WELL W383 REPLACEMENT (W383R)
INDEPENDENCE WELLFIELD

PRE-CONSTRUCTION EVALUATION REPORT

Eastern Sierra Environmental Group

Water Operations Division

Los Angeles Department of Water and Power

October 2023

1. PURPOSE

The City of Los Angeles Department of Water and Power (LADWP) plans to drill and construct a well to replace the existing Well W383 located in Independence-Oak Wellfield to supply water to the same uses as the existing well in the town of Independence. The replacement well should improve LADWP's operational flexibility and facilitate rotational pumping in the wellfield. This report's purpose is to satisfy Section IV.B of the Greenbook (the Technical Appendix to the Water Agreement), Guidelines for Drilling and Activating New Production Wells.

2. BACKGROUND

2.1 Introduction

Enhancement and mitigation (E&M) well W383 is among the two E&M wells located in the Independence Wellfield. Both wells discharge water to the Independence Tree Farm in the town. Well W383 was constructed in 1986 to a depth of 4575 feet below the ground surface (feet-bgs) and is screened from 264 to 565 feet-bgs (well log included as Addendum A). Generally, W383 operates during the irrigation year, but its pumping capacity has decreased in recent years due to. LADWP plans to replace production well W383 in Big Pine Wellfield using the current industry standards for well construction and improve LADWP's operational flexibility in managing water resources in Owens Valley. The purpose of this report is to satisfy the requirements of Section IV.B. of the Greenbook, Guidelines for Drilling and Activating New Production Wells. According to Section VI of the Inyo/LA Long-Term Water Agreement (Water Agreement),

> *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.*

According to the 1991 EIR, the pumping capacity of W383 is 2.4 cubic feet per second (cfs).

2.2 Geographic Setting

Independence-Oak Wellfield is near the town of Independence in the southern portion of Owens Valley. The main hydrologic features in the area are Independence and Oak Creeks which flow to the LAA. The location of the existing W383 Canal and the proposed location of the replacement well W383R are presented in **Figure 1**. The replacement well will be used for the same purposes as the existing well.

3. HYDROGEOLOGIC CONDITIONS

3.1 Geology

3.23.1.1 Overview

The conceptual geological framework of the Owens Valley was presented in a U.S. Geological Survey (USGS) report "Geology and Water Resources of Owens Valley, California" (Hollett, et. al., 1991). Owens Valley is a structural graben filled by debris eroded from the White and Inyo Mountains to the east and the Sierra Nevada mountain range to the west.

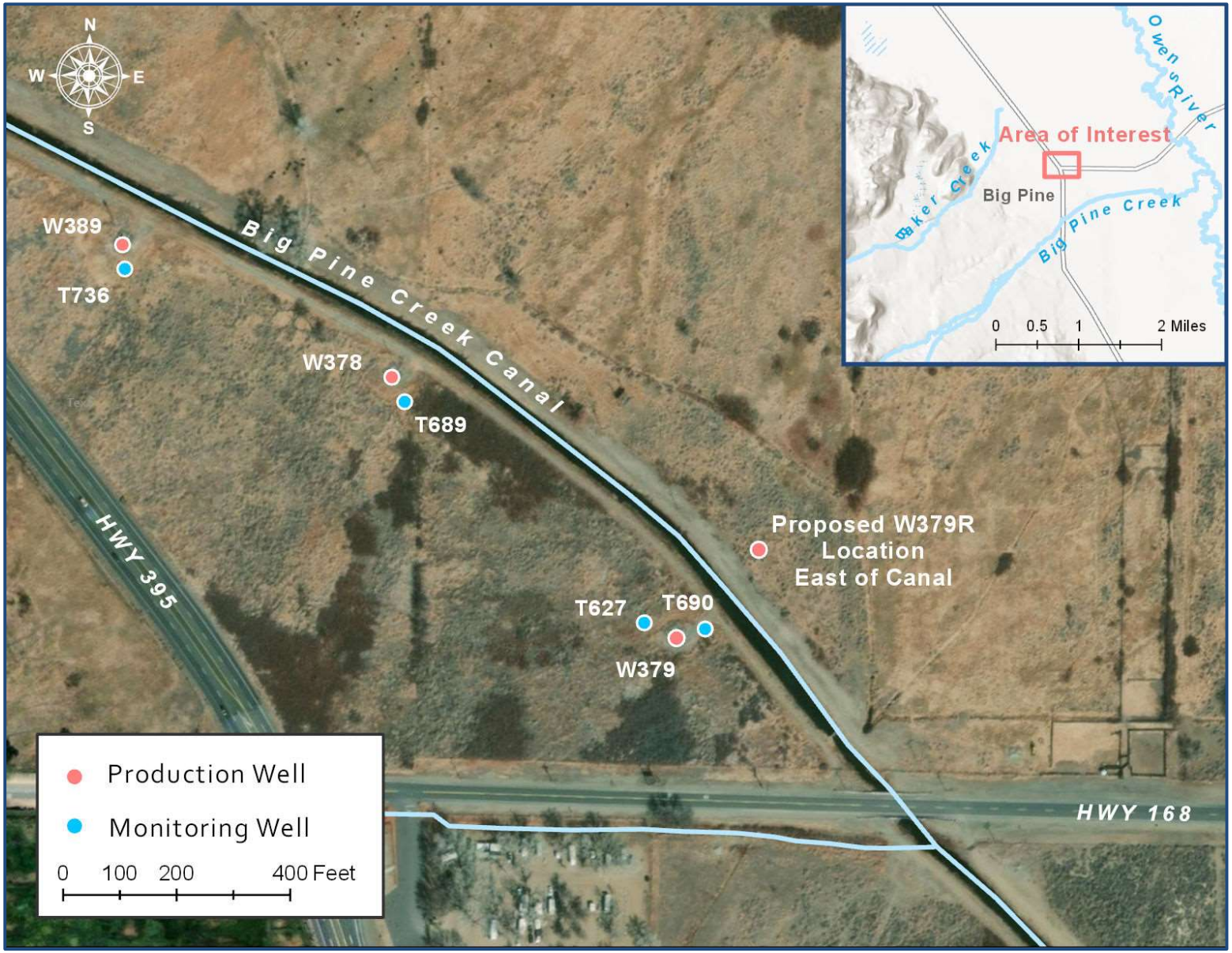

FIGURE 1 – LOCATIONS OF EXISTING WELL W383 AND REPLACEMENT W383R IN BIG PINE WELLFIELD

Lithological logs throughout the Independence-Oak wellfield exhibit relatively consistent coarse strata interbedded with fines, mostly in the central and eastern parts of the wellfield. The effect of the interbedded clay layers on the aquifer is semi-confinement (leaky aquifer) from approximately 100 to 200 feet-bgs.

A comparison of groundwater levels in the two nearby monitoring wells T632 and T651 exhibits the semi-confined aquifer in the vicinity of W383. T632 is completed at a depth of 420 feet-bgs with groundwater levels ranging from 40 to 95 feet-bgs. Well T651 is completed to a depth of 42 feet-bgs with groundwater levels ranging from 10 to 40 feet-bgs. The 42.5-foot mean difference in groundwater levels between these two wells indicates the possible presence of a leaky aquifer. The difference in groundwaters in T936 and T937 represents the effect of 1872 Owens Valley fault on groundwater movement west of town. Groundwater levels at T632 and T651, in addition to other monitoring wells throughout the wellfield, are presented in **Table 1**. They are presented in pairs of one shallow and one deep monitoring well. The locations of the monitoring wells are shown in the map in **Figure 2**.

To improve understanding of this semi-confinement, the existing W383 may be converted to a monitoring well, measuring groundwater levels in the shallow and deep aquifers.

Table 1 – Comparison of Groundwater Levels in Paired Monitoring Wells

Wellfield Area	Shallow		Deep	
	Well (depth ft-bgs)	DTW Range (ft-bgs)	Deep (depth ft-bgs)	DTW Range (ft-bgs)
North	T690 (55)	5-15	T627 (200)	45-55
South	T651 (42)	10-40	T632 (420)	40-95
East	T232A (20)	10-15	V295 (620)	20-25
West	T936 (150)	35-45	T937 (250)	110-120
Far South	V017GC (49)	15-30	V017GA (390)	25-50

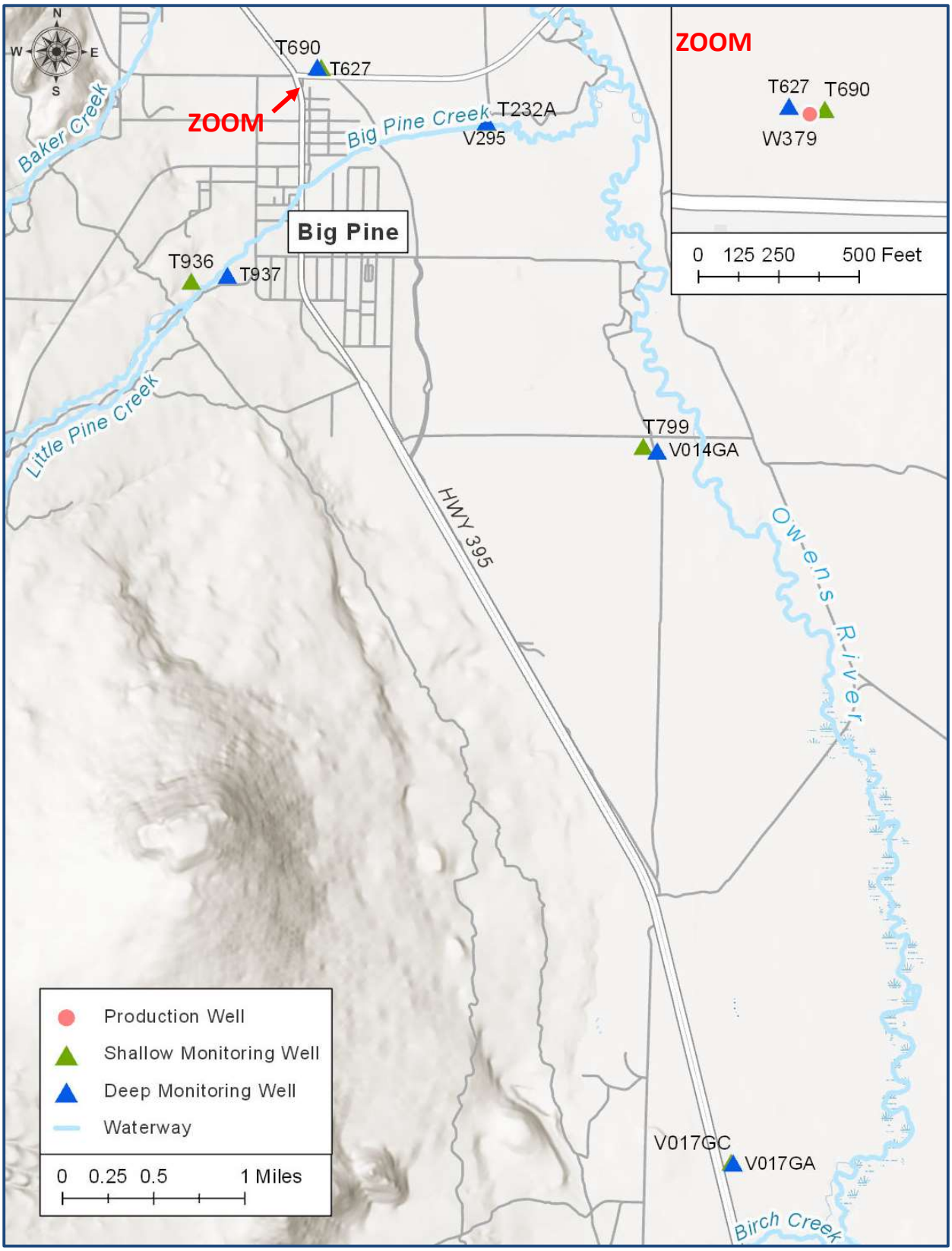

FIGURE 2 – SHALLOW AND DEEP AQUIFER MONITORING WELLS IN INDEPENDENCE-OAK WELLFIELD

3.3 Hydrology

3.3.1 Groundwater

Groundwater in Independence-Oak Wellfield resides mostly in the alluvial and valley fill that consists of debris flows and fluvial material originating from mountain canyons. Groundwater in the wellfield generally flows southward from the recharge areas north, east, and mainly west of the wellfield. The Independence and Oak Creeks are the primary source of recharge for wellfield. Overall, this wellfield receives a moderate amount of recharge (median of 21,000 AF over the last 2 decades) compared to other wellfields.

A review of the driller's logs for existing wells in Independence-Oak Wellfield indicates relatively consistent sand and gravel strata. Additionally, groundwater levels at T632 and T651 indicate the presence of leaky aquifer conditions in the vicinity of W383, as described in the previous section. Hollett et al. (1991) estimated vertical hydraulic conductivity of the confining clays in the valley ranges from 0.002 to 0.00083 ft/day.

Currently, LADWP has 11 production wells in Independence-Oak Wellfield, 4 of which were operational during the 2022-23 runoff year (RY). The locations of these production wells are presented in the map in **Figure 3**. The historical total wellfield annual pumping volume since the 1971 RY is listed in **Table 2**. As listed in the table, groundwater pumping in Independence-Oak Wellfield has ranged generally between 15 and 26 thousand acre-feet per year (AFY) since 1991, when Water Agreement implementation started. In addition to the LADWP wells shown in **Figure 3**, there are several relatively deep private, tribal, and community domestic supply wells in Independence-Oak, but none are located in the immediate vicinity of W383.

FIGURE 3 – LADWP PRODUCTION WELLS IN THE VICINITY OF W383 IN BIG PINE WELLFIELD

TABLE 2 – GROUNDWATER PUMPING FROM WELLS IN THE VICINITY OF W383 IN BIG PINE WELLFIELD (AFY)

RO Year	W057†	W077‡	W059	W060	W061	W063	W065	W357	W383	W384	W391	W400	W401	Total
1971-72	1,452	977	728	1,232	747	791	1,864							7,791
1972-73	2,640	1,933	1,780	2,135	1,590	1,527	3,600							15,205
1973-74	2,423	815	1,221	886	189	1,349	1,827							8,710
1974-75	2,847	0	622	345	337	902	736							5,789
1975-76	2,704	0	718	551	129	774	2,942							7,818
1976-77	1,882	278	696	1,718	0	35	2,031							6,640
1977-78	1,550	1,035	1,389	1,715	1,204	1,230	2,004	2,079						12,206
1978-79	502	67	65	0	64	56	92	1,598						2,444
1979-80	1,825	1,016	291	1,328	0	786	20	801						6,067
1980-81	780	0	0	3	0	0	0	390						1,173
1981-82	83	1	24	32	196	0	49	569						954
1982-83	520	35	35	50	36	32	52	307						1,067
1983-84	0	0	0	2	2	0	0	342						346
1984-85	289	132	178	261	132	0	270	336						1,598
1985-86	357	420	239	496	424	305	405	359						3,005
1986-87	153	0	0	600	1	0	0	337						1,091
1987-88	2,894	2,126	2,030	2,033	2,121	1,804	2,902	376	873	386				17,545
1988-89	2,692	1,118	2,096	1,987	1,828	1,701	2,945	416	1,043	881				16,707
1989-90	2,523	0	1,928	3,055	1,706	16	3,406	454	1,701	1,188				15,977
1990-91	321	109	1,260	1,931	935	84	2,084	425	1,653	1,099	12			9,913
1991-92	385	1	1,601	2,898	802	14	1,831	422	1,667	1,164	0			10,785
1992-93			1,221	2,023	1,182	92	1,681	441	1,345	501	0	0	2,406	10,892
1993-94			66	2,514	940	75	1,060	508	967	505	112	75	0	6,822
1994-95			154	3,085	1,434	62	1,827	504	1,215	878	0	94	343	9,596
1995-96			0	2,392	1,146	0	1,315	477	1,693	1,337	0	0	823	9,183
1996-97			0	1,721	1,256	0	1,529	510	1,784	1,178	0	0	0	7,978
1997-98			39	1,709	1,239	44	1,458	477	1,004	669	64	44	78	6,825
1998-99			79	1,681	1,195	20	1,387	445	936	554	127	97	171	6,692
1999-00			0	1,615	1,237	0	1,167	1,195	1,152	615	0	0	0	6,981
2000-01			30	1,748	1,311	32	1,166	705	1,135	1,110	0	33	57	7,327
2001-02			0	1,654	1,061	0	1,372	567	1,189	1,021	0	0	0	6,864
2002-03			979	1,897	1,063	0	1,012	534	1,340	723	0	0	3,009	10,557
2003-04			1,807	1,935	1,087	0	923	563	1,005	1,084	0	0	3,355	11,759
2004-05			384	2,490	1,019	0	1,429	485	997	696	0	0	2,443	9,943
2005-06			38	2,110	1,090	0	1,163	467	1,010	608	0	0	171	6,657
2006-07			1,194	2,020	1,147	0	1,543	477	1,121	578	216	14	997	9,307
2007-08			37	2,012	898	0	1,567	522	1,089	781	0	127	0	7,033
2008-09			0	1,918	1,018	0	1,599	498	1,209	761	0	0	0	7,003
2009-10			0	1,767	956	0	1,398	472	1,040	810	0	0	0	6,443
2010-11			0	1,873	956	0	1,389	460	1,036	784	0	0	0	6,498
2011-12			7	2,899	939	0	2,096	438	919	786	0	0	1,066	9,150
2012-13			0	1,654	964	0	1,591	490	875	740	17	0	1,625	7,956
2013-14			0	1,605	1,824	11	1,005	444	767	683	17	11	3,252	9,620
2014-15			0	1,613	1,728	18	1,008	444	495	720	23	17	2,482	8,549
2015-16			485	2,731	1,724	0	1,827	336	702	704	0	0	1,986	10,494
2016-17			0	2,988	820	0	1,022	420	639	701	0	0	2,860	9,450
2017-18			0	1,500	537	0	1,335	413	523	777	0	181	509	5,774
2018-19			1,815	1,520		1,471	1,837	424	489	708	0	554	2,752	11,570
2019-20			998	1,567		209	1,358	401	228	634	0	0	323	5,718
2020-21			693	2,440		560	1,609	491	534	781	0	0	706	7,814
2021-22			1,565	1,534		0	1,445	500	447	640	0	0	1	6,133
2022-23			1,095	961		0	865	450	437	631	0	0	1,076	5,514
5-Year Average	NA	NA	1,233	1,604	NA	448	1,423	453	427	679	0	111	972	7,350

Gray cells indicate well were offline

†*W401 replaced W057 in 1992. W057 was subsequently abandoned.*

‡*W400 replaced W077 in 1992. W077 was subsequently designated a flowing well.*

3.2.2 Surface Water

The main water features in Independence-Oak Wellfield include Owens River, , Independence Creek, and Oak Creek, which recharge the groundwater aquifer. The weather station at LADWP's Big Pine Powerhouse Weather Yard is the closest station to W379, with long-term average precipitation (from 1991 to 2022 hydro years) of 3.6 inches per year, lower than the historical average precipitation in the Owens Valley.

The major flow gauges and their associated flows in Independence-Oak Wellfield are listed in **Table 3**. The locations of the flow gauges are presented in the map in **Figure 4**. Some of the flow gauges listed in **Table 3** are outside of the area presented in the map in **Figure 4**. Independence-Oak Wellfield receives the second highest volume of water in its creeks and ditches.

FIGURE 4 – KEY STREAMFLOW GAUGES IN INDEPENDENCE OAK WELLFIELD NEAR W383

TABLE 3 – FLOW MEASUREMENTS IN KEY INDEPENDENCE AREA STREAMFLOW GAUGES

Station ID	Station Name	Volume [AFY] Average 1991-2022 RY
0074	Oak Ck North Fork Base of Mountain	6,448
0075	Oak Ck South Fork Base of Mountain	5,049
0072	Independence Creek USGS Station	8,260
0354	Lower Owens River Mazurka Canyon Road	40,721

Station 0354 record begins the 2007 RY

4. ENVIRONMENTAL RESOURCES

4.1 Vegetation in the Vicinity of the Replacement Well

Vegetation parcels in the Independence area were inventoried from 1987 and later classified according to the Water Agreement based on water use with designations of Type A to Type E. Vegetation parcels in the vicinity of W383 are presented in **Figure 5**. According to the Green Book, Section II.A.2, "parcel boundary lines were transferred to orthophoto quadrangles at 1:24,000 scale. The final maps overlay the USGS 7.5-minute quads." Once installed the replacement production well would be in the immediate vicinity of Type B, C, and E vegetation parcels. However, generally, there is little to no effect on shallow groundwater levels from operating the intermediate aquifer screened, existing W383. Likewise, operating the deeper replacement well W383R would have little to no effect on groundwater-dependent vegetation.

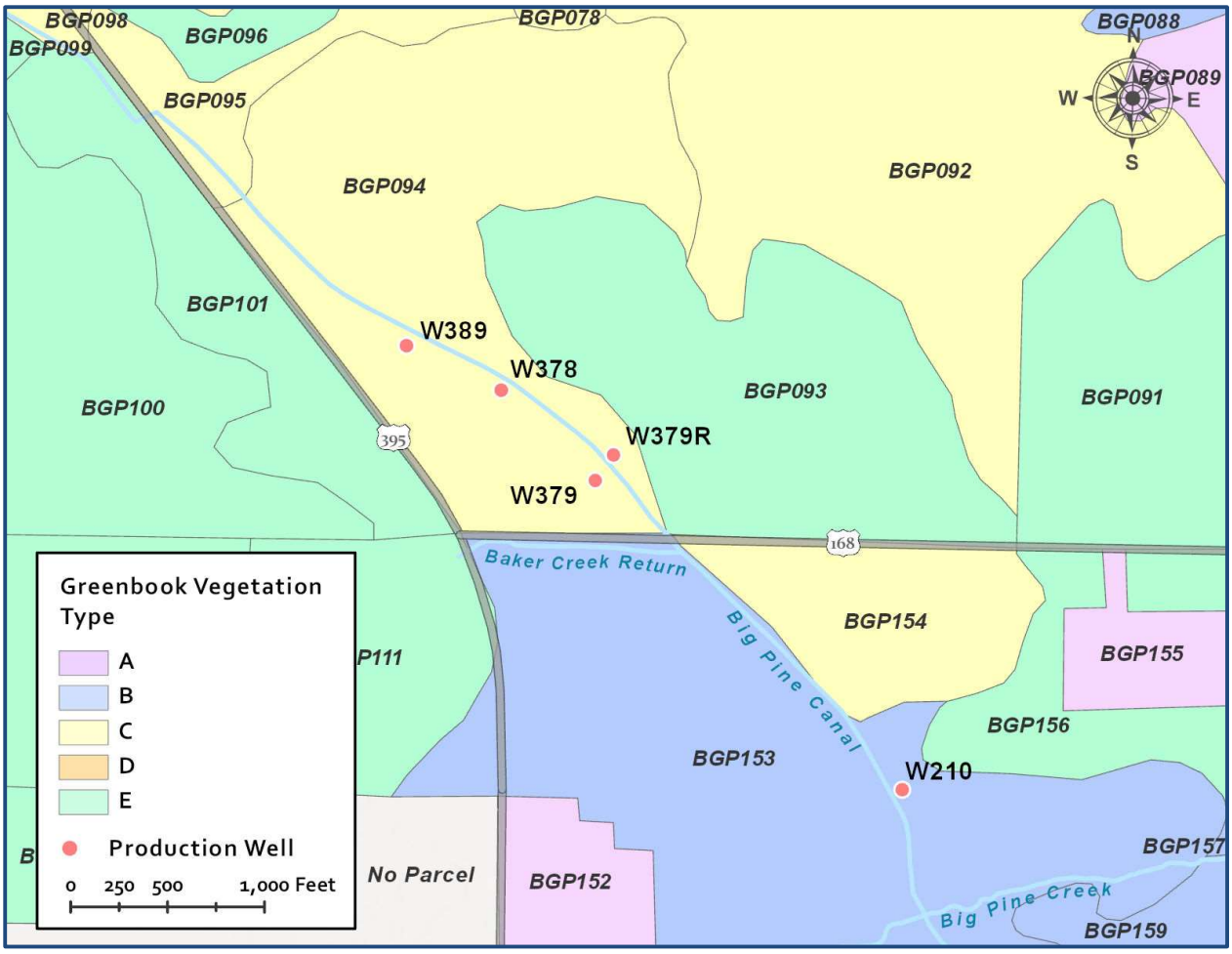

FIGURE 5 – VEGETATION PARCEL INDEPENDENCE-OAK WELLFIELD IN THE VICINITY OF W383

4.2 Springs, Seeps, Flowing Wells

There are several known springs and flowing wells in Independence area. The locations of the flowing wells are presented in the map in **Figure X**. The long-term average volume from flowing wells (from 1991 to 2022 RY) is approximately 2,700 AFY. Note that this includes wells in the wellfields near Independence-Oak Wellfield.

Figure X – Flowing Wells in the Independence Area

4.3 Non-LADWP Wells

There are a few private wells in the town of Big Pine that provide water for domestic and irrigation purposes. The Big Pine Reservation supply well is located south of town, approximately 1.4 miles southwest of W379. No data on the depth, diameter, or pumping record of the Big Pine Reservation supply well is available. The non-LADWP wells typically have smaller diameters and shallower depths, drawing water from the shallow aquifer and, therefore, are affected primarily by changes in groundwater levels in the shallow aquifer. Because the shallow aquifer is recharged primarily by the infiltration of water from excess irrigation water, the creeks, and ditches running throughout Big Pine, changes in ditch operations could potentially affect groundwater levels in private and community supply wells. The locations of known non-LADWP wells in the vicinity of W379 based on available data from the California State Department of Water Resources (DWR) are presented in **Figure 6**. Based on the available data, there are no non-LADWP within 3,600 feet of the planned production well W379R.

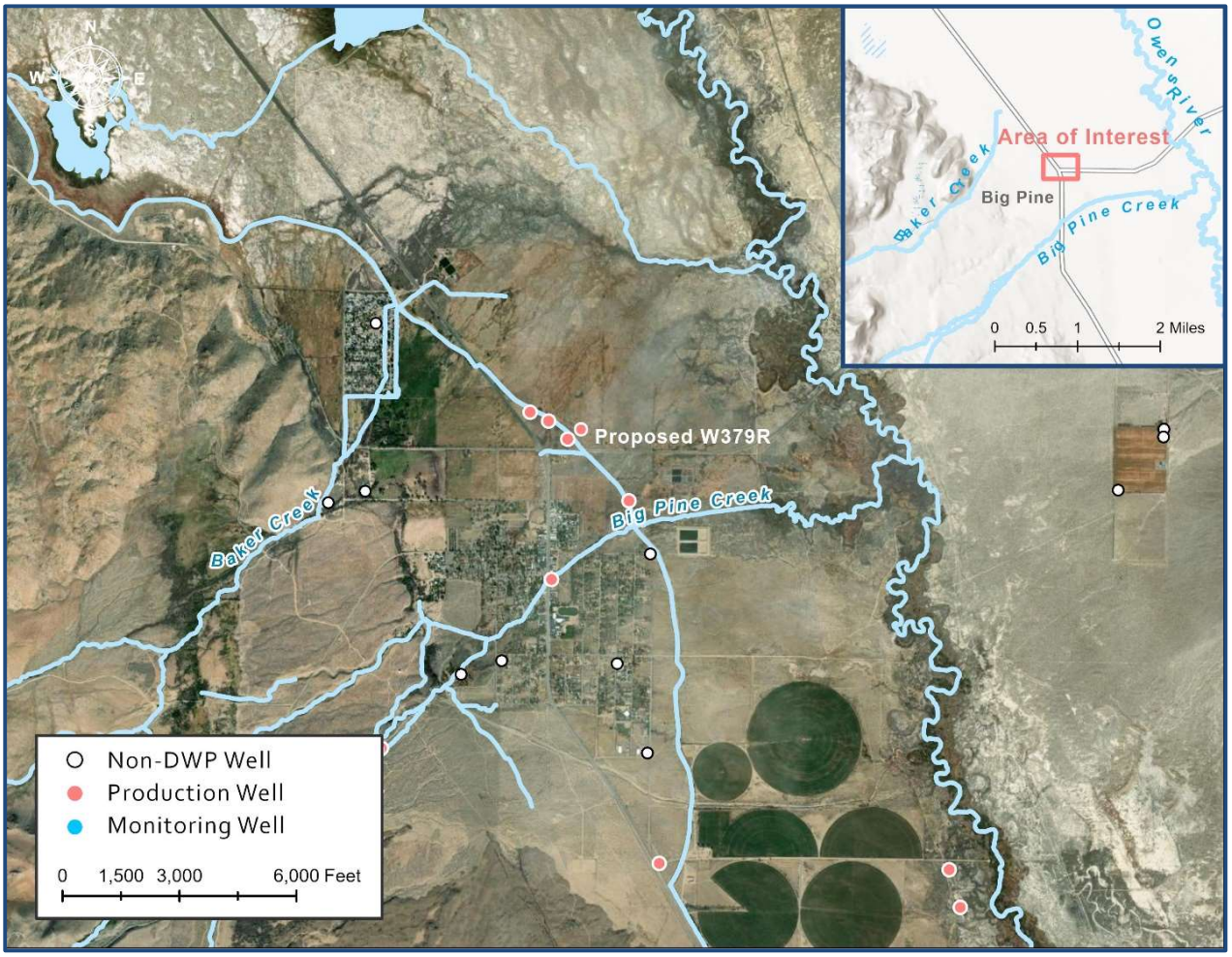

FIGURE 6 – NON-DWP WELLS IN THE VICINITY OF W3783

5. CONSTRUCTION AND TESTING

5.1 New Well Design

To minimize potential effects of operating the replacement well on vegetation depending on water from the shallow aquifer, W383R will be screened below the semi-confinement separating shallow and deep aquifers in the Independence area. An exploratory borehole for W383R will be drilled to approximately 700 feet-bgs. The final depth and screen zone of the replacement well will be determined after reviewing the lithologic and geophysical logs of the borehole. The preliminary design of W383R with an interval of 350 to 700 feet-bgs is presented in **Figure 7**. This screen depth should ensure that W383R will primarily draw water from the deep aquifer. The zone above the screen will be sealed to the ground surface. The replacement well will be constructed with an 18-inch diameter casing and screen using high-strength/Low-Alloy steel. Using an 18-inch diameter screen and casing is the current industry standard for municipal wells and allows easier well and pump maintenance.

Current industry standards for well drilling and design are incorporated in plans for the installation of the well W383R. These plans include using a mud rotary method for drilling, a pre-fabricated casing and screen, and placing a properly sized filter pack in the annular space between the screen and the borehole wall. The appropriate screen slot size will be determined by performing a sieve analysis. The annular space between the casing and borehole, above the filter pack to the ground surface, will be sealed with cement grout and bentonite chips to ensure that groundwater is protected from potential surface contamination and the well is not drawing water from the shallow aquifer. After construction, the production well will be developed by removing the drilling mud from the casing, swabbing and airlifting the screen zone, and pumping/surging. The development will be complete once the discharge water is clear and turbidity is below 10 NTU.

The initial pumping capacity of W383R should be approximately 2.0-3.0 cfs. Analysis of the data from the well development and the planned aquifer test will be used to determine the actual pumping capacity of W383R. It is also expected that the pumping capacity of W383R will decrease over time, which is typical for all water supply wells.

If the pumping capacity of the well is higher than that of the existing well, the replacement well will be equipped with a pump with the same or lower pumping capacity than that of the one it is replacing.

The Technical Group will develop a monitoring plan prior to the first season of the operation of the replacement well to avoid potential impacts on nearby environmental

resources, including vegetation, private wells, flowing wells, and springs. A draft monitoring plan is attached to this report.

After activation of the replacement well W383R, the existing well W383 will be either abandoned or converted to a deep monitoring well during the following round of LADWP's contractor fieldwork.

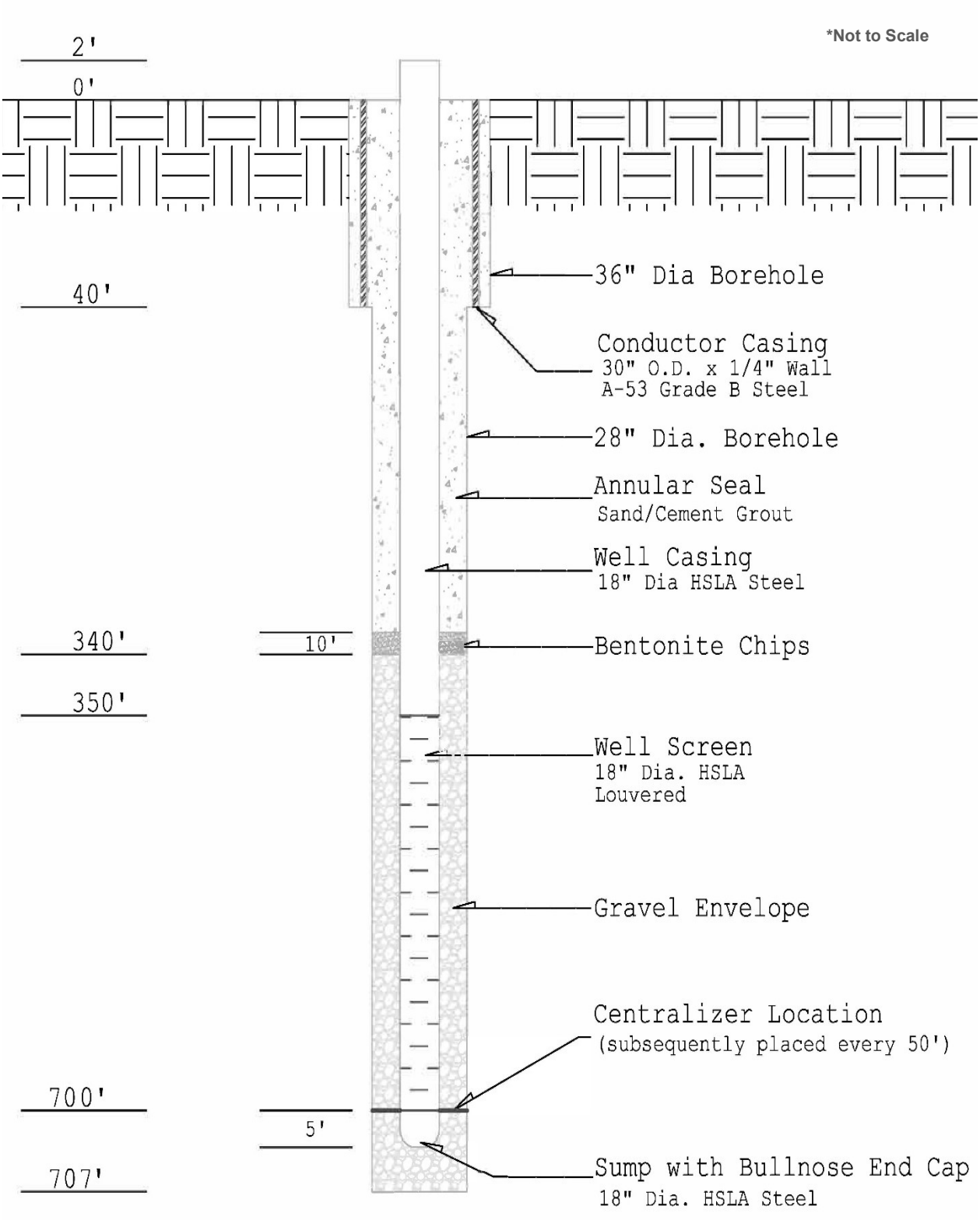

FIGURE 7 - PRELIMINARY DESIGN FOR W383R IN BIG PINE WELLFIELD

5.2 Aquifer Test

Once the replacement well W383R is installed, the contractor will place a temporary pump in the well for pumping development and conducting a step-drawdown test with up to four steps. The step drawdown test data and analysis will determine the appropriate pumping rate during the constant-rate aquifer test. The aquifer test will include pumping for a minimum of 24 hours but will continue for 48 and up to 72 hours if the water levels in the designated monitoring well or wells have not stabilized. Appropriate portions of the monitoring plan will be implemented during the aquifer test.

6. POTENTIAL IMPACTS ON GROUNDWATER-DEPENDENT RESOURCES

6.1 Well Operation Simulations

A groundwater flow model that was developed for the Southern Owens Valley by MWH Americas, Inc. (now Stantec Consulting) was utilized to estimate the effect of operating the proposed replacement well W383R on the shallow aquifer groundwater levels. This MODFLOW-based groundwater model represents the groundwater aquifer in three model layers, simulating the shallow, intermediate, and deep aquifer with a uniform cell size of 500 feet by 500 feet. The Southern OV model was recently updated in 2023. Data to be gathered from the planned aquifer test of W3839R should improve the predictability of the model. The existing well W383 is primarily screened in the intermediate aquifer zones (layer 3). Replacement well W383R is planned to be primarily screened in the deep aquifer zone (layer 4). According to the 1991 EIR, the well had an operational capacity of 2.4 cfs. To determine the relative effect of pumping existing well W383 and the replacement well W383R, the simulated drawdown resulting from pumping the W379 at an average rate of 2.4 cfs and the W383R at the same average pumping rate for one year of operation were compared.

The resulting one-year pumping simulation drawdown contours of groundwater levels in the shallow, intermediate, and deep aquifers are presented in **Figures 8 to 10**. The resulting one-year pumping simulation of W383R resulted in less drawdown in the shallow aquifer (about 4 feet less within a 500-foot radius), and more in both the intermediate and deep aquifers (about 10 and 6 feet more, respectively, within a 500-foot radius), compared to the original W379R.

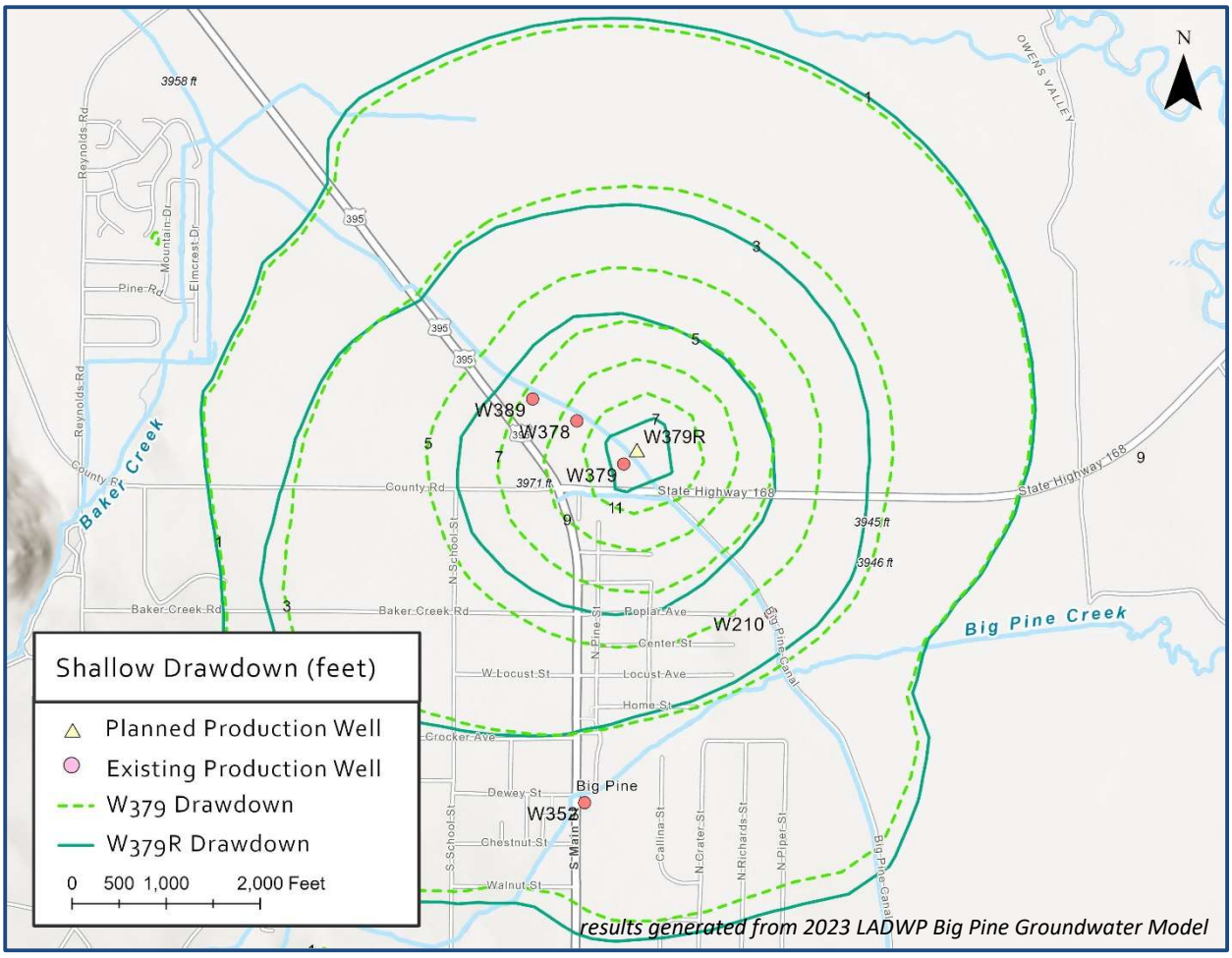

FIGURE 8 - SHALLOW AQUIFER **GROUNDWATER LEVELS (FT-AMSL) FROM OPERATING EXISTING W383 AND REPLACEMENT W383R AT 2.4 CFS FOR ONE YEAR**

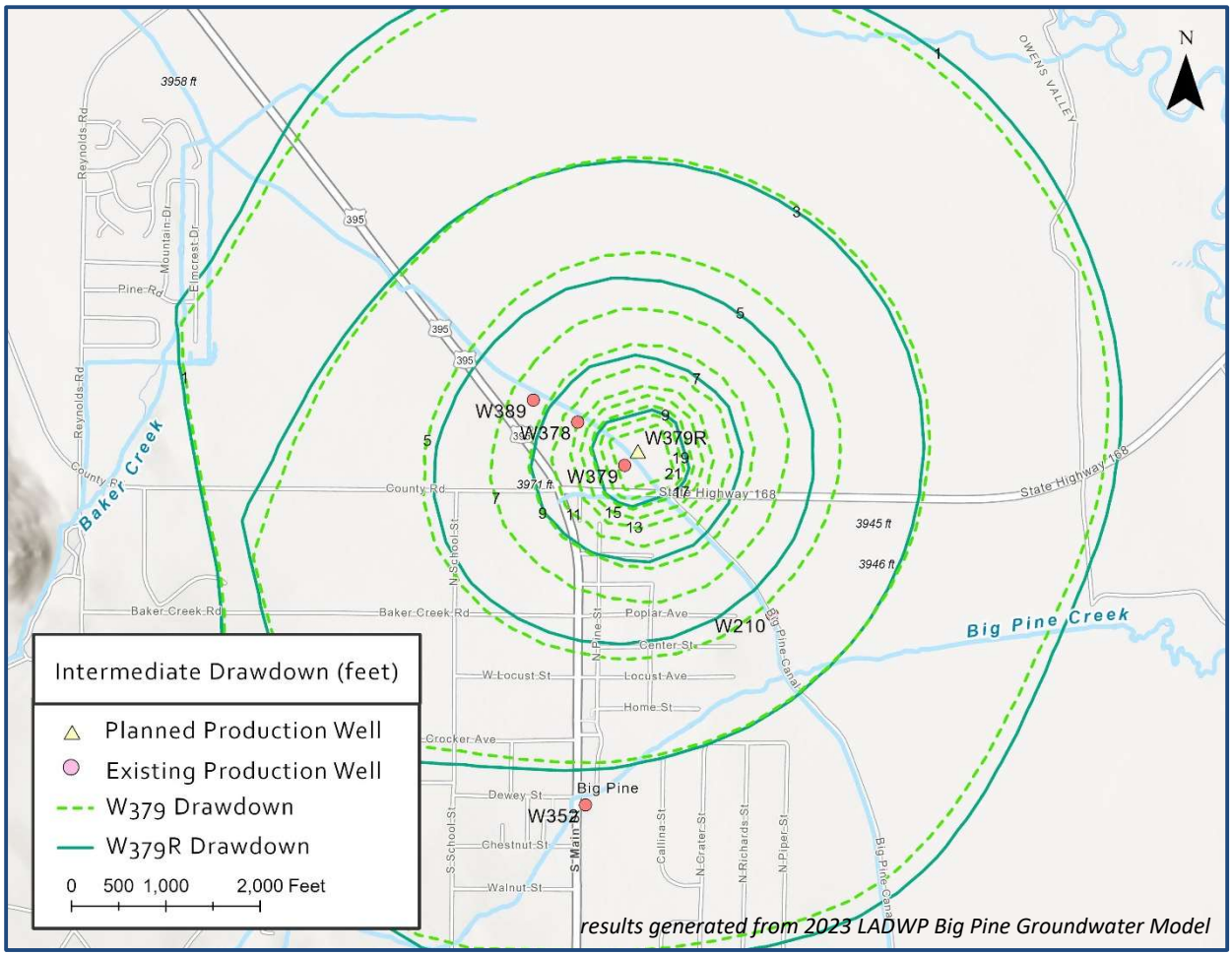

FIGURE 9 - INTERMEDIATE AQUIFER **GROUNDWATER LEVELS (FT-AMSL) FROM OPERATING EXISTING W383 AND REPLACEMENT W383R AT 2.4 CFS FOR ONE YEAR**

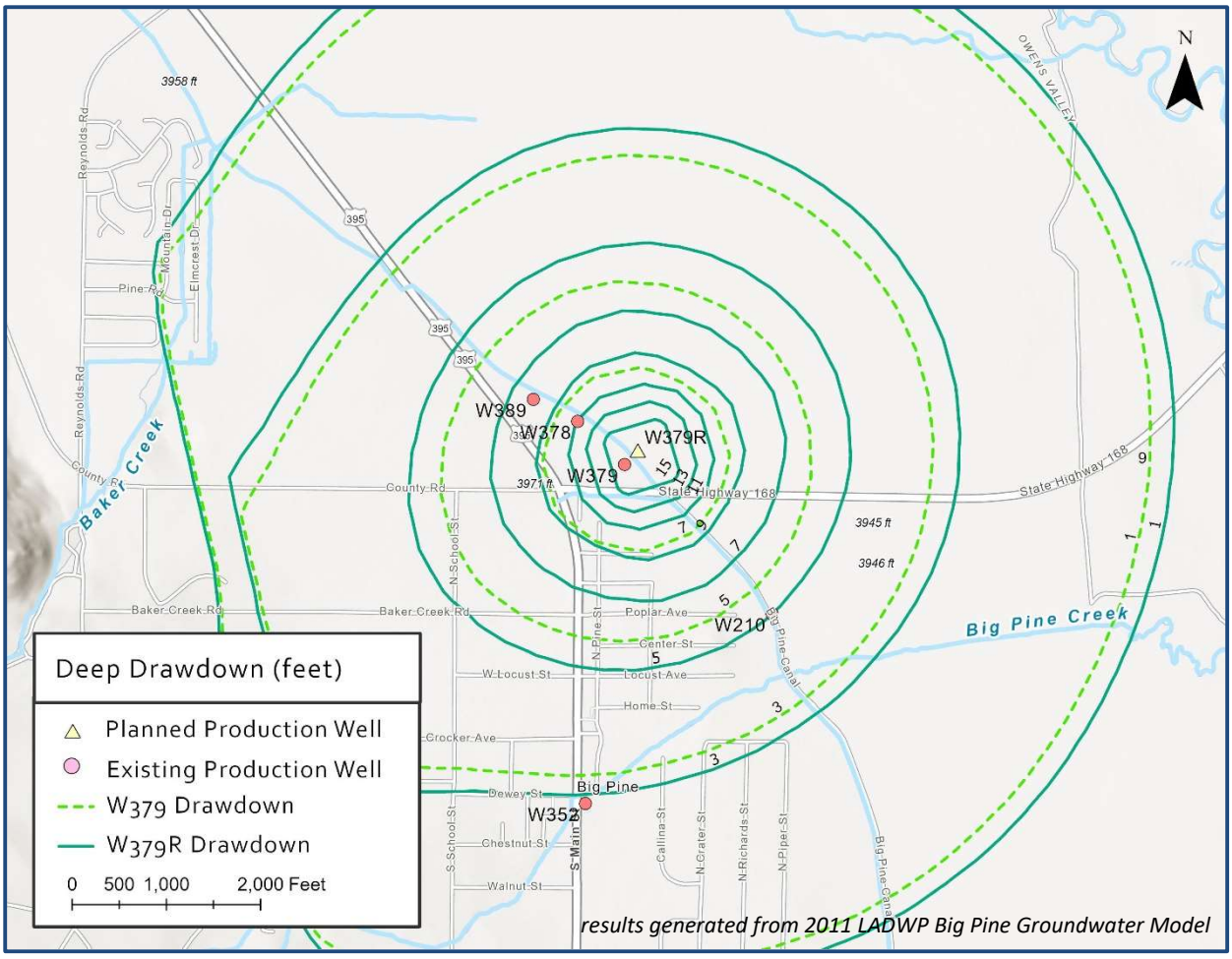

FIGURE 10 - DEEP AQUIFER **GROUNDWATER LEVELS (FT-AMSL) FROM OPERATING EXISTING W383 AND REPLACEMENT W383R AT 2.4 CFS FOR ONE YEAR**

Once W383R is drilled and data from an aquifer test are analyzed, the calculated aquifer characteristics from the tests will be used to update and re-calibrate the Big Pine groundwater model in the area near W383R. This updated model should improve the understanding of aquifer characteristics and produce a more realistic effect of pumping on groundwater levels. Using the updated model, multiple-year pumping scenarios during various runoff conditions can be simulated.

6.2 Potential Effects on Vegetation

The simulations of the one-year operation of the existing and replacement wells W383 and W383R result in a similar effect on the shallow aquifer water levels. Therefore, no additional potential effect from operating the replacement of W383 on groundwater-dependent vegetation is expected.

6.3 Potential Effects on non-LADWP wells

As the nearest non-LADWP well is approximately 3,600 feet away from the proposed production well, no effects are expected from operating W383R on non-LADWP wells in the Big Pine Area. The nearest non-LADWP wells within a 2-mile radius of W383R are screened generally shallow with the screen higher than 165 feet-bgs.

7. OPERATION

The pump, motor, and related equipment will be designed and installed in the well using the results from the analysis of the data collected during the aquifer tests and the calculated pumping capacity. Operation of W383R, similar to W383, will be exempt from ON/OFF protocols of the Water Agreement as it is considered an E&M well. .

According to the Water Agreement, the Technical Group is responsible for developing and implementing a monitoring plan during the initial operation of new wells. The monitoring plan will include both hydrologic and vegetation monitoring. The goal of the initial operation is to determine the potential long-term effects of operating the well. A draft monitoring plan for the first season of W383R operation is attached. The applicable portions of the monitoring plan will be implemented during the aquifer test by the Contractor. The monitoring plan will be updated using the findings from the aquifer test data analysis and modeling effort. After the completion of the initial operation phase of W383R, the regular operation of this well will be included in LADWP's annual operation plan for Owens Valley.

8. ENVIRONMENTAL ASSESSMENT

Well W383R will replace and be located adjacent to the existing well W379. The well will extract water from the intermediate and deep aquifers and water will be used for the same purposes as the well it is replacing. Computer model simulations show that the operation of the replacement well should have minimal effect on groundwater levels in the shallow aquifer that supports vegetation. Therefore, no further impact on nearby vegetation is expected from the operation of the replacement well. Additional assessment will not be conducted for the *replacement well W379R, and LADWP will file a Notice of Exemption under Class 2 of the California Environmental Quality Act with the Inyo County Recorder's Office.* A Class 2 exemption consists of replacing or reconstructing existing structures and facilities where the new structure will be located on the same site as the structure replaced and will have substantially the same purpose and capacity as the structure replaced.

9. REFERENCES

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