

ARIZONA DEPARTMENT OF WATER RESOURCES
HYDROLOGY DIVISION

MEMORANDUM

TO: File
THRU: Karen Modesto
FROM: Andy Kurtz
DATE: December 5, 2000
October 18, 2004 (modified)
August 28, 2006 (most recent modification)

RE: Empirita Water Company (21-402251.0000)
Application for modification of Designation

Other assoc. files:

Empirita Water Company (formerly Anderson Water Co.) (21-401435.0000)
Empirita Highlands @ the J-6 Ranch (22-400432), Section 19, T 17 S, R 19 E.
Redhawk subdivision (91 lots)

Introduction:

The above referenced water provider is located at the east edge of the Empire Ranch, known as the J-6 Ranch. This ranch (J-6) occupies portions of Sections 14, 23, 24, 25, 26, and 36 Township 17 South Range 18 East, as well as portions of Sections 19, 20, 21, 29, 30, 31, and 32 Township 17 South Range 19 East. Of this, the Empirita Water Company's CC&N occupies T17S R19E, sec. 20 (all), portions of sections 19, 21, 29, and 30. The water company's wells are located in the CC&N of the adjacent Anderson Water Company.

Originally, a study was provided to aid in the determination of available groundwater supplies ONLY for the subdivision identified above found in section 19. However, on September 24, 2004, ADWR received an application for Designation of an Adequate Water Supply (21-401435.0000). A supplemental hydrologic report was submitted in support of the application that was prepared by Chuck Dickens (a consultant).

On August 3, 2006, the ADWR Hydrology Division received a copy of the application for modification of the designation. Previously, the water provider was designated for 117.6 ac-ft/yr needed to meet their current and projected demands through the year 2015. In addition, it was determined that about 185 ac-ft/yr was reasonably proven available. The modification is requesting to be designated for 321 ac-ft/yr.

Water Provider: Empirita Water Company

current demands :	0.00	ac-ft/yr	
committed demands:	NED	ac-ft/yr.....	Redhawk subdivision??
<u>future demands:</u>	<u>NED</u>	<u>ac-ft/yr</u>	
TOTAL:	NED	ac-ft/yr	

ADWR Comments & Concerns:

- This will be a separate service system from that associated with the "Empire Ranch". No ongoing demands are known.
- The proposed service/production wells are not located within the CC&N of the water provider, but instead are located about 1 mile to the west.

Water Company wells:

The wells listed below were the "original wells" to provide water needed to meet the expected demands.

<u>location</u>	<u>DWR #</u>	<u>TD</u>	<u>DTW</u>	<u>Year Drilled</u>
D(17-18) 24 bdc - 1	632436	445	300	??? 2000
D(17-18) 24 bbc - 2	509703	425	300	??? 2000

The following wells were listed in the 2006 hydrologic study as the "service area wells"

<u>Location</u>	<u>DWR #</u>	<u>TD</u>	<u>DTW</u>	<u>Yr drilled</u>	<u>Pumpsized</u> <u>GPM</u>	<u>Tested</u> <u>Rate (gpm)</u>
D(17-18) 24bdc (#1)	579078	445	263	2000	60	42
D(17-18) 24bbc (#2)	580933	425	263	2000	60	44
D(17-18) 23adb (#3)	580934	460	248	2006	100	103
D(17-18) 23cca (#4)	203721	800	184	2004	250	275

ADWR Comments & Concerns:

- The total GPM for all the wells is about 758 ac-ft/yr. However, the pump size does not necessarily reflect the characteristics of the aquifer.

Water Supply Introduction:

The water supply for the proposed subdivision is to be solely from available groundwater resources found in the area. Originally, water for the proposed development is from wells located outside the subdivision's boundaries, but within the CC&N of the Anderson Water Company. Recent data submitted does not indicate that the proposed production wells lie within the CC&N(?) of the Empirita Water Company.

Aquifer tests were performed on the proposed production wells. The consultant presented the data and their determinations of transmissivity and storage coefficient. (See aquifer parameter section).

ADWR's Comments & Concerns:

- The currently proposed production wells appear to lie outside the CC&N of the Empirita Water Company.

Geology - Hydrology:

The geology of the surrounding area near the water provider is composed of a blend of quartz monzonite, limestone, and some basin fill material. To the south and east of the Water Company's CC&N (Empirita), hydrologic bedrock outcrops and is flanked by an extensive fault complex. Beneath the property itself, it appears that there is basin fill alluvium composed of sands and clays, underlain by conglomerates and remnant volcanic strata.

The volcanics and some of the conglomerates appear to create a somewhat "confined(?)" aquifer system. This is recognized by the difference between the original depth to water determined at the time of drilling as compared to the static depth to water identified at a later time. It is unclear what the extent of this condition is, but it is believed to be limited in extent given the nature of the area.

ADWR Concerns:

- The consultant has failed to delineate the "confining" strata associated with the aquifer.
- Though the transmissivity values (ADWR's values) appear reasonable, the storage coefficient, .000013, is more representative of a confined system or of an unconfined fractured aquifer.

Aquifer Parameters

The consultant has conducted aquifer tests associated with the use of observation well. These tests were plotted and values of transmissivity were determined from the recovery tests only. ADWR recalculated the transmissivity estimates for verification. It was found that the consultant used very late recovery test data where ADWR used recovery data mid-range. Early test data is representative of the well bore refilling immediately after the pumping stops. Mid-range is the aquifer actively replenishing. Late range the water levels in the well has basically recovered and is achieving equilibrium.

In addition, values of specific capacity were reviewed by ADWR and values of transmissivity were estimated.

<u>Well site</u>	<u>Consultant</u>	<u>Transmissivity Value Estimates (gpd/ft)</u>		
		<u>ADWR</u>	<u>Test Length (days)</u>	<u>T (via Sp.Cap)</u>
# 1	8,000 – 10,000	5,544	3	1500 - 2000
# 2	10,500	4,646	2.8	3000 - 4000
#3	10,900	5,438	3	3,300 – 4,400
#4	18,500	5,186	2	2,625 – 3,500

The consultant has stated that an average T-value of 12,000 gpd/ft as a reasonable value. ADWR conducted additional research and found that though aquifer test data was not available, specific capacity data was that has allowed for the following transmissivity estimates:

Additional Transmissivity Estimates

Other Wells	DWR #	TD	DTBedrock	DTW (@time of drilling)	From Spec.Cap. (gpd/ft)
D(17-18) 13dda	55-557421	420	NDE-congl	360	1200
D(17-18) 13dda	55-523859	434	NDE-congl	355	1,600
D(17-18) 13dcb	55-532789	440	NDE-congl	273	2,000
D(17-18) 13dcb	55-522015	460	NDE-congl	380	500
D(17-18) 13dcb	55-520086	460	NDE-congl	280	1,000
D(17-18) 13cca	55-516511	350	NDE-congl	265	1,250
D(17-18) 14caa	55-534447	340	NDE-congl	175	880
D(17-18) 14cad	55-539509	370	NDE-alluv.	305	522
D(17-18) 14cbc	55-538336	355	NDE-congl	200	2,000
D(17-18) 14dcd	55-519694	355	NDE-granite	300	2,000
D(17-19) 17ddc	55-508387	300	300 - granite	230	500
D(17-19) 17ddd	55-535014	400	NDE-sandst	309	118
D(17-19) 18ccc	55-501663	550	NDE-congl	355	133
D(17-19) 18cdc	55-549670	640	610 - vole	580	172
D(17-19) 18dca	55-502816	630	200 schst	280	65
D(17-19) 18dcc	55-516644	400	NDE-congl	260	444
D(17-19) 18dcd	55-516450	420	NDE-congl	350	222
D(17-19) 18ddb	55-510089	465	60 granite	390	5,000
D(17-19) 18ddc	55-515372	720	600 granite	220	319
D(17-19) 18dde	55-515622	720	320 granite	240	422
D(17-19) 18ddd	55-502549	500	NDE-congl	400	272
D(17-19) 18ddd	55-536200	500	NDE-congl	165	225
D(17-19) 29dac	55-540330	320	0-320 granite	80	318

The consultant used the observation well to aid in the determination of storage coefficient. The value determined appears to be very small, typical of a confined system, or possibly of a fracture system.

Specific Yield: 10 % estimated as reasonable by consultant for impact analysis
Storage Coefficient: .000013 (confined????) data from consultant

Depth to Water.

A value of 184 feet below land surface was stated as being the current DTW in the area. Of interest is that the water in the wells is found at a much lower dept, indicating that the system may be confined in nature. The following data was collected from the GWSI database.

Wellsite:	DWR #	DTW	Elev.	Date	Comment
D(17-18) 13ddd	604602	348.2	3892	2005	
D(17-18) 13abd	NDA	248.8	3891	2005	
D(17-19) 29bba	NDA	142.4	4321	2005	edge of hard rock

The consultant has listed additional DTW/Elev. Data in Figure 2. It is unclear how this data was measured as well as the data of measurement. The values do not appear to be unreasonable but the DTW stated by the consultant of 184 ft bls does not correlate with the map provided where the DTW for the production wells ranges from 184 to 263. Three of the four wells have DTW ranging from 249 to 263 bls.

ADWR Comments & Concerns:

- If the depth to water is 184 ft bls, then the groundwater appears to have risen and may possibly be in a confined zone. A storage coef. value of .000013 may be more representative than a value of 10 % selected by the consultant.
- *To the east of the property a dry hole was found.* Nearby wells indicated that this area is not very productive. DRY HOLE D(17-19) 17ddd encountered volcanics @ 280 ft bls. This well is located about 2 ½ miles east of the proposed production wells.
- The future proposed production well has been "spotted" to be drilled within ½ mile of this Dry Hole, D(17-19) 17ddd.
- REFER TO THE CONSULTANT'S STUDY FOR DETAILED INFORMATION

Depth to Bedrock

The consultant has provided a map with depth to bedrock listed. At the production well sites it appears that the bedrock is found at about 420 feet below land surface.

(See figure 4, Haley & Aldrich)

REFER TO THE CONSULTANT'S STUDY FOR DETAILED INFORMATION

Saturated Thickness

Current DTW:	184- 263 ft bls
DT Bedrock:	420 - > 800 feet bls
Saturated thickness (locally):	236 - 616 feet via piezometric surface (confined)

ADWR comments & Concerns:

Three of the four wells of the water provider were drilled to a depth that ranges from 425 - 460 ft. Only one well was drilled to about 800 feet. Review of the cross-section prepared by the consultant (Figure 4) suggest that a conservative value of saturated thickness be used if the system is to be considered to be unconfined.

Groundwater In Storage

This was not addressed by the applicant or ADWR

Flux

The applicant did address this item. ADWR's re-evaluation is as follows:

	<u>Consultant</u>	<u>ADWR</u>	<u>ADWR</u>
Q = TiL	T = 12,000 gpd/ft	2,000	5000
	I = .02 ft/ft	.02	.02
	L = 6000	5280	5280
	Q = 1,613 ac-ft/yr	236.6 ac-ft/yr	591 ac-ft/yr

ADWR Comments & Concerns:

- The flux appears to be driven by flow from the Cienega Creek area. It is unclear if this flow could be maintained as the groundwater levels decline over time. Where the flow enters the zone of the production wells, there appears to be a bounding fault, such that the groundwater must maintain an elevation that exceeds the upthrown elevation of this faulted strata where the production wells are found.
- In addition, where the production wells are located, they will intercept flow moving north and directly impact groundwater supplies previously available to dry-lot developments found to the north of the Empirita Water Company.

Recharge:

This item was not addressed by the applicant. However there is about 14 inches of rain ever year with the majority falling during the summer monsoon season.

Other available information suggests that there is a groundwater inflow component, that appears to feed the well field, from the south. This component's source is from the Cienega Creek Basin. Estimates of inflow may be best portrayed through examination of the groundwater flux. Data suggests that the flux may vary from greater than 591 ac-ft/yr, at a maximum, to a minimum of 236 ac-ft/yr.

As the current well field is developed, thus capturing the groundwater flow, nearby wells to the north and east of the water company's well field will most likely be impacted. Groundwater levels in these nearby wells will most likely experience declines in their current depth-to-water.

Decline Rates

This item was not addressed by the applicant.

Review of the GWSI records does not allow a ready determination of the long-term groundwater level declines. The following is a summary of some nearby regional declines

<u>Wellsite</u>	<u>DWR #</u>	<u>TD</u>	<u>decline rate (ft/yr)</u>
D(17-18) sec. 13ddd	55-604602	434	.52 (1981 - 2005)
D(17-19) sec. 8bab	55-807250	300	.18 (1981 - 2001)
D(17-19) sec.12cbd	55-642581	550	.62 (1990 - 2001)
D(17-19) sec. 14aca	NDA	670	.54 (1982 - 2005)
D(17-19) sec.17bba	NDA	NDA	.34 (1981 - 2001)
D(17-19) sec.29bba	NDA	NDA	.81 (1990 - 2005)
D(17-19) sec.29cda	55-632434	190	1.29 (1987 - 2005)

ADWR Comments & Concerns:

- It appears that the ongoing decline rate ranges from about .5 to 1 ft/yr. It is suggested that a value of at least 1.0 ft/yr be used as being representative of the current demands of the area.

Impact Analysis

The consultant conducted a well impact analysis using the Theis method.

For this new/revised application (for designation of AAWS), the consultant, Chuck Dickens, conducted an impact analysis. ADWR re-calculated the impact with what may be considered as more conservative aquifer parameters. The results are as follows:

	<u>Consul.</u>	<u>Consul</u>	<u>ADWR-1</u>	<u>ADWR-2</u>	<u>ADWR-3</u>
Hydrologic system					
Unconfined		X		X	X
Confined	X		X		
Transmissivity	12,000	12,000	2000/5000	5000	5000
Storage Coef./specific yield	.000013	10	.000013	.05	.05
Saturated Thickness	NA	NED	NA	216	616
# of Hydro. Boundaries	2	2	2	2	2
Number of Prod. wells	1	1	1	1	1
Number of Image wells	2	2	2	2	2
Discharge/ well (gpd)					
Current DTW	184	184	-----184-----		
Proj. decline rate (100 yrs.)	0	0	100	100	100
100 yr. Impact from wells	52.6	103.7	584-246	dewater-15	152
100 year Depth to Water	236.6	287.7	868-530	dewatered	436

Note: The value of specific yield in Runs ADWR 2 & 3 have been estimated at 5 % for a fractured conglomerate via the use of the Driller's Log Program.

ADWR Comments & Concerns:



- The consultant has chosen to use a transmissivity value that is much greater than what ADWR has determined is reasonable and representative for the region (2000 – 5000 gpd/ft).
- General transmissivity estimations for the area are typically 2000 gpd/ft or below (via specific capacity data).
- The ADWR review determined that the 100 year DTW
- Impact from the pumping of the production wells are expected to capture what little groundwater flow there is toward the north where the dry-lot subdivisions are found. It is expected that many of the existing private wells may experience dramatic declines in their DTW.

Water Quality

There is no known poor groundwater quality issue known to exist in this area.

	mg/lit	MCL
Nitrate	1.7	10
Flouride	1.5	4
TDS	200	500

Conclusion:

- The production wells appear to lie outside the CC&N for the Empirita Water Company.
- ★ • Given the available information and data, there appears to be sufficient groundwater available for the water provider
- The best estimate of transmissivity ranges from 2,000 gpd/ft to a little over 5,000 gpd/ft.
- The designated amount of groundwater sought (321 ac-ft/yr will probably capture the majority of the groundwater flux through the area (236 to 591 ac-ft/yr)
- The impact analysis results suggest that the aquifer groundwater levels will be drawdown to a depth ranging from about 436 to 530 feet below land surface.
- The depth-to-bedrock is not known at the production well.
- ★ • Impacts to the domestic wells (upwards of 75 wells) found in the vicinity (about 1 mile) of the well field for the Empirita water Company will likely experience large impacts due to declines in the groundwater table. Many domestic wells will probably need to be deepened, or will go dry.

Item	Pass	Fail
Quantity	X	
Quality	X	
Dependability		X

Office of Assured and Adequate Water Supply Hydrology Review

File Number **21-402251.0000** Subdivision **Empirita Water LLC**

SubBasin	CCK	Aquifer description	basin-fill alluvium
Depth to Water, ft	184 - 262	Regional decline, ft/yr	1.0
T, g/d/ft	2000 - 5	Groundwater stored, af	0
SY, %	.05	Recharge, af/yr	
Sat Thickness, ft	216 - 616	Groundwater Flux, af/yr	236 - 591
		Method of Analysis	Theis - Thwells

Impact

Projected water level decline, ft/yr	upwards of 5.3	Estimated Depth to Water After 100 Years:
Within area of impact of a recharge facility?	<input type="checkbox"/>	min, ft 436 Location D(17-18) sec
If yes, is criteria met w/o considering stored water?	<input type="checkbox"/>	max, ft 530 Location D(17-19) sec

Surface Water Supply Analysis

Source	not applicable	Firm yield, af/yr	0
SW Right No.	0	Median flow, af/yr	0.000
Type of Right	decree <input type="checkbox"/>	Cert. of Appropriation	<input checked="" type="checkbox"/>
	Pre-1919 Right <input type="checkbox"/>	Permit of Appropriation	<input type="checkbox"/>

Demand

Applicant's projected demand, af/100 yrs	0
AMA's projected demand, af/100 yrs	32100
Demand served by service area wells, af/100 yrs	0

Groundwater Supply

Basis of Physical Availability	<input checked="" type="checkbox"/> Study included w/ application
<input type="checkbox"/> Water Availability Letter/PAD	<input checked="" type="checkbox"/> Hydrologic data on file
<input type="checkbox"/> Analysis	Model used Thwells
Year 2006	Original amount of physical availability, af/yr 321
File No.	Balance after this application, af/yr 321

Comments

- The production wells appear to lie outside the CC&N for the Empirita Water Company.
- Given the available information and data, there appears to be sufficient groundwater available for the water provider
- Impacts to the domestic wells (upwards of 75 wells) found in the vicinity (about 1 mile) of the well field for the Empirita water Company will likely experience large impacts due to declines in the groundwater table. Many domestic wells will probably need to be deepened, or will go dry.

Hydrologist A. Kurtz

Section Manager

Approved Not Approved

Date 8/29/2006

Approved Not Approved

Date 8/29/06