

# ICWD 2024-25 ANNUAL REPORT

## SOIL WATER CONDITION

### Introduction

The Long Term Water Agreement (LTWA or Agreement) established procedures to determine which LADWP pumping wells can and cannot be operated based on soil water and vegetation measurements (On/Off status). Through this program, termed On/Off, ICWD regularly measures depth to groundwater (DTW) and soil water content at 25 monitoring sites in wellfields and eight sites in control areas. DTW is informational only and has no role in On/Off determination. Three of the wellfield sites (TA1, TA2, TS6) are not used to determine the operational status of nearby pumping wells but are monitored to continue the data record. Each site is equipped with 1 to 6 soil water monitoring locations (i.e., 2-inch PVC access tubes). Soil water measurements are collected using a neutron gauge calibrated for each site (Dickey, 1990; Steinwand, 1996).

The purpose for monitoring soil water and the On/Off procedures is to manage pumping to protect plant communities that require periodic access to the water table for long-term survival. Generally, the sites with “On” status have wet soil and shallow water tables, and sites in “Off” status have dry soil and relatively deep water tables.

To assist the evaluation of LADWP pumping proposals, ICWD examined the DTW and soil water data to determine whether groundwater was accessible to plants at the permanent monitoring sites at the beginning of the 2025 growing season.

How well plants can access groundwater depends on the vegetation type and water table depth. In similar soils, a shallower water table is necessary to supply groundwater to grasses than shrubs because of the shallower roots of grasses.

For management, shrub-dominated sites are assigned a root zone of 4 meters (13.1 feet); grass-dominated or mixed grass and shrub assemblages are assigned a root zone of 2 meters (6.6 feet). These approximate values are not the actual rooting depth at a particular monitoring site, but they are useful to compare with the soil depth that received recharge from groundwater.

Soil water in the root zone can be supplied by infiltration from the surface (i.e., rain or irrigation) or from contact with the water table. It is usually possible to discriminate deeper soil affected by groundwater from soil near the surface affected by infiltration based on the depth and timing of the measured changes in soil water content. Plant roots can utilize groundwater directly, and if the water table is within the root zone, it is reasonable to conclude that groundwater is available. A rising water table can progressively wet the root zone from below and provide water to plants. Plant roots can also tap groundwater that is drawn into the soil above the water table by capillarity where it is held in soil pores or adsorbed to soil particles.

Plant uptake during the summer depletes soil water, and when transpiration ceases in the fall, water from the moist soil above the water table will replenish the drier soil in the root zone via capillarity or

through inactive plant roots even if the water table is stable or declining. This is a slow process and usually provides much less soil water recharge than a rising water table.

## Results

Monitoring results for available soil water, vegetation water requirement, water table depth, and the On/Off status for all sites are presented in the figures that are periodically updated and available at Technical Group meetings and on the ICWD website ([inyowater.org](http://inyowater.org)). Tubes LW3\_3, BC2\_3, BP3\_2, TS1\_4, TS1\_5, and BG2\_3 need to be replaced due to failed bottom cork plugs but groundwater levels at the sites need to drop low enough for ICWD staff to be able to accomplish this work.

At the beginning of the 2024-25 runoff year (April 1, 2024), 20 sites were in “On” status: L1, L2, L3, BP1, BP3, BP4, TA3, TA4, TA5, TA6, TS1, TS2, TS3, TS4, IO1, IO2, SS1, SS3, SS4, and BG2 (the same On/Off Status as shown on Table 1). Site IO1 changed to “Off” status October 1, 2024 (Table 2), and back to “On” status March 1, 2025. At the end of the runoff year (March 31, 2025), the same 20 sites were in “On” status (Table 3).

**Table 1. June 2024 monitoring site status and July 1, 2024, soil/vegetation water balance calculations according to Green Book, Section III\*. All values are in cm.**

Site	June 2024 On/Off Status	July 2024 Vegetation Water Requirement	July 2024 Required Soil AWC For Turn-On	July 2024 Actual Soil AWC	July 2024 On/Off Status
LW 1	ON	6.2	NA	142.2	ON
LW 2	ON	3.8	NA	62.3	ON
LW 3	ON	6.1	NA	59.8	ON
BP 1	ON	8.8	NA	47.3	ON
BP 2	OFF	5.4	28.4	8.1	OFF (7/98)
BP 3	ON	8.1	NA	109.8	ON
BP 4	ON	3.8	NA	90.8	ON
TA 3	ON	6.7	NA	16.7	ON
TA 4	ON	6.7	NA	29.8	ON
TA 5	ON	3.0	NA	22.5	ON
TA 6	ON	9.7	NA	55.1	ON
TS 1	ON	12.0	NA	34.9	ON
TS 2	ON	4.8	NA	35.3	ON
TS 3	ON	10.4	NA	47.5	ON
TS 4	ON	18.2	NA	46.4	ON
IO 1	ON	19.0	NA	36.4	ON
IO 2	ON	1.8	NA	5.1	ON
SS 1	ON	8.3	NA	55.6	ON
SS 2	OFF	1.4	25.6	6.4	OFF (7/11)
SS 3	ON	9.4	NA	46.9	ON
SS 4	ON	6.3	NA	12.3	ON
BG 2	ON	7.8	NA	63.7	ON

\*These values of soil water required for well turn-on were derived using calculations based on percent cover that were routinely performed in the past. The values have not been updated to conform to the Green Book equations in section III.D.2, p. 57-59.

**Table 2. Monitoring site status and soil/vegetation water balance calculations for October 1, 2024, according to Green Book, Section III\*. All values are in cm.**

Site	July 1, 2024 On/Off Status	October 2024 Vegetation Water Requirement	October 2024 Required Soil AWC For Turn-On	October 2024 Actual Soil AWC	Soil AWC +50% Annual Precip.	October 1, 2024 On/Off Status
LW 1	ON	10.9	NA	136.7	144.6	ON
LW 2	ON	7.0	NA	57.7	65.6	ON
LW 3	ON	11.2	NA	46.6	54.5	ON
BP 1	ON	16.1	NA	43.3	51.2	ON
BP 2	OFF (7/98)	10.1	28.4	7.7	NA	OFF (7/98)
BP 3	ON	14.4	NA	102.6	110.2	ON
BP 4	ON	6.8	NA	87.1	95.3	ON
TA 3	ON	12.5	NA	14.3	21.6	ON
TA 4	ON	12.5	NA	22.9	30.2	ON
TA 5	ON	5.4	NA	20.8	29.0	ON
TA 6	ON	18.0	NA	44.7	52.0	ON
TS 1	ON	22.3	NA	24.7	32	ON
TS 2	ON	8.7	NA	27.8	35.1	ON
TS 3	ON	19.2	NA	25.5	32.8	ON
TS 4	ON	33.1	NA	36.7	44	ON
IO 1	ON	35.6	35.6	26.8	33.3	OFF (10/24)
IO 2	ON	3.3	NA	3.9	10.4	ON
SS 1	ON	15.2	NA	48.8	55.3	ON
SS 2	OFF (7/11)	2.6	25.6	5.0	NA	OFF (7/11)
SS 3	ON	17.6	NA	40.7	47.2	ON
SS 4	ON	11.8	NA	9.1	15.7	ON
BG 2	ON	14.3	NA	46.6	53.2	ON

\*These values of soil water required for well turn-on were derived using calculations based on percent cover that were routinely performed in the past. The values have not been updated to conform with the Green book equations in section III.D.2, p. 57-59.

**Table 3. Monitoring site status on April 1, 2025, according to Green Book, Section III\*. All values are in cm.**

Site	October 1, 2024 Actual Soil AWC	50% Annual Precipitation	Projected Soil AWC	October 1, 2024 Vegetation Water Requirement	October 1, 2024 Required Soil AWC For Turn-On	October 1, 2024 On/Off Status	April 1, 2025 Soil AWC	April 1, 2025 Required Soil AWC For Turn-On	April 1, 2025 On/Off Status
LW 1	136.7	7.9	144.6	10.9	NA	ON	115.8	NA	ON
LW 2	57.7	7.9	65.6	7.0	NA	ON	53.5	NA	ON
LW 3	46.6	7.9	54.5	11.2	NA	ON	46.7	NA	ON
BP 1	43.3	7.9	51.2	16.1	NA	ON	32.3	NA	ON
BP 2	7.7	NA	NA	10.1	28.4	OFF (7/98)	14.2	28.4	OFF (7/98)
BP 3	102.6	7.6	110.2	14.4	NA	ON	114.3	NA	ON
BP 4	87.1	8.2	95.3	6.8	NA	ON	92.0	NA	ON
TA 3	14.3	7.3	21.6	12.5	NA	ON	20.6	NA	On
TA 4	22.9	7.3	30.2	12.5	NA	ON	35.3	NA	ON
TA 5	20.8	8.2	29.0	5.4	NA	ON	23.3	NA	ON
TA 6	44.7	7.3	52.0	18.0	NA	ON	57.1	NA	ON
TS 1	24.7	7.3	32	22.3	NA	ON	33.9	NA	ON
TS 2	27.8	7.3	35.1	8.7	NA	ON	38.1	NA	ON
TS 3	25.5	7.3	32.8	19.2	NA	ON	51.6	NA	ON
TS 4	36.7	7.3	44	33.1	NA	ON	54.0	NA	ON
IO 1	26.8	6.5	33.3	35.6	35.6	OFF (10/24)	36.7	NA	ON
IO 2	3.9	6.5	10.4	3.3	NA	ON	6.7	NA	ON
SS 1	48.8	6.5	55.3	15.2	NA	ON	52.4	NA	ON
SS 2	5.0	NA	NA	2.6	25.6	OFF (7/11)	6.3	25.6	OFF (7/11)
SS 3	40.7	6.5	47.2	17.6	NA	ON	44.1	NA	ON
SS 4	9.1	6.6	15.7	11.8	NA	ON	10.3	NA	ON
BG 2	46.6	6.6	53.2	14.3	NA	ON	46.8	NA	ON

\*These values of soil water required for well turn-on were derived using calculations based on percent cover that were routinely performed in the past. The values have not been updated to conform with the Green book equations in section III.D.2, p. 57-59.

**Table 4. Comparison of DTW preceding the growing seasons (April) in 2024 and 2025. Depths are below ground surface. Positive values denote a rise in the water table.**

Wellfield	April 1, 2024	April 1, 2025	DTW Change 2024-25	
	DTW	DTW	(m)	(ft)
Site	(m)	(m)	(m)	(ft)
<b>Laws</b>				
L1	0.69	2.06	-1.37	-4.50
L2	1.83	2.86	-1.03	-3.39
L3	1.33	3.02	-1.70	-5.56
<b>Bishop Control</b>				
BC1	1.16	2.13	-0.97	-3.17
BC2	2.29	3.49	-1.20	-3.94
BC3	1.11	1.14	-0.03	-0.10
<b>Big Pine</b>				
BP1	2.56	3.31	-0.75	-2.46
BP2	4.90	4.86	0.04	0.12
BP3	0.73	1.48	-0.76	-2.48
BP4	1.84	1.77	0.07	0.23
<b>Taboose Aberdeen</b>				
TA1	0.67	0.66	0.02	0.05
TA3	2.78	3.02	-0.24	-0.79
TA4	1.20	1.46	-0.27	-0.87
TA5	4.20	4.20	0.00	0.00
TA6	0.76	1.07	-0.30	-0.99
TAC	0.53	0.57	-0.04	-0.13
<b>Thibaut Sawmill</b>				
TS1	2.09	3.05	-0.96	-3.16
TS2	1.49	1.94	-0.46	-1.50
TS3	0.77	1.32	-0.55	-1.79
TS4	1.60	1.85	-0.25	-0.82
TS6	2.62	2.88	-0.26	-0.87
TSC	0.97	1.34	-0.37	-1.22
<b>Independence Oak</b>				
IO1	2.18	2.72	-0.54	-1.78
IO2	6.07	6.62	-0.55	-1.82
IC1	0.60	0.68	-0.09	-0.28
IC2	1.47	2.10	-0.63	-2.07
<b>Symmes Shepherd</b>				
SS1	3.12	3.28	-0.16	-0.53
SS2	5.34	5.51	-0.17	-0.57
SS3	2.53	2.81	-0.28	-0.91
SS4	5.36	5.40	-0.04	-0.13
<b>Bairs George</b>				
BG2	2.05	3.34	-1.29	-4.24
BGC	1.73	2.42	-0.69	-2.27

Hydrographs for the permanent monitoring sites are presented on the ICWD website ([ICWD Annual Report - Vegetation Graphs](#)), and the DTW measured near April 1 (i.e., the end of March) before the 2024 and 2025 growing seasons are presented in Table 4. At most sites, the shallowest DTW occurs near April 1. At sites BP1 and BP3, the water table typically rises during the summer and reaches a shallowest depth in the fall coinciding with the timing of diversions into the Big Pine canal for irrigation.

In 2024-25, the water table lowered an average of -1.6 feet in wellfields and also -1.6 feet in control areas from April 1, 2024, to April 1, 2025. These declines are consistent with the average runoff year (99% of the 1971-2020 average) combined with less than average groundwater pumping following the very wet 2023-24 runoff year. See the Hydrology section of this report ([ICWD Annual Report](#)) for an assessment of groundwater level changes using a larger set of monitoring wells.

At many sites it was relatively straightforward to discriminate groundwater recharge from surface infiltration because of the vertical gap between the deeper groundwater recharge and the shallow infiltration from winter precipitation (Tables 5 and 6). Infiltration due to precipitation from winter 2024-25 was primarily limited to the top 70 or 90 cm of the soil. Winter precipitation on the valley floor was approximately 90% of average.

**Table 5. Soil depth below ground surface replenished by groundwater in April 2025 at wellfield sites. Values are provided for each monitoring location within a site unless the identification of a specific depth was uncertain (UNK in table). Minimum DTW was measured in the associated test well from April 2024 to March 2025. If groundwater not recharging soil, greater than ">" sign used at maximum tube depth.**

Site	Dominant plant species	Root Zone (m)	Minimum DTW (m)	Groundwater recharge depth (m)
L1	greasewood	4	0.5	0.9, 1.1, 1.1
L2	alkali sacaton, greasewood, saltbush	2	1.5	2.3, 1.7, 2.5, 2.5, 2.1
L3	alkali sacaton, saltgrass	2	1.3	1.3, 1.9, 1.9, 2.1, 1.7, 1.7
BP1	saltbush, greasewood	3	1.4	1.3, 1.3, 1.1, 1.3, 1.1
BP2	saltbush, rabbitbrush	4	4.5	2.7, 2.3, >3.9
BP3	greasewood, rabbitbrush	4	0.9	0.9, 0.9, 0.9
BP4	saltbush, greasewood	4	1.7	0.9, 1.3, 0.9
TA1	alkali sacaton, saltbush	2	0.6	UNK
TA2	alkali sacaton, saltbush, greasewood, rabbitbrush	2	0.6	UNK
TA3	saltbush, alkali sacaton, sagebrush	2	2.9	1.1, 1.5, 1.3
TA4	rabbitbrush, alkali sacaton	2	1.5	0.9, 1.3, 1.3
TA5	greasewood, alkali sacaton	2	3.7	1.7, >3.9, 3.1
TA6	saltbush, rabbitbrush	4	0.9	0.9, 0.9, 1.1
TS1	weeds, alkali sacaton	2	2.3	2.7, 0.9, 1.5, 2.1, 1.9
TS2	sagebrush, saltbush, alkali sacaton	2	1.6	1.3, 1.7, 1.7
TS3	saltgrass, alkali sacaton	2	0.9	0.7, 0.7, 0.9, 1.3, 1.3, 0.7
TS4	greasewood, alkali sacaton, saltbush, saltgrass	2	1.7	1.1, 1.1, 0.9, 0.9
TS6	alkali sacaton, saltbush, saltgrass	2	2.6	1.3
IO1	rabbitbrush, alkali sacaton, saltbush	2	2.2	1.1, 1.5, 1.5
IO2	saltbush	4	6.0	4.9, >3.9, >3.9
SS1	saltbush, greasewood	4	3.1	2.3, 2.3, 1.9

Site	Dominant plant species	Root Zone (m)	Minimum DTW (m)	Groundwater recharge depth (m)
SS2	saltbush	4	5.3	4.5, >3.9, >3.9
SS3	saltbush	4	2.6	1.5, 2.1, 1.7
SS4	saltbush	4	5.4	3.5, >3.7, >3.9
BG2	inkweed, saltbush	4	2.2	2.3, 3.1, 2.1

**Table 6. Soil depth below ground surface replenished by groundwater in April 2025 at control sites. Values are provided for each monitoring location within a site unless the identification of a specific depth was uncertain (UNK in table). Minimum DTW was measured in the associated test well from April 2024 to March 2025. If groundwater not recharging soil, greater than “>” sign used at maximum tube depth.**

Site	Dominant plant species	Root Zone (m)	Minimum DTW (m)	Groundwater recharge depth (m)
BC1	rabbitbrush, saltbush, greasewood, alkali sacaton	4	0.9	1.1, 1.7, 1.9
BC2	rabbitbrush, saltgrass	2	2.3	1.5, 1.1, 1.1, 0.9
BC3	rabbitbrush, saltgrass, saltbush	2	1.0	0.9, 0.9, 0.7
TAC	saltbush, rye grass, saltgrass, alkali sacaton	2	0.5	<0.7, <0.7, <0.5, 0.7
TSC	alkali sacaton, rabbitbrush, greasewood.	2	1.0	1.1, 0.9, 0.9
IC1	saltbush, saltgrass, rabbitbrush	2	0.7	0.9, 1.1, <0.5
IC2	rabbitbrush, alkali sacaton	2	1.5	1.9, 1.9, 1.5
BGC	saltbush, saltgrass	4	1.8	0.9, 1.5, 1.1

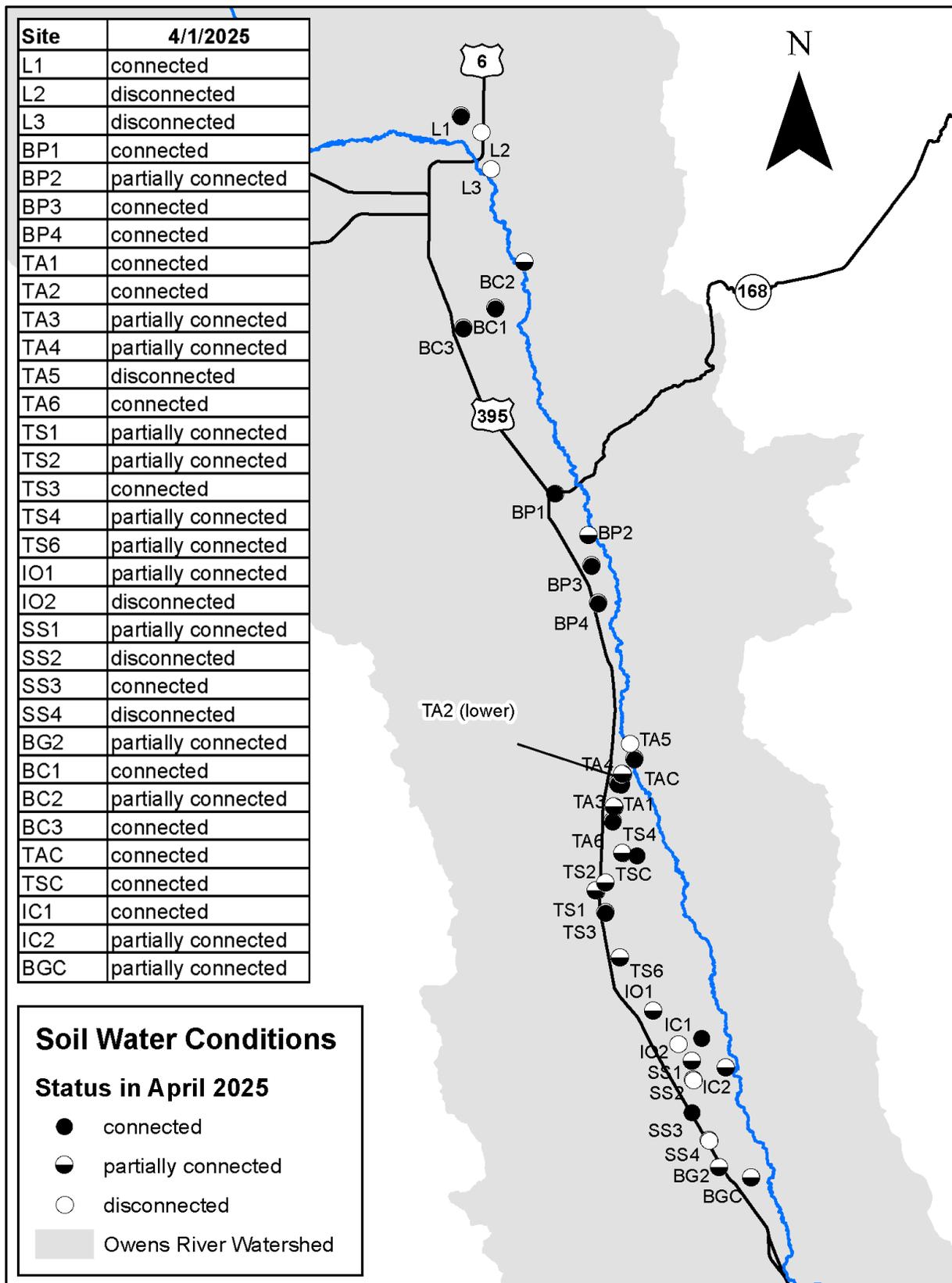
Most sites experienced some level of groundwater recharge into the root zone of plants (2-4 meters deep) in 2024-25 but at lesser amounts than the previous year. Soil moisture amounts decreased in all seven wellfields as measured from April 1, 2024, to April 1, 2025. Control area soil moisture also decreased year-to-year.

Where possible, the monitoring sites were grouped into simple categories to summarize the connection between soil water in the root zone and the water table as of April 2025. Brief descriptions of the three categories and the results are given below:

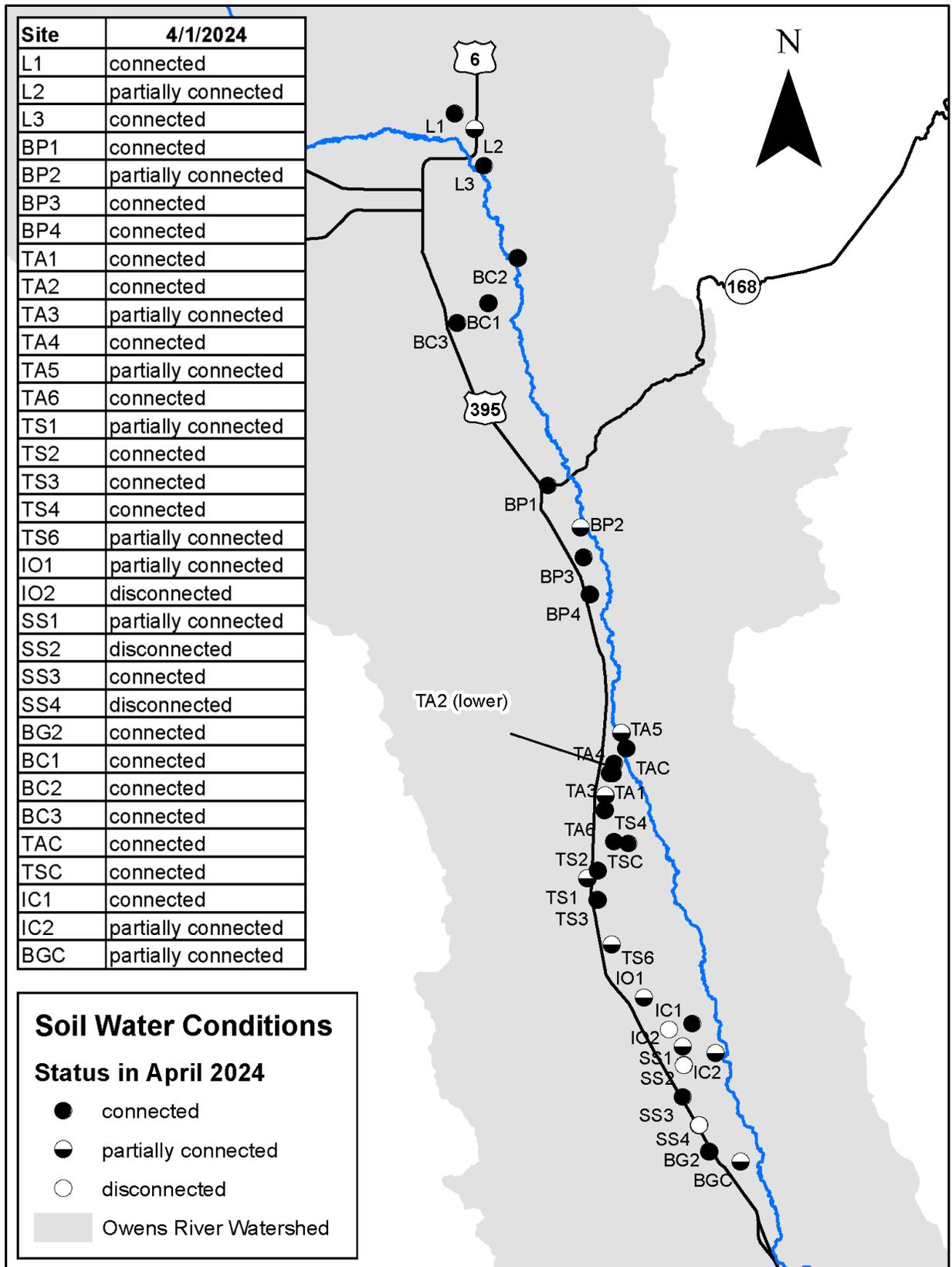
1. **Connected:** Water table fluctuations resulted in soil water recharge in the top half of the root zone at most monitoring locations within a site. Nine wellfield and five control sites were placed in this category.
2. **Partially connected:** Water table fluctuations resulted in soil water recharge in the bottom half of the root zone at most monitoring locations within a site. Ten wellfield and three control sites were placed in this category.
3. **Disconnected:** No recharge from groundwater occurred in the root zone. Six wellfield sites and no control sites were in this category.

At some monitoring locations (e.g., BP2), soil water content exhibited increasing amounts at certain depths well above the water table while lower depths showed little or no change. Water can be transported during winter from wetter, deeper soil layers through plant roots to recharge dry soil at shallower depths (Horton and Hart, 1998; Jackson et al., 2000), but without additional information, assigning that cause is speculative. The increase in water content was small and barely detectable. Regardless of the exact mechanism causing the increase in soil water, the monitoring and On/Off management were able to measure and account for that source of water.

At the beginning of the 2025 growing season (April), the water table had supplied, or was capable of supplying, water to the root zone at 19 of the 25 wellfield monitoring sites (Figure 1). The trend from 2024 to 2025 was for soil moisture at monitoring sites to become less connected to the water table corresponding to overall groundwater level decreases (Figure 2, previous year's April status). Six wellfield sites (LW2, LW3, TA5, IO2, SS2, and SS4) are now disconnected from the water table and have low soil moisture levels; three of these sites were mapped as Alkali Meadow vegetation during the baseline vegetation inventory of the mid-1980s. The eight control sites had groundwater supplied to their respective root zones.



**Figure 1. Owens Valley permanent monitoring sites and groundwater recharge classes as of April 2025. It is difficult to distinguish TA1 and TA2 on this map because of their proximity to one another. TA1 and TA2 are connected.**



**Figure 2. For comparison purposes, Figure 2 contains the Soil Water Conditions “connection” status as of the previous year (April 2024). It is difficult to distinguish TA1 and TA2 on this map because of their proximity to one another. TA1 and TA2 were connected.**

## References

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