



State of Idaho

DEPARTMENT OF WATER RESOURCES

Western Region, 2735 Airport Way • Boise, Idaho 83705-5082

Phone: (208) 334-2190 • Fax: (208) 334-2348 • Web Site: www.idwr.idaho.gov

C. L. "BUTCH" OTTER
Governor

GARY SPACKMAN
Interim Director

March 30, 2012

LAYNE AND/OR LORI THORNTON
3224 SWAN FALLS RD
KUNA, ID 83634-1732

RE: South Ada County Ground Water Area
Application for Permit No. 63-33401 -- Thornton

Dear Applicant:

The purpose of this letter is to provide you with information regarding the local ground water aquifer sourced to your application and update you with the processing status of your application.

Ground Water Aquifer

The cold water aquifer in the area has been declining since the 1960's with an average rate of decline of 0.3 to 0.4 feet per year during the past 30 years. There appears to be a correlation between the increase in water right approvals and declines in the aquifer level. In 1960, the non domestic ground water diversions equaled approximately 100 cfs. By 1980, the cumulative diversion rate had approached 500 cfs and currently the withdrawal rate is approximately 600 cfs. It appears the aquifer is currently in overdraft as water levels have not yet stabilized to the current demand (see attached hydrologic memorandum).

Low temperature geothermal water (> 85 degrees) may be encountered as close as 400 feet in depth in this area. As water levels continue to decline, an increase in the ground water temperatures will occur. The reduced volume of cold water stored in the aquifer will cause an increase in the upwelling of geothermal waters from below. Our state water statutes require low temperature ground water be utilized primarily for the water heat value first and secondarily for the water value as in irrigation. Low temperature geothermal water cannot be a source for primary irrigation use.

At present, the Department has very limited data and knowledge regarding the area hydrology and aquifer characteristics. Additional data and information will continue to be compiled to obtain a true picture of the area ground water resources and potential for new water appropriations. However, recent reductions in Department resources and staff will make this a slow process; it will not likely be completed soon.

New Appropriation Applications

Idaho Code (IC) 42-203A requires the Department to consider certain evaluation criteria in the processing of new appropriation applications. The applicant has the burden of proof and must provide evidence for the Department to evaluate the following criteria:

1. Will the new appropriation reduce the quantity injure existing water rights?
2. Is the water supply sufficient for the purpose for which it is sought?
3. Is the application made in good faith or for delay or speculation?
4. Does the applicant have sufficient financial resources to complete the project?
5. Will the proposed use conflict with the local public interest, where local public interest is defined as interests that the people in the area directly affected by a proposed water use have in the effects of such use on the public water resource?
6. Will the proposed use be contrary to the conservation of water resources within the State of Idaho?

Currently, there are 21 groundwater applications filed with our agency proposing a total flow rate of 27.5 cfs. in the area. Of the 21, the two Kuna-Cole 880 (Kirkwood) applications are protested. By priority received, the Kuna-Cole (Kirkwood) application no. 63-32860 is the next application to be processed (see attached application listing). A prehearing conference for this contested application is scheduled for early summer.

Options for Consideration

Given the limited hydrologic information and data regarding the aquifer, the following are options regarding your application:

- 1. Provide the Department convincing evidence and data that will satisfy the above evaluation criteria under IC 42-203A for continued processing. The evidence should include data analysis, arguments, and documents.*
- 2. Withdraw the Application; you may re-file at a later date if desired.*
- 3. Continue to have the application held until there is sufficient evidence and data available for the Department to further consider the application.*

It will be assumed you wish your application to continue to be held unless either convincing evidence and data (1) or an application withdrawal (2) is submitted.

Should you have questions, please contact me at the Western Regional Office, phone 334-2190.

Sincerely,



John Westra, Manager

Enclosure: application listings, boundary map, hydrologic memorandum, withdrawal form

SOUTH ADA COUNTY GROUND WATER APPLICATIONS IDWR WESTERN REGION

GENERALLY

- ground water
- various (irrigation, municipal, etc.) use
- “Active” Status in database
- P/D in South Ada Co Ground Water Area of Concern
- Protested applications
- Advertised applications – no protests received
- Application being processed

<u>NAME</u>	<u>WR NUMBER</u>	<u>DATE FILED/ PRIORITY</u>	<u>CFS</u>	<u>USE</u>
1) Kuna-Cole 880 et al -to- Kirkwood Bank & Trust Co.	63-32680	05/22/07	5.22	IRR
2) Smith	63-33032	04/11/08	0.20	IRR
3) Halladay	63-33199	04/30/09	0.14	IRR
4) Brown	63-33235	07/07/09	0.20	IRR/ STOCK
5) Derr	63-33236	07/08/09	0.26	IRR/DOM/STOCK
6) Tippetts	63-33237	07/08/09	0.28	IRR/DOM/STOCK
7) Vollman	63-33261	08/06/09	0.20	IRR
8) Vollman	63-33262	08/06/09	0.20	IRR
9) Gust	63-33263	08/12/09	0.84	IRR/DOM
10) Kuna-Cole 880 et al -to- Kirkwood Bank & Trust Co.	63-33296	11/06/09	10.46	IRR
11) Vesel and/or Pupilidy	63-33312	12/04/09	0.18	IRR/STOCK
12) Hutchings	63-33207	05/15/09	3.00	IRR
13) Thornton	63-33401	07/12/10	0.84	IRR
14) Orlando -to- Axel	63-33402	07/21/10	0.20	IRR/DOM/STOCK
15) Orlando	63-33403	07/21/10	0.20	IRR/DOM/STOCK
16) Orlando -to- Fisher	63-33404	07/21/10	0.20	IRR/DOM/STOCK
17) Orlando -to- Wallace/Williams	63-33405	07/21/10	0.20	IRR/DOM/STOCK
18) D Yamamoto Development LLC	63-33415	08/19/10	2.98	IRR
19) Severe	63-33434	10/29/10	0.19	IRR/DOM
20) Fick	63-33531	06/13/11	0.76	IRR/DOM/STOCK
21) Belman	63-33598	11/02/11	0.78	IRR

TOTAL DIVERSION RATE ALL APPLICATIONS

27.53 cfs

**WITHDRAWAL
OF
APPLICATION FOR PERMIT**

TO WHOM IT MAY CONCERN:

**I hereby withdraw Application for Permit to
Appropriate the Public Waters of the State of Idaho**

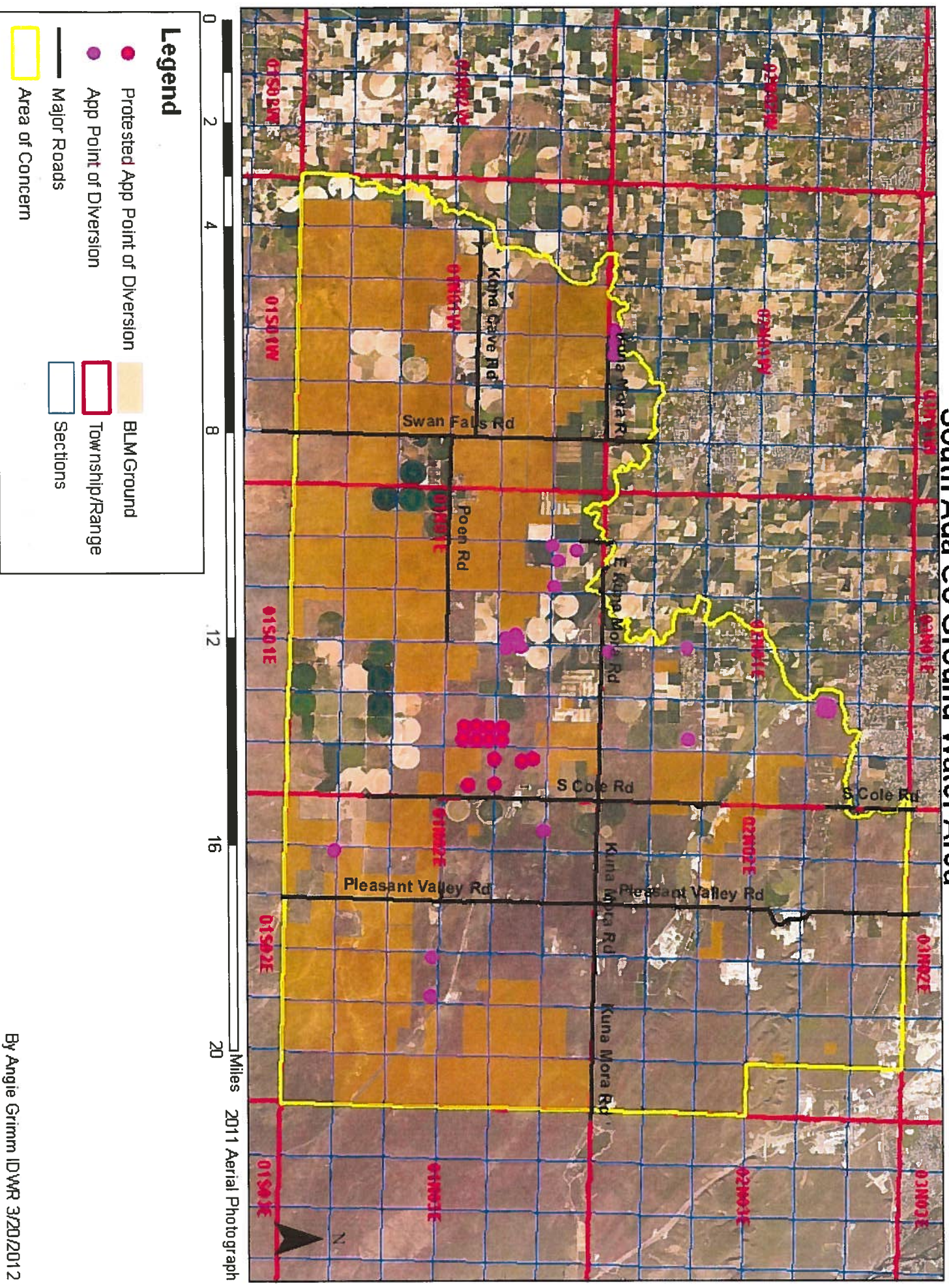
No. _____.

Signed this _____ day of _____, 20____.

Signature of Applicant

Printed Name of Applicant

South Ada Co Ground Water Area



MEMO

State of Idaho

Department of Water Resources

322 E Front Street, P.O. Box 83720, Boise, Idaho 83720-0098

Phone: (208) 287-4800 Fax: (208) 287-6700

Date: September 13, 2010

To: John Westra, Western Region

From: Dennis Dwyer, Hydrology Section, State Office

cc: Sean Vincent and Rick Raymondi

Subject: SE Kuna/S Boise Significant Water Right Development Proposals -- Revised

Introduction

A request was submitted to the Hydrology Section at the State Office to analyze a group of twenty-one permit applications for ground water development in the area southeast of Kuna. The request identified the following concerns:

- 1) **Sufficiency of cold water ground water supply.** Only a few deep wells exist in this area, many of which have encountered low temp geothermal water below 400 ft. Applications 63-12546 (200-500 ft), 63-32860 (350-650 ft), 63-33186 (200-431 ft), 63-33207 (300-480 ft), 63-33263 (190-465 ft), and 63-33296 (350-700 ft) all indicate a proposed water bearing zone below 400 ft.
- 2) **Potential injury to existing users and cumulative impact** the proposed appropriations may have on current water right users and the ground water resource in this area.
- 3) **Appropriation of ground water for the proposed uses in the public interest.** The State of Idaho (Penitentiary) has protested Tyson Fresh Meats Inc.'s application 63-12546 based on the claim that approval of this permit is not in the public's best interest due to close proximity to the Penitentiary and the potential negative impact to existing municipal uses there.

Summary of Water Right Applications

The location of proposed ground water development is the 216 mi² area southeast of Kuna defined by townships 02N01W, 02N01E, 02N02E, 01N01W, 01N01E, and 01N02E (Figure 1). There are currently 21 permit applications for development of ground water within this area. The primary use for most of these 21 applications is irrigation. The combined total maximum diversion rate is 54 cubic feet per second (cfs).

In addition to the 21 pending applications, there are 79 approved ground water permits with a combined total maximum diversion rate of 106 cfs that are currently being developed in this area. In

combination, the pending and previously approved permits in the area amount to more than 160 cfs of ground water extraction, which is a significant increase considering the total maximum diversion rate for existing ground water rights in the area is approximately 600 cfs.

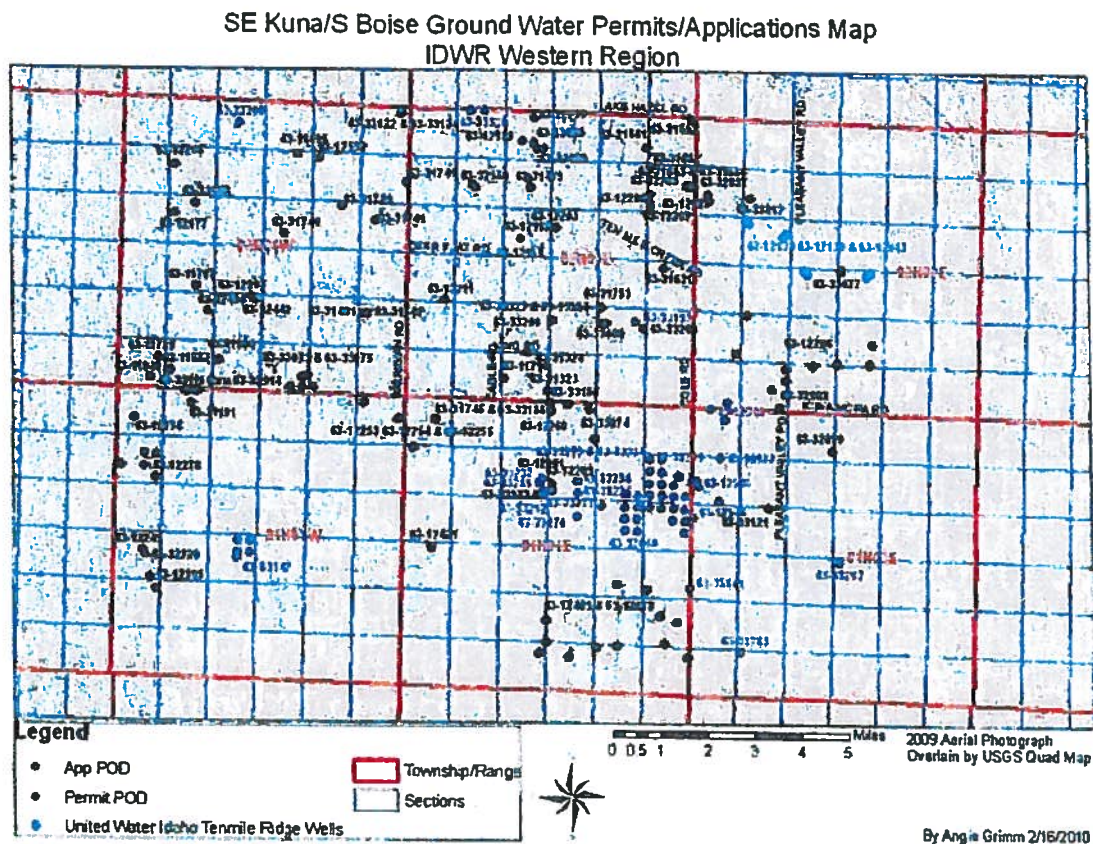


Figure 1. Pending and approved water right permits and applications.

Hydrogeology

The hydrogeology of the area consists of basalt flows and sedimentary units of the Idaho Group (Ralston and Chapman, 1970). The area of interest is bisected by a northeast trending zone of complex faulting and is at the edge of the basalt flows that are exposed at the surface southwest of Kuna (Mitchell, 1981). Shallow basalt flows encountered during drilling are generally thicker in the southwest portion of the study area (Figure 2). Sand, silt, clay, and gravel layers are below the basalt units and form the primary aquifer of the area.

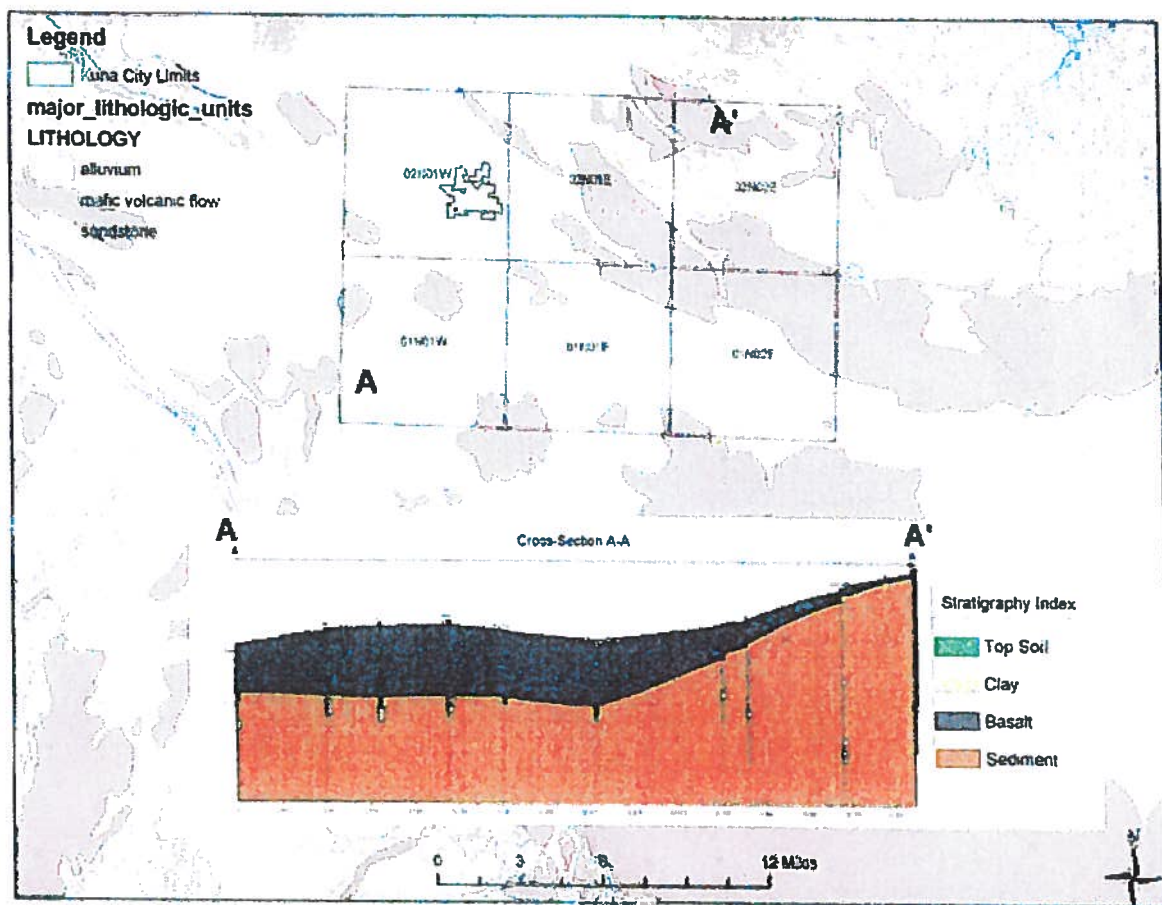


Figure 2. Generalized geologic cross section across the study area from the southwest (A) to the northeast (A').

The area has undergone significant faulting and both northeast and northwest trending faults are present (Otto and Wylie, 2003). Fault zones impact water temperatures by providing a conduit for geothermal water to flow upward into the overlying cold water aquifer within the Idaho Group (Mitchell, 1981).

Primary sources of recharge to the cold water aquifer are irrigation leakage (canal seepage and flood irrigation) and geothermal input (Otto and Wylie, 2003). Hydrographs for two area wells (02N01W18BBB1 and 02N01W04DDA1) suggest a positive response to development of the canal system in the Treasure Valley in the early 1900's (Figure 3). These hydrographs lend support to the notion that irrigation water is a significant source of aquifer recharge. The first well (02N01W18BBB1) is 300 feet deep and experienced a water level increase of approximately 50 feet between 1917 and 1953. The second well (02N01W04DDA1) is 203 feet deep, and demonstrates a water level increase of approximately 80 feet between 1914 and 1953. Based on these two hydrographs, it appears the response to surface recharge is less significant at depth since the shallower of the two wells showed the greater response.

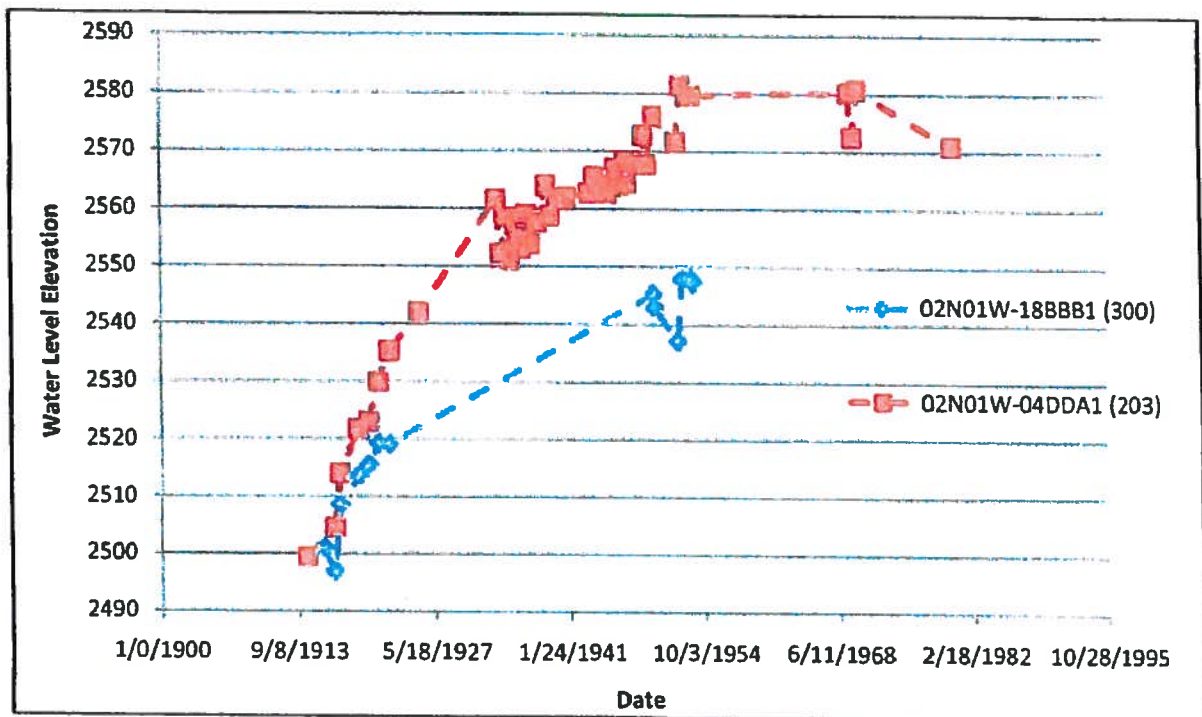


Figure 3. Hydrographs showing water level increases during the period following development of surface water irrigation in the area.

Ground water flow direction in the study area is generally to the south/southwest, towards the Snake River (Figure 4). Although gage data is limited, Snake River to the south of the study area is a gaining reach and receives ground water that discharges from this study area (Petrich, 2004; Newton, 1991). Based on the potentiometric map of the region (Figure 4), it appears a significant portion of the ground water flow across the study area discharges to the Snake River below the Murphy gage. The hydraulic conductivity of the aquifer varies, depending on the type of aquifer material encountered, with production rates ranging from 11 to over 3,000 gallons per minute (gpm). Transmissivity estimates based upon analysis of specific capacity data from well driller's reports range from approximately 1,000 ft²/day to 250,000 ft²/day.

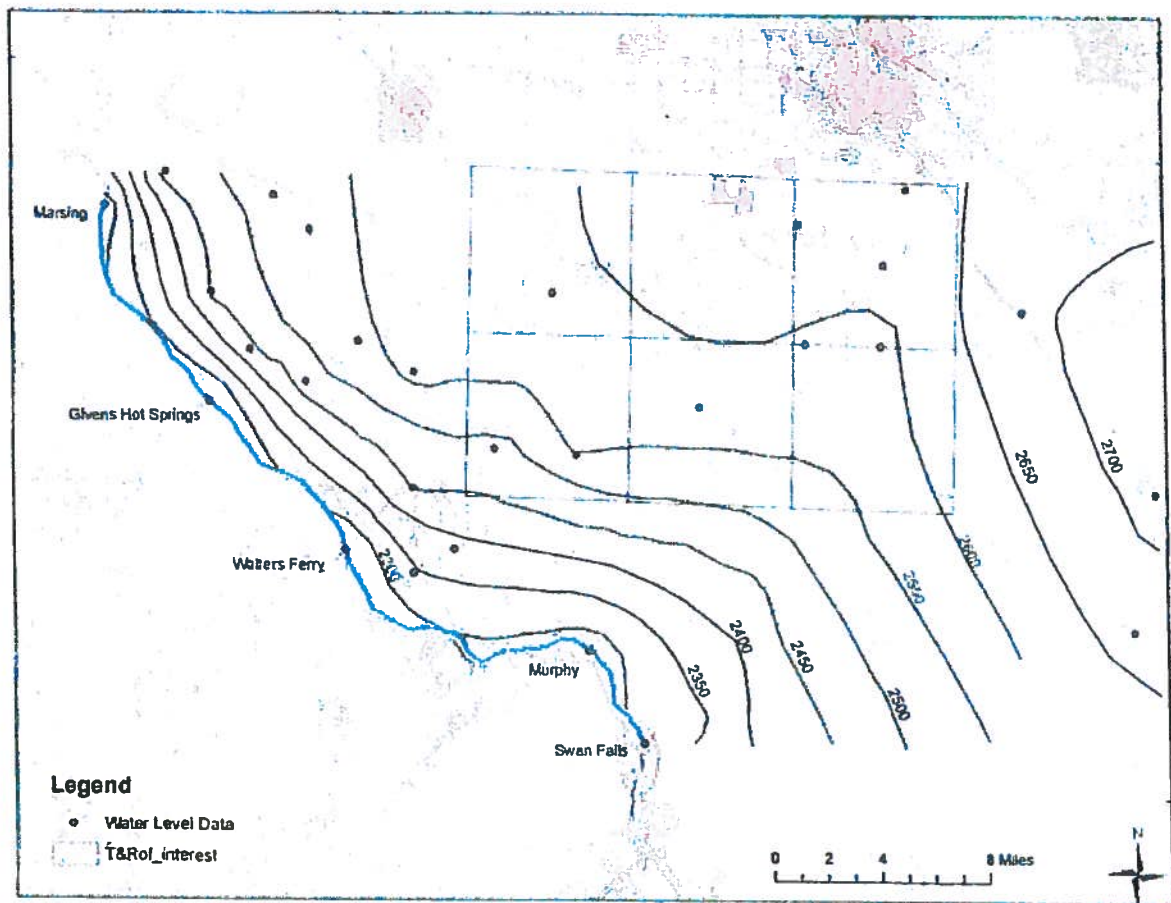


Figure 4. Potentiometric surface map for spring 2009.

Water levels have been declining since the 1960's with measured declines of approximately 10 to 13 feet during the past 30 years (Figure 5). The average rate of decline is approximately 0.3 to 0.4 feet per year, indicating the rate of aquifer recharge has been exceeded by rate of withdrawal. Figure 6 shows individual hydrographs for a suite of wells with detailed water level histories.

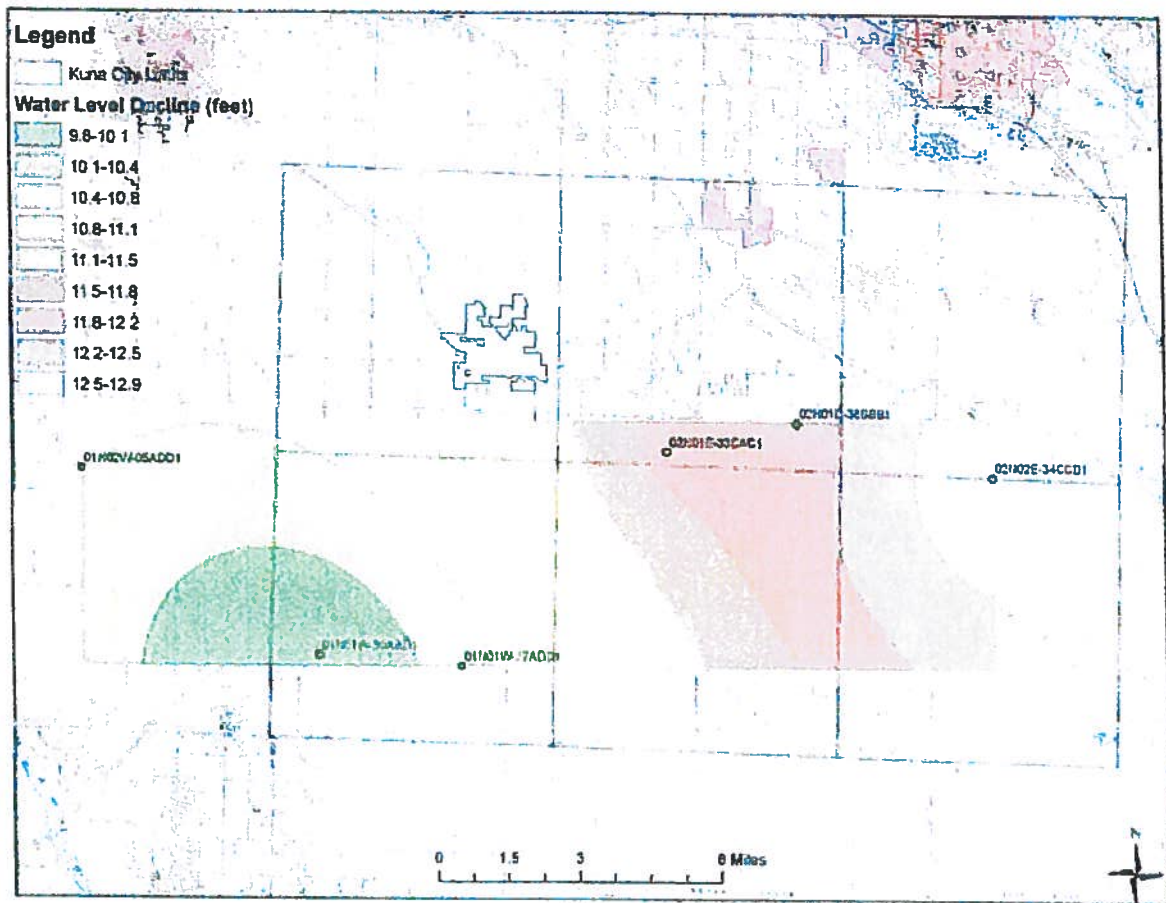


Figure 5. Water level declines for the period 1976 through 2009.

Response to Technical Concerns

1. **Sufficiency of a cold ground water supply.** Only a few deep wells exist in this area, many of which have encountered low temp geothermal water below 400 ft. Applications 63-12546 (200-500 ft), 63-32860 (350-650 ft), 63-33186 (200-431 ft), 63-33207 (300-480 ft), 63-33263 (190-465 ft), and 63-33296 (350-700 ft) all indicate a proposed water bearing zone below 400 ft.

The cold water aquifer has sufficient productivity to develop large capacity irrigation or municipal wells. This statement is based on the fact that many deep wells exist throughout this area that produce cold water. In addition, specific capacity data reviewed from driller's reports indicates high transmissivity values, supporting the conclusion that the aquifer has sufficient productivity for developing deep cold ground water wells.

Although the cold ground water supply is currently sufficient for additional well development in terms of aquifer productivity, the declining water levels indicate the aquifer is currently in an overdraft with respect to the local ground water budget. Future impacts from ground water permit applications and approved but undeveloped ground water permits may increase the rate

of water level decline and could cause an increase in water temperature from the geothermal contribution to the aquifer.

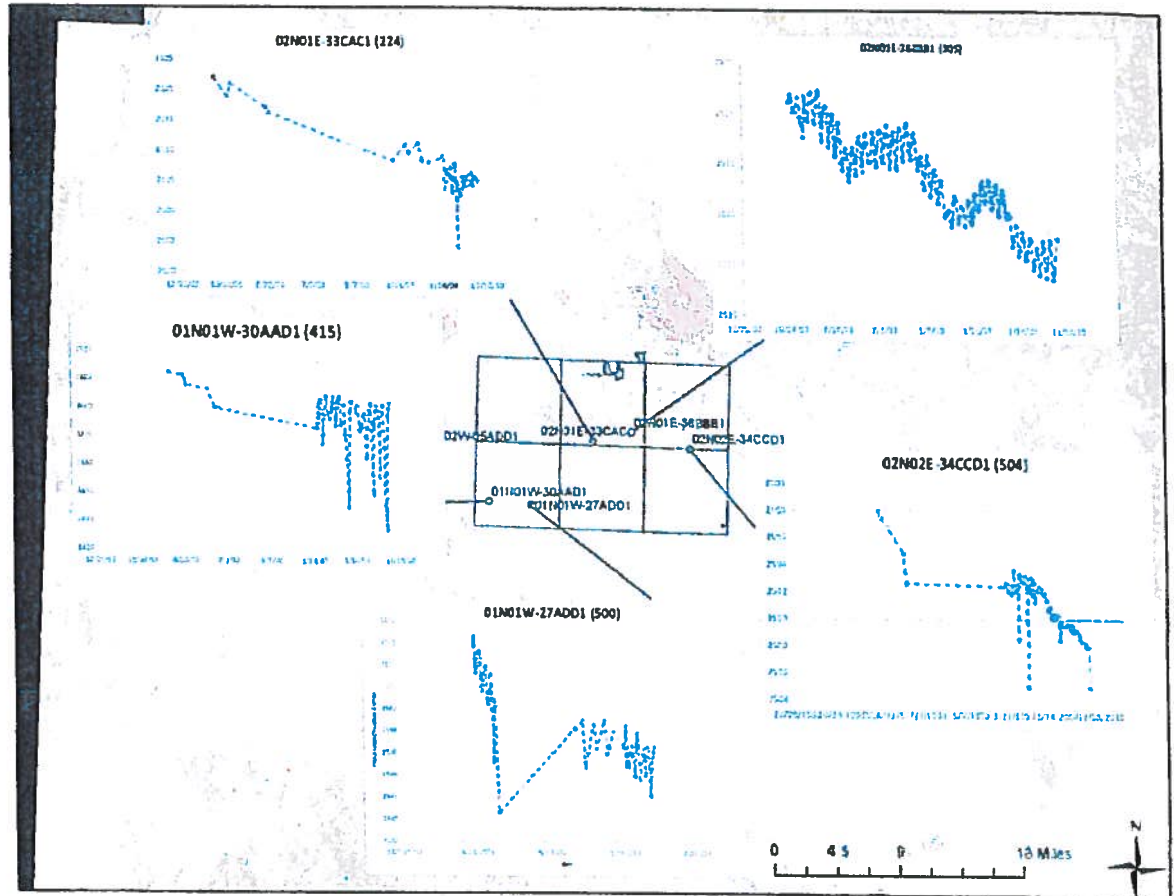


Figure 6. Hydrographs for select study area wells.

The recharge rate to the cold ground water aquifer appears insufficient to sustain additional ground water development without additional water level declines. Hydrographs and water level data indicate that the ground water pumping in this area has exceeded the recharge rate, resulting in ground water level declines. The declines indicate a portion of the ground water currently being withdrawn is being removed from storage. The magnitude and timing of the additional water level declines cannot be accurately predicted, but it can be assumed to at least be equal to or more likely exceed the historic water level declines. It is likely that ground water levels will continue to decline, until ground water withdrawals and recharge rates reach an equilibrium. The timing and water level at which this new equilibrium will be met cannot be accurately forecasted at this time.

At some point in the future, the depletions and decrease in head may be sufficient to allow the geothermal contribution to impact the cold water supply, resulting in elevated ground water

temperatures across the area. The timing and depth at which this may occur cannot be precisely determined due to a lack of data regarding the locations and rates of geothermal input into the cold water aquifer system.

To assess the potential of encountering low temperature geothermal water, a review of driller's reports and records within the IDWR geothermal database was conducted. Between the two data sources, 237 water temperature records were reviewed. Reported temperatures ranged from 50 to 99 degrees, with six wells reporting water temperatures classified as low temperature geothermal (85 degrees or greater).

Figure 7 is a plot of water temperature versus well depth. The relatively low correlation coefficient (R^2) of 0.31 indicates that temperature is not strongly correlated to total well depth. The weakly correlated data suggest a temperature gradient of approximately 17 degrees Fahrenheit for every 200 feet of depth (8.5 °F/100 ft). This gradient is approximately three times higher than the gradient of 29 degrees Fahrenheit for every 1000 feet of depth (2.9 °F/100 ft) reported by Otto, and Wylie (2003) and roughly two times higher than the gradient of 9 degrees Fahrenheit for every 200 feet of depth (4.5 °F/100 ft) reported by Mitchell (1981) for this same aquifer system.

The average temperature gradient for the data on Figure 7 is biased upward by data from several wells that exhibit significantly elevated temperatures. Most notably, the warmest water (99 degrees Fahrenheit) is from a well that is only 553 feet deep. The temperature is considered anomalous because there are 27 wells deeper than 553 feet in which the water temperature is consistently cooler than 99 degrees. This variability required a review of the spatial distribution of elevated water temperatures to determine the potential of applicants to encounter warm water.

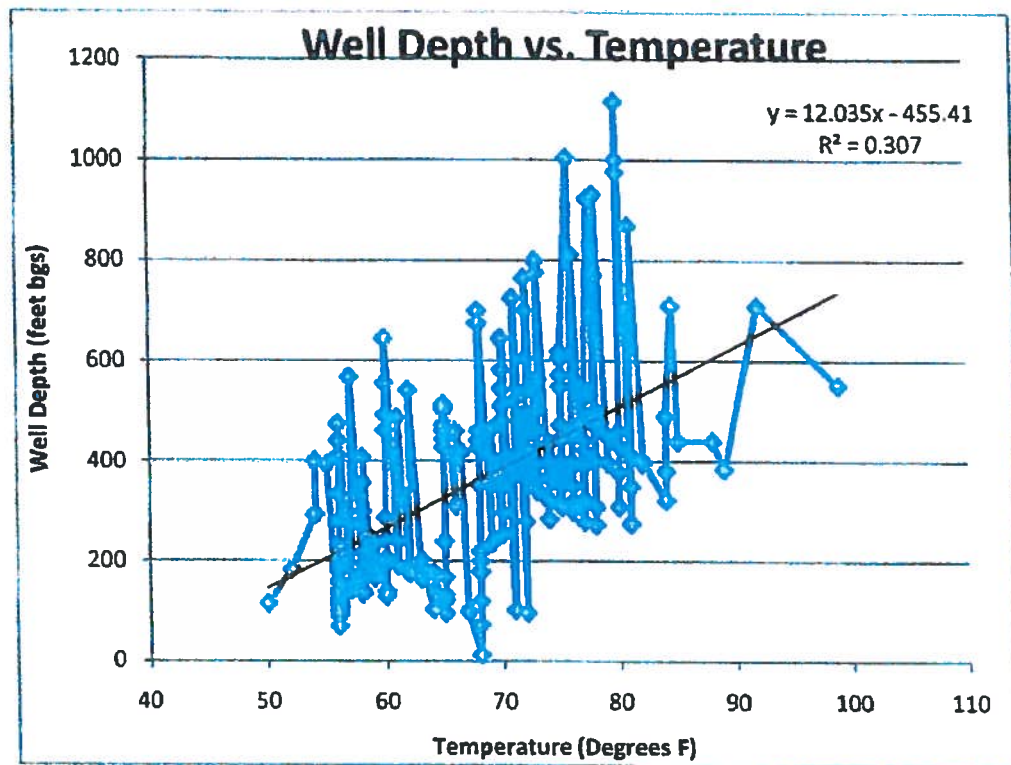


Figure 7. Plot of well depth versus temperature within the study area.

Figure 8 shows wells with elevated (68 degrees or warmer) temperatures in the study area are located throughout the area and do not appear to be completely controlled by structural features. A mapped "zone of complex faulting and northeastern edge of the basalt flows" (Mitchell, 1981) southwest of Kuna appears to correlate with a linear trend of wells with elevated temperatures in that area (Figure 9). In addition to well depth, this zone of faulting appears to be a contributing factor to elevated water temperatures.

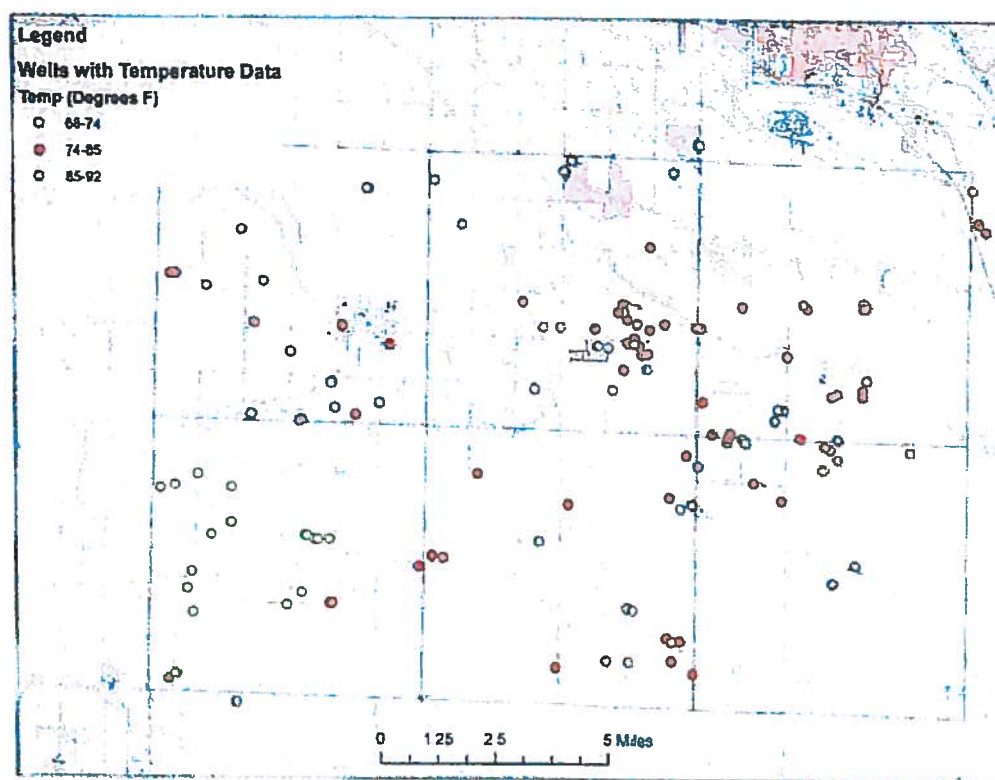


Figure 8. Wells with elevated temperatures (above 68 degrees).

Additional unmapped faults may exist in this area that also contribute to the elevated temperatures by providing a conduit of deep geothermal water to enter the cold water aquifer system of the area. It appears that elevated water temperatures within the area of interest can be attributed to a combination of well depth and proximity to conductive fault zones.

The mapped faults to the northwest of the study area have a NW/SE trend. If this trend was extrapolated linearly to the southeast into this area of concern, the extrapolated location of the fault zone would be positioned in the direct vicinity of majority of the applications associated with this request (off of South Cole Road). Therefore, there is the potential for encountering geothermal waters in this area, and any future drilling should be conducted cautiously, so that low temperature geothermal water is not developed.

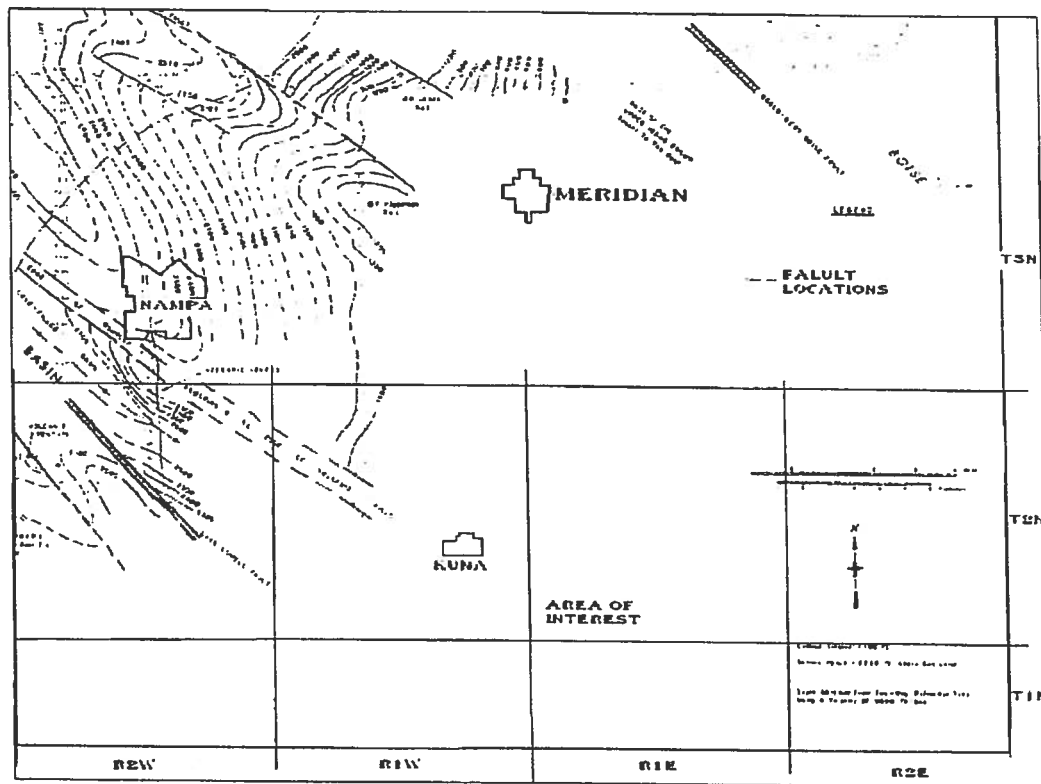


Figure 9. Structural map of the Idaho Group sediments showing the locations of mapped faults in the area (modified from Mitchell, 1981).

2. Potential injury to existing users and cumulative impact the proposed appropriations may have on current water right users and the ground water resource in this area?

As previously mentioned, water levels across this area have been declining for decades. The information provided by the consultant representing Kuna-Cole 880 LLC (Application for Permit 63-32680), dated January 26, 2007, also shows declining water levels in the area (SPF, 2007). To investigate the magnitude of the water level declines, historic water level records were reviewed.

Figure 10 is a plot of cumulative water right diversions over time with one hydrograph containing a long detailed water level record. Well 02N01W07BBC1 had a historic high water level in August, 1960. Since that time, the water level in this well has continually declined. This well is 103 feet deep, and should represent a best case scenario for water levels since shallower wells have generally demonstrated a more direct response to surficial recharge.

There appears to be a correlation between the large increase in approved water rights in the 1960's and 1970's and water level declines. In January of 1960, non-domestic ground water diversions equaled approximately 100 cfs. By January of 1970, the cumulative maximum diversion rate had increased to nearly 300 cfs. In January of 1980, the cumulative maximum diversion rate had approached 500 cfs. The past 20 years have shown an increase of

approximately 100 cfs, as the current ground water withdrawal rate within this area is approximately 600 cfs. The increase in approved ground water withdrawals in the 1960's and 1970's appears to have exceeded the natural recharge rate, resulting in water level declines.

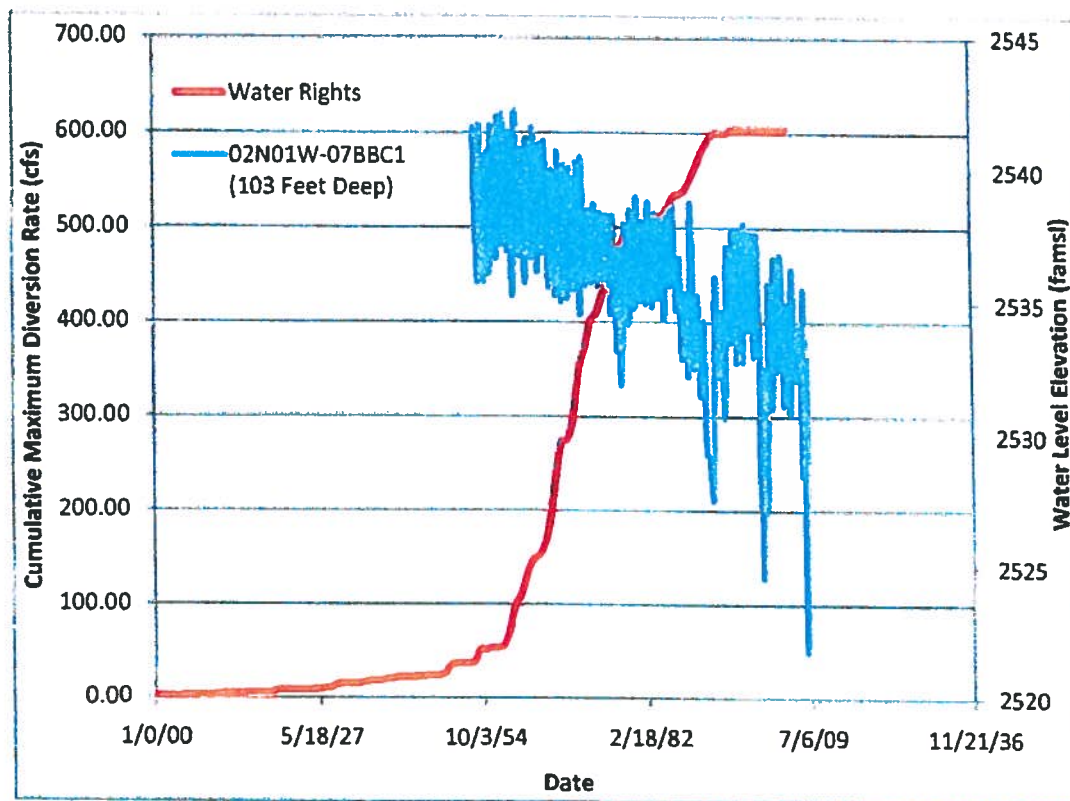


Figure 10. Plot showing trends of cumulative maximum ground water diversion rate and water level elevation in a 103-foot deep well in the northwest part of the study area.

To evaluate the potential injury to existing users and cumulative impacts of the approval of these water right applications, the increase in overall withdrawal rates was reviewed. As previously noted, the current cumulative maximum ground water diversion rate for existing water rights in the area is 603 cfs. An additional 106 cfs is currently permitted in the area and impacts from these permits have not been evaluated through monitoring data. Adding 54 cfs of ground water withdrawals associated with this request is expected to increase ground water declines across the area.

As indicated in the consulting report for Application 63-32680:

"Future water levels will likely stabilize at a new water level equilibrium if groundwater withdrawals stabilize." (pg. 3, SPF, 2009)

This conclusion agrees with the data that has been reviewed for this group of applications that shows a regional water level decline in response to ground water withdrawals associated with

previously approved water rights. It is currently unknown if an additional increase in ground water withdrawals will accelerate the current rate of decline but it seems unlikely that the aquifer system will stabilize until the withdrawal rates stabilize. Wells that were drilled too shallow to accommodate future water level declines will have to be deepened or replaced at some point in the future if the water level declines continue.

Well to well impacts are predicted to be significant only in wells that are located within close proximity to one another (Baker, 1993). Drawdown predicted from a well pumping 1,550 gpm is approximately 7 feet at a distance of ¼ mile, with drawdown decreasing with distance from the pumping well (Baker, 1993).

To further assess potential impacts, the predictive modeling scenarios completed as part of the Treasure Valley Hydrologic Project were reviewed. One predictive scenario included an overall increase of 20% of the ground water withdrawals across the Treasure Valley. The results for this area indicated a general water level decline ranging from approximately 10 to 20 feet for this particular area (Petrich, 2004). The 20% water right increase modeled in this scenario is similar in magnitude to the increase in water rights associated with the applications and permits associated with this review.

With respect to potential impacts to the Snake River, an increase in pumping would reduce the amount of ground water discharge entering the Snake River to the south. The USGS estimated 280,000 acre-feet of ground water discharge to the Snake River between the King Hill and Murphy (Newton, 1991). This estimate includes ground water discharge from both the north and south sides of the river, that contributes about 4% of the total Snake River flow at Murphy (Newton, 1991). Modeling efforts associated with the TVHP project estimated 290,800 acre-feet of ground water discharge to the Snake River between Swan Falls Dam and the confluence with the Boise River (Petrich, 2004). This estimate includes direct ground water discharge to the river as well as drain return flows. Using the 1996 water budget estimates for the Treasure Valley, the Bureau of Reclamation estimated that the Treasure Valley aquifer system discharged 276,800 acre-feet along the north side of the river between Murphy and Nyssa (BOR, 2008).

3. *Appropriation of ground water for the proposed uses in the public interest?*

The public interest issue is not a technical concern and, consequently, it will not be addressed herein.

Conclusions

The following conclusions are based upon the preceding analysis of currently available information:

1. *Sufficiency of a cold water ground water supply?*

- The current quantity of cold water available is unknown, but the aquifer appears sufficiently productive to complete large scale production wells. The long term sustainability of the cold water supply is also unknown, but based on the declining water

levels across the area; it appears the area is currently in an overdraft and water levels have yet to stabilize to the current demands.

- Only six of the 237 wells reviewed with temperature records indicate low temperature geothermal water was encountered. Elevated temperatures are common across the area, but only a few of the wells exceed the temperature threshold of 85 degrees Fahrenheit.
- The likelihood of encountering low temperature geothermal water increases with depth but also is dependent on the proximity of the well to zones of upwelling associated with faulting. It is assumed that these faults are the primary sources of geothermal water mixing with the cold water aquifer. Based on the existence of the mapped faults to the northwest of the study area, the potential of encountering low temperature geothermal water in the vicinity of the applications along South Cole Road is high.
- As water levels continue to decline across the area, an overall increase in ground water temperatures may occur, as there will be a reduced volume of cold water stored in the aquifer to be mixed with the upwelling geothermal waters.
- Future land use changes (agricultural land converted to residential, the development of additional ground water supplied agricultural acres) could alter the current ground water budget, resulting in additional ground water declines.

2. *Potential injury to existing users and cumulative impact the proposed appropriations may have on current water right users and the ground water resource in this area?*

- Based on analysis of the hydrographs presented in this memo, water levels have declined across the study area for approximately 50 years. The water level trends suggest that the aquifer has not yet stabilized.
- The fact that the water levels are declining suggests that the withdrawal rates of ground water have exceeded the rate of natural recharge.
- Additional withdrawals from the aquifer in this area are expected to result in additional ground water declines. The rate of decline is difficult to predict without a transient numerical groundwater flow model, but it is reasonable to assume that the average rate of decline will equal or exceed the long-term approximate average rate of 0.3 to 0.4 feet per year. Development of a transient version of the Treasure Valley numerical groundwater flow model is underway but it is not scheduled to be available for at least a year. The simulations performed with this updated version of the ground water flow model may be used to assess potential impacts to flow in the Snake River and to evaluate the timing and magnitude of water level declines.
- Based on the relatively high aquifer transmissivity estimates that are derived from specific capacity data submitted on driller's logs, well to well impacts will most likely be minimal. In combination, indications that the aquifer is transmissive and that the rate of withdrawals exceed the rate of recharge make it likely that regional water level declines will continue to be a more significant problem than well to well impacts. If required, the distribution of water level declines that results from pumping (i.e., drawdown) can be calculated on a case by case basis using the semi logarithmic approximation of the Theis (1935) equation. Previous research in this area has predicted drawdown associated with a well pumping 1,550 gpm will result in approximately seven feet of drawdown at a distance of ¼ mile, and less than a foot of drawdown at ¾ mile (Baker, 1993). Wells with

water levels at or near the level of the pump intake will either have to have the pumps lowered or be deepened if the water level declines continue into the future.

3. *Appropriation of ground water for the proposed uses in the public interest?*

- Determination of what is in the public interest is an administrative rather than technical issue. It is my recommendation that administrative personnel make public interest determinations on a case by case basis.

In summary, it appears that this area of the Treasure Valley is experiencing water level declines associated with withdrawal rates exceeding natural recharge. In addition, the fact that elevated ground water temperatures exist in the area limits the potential of developing the deeper cold water aquifer system. Ongoing ground water level monitoring and water temperature monitoring during the development of the 79 ground water permits will help determine whether additional water is available for appropriation. The water level monitoring will indicate whether the rate of water level decline increases or stabilizes and provide a basis for determining impacts associated with additional ground water pumping. The water temperature monitoring will indicate whether the cold water resource in the area is being depleted to a point in which an increase in temperature can be monitored.

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