Proposition 1 SDAC Grant Task 5: Water Vulnerability & New Extraction Well Site Feasibility Analysis

Borrego Water District (BWD)

August 30, 2018

DUDEK

This presentation provides results for the Proposition 1 Severely Disadvantaged Community (SDAC) grant Task 5: Water Vulnerability & New Extraction Well Site Feasibility Analysis for the critically overdrafted Borrego Springs Groundwater Basin of the Borrego Valley Groundwater Basin (BVGB). The source of the grant for this scope of work is the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1 or 2014 Water Bond) administered by the California Department of Water Resources (DWR).

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

New Extraction Well Location Approach

Two methods were used to determine the best location for a new BWD extraction well. Once new well sites had been narrowed down, well condition scenarios were run through the updated BWD WaterCAD model.

- Existing BWD Informational Review by Well
- Well Location-Ranking Matrix by Parcel

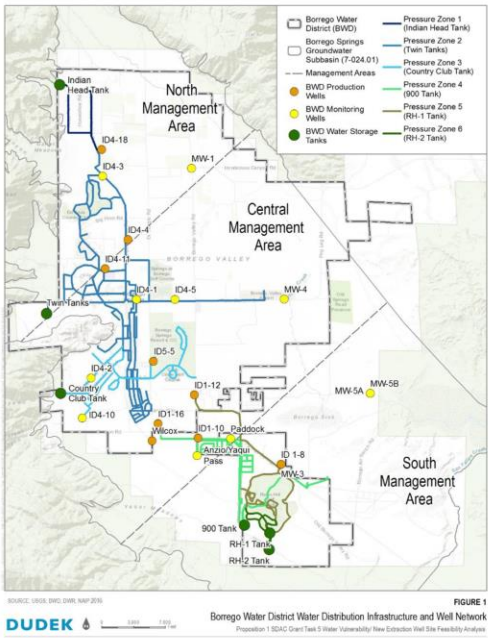
Two approaches were used to inform recommendations for a new BWD extraction well. First, available Borrego Water District (BWD) water distribution and production well data were reviewed to identify potential replacement wells in existing well locations. Second, a well location-ranking matrix was developed to locate a new extraction well on BWD and County owned property.

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

Review of Existing BWD Information

Available BWD water distribution and well information were reviewed and include:

1. Update of the WaterCAD Model
2. Review available BWD well completion information
3. Review pump efficiency
4. Estimate remaining useful life of wells

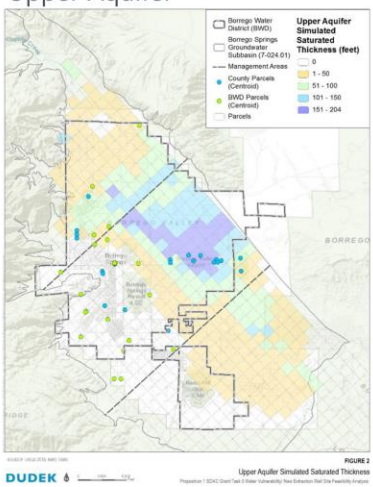


The BWD water distribution infrastructure was identified and mapped using information from the updated District water system distribution model in Bentley® WaterCAD. Interviews were conducted with BWD staff to determine existing well conditions. The BWD provided specific details about the overall condition of each well. Input from the BWD staff on the recommended location of various well sites was considered and reviewed. Information from BWD well logs was reviewed and compiled. The BWD provided the 2018 results of a well and pump efficiency analysis conducted by Pump Check. The remaining useful life of all wells owned by the BWD was estimated. This information was used to determine potential new extraction well locations based on the existing and future water supply requirements of the BWD.

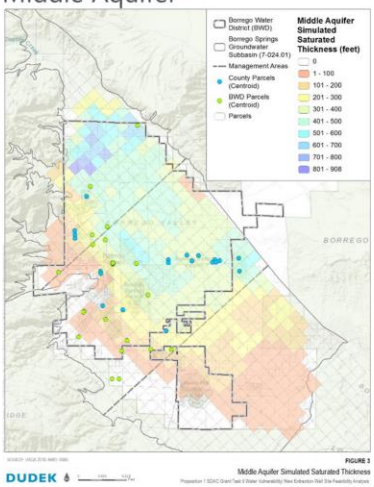
Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

Simulated Saturated Aquifer Thickness

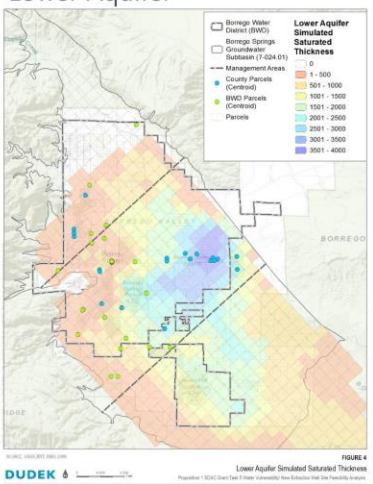
Upper Aquifer



Middle Aquifer



Lower Aquifer



The subsurface of the Subbasin has been divided into three main aquifer units by DWR (DWR 1984) and the USGS (Faunt et al., 2015). The upper, middle, and lower units have been defined and incorporated into a 3D Rockworks hydrogeologic visualization model, and the Borrego Valley Hydrologic Model (BVHM), a numerical groundwater model. The BVHM was completed by the USGS in cooperation with the BWD, and recently updated by Dudek. The BVHM was used to define simulated saturated upper, middle and lower aquifer thickness. Sites with the greatest simulated saturated thickness for the middle and lower aquifers were considered most favorable. The upper aquifer was excluded from the ranking matrix because of the limited saturated thickness and potential for water quality issues resulting from irrigation and septic return flows. It was also assumed that new wells would require a minimum of 50 to 100 feet of blank casing extending below the water table to allow for projected groundwater level decline during the 20-year SGMA implementation period and for suitable submergence of well pump intakes

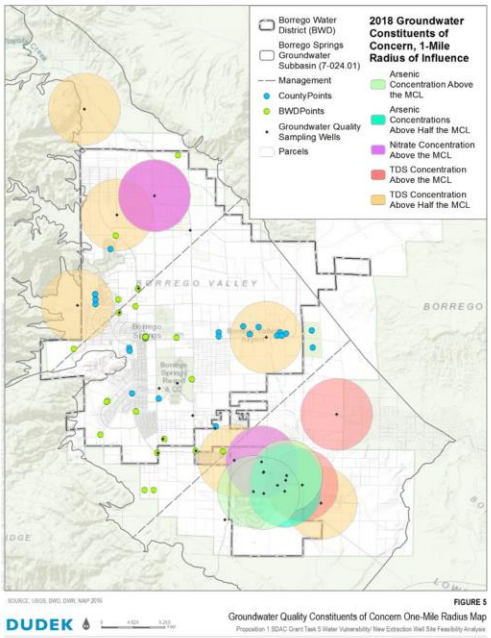
For BWD and County owned parcels, the underlying saturated thickness of the middle aquifer ranged from 0 to 668 feet and the lower aquifer ranged from 0 to 3,713 feet. The range of saturated thickness for each aquifer was divided into four equal groups to assign a saturated aquifer thickness ranking of 1 to 4 for each aquifer. The greater the saturated thickness, the higher the score.

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

Parcel Review: Water Quality

Major constituents of concern in the Subbasin are:

- Arsenic
- Nitrate
- Total Dissolved Solids (TDS)



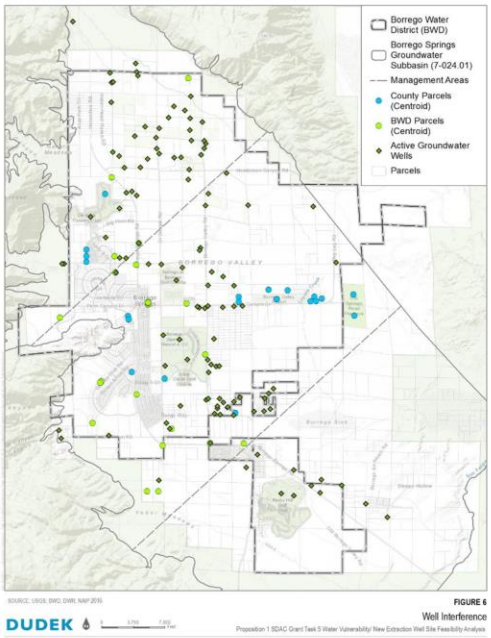
Water quality data from BWD extraction wells, BWD monitoring wells, and other nearby wells was used to evaluate major water quality constituents of concern (COC). Based on a review of historical and recent water quality results, the major COCs in the Subbasin are arsenic, nitrate, and total dissolved solids (TDS). Wells that exceeded California drinking water maximum contaminant levels (MCLs) specified in Title 22 of the California Code of Regulations for the COC are mapped with a one-mile radius to show possible problem areas.

Since arsenic concentrations are detected above the MCL of 10 micrograms per liter (µg/L) in samples collected from several wells in the SMA, this area is not considered suitable for locating new municipal extraction wells. Wellhead treatment for arsenic is considered too costly at this time given that alternative locations in the Subbasin would likely not require any treatment. Nitrate and TDS concentrations were higher in some areas in the Subbasin. These areas were avoided, if possible.

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

Parcel Review: Well Interference

Well Interference: decreased groundwater level caused by pumping.

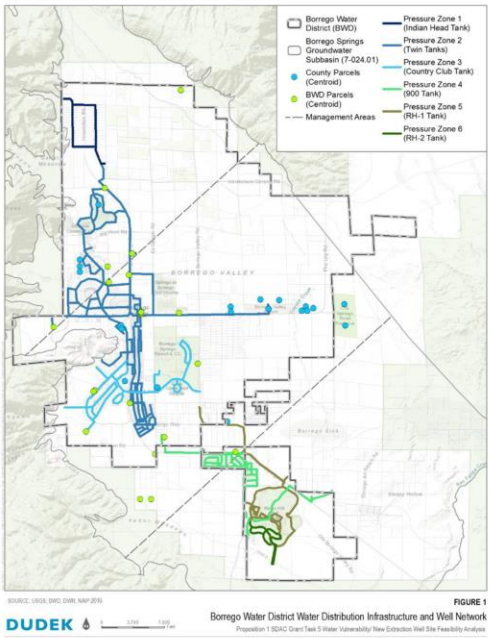


Well interference was reviewed in order to determine nearby pumping influences of potential wells. The time and duration of groundwater production from nearby pumping wells can affect the long-term use of a new BWD extraction well. Distances to nearby agriculture and recreation extraction wells were measured to define the locations that would incur the least amount of well interference. Potential well locations with the greatest distance from nearby wells were rated most favorable.

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

Parcel Review: Water Distribution

Reviewed distance to existing water distribution infrastructure.



The cost to install additional water distribution infrastructure was considered for the well ranking system. BWD and County owned parcels that measured the shortest distance from existing water system distribution infrastructure were considered most favorable.

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

Well Location-Ranking Matrix

The matrix was used to rank the most favorable parcels for a new extraction wells.

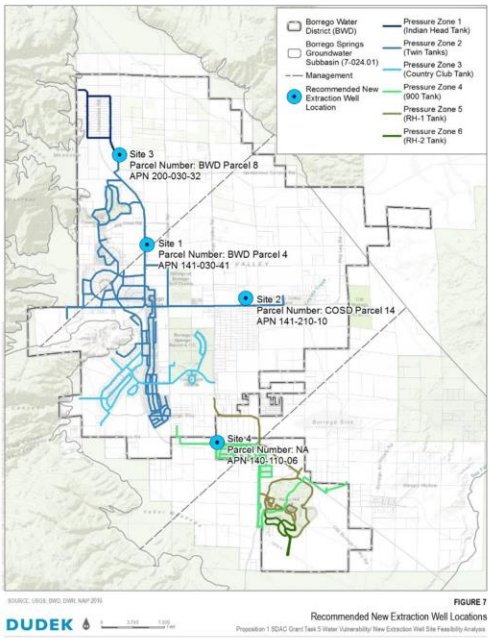
Category	BWD Parcel 1	BWD Parcel 2	BWD Parcel 3	BWD Parcel 4	BWD Parcel 5	BWD Parcel 6	BWD Parcel 7	BWD Parcel 8	BWD Parcel 9	BWD Parcel 10	BWD Parcel 11
Assessor Parcel Number	197-040-23	140-030-09	140-280-30	141-030-41	141-271-09	198-051-07	199-100-23	200-030-32	200-130-01	200-051-11	200-020-24
Management Area	NMA	NMA	NMA	NMA	NMA	CMA	CMA	CMA	CMA	CMA	CMA
Total Area (acres)	0.12	62.60	0.13	0.98	1.91	1.00	0.99	2.28	78.52	0.05	0.57
Simulated Saturated Thickness of the Middle Aquifer	19	668	475	420	343	253	342	182	0	220	4
Ranking of Simulated Saturated Thickness of the Middle Aquifer	1	4	3	3	3	2	3	2	1	2	1
Simulated Saturated Thickness of the Lower Aquifer	181	0	459	221	240	521	2,670	1,138	37	1,498	601
Ranking of Simulated Saturated Thickness of the Lower Aquifer	1	1	1	1	1	1	3	2	1	2	1
Approximate Distance to Nearest Well (feet)	6,452	2,241	1,658	2,339	415	4,210	2,257	3,596	738	2,116	2,195
Ranking of Well Interference	4	2	1	2	1	3	2	3	1	2	2
Distance to Existing BWD Water Distribution Infrastructure (feet)	190	18,478	50	0	2,240	150	3,299	0	6,971	138	1,458
Ranking of Proximity to Infrastructure	3	1	4	4	1	3	1	4	1	3	1
One-mile radius: Arsenic Concentration Ranking	4	4	4	4	4	4	4	4	4	4	4
One-mile radius: TDS Concentration Ranking	4	4	2	4	4	4	4	4	4	2	4
One-mile radius: Nitrate Concentration Ranking	4	4	4	4	4	4	4	4	4	4	4
Is there already a well located on the parcel (Extraction/Monitoring/None)	None	None	None	Extraction (ID4-4)	None	None	None	Extraction (ID1-10)	None	None	Extraction (Wilcox)
Totals:	**21**	**20**	**19**	**22**	**18**	**21**	**21**	**23**	**16**	**19**	**17**

Each category was assigned a ranking that ranged from one (“least favorable”) to four (“most favorable”). The rankings for each category were totaled for each parcel. The highest total value represented the most favorable parcel for installing an extraction well.

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

Recommendation

Based on the review of BWD data and the results of the well location-ranking matrix, four new extraction well sites were recommended.



Based on the review of BWD data and the results of the well location-ranking matrix, four new extraction well sites were recommended. Sites 1, 3, and 4 are replacement wells for existing BWD production wells. Site 2 is an exploration site located on a County owned parcel near the Borrego Springs Airport.

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

Next Steps

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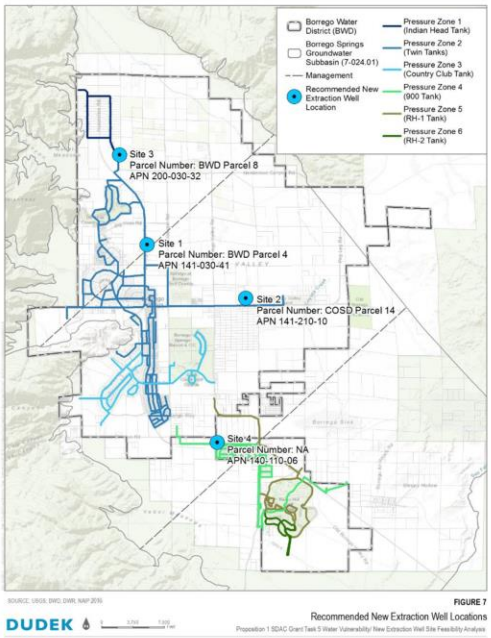
- An additional site-specific analysis should be conducted for the most favorable well locations to develop a preliminary well design.
- Final well design should be based on results of pilot borehole drilling and zone testing.



An additional site-specific evaluation should be conducted for the most favorable well locations to develop a preliminary well design. Final well design should be based on results of pilot borehole drilling and depth-specific zone testing to determine water quality.

Proposition 1 SDAC Grant Task 5:
Water Vulnerability & New Extraction Well Site Feasibility Analysis

QUESTIONS?

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