Well W076 Replacement (W076R) in Bairs-George Wellfield

Preconstruction Evaluation

Summary

LADWP plans to replace Well W076 in the Bairs-George Wellfield to improve operational flexibility in managing groundwater resources in Owens Valley. The purpose of this report is to satisfy the requirements of Section IV.B. of the Green Book (the Technical Appendix to the Inyo/LA Water Agreement), Guidelines for Drilling and Activating New Production Wells.

Well W076 was installed in 1925 to a depth of 210 feet below ground surface (bgs) with screen slots from 10 to 210 feet bgs. According to the 1991 Environmental Impact Report (EIR), W076 had a pumping capacity of 3.8 cubic feet per second (cfs) pre-1970 and 2.6 cfs post-1970. Because of casing and screen alignment issues, W076 was abandoned late 1990s and LADWP drilled a replacement (W424) for W076 in 2012 to a total depth of 700 feet bgs and screened below 350 feet bgs to draw water only from the deep aquifer. However, during the well development, the pumping capacity was far less than that of W076 (a fraction of 1.0 cfs). Therefore, W424 was abandoned with the plan to install a nearly in-kind replacement for well W076 (W076R).

The planned replacement well W076R will be drilled using the current industry standards for well construction and should meet California Well Drilling Standards (DWR Bulletin 74-90). Therefore, the replacement well will be sealed to a minimum depth of 50 feet bgs to prevent potential contamination of the aquifer and completed to a total depth of approximately 400 feet. The screened section of W076R will be determined after reviewing the lithological and geophysical logs of the exploratory borehole. The pumping capacity of the replacement well will be determined after conducting a 24-hr pumping test and analyzing the data.

Pumping from the replacement well will be controlled by vegetation monitoring site BG2 and the overall pumping from Bairs-George Wellfield will be managed to avoid impacting flow in Reinhackle Spring located 1.5 miles southeast of the replacement well. Comparing the simulations of one-year pumping of W076 and the replacement well W076R shows that the replacement well will have less effect on groundwater levels in the shallow aquifer than W076.

Installation of a replacement for W076 should help recover a portion of the more than 50% wellfield pumping capacity loss that has happened since 1990, from 8.3 cfs down to 3.9 cfs. The recovery of wellfield pumping capacity will provide LADWP with the flexibility in managing groundwater in Owens Valley.

Background

LADWP owns over 100 production wells in the Owens Valley. Many of these wells were drilled in the 1920s using drilling and construction techniques available at that time. Since then, some wells have failed for a variety of reasons and have been replaced accordingly. The replacement wells use current industry standards for well drilling with the goal of maximizing efficiency and reducing potential impacts on nearby environmental resources.

The City of Los Angeles and Inyo County entered into an agreement for the long-term management of groundwater in the Owens Valley in 1991 (Agreement). Based on Section VI of the Agreement, LADWP "may replace existing wells and construct new wells in areas where hydrologic conditions are favorable, and where the operation of that well will not cause change in vegetation." Prior to the implementation of the well, the Technical Group shall jointly evaluate the location of the replacement well "as to the potential impact of its operation on the valley's vegetation and environment,". Since the implementation of the Agreement, LADWP has replaced a number of wells throughout the Owens Valley.

Location

Well W076 is located in the Bairs-George Wellfield, approximately 8.5 miles north of Lone Pine and 8 miles south of Independence (Figure 1). The main landmarks near the Bairs-George Wellfield are the Alabama Hills to the south, Los Angeles Aqueduct (LAA) running through the eastern portion of the wellfield, and Manzanar National Monument to the north. The Bairs, George, and Hogback Creeks run through this wellfield. A very long alluvial fan (approximately 7 miles) with a relatively mild slope lies to the west of the Bairs-George Wellfield.

The replacement well will be installed in an open area, approximately 1,000 feet east of the original W076 and adjacent to George Creek (Figure 2).

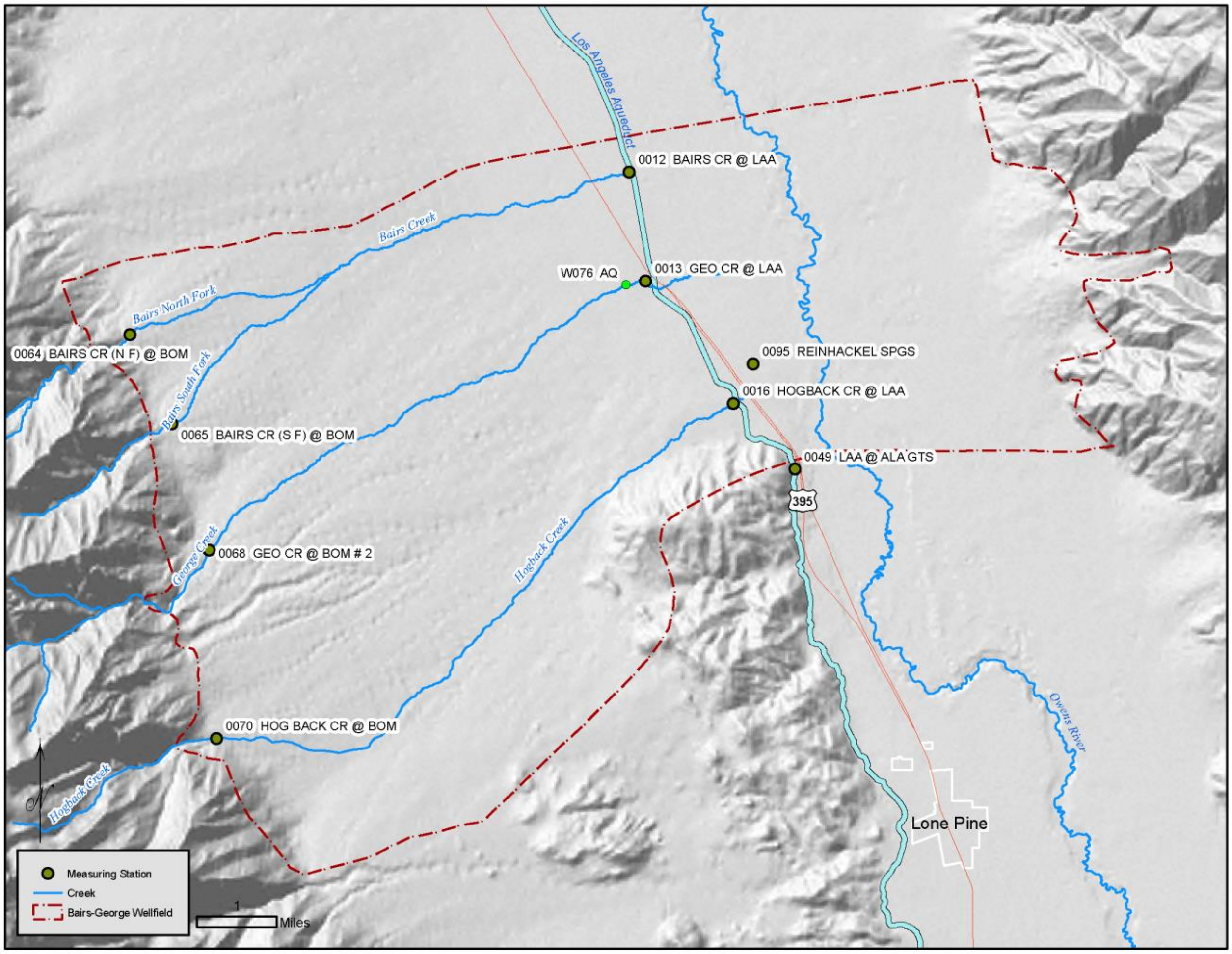

Figure 1- Surface water gauges in Bairs-George Wellfield

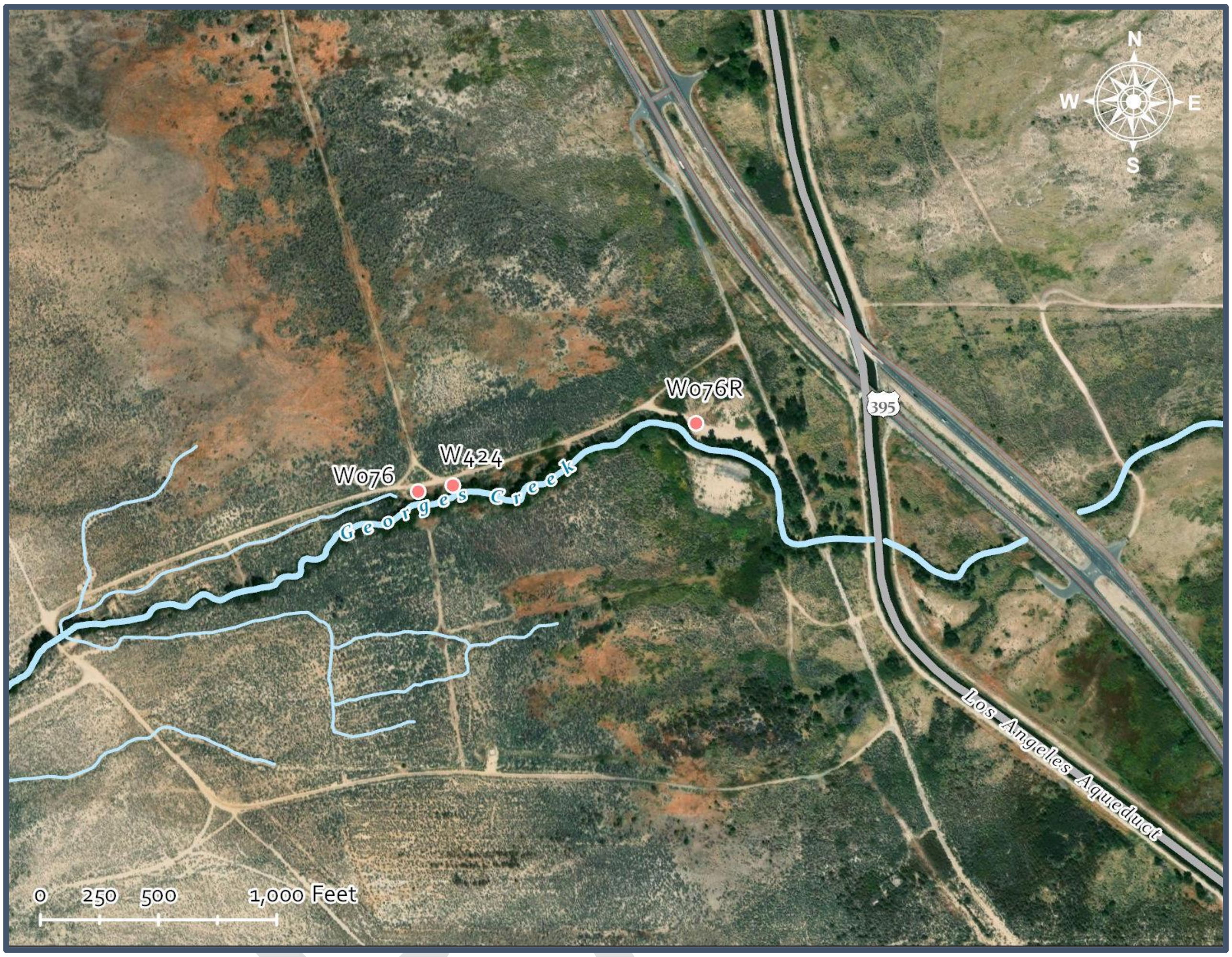

Figure 2 - Original W076, W424, and proposed replacement well W076R

Geology

The conceptual geological framework of the Owens Valley was presented in a United States Geological Survey (USGS) report in 1991 (Hollett, et. al., 1991). The Owens Valley was formed by a graben that is filled by debris eroded from White/Inyo Mountains to the east and Sierra Nevada Mountains to the west. The Bairs-George Wellfield is one of LADWP's nine wellfields and is located in the southern half of the Owens Valley. The main geologic feature near this wellfield is the Alabama Hills to the south, which is an outcrop of bedrock east of the Sierra Nevada Mountains. The 1872 Fault along with a number of smaller north-south trending faults affect the east-west flow of groundwater. Reinhackle Spring is created along the 1872 Fault, where the groundwater moving from west to east and toward the Owens River emerges to the ground surface. The long alluvial fan west of the Bairs-George Wellfield is classified by the USGS as an older alluvial fan deposit with poorly unconsolidated to moderately consolidated gravel, sand, silt, and clay.

Hydrology

The main water features in the Bairs-George Wellfield include Bairs Creek, George Creek, and Hogback Creek all flowing from west to east, the Los Angeles Aqueduct (LAA) flowing from north to south, and Reinhackle Spring flowing along the1872 Fault, east of Highway 395. The surface water flow measuring gauges in this wellfield are listed in Table 1 and shown in Figure 1. George Creek is the largest creek in this wellfield with a long-term average flow of 8.4 cfs measured at the base of mountain (measuring station 0068).

All three creeks in the Bairs-George Wellfield have gauges at the base of mountain and at the LAA, allowing for the calculation of recharge to the groundwater aquifer through infiltration from the creek bed. Estimates of long-term average recharge from these creeks by USGS are: 3,200 acre-feet (AF) from Bairs Creek, 3,800 AF from George Creek, and 2,100 AF from Hogback Creek. Additionally, USGS estimated a total of 2,250 AF of mountain-front recharge between Bairs Creek to the north and Lone Pine Creek to the south and 63 AF from the northern side of the Alabama Hills (Danskin, 1998).

The LAA is unlined north of Alabama Gates. A geochemical evaluation (MWH, 2004) verified close similarity between the water chemistries of the LAA and the flow in Reinhackle Spring, indicating seepage of LAA water into the shallow groundwater aquifer. However, a good estimate of loss rate from the LAA in this area is not available at this time.

The long-term average precipitation measurements of the Independence and Lone Pine yards gauges are 5.5 and 4.0 inches per year, respectively.

Table 1 - Average annual flow in surface water gauges in Bairs-George Wellfield

YEAR	Hogback Creek @ BOM	Hogback Creek @ LAA	Georges Creek @ BOM	Georges Creek @ LAA	Bairs Creek (North Fork) @BOM	Bairs Creek (South Fork) @BOM	Bairs Creek @ LAA	Reihackle Spring	LAA @ Alabama Gates
	0070	**0016**	**0068**	**0013**	**0064**	**0065**	**0012**	**0095**	**0049**
1990-91	1,240	21	3,013	415	844	486	0	814	127,262
1991-92	1,944	163	5,084	1,848	1,480	1,010	90	1,171	209,438
1992-93	2,163	216	5,440	2,417	1,684	1,213	247	1,430	260,922
1993-94	2,929	449	6,388	3,224	2,330	1,623	450	1,579	294,262
1994-95	1,704	65	4,372	1,618	1,314	790	66	1,474	191,292
1995-96	4,631	841	9,284	4,619	3,352	2,475	810	1,842	430,273
1996-97	4,041	1,378	8,225	5,121	2,545	2,070	1,153	1,950	416,401
1997-98	4,005	1,823	8,404	5,757	2,712	1,963	1,482	1,684	387,226
1998-99	4,947	2,211	9,578	5,653	3,150	2,446	2,462	1,595	411,243
1999-00	2,023	740	4,474	2,129	1,420	830	473	1,464	295,438
2000-01	1,620	268	4,322	1,919	1,086	726	81	1,472	252,076
2001-02	2,915	992	6,197	3,919	1,976	1,417	894	1,554	257,124
2002-03	1,450	75	3,673	1,140	913	576	0	1,399	246,253
2003-04	2,311	471	5,011	2,204	1,591	1,061	323	1,686	274,333
2004-05	2,156	326	5,185	2,223	1,707	1,320	140	1,620	248,792
2005-06	4,519	1,736	9,988	5,323	3,768	2,831	2,100	1,704	384,941
2006-07	3,679	1,431	8,515	3,036	2,750	1,774	869	1,840	410,495
2007-08	1,009	11	3,157	255	853	537	0	1,249	164,241
2008-09	2,575	672	5,360	2,162	1,812	1,325	377	1,354	193,304
2009-10	1,816	170	4,610	1,315	1,430	1,006	8	1,328	197,648
2010-11	3,008	780	7,052	4,049	2,315	1,841	680	1,486	317,030
2011-12	4,745	2,150	9,293	5,215	2,974	2,334	1,419	1,622	378,020
2012-13	910	48	2,401	417	679	311	0	1,277	203,663
2013-14	1,098	175	2,938	800	1,105	441	82	838	123,495
2014-15	1,302	19	3,325	1,089	1,284	572	29	828	100,528
2015-16	1,093	0	3,099	1,071	1,048	498	12	1,139	65,353
2016-17	1,832	233	4,568	2,490	1,934	1,264	139	1,814	176,294
2017-18	6,512	2,534	14,818	5,238	5,943	3,405	1,615	1,978	383,047
2018-19	1,659	323	4,860	2,885	2,015	828	9	1,425	311,278
2019-20	4,335	1,120	10,383	5,788	4,250	2,861	1,535	1,598	361,202
Average (af)	2,672	715	6,101	2,845	2,075	1,394	585	1,474	269,096
Average (cfs)	3.69	0.99	8.43	3.93	2.87	1.93	0.81	2.04	371.68

Groundwater

Groundwater in the Bairs-George Wellfield flows generally from west to east. This easterly groundwater flow is controlled mainly by several north-south trending faults. The infiltration from creeks, the mountain front area between Bairs Creek and Hogback Creek, and the unlined LAA recharges the shallow groundwater aquifer.

Bairs-George is one of the smaller wellfields in the Owens Valley with LADWP production wells W076, W343, W348, and W403. A small production well, V082, in the Bairs-George Wellfield has been used by Inyo County to supplement water for Diaz Lake south of Lone Pine. There are also over 40 shallow and deep monitoring wells in Bairs-George Wellfield. Figure 3 shows the locations of the production and monitoring wells. The annual pumping from production wells in this wellfield since the 1972 runoff year are presented in Table 2 and shown in Figure 4. The annual pumping in the Bairs-George Wellfield has declined since 1972.

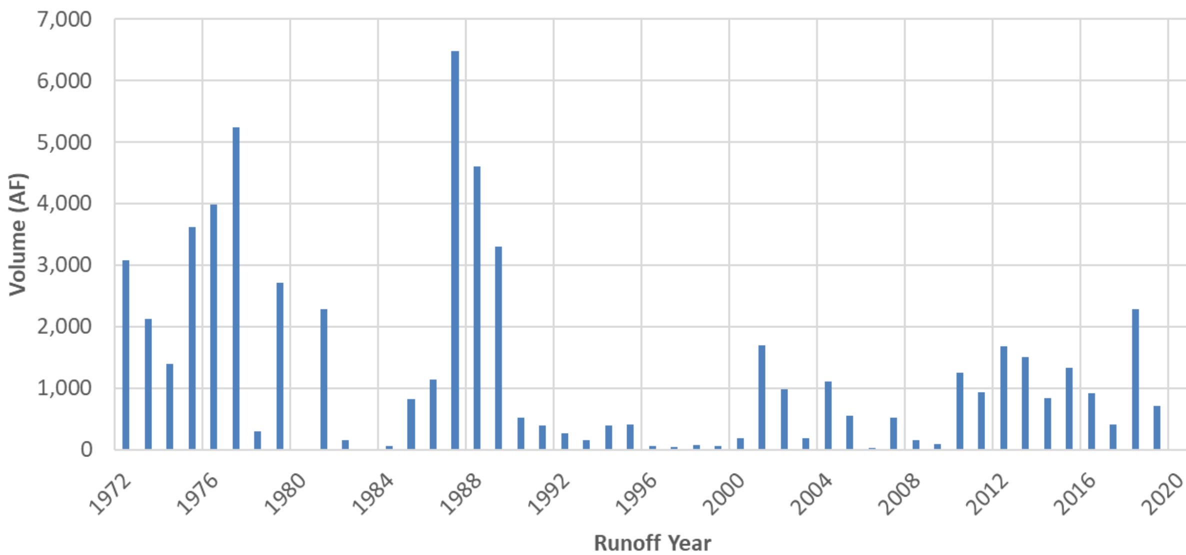

Figure 4 –Annual Pumping in Bairs-George Wellfield from 1972-2020

Well W076 was pumping as much as 2,250 AF per year or an average rate of 3.1 cfs, but stopped operating in 1990, mainly due to mechanical problems. This well was abandoned in late 1990s with the plan to be replace with a new well.

W348 is located approximately 1 mile southeast of W076 and has been operating since 1971 and was screened from 70 to 300 feet and 330-460 feet bgs. The upper portion of the screen was sealed in 2014, reducing the screen length by about 200 feet, as part of a well modification process to pump primarily from the deep aquifer zone. As a result, the pumping capacity in this well has reduced to its current 1.6 cfs (see Table 2 for annual pumping volume since 1974).

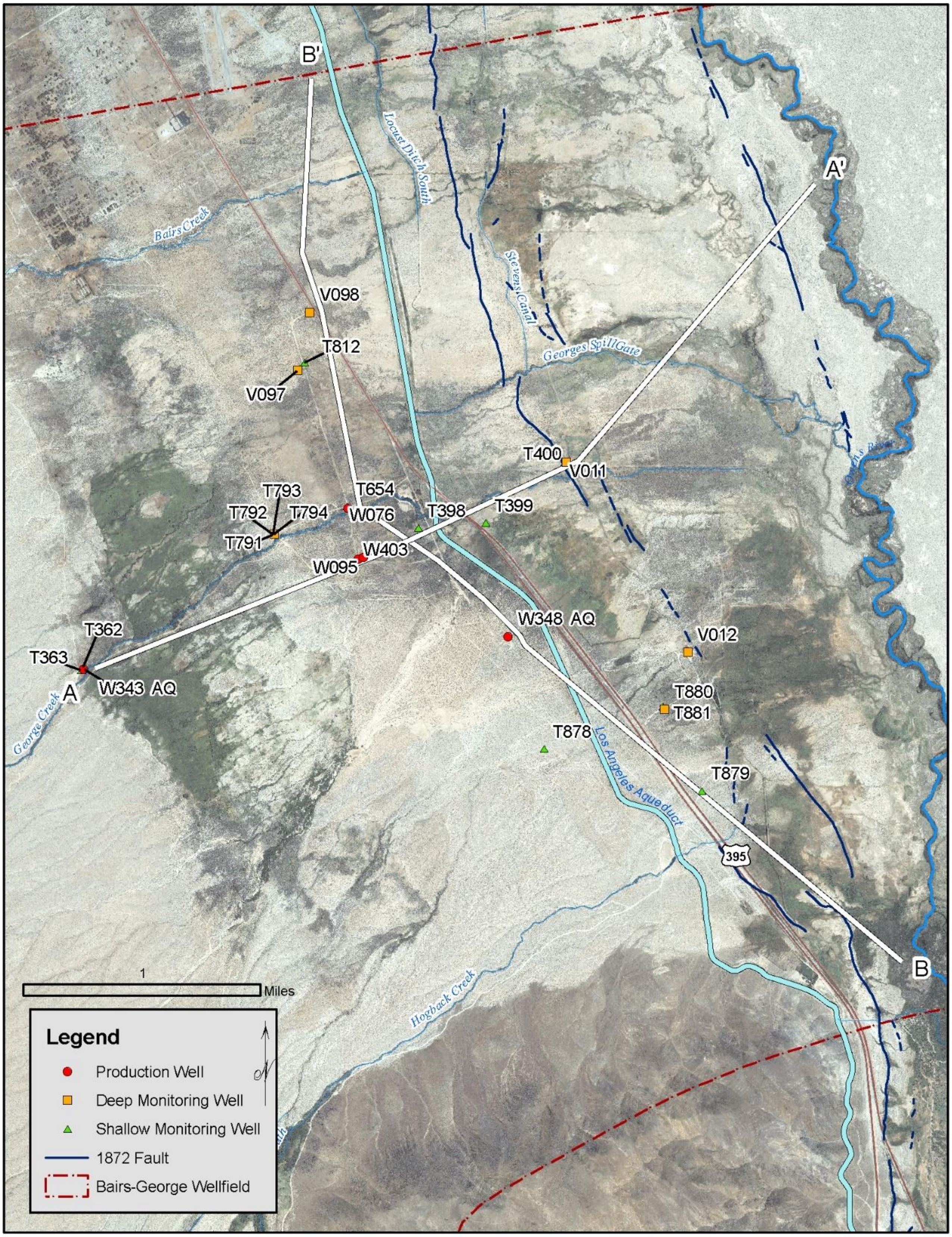

Figure 3 - Production and monitoring wells in Bairs-George Wellfield

Table 2 - Groundwater pumping in Bairs-George Wellfield in acre-feet per year

YEAR	W095	W403	W343	W348	W076	V082	Total
1972-73	934	-			2,145	-	3,079
1973-74	518	-		439	1,167	-	2,124
1974-75	83	-		744	560	-	1,387
1975-76	53	-		1,859	1,708	-	3,620
1976-77	96	-	385	1,486	2,017	-	3,984
1977-78	563	-	950	1,483	2,250	-	5,246
1978-79	40	-	10	149	88	-	287
1979-80	404	-	360	1,026	930	-	2,720
1980-81	0	-	0	0	8	-	8
1981-82	9	-	352	593	1,334	-	2,288
1982-83	18	-	34	59	45	-	156
1983-84	1	-	0	0	2	-	3
1984-85	0	-	0	64	0	-	64
1985-86	188	-	165	0	473	-	826
1986-87	155	-	266	388	331	-	1,140
1987-88	808	-	1,740	2,083	1,854	-	6,485
1988-89	739	-	754	1,383	1,726	-	4,602
1989-90	372	-	894	965	1,063	-	3,294
1990-91	0	-	356	1	1	160	518
1991-92	0	-	231	0	0	152	383
1992-93	-	30	203	0	0	32	265
1993-94	-	3	79	1	0	69	152
1994-95	-	0	246	0	0	137	383
1995-96	-	45	73	156	0	127	401
1996-97	-	0	0	0	0	60	60
1997-98	-	0	0	48	0	0	48
1998-99	-	24	0	48	0	0	72
1999-00	-	0	1	0	0	60	61
2000-01	-	0	157	0	0	29	186
2001-02	-	196	737	765	0	0	1,698
2002-03	-	130	43	810	-	0	983
2003-04	-	107	73	0	-	0	180
2004-05	-	9	331	731	-	35	1,106
2005-06	-	180	0	306	-	64	550
2006-07	-	0	0	0	-	17	17
2007-08	-	0	466	0	-	56	522
2008-09	-	0	149	1	-	0	150
2009-10	-	0	86	0	-	0	86
2010-11	-	176	320	756	-	0	1252
2011-12	-	399	0	530	-	0	929
2012-13	-	602	703	373	-	0	1678
2013-14	-	442	881	187	-	0	1510
2014-15	-	2	828	0	-	0	830
2015-16	-	199	1124	0	-	0	1323
2016-17	-	460	455	0	-	0	916
2017-18	-	0	357	46	-	0	403
2018-19	-	537	1005	739	-	0	2281
2019-20	-	0	618	97	-	0	715

Reinhackle Spring

Reinhackle Spring is located in the Bairs-George Wellfield between the LAA and the Owens River and west of the 1872 Owens Valley Fault. Flow from Reinhackle Spring supports the nearby pasturelands and willow trees approximately 1.5 miles southeast of the proposed site for W076R. The average monthly flows in the spring since 1991 and the total annual spring flows since 1991 (from measuring station 0095) are presented in Figures 5 and 6, respectively, with an average flow of 1,500 AF, ranging from 1,200 AF in 1991 to 1,950 AF in 1996. Per the 1991 EIR recommendation, future groundwater pumping in the wellfield should be managed to avoid causing a reduction of spring flow that would result in decreases or changes in native vegetation.

The ICWD and LADWP conducted a cooperative study in 2003 to characterize the geochemical signature of the deep and shallow aquifer in Owens Valley (MWH, 2004). As part of this study, the geochemistry of flow from Reinhackle Spring was also studied. Results of the study showed flow in Reinhackle Spring has a similar composition to both the LAA and the shallow aquifer. The geochemistry study suggested the water emerging from Reinhackle Spring is predominately from the LAA or sources similar in composition to the LAA.

In accordance with the Greenbook, LADWP will assess potential significant effects on Reinhackle Spring to prevent “reduced flow resulting in significantly less water available to surrounding vegetation.” Groundwater model simulations suggest significantly less drawdown in the vicinity by the replacement well W076R compared to the original W076.

After installation of W076R, an aquifer test will be conducted to ensure there will be no significant effect on flow from Reinhackle Spring. During operation, the Technical Group will conduct groundwater level and vegetation monitoring. If it is projected that a decrease or change in vegetation, dependent on flow from Reinhackle Spring, will result if flow from the spring stops or reduced, LADWP will reduce pumping to the degree necessary to restore the flow to avoid such decreases or changes or provide surface water to avoid such decreases or changes.

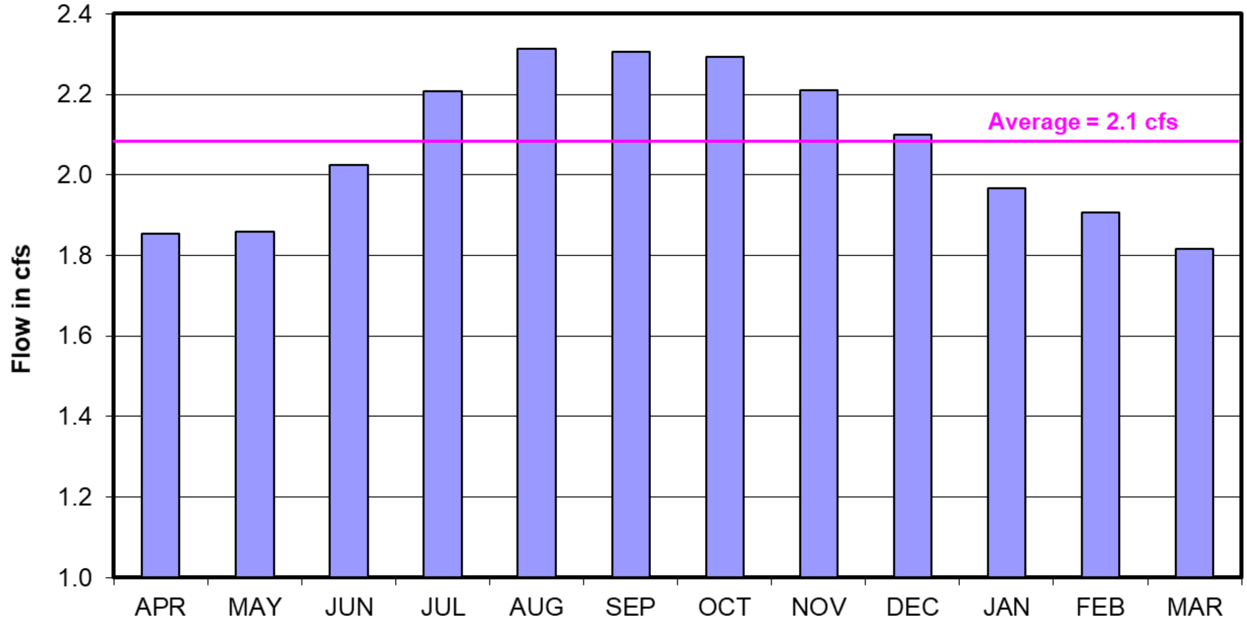

Figure 6 - Average monthly flow in Reinhackle Spring 1991-2020 (measuring station 0095)

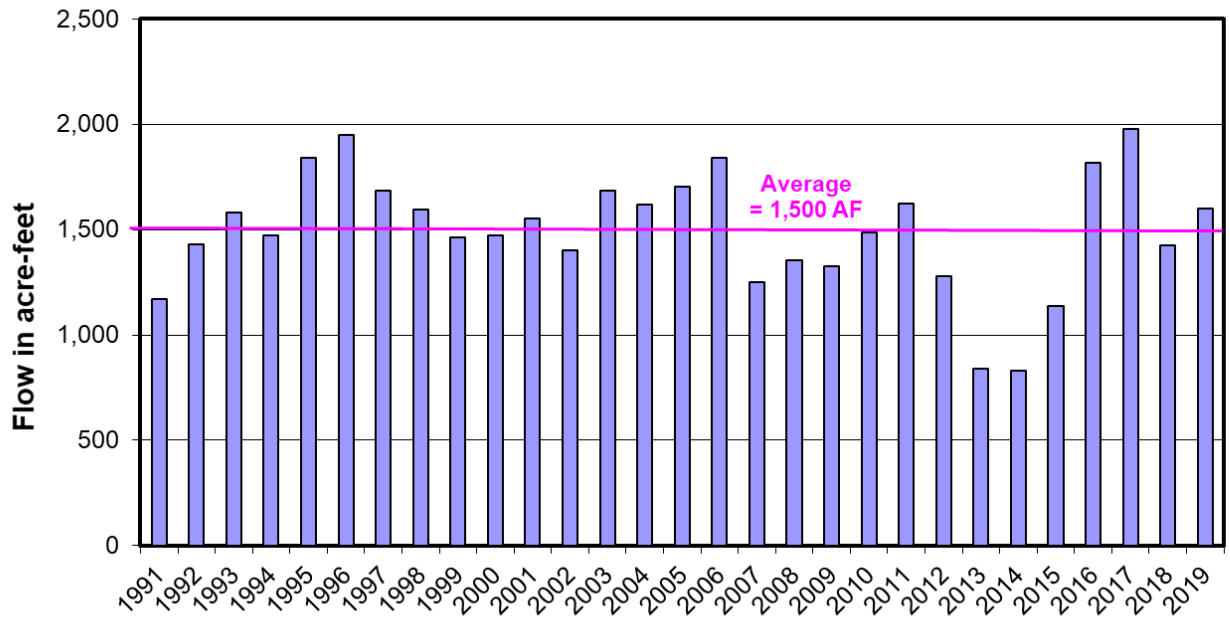

Figure 7 - Annual flow in Reinhackle Spring 1991-2020 (measuring station 0095)

Vegetation

The locations of vegetation parcels in the area near W076 that were inventoried for baseline conditions in 1985 are presented in Figure 7. These parcels were classified according to the Agreement based on water use with designations of Type A to Type E. These parcels, the classifications, and community designations are noted in Table 3.

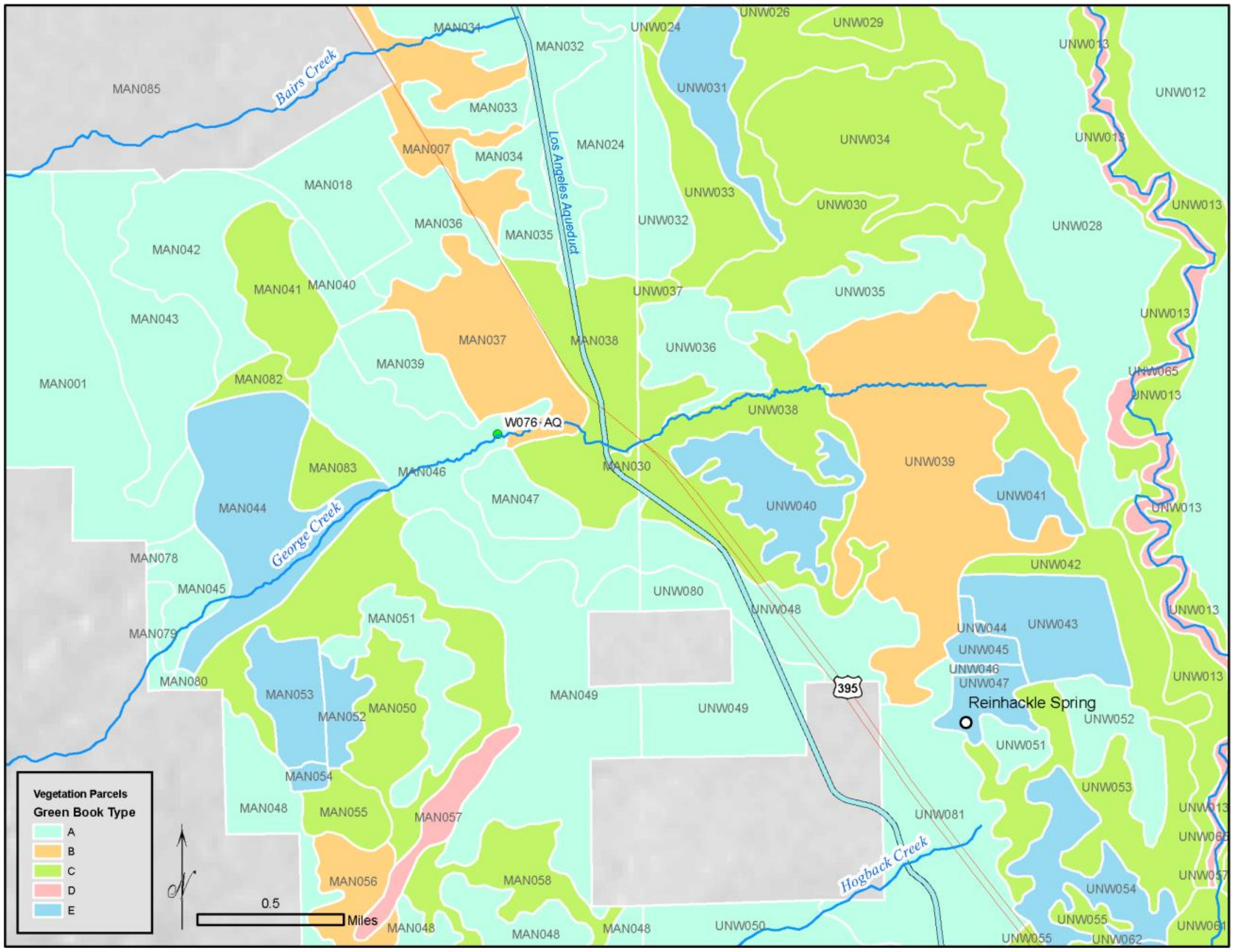

Figure 7 - Vegetation parcels in the vicinity of W076

Table 3 - Information on vegetation parcels located in the vicinity of W076R

Parcel Number	Vegetation Type	Community
MAN030	C	Alkali Meadow
MAN034	B	Nevada Saltbush Scrub
MAN035	A	Desert Sink
MAN036	A	Desert Greasewood Scrub
MAN037	B	Nevada Saltbush Scrub
MAN038	C	Nevada Saltbush Meadow
MAN039	A	Barren Land
MAN040	A	Shadscale Scrub
MAN041	C	Alkali Meadow
MAN044	E	Irrigated Agriculture
MAN046	A	Big Sagebrush Scrub
MAN047	A	Barren Land
MAN049	A	Shadscale Scrub
MAN050	C	Alkali Meadow
MAN051	A	Shadscale Scrub
MAN082	C	Alkali Meadow
MAN083	C	Alkali Meadow

Documented Design and Capacity of Existing Well

Well W076 is among the older LADWP wells in the Owens Valley. This well was drilled in 1924 and has been mainly used to supply the LAA. As shown in Table 2, W076 has been operated every year from 1972 to 1990, when it stopped operating. This well was drilled utilizing standard technology at that time, which included drilling by the cable tool method and an earlier version of a casing perforator known as Mill's knife. The total depth of W076 was 210 feet bgs with a standard 16-inch casing. To maximize its pumping capacity, the well was perforated throughout the length of the casing, mainly within the shallow aquifer. As documented in Table 9-5 of the 1991 Owens Valley EIR, W076 had a capacity of 3.8 cfs prior to 1970 and 2.6 cfs between 1970-1990.

A replacement well for W076 (W424) was completed in 2012 and screened from 300 to 600 feet bgs with the intention of drawing water from the deep aquifer and avoid potential impacts to resources. The pumping test however, showed that W424 had a pumping capacity of a fraction of 1.0 cfs and was never placed into operational service.

Planned Location, Design, and Expected Capacity of the Replacement Well

The location of the replacement well will be approximately 1,000 feet to the east of the current location in an open area (Figure 2). An archeological and biological survey was conducted at this location to ensure that drilling at this site will not have an impact to the site's resources.

In designing W076 replacement, the current industry standards of drilling are incorporated. These include using a mud rotary method for drilling and using pre-fabricated casing and screen, along with the placement of a properly sized gravel filter pack in the annular space between the screen and borehole wall. The use of gravel pack should prevent sand production problems. The current standard in municipal well installation is to use an 18-inch diameter casing and screen. The design of the W076 replacement well is presented in Figure 8.

The capacity of the replacement well is expected to be approximately the same as that of W076. In the event that the initial testing shows that the replacement well has a higher capacity than the documented capacity of W076 in the 1991 EIR, LADWP will either adjust the pump size to limit pumping capacity to the capacity in the 1991 EIR, or will treat the additional capacity as a new well and will conduct an evaluation of the additional pumping capacity.

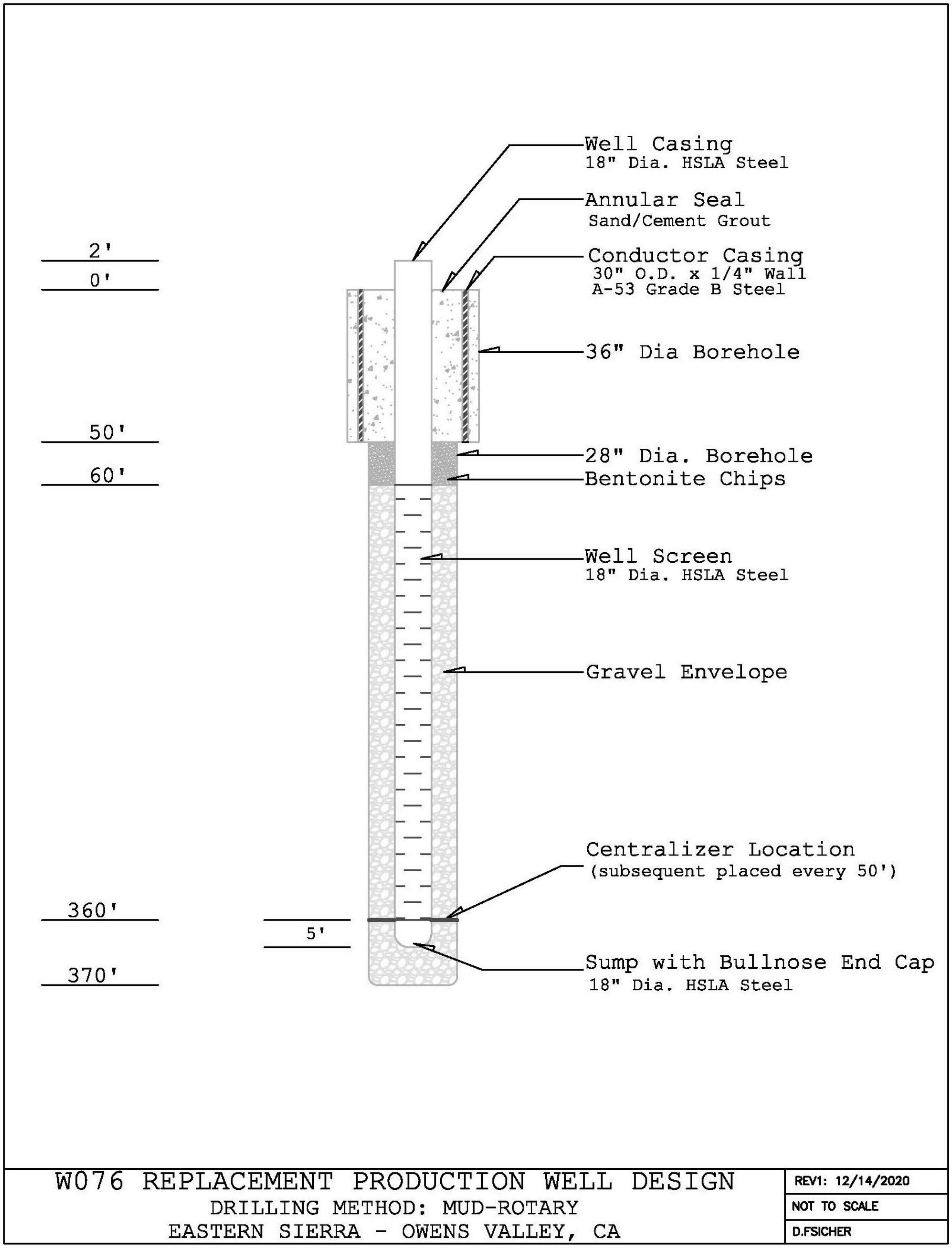

Figure 8 - Preliminary design of W076R, replacement for well W076

Environmental Assessment

Modeling Simulation

To compare the effect of pumping the replacement well W076R with that of the existing well W076 on shallow groundwater levels, a groundwater flow model that was developed by MWH, consultant to LADWP, for the southern Owens Valley was utilized. The model covers an area from south of Thibaut-Sawmill Wellfield in the north and extends to the south of Lone Pine Wellfield. This MODFLOW-based groundwater model includes three layers simulating the shallow, intermediate (semi-confining), and deep aquifers. These layers are designated as Layers 1, 2 and 3, respectively. The cell size in the model is 500 feet by 500 feet and utilized six-month stress periods from 1985 to 2012 runoff years.

Starting from the steady state condition, two scenarios of 2.6 cfs pumping for 1 year were simulated in both the original W076 (first scenario) and replacement W076R. All other inputs to the model were kept the same as the steady state condition. For both scenarios contour maps of the shallow aquifer (Layer 1) were generated. A drawdown contour map resulting from 1 year of pumping the W076, primarily screened in Layer 1, is presented in Figure 9. A drawdown contour map resulting from 1 year of pumping W076R, primarily screened in Layers 1 and 2, is presented in Figure 10. The drawdown profiles show that pumping from combined Layers 1 and 2 results in a reduced drawdown in the shallow aquifer than only pumping from Layer 1. The difference in groundwater levels between the two simulations is presented in Figure 11.

The proposed W076 replacement will draw water from the shallow and intermediate aquifers depending on results from borehole lithological investigations when after the initial investigatory borehole is drilled.

Figure 9 - Drawdown contours for layer 1 when pumping original W076 at 2.6 cfs for one year (W076 is screened primarily in layer 1)

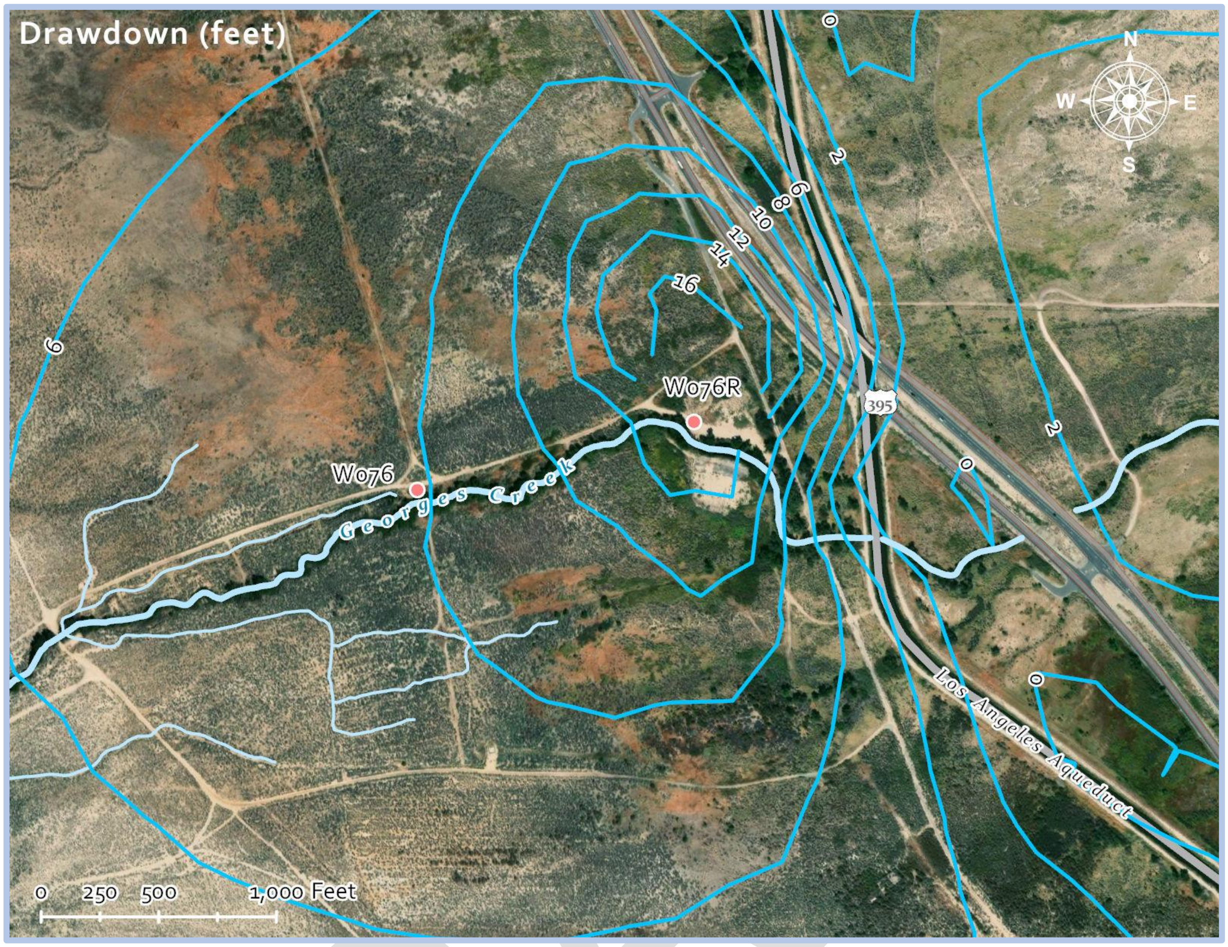

Figure 10 - Drawdown contours for layer 1 when pumping W076R at 2.6 cfs for one year (W076R is screened within layers 1 and 2)

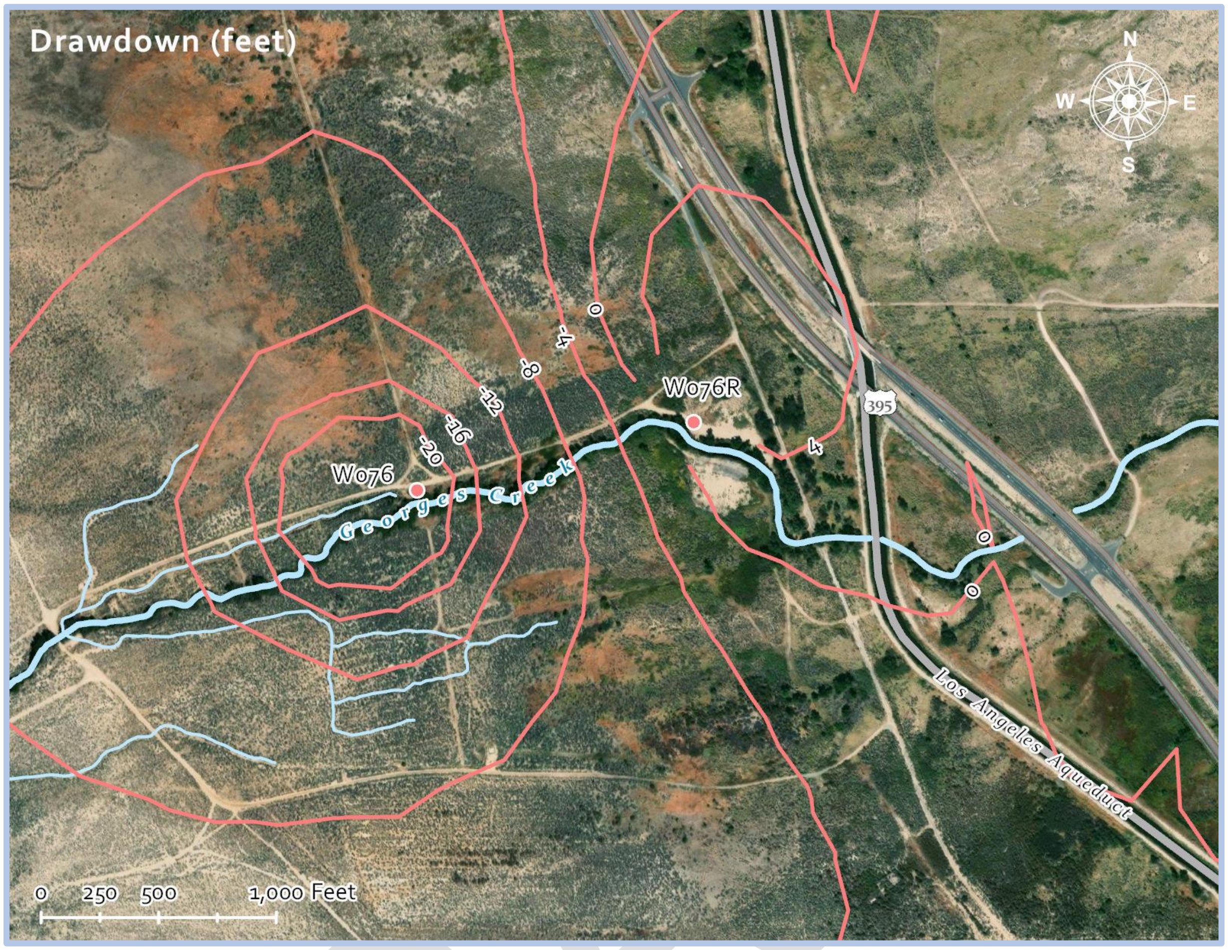

Figure 11 – Difference in groundwater levels in layer 1, representing shallow aquifer, of W076 and W076R at pumping at 2.6 cfs for one year (i.e. shallow groundwater levels for W076 minus W076R)

<u>Potential Effects on Vegetation</u>

Green Book Section IV.B.1.b. Discusses:

> "Inventorying and classifying the vegetation that could be affected by operation of the well (use vegetation inventories that reflect conditions from 1984 to 1987).
>
> i. Identifying vegetation that has the greatest chance of being adversely impacted by pumping (the area where drawdown is greater than or equal to 10 feet).
>
> ii. Identifying new sites for monitoring vegetation, soil moisture, and water level as necessary."

All vegetation types are described in the Greenbook, Section II.C.5 as types A, B, C, D, and E depending the typical evapotranspiration and average precipitation.

Simulation contours discussed in the previous section are overlaid with the mapped vegetation parcels in the area (Figures 12-14). The acreage of each type of vegetation parcel which lie within the 10 foot or greater predicted drawdown contours for W076R (Figure 13) are presented in Table 4.

Table 4. Area of vegetation parcels within ZOI of W076 and W076R

Vegetation Parcel Type	W076		W076R	
	Acreage in ZOI	Parcels in ZOI	Acreage in ZOI	Parcels in ZOI
A	317	*MAN039, MAN040 MAN046, MAN047, MAN048, MAN049, MAN051*	3	*MAN046*
B	110	*MAN037*	28	*MAN037*
C	86	*MAN030, MAN038, MAN041, MAN050, MAN082*	9	*MAN038*
D	0	-	0	-
E	6	*MAN044*	0	-
Total	519	-	40	-

*Zone of influence (ZOI) that is within 10 foot or greater simulated drawdown

Type A vegetation, including MAN046, are not considered to be groundwater dependent. MAN037 was mapped as a Nevada Saltbush Scrub community with 45 percent cover dominated by *Atriplex lentiformis* ssp. *torreyi* (Nevada Saltbush) and *Ericameria nauseosa* (Rubber Rabbitbrush). MAN038 was mapped as a Nevada Saltbush Meadow with 50 percent cover dominated by *Atriplex lentiformis* ssp. *torreyi* (Nevada Saltbush) and *Disticlis spicata* (Inland Saltgrass). Type E vegetation is considered irrigated agriculture.

Pumped water from W076R will discharge into George Creek, providing additional recharge to the portion of MAN037 that lies closest to the replacement well W076R and on either side of the creek particularly in low flow conditions. The replacement well W076R would result less drawdown over a smaller area than W076, with less potential impact on groundwater dependent vegetation.

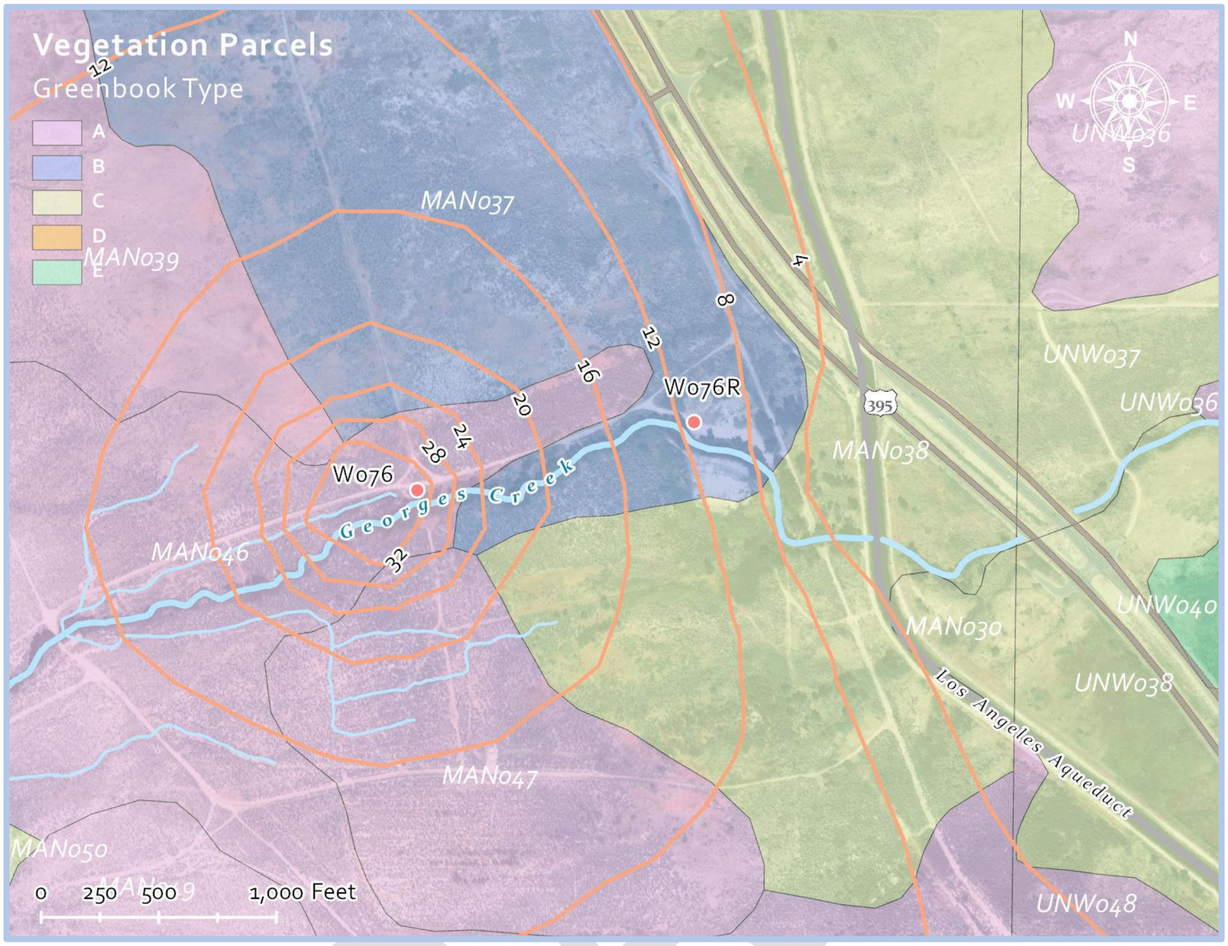

Figure 12 - Vegetation parcels with drawdown contours resulting from the original W076 for a one-year pumping simulation

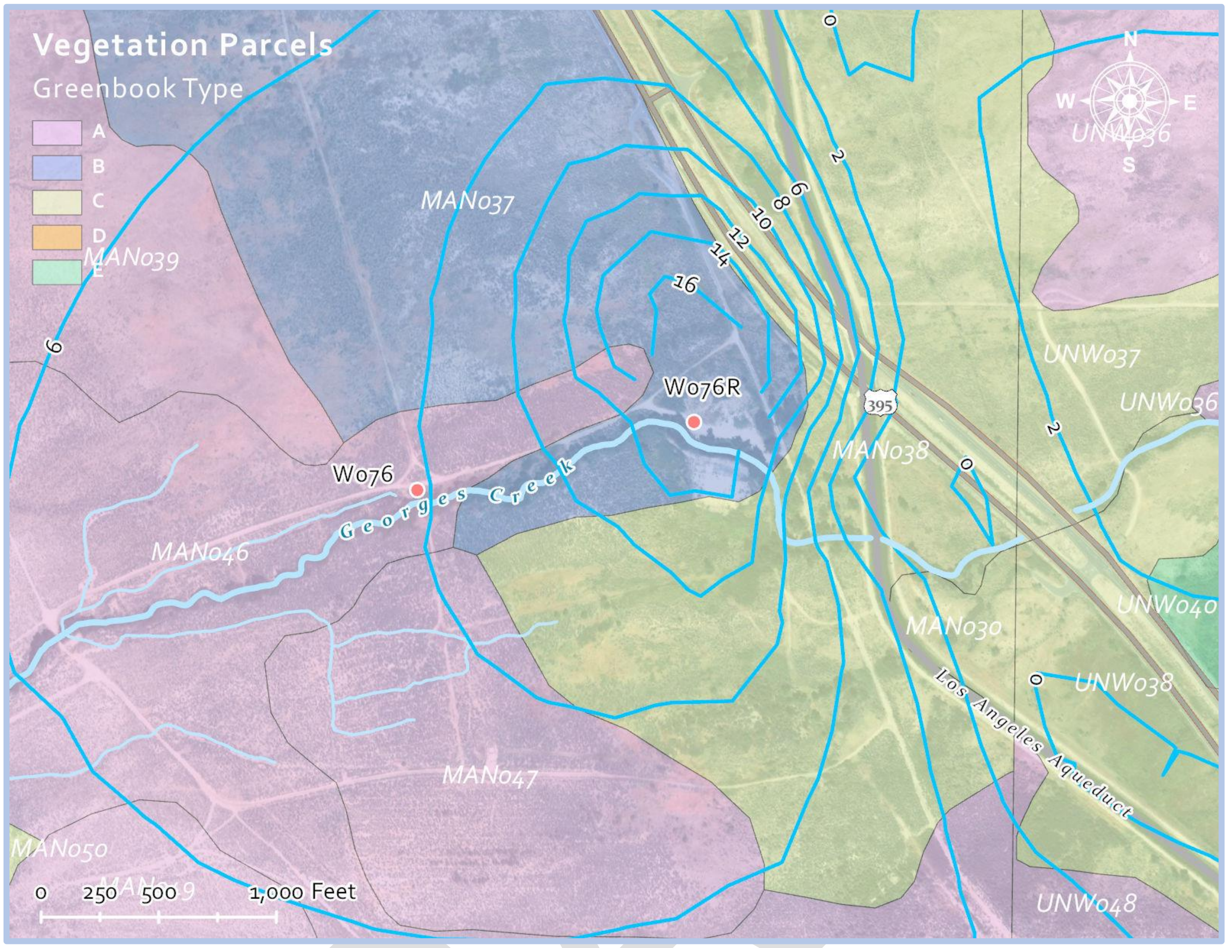

Figure 13 - Vegetation parcels with drawdown contours resulting from W076R for a one-year pumping simulation

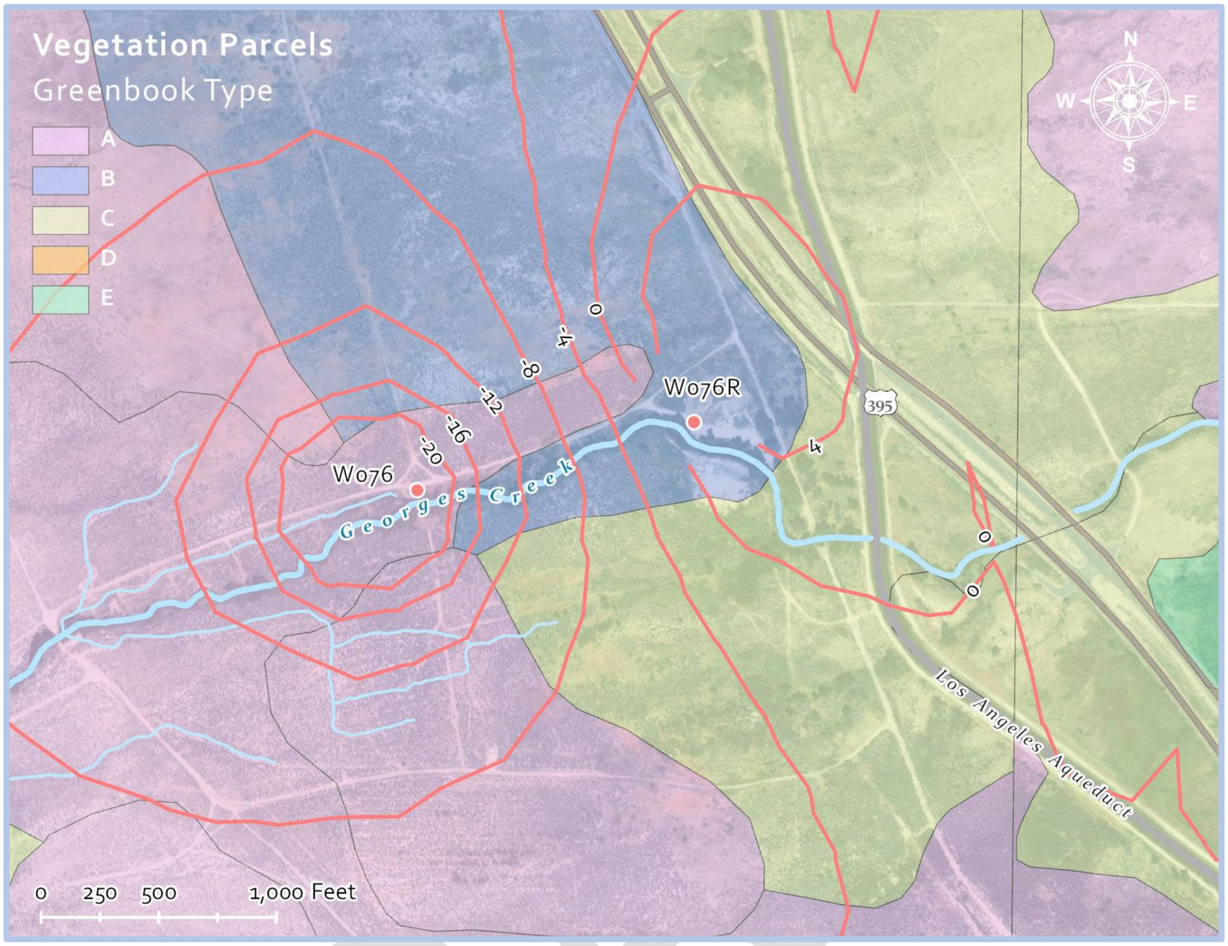

Figure 14 - Vegetation parcels and the groundwater levels difference for W076 and W076R with one-year pumping simulations

Vegetation monitoring site BG2 located in vegetation parcel MAN37 is identified as the site that controls the ON-OFF status of W076. BG2 is proposed to be utilized as the monitoring site for controlling the operation of the replacement well W076R.

Initial Testing Procedure

One-Day Pumping Test

Following the installation of the W076R, the contractor will perform a step-drawdown and a 24-hour constant rate pumping tests of the new well while collecting water level data from nearby shallow and deep monitoring wells. Data from the pumping test will be used to calculate aquifer characteristics at that location. This data should provide information on the pumping capacity of the replacement well. It is expected that the capacity of the replacement well W076R will be approximately the same as that of Well W076. The same size pump will be installed in the replacement well W076R as the one in Well W076.

Initial Operation

According to the procedures outlined in the Water Agreement and its technical appendix, the Green Book, non-exempt production wells in the Owens Valley are linked to certain nearby vegetation monitoring sites. The ON/OFF status of a well is determined by comparing the available soil moisture and the water demand of the vegetation at the monitoring site. All production wells in the Bairs-George Wellfield, including W076, are linked to vegetation monitoring Site BG2, located north of the wellfield. The replacement for W076 will also be linked to the same monitoring site and therefore, its pumping status will be governed by the same criteria as W076. During the operation of the replacement wells in the first season, data will be collected from the nearby shallow and the deep monitoring wells, as well as flow in Reinhackle Spring and other surface water. Collected data will be evaluated to determine if the operation plan for wells in the Bairs-George Wellfield should be revised. Additionally, long-term operation plan for wells in the Bairs-George Wellfield may be affected by the provisions to protect vegetation that depend on the flow in Reinhackle Spring.

Table 5 - Select monitoring wells in Bairs-George Wellfield

Well Member	Depth (ft)	Ground Elevation (ft)	Average Depth to Water (ft)*
T362	69	4095.8	37
T363	73	4099.5	43
T398	20	3801.7	3.2
T399	20	3785.9	3.3
T400	21	3753.4	4.5
T654	31	3827.0	9
T791	140	3858.2	9
T792	480	3858.2	43
T793	620	3858.2	53
T794	355	3858.2	37
T812	28	3825.4	15
T878	45	3815.8	36
T879	44	3776.9	13
T880	275	4008.5	-5.7
T881	45	3771.1	4
V011	301	3853.3	Flowing**
V012	485	3753.3	Flowing**
V097	319	3827.7	13
V098	330	3821.1	10

**Average taken over the past 5 years.*
***Unable to take precise measurement, because to isolate the gage the valve downstream must remain closed to supply water to livestock.*

References

LADWP. Inyo/Los Angeles Long-Term Groundwater Management Plan: 1991 Agreement. 1991.

Hollett, et. al. Geology and Water Resources of Owens Valley, California. 1991.

Danskin, W. R. Evaluation of the Hydrologic System and Selected Water-management Alternatives in Owens Valley, California: U.S. Geological Survey Water-Supply Paper 2370-H. 19919.

MWH, GTC, LADWP, ICWD. Inyo/LA Geochemical Cooperative Study. Final Report. December 2004.

LADWP. Environmental Impact Report: Water from the Owens Valley to Supply the Second Los Angeles Aqueduct: Environmental Impact Report. 1991.