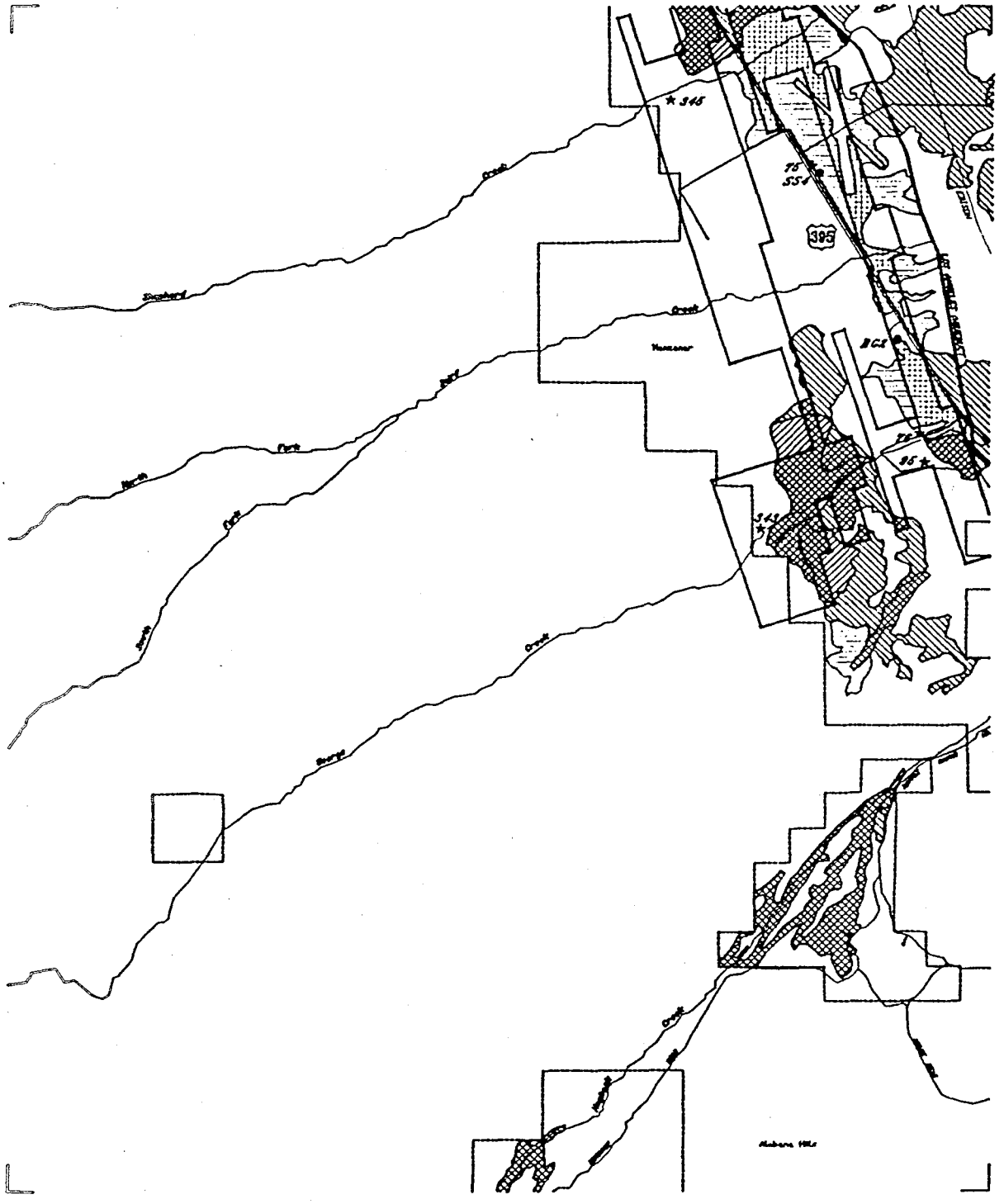
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	1408 Ac.	9756 Ac.	11164
TYPE B CLASSIFICATION	140 Ac.	867 Ac.	1007
TYPE C CLASSIFICATION	1180 Ac.	10148 Ac.	11328
TYPE D CLASSIFICATION	137 Ac.	268 Ac.	405
TYPE E CLASSIFICATION	1374 Ac.	1332 Ac.	2706
TOTALS	4238 Ac.	22401 Ac.	26704

- ★ PUMPING WELL
- ▲ NON PUMPING WELL
- ● VEGETATION MONITOR SITE
- —— WATER TABLE CHANGE BNDRY.
- —— LADWP PROPERTY LINE

INDEPENDENCE, CALIF.
(372-3H)

VEGETATION AND WELLFIELD MANAGEMENT AREA



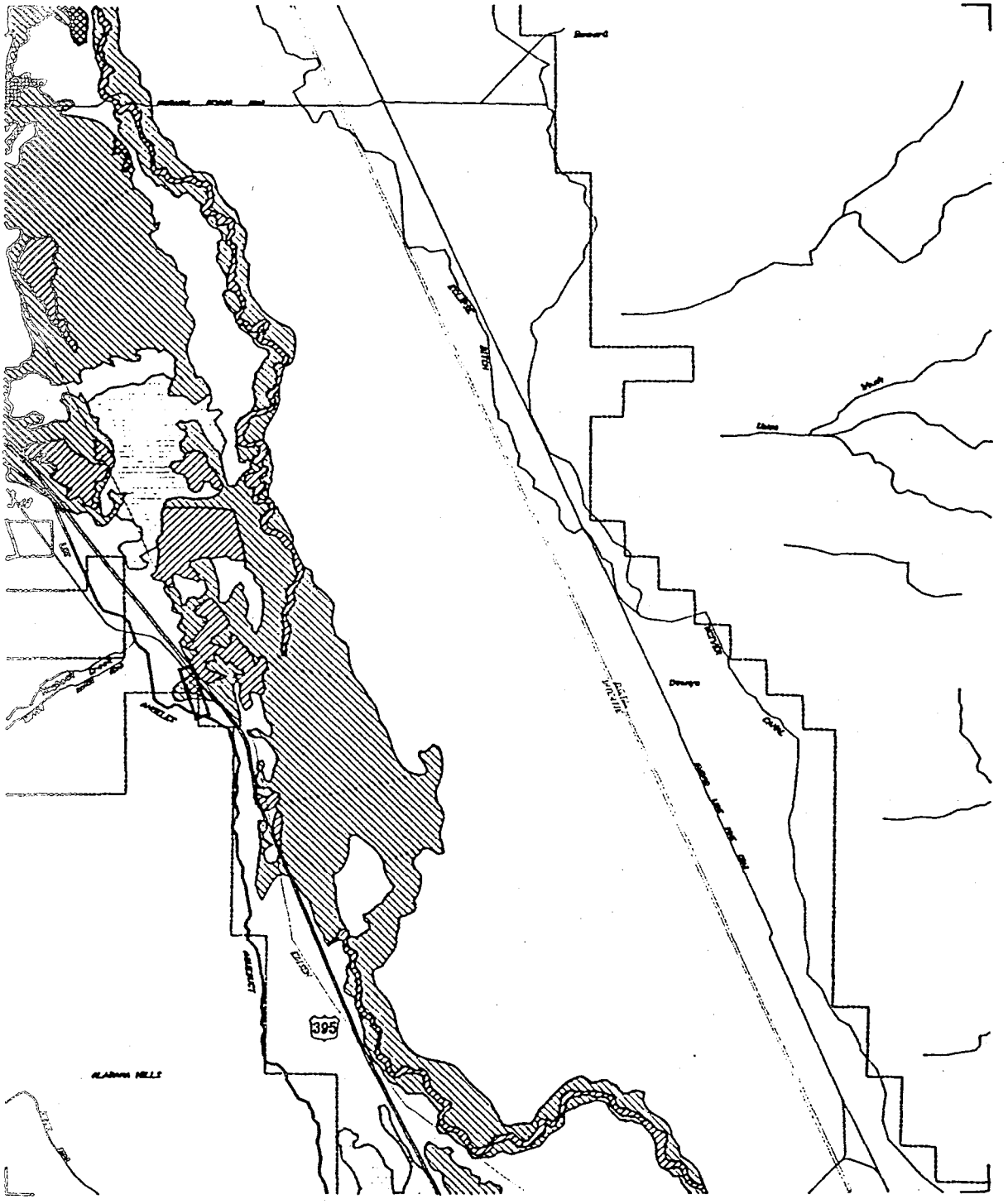
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	1639 Ac.	4454 Ac.	6093
TYPE B CLASSIFICATION	363 Ac.	817 Ac.	1180
TYPE C CLASSIFICATION	133 Ac.	1102 Ac.	1235
TYPE D CLASSIFICATION		351 Ac.	351
TYPE E CLASSIFICATION	248 Ac.	140 Ac.	388
TOTALS	2373 Ac.	6994 Ac.	9367

★ PUMPING WELL
▲ R&M PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE BNDRY.
—— LADWP PROPERTY LINE

MANZANAR, CALIF.
(361-EK)

VEGETATION AND WELLFIELD MANAGEMENT AREA



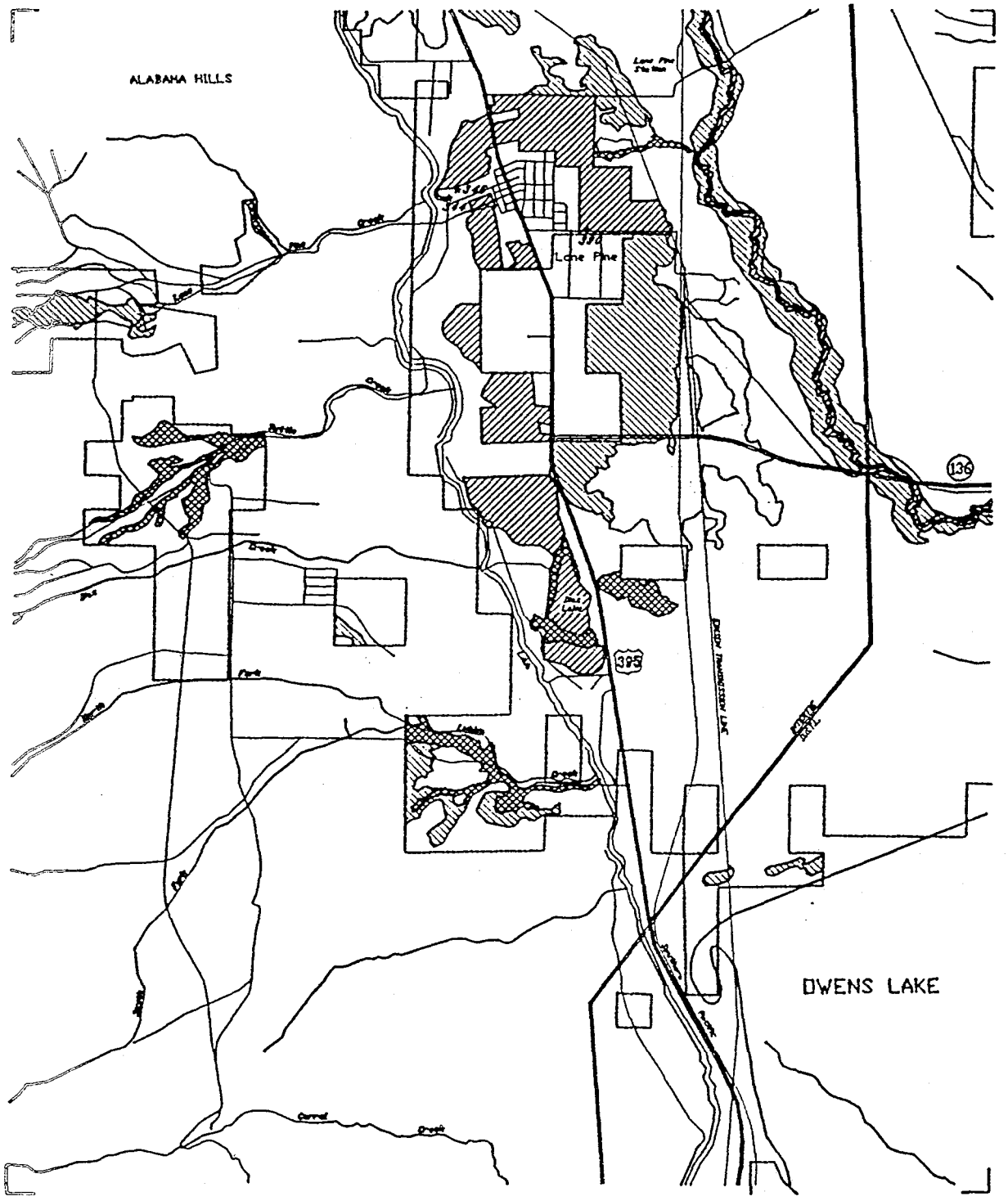
LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION	14 Ac.	18175 Ac.	18189
TYPE B CLASSIFICATION		684 Ac.	684
TYPE C CLASSIFICATION	9 Ac.	3962 Ac.	3971
TYPE D CLASSIFICATION		47 Ac.	47
TYPE E CLASSIFICATION		732 Ac.	732
TOTALS	23 Ac.	23380 Ac.	23403

★ PUMPING WELL
▲ RAW PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE BNDRY.
—— LADWP PROPERTY LINE

UNION WASH, CALIF.
(361-IX)

VEGETATION AND WELLFIELD MANAGEMENT AREA



LEGEND

	WATER TABLE CHANGE GREATER THAN 10 FEET	WATER TABLE CHANGE LESS THAN 10 FEET	TOTAL ACREAGE
TYPE A CLASSIFICATION		12716 Ac.	12716
TYPE B CLASSIFICATION		713 Ac.	713
TYPE C CLASSIFICATION		1638 Ac.	1638
TYPE D CLASSIFICATION		443 Ac.	443
TYPE E CLASSIFICATION		1137 Ac.	1137
TOTALS		16647 Ac.	16647

★ PUMPING WELL
▲ RAW PUMPING WELL
● VEGETATION MONITOR SITE
—— WATER TABLE CHANGE EVENT
—— LADWP PROPERTY LINE

LONE PINE, CALIF.
(1961-62)

VEGETATION AND WELLFIELD MANAGEMENT AREA

August 1, 1989

AGREEMENT BETWEEN THE COUNTY OF INYO AND THE CITY OF LOS ANGELES AND ITS DEPARTMENT OF WATER AND POWER ON A LONG TERM GROUNDWATER MANAGEMENT PLAN FOR THE OWENS VALLEY AND INYO COUNTY

SUPPLEMENTAL INFORMATION

Technical Group:

The draft agreement provides that the Inyo/Los Angeles Technical Group will play an important role in making determinations called for in the agreement. The Technical Group is comprised of up to ten people, five of whom are appointed by the Inyo County Board of Supervisors and five of whom are appointed by the Department of Water and Power. Inyo County and the Department each have only one vote on the Technical Group.

Inyo County's representatives to the Technical Group currently are hydrologist, Bill Hutchison, plant ecologist, David Groeneveld, County Administrator, Brent Wallace, and County Counsel/Water Director, Greg James. The County's representatives to the Technical Gruop have been directed by the Board of Supervisors to take no final action on a matter pending before the Technical Group without first consulting with the Board. Written summaries of Technical Group meetings are distributed to the Standing Committee, the Board of Supervisors, the County Water Commission and the public. A copy of the Memorandum of Understanding between Inyo County and the Department of Water and Power which establishes the Technical Group and the Standing Committee is attached as "A."

Definitions:

Paragraph III(c) on page 5 of the draft agreement provides that the terms "mitigation" and "feasible" are to be defined as under "CEQA" as of July 1, 1989. The definitions of these terms as set forth in CEQA on July 1, 1989 are set forth on attachment "B."

Groundwater Mining:

Paragraph III (B) on page 4 of the draft agreement provides that annual groundwater pumping will be managed so that the total pumping in a well field area over a 20 year period does not

exceed the total recharge to the same well field area over the same period. It also provides that the Technical Group will determine the total recharge to each well field area over each 20 year period using information developed by USGS and other relevant information.

A memorandum from the Technical Group to the Standing Committee presenting a summary of recharge and pumping for water years 1968-69 through 1987-88 is attached as "C." This memorandum presents a sample of how recharge and pumping may be determined by the Technical Group as required by the draft agreement.

Green Book:

Paragraph III (E) on page 6 of the draft agreement describes a technical document called the "Green Book." The "Green Book" is not a policy document. All policies of the agreement are set forth in the draft agreement; the "Green Book" only describes the technical procedures that implement the policies of the agreement.

The "Green Book" is not fully compiled in written form at present, but it will be available before the release of a draft EIR on the agreement. Because the Green Book is not now available, the Technical Group has prepared a memorandum to the Standing Committee that describes the contents of the "Green Book" and details of how soil moisture available to plants is calculated. This soil moisture calculation is used to determine whether wells are to be turned off or turned on. A copy of the memorandum is attached as "D."

"Bishop Cone":

Paragraph VII on page 23 of the draft agreement addresses groundwater pumping on the "Bishop Cone." In response to inquiries as to the boundaries of the "Bishop Cone," a map of the "Cone" is attached as "E."

CEQA GUIDELINES DEFINITIONS
(July 1, 1989)

Mitigation:

"Mitigation" includes:

A. Avoiding the impact altogether by not taking a certain action or parts of an action.

B. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

C. Rectifying the impact by repairing, rehabilitating, or restoring the impacted environment.

D. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

E. Compensating for the impact by replacing or providing substitute resources or environments.

(Guidelines for Implementation of the California Environmental Quality Act - Section 15370)

Feasible:

"Feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social and technological factors.

(California Environmental Quality Act - California Public Resource Code section 21061.1)

Exhibit "B"

MEMORANDUM OF UNDERSTANDING

In consideration of the terms, covenants and conditions set forth herein, the COUNTY OF INYO, a political subdivision of the State of California (hereinafter "COUNTY") and the CITY OF LOS ANGELES DEPARTMENT OF WATER AND POWER (hereinafter "DEPARTMENT") agree this 7th day of September, 1982, as follows:

1. By this Agreement, the parties intend to work together to identify and recommend methods to meet the needs of the Owens Valley and its water users and the needs of the City of Los Angeles and its water users. COUNTY and the DEPARTMENT desire a Groundwater Study of the Owens Valley to be made by the UNITED STATES GEOLOGICAL SURVEY.

2. Standing Committee and Technical Group. Each party shall select representatives to serve on the Standing Committee. The Standing Committee shall select representatives to serve on a technical group.

The DEPARTMENT representatives on the Standing Committee shall include at least one (1) member of the LOS ANGELES CITY COUNCIL, two (2) members of the BOARD OF WATER AND POWER COMMISSIONERS, and three (3) staff members. The COUNTY representatives on the Standing Committee shall be at least one (1) member of the INYO COUNTY BOARD OF SUPERVISORS, two (2) INYO COUNTY WATER COMMISSIONERS, and three (3) staff members. The Standing Committee shall meet at least every two (2) months to review and discuss reports and

recommendations from the Technical Group; to discuss and suggest resolutions to differences between the parties; to issue reports; and to make recommendations to the appropriate governing bodies of the parties.

3. The Technical Group shall be comprised of not more than five (5) representatives selected by COUNTY and five (5) by DEPARTMENT. The Technical Group shall meet at least every two (2) months to exchange information and data, including forecasts of runoff and surface and groundwater operations; to review work and data as available from other studies; to report to the Standing Committee on the progress of any other studies; to recommend to the Standing Committee that additional studies be conducted which are aimed at resolving factual differences between the parties; and to perform any additional duties requested by the Standing Committee.

4. Neither the Technical Committee nor the Standing Committee shall make a recommendation as called for herein without first obtaining a majority vote of both the DEPARTMENT'S representatives and the COUNTY'S representatives to such Committee. In the event that such majority votes cannot be obtained on the Technical Committee, the Technical Committee shall submit a comprehensive report to the Standing Committee detailing the nature of the disagreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day first written above.

INYO COUNTY WATER COMMISSION

By _____
Chairman

COUNTY OF INYO
BOARD OF SUPERVISORS

By _____
Chairman

DEPARTMENT OF WATER AND POWER
OF THE CITY OF LOS ANGELES
by
BOARD OF WATER AND POWER
COMMISSIONERS OF THE CITY OF
LOS ANGELES

By _____

And _____
Secretary

AUTHORIZED BY RES. [illegible]

MEMORANDUM

TO: STANDING COMMITTEE

FROM: TECHINICAL GROUP

DATE: AUGUST 1, 1989

RE: ANALYSIS OF OWENS VALLEY GROUNDWATER RECHARGE AND PUMPING -- 1968-69 THROUGH 1987-88 WATER YEARS (OCTOBER 1 - SEPTEMBER 30)

The August 1, 1989 version of the proposed long-term agreement contains a definition for groundwater mining that relies on a comparison of pumping and the estimated recharge over a twenty year period. The definition states that annual pumping will be managed so that the total pumping from any well field area over a twenty year period does not exceed the estimated recharge to the same well field area over the same twenty year period. In order to advise the Standing Committee on the recent pumping and recharge history of the various well field areas in the Owens Valley, this memorandum presents a summary of recharge and pumping for the water years 1968-69 through 1987-88. These years were included in the period considered by the United States Geological Survey (USGS) during their modeling and study of the Owens Valley groundwater flow system.

The USGS estimate for recharge for the entire Owens Valley for the period is over 3.8 million acre-feet (approximately 191,000 acre-feet/year). The total recharge has been distributed into hydrologic subzones, or well field areas, for the purposes of comparing recharge and pumping. The number of hydrologic subzones, or well field areas, is a subject of technical disagreement between Los Angeles and Inyo. Los Angeles subdivides the Valley into six zones (Laws, Bishop, Big Pine, Taboose-Thibaut, Independence-Symmes-Bairs, and Lone Pine. Inyo subdivides the Valley into seven zones, differing only in the separation of the Taboose-Thibaut area into two areas, Taboose-Aberdeen and Thibaut-Sawmill. There is also disagreement on the flow of recharge from Oak Creek; Los Angeles believes that Oak Creek recharges the Independence-Symmes-Bairs (ISB) well field area, while Inyo believes that 50 percent of Oak Creek recharges the ISB area and 50 percent recharges the Thibaut-Sawmill area. These disagreements do not affect the conclusion of this analysis and should be resolved in the future through a detailed evaluation of the groundwater flow system of the area in question.

Summary tables for the northern three well field areas (Laws, Bishop, and Big Pine), and the Lone Pine area are attached along with two versions of the Taboose-Aberdeen, Thibaut-Sawmill, and Independence-Symmes-Bairs well fields areas. These tables show both total estimated annual recharge and annual pumping for the twenty year period.

The summary tables indicate that under either the Los Angeles or Inyo approach, pumping has not exceeded recharge over the twenty year period in any area. Therefore, groundwater mining has not occurred under the agreed upon definition. Recent drought conditions (high pumping and low runoff) have caused groundwater levels to decline in all areas of the valley. Based on an analysis of past pumping, runoff and water levels, it is expected that water levels will recover after one or more years of high runoff and low pumping, except in the Fish Springs and Black Rock hatchery areas where continuous pumping of groundwater is required and has created localized depressions of water levels.

It should be recognized that the recharge estimates and subzone delineations were developed for the 1968-69 to 1987-88 period. As pumping amounts and patterns change, the amount of recharge and the distribution of hydrologic subzones may change. It will be necessary to analyze total recharge, recharge components, water level changes, and groundwater flow patterns in the future to determine recharge conditions for any future twenty year period in order to comply with the requirement that groundwater mining not occur.

SUMMARY OF 1968-69 TO 1987-88 ESTIMATED RECHARGE AND HISTORICAL PUMPING
AGREED UPON BY LOS ANGELES AND INYO - ALL VALUES IN ACRE FEET

YEAR	LAWS		BISHOP		BIG PINE		LONE PINE	
(OCT-SEP)	RECHARGE	PUMPING	RECHARGE	PUMPING	RECHARGE	PUMPING	RECHARGE	PUMPING
68-69	38282	0	73212	0	56899	534	24695	1260
69-70	10671	2616	42589	0	27968	2219	13705	2154
70-71	10307	21020	37128	0	22770	26715	11410	2014
71-72	10125	28541	34956	2363	20443	41621	10298	2357
72-73	10797	22510	43444	7593	28291	21493	14486	2364
73-74	18060	8528	44547	1516	28934	13009	14555	2350
74-75	13440	8982	39921	2415	24540	32314	12396	1958
75-76	10035	15138	34365	4867	19386	28566	9740	2167
76-77	9871	15661	33275	11281	17402	29603	8716	2103
77-78	23109	7773	53628	2758	40701	34355	17650	2685
78-79	12672	6533	43754	5420	30831	25796	13610	2038
79-80	24903	12511	55732	2364	41866	26614	18600	1762
80-81	12461	12338	41543	6919	26287	27211	12587	1673
81-82	23619	14525	54900	6271	39513	24302	18690	1306
82-83	35780	1038	70015	11	54567	25543	23928	1250
83-84	11760	6854	54462	3773	34321	27154	17457	1772
84-85	10913	10016	43998	9777	26655	26937	13616	2197
85-86	31218	9953	60341	1809	47990	25054	20541	2439
86-87	12405	21220	38440	9558	22817	38946	11775	1660
87-88	12537	22486	36703	10900	20630	33667	10896	1389
TOTAL	342965	248243	936953	89595	632811	511653	299351	38898
AVERAGE	17148	12412	46848	4480	31640	25583	14968	1945

SUMMARY OF 1968-69 TO 1987-88 ESTIMATED RECHARGE AND HISTORICAL PUMPING
LOS ANGELES VERSION - ALL VALUES IN ACRE-FEET

YEAR (OCT-SEP)	TABOOSE-THIBAUT RECHARGE	TABOOSE-THIBAUT PUMPING	IND-GYM-BAIRS RECHARGE	IND-GYM-BAIRS PUMPING
68-69	56757	3501	83425	662
69-70	28899	2546	43602	2929
70-71	23903	21482	35304	23852
71-72	21404	48158	31186	39814
72-73	30650	39503	46194	31596
73-74	30900	28239	46938	18678
74-75	26151	40240	38998	16299
75-76	20153	53114	29122	29641
76-77	17905	44712	25430	23190
77-78	38863	33383	57921	23572
78-79	28651	15030	43181	3782
79-80	41747	28047	61243	14297
80-81	26401	21354	39822	4702
81-82	40751	26429	61736	8054
82-83	55008	14433	80496	318
83-84	40498	13691	57130	367
84-85	28651	27460	43210	8788
85-86	47264	27325	67894	7842
86-87	23651	53314	35398	32542
87-88	21154	55195	31648	40348
TOTAL	649361	597186	959578	331273
AVERAGE	32468	29858	47979	16564

INYO VERSION - ALL VALUES IN ACRE FEET

YEAR (OCT-SEP)	TABOOSE-ABERDEEN RECHARGE	TABOOSE-ABERDEEN PUMPING	THIBAUT-SAWHILL RECHARGE	THIBAUT-SAWHILL PUMPING	IND-GYM-BAIRS RECHARGE	IND-GYM-BAIRS PUMPING
68-69	41651	3460	25784	41	72748	662
69-70	21572	2207	12702	339	38228	2929
70-71	17433	19304	10751	2178	31033	23852
71-72	15364	44241	9775	3917	27452	39814
72-73	23022	28742	13385	10761	40437	31596
73-74	23230	14240	13482	13999	41126	18678
74-75	19295	27821	11629	12419	34225	16299
75-76	14327	40383	9287	12731	25661	29641
76-77	12465	30084	8409	14628	22461	23190
77-78	28818	19511	17333	13872	50633	23572
78-79	21367	6174	12604	8856	37861	3782
79-80	30472	16010	19000	12037	53518	14297
80-81	19503	10624	11726	10730	34695	4702
81-82	30681	15410	17850	11019	53956	8054
82-83	40202	3829	25101	10604	70202	318
83-84	28404	3183	19273	10508	49952	367
84-85	21367	15063	12604	12397	37890	8788
85-86	33787	14643	22077	12682	59294	7842
86-87	17226	34862	10652	18452	31172	32542
87-88	15156	37450	9678	17745	27969	40348
TOTAL	475342	387241	299102	209918	840503	331273
AVERAGE	23767	19362	14655	10496	42025	16564

MEMORANDUM August 1, 1989

TO: Standing Committee
FROM: Technical Group

RE: SUMMARY OF KEY GREEN BOOK PROVISIONS

The "Green Book" is a technical document written to describe the monitoring sites, activities and interpretations. The sole purpose for the Green Book is to set forth the techniques to implement the management goals specified in the Inyo County and City of Los Angeles Agreement.

The Green Book is an adjunct document separate from the Inyo/Los Angeles Agreement. The terms in the Agreement are mutually agreed to and should not change. The Green Book, however, is based upon scientific research. Its contents and procedures may be changed as better understanding for environmental management is gained through further study. Maintaining the Green Book as a separate document from the Agreement ensures flexibility to encorporate new information.

The Green Book consists of two major sections dealing with hydrology and issues for vegetation management. In combination, these sections will set forth:

- Selection of monitoring sites and technique for tying pumping wells to monitoring sites.
- Procedure for testing and evaluating new well locations.
- Testing whether groundwater mining is occurring.
- Vegetation mapping techniques and incorporation of the existing vegetation inventory for management.
- Monitoring leaf area and soil water, interpreting the data and projecting plant water balance.
- Large scale vegetation monitoring by air photographs and satellite data.

CALCULATION OF THE SOIL WATER AVAILABLE TO PLANTS

One extremely important consideration of the Green Book is for turning off pumping wells when insufficient soil water is predicted through monitoring to maintain the vegetation at its present cover. This calculation determines the water available for plant use at each site and projects whether sufficient water will be available in the soil to maintain the vegetation through one or more growing seasons. The water available to plants is compared to transpiration needs for a growing season or portion of a growing season. If a deficit condition is predicted at a monitoring site, the pumping wells that affect the groundwater levels at that site are turned off.

Monitoring sites have been chosen in the Owens Valley wellfields that are representative of large areas of vegetation and soils. Control sites, located in zones that are unaffected by groundwater pumping are used to determine the response of

native vegetation to drought conditions alone. At these sites, the shallow water table fluctuates due to natural conditions and not to groundwater pumping.

The amount of soil water use by plants from transpiration is calculated for each species according to leaf area using set curves with respect to time. These curves were determined during 5 years of intensive field study in the Owens Valley. The projected water use for each species is then summed to yield an estimate of the water required by the total vegetation cover.

Vegetation cover is determined by highly accurate transects which are measured at each monitoring site. For comparison of leaf area or cover among growing years and for purposes of calculating water requirements, the vegetation is subjected to these transects during a three week period centered around the summer solstice (June 21).

Soil water monitoring at each site relies upon psychrometers which are very sensitive and accurate instruments used to evaluate soil water potential. The sensors are implanted in triplicate within the root zone of the vegetation at the center of one meter soil slices to a depth of four meters.

Soil water potential, measured by psychrometers, is converted to soil water content using a soil water characteristic function based upon soil particle surface area and interpreted by the quadratic formula. The soil water that is available to each of the major plant species inhabiting the Owens Valley floor is then calculated by subtraction of the theoretical limiting soil water from the actual soil water present within each one-meter soil slice in the root zone.

The limiting soil water content is calculated for each one-meter soil slice by the calibrated characteristic function with reference to the lower limiting water potentials for the major plant species interpreted as a function of depth. The lower limits of survival for water stress were determined in specially designed greenhouse studies. Functions for applying the lower water potential limits by depth were determined under field study at sites with controlled water table drawdown. These functions reflect the decreasing density of roots with depth.

Total available soil water is calculated as the sum for each one-meter slice of soil. The available water in the top two one-meter slices are added to calculate the amount of water for grasses. For shrubs, the top four one-meter slices are added.

Finally, the total available water is then compared to the estimated needs of the vegetation. If there is a projected deficit, the affecting well must be turned off. If the well has been shut off in the past to protect the vegetation but a sufficient surplus of soil water has become available to meet plant water requirements back when the deficit was predicted, the well may again be operated safely.

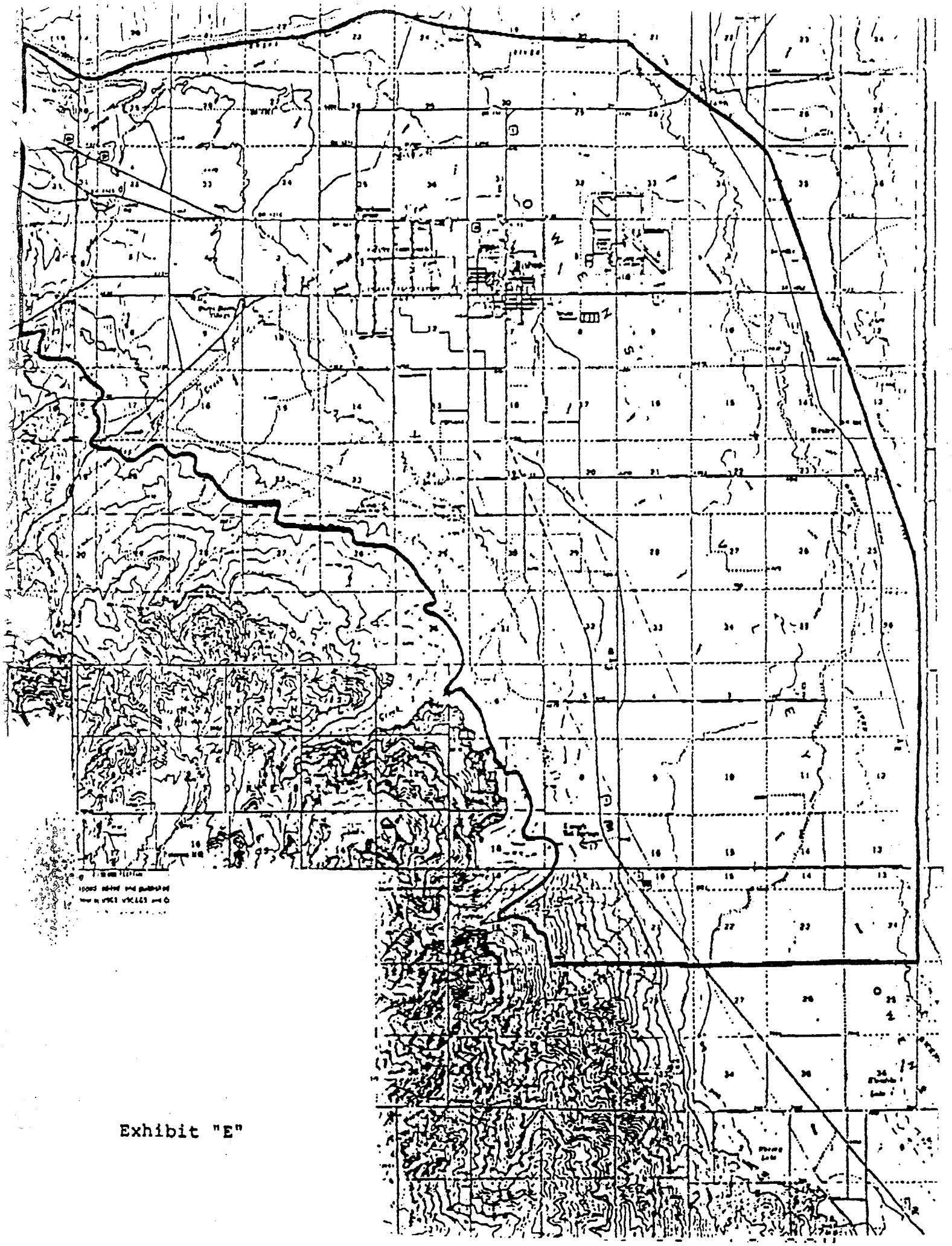


Exhibit "E"

Owens Valley Groundwater Sustainability Plan:
Monitoring Plan and Data Gaps Analysis

Prepared For

Owens Valley Groundwater Authority
Owens Valley, CA

OWENS VALLEY GROUNDWATER AUTHORITY

Prepared by

DBS&A
Daniel B. Stephens & Associates, Inc.
a Geo-Logic Company

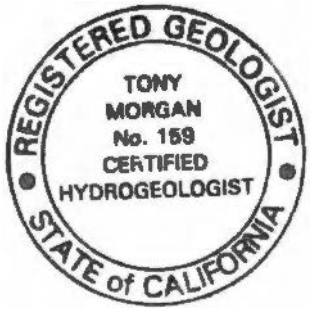
3916 State Street, Garden Suite
Santa Barbara, California 93105
www.dbstephens.com
Project #DB18.1418.00

November 30, 2021

Certification

This document was prepared in accordance with generally accepted professional hydrogeologic principles and practices. This document makes no other warranties, either expressed or implied as to the professional advice or data included in it. This document has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

DANIEL B. STEPHENS & ASSOCIATES, INC.



Douglas Tolley, PhD
Staff Hydrogeologist
gtolley@geo-logic.com
143E Spring Hill Drive
Grass Valley, CA 95945

Tony Morgan, PG, CHG
VP / Principal Hydrogeologist
tmorgan@geo-logic.com
3916 State Street, Garden Suite
Santa Barbara, CA 93105

Date signed: December 1, 2021

Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

Acronym	Acronym definition
AB	assembly bill
ADCP	acoustic doppler current profiler
AF	acre-feet
AFY	acre-feet per year
Ag	agriculture
AMI	automated (or advanced) metering infrastructure
amsl	above mean sea level

APN	assessor parcel number
B	boron
BCM	Basin Conceptual Model (USGS)
bgs	below ground surface
BMP	best management practices
BOS	bottom of screen
CA	California
CalGEM	Geologic Energy Management Division (formerly DOGGR)
CASGEM	California statewide groundwater elevation monitoring
CCR	California Code of Regulations
CDPH	California Department of Public Health
CFS	cubic feet per second
CIMIS	California irrigation management information system
Cl	chloride
COC	chemical of concern
CWC	California Water Code
DBS&A	Daniel B. Stephens & Associates, Inc.
DDW	[SWRCB] Division of Drinking Water
DEM	digital elevation model
DOGGR	Division of Oil, Gas, and Geothermal Resources (reorganized as CalGEM)
DPWM	Distributed Parameter Watershed Model
DQO	data quality objective
DTW	depth to water
DWR	[CA] Department of Water Resources
DWUs	downstream water users
EGM96	Earth Gravitational Model of 1996
EPA	U.S. Environmental Protection Agency
ET	evapotranspiration

ET_0	reference evapotranspiration
FT or ft	feet
GAMA	[USGS] groundwater ambient monitoring & assessment
GIS	geographic information system
GPS	global positioning system
GBUAPCD	Great Basin Unified Air Pollution Control District
GSA	groundwater sustainability agency
GSP	groundwater sustainability plan
HASP	health and safety plan
HCM	hydrogeologic conceptual model
Hydrodata	hydrologic data server
ID	identification
IWVWA	Indian Wells Valley Groundwater Authority
JPA	Joint Exercise of Powers Authority
LADWP	Los Angeles Department of Water and Power
LAUWMP	Los Angeles Urban Water Management Plan
LiDAR	light detection and ranging
NCCAG	natural communities commonly associated with groundwater
M&I	municipal and industrial
MCL	maximum contaminant level
MOU	memorandum of understanding
MS4	municipal separate storm sewer system
NAD	North American datum
NAVD88	North American vertical datum of 1988
ND	not detected
NGVD29	national geodetic vertical datum of 1929
NO3	nitrate
NWIS	national water information system

OFR	open file report
OLGDP	Owens Lake Groundwater Development Program
OVGA	Owens Valley Groundwater Authority
PBP	priority basin project
PSI	pounds per square inch
PSW	public-supply well
PVC	polymerizing vinyl chloride
QA	quality assurance
QC	quality control
RASA	regional aquifer-system analysis
RP	reference point (elevation)
RWQCB	[CA] Regional Water Quality Control Board
SAP	sampling and analysis plan
SO4	sulfate
SUM	summation
SWL	static water level
SWN	[CA DWR] state well number
SWRCB	[CA] State Water Resource Control Board
TD	total depth
TDS	total dissolved solids
TFR	total filterable residue
TMDL	total maximum daily load
TNC	The Nature Conservancy
TOS	top of screen
URL	uniform resource locator (web address)
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
WGS84	world geodetic system 1984

WL	water level
WLE	water level elevation
WQ	water quality
WY	water year

Executive Summary

Development of an acceptable groundwater sustainability plan (GSP) requires information provided by a number of datasets to inform past, present, and future conditions in the context of the six undesirable results that can occur when a groundwater basin is managed unsustainably. These datasets (excluding those related to subsidence and interconnected groundwater and surface water) were reviewed on a management area basis for this document. Summaries of available data, including spatial maps and time series of representative monitoring points, are presented for each management area. Data gaps were assessed by evaluating the spatial coverage of data relative to the aquifer and management area boundaries, the time period for which data are available, and hydrogeologic context. Identified data gaps were then given priority ranking with recommendations on how to address them.

The highest priority data gaps occur within the Fish Slough and Tri-Valley management area, where limited groundwater elevation, well location, groundwater extraction, and subsurface flow data have been collected. The few data points available show steady, long-term groundwater level declines in the Tri-Valley area on the order of one to two feet per year. A connection between the Owens Valley subbasin and the Fish Slough subbasin is observed in correlated water level and spring flow declines, but no groundwater flow model has been developed to quantify fluxes between the two subbasins. Lower priority data gaps include obtaining data that were not assimilated into the Owens Valley Groundwater Authority (OVGA) database as they were discovered after that phase of initial GSP development had been completed, and further refining water budget components.

Introduction

Daniel B. Stephens & Associates, Inc. (DBS&A) has prepared this Owens Valley Monitoring Program and Data Gap Analysis Technical Memorandum (Tech Memo) for the Owens Valley Groundwater Authority (OVGA) and is under contract to prepare their Groundwater Sustainability Plan (GSP or Plan) as required by the 2014 Sustainable Groundwater Management Act (SGMA). This Tech Memo is intended to be included as an Appendix in the final GSP.

SGMA requires that all groundwater basins designated by the California Department of Water Resources (DWR) as “medium” and “high” priority basins be managed sustainably, defined as the absence of "significant and unreasonable" undesirable results that occur when the basin is not in a long-term dynamic steady-state condition. Basins identified as “Critically Overdrafted”

are required to submit their Plans to the DWR by January 31, 2020. Although Owens Valley is currently listed as "low" priority and therefore not required to submit a GSP, the OVGA is voluntarily submitting one by the January 31, 2022 deadline for "medium and "high" priority basins. For the purposes of this Tech Memo, Owens Valley refers to the DWR subbasins 6-012.02 (Owens Valley) and 6-012.02 (Fish Slough) unless stated otherwise.

1.1 Purpose and Background

This section describes the purpose of the Tech Memo and provides technical background information for Owens Valley.

1.1.1 Purpose

The purpose of this Monitoring Program and Data Gap Analysis Tech Memo is to aid in the development of a monitoring network that is capable of providing sustainability indicator data of sufficient accuracy and quantity to demonstrate sustainable management of Owens Valley groundwater basin. The Tech Memo describes the datasets available for GSP preparation, established monitoring networks and how data (knowledge) gaps could be filled in the future. Tech Memo components detail:

- Historical datasets
- Existing monitoring networks
- Groundwater data trend analysis
- Data gap analysis
- Recommendations

This Tech Memo is not intended to impose specific monitoring wells and/or sampling locations on OVGA with respect to their existing long-standing monitoring programs. However, SGMA requires principal aquifer-specific evaluation (DWR, 2016b), which from a review of the existing monitoring networks, may be a challenge in Owens Valley (see Section 1.2.6). Aquifers outside of the adjudicated area (see Section 1.1.2) in the Owens Valley are relatively lightly pumped, or not pumped at all, which minimizes drawbacks of the lack of an aquifer specific analysis. Optimization and/or expansion of current monitoring programs may be necessary as many existing groundwater monitoring points in the basin utilize agricultural wells or municipal wells potentially screened across multiple water-bearing units, or are located on LADWP lands that are exempt from SGMA (see Section 1.1.2).

Where appropriate, hydrologic data are displayed graphically on maps and charts in this Tech Memo and can also be viewed on the Owens Valley GSP data portal (https://owens.gladata.com). This Tech Memo serves as a starting point for GSP preparation and provides a general data summary and overview of historical and current groundwater conditions in the basin.

1.1.2 Background

Much of the land and the majority of water rights in Owens Valley are owned by the City of Los Angeles Department of Water and Power (LADWP) for the purpose of exporting water from the eastern Sierra to Los Angeles. Los Angeles has developed extensive facilities for water storage and export, land and water management, groundwater production, groundwater recharge, surface water and groundwater monitoring, and dust control. Because of the importance of water supplied from Owens Valley to Los Angeles, LADWP water monitoring is extensive and considerable study has been devoted to Owens Valley hydrology. Because Los Angeles owns relatively little land in Chalfant, Hammil, and Benton valleys, they are less studied and monitoring is sparse compared to the rest of the Owens Valley.

For the purposes of SGMA, lands owned by LADWP are considered adjudicated under the Inyo-Los Angeles Long Term Water Agreement (LTWA). Therefore, LADWP land is exempt from SGMA regulations. Other SGMA exemptions in Owens Valley include tribal lands owned by the Bishop Paiute Tribe, Big Pine Paiute Tribe, Fort Independence Paiute Tribe, Lone Pine Paiute Shoshone Tribe, and lands held in trust by the US Bureau of Indian Affairs (Figure 1-1). The GSP area is defined as the area of the groundwater basin that does not coincide with the SGMA exempt lands. Spatial coverages for the groundwater basin and the SGMA-exempt lands were all obtained from the DWR SGMA Data Viewer (https://data.cnra.ca.gov/showcase/sgma-data-viewer).

DBS&A has developed this Tech Memo as a companion document to the Owens Valley Sampling and Analysis Plan (SAP) (OVGA, 2020). The SGMA focused SAP details monitoring protocols and standard methods for water quality and groundwater level data collection in the Owens Valley.

The SAP is referenced throughout this Tech Memo where applicable. SAP components include, but are not necessarily limited to, descriptions of the following:

- Water sample collection procedures
- Analytical methods to be used

- Groundwater level measurement protocol in water wells
- Data quality assurance (QA) and quality control (QC) procedures

1.1.3 Technical and Regulatory Guidance

DBS&A has developed this Tech Memo in accordance with the Best Management Practices (BMP) technical guidance series produced by the DWR. This Tech Memo has been prepared in general accordance with the DWR's BMP #2 - Monitoring Networks and Identification of Data Gaps (DWR, 2016b). Much of the content contained in the DWR's BMP #2 was directly applicable to the development of this Tech Memo and BMP content has been liberally reproduced in this Tech Memo. URL links to complete documents, available online (OVGA.us) and cited in this Tech Memo, are included in the References Section, where available.

Additional sources of technical guidance considered in preparation of this Tech Memo include, but are not limited to, the following documents:

- BMP #1 - Monitoring Protocols, Standards, and Sites (DWR, 2016a)
- Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4 (EPA, 2006)
- Title 23 of the California Code of Regulations (CCR)

This Tech Memo has been prepared to satisfy, in part, criteria contained in 23 CCR Subarticle 4 - Monitoring Networks:

- § 354.32 - Intro to Monitoring Networks
- § 354.34 - Monitoring Networks
- § 354.36 - Representative Monitoring
- § 354.38 - Assessment & Improvement of Monitoring Networks (Data Gaps)
- § 354.40 - Reporting Monitoring Data to the Department (addressed in the SAP)

Monitoring programs are to be reviewed and modified, as necessary, at least every five years as part of the periodic GSP evaluation (5 year updates).

1.1.4 SGMA Sustainability Indicators

Six sustainability indicators are defined in the SGMA legislation. These are potential effects caused by groundwater conditions occurring in a basin that, when significant and unreasonable, are considered undesirable results. The GSP will describe sustainable management criteria (SMCs) that will serve as metrics for evaluating undesirable results relative to the sustainability indicators. Data must be sufficient to limit uncertainty when used to assess the sustainability indicators (DWR, 2017). The six indicators are related to:

- Groundwater levels
- Groundwater storage
- Seawater intrusion
- Water quality
- Land subsidence
- Interconnected surface water

Land Subsidence and Ecological (i.e., interconnected surface water) monitoring networks and available data are not included in this Tech Memo, as they are discussed separately in other appendices included with the GSP. This Tech Memo addresses data collection related to water quality and groundwater levels. Seawater intrusion is not an applicable sustainability indicator of concern for the Owens Valley due to its geographic location.

1.1.5 Historical and Current Groundwater Management

Prior to SGMA, groundwater management for the Inyo County portion of Owens Valley was performed pursuant to the LTWA. The overall goal of the LTWA is "to avoid certain described decreases and changes in vegetation and to cause no significant effect on the environment which cannot be acceptably mitigated while providing a reliable supply of water for export to Los Angeles and for use in Inyo County" [City of Los Angeles v. County of Inyo, 1991]. Implementation methods for these goals are described in the "Green Book," a technical appendix to the LTWA [County of Inyo and City of Los Angeles, 1990]. All lands owned by the City of Los Angeles in Inyo County are governed by the LTWA, and these lands are considered adjudicated and exempt for the purposes of SGMA.

In general, the primary goal of LTWA groundwater management for the LA-owned portion of the Owens Valley in Inyo County is to manage groundwater pumping to protect and sustain

phreatophytic vegetation that depends on shallow groundwater as a primary water source. The primary goal is accomplished by a combination of monitoring, modeling, and forecasting of vegetation and hydrologic conditions on an annual basis. If pumping reduces, or is projected to reduce, soil moisture below a threshold that would cause irreversible damage to vegetation then pumping is decreased or stopped completely until water levels and soil water recover. Annual pumping plans provided by LADWP are prepared and analyzed using recent monitoring data and modeling. Since the vast majority of groundwater is pumped by the LADWP, the LTWA applies to most groundwater extraction in the Inyo County portion of Owens Valley.

In the Mono County portion of the Owens Valley, groundwater management is the responsibility of the Tri-Valley Groundwater Management District (TVGMD). According to the most recent General Plan Update [County of Mono, 2015], the TVGMD was formed in response to concern over possible exportation of groundwater from the area and implements an area-wide well-monitoring program. However, it is not clear that a comprehensive pumping or water level monitoring program exists as no groundwater data has been provided to the OVGA by the TVGMD to date. Furthermore, the TVGMD website appears to function primarily to host public announcements of monthly meetings, and does not contain groundwater management plans, or reporting and monitoring requirements. As noted by Langridge and others [2016], the TVGMD is a functioning public agency which holds periodic public meetings, but with no permanent staff and no employees on payroll. The scope of the district's activities appear to be quite limited and primarily focused on preventing groundwater export from the area.

1.2 Hydrogeologic Conceptual Model

The varying combinations of topography, geology, and climate over the large area of the Owens Valley groundwater basin has resulted in hydrogeologic conditions varying spatially, generally from north to south. These can be broadly grouped into three categories representing the hydrogeologic conditions. The spatial distribution of these categories are used in the GSP to divide the basin into separate management areas (Figure 1-2) which allow for development of unique SMCs that take into account hydrogeologic conditions present in the area.

The following is a summary description of the Owens Valley Hydrogeologic Conceptual Model (HCM). Data used to develop the conceptual model are presented for the basin as a whole, but the hydrogeologic framework for each management area is discussed individually. For a more detailed description, please refer to Appendix 7 and Section 2.2.1 of the Owens Valley GSP.

1.2.1 Geography and Physiography

Owens Valley is located on the eastern side of the Sierra Nevada Mountains in California on the western edge the Basin and Range Province. The Owens River watershed is approximately 3,287 mi^2, extending from Long Valley and Benton Valley in the north to Haiwee Reservoir in the south. The watershed is comprised of two main geographic components: the mountains that surround the valley and provide most of the water in the form of snowmelt runoff, and the relatively flay lying valley floor which makes up the groundwater basin (Figure 1-3). The groundwater basin is a geographic subset of the watershed. Locally, the northern arm of the Owens Valley subbasin that contains Chalfant, Hammil, and Benton Valleys is referred to as "Tri-Valley." Fish Slough is a small subbasin to the west of Chalfant and Hammil Valleys that discharges groundwater to the Owens Valley north of the City of Bishop. Elevations in the watershed range from 14,505 ft above mean sea level (amsl) at the summit of Mt. Whitney to 3,529 ft amsl in the Owens Dry Lake portion of the watershed. The Owens Valley is a closed basin due to the Coso Range at the southern end of the watershed preventing groundwater and surface-water outflow.

Although the terms “watershed” and “groundwater basin” are commonly used interchangeably, they have very specific meanings in this document. The watershed is defined as the area that channels rainfall and snowmelt to the Owens Lake area as there is no natural outlet from the watershed. This includes the high elevation mountains that surround the Owens Valley. The groundwater basin is the portion of the watershed where alluvial and fluvial sediments have accumulated to form aquifers, typically characterized by relatively low topographic relief. The boundaries of the Owens River watershed and the Owens Valley groundwater basin are shown in Figure 1-3.

1.2.2 Climate

Climate in Owens Valley watershed is strongly correlated with elevation. The high elevation portions of the watershed are cooler and receive the greatest amount of precipitation (Figure 1-4), primarily as snow from October-March. The watershed experiences a strong precipitation gradient due to the "rain shadow effect" caused by the Sierra Nevada. Moist air masses moving westward off the Pacific Ocean rise when they encounter the Sierra Nevada, the rising air cools, and water vapor condenses and falls as rain or snow. As air masses descend the eastern slope, the descending air warms, clouds evaporate, and precipitation declines east of the Sierra Nevada. The combination of topography and the "rain shadow effect" results in highly variable precipitation in the watershed.

1.2.3 Vegetation

Native vegetation covers most the Owens Valley watershed (Figure 1-5) as the majority of land is owned by federal, state, or municipal ownership. Vegetation in the Owens Valley groundwater basin varies with elevation, floristic region, soil salinity, and water availability. Vegetation communities range from salt-tolerant shadscale scrub, alkali sink scrub, desert greasewood scrub, alkali meadow, and desert saltbush or rabbitbrush scrub on the low elevations of the valley floor, to more drought-tolerant Mojave Mixed Woody Scrub, Blackbush Scrub, and Great Basin mixed scrub on alluvial fans [USGS, 2011; Howald, 2000].

In the arid environment of the Owens Valley, vegetation communities are mediated by hydrology. On alluvial fan surfaces, where the water table is disconnected from the root zone, plants subsist on precipitation alone. Near stream channels, ditches, canals, and along the Owens River, surface-water supports riparian communities such as meadows, marshes and patches of willow and cottonwood. Areas of shallow groundwater, primarily located along the valley floor adjacent to the Owens River, support alkali meadow, alkali sink scrub, shadscale scrub, and desert saltbush and rabbitbrush scrub communities and intermediate types between these general classes. Discrete groundwater discharge zones, often related to faulting, support springs, alkali meadow, phreatophytic scrub communities, transmontane alkali marsh and aquatic habitat.

1.2.4 Soils

Surficial soil data were obtained from the Natural Resources Conservation Service (NRCS) soil survey geographic (SSURGO) database. Areas of similar soils are grouped into map units, which have similar physical, hydrologic, and chemical properties. Map unit properties are assigned a range of values based on the soils contained within them.

The large geographic extent and complex geology of Owens Valley results in a wide range of soil types. A total of 598 soil-map units were identified within the Owens Valley watershed, with 263 overlying the groundwater basin. Figure 1-6 shows a general summary of these map units classified by soil texture, which covers approximately 78% and 91% of the watershed and groundwater basin area, respectively. Areas not covered by the SSURGO data include the eastern Sierra Nevada and the southeastern portion of the watershed. Soil development is these areas is likely limited due to steep topography and/or very little precipitation.

Surface soil textures are dominated by sands and gravels, primarily silty sand which accounts for 46% of the groundwater basin area and generally results in high infiltration rates for the basin. Finer grained soil textures such as silts and clays make up approximately 25% of the area and

are generally located adjacent to the Owens River. About 12% of the area is labeled "Unknown" in the SSURGO database. The majority of this category is located near Owens Lake, where soils are dominated by evaporite salt deposits [Murphy, 1997].

1.2.5 Geology

The geologic history of Owens Valley is a complex mixture of rifting, faulting, volcanism, and deposition (Figure 1-7). The basin formed as a result Basin and Range extensional tectonics that caused land surface parallel to the fault trace to subside. This subsidence created space into which valley-fill has accumulated, consisting mainly of sediment shed from the adjacent uplifted mountain blocks. Volcanic deposits associated with crustal thinning from the extensional tectonic regime are interbedded with the valley-fill in numerous locations. Sedimentary material consists of unconsolidated to moderately consolidated alluvial fan and glacial moraine deposits adjacent to the mountain range fronts, fluvial plain deposits near the axis of the valley, deltaic deposits, and lacustrine deposits. Older alluvial fan deposits tend to be elevated and at the margins of the valleys. Sediments of the central axis of the valleys are typically fluviolacustrine, playa, and dune deposits. In well logs, valley fill sediments are expressed as sands, gravels, boulders, and clay layers. Sedimentary strata are variable vertically and laterally. Depositional environments change over relatively short horizontal distances resulting in laterally discontinuous sand, gravel, and clay lenses. Tectonic activity and climate variations change sediment supply and depositional energy at any given point, resulting in lithologies changing over vertical distances of a few feet to a few dozen feet. Laterally extensive clay strata are present beneath Owens Lake and in the Big Pine area. Total thickness of the basin alluvium ranges from a few feet on the margins of the valley to more than 8,000 ft beneath Owens Lake, although most wells are only screened in the upper 700 ft [Hollett and others, 1991; Danskin, 1998].

1.2.6 Hydrogeologic Framework

The following sections describe the general hydrogeologic conditions of each management area.

1.2.6.1 Fish Slough and Tri-Valley Management Area

Fish Slough, located to the north of the City of Bishop and to the west of Hammil and Chalfant Valleys in an area known as the Volcanic Tablelands, is a federally-designated Area of Critical Environmental Concern (ACEC) due to the presence of rare plants and animals. The aquifer is unconfined and composed of recent alluvium that has filled an asymmetric half-graben [Jayko and Fatooh, 2010; Zdon and others, 2019] bounded by the relatively impermeable Bishop Tuff.

Groundwater flows generally from the north to the south. Several springs discharge water along the Fish Slough fault zone and support habitat in the area. Water discharged along faults is considered to be the primary input to Fish Slough, as little precipitation falls directly on the subbasin and there are no natural drainages terminating within it (Figure 1-8). Based on geologic, hydrologic and geochemical studies, it is hypothesized that most of the water discharging from Fish Slough is sourced from the Tri-Valley and Casa Diablo areas via fracture flow though the Volcanic Tablelands that physically separate them. Spring flow is sufficient to establish a continuous meandering stream that is managed to support ponds, marsh, and meadow habitat and which eventually flows into the Owens River about seven miles to the south. This runoff, along with ET from phreatophytic vegetation, are the primary water-balance outflows from Fish Slough.

The majority of the Tri-Valley aquifer is unconfined, bounded by the Benton Range to the north, the Volcanic Tablelands (Bishop Tuff) to the west, the White Mountains to the east. It is composed of alluvial sediments shed from the surrounding uplands. Depth of alluvium has not been determined, but appears to be at several thousand feet thick in some locations [Bateman, 1965; PWA, 1980].

Recharge is primarily sourced from infiltration of runoff from the mostly ephemeral streams draining the White Mountains on the eastern side of the valley (Figure 1-8). Model results indicate direct precipitation on the valley floor contributes little to aquifer recharge (see Section 2.2.3 and Appendix 10 of Owens Valley GSP). Other potential inflows to the Tri-Valley aquifer are lateral groundwater flows across the California-Nevada border, recharge from runoff coming into the valley from the Volcanic Tablelands, and mountain front recharge along the margins of the valley. Lateral groundwater flows from Nevada and runoff from the Volcanic Tablelands are not anticipated to be large groundwater inflows. Contributions from mountain front recharge are poorly understood and commonly estimated during calibration of a groundwater flow model, which has not been developed for the Tri-Valley area.

Outflows from the Tri-Valley aquifer include groundwater pumping, intercepted groundwater that discharges within Fish Slough, ET from phreatophytic vegetation and irrigated lands, and lateral groundwater flow from Chalfant Valley to the Laws area of Owens Valley. Groundwater pumping for irrigated agriculture is likely the largest outflow from the Tri-Valley aquifer based on estimated pumping rates compared to observed Fish Slough discharge. Groundwater pumped for domestic use is likely a small fraction of the total volume of groundwater use given the low population density of the area.

Groundwater flow is generally north to south and toward the axis of the valley, following the topographic gradient. Gravity data indicate a bedrock high exists at the southern end of Chalfant Valley, which either limits lateral groundwater flow to the Owens Valley or deflects flow to the west under Fish Slough where the Bishop Tuff was deposited on top of the aquifer [Pakiser and others, 1964; Bateman, 1965; Hollet and others 1991]. No direct surface-water connection exists between the Tri-Valley area and the Owens River except for an ephemeral wash that occasionally flows from Chalfant into the Laws area during extreme precipitation events.

1.2.6.2 Owens Valley Management Area

The aquifer system of the Owens Valley management area is a complex, highly heterogeneous mixture of alluvial, fluvial, and lacustrine sediments interlayered with volcanic flows bounded by the Sierra Nevada to the west and the White/Inyo Mountains to the east. While no individual aquifers or extensive zones of permeability have been defined from well log data, the groundwater system is commonly described as a two aquifers separated by a confining layer (Danskin, 1988; Hollet and others 1991; Harrington, 2016). The upper unit is unconfined, while the lower unit is confined to semi-confined (Figure 1-9). Near the margins of the valley the confining unit generally thins out and the upper and lower units coalesce and form a single hydrogeologic unit. Therefore, aquifer characteristics are dependent on the specific location within the basin.

Most of the valley fill is clastic material shed from the surrounding mountains, the majority of which is sand and gravel. Alluvial fan sediments are coarse, heterogeneous, and poorly sorted at the head of the fans and finest at the toes, beyond which fans transition to lake, delta, or fluvial plain sediments [Hollett and others, 1991]. The transition zone from fan to valley floor is characterized by relatively clean, well-sorted sands and gravels that likely originated as beach, bar, or river channel deposits. This zone is a favored location for LADWP groundwater wells because the well-sorted sandy aquifers provide high well yields. This transition zone between the alluvial fans and valley floor roughly corresponds to the alignment wellfields that supply the Los Angeles-owend lands and the aqueduct. Extraction of groundwater from the transition zone has impacted groundwater dependent vegetation such that LADWP has implemented or plans to implement a number of revegetation, irrigation, and habitat enhancement projects to mitigate the effects of groundwater pumping [County of Inyo and City of Los Angeles, 1991].

Although volcanic flows comprise a relatively small volume of the valley fill, the most transmissive aquifers in the Owens Valley management area occur in basalt flows between Big Pine and Independence. Historically, the largest springs in the Owens Valley management area

occurred where high permeability basalt flows terminate against lower permeability sediments or are in fault contact with sediments. Most of these large springs stopped flowing shortly after 1970 due to increased groundwater pumping.

The Owens Valley management area aquifer system is dominated by infiltration of water from streams draining the Sierra Nevada as they flow over alluvial fans on the west side of the basin. Recharge from streams draining the Inyo Mountains on the east side of the basin also occurs, but the magnitude is much less due to the rain-shadow effect. A minor amount of recharge from direct precipitation on the valley floor also occurs, estimated to be less than 10 percent of the average annual precipitation rate [Danskin, 1998]. Deep percolation of water applied to irrigated agricultural fields is also an inflow but is partly comprised of pumped groundwater and is considered to be a small fraction of the overall water budget. Mountain front recharge may also contribute water to the aquifer system, but this process is poorly understood and therefore estimated values are highly uncertain.

Outflow from the Owens Valley management area aquifer system is primarily groundwater extracted from flowing artesian and pumped wells. Some of this water is used for irrigation, municipal, and domestic purposes within the valley, but the majority is exported out of the basin via the Los Angeles Aqueduct. Natural groundwater discharge includes evapotranspiration (ET) by phreatophytic vegetation that extract water from the shallow aquifer, discharge of water by springs and seeps, discharge of groundwater along gaining sections of the Owens River, and lateral groundwater flow to the south into the Owens Lake management area aquifer system.

1.2.6.3 Owens Lake Management Area

The Owens Lake management area is the most southern portion of the Owens Valley and the natural terminus of the basin. Prior to construction of the Los Angeles Aqueduct in the early 20th century inflows to the valley generally exceeded ET rates and formed Owens Lake, which covered more than 100 mi^2 and had depths greater than 20 ft [Danskin, 1998]. Climatic variations throughout recent geologic history created transgressive/regressive sedimentation at the lake and this depositional environment has resulted in the most stratified aquifer system in the groundwater basin, with at least five aquifers identified (Figures 3-3 through 3-8 in MWH, 2013b). All of these aquifers are confined due to the presence of a thick clay layer at the surface, with groundwater movement primarily directed upwards and towards the southern end of the brine pool (the lowest elevation of the dry lake) [MWH, 2013b].

Inflows to the Owens Lake management area aquifer system include recharge from streams draining the Sierra Nevada and Inyo/Cosos mountains as they cross over alluvial fans, down-valley groundwater flow from the Owens Valley management area, and northward seepage from

Haiwee Reservoir. Recharge enters along the margins of the Owens Lake management area, as the thick clay units that make up the playa bed combined with high ET rates and upward hydraulic gradients in the area prevent any direct recharge from precipitation.

Outflow from the Owens Lake management area aquifer system is primarily evaporation of water from the saturated clay layers that make up the playa surface and from discharge of water via springs, seeps, and flowing artesian wells. Evaporative concentration of solutes (primarily salts) in the aquifer due to the lack of a physical outlet has resulted in generally poor groundwater quality, and therefore limited pumping demand. The largest groundwater pumper in the area is the LADWP, which extracts approximately 1,500-2,000 acre-ft/yr near Olancha for agricultural irrigation when surface-water is not available. Crystal Geyser Roxane operates a bottling facility near Olancha and exports approximately 300 acre-ft/yr. The volume of groundwater pumped for municipal or domestic use is likely small due to the very low population density of the area. Groundwater extractions in the Owens Valley management area may increase in the future as LADWP is evaluating replacing some of the high-quality aqueduct water it currently uses for dust suppression activities on the playa with low-quality groundwater from the Owens Lake aquifer system [MWH, 2013a]. Owens Lake is owned and managed by the State of California; LADWP (or OVGA) activities on the lakebed must be permitted and conducted in cooperation with the California State Lands Commission.

1.3 Groundwater Flow Models

No groundwater flow model has been developed for the entirety of the Owens Valley groundwater basin. The model with the largest extent in the valley was developed by the U.S. Geological Survey (USGS) and simulates groundwater flow from the southern portion of Chalfant Valley to the southern tip of the Alabama Hills (see Figure 2 in Danskin, 1998) from October 1, 1962 to September 30th, 1988 (water years 1963-1988). This model is publically available, but of limited use as it has not been updated in over 30 years and has relatively coarse spatial (2,000 ft grid cells) and temporal (annual time steps) discretization reflective of the computational limitations at the time.

The LADWP has developed several groundwater flow models that cover the majority of the Owens Valley groundwater basin for the Owens Valley and Owens Lake management areas (Figure 1-10). Reports discussing model development have been provided by the LADWP, but repeated requests for model input files or detailed results from the LADWP models have not been fulfilled as of the date of this Tech Memo.

1.4 Data Quality Objectives

The quality of the available data evaluated in this Tech Memo were assessed with respect to sufficiency for use in GSP preparation. Members of the OVGA board, technical staff, and stakeholders must have a satisfactory level of confidence in the quality of the data which inform their decisions. Two primary data quality attributes are quantity (e.g., spatial and temporal coverage) and accuracy (see Appendix 4 of the OVGSP). Tech Memo evaluations are performed to assure that Data Quality Objectives (DQOs) are met, and that the analysis level of confidence is known and documented.

1.4.1 U.S. EPA Data Quality Objective Process

The following excerpt is from DWR's BMP #2:

> *"The GSP Regulations require GSAs to develop a monitoring network. The monitoring network must be capable of capturing data on a sufficient temporal frequency and spatial distribution to demonstrate short-term, seasonal, and long-term trends in basin conditions for each of the sustainability indicators, and provide enough information to evaluate GSP implementation. A monitoring network should be developed in such a way that it demonstrates progress toward achieving measurable objectives.*
>
> *As described in the Monitoring Protocols, Standards, and Sites BMP, it is suggested that each GSP incorporate the Data Quality Objective (DQO) process following the U.S. EPA Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA, 2006). Although strict adherence to this method is not required, it does provide a robust approach to consider and assures that data is collected with a specific purpose in mind, and efforts for monitoring are as efficient as possible to achieve the objectives of the GSP and compliance with the GSP Regulations"* (DWR, 2016b).

DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA, 2006). The DQOs clarify the monitoring program objectives, define the most appropriate types of data and conditions under which to collect the data, and specify acceptance criteria that will be used to evaluate whether the quantity and quality of data collected are sufficient to support decision making. The DQOs are used to develop a scientific and resource-effective design for data collection.

1.4.2 Basin-Specific Data Quality Objectives

The seven steps of the DQO process for this Tech Memo are presented in Table 1-1.

Table 1-1. Data Quality Objective Process

Step 1: State the Problem - define sustainability indicators and planning considerations of the GSP and sustainability goal
Historical datasets and existing monitor sites included in active monitoring networks (e.g., water quality and groundwater level data collection) are administered by independent entities that are not necessarily directly regulated by the OVGA and were designed and developed prior to SGMA with their entity specific purposes and goals. Data originally collected for other purposes must be sufficient to limit uncertainty when used to assess the sustainability indicators.
Step 2: Identify the Goal(s) - describe the quantitative measurable objectives (MOs) and minimum thresholds (MTs) for each of the sustainability indicators
Develop an OVGA monitoring program, relying on existing monitoring networks to the extent practicable, that is capable of providing sustainability indicator data of sufficient accuracy and quantity to demonstrate that the basins are being sustainably managed. MOs and MTs will be developed by the OVGA board of directors as part of the basin GSP's sustainable management criteria.
Step 3: Identify Required Information - describe the data necessary to evaluate the sustainability indicators and other GSP requirements (i.e., water budget)
Water budget components that are described in this Tech Memo include, but are not necessarily limited to, the following: • Land surface water budgets • Groundwater extraction (production) • Streamflow Additional data necessary to evaluate the sustainability indicators described in this Tech Memo include, but are not necessarily limited to, the following: • Water level data • Water quality data • Remotely sensed (satellite) data
Step 4: Define the Boundaries of the Study - This is commonly the extent of the Bulletin 118 groundwater basin or subbasin, unless multiple GSPs are prepared for a given basin. In that case, evaluation of the coordination plan and specifically how the monitoring will be comparable and meet the sustainability goals for the entire basin should be described
• Horizontal study boundaries are defined as the Owens Valley (6-012) Bulletin 118 groundwater basin. • Vertical boundaries are defined as the base of groundwater below ground surface that is of a sufficient quality and quantity that it can be beneficially used.

• There is no foreseeable temporal boundary as up-to-date water quality and water level data will continue to be necessary through GSP implementation and into the future to ensure sustainability in the basins is maintained once achieved.
Step 5: Develop an Analytical Approach - Determine how the quantitative sustainability indicators will be evaluated (i.e., are special analytical methods required that have specific data needs)
• Groundwater levels will be compared to the OVGA approved sustainable management criteria for which water level is established as a viable proxy in the basin's GSP. • Groundwater quality sample analytical results will be compared to the OVGA approved sustainable management criteria protective of water quality in the basins.
Step 6: Specify Performance or Acceptance Criteria - Determine what quality the data must have to achieve the objective and provide some assurance that the analysis is accurate and reliable
Analytical and Methodological Data Quality Objectives are described in the OVGA SAP (OVGA, 2020). The Data Gap Analysis component (Section 5) in this Tech Memo evaluates historical datasets and active monitoring sites included in current monitoring networks active in the basins. Spatial and temporal data gaps are considered in this evaluation and recommendations are presented on how refinement and expansion of the existing monitoring programs might minimize or eliminate data gaps, especially in critical areas.
Step 7: Develop a Plan for Obtaining Data - Once the objectives are known, determine how these data should be collected. Existing data sources should be used to the greatest extent possible
It is not the purpose of this Tech Memo to establish specific monitoring points but it is recognized that optimization and/or expansion of current monitoring programs may be necessary as many existing groundwater monitoring points are located outside of or adjacent to the GSP area.

1.5 Representative Monitoring Points

Representative Monitoring Points (RMPs) are a subset of the complete monitoring network within a basin [DWR, 2016b], which can be used to consolidate reporting of quantitative observations when multiple monitoring points exhibit similar behavior and trends. It is at the discretion of the GSA to adopt a single network of RMPs or identify RMPs for each sustainability indicator.

The following excerpt is from DWR's BMP #2:

> *"If RMPs are used to represent groundwater elevations from a number of surrounding monitoring wells, the GSP should demonstrate that each RMP's historical measured groundwater elevations, groundwater elevation trends, and seasonal fluctuations are similar to the historical measurements in the surrounding monitoring wells. If RMPs are used to represent groundwater quality from a number of surrounding monitoring wells, the GSP should demonstrate that each*

RMP's historical measured groundwater quality and groundwater quality trends are similar to historical measurements in the surrounding monitoring wells.

The use of groundwater levels as a proxy may be utilized where clear correlation can be made for each sustainability indicator. The use of the proxy can facilitate the illustration of where minimum thresholds and measureable objectives occur. A series of RMPs or a single RMP may be adequate to characterize a management area or basin. Use of the RMP should include identification and description of possible interference with the monitoring objective" (DWR, 2016b).

Numerous monitoring points have been established in the Owens Valley by multiple entities for various purposes (See Section 2.1.1). The majority of water levels in the basin are measured on a monthly or semi-annual basis by the LADWP or Inyo County Water Department (ICWD) as part of the LTWA. Other water level measurements in the basin include quarterly observations at solid waste (landfill) facilities, biannual observations collected as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) program, observations collected monthly to biennially from public water providers, and observations collected by private well owners. From late 1997 through early 2010 hourly data is available for some shallow piezometers in the Owens Lake management area. These wells represent a viable starting point for identifying RMPs for the basin and were included in the database management system supporting the GSP development and used for trend analysis in Section 4 of this Tech Memo.

Historical Datasets

This Section describes historical datasets and Section 3 discusses existing monitoring networks in the basins that will serve as ongoing sources of data collection in the basin that will add to the historical datasets and provide additional data for analysis that will inform GSP annual reporting and 5-year updates.

An initial data transfer was received from the ICWD for use in preparation of the GSP in mid-February 2019. This dataset included available groundwater level, production, and stream gaging data collected by the LADWP and ICWD. Requests for data were made at OVGA board meetings and resulted in water levels and/or production data being provided by the City of Bishop, Eastern Sierra Community Service District, Indian Creek-Westridge Community Service District, and Wheeler Crest Community Service District. The Great Basin Unified Air Pollution Control District (GBUAPCD) provided water levels for shallow (<30 ft) piezometers and spring

flow rates in the Owens Lake area. Additional well location, water level and water quality data were obtained from publically available sources.

Nearly all available groundwater level and water quality records contained in the available datasets are associated with a water well included in the OVGA well inventory (see Section 2.1.1). Spatial coordinates for six wells where water levels have been measured have not been identified. All data associated with these wells has been added to the database, but until locations are determined they are excluded from analysis. Additional information on how the OVGA intends to QA/QC data collected in the future for use in assessing sustainability in the context of the six Sustainability Indicators is available in the Sampling and Analysis Plan (Appendix 4 OVGA GSP).

The OVGA has developed an online, interactive, map-based data portal to provide the public access to data used in preparation of the Owens Valley GSP (https://Owens.GLAdata.com). This publicly accessible database includes basic querying and graphing (i.e., water level hydrographs and water quality time-series data charting) tools for public use. The ICWD plans to use this database as a repository for LADWP data for their daily operations in the future, and therefore it is anticipated to be updated regularly as additional data are collected and become available for import. The OVGA will determine the timing of acquisition and updating of other data contained in the database as funding and need requires.

2.1 Groundwater Data

Available subsurface data (e.g., well logs, groundwater levels, groundwater quality, etc.) for GSP preparation in the Owens Valley has historically been collected by several organizations. Current sources (monitoring entities) of these data are described in Section 3 of this Tech Memo. Most data are available through the Owens Valley GSP data portal.

2.1.1 Well Inventory

Well locations and construction information were primarily obtained from the ICWD and the DWR Well Completion Report database. Piezometer location and construction data was obtained from the GBUAPCD. Until development of the Owens Valley GSP, no single database contained all wells within the groundwater basin. Generally, coordinates provided by the ICWD and the GBUAPCD were for the actual well location and accurate to within a couple hundred feet or less. Coordinates obtained from the DWR are typically for the centroid of the section the well is located within, and therefore only accurate to approximately one half mile (about 2,700 ft). Locations of all identified wells in the OVGA database and subsets of wells with water level and

Table 2-1. Well Information Summary

	Groundwater Basin	GSP Area	Fish Slough and Tri-Valley Management Area	Owens Valley Management Area	Owens Lake Management Area[a]
Wells	4929	-	-	-	-
Wells with coordinates	4481	1903	287	935	681
Wells with accurate coordiantes [1]	2422	936	72	465	399
Wells with screen depth information [1,2]	1095	522	18	206	298
Wells with recent water level data [1,3]	874	123	20	62	41
Wells with recent pumping data [1,3]	179	15	0	15	0
Wells with recent water qualiy data [1,3,4]	117	83	12	62	9

1. Coordiantes do not correspond with centriod of section
2. Top of screen depth reported
3. Measurement collected since January 1, 2010
4. Limited to wells sampled for arsenic, chloride, sodium, nitrate, or total dissolved solids (TDS)
a. Includes piezometers

water quality data are shown in Figures 2-1a through 2-1c. Summary statistics for each management area are presented in Table 2-1.

A total of 4,929 wells have been identified as being located within the Owens Valley groundwater basin. Of these wells, 4,481 (91%) have reported coordinates and 2,422 (49%) have coordinates that are expected to be within 200 feet of the actual well location. The majority of wells (58%) identified in the Owens Valley are located on lands owned by the LADWP or tribal lands and therefore not subject to SGMA regulations.

It should be noted that the number of wells within the GSP area reported in Table 2-1 is overestimated. This due to the fact that the polygons shapefile of adjudicated lands obtained from the DWR omitted easements adjacent to roads and highways. Wells are commonly installed near roadways as they provide easy access for drilling equipment. This results in wells technically being located within the GSP area (as defined in Section 1.1.2) despite more accurately being associated with adjudicated lands within the groundwater basin (Figure 2-2).

Table 2-2. Well Use Summary

Well Use	Groundwater Basin	GSP Area	Fish Slough and Tri-Valley Management Area	Owens Valley Management Area	Owens Lake Management Area[a]
Agricultural	113	57	36	5	16
Domestic	1412	686	185	347	154
Flowing Artesian	77	8	0	0	8
Groundwater Monitoring	1627	577	24	234	319
Municipal and Industrial	516	208	22	140	46
Other[1]	280	63	4	44	15
Unknown	904	305	17	165	123

1. Exploratory borings, contaminant extraction wells, heat exchange wells, toes drains, vapor extraction wells, and toe drains
a. Includes piezometers.

Well use varies by management area (Table 2-2). The majority of wells in the Fish Slough and Tri-Valley management area are used for irrigated agriculture and domestic water supply. Most of the wells identified in the Owens Valley and Owens Lake management areas are used for groundwater monitoring, domestic water supply, and municipal and industrial water supply. It is assumed that most of the "Unknown" wells are used for domestic water supply and therefore considered *de minimus* users defined by SGMA.

2.1.2 Groundwater Levels

More than 535,000 water level measurements have been recorded in the Owens Valley at 1,314 wells between July 1924 and May 2020. Measurements are collected as a depth to water from a reference point, typically the top of the well casing. This value is then converted into a groundwater elevation using the elevation of the reference point. If the ground surface elevation is also known, a depth to water below ground surface (bgs) can be also be calculated. Groundwater level data assembled in the Owens Valley database were collected by multiple entities, and as such have varying degrees of data quality. Due to the sheer number of water level observations a complete review of data quality prior to development of the GSP was not

possible. Priority was given to checking data quality for representative monitoring points for which sustainable management criteria are based. It is anticipated that data quality issues will be addressed as they are discovered in the future.

Depth to water in the database is reported with the z axis increasing downwards, with deeper water levels having greater absolute values. Negative values of depth to water indicate confined conditions where the water level elevation is greater than the reference point elevation for the well (flowing artesian conditions). Reported depths are primarily for static water level measurements. Pumping-depressed water levels, while useful for some purposes, are generally not included in the database. Questionable measurement qualifiers are used to flag records in the database that may not represent static groundwater level conditions. Additional information on qualifying groundwater level data is presented in the Owens Valley Sampling and Analysis Plan (Appendix 4, OVGA GSP).

2.1.3 Spring Flow

Springs and seeps occur in the valley when groundwater discharges to the land surface and provide important habitat for flora and fauna. Springs are most commonly located at the toe of alluvial fans due to a combination of geologic properties, recharge from tributary streams, and the decreased surface slope at the boundary of the fan and the valley floor. They are also found in Fish Slough where groundwater discharges along faults, and in the Owens Lake area (although some of the springs are likely not naturally occurring but abandoned flowing artesian wells).

A total of 138 springs have been identified in the Owens Valley groundwater basin, with the majority of the gaged springs flows located on LADWP adjudicated lands. The only spring flow data identified in the groundwater basin is located within Fish Slough. Monthly flow volumes for a single spring (SW3208) are measured by the LADWP.

2.1.4 Groundwater Quality

The Owens Valley database contains nearly 88,000 observations of water quality at 676 wells in the groundwater basin from September 1934 to December 2019. Data are compiled from multiple sources, including the Groundwater Ambient Monitoring and Assessment Program (GAMA), GeoTracker, GBUAPCD, and municipal water providers.

With the exception of the Owens Lake area, where evaporative concentration has resulted in naturally elevated solute concentrations, water quality on the Owens Valley groundwater basin is generally good. This explains the general lack of water quality data in the basin, and why most

water quality data has been collected from wells and piezometers in the Owens Lake Area. Leaking underground storage tanks and landfills appear to be the primary source of anthropogenic groundwater contamination in the basin, and therefore are highly localized and already regulated by other agencies. No Superfund sites have been established within the groundwater basin.

Time series graphs for wells that contain at least three analytical results for arsenic (As), chloride (Cl), sodium (Na), nitrate (NO_3), or total dissolved solids (TDS) are included in Appendix D of the GSP. A trend analysis of these chemicals (analytes) is included in Section 4.1 of this Tech Memo for wells in the groundwater basin that contain sufficient data (i.e., at least six data points) to perform the analysis.

2.1.5 Groundwater Extractions

Groundwater in the Owens Valley is extracted via pumping wells or flowing artesian wells. Data requests for groundwater pumping data were made to Inyo County, Mono County, Tri-Valley Groundwater Management District (TVGMD), municipalities, community service districts, and Crystal Geyser Roxane. Responses were received by the City of Bishop, Indian Creek-Westridge community service district (ICWCSD), Eastern Sierra community service district (ESCSD), and Wheeler Crest community service district (WCCSD), with only the City of Bishop and ICWCSD having records of pumping data. Pumping for Big Pine, Independence, and Lone Pine is from LADWP-owned wells and available through the ICWD.

2.1.5.1 Fish Slough and Tri-Valley Management Area

There are no groundwater extractions within Fish Slough due to its status as an ACEC. Groundwater pumping in the Tri-Valley area is primarily used for agricultural irrigation and domestic purposes, with agriculture being the dominant use. No pumping data have been provided by Mono County or the Tri-Valley Groundwater Management District, if any exist.

Harrington [2016] estimated agricultural groundwater pumping in 2014 was approximately 21,000 acre-ft/yr, based on irrigated acreage and an assumed application rate of 5 ft/yr. This likely represents an upper limit of groundwater pumping in Tri-Valley due to irrigation efficiency improvements in the area. Taking this and the fact that some fields have access to surface water into account, agricultural groundwater pumping in the Tri-Valley area is estimated to be 13,000 to 19,000 ac-ft/yr, using an average irrigated area of 3,800 acres [DWR, 2020] and a range of 3.5 to 5 ft/yr of applied groundwater. Pumping for domestic use is expected to be about 500 acre-ft/yr as fewer than 1,000 people live in the Tri-Valley area [Mono County, 2008].

2.1.5.2 Owens Valley Management Area

Groundwater in the Owens Valley management area is extracted via pumping wells or flowing artesian wells. Monthly volumes of water extracted are recorded by the LADWP for all of their wells and these data are provided to the ICWD as part of the LTWA. This extraction data is requested and received by the ICWD annually (most recent though 2020). While these data are helpful in creating a basin-wide groundwater budget, nearly all of the wells are located on lands owned by the LADWP and therefore exempt from SGMA regulations.

There are approximately 11,000 irrigated acres in the Owens Valley management area between the Inyo-Mono county line and the northern tip of the Alabama Hills where the transition to the Owens Lake portion of the basin begins [DWR, 2020]. It is difficult to calculate the irrigated acreage within the GSP area, as the clipping artifact from omitting road easements discussed in Section 2.2.1 results in edges of fields that clearly overly lands owned by the LADWP appearing within the GSP area (Figure 2-3). Although this area is relatively small for an individual field, it becomes significant when aggregated over the basin. Less than 900 (<8%) irrigated acres overlie the GSP area and are primarily located in Round Valley west of the City of Bishop. The DWR shapefiles do not indicate the water source for each field, but aerial imagery and local knowledge of irrigation practices suggest surface-water is used for almost all of the fields. Assuming that 20% of the agricultural area within the GSP is irrigated with groundwater at a rate of 5 ft/yr, an upper limit estimate of groundwater pumping for agricultural use in the Owens Valley management area is about 900 acre-ft/yr. As more detailed identification of agricultural lands within the GSP area would most likely result in a smaller irrigated acreage within the Owens Valley management area due to the removal of the clipping artifact present in the DWR data, actual groundwater pumping for irrigation within the GSP area is expected to be lower.

Recent extraction volumes provided by the City of Bishop and the ICWCSD show the combined pumping of the two averages about 1,600 acre-ft/yr. The City of Bishop has the greatest population in the Owens Valley, and therefore represents a significant fraction of domestic water use. Other population centers in the Owens Valley management area include Laws, Big Pine, and Independence, which are provided water from LADWP wells as part of the LTWA. Although monthly pumping volumes for these wells are known, they are significantly greater than anticipated usage based on population and indicate the wells are used for purposes in addition to local municipal supply. Assuming a conservative per capita water use of 450-500 gallons per day and a population of about 14,000 people [Alpert and others, 2019], estimated groundwater pumping for domestic use in the Owens Valley management area totals about 7,000 -8,000 acre-ft/yr.

2.1.5.3 *Owens Lake Management Area*

Similar to the Owens Valley management area, groundwater in the Owens Lake management area is extracted via pumping wells or flowing artesian wells. The dominant groundwater use is for irrigated agriculture to the south of the brine pool. Groundwater is also used for export in the form of bottled water from Crystal Geyser Roxane, and domestic purposes. Abandoned flowing artesian wells have also become artificial springs that support wildlife habitat. Groundwater extraction in the Owens Lake management area is relatively low due to the low population density, little LADWP extraction, and generally poor water quality in the vicinity of the lake itself. Most extraction wells are located along the margin of the playa where water quality is better, because relatively low TDS concentration recharge water occurs before mixing with the high TDS concentration aquifer water under the lakebed.

There are approximately 950 irrigated acres within the Owens Lake management area, with about 500 acres (53%) located within the GSP area. Estimated groundwater pumping for fields located within the GSP area ranges from about 5,000 - 6,000 acre-ft/yr assuming application rates of 10-12 ft/yr. The high application rates in this portion of the groundwater basin are due to the high solar intensity, aridity, and wind speeds (Aaron Steinwand, personal communication).

Pumping records were requested from Crystal Geyser Roxane but no response was received. Harrington [2016] estimated the pumping volume from the bottling plant to be 300 acre-ft/yr. Population in the Owens Lake management area is approximately 1,000 people so domestic groundwater use is expected to be less than 500 acre-ft/yr. This population includes the town of Lone Pine which has a community services district serviced by two wells (W344 and W346) located outside of the GSP area on lands owned by the LADWP. Since the year 2000, extractions from these wells have averaged about 680 acre-ft/yr.

2.2 Surface-water Data

Streamflow and water quality datasets for the Owens River and its tributaries are described below.

2.2.1 Streamflow Gaging

A total of 627 stream gaging locations operated by the LADWP and the USGS have been identified in the Owens Valley watershed (Figure 2-4), with 470 having at least one flow observation collected since January 1, 2010. The majority of the stream gages in the basin are operated by the LADWP. The only active USGS gages in the basin are located within the Bishop Creek sub-watershed.

Data collected by the LADWP are typically reported as monthly volumetric flow for the gage, whereas data from the USGS are commonly reported as average daily flow rates. Excluding the Tri-Valley area, most tributaries that contribute a significant amount of runoff into the basin are gaged, and these data provide a good estimate of the runoff entering the Owens Valley. With the exception of Coldwater and Piute creeks, streams entering the Tri-Valley area are not currently nor have been historically gaged.

2.2.2 Surface-water Quality

Surface-water runoff entering the Owens Valley is primarily sourced from Sierra Nevada snowmelt and is generally considered to be excellent in quality. As a result, limited surface-water quality data has been collected in the basin, typically consisting of a single sample for a given location. As it is impossible to determine water quality trends from a single data point, and the OVGA does not have any legal jurisdiction over surface-water, these data were not assimilated into the Owens Valley database. This may change if more surface-water quality data become available in the future.

2.3 Meteorological Data

2.3.1 Precipitation

Measured precipitation data are available at several monitoring sites within the Owens Valley watershed (Figure 2-5). The majority of stations report rain or snow accumulation on a monthly basis. Hourly data is available at the Benton (BTN) and Bishop CIMIS stations.

2.3.2 Evapotranspiration

Daily reference ET (ET_0) are available at the California Irrigation Management Information System (CIMIS) station located in the City of Bishop (Figure 2-5) from February 4th, 1983 to the present. These daily values are multiplied by a crop coefficient (K_c) factor to obtain an estimate of plant water demands [Allen and others, 1998].

Estimates of ET for the Tri-Valley area are typically based on irrigated acreage, as depth to groundwater is generally deeper than what is accessible by phreatophytic vegetation except for small acreages of GDE's outside of Fish Slough (Appendix 9 OVGA GSP). Duell [1990] estimated annual ET rates for Alkaline scrub and meadow communities between Laws and Independence from 1984-1985 in areas with relatively shallow groundwater levels (<5 ft below ground surface). Values ranged from about 11.6 in/yr at a low-density scrub site to 44.8 in/yr at a high-density meadow site. Steinwand and others [2006] estimated annual ET for similar vegetation types and

shallow groundwater conditions to range from about 7.1 in/yr to 27.0 in/yr. The authors note that the growing season ET rates are similar between the two studies; Duell [1990] estimated winter ET rates that were 1.5 to 4 times greater and assumed no interannual changes in vegetation cover, an assumption that drew skepticism. Estimates of ET rates from the Owens Lake portion of the basin range from 3.4 in/yr for evaporation from bare, sandy soils to 45.0 in/yr for free-surface evaporation from the brine pool (see Table 14 in MWH 2013b).

Recently, the LADWP has contracted with Formation Environmental, LLC to develop basin-wide estimates of actual ET from the mid-1980s to the present on a monthly time step using a combination of remote sensing and monitoring stations. These data were requested from the LADWP, but has not been released as the analysis has not been completed. It is expected this data may be included in the GSP five year update.

Existing Monitoring Networks

Multiple entities have established monitoring networks in the Owens Valley groundwater basin. The largest and most frequently measured monitoring well network is maintained by the LADWP and Inyo County Water Department. The U. S. Geological Survey (USGS) has historically conducted studies in the basin, but does not routinely monitor groundwater levels or water quality. Several studies have included targeted data collection programs and have contributed to the available datasets in the basins.

Adequacy of the existing monitoring well network for evaluating groundwater level and quality spatially is discussed in Sections 5.3 and 5.4, respectively. This includes consideration of the number and distribution of wells screened discretely within in a single aquifer zone in the groundwater basin.

3.1 Groundwater Levels

Existing monitoring networks in the Owens Valley groundwater basin form the basis for the Development of the OVGA water level monitoring program that is intended to demonstrate sustainable groundwater management. Entities that collect groundwater data in the Owens Valley include, but are not limited to:

- LADWP
- Inyo County Water Department
- USGS special studies

- Municipalities (e.g., City of Bishop, community water districts, etc.)
- Landfill operators (e.g., Benton, Chalfant, etc.)
- Consultant reports and technical studies
- Private well owners and purveyors of pumped groundwater

There are 890 wells identified with recent (January 1st, 2010 and later) water level observations, most of which are operated by the LADWP (Figure 3-1a). The vast majority of these wells are located on adjudicated lands, with only 128 wells with recent water level data identified within the GSP area (Figure 3-1b). As mentioned in Section 2.1.1, this number is also an overestimate due to many of these wells being located within road easements that were not included in the adjudicated lands shapefile provided by the DWR.

Monitoring frequency varies by entity. The LADWP typically collects monthly or bimonthly measurements. Water levels at landfills in the basin are collected on a quarterly basis. Municipalities appear to collect water level data on a quarterly to annual basis. Most of the data appear to be discreet observations collected manually; there is no evidence of a groundwater level telemetry system operational in the valley. Pressure transducers appear to have been deployed in the Owens Lake area from about the mid-1990s to early 2010, but their use has been discontinued since.

3.2 Groundwater Quality

Due to the generally high quality of water in the Owens Valley, no formal network has been established to measure and monitor groundwater quality in the basin. Monitoring is typically done on a well-specific basis according to the California Regulations Related to Drinking Water, or a site-specific basis according to the California State Water Resources Control Board in response to localized groundwater contamination (e.g., leaking underground storage tank). As a result, most groundwater quality observations are clustered around population centers in the basin.

A total of 115 wells that have at least three analytical results for arsenic (As), chloride (Cl), sodium (Na), nitrate (NO_3), or total dissolved solids (TDS) and have been sampled since January 1, 2010 have been identified within the groundwater basin (Figure 3-2a), with 82 of these wells located within the GSP area (Figure 3-2b). Most of these wells are located in and around the City of Bishop, and therefore groundwater quality data are limited or nonexistent for many portions of the basin.

Trend Analysis

The trend analysis included in this Section includes evaluation of groundwater level and quality observations from select wells in the Owens Valley groundwater basin that contain sufficient data for analysis. This includes some of the LADWP wells located outside of the GSP area, as they represent the most frequently monitored wells with the longest observation records, and also provide important context for groundwater conditions within the basin as a whole. Trends for each management area are presented separately and evaluated in the context of dry,

Table 4-2. Water year type classifications

Condensed WY Index Classification	DWR Water Year Index Classification	Representation on Hydrograph
Dry	D (dry year type). C (critical year type)	Red rectangle
Average	AN (above normal year type), BN (below normal year type)	--
Wet	W (Wet year type)	Blue rectangle

average, and wet water year types (if sufficient data exist to do so). Water year types are defined using the San Joaquin Valley Water Year (WY) Index calculated by the DWR (2020). For better readability, the water year indices were condensed into the three categories shown in Table 4-1. Consideration of the aquifer zone or zones in which a well is screened (open) is taken into account when that information is available, as it can be important in appropriately interpreting observed trends.

4.1 Groundwater Levels

The Sections below contain the groundwater level trend analyses for the three management areas of the Owens Valley groundwater basin. The red and blue rectangles at the bottom of the plots indicate dry and wet years, respectively (see Section 4). Well locations for each management area are shown and can also be found by searching the Owens Valley online data portal (https://owens.GLAdata.com) using the well name indicated on the plot.

4.1.1 Fish Slough and Tri-Valley Management Area

Water level trends were analyzed for four representative wells in the Fish Slough and Tri-Valley management area (Figure 4-1). Figure 4-2 shows groundwater levels for four representative wells in the Fish Slough and Tri-Valley management area. The black line on the plot displays a linear regression, with the rate of decline and coefficient of determination (R^2) displayed. In general, water levels have been slowly but steadily declining since the late 1980s. Benton and Chalfant Valleys show similar rates of decline that average about -0.5 ft/yr, with total historical declines of about 9.5 ft and 15.3 ft, respectively. Hammil Valley water levels show an even faster rate of decline of approximately -1.8 ft/yr based on limited data.

Water levels in Fish Slough also show persistent groundwater declines since the late 1980s, with timing consistent with declines observed in the Chalfant Valley. Unlike water levels in the Tri-Valley, water year type appears to have a greater influence on water levels in the Fish Slough, with water levels appearing to stabilize or even increase slightly during wet years. As a result, the rate of water level decline is lower at approximately -0.15 ft/yr.

4.1.2 Owens Valley Management Area

Groundwater levels and trends in the Owens Valley management area vary depending on time and location. This is a result of both complicated geology, the high degree of groundwater and surface-water management in the area, and the LTWA. Figure 4-3 shows the locations of representative monitoring wells in the Owens Valley management area. Generally, groundwater levels appear to be in a dynamic steady state that track hydrologic conditions: water levels increase during wet years and decrease during wet years (Figures 4-4a through 4-4d). The rate at which this increase or decrease occurs during a given dry period appears to be well-specific, likely influenced by multiple local factors such as nearby pumping, managed surface water spreading (managed aquifer recharge or MAR), well screen interval, and geologic conditions.

The two major periods of groundwater decline observed in the Owens Valley management area since 1980 coincide with the two major droughts during this period (1986-1992 and 2012-2016).

Water levels for most wells reached their lowest values during the 1986-1992 drought, due to the severity of the drought and also due to pre-LTWA water management which included the highest annual pumping totals in history by the LADWP. Water levels during the more recent drought are generally higher than the 1986-1992 period due to full, ongoing implementation of the LTWA and a reduction in LADWP pumping during later droughts. All wells appear to have recovered or mostly recovered from the 2012-2016 drought or are showing increases in groundwater levels since January 2017. Where possible, Figures 4-4a through 4-4d are annotated with the aquifer zone (unconfined or confined) the well is believed to be screened in. Wells with screen intervals within 100 ft bgs or wells with dry observations were assumed to be screened in the shallow unconfined aquifer zone.

4.1.3 Owens Lake Management Area

Groundwater levels in the Owens Lake management area are highly dependent on spatial location and screened interval of the well. This is due to a combination of effects such as the highly stratified ("layer cake") geology that results in five separate aquifers, the asymmetric depth of this portion of the basin which results in a great deal of lithostatic pressure exerted on the lower aquifers on the western side of the management area, and this area being the natural terminus of the groundwater basin. This results in water level elevations that can vary over 80 ft within the same aquifer unit (see Figure 19 in MWH, 2013b). However, within a given well, water levels show relatively minor fluctuations. Locations of representative monitoring wells are shown in Figure 4-5, with water level trends for each aquifer system discussed below.

Figure 4-6a shows water level elevations for a single well screened from 30-40 ft bgs and three shallow piezometers screened between 3 and 10 ft bgs. Water levels appear to be in a dynamic steady state condition, showing both seasonal fluctuations and multi-year trends. Water levels decrease during dry years and increase during wet periods. Pumping stress in this management area is relatively constant and low. While the piezometer data is only available through early 2010, water levels in T588 quickly recovered following the 2012-2016 drought. For the time period data are available, water levels in the shallow aquifer system have fluctuated about 16 feet in T588 (Lone Pine) and about 4 feet in the shallow piezometers.

Water level data for Aquifers 1-5 are presented in Figures 4-6b through 4-6f. Assignment of wells to a specific aquifer is the same as that presented in the LADWP's Owens Lake Updated Conceptual Model Report (see Appendix H of MWH [2013b]). Of the 58 wells assigned to Aquifers 1-5, 31 had water level data available. Water level trends are generally consistent across the aquifers, with levels decreasing during the 2012-2016 drought and then recovering during the following wet period. These fluctuations are relatively minor, typically ranging between 2

and 8 feet total for the period of record. Groundwater elevations in the lower aquifers are greater than those in the upper aquifers, resulting in a general upward gradient in the playa area of the old lake bed.

Wells T901 (Aquifer 1) and T899 (Aquifer 5) show much more stable water levels compared to the other wells screened in Aquifers 1-5. The timing of the increased groundwater levels following the 2012-2016 drought is consistent for these two wells, suggesting similar hydrologic processes are influencing their groundwater elevations. The presence of Inyo Mountain Front Fault to the east of these wells (Figure 4-5) may restrict groundwater flow and/or compartmentalize the aquifers in this portion of the management area.

The two wells that show the greatest fluctuations in water levels are River Site Lower (Aquifer 2) and SFIP MW (Aquifer 3). The high frequency and short duration of the fluctuations is attributed to pumping from wells located nearby the monitoring wells. Despite the relatively large drawdown, water levels quickly recover to their pre-pumping levels and do not show long-term decline.

Another spatially localized trend is visible in the DVF South Upper, Middle and Lower wells that correspond to Aquifers 1-3, respectively. Water levels showed larger declines during the summer of 1999 and 2000 compared to years prior and following. This is likely due to increased pumping from the LADWP in the nearby Lone Pine well field from spring 1998 through 2000. Water levels recovered the following winter in both instances. This indicates that groundwater pumping from the Lone Pine well field influences water levels in the northern portion of the Owens Lake aquifer system, but recent management of pumping has kept groundwater levels in a dynamic steady state equilibrium as evidenced by recent water levels in nearby wells T904 (Aquifer 1), River Site Lower (Aquifer 2), and T917 (Aquifer 3).

4.2 Spring Flow

Annual volumetric discharge from the gaged spring as well as total runoff from Fish Slough is shown in Figure 4-7. Flow data collected from the Fish Slough northeast spring (SW3208) show discharge has steadily decreased since the early 1990s at a rate of approximately -18 AF/yr. The rate of decline tends to increase during dry years and decrease during wet years. These data correspond with reductions of Fish Slough total annual runoff (SW3216; Figure 4-7, bottom) of about -87 AF/yr since at least 1980. Since there are no surface-water features that terminate within Fish Slough and estimated runoff from precipitation within the subbasin is only about 50 AF/yr (Appendix 10 OVGA GSP), the majority of runoff must be sourced from groundwater discharge. Since total runoff has steadily declined, either inputs (e.g., groundwater discharge) to

the subbasin have decreased or outputs from the subbasin (e.g., ET) have increased. Increased ET is an unlikely explanation, as decreasing groundwater levels observed in the subbasin would ultimately lower ET rates as water would become increasingly inaccessible for use by phreatophytic plants. Therefore, the most plausible explanation for the decrease in total runoff is a decrease in groundwater discharge within the basin that ultimately becomes runoff. This is supported by the observed decrease of flow from the northeast spring (SW3208).

Gaged spring flow data from outside of the adjudicated portions of the OVGB has not been identified. As a result, no trend analysis was performed on springs located in other portions of the groundwater basin.

4.3 Groundwater Quality

The sections below contain water quality trend analyses for the three management areas of the Owens Valley groundwater basin. Constituents of general concern in the groundwater basin are arsenic, nitrate, total dissolved solids (TDS), chloride, and sodium. Both arsenic and nitrate have legally enforceable maximum contaminant levels (MCLs) of 10 micrograms per liter (µg/L) and 10 milligrams per liter as nitrogen (mg/L as N), respectively. Secondary, non-enforceable standards for TDS and chloride have been set at 500 mg/L and 250 mg/L, respectively. Sodium was included in the analysis because it is part of the conditional use permit issued by Inyo County for the Crystal Geyser Roxane water bottling plant expansion in the Owens Lake management area, although no state or federal standard has been set for it.

4.3.1 Fish Slough and Tri-Valley Management Area

Representative wells with recent water quality data in the Fish Slough and Tri-Valley management area are shown in Figure 4-8. Groundwater quality is generally good, with only CH-MW3 exceeding the secondary standard for TDS (Figure 4-9). CH-MW3 is a landfill monitoring well, so the elevated solute concentrations are likely due to proximate infiltration of leachate. The other constituents evaluated do not appear to show any significant trend, suggesting the observed concentrations are generally indicative of natural conditions in the basin. No water quality data is available for the Fish Slough subbasin as of 2018, but since there is no development in that area water quality is assumed to be consistent with natural conditions.

4.3.2 Owens Valley Management Area

Representative wells with recent analytical data in the Owens Valley management area (Figure 4-10) show groundwater quality is generally very good, with none of the representative wells exceeding any of the primary or secondary MCLs (Figures 4-11a through 4-11d). Concentrations

in the representative monitoring wells for the five constituents evaluated generally appear to be stable over the last three decades. Nitrate concentrations, which are a common concern for many California groundwater basins, are typically less than 2 mg/L as N and therefore well below the MCL of 10 mg/L as N.

Elevated concentrations of arsenic above the MCL of 10 µg/L are observed in some wells (OV-32, 1400036-001, COB 1, F131, OVU-02, and OV-35) within and adjacent to the Owens Valley management area. These are naturally occurring due to the numerous volcanic deposits present in this portion of the basin which commonly contain high arsenic concentrations. Municipal wells with elevated concentrations above the MCL for a given constituent are typically operated on a stand-by basis only (City of Bishop, 2008).

4.3.3 Owens Lake Management Area

Locations of representative monitoring wells for the Owens Lake management area are shown in Figure 4-12. Each of the five aquifers has at least one well with recent water quality data for all five contaminants of concern (Figures 4-13a through 4-13e). In general, water quality in the vicinity of the lake itself is very poor due to evaporative concentration of solutes. Concentrations of most constituents evaluated appear to increase from north to south, suggesting concentrations vary more in the horizontal direction than they do in the vertical direction. While the limited number of data points makes this far from a definitive trend it is consistent with the conceptual model of groundwater flow and evaporative discharge for this portion of the basin. Concentrations of TDS, chloride, and sodium are relatively stable within a given well. Arsenic is the only constituent that shows erratic concentrations that fluctuate between non-detectable to nearly an order of magnitude greater than the MCL of 10 µg/L. Nitrate was not detected in any of the representative monitoring wells, and is typically observed at concentrations well below the MCL of 10 mg/L as N.

Analysis of Potential Data Gaps

A data (or knowledge) gap is defined in the SGMA regulations as a "lack of information that significantly affects the understanding of the basin setting or evaluation of the efficacy of Plan implementation, and could limit the ability to assess whether a basin is being sustainably managed" [23 CCR §351 (l)]. Data gaps are addressed in the SGMA regulations regarding Assessment and Improvement of Monitoring Network (a)-(e) contained in 23 CCR §354.38 (reproduced below):

(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.

(c) If the monitoring network contains data gaps, the Plan shall include a description of the following:

(1) The location and reason for data gaps in the monitoring network.

(2) Local issues and circumstances that limit or prevent monitoring.

(d) Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

(e) Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:

(1) Minimum threshold exceedances.

(2) Highly variable spatial or temporal conditions.

(3) Adverse impacts to beneficial uses and users of groundwater.

(4) The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.

The term "potential" data gap is used in this Section since the determination of "information that significantly affects the understanding of the basin setting or evaluation of the efficacy of Plan implementation" is largely subjective. Comparison of data collection cost with respect to significance to GSP preparation, implementation, and periodic reevaluation should be

Table 5-1. Fish Slough and Tri-Valley well location and construction data

Well Location and Construction Data		
Reported Data Type	**Number of Wells**	**Percentage of Wells (%)**
Coordinates	287	100
Accurate coordinates	58	20.2
Total depth	39	13.5
Depth to top of screen	214	74.6
Depth to bottom of screen	218	76.0
Pump depth	0	0

considered when prioritizing the filling of data gaps. In addition, not all data gaps must be filled at the time the GSP is submitted in order to produce a SGMA compliant GSP. However, flow additional data points will likely inform subsequent GSP 5-year assessments (i.e., updates). The chart depicted in Figure 5-1 is from BMP #2 and lays out the path GSA's should follow to identify and address data gaps in their sustainability planning [DWR, 2016b].

Data available in the Owens Valley groundwater basin reviewed while preparing this Tech Memo are generally of high quality, but spatial and temporal coverage vary depending on the management area. Potential data gaps are present in the historical groundwater datasets presented in Section 2 and in existing monitoring networks summarized in Section 3. A number of potential data gaps grouped by management area and data type are presented in this Section. Recommended prioritization for filling identified data gaps can be found in Section 6.

5.1 Fish Slough and Tri-Valley Management Area

5.1.1 Well Geographic Location and Construction

Data related to the location and construction of wells in the Fish Slough and Tri-Valley management area are mixed in terms of completeness. Table 5-1 summarizes the number and percentage of wells with various location and construction data relevant to developing sustainable management criteria for the GSP. Although a large percentage (nearly 75%) of wells have reported screen intervals, few wells have accurate coordinates associated with them. Minimum values for some unreported data can be inferred from other sources. For example, only 13.5% of wells have a reported total depth, but 75.7% wells have a reported depth to bottom of screen. Therefore, the bottom of screen depth could be used as a minimum value for the total depth of the well.

Unfortunately, the lack of a precise location for most wells makes the screen depth information largely unusable. This is because the high degree of topographic relief in the valley means that ground surface elevation may range by tens of feet or more within the possible area most wells are located. This level of uncertainty makes a meaningful well vulnerability assessment difficult.

5.1.2 Groundwater Level Data

Groundwater level data availability in the Tri-Valley area is generally highly localized. In the Benton Valley, only five wells associated with a landfill collect groundwater level data on a quarterly basis. Although the data from these wells is considered very high quality and dates back to the early 1990s, their lateral spacing is so close that at the scale of the valley they can be considered a single monitoring point (Figure 4-1). Currently, the OVGA database contains water levels in the Hammil Valley collected from two private wells, one (Hammil 1) with seven observations collected irregularly since July 2007 and the other (Hammil 2) with a single observation from May 2019. Monitoring wells with groundwater level data have a much greater spatial distribution in the Chalfant Valley compared to the Benton and Hammil Valleys. This is largely due to data collection by the LADWP which has installed several wells in this portion of the management area (Figure 4-1). Additional water level observations (locally known as the "Hutton" dataset) for the Tri-Valley exist, but these have not been provided to the OVGA as of the date of this report.

The lack of spatially distributed water levels in the Benton and Hammil Valleys is a significant data gap because the configuration of the water table cannot accurately be determined. Although observed water level declines have been remarkably consistent at locations where data has been collected, projecting water levels beyond the immediate vicinity of these wells is highly uncertain because local or valley-specific water table gradients cannot be calculated using only a single spatial location. Using wells across multiple valleys to calculate groundwater gradients is not advised due to the stepped topographic profile of the Tri-Valley area.

Groundwater level data availability for Fish Slough is generally good. Three wells (T397, FS-1, and Zack) have been completed and screened in the Bishop Tuff and provide an estimate of regional groundwater levels from the deeper aquifer. Two other wells (FS-2 and FS-4) are screened in the alluvial aquifer of Fish Slough. FS-4 is a very shallow well (8 ft) and has been reported dry since 2009, but FS-2 generally shows seasonal fluctuations in the alluvial aquifer with a slightly decreasing trend. Additionally, four new monitoring wells (two clusters containing a shallow and deep pair) have been installed by LADWP since 2018 in the southern portion of Fish Slough. It is anticipated that data from these wells will be added to the ICWD and OVGA databases regularly.

Table 5-2. Owens Valley well location and construction data

Owens Valley Management Area Well Location and Construction Data		
Reported Data Type	**Number of Wells**	**Percentage of Wells (%)**
Coordinates	938	100
Accurate coordinates	297	31.7
Total depth	240	25.6
Depth to top of screen	507	54.1
Depth to bottom of screen	516	55.0
Pump depth	0	0

5.1.3 Groundwater Quality Data

Wells where groundwater quality has been recently sampled multiple times is limited to the Benton and Chalfant Valleys (Figure 4-8). Although spatial coverage of water quality data is limited, anthropogenic (human-caused) sources of groundwater contamination are considered to be limited due to the rural nature of the area. Since agriculture and ranching are the dominant land uses, nitrate would be the most likely constituent with non-naturally elevated concentrations. However, nitrate concentrations are well below the MCL of 10 mg/L as N for all samples collected (Figure 4-9). These observed concentrations are consistent with the dominant crop type being alfalfa, which does not require significant N-fertilizer application as it fixes is own nitrogen in the soil. Trends for the five evaluated constituents appear to be generally stable, and indicative of naturally occurring conditions.

5.1.4 Groundwater Extraction Data

No groundwater extraction data have been provided for wells within the Fish Slough and Tri-Valley management area. Estimates of groundwater pumping are typically calculated using an assumed application rate (typically 3-5 ft/yr) and the irrigated area (about 3,900 to 4,200 acres). Groundwater pumping in the Hammil Valley appears to be greater than in the Benton and Chalfant Valleys based on irrigated acreage [Harrington, 2016] and rate of groundwater level decline (Figure 4-2).

5.2 Owens Valley Management Area

5.2.1 Well Construction and Geographic Location

Nearly 940 wells have been identified within the Owens Valley management area, although this number is overestimated due to artifacts in the DWR adjudicated lands shapefile (see Section

2.1.1). Approximately one-third of these wells have accurate spatial coordinates, with half of the wells being located at section centroids. Screen depths are reported for a little over half of the wells, but as discussed in Section 5.1.2 the lack of accurate spatial data combined with the high degree of topographic relief and varying well construction over time in the valley currently precludes a meaningful well vulnerability assessment.

5.2.2 Groundwater Level Data

Spatial observations of groundwater levels within the Owens Valley management area are generally sparse since the majority of the groundwater monitoring is conducted by the LADWP on adjudicated (SGMA-exempt) lands. The LADWP groundwater monitoring network includes a small number of wells located within or immediately adjacent to the GSP area on the west side of the management area from Aberdeen to Lone Pine Creek (Figures 4-4c and 4-4d). Although the sampling frequency of these wells is quite high, they are spaced about 2.5 miles or greater apart. Most of Round Valley, located northwest of the City of Bishop, and numerous small segments of the basin along the western margin of the GSP area do not have nearby water level data. The largest portion of the management area without any groundwater level information is the eastern side, particularly near Crooked Road Canyon, along Death Valley Road, and Harkless Flat. However, this area contains isolated public lands which are undeveloped.

5.2.3 Groundwater Quality Data

The majority of wells used as representative monitoring points for groundwater quality in the Owens Valley management area are typically located either outside of the GSP area or near the down-gradient boundary with adjudicated lands. The lack of water quality observations within the GSP area is not necessarily a problem, since the constituents being evaluated will be transported in the same direction as groundwater flow. Therefore, if a representative monitoring point is along a flow path coming from the GSP area, then concentrations in that well will be a reflection of concentrations in the GSP area upstream if there is no significant mixing of water coming from another source.

The spatial and temporal coverage of the water quality data from the representative wells is generally good for the western portion of the management area, with multiple samples collected at most wells for each of the constituents evaluated. The population centers of the City of Bishop, Big Pine, and Independence all have relatively dense water quality observations. The largest portion of the management area lacking water quality information is the eastern side where no water quality data has been identified, either within the GSP area or down-gradient of

it. This data gap is largely due to the lack of development and use of groundwater from this area.

5.2.4 Groundwater Extraction Data

The vast majority of groundwater extraction in the Owens Valley management area occurs from pumping or flowing artesian wells on adjudicated lands owned by the LADWP. Pumped volumes for each well are measured on a monthly basis, and provide an accurate assessment of total groundwater pumping in the basin. Annual groundwater extractions from the entire Owens Valley (including adjudicated lands) range from about 52,000 acre-ft/yr to 92,000 acre-ft/yr (LADWP Annual Operations Plan). Assuming uses within the Owens Valley management area total about 9,000 acre-ft/yr (see Section 2.1.5.2), pumping by the LADWP accounts for approximately 80 to 90% of groundwater extractions in the Owens Valley.

Pumping within the Owens Valley management area is assumed to be localized to population centers (e.g., City of Bishop, Big Pine, Independence, etc.) given the low population density of the basin, lack of available private land, few industrial users, and the low acreage of private agricultural fields. Two of the municipal water providers in northern portion of the management area, the City of Bishop and Indian Creek-Westridge Community Services District, have provided the volume of groundwater pumped on a monthly basis since about 2013. Groundwater used by Laws, Big Pine, and Independence is provided by LADWP wells and therefore metered, but those wells appear to be used for purposes in addition to local municipal supply. The few remaining municipal water suppliers in the management area that have either not provided pumping data or do not measure it represent a small number of connections and therefore have relatively limited extraction volumes.

5.3 Owens Lake Management Area

5.3.1 Well Construction and Geographic Location

The Owens Lake management area has been the focus of numerous hydrogeologic investigations since the mid-1990s due to it being one of the largest sources of dust pollution in the U.S. Documentation and reporting of new wells drilled or piezometers installed for these projects is generally very good, particularly by MWH [2013a] where they identified wells screened within each of the five stratified aquifers. Generally, the distribution of wells both horizontally and vertically appears to be sufficient for developing SMCs for the management area.

Table 5-3. Owens Lake well location and construction data

Owens Lake Management Area Well Location and Construction Data		
Reported Data Type	**Number of Wells/Piezometers**	**Percentage of Wells/Piezometers (%)**
Coordinates	506	100
Accurate coordinates	204	40.3
Total depth	152	30.0
Depth to top of screen	316	62.5
Depth to bottom of screen	316	62.5
Pump depth	0	0

5.3.2 Groundwater Level Data

Prior to 2010, most groundwater level data in the Owens Lake management area was collected by the GBUAPCD. Pressure transducers that recorded water levels at 15-minute intervals were installed in numerous shallow piezometers and wells starting in mid-1997. In 2010, groundwater level monitoring was transferred from the GBUAPCD to the LADWP. Although water levels continued to be monitored in these wells, the data were stored in a different database than the one LADWP routinely provides to the ICWD as part of the LTWA. This was not realized until after GSP data assimilation tasks had been completed, and the format of the water level data for these wells requires significant manual processing. As of the date of this report these data are not included in the OVGA database nor in any statistical analyses used to develop sustainable management criteria (SMCs). However, their addition into the OVGA database will be given high priority and included in the 5-year update. Additional wells in the Owens Lake management area have been added to the LADWP monitoring network since 2010, and water level observations recorded in these new wells have been assimilated into the OVGA database. Water level trends pre- and post-2010 for the Owens Lake management area appear to be similar and stable, so the omission of post-2010 data for some wells is not anticipated to significantly change interpretations or statistical analyses performed in this area.

With the exception of Aquifer 4, each of the Owens Lake management area aquifers has multiple wells spatially distributed around the playa. There is only one well (DVF North MW) currently identified as being screened in Aquifer 4 and is located on the northern edge of the playa. However, water level trends are correlated with spatial position of the well as opposed to which aquifer the well is screened with in, so other wells may be used as proxies for conditions in Aquifer 4. Furthermore, if conditions in Aquifers 3 and 5 are known then conditions in Aquifer 4 can be reasonably estimated.

5.3.3 Groundwater Quality Data

Prior to 2010 water quality was monitored on an approximately annual basis at multiple wells in Aquifers 1-4, and at a single well in Aquifer 5. The trend analysis in Section 4.4.3 shows that solute concentrations are naturally elevated but stable. Since monitoring was transferred to the LADWP in early 2010, water quality results that include the five constituents evaluated for the GSP are only available near the population centers of Lone Pine and Olancha.

According to a report titled "Baseline Groundwater Quality at Owens Lake" [LADWP, 2020a], water quality sampling has been conducted in 2011, 2014, 2016, 2017, and 2019. These data have not been incorporated into the OVGA database because sampling dates were not included in the report. This report also identifies "shallow," intermediate," and "deep," depth classes for wells instead of assigning wells to a specific aquifer, possibly because they are screened across multiple aquifers.

5.3.4 Groundwater Extraction Data

Measured groundwater extractions near Owens Lake are only available at LADWP production wells located on adjudicated lands. There are no groundwater extraction data for any wells within the Owens Lake management area. Known groundwater extractions include pumping by Crystal Geyser just north of Olancha for export as bottled water, irrigation of a small number of agricultural fields to the south of Olancha, municipal and domestic use for the small number (<500) of people that live in the area, and recreational use at a 6 acre water ski pond. Pumping volumes from Crystal Geyser have been requested multiple times with no response.

Groundwater pumping volumes for LADWP wells outside of the GSP area are available for several wells located near Lone Pine and a single well located near Olancha. Pumping brackish water from the aquifers beneath Owens Lake for use in dust control management has been proposed by the LADWP and would be evaluated in a CEQA EIR. While this project is still in the evaluation phase, groundwater pumping in the area will increase significantly if it is ultimately approved. If this happens, re-evaluation of the current groundwater monitoring network is recommended.

Data Gaps Summary and Priority Ranking

This final Section summarizes and prioritizes recommendations on how refinement and or expansion of the existing monitoring networks in the basin might minimize or eliminate data gaps. GSP preparation and submittal to the DWR by January 2022 is will utilize to the extent

possible the previously collected data described in this Tech Memo. Due to financial and logistical constraints, the recommendations offered here are not anticipated to be included in the initial version of the GSP. However, they can be used to inform the required 5-year update assessments and annual reporting. Direct actions to fill data gaps include:

- Increasing monitoring frequency. For example, increasing water level measurements at a specific well from twice per year (typically spring and fall) to four per year (quarterly) or more.
- Increasing the spatial distribution and density of the monitoring network. For example, install new monitoring wells or add monitoring data from existing wells in locations that currently have sparse coverage.
- Increasing the quality of data through improved collection methods and data management methods.

A number of data gaps and potential existing monitoring network enhancements were identified in Section 5. Prioritization levels are used to rank OVGA monitoring program recommendations included herein. Priority ranking is "value added" such that the improved ability to understand the basin setting, determine SMCs, or evaluate basin sustainability is weighed against the cost of collecting the data. For example, it could be advantageous to only use groundwater data collected from properly constructed, multiple-well monitoring sites with completions in each of the aquifer zones in the GSP area and monitored on a daily basis. This would greatly decrease GSP analysis uncertainty and would be consistent with the DWR's data quality recommendations. However, the additional installation and monitoring cost would be extremely prohibitive for the members of the OVGA and the relatively small number of rate payers they represent, especially given the current "Low" prioritization status of the basin and the frequency of observed groundwater level fluctuations.

The sections below describe the data gaps ordered from "High" to "Low" priority ranking, a justification for the assigned ranking, and a recommendation for filling the data gap. These are summarized in Table 6-1.

Table 6-1. Summary of data gaps and prioritization

Priority Ranking	Management Area	Data Gaps Summary	Recommended Action
High	Fish Slough and Tri-Valley	Limited spatial distribution of water levels for Benton and Hammil Valleys.	Implement a well registration and reporting program. Conduct single monitoring campaign at as many wells as possible. Use information obtained from sampling campaign to inform which wells should be added to the existing monitoring network.
High	Fish Slough and Tri-Valley	Limited well coordinate accuracy for Tri-Valley wells.	Obtain better well location information or GPS coordinates of wells measured during monitoring campaign.
High	Fish Slough and Tri-Valley	Lack of subsurface flow information.	Development of a physically based numerical groundwater flow model of the Fish Slough and Tri-Valley area.
Medium	Fish Slough and Tri-Valley	Limited information regarding groundwater extraction volume.	Development of an agricultural water demand model, installation of flow meters on agricultural production wells, or estimation of pumping rates and volumes using power consumption.
Medium	Owens Valley	Limited well coordinate accuracy and well construction data for private domestic wells.	Field inspections by ICWD staff as time allows to update well location and construction information.
Medium	Owens Lake	Most recent water quality observations in the OVGA database are pre-2010.	Assimilate water quality data collected by LADWP since 2010 into OVGA database.
Medium	Owens Lake	Missing Crystal Geyser Roxane bottling plant groundwater extractions.	Obtain groundwater extraction volumes from Crystal Geyser Roxane.
Medium	Owens Valley and Owens Lake	Lack of subsurface flow information.	Obtain groundwater flow models from the LADWP or relevant information from selected model input and output files.
Low	Fish Slough and Tri-Valley	Limited spatial distribution of water quality data.	Additional water quality sampling if grant or other funds become available.
Low	Owens Valley	Limited groundwater elevation data for some portions of the	Additional water level sampling if grant or other funds become available.

Table 6-1. Summary of data gaps and prioritization (cont.)

Priority Ranking	Management Area	Data Gaps Summary	Recommended Action
Low	Owens Valley	Limited groundwater quality data for some portions of the management area.	Additional water quality sampling if grant or other funds become available.
Low	Owens Valley	Groundwater extractions from some municipal water system within the GSP area.	Obtain missing groundwater extraction data for municipal water suppliers if available. Install flow meters on municipal production wells if grant or other funds become available.
Low	Owens Lake	Limited well coordinate accuracy and well construction data for private domestic wells.	Field inspections by ICWD staff as time allows to update well location and construction information.
Low	Owens Lake	Limited water level data for Aquifers 2 and 4 since 2010.	Assimilate water level data collected by LADWP since 2010 into OVGA database.

6.1 High Priority Data Gaps

High priority data gaps are those that significantly limit the understanding of the basin setting, the ability to establish SMCs, or to evaluate basin sustainability. While these data gaps are unlikely to be addressed in the GSP that will be submitted to the DWR in January 2022, it is highly recommended they are addressed within the first 5-year required update of the GSP.

6.1.1 Benton and Hammil Valley Water Levels

The current water level monitoring network in the Benton and Hammil Valleys is insufficient for mapping the water table surface within each respective valley. Without a reasonable estimation of the location of the water table, a meaningful well vulnerability assessment is difficult and heavily reliant on assumed conditions. This adds considerable challenges and uncertainties when developing SMCs, especially since water levels have been slowly but consistently declining in the Tri-Valley area for decades.

Filling of this data gap is recommended in two stages. The first would be to conduct a single monitoring campaign at as many existing wells (Figure 6-1) as possible in order to construct a detailed map of water level elevations within each valley. Using this information, the optimum number of monitoring wells to add and their locations can be determined. A minimum of three wells spaced sufficiently far apart is required for determining the orientation of a sloped surface.

Therefore, it is recommended a minimum of two additional wells be added to each of the monitoring networks in the Benton and Hammil Valleys if the water table surface is not overly complex. Additional monitoring wells may be necessary to characterize the water table surface if the geometry is more complicated than a simple sloped surface.

6.1.2 Tri-Valley Well Construction and Geographic Location

Although there is a relatively high percentage of wells with screen depths reported in the Tri-Valley, as discussed in Section 5.1.1 the lack of accurate location data limits accuracy of a well vulnerability assessment Furthermore, well locations and measurement points must be known within a reasonable degree of accuracy for any water level observations collected from them to be of use. Collecting water level data from existing wells is the most expedient and cost-effective solution for filling the data gap discussed in Section 6.1.1. Therefore, any wells added to the Tri-Valley groundwater monitoring network (either temporarily or permanently) should have more accurate location information than the centroid of the section the well is located within. With most smart phones having the ability to display and/or record GPS coordinates, reasonably accurate spatial locations can be easily determined during sampling. Depending on availability and completeness, driller's logs could then be used to cross reference existing wells in the OVGA database with these new coordinates.

6.1.3 Fish Slough and Tri-Valley Numerical Groundwater Flow Model

Correlations in water level declines observed in Fish Slough and Tri-Valley (Figure 4-2), the intersection of the Fish Slough fault zone with the southern portion of the Hammil Valley [Jayko and Fatooh, 2010], geochemical identification of Fish Slough source water [Zdon and others, 2019], geophysical data [Pakiser 1964; Hollet 1991], and the general topography of the area strongly indicate that some portion of water discharged within Fish Slough is sourced from the Tri-Valley area. The lack of a groundwater flow model prevents further investigation of the proportion of water Fish Slough receives from the Tri-Valley area compared to the portion received from the northwest portion of the watershed (Long Valley) through the Volcanic Tablelands. Understanding the degree of connectivity between these two source areas and Fish Slough is necessary for future refinement of SMCs that protect the unique habitat of Fish Slough while not being overly restrictive on Tri-Valley users and stakeholders.

The development of a physically based numerical groundwater flow model of the Fish Slough and Tri-Valley area is highly recommended. Two land surface models that simulate precipitation, ET, runoff, and recharge are available for the area. The first was developed by the USGS using the Basin Characterization Model (BCM) as part of a statewide modeling effort, and the second

was a finer resolution, basin-specific effort developed by DBS&A using the Distributed Parameter Watershed Model (DPWM; Appendix 10 OVGA GSP). These land surface models can be used to inform boundary conditions required for a groundwater flow model, specifically the seasonal and inter-annual groundwater recharge that is spatially distributed across the basin.

6.2 Medium Priority Data Gaps

Medium priority data gaps are those where information is available but limited in spatial coverage and/or sampling frequency. Filling of these data gaps would either strengthen the monitoring network used to demonstrate basin sustainability, or help refine SMCs in some management areas. While these data gaps are unlikely to be addressed in the GSP that will be submitted to the DWR in January 2022, it is recommended that they are addressed within the first 5-year required update of the GSP if funding sources are available.

6.2.1 Tri-Valley Groundwater Extractions

Measured values of groundwater extractions in the Tri-Valley area either do not exist or have not been provided by the TVGMD. Agricultural pumping is assumed to be the predominant use of groundwater given the very low population density of the area. Estimations of annual pumped volume have been made using a simplified approach that multiplies the irrigated acreage in Tri-Valley by an assumed application rate of 5 ft/yr [Harrington, 2016]. While this provides a general estimate that is useful for long-term average water budgets, it does not account for the numerous complicating factors involved with agricultural irrigation (e.g., mixed water sources, soil properties, irrigation method, crop rotation patterns, precipitation timing, etc.) that can result in different pumped volumes from year to year. Furthermore, development of a numerical groundwater flow model of the Tri-Valley would require assignment of groundwater pumping to specific wells.

More detailed estimation of groundwater pumping, or metering of pumping volumes from agricultural wells, is recommended. This would help refine inter-annual water budgets and boundary conditions for a groundwater flow model. The most cost-effective way to achieve more detailed pumping estimates would be to use an agricultural crop-water demand model that simulates plant demands on a daily basis. These models are relatively inexpensive to develop and can provide well-specific estimates of groundwater pumping. An advantage of this method is that future crop demands that take into account climate change can also be estimated.

Another approach for refining groundwater extraction data in the Tri-Valley area would be to install flow meters on agricultural wells. While this would provide more accurate pumping data

compared to the modeling approach, it is likely cost-prohibitive and several years of data collection would be required to observe any inter-annual changes in groundwater pumping, if they exist. Alternatively, power usage at wells combined with knowledge of the depth to water can be used to estimate the volume of groundwater pumped. The lack of water level observations in the Tri-Valley would add additional uncertainty to the power usage analysis. Using either approach, additional work would be required to estimate the effects of climate change on future pumping rates. Therefore, the modeling approach is currently recommended as it provides the best value for filling the groundwater extraction data gap.

6.2.2 Owens Valley Management Area Well Construction and Geographic Location

Private wells in the Owens Valley management area are the most likely to have the greatest location uncertainty as the coordinates provided by the DWR are typically the centroid of the section they are located within. As discussed in Section 5.1.1, the high degree of topographic relief in the valley precludes a meaningful well vulnerability analysis for inaccurately located wells. While a well vulnerability assessment is important and should be completed, this data gap has been classified as a medium priority due to water levels in the area being either stable or showing inter-annual trends consistent with water year type. That is, water levels generally decrease during dry periods and increase during wet years. Deviations from this trends are attributable to LADWP pumping, which is constrained by the LTWA. Therefore, defensible SMCs can be developed using the lowest water levels from the 2012-2016 drought as the minimum threshold as a substitute for a full vulnerability analysis. Accurate well locations can be determined by field inspections as staff time allows before the first 5 year plan review. These SMCs can be refined if needed at that time.

6.2.3 Owens Lake Groundwater Quality

Prior to 2010, before monitoring was transferred from the GBUAPCD to the LADWP, water quality data was generally collected at multiple wells in each aquifer on an approximately annual basis. Groundwater quality observations in the OVGA database sampled post 2010 have been collected primarily from wells with mostly unreported screen depths. Without a reported screen interval depth it is impossible to assign the well, and observations obtained from it, to a specific aquifer. The water quality trends for the Owens Lake area presented in Section 4.3.3 indicate concentrations are relatively stable and generally correlated with horizontal position on the playa rather than with a specific aquifer. Similar behavior was observed with water level trends (see Section 4.1.3) and indicates compartmentalization of the aquifer due to restriction of flow

across faults in the area. Better descriptions of the well construction information may be available and should be pursued by the OVGA before the first 5 year update.

Groundwater quality observations that are not currently in the OVGA database have been identified in a recent LADWP report [2020a], and states that water quality data have been collected in 2011, 2014, 2016, 2017, and 2019. Wells identified in that report appear to be some of the same wells as those sampled by the GBUAPCD, so assimilation and cross checking well names and locations and the data contained within it will likely fill the current data gap of not having water quality observations in the representative monitoring wells post 2010 (see Figures 4-13a through 4-13e). The complete dataset of water quality results sampled post 2010 should requested from the LADWP and incorporated into the OVGA database. If these wells are routinely sampled by the LADWP and the data made available to the OVGA, then additional water quality sampling would not be considered necessary.

6.2.4 Owens Lake Groundwater Extractions

Since groundwater extraction in the Owens Lake management area is assumed to be relatively small due to the low population density and lack of agriculture, the volume of groundwater pumped by the Crystal Geyser Roxane bottling plant near Olancha likely represents a significant portion of total groundwater extractions in the area and could better inform the groundwater budget. As mentioned in Section 2.1.5.3, requests for these pumping data from Crystal Geyser Roxane have not been responded to. Filling this data gap would require minimal investment of resources as it is assumed to have already been collected by Crystal Geyser Roxane as part of their operations.

6.2.5 Owens Valley and Owens Lake Numerical Groundwater Flow Models

As discussed in Section 1.3, groundwater flow models that collectively cover the majority of the Owens Valley and Owens Lake management areas have been developed by the LADWP. Review of the model documentation provided by the LADWP indicates that these models would be useful for certain GSP elements that are currently poorly defined or unknown, such as historical groundwater budgets and simulated water level elevations in areas with few monitoring wells. In addition, these models could potentially be used to estimate future water budgets using climate change factors provided by the DWR. The LADWP declined an initial request for the model files. A subsequent request for model output files along with selected input files that contain relevant aquifer geometry and which aquifer wells are screened in was not responded to.

6.3 Low Priority Data Gaps

Low priority data gaps are those where additional data collection would only marginally improve the understanding of the basin setting, ability to establish SMCs, or evaluate basin sustainability. This is generally because the existing monitoring networks and historical data sets are generally sufficient and other sources of information (e.g., land use, population, etc.) can be used to make reasonable assumptions about conditions that affect the hydrologic system. These data gaps will not be addressed in the GSP that will be submitted to the DWR in January 2022. It is recommended these data gaps only be filled if funding sources are available and the high and medium data gaps discussed above have already been addressed.

6.3.1 Fish Slough and Tri-Valley Water Quality

Water quality data in the Fish Slough and Tri-Valley management area is only available at a small number of clustered wells in the Benton and Chalfant Valleys. Groundwater flow is generally from north to south with a fork near Hammil Valley. This results in two regional flow paths that both begin in Benton Valley: one that flows toward Hammil Valley and then towards Fish Slough, and the other which flows toward Hammil Valley and then continues south toward Chalfant Valley. Solute concentrations in Chalfant Valley are similar to those in Benton Valley (except for TDS which is discussed in Section 4.3.1), indicating there is no significant source in Hammil Valley or Fish Slough for the five constituents evaluated. This is consistent with the rural nature of the area and the primary agricultural crop being alfalfa, which does not require nitrogen fertilization. Additional water quality sampling could be performed in Hammil Valley and Fish Slough, but would likely show similar concentrations as those observed in Benton and Chalfant Valleys.

6.3.2 Owens Valley Management Area Groundwater Levels

There are relatively few monitoring wells located within the GSP area, and those that are within the GSP area are typically located just inside near the boundary with the adjudicated (SGMA exempt) lands. In order to develop SMCs for the area a combination of existing monitoring well, land use, population density data, and hydrologic expertise is required. Since the majority of the Owens Valley management area is owned by federal and state agencies (Figure 6-2) and therefore lacking in private (i.e., developable) land, the uncertainty typically associated with predicting the effects of groundwater pumping in areas with limited data is significantly reduced. Additional monitoring points within the GSP area would provide more direct evidence that the area is being managed sustainably.

Filling this data gap can be accomplished by adding existing wells to the monitoring network, or drilling new monitoring wells. Adding existing wells is generally the most cost-effective way to expand a monitoring well network, as there is considerable expense associated with drilling new wells. Figure 6-3 shows the locations of existing wells that could potentially be added to the monitoring network. The lack of existing wells identified in the GSP area suggests that groundwater use in most of the Owens Valley management area is likely limited, consistent with inferences drawn from land use and population data.

6.3.3 Owens Valley Management Area Groundwater Quality

A large portion of the wells used to assess groundwater quality conditions in the Owens Valley management area are located outside or just within the GSP area. Groundwater in this area generally flows from the alluvial fans along the margin to the axis of the valley, and then to the south. The wells used as representative monitoring points are located at or near the end of flow paths coming from the GSP area, and therefore water quality results from them are a culmination of the processes happening within the GSP area. The low solute concentrations observed in the representative monitoring wells indicate there are so significant sources of the five constituents of concern evaluated within the GSP area. This is consistent with the hydrologic conceptual model of the basin where high quality water derived from Sierra Nevada snowmelt recharges groundwater as tributaries flow across alluvial fans along the margin of the basin. This, combined with a lack of development and therefore potential sources of contamination, is strong evidence that water quality within the Owens Valley management area is high. Additional water quality sampling could be performed within the GSP area, but would likely produce similar results as wells located outside the GSP area.

6.3.4 Owens Valley Management Area Groundwater Extractions

Pumping by the LADWP represents the vast majority of groundwater extractions that occur within the groundwater basin. The two water suppliers within the GSP area that have provided recent pumping volumes, the City of Bishop and the Indian Creek-Westridge Community Services District, represent a large portion of the population within the GSP area that relies on groundwater. Pumped volumes from the remaining public water suppliers are unlikely to significantly alter our understanding of the groundwater budget, since the extracted volume is expected to be small relative to the pumping volumes already collected. Communities within the valley are unlikely to expand in the future because either LADWP or other public agencies (state or federal) own the surrounding land, so increased demand due to population growth is not considered to be a significant concern. The lack of chronic groundwater declines indicates that current pumping rates do not exceed long-term recharge rates. Therefore, historical or future

pumping data collected from wells collected as part of a water supplier's internal operations can be easily incorporated into the GSP, but installation of new equipment to monitor groundwater pumping is not considered to be cost-effective at this time.

6.3.5 Owens Lake Well Construction and Geographic Location

Recent geologic, hydrologic, and geophysical investigations in the Owens Lake management area, particularly those performed by the GBUAPCD and MWH as part of the Owens Lake Groundwater Evaluation Project (OLGEP), have resulted in a number of monitoring wells screened within each of the five stratified aquifers. Several of these wells are nested, allowing for both horizontal and vertical comparison of water level and quality data. Private wells with inaccurate coordinates are less of a concern in the Owens Lake area because water levels are generally very stable and near or above the land surface (flowing artesian conditions), and the topographic relief of the area is much lower compared to the rest of the GSP area. A simple inventory of any wells that went dry during the 2012-2016 drought (OVGA staff are unaware of any dry wells) could be done in lieu of a more formal well vulnerability assessment required for the other GSP management areas.

6.3.6 Owens Lake Groundwater Levels

Groundwater level monitoring data post 2010 in the OVGA database is primarily from Aquifers 1 and 5 and conducted on a monthly basis. With current levels of groundwater pumping, which are minimal, additional monitoring of water levels in Aquifers 2-4 is not considered to be necessary. This is because the current and natural state of the aquifer system is generally upward vertical flow. Groundwater levels in the middle aquifers must therefore be some elevation between those found in Aquifers 1 and 5. Significant pumping from Aquifers 2-4, such as that proposed by the LADWP as part of their Owens Lake Groundwater Development Project (OLGDP), could change this so re-evaluation of the monitoring network would be necessary.

Additional water level data not present in the OVGA database have been identified in a quarterly monitoring report from the LADWP [2020b]. These data appear to be from the same monitoring well and piezometer network established by the GBUAPCD, whose locations are in the OVGA database. These water level data should be requested from the LADWP and assimilated into the OVGA database.

References

Allen, R. G., Pereira, L. S., Raes, D., & Smith, M. (1998). Crop evapotranspiration-Guidelines for computing crop water requirements-FAO Irrigation and drainage paper 56. FAO, Rome, 300(9), D05109. http://www.fao.org/3/x0490e/x0490e00.htm

Alpert, H., Kattelmann, R., Drew, M., Hatfield, J, Crall, H, & Dodds, A. (2019). Inyo-Mono Integrated Regional Water Management Plan: 2019 Update. 490 pages. https://inyo-monowater.org/our-work/inyo-mono-irwm-plan/

Bateman, P.C. (1965). Geology and tungsten mineralization of the Bishop district, California, with a section on gravity study of Owens Valley and a section on seismic profile. U.S. Geological Survey Professional Paper 470. https://pubs.er.usgs.gov/publication/pp470

California Department of Water Resources (2020). Chronological Reconstructed Sacramento and San Joaquin Valley Water Year Hydrologic Classification Indices. https://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST

California Department of Water Resources (2016a). BMP 1: Best Management Practices for the Sustainable Management of Groundwater Monitoring Protocols, Standards, and Sites, December 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-1-Monitoring-Protocols-Standards-and-Sites_ay_19.pdf

California Department of Water Resources (2016b). BMP 2: Best Management Practices for the Sustainable Management of Groundwater Monitoring Networks and Identification of Data Gaps, December 2016. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps_ay_19.pdf

California Department of Water Resources (2017). Draft BMP 6: Best Management Practices for the Sustainable Management of Groundwater Sustainable Management Criteria, November 2017. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-6-Sustainable-Management-Criteria-DRAFT_ay_19.pdf

California Department of Water Resources (2020a). Statewide Crop Mapping GIS Shapefiles. https://data.cnra.ca.gov/dataset/statewide-crop-mapping

City of Bishop (2008). City of Bishop Water Master Plan. https://www.cityofbishop.com/Document%20Center/Department/Public%20works/Water/WaterMasterPlan2008.pdf

City of Los Angeles v. County of Inyo (1991). Superior Court of California, County of Inyo. Case No. 12908. https://www.inyowater.org/wp-content/uploads/legacy/Water_Resources/long_term_water_agreement.pdf

County of Inyo and City of Los Angeles (1991). Green Book for the Long-Term Groundwater Management Plan for the Owens Valley and Inyo County. https://www.inyowater.org/wp-content/themes/rttheme16child/documents/Greenbook.pdf

County of Mono (2015). Regional Transportation Plan and General Plan Update, Draft EIR SCH#2014061029. https://monocounty.ca.gov/sites/default/files/fileattachments/planning_division/page/8022/2_draft_eir_with_appendices_7.31.15.pdf

Danskin, W. R. (1988). Preliminary evaluation of the hydrogeologic system in Owens Valley, California (Vol. 88, No. 4003). Department of the Interior, US Geological Survey. https://pubs.er.usgs.gov/publication/wri884003

Danskin, W. R. (1998). Evaluation of the Hydrologic System and Selected Water-Management Alternatives in the Owens Valley, California. U.S. Geological Survey Water-Supply Paper 2370-H, in Hydrology and Soil-Water-Plant Relations in Owens Valley, California. https://pubs.er.usgs.go/publication/wsp2370H

Duell, L.F.W. (1990). Estimates of Evapotranspiration in Alkaline Scrub and Meadow Communities of Owens Valley, California, Using the Bowen-Ratio, Eddy-Correlation, and Penman-Combination Methods. U.S. Geological Survey Water-Supply Paper 2370-E. https://pubs.usgs.gov/wsp/2370e/report.pdf

Gill, T. E. (1996). Eolian sediments generated by anthropogenic disturbance of playas: human impacts on the geomorphic system and geomorphic impacts on the human system. *Geomorphology*, 17(1-3), 207-228.

Harrington, R. (2016). Hydrogeologic Conceptual Model for the Owens Valley Groundwater Basin (6-12), Inyo and Mono Counties. 43 pages. https://www.inyowater.org/wp-content/uploads/2015/12/owens_valley_conceptual_model.pdf

Hollett, K. J., Danskin, W. R., McCaffrey, W. F., & Walti, C. L. (1991). Geology and water resources of Owens Valley, California. U.S. Geological Survey Water-Supply Paper 2370-B. https://pubs.er.usgs.gov/publication/wsp2370B

Howald, A. (2000). Plant communities. Sierra East: Edge of the Great Basin. University of California Press, Berkeley, *CA*.

Jayko, A.S. & Fatooh, J. (2010). Fish Slough, a geologic and hydrologic summary, Inyo and Mono Counties, California. U.S. Geological Survey Administrative Report.

Langridge, R., Sepaniak, S., & Conrad, E. (2016). An Evaluation of California's Special Act Groundwater Districts. https://escholarship.org/uc/item/3cr8k66v

Los Angeles Department of Water and Power (2020a). Baseline Groundwater Quality at Owens Lake. 44 pages. https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB725115&RevisionSelectionMethod=LatestReleased

Los Angeles Department of Water and Power (2020b). State Lands Commission Lease Agteement: No. 9597.9, Quarterly Report, November 2020. https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB724371&RevisionSelectionMethod=LatestReleased

Murphy, T. P. (1997). Soils of the Owens Lake Playa, Report 1. Great Basin Unified Air Pollution Control District, Keeler, CA.

Mono County (2008). Tri-Valley Community Profile, Mono County, California [DRAFT]. 49 pages. https://monocounty.ca.gov/sites/default/files/fileattachments/planning_division/page/3157/trivalleycommunityprofile_000.pdf

MWH (2003). Confining Layer Characteristics Cooperative Study: Final Report. 159 pages.

MWH (2013a). Final Report on the Owens Lake Groundwater Evaluation Project, October 2012 (revised January 2013). 93 pages.

MWH (2013b). Updated Conceptual Model (November 2011), Appendix H of Final Report on the Owens Lake Groundwater Evaluation Project, October 2012 (revised January 2013). 108 pages.

Pakiser, L. C., Kane, M.F., & Jackson, W.H. (1964). Structural Geology and Volcanism of Owens Valley Region, California - A Geophysical Study. U.S. Geological Survey Professional Paper 438. https://pubs.er.usgs.gov/publication/pp438

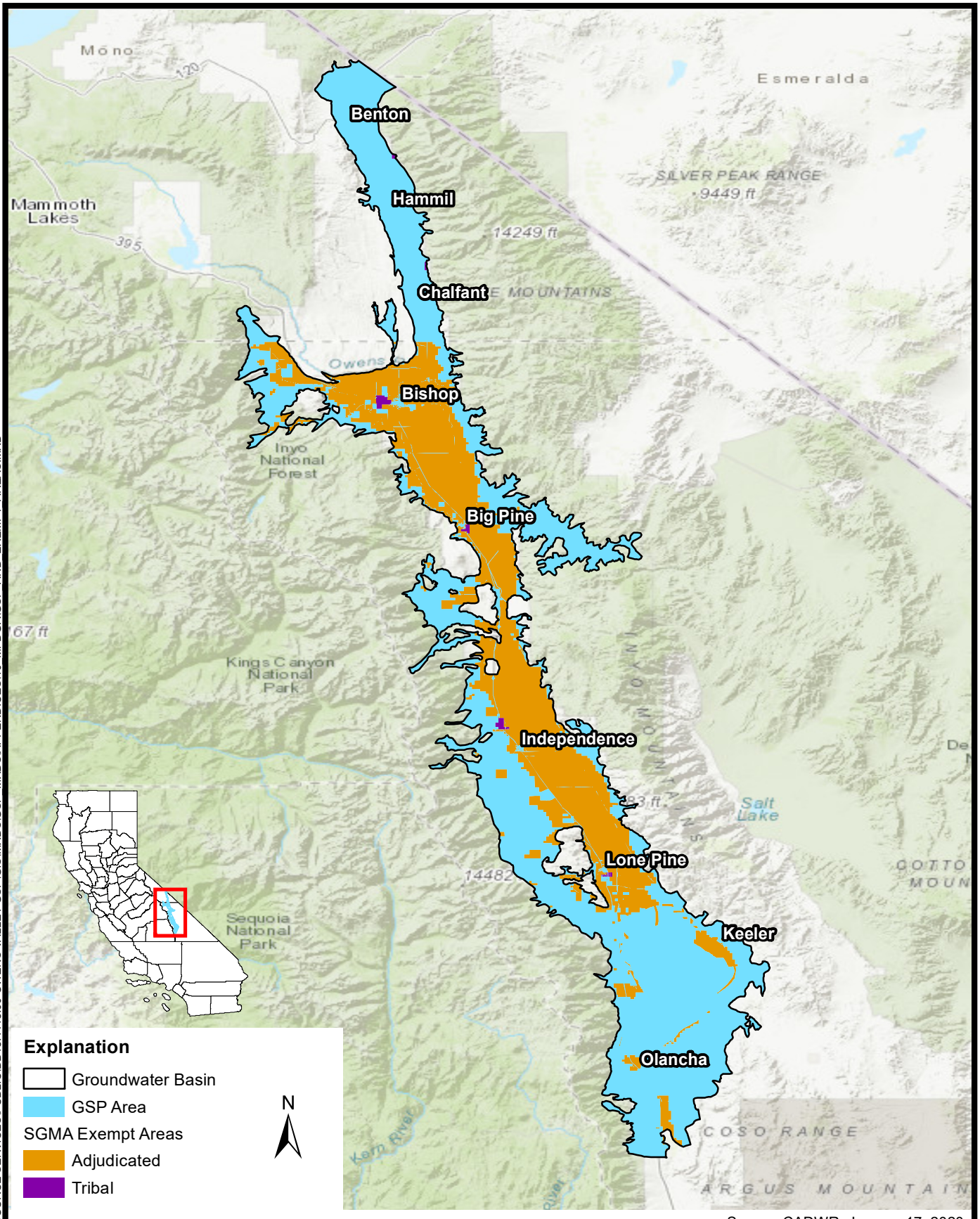
PWA (1980). Water Resources and Their Relationship to Agricultural and Urban Development of Hammil Valley. 54 pages.

Saint-Armand, P., Mathews, L. A., Gaines, C., & Roger, R. (1986). Dust storms from Owens and Mono valleys, California. Naval Weapons Center, China Lake,CA.

U.S. Environmental Protection Agency (2006). Guidance on systematic planning using the data quality objectives process. *EPA QA/G-4*. EPA/240/B-06/001, February 2006. https://www.epa.gov/sites/production/files/2015-06/documents/g4-final.pdf

U.S. Geological Survey Gap Analysis Program, 20160513, GAP/LANDFIRE National Terrestrial Ecosystems 2011: U.S. Geological Survey, https://doi.org/10.5066/F7ZS2TM0

Zdon, A., Rainville, K., Buckmaster, N., Parmenter, S., & Love, A. H. (2019). Identification of Source Water Mixing in the Fish Slough Spring Complex, Mono County, California, USA. Hydrology, 6(1), 26.



Source: CADWR, January 17, 2020

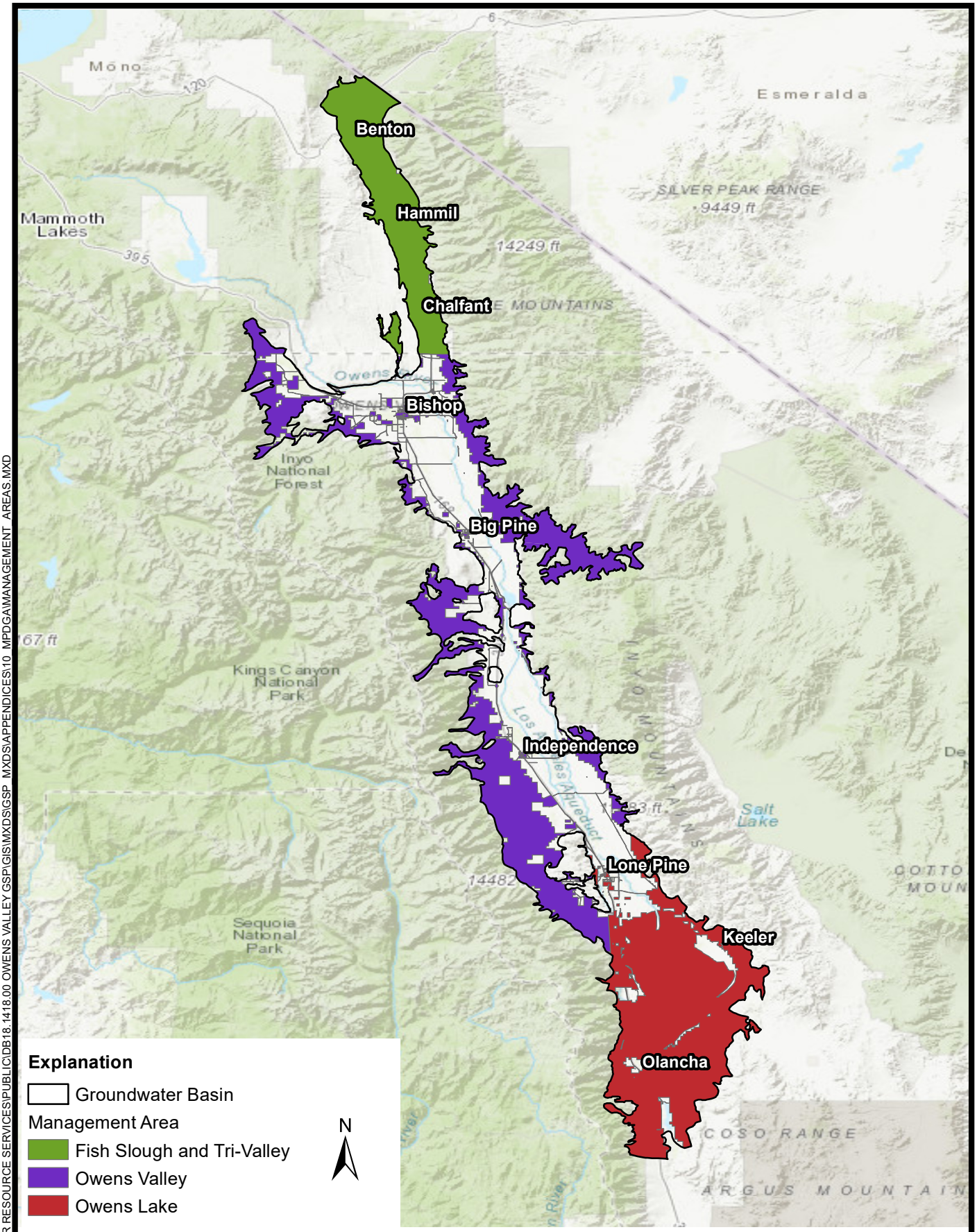
K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB18.1418.00 OWENS VALLEY GSP\GIS\MXDS\GSP MXDS\APPENDICES\10 MPDGA\GSP AND EXEMPT AREAS.MXD

MONITORING PLAN AND DATA GAPS ANALYSIS

Groundwater Sustainability Plan Area and Lands Exempt from SGMA

DBS&A
Daniel B. Stephens & Associates, Inc.
5/11/2021 DB18.1418

Figure 1-1



K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB18.1418.00 OWENS VALLEY GSP\GIS\MXDS\GSP_MXDS\APPENDICES\10_MPDGAIMANAGEMENT_AREAS.MXD

DBS&A
Daniel B. Stephens & Associates, Inc.
5/11/2021
DB18.1418

MONITORING PLAN AND DATA GAPS ANALYSIS

GSP Management Areas

Figure 1-2