

Witness List – Transfer NO. 77610 Parkinson Farms

Roger Totten, water master of Water Dist #34

Dr Tom Wood, Clearwater Geosciences, LLP

Ralph Parkinson

Scot Parkinson

RECEIVED
MAY 03 2012
Department of Water Resources
Eastern Region

Exhibit I – Transfer NO. 77610 Parkinson Farms

Water cycle – renewable resource

There seems to be an abundance of water; however it has to be managed. One of the key elements of management is to recharge. Recharging is like a savings account at the bank. You can use it when you need it.

“The estimated average annual water yield of the basin is 470,000 acre-feet (Crosthwaite and others, 1970). In 1970, Crosthwaite and others estimated that an average of 54,000 acre-feet were lost as surface water discharge to the Snake River plain, 308,000 acre-feet were discharged as subsurface flow, and 109,000 acre-feet were lost by evapotranspiration, annually. Mackay Reservoir, on the Big Lost River near Mackay, has a current storage capacity of about 44,000 acre-feet, and is principally used to store snowmelt runoff for irrigation.” (page 8, *Ground-Water Pumping Impacts on Surface Water Irrigation Diversions from Big Lost River*, by Gary Johnson, Dale Ralston, Leland Mink: Submitted to Idaho Department of Water Resources, Boise, Idaho: Idaho water Resources Research Institute University of Idaho, Moscow, Idaho. December, 1991)



Exhibit II – Transfer NO. 77610 Parkinson Farms

(Water Right NO. 34-7176) Why Parkinson Farms deepened the well and filed Application No. 77610.

*Jay Jensen has a well within a couple of miles north from Parkinson Farm's well. He said it was pumping between 240-260 inches of water. It was 160 feet deep, and he deepened it to 240 feet deep. The result was that it pumped a little over 400 inches and has done so ever since.

The Parkinson Farms Well, NO. 34-7176, was pumping approximately 280 inches of water. Because of Jay Jensen's success, Parkinson Farms resolved to do the same.

* Doug Schureman had a situation similar to Parkinson Farms, and was successful in making a comparable transfer to his well. His well is located within a couple of miles south of Parkinson Farm's well. Parkinson Farms resolved to do the same. (See transfer #75394).

Additional Information:

*Shelly Keen from the Department of Water Resources suggested that as part of the transfer process Parkinson Farms should do a pump test to see if there would be any injury to the neighboring wells. Dr. Tom Woods did the test during the summer of 2011.

*Transfer NO. 77610 is now in process, however Parkinson Farms received several protests on this transfer. A pre-hearing conference was held on January 20, 2012. Seth Beal, one of the protesters, withdrew his protest as a result of this pre-hearing conference. Parkinson Farms was pleased by this withdrawal, because Seth Beal has a reputation of being a conscientious and involved member of the community. He is chairman of the advisory board of water district 34, a county commissioner, and has functioned in many other positions of leadership in the community. Parkinson Farms is fortunate for his involvement in this transfer process.



Exhibit III - Transfer NO. 77610 Parkinson Farms

Protest item #1 Injury to our neighbors:

- A. See Dr. Tom Wood's report on his test.
- B. See Roger Totten's test, 2011. (Watermaster District #34) Exhibit VIII.
- C. Ralph & Scot Parkinson's test measurement of cone of depression as follows:

With the pump running and pumping about 585 inches, we then turned it off for approximately 5 minutes and then turned it back on.

Results: It would pump over 600 inches. This indicates a very steep cone of depression.



Exhibit IV - Transfer NO. 77610 Parkinson Farms

Protest Item #2 Enlargement in use:

*The conservative goal of Parkinson Farms is to irrigate the farms with 12 C.F.S. from Well 34-7176 after the transfer has been completed. The Farms also use 2 C.F.S. of storage water, which Parkinson Farms has been able to obtain from neighbors for the past several years.

*Parkinson Farms is licensed for a total of 21.62 C.F.S. to use on the farms. Using 14 C.F.S. is 65% of the total. This is not an enlargement in rate of use.

*Parkinson Farms is licensed for 210 days per year of pumping. The average pumping time for Parkinson Farms is approximately 90 days. This would be 43% of the total. This is not an enlargement in use of days.

*Parkinson Farms is licensed to irrigate a total of 885 acres. The farms will be irrigating approximately 800 acres. This is not an enlargement in number of acres irrigated.

*Parkinson Farms is licensed for a total combined annual diversion volume of 3784 acre feet. Parkinson Farms will be irrigating an average of 2 inches per week for 14 weeks. 28 inches total over the 14 week period. This would be 2.33 acre feet per acre X 800 acres for a total volume of 1864 acre feet. This would be 49% of the total volume licensed. This is far from an enlargement in total volume of acre feet used.



Exhibit V - Transfer NO. 77610 Parkinson Farms

Protest Item #3 Conservation of water resources:

*See Exhibit IV, it also applies to conservation.

*Parkinson Farms is putting the water to beneficial use, as the operation is agricultural and the crops are alfalfa and grain.

*Parkinson Farms uses pivots with drops and low pressure nozzles for all of the irrigation. Pivots are very conservative in use of water as compared to hand or wheel lines. Parkinson Farms is conscientious in trying to conserve water.



Exhibit VI - Transfer NO. 77610 Parkinson Farms

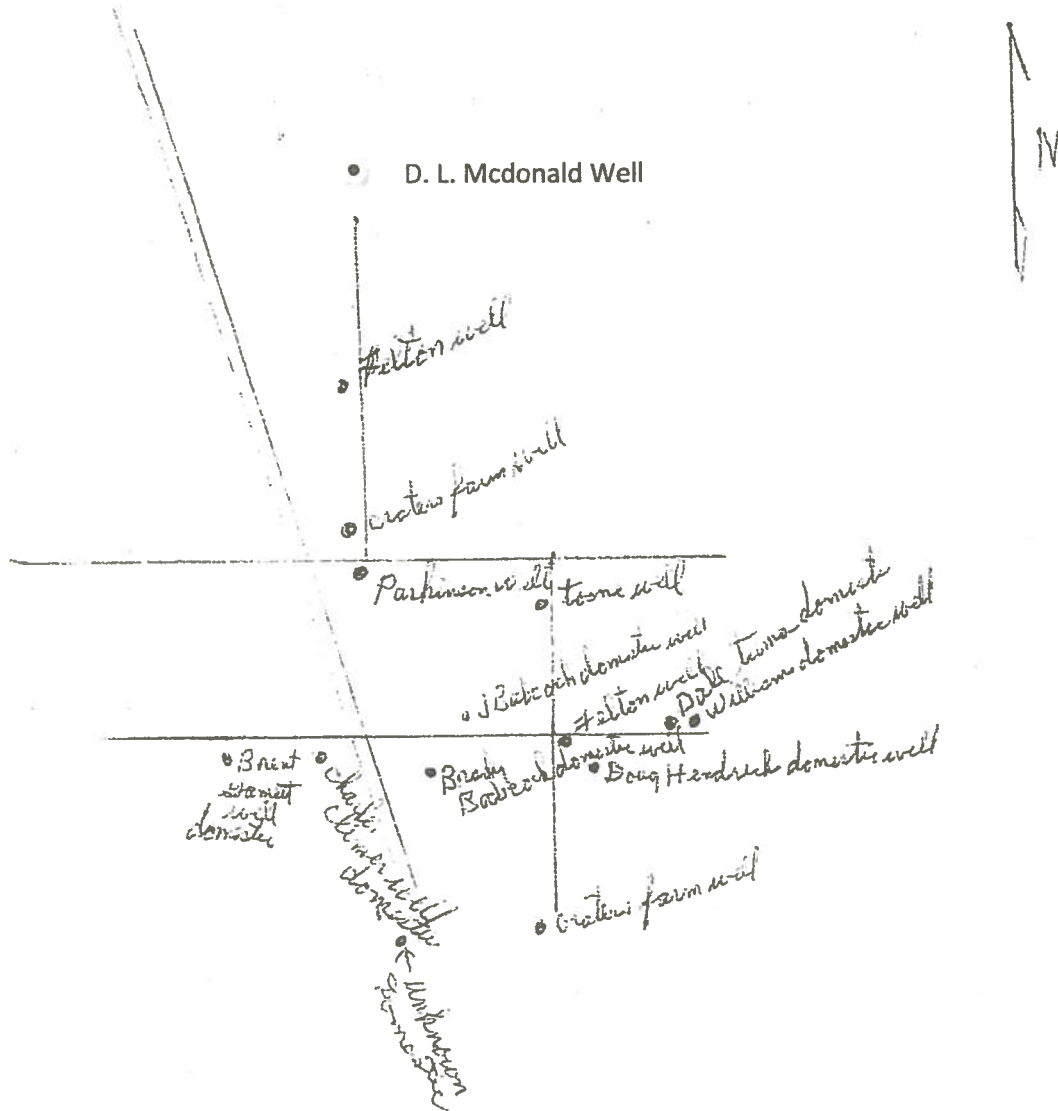
Protest Item #4 Local Public Interest:

*Parkinson Farms is involved in the local economy. Parkinson Farms pay county taxes, water assessments and patronizes many local businesses.



Exhibit VII - Transfer NO. 77610 Parkinson Farms

Wells within ½ mile of the Parkinson well. (NO. 34-7176)



*Parkinson Farms well is 220 feet from Craters Farm Well.

*Also see map on page 9 of Tom Wood's report.



Exhibit VIII Roger Totten's Test (Watermaster Dist. 34)

Parkinson - Island well

Parkinson

Telford

July 30 585"

IV S
472" 472"

Aug 27 577"

472" 470"

Sept 9 575"

470" off

Sept 12 570"

475" off

Sept 15 off

off off

Measured by Roger Totten

Watermaster District #34

2011





Clearwater Geosciences, LLP
Ground Water Development and Exploration

April 29, 2011

Mr. Blake Jordan
Idaho Department of Water Resources
900 North Skyline Drive, Suite A
Idaho Falls, ID 83402-1718

RECEIVED
MAY 03 2012
Department of Water Resources
Eastern Region

RE: FINAL AQUIFER ANALYSIS - PARKINSON WATER RIGHT TRANSFER

Dear Mr. Jordan:

A groundwater impact assessment is provided in this report for the Ralph Parkinson Water Right transfer application near Arco, Idaho. Mr. Parkinson has been working with you on the water right transfer from his property southwest of Arco to this property near Moore. This letter provides an assessment of the impact of adding an additional 200 inches (1796 gpm) to the Moore location (Figure 1). For this impact analysis a pumping test was conducted July 28 to August 1 in the Parkinson well. The parameters from the aquifer test are used in a computer simulation to predict the potential impacts (i.e. drawdown) to neighboring wells within ½ mile of the proposed point of diversion (POD). The results of the computer analysis show that the proposed diversion rate will have a negligible impact on neighboring wells.

Geology

The best summary of the Basin hydrogeology is found in a USGS Report entitled "Water Resources in the Big Lost River Basin, South-Central Idaho" (Crosthwaite, et al., 1970). Much of the general geology presented in this section is taken from this report. References used in this geology section include the following or as cited in the text.

- Crosthwaite, E. G., C. A. Thomas, and K.L. Dyer, 1970, Water Resources in the Big Lost River Basin, South-Central Idaho, Open-File Report 70-93, U.S. Geological Survey.
- Johnson, G. S., D. R. Ralston and L.L. Mink, 1991, "Ground-Water Pumping Impacts on Surface Water Irrigation Diversions from Big Lost River", Idaho Water Resources Research Institute, December, 1991.
- Mundorff, M.J., E. G. Crosthwaite and C. Kilburn, 1964, "Ground Water for Irrigation in the Snake River Basin in Idaho", Geological Survey Water-Supply Paper 1654.
- Skipp, B, L.G. Snider, S.U. Janecke, and M.A. Kuntz, 2009, "Geologic Map of the Arco 30x60 Minute Quadrangle, Idaho, Geologic Map 47, Idaho Geologic Survey.
- Szczepanowski, S.P., 1982, "Review of Ground-Water Conditions in the Big Lost River Valley", Idaho Department of Water Resources

The Big Lost River Valley was produced by Basin and Range faulting, which began about 17 million years ago, long after thrusting and folding of the geologic formations had ceased. Steep faults, dipping more than 60°, bound the surrounding mountains. The valley was formed between the surrounding mountain ranges as a block of the earth's crust was down-dropped forming a half-graben. The major fault in the Big Lost River Valley is a normal fault that runs along the northeast side of the valley (Skipp, et al., 2009). This active fault is called the Lost





River Fault Zone, which last moved in 1983 during the Borah Peak earthquake. It bounds the east side of the Lost River Valley east of Arco, Darlington and Moore.

The mountains are largely composed of Mesoproterozoic Belt Supergroup overlain by Paleozoic strata, mainly carbonates. The rocks were folded and thrust faulted in the Cretaceous Sevier Orogeny. Eocene age Challis volcanic rocks cover portions the older strata in the Lost River Range and valley floor, and are in turn overlain by Oligocene and Miocene tuffs, conglomerates and lake beds.

During the ice ages, glacial and stream deposits filled the valley. Much of the older sediment is comprised of cemented alluvium, which transmits water slowly compared to the younger and shallower valley fill. The floor of the valley is covered with loam and gravelly loam soils. Basalt of the Snake River Group is present in the subsurface near the mouth of the Big Lost River Basin.

The relatively young, unconsolidated alluvial deposits transmit large amounts of water, yielding large flows of water to wells. These unconsolidated alluvial deposits are the best aquifer material in the Big Lost River Basin. The older rocks of the surrounding mountains and cemented alluvium only transmit small quantities of water to wells making them less suitable for irrigation purposes. The unconsolidated alluvial deposits include river alluvium, glacial deposits, and young alluvial fans. The alluvial deposits vary significantly from one location to the next and include clay, silt, sand, gravel and boulders. Well driller's logs show that the alluvial deposits are highly variable in particle size and in degree of sorting. In general, better sorting (more uniform grain size) creates better aquifer permeability. The fan deposits consist of materials ranging in size from clay to boulders. Thus wells drilled on the alluvial fans normally encounter poorly sorted material. The Big Lost River has in places eroded the toes of the fans and reworked the deposits. This resulted in the formation of good aquifers composed largely of well-sorted and stratified sand and gravel. Most wells drilled on the flood plain of the river are finished in these aquifers.

The lithology in the area is of the Parkinson well is a series of unconsolidated gravels and sands with minor layers of clay. There is not a marker layer or geologic unit that can be correlated over distances between wells based on a comparison of the lithology recorded on the well logs. The inability to correlate geologic layers is consistent with the area being situated in a cut and fill sequence of the Big Lost River.

Hydrogeology

As described above, the Big Lost River Valley is a sediment filled graben between two mountain ranges. Clean layers of sand and gravel produce large quantities of water to wells. The surrounding Mountain Ranges have much lower permeability than the valley sediment. The Big Lost River flows through the valley and enters the Eastern Snake River Plain where it flows to its terminus, or is lost via seepage to the Eastern Snake River Plain aquifer. The ground water in the aquifer flows through the valley and discharges to Eastern Snake River Plain aquifer directly (Said, et al., 2003).



Crosthwaite et al., 1970, described the strong relationship between river flow in the Big Lost River and water levels in the aquifer (Figure 27, page 77) and found that groundwater moves rapidly through the sediments, flowing down valley to be discharged to the Snake River Plain Aquifer beneath the mouth of the basin. Seasonal and climatic cycles have a pronounced effect on flow in the river and water levels in the aquifer. Figure 26, page 76, in Crosthwaite et al. 1970, shows tens of feet fluctuation in well water levels over periods as short as 3 years. Wide fluctuations of ground water levels are the norm in the Big Lost River Valley.

Aquifer Properties, Confinement and Boundary Conditions

Crosthwaite, et al., 1970, considered the aquifer to be mostly under unconfined conditions. The authors state that *“ground water occurs mostly under water-table conditions (unconfined) in the main valley but locally artesian conditions exist (confined). Because of the variability of the alluvial deposits, weak artesian pressures may be present in other parts of the basin, but they have not yet been observed.”*

Conceptual Aquifer Model

On the basis of the available data the aquifer near the Parkinson Well is unconfined but may have portions that are locally confined. This is based on the driller's log for the Parkinson Well as is described below and on regional considerations of the hydrogeology. The well depths and other data indicate that aquifer is at least 200 ft thick. The aquifer is long and narrow being constrained by the older, less permeable rocks that form the surrounding mountains. The flow is to the south and discharges to the Snake River Plain Aquifer. Said et al., 2003, estimates that approximately 370 cfs of ground water flows from Big Lost River Valley. This conceptual model is consistent with other studies (Szczepanowski, 1982, Johnson et. al., 1991, Mundorff et al., 1964, Said et al., 1993, and Whitehead, 1992).

Parkinson Well

The Parkinson Well is located in the SW of the SW quarter of Section 34, T5N, R26E. It was originally drilled to 160 ft in 1977 using a cable tool rig to install 20-inch steel casing, which was perforated between 30 and 150 ft. The original well was pump tested at 4200 gpm for 9 hours and had 50 ft of drawdown. In 2010, the well was deepened to increase the water yield using a cable tool rig to advance 16-inch casing through the existing 20-inch casing. The casing was drilled to 249 ft when it was noted that sand came into the well. To seal off the sand, the bottom ten feet of the hole was plugged with rock and cement. The 16 inch casing was perforated from 153 ft to 239 ft. In total, the well has 209 ft of perforations from 30 to 239 ft. The pumping test described in a later section indicates that deepening of the well was successful in increasing the well yield and decreasing the drawdown caused by pumping. The driller's reports for the original well and deepening of the Parkinson well are provided in Attachment 1.

Nearby Water Rights

An evaluation was made for all existing water rights within a ½ mile radius of the proposed well location. Figure 2 shows a circle of ½ mile radius centered on the Parkinson well. The circle encompasses portions of sections 34 and 33, T5N, R26E and sections 3 and 4, T4N, R26E. A search of the IDWR on-line data base indicates that there are numerous groundwater diversion permits in Sections 33, 34, 3 and 4. The water rights within one half mile are provided in Table 2-1 in Attachment 2.



Pumping Test

A pumping test was conducted on the Parkinson Well beginning on July 28, 2011 and ending August 1, 2011. Permission was gained for one observation well $\frac{1}{4}$ mile to the south-southwest of the Parkinson Well (Labeled Observation well in Figure 2). Even though permission was granted for access to the Crater Farms well located 222 ft from the Parkinson Well, physical access could not be obtained due to the well's construction not having a water level access port. Both the Parkinson Well and the Observation well were equipped with INSITU brand downhole pressure transducers to collect automated water levels during the pumping test. Flow was measured using a box weir. The pumping test began at 3:30 PM on July 28, 2011 and the well was pumped at an average rate of 5,117 gpm for four days. Plots of the data can be found in Attachment 3.

Curve matching methods were conducted using the AQTESOLV aquifer test software. Output plots from the AQTESOLV analyses are presented in Attachment 3. Figure 3-4 shows the match of the data to the Theis unconfined solution. The calculated transmissivity is $2.9 \times 10^4 \text{ ft}^2/\text{day}$ and the storage coefficient is 0.37. The match of the data to the Cooper-Jacob solution is shown in Figure 3-6 and the calculated transmissivity is $3.5 \times 10^4 \text{ ft}^2/\text{day}$ with a storativity of 0.12. The calculated storage coefficient using the Theis solution although theoretically possible, is a bit too high. The reason for this is unknown. The storage coefficient for the Cooper-Jacob solution is more realistic. Because the storativity is lower and more realistic the Cooper-Jacob solution is used for the long term pumping evaluation. The transmissivity and storage coefficient are typical for these types of unconsolidated aquifer materials (Freeze and Cherry, 1979).

Impact Assessment

Mr. Parkinson wishes to transfer 200 inches or 1800 gpm of pumping to the flow of this well. For assessing the potential impact to nearby wells it is only necessary to calculate the additional drawdown caused by pumping an additional 1800 gpm and not the entire volume pumped by Mr. Parkinson, which includes previously approved water rights. This is a standard approach that is appropriate because of the linear relationship between pumping and drawdown (Freeze and Cherry, 1979).

To estimate the long-term drawdown and impact to neighboring wells from pumping of the proposed increase, the forward solution capabilities of the AQTESOLV program were employed. The input parameters to the model are listed in Table 4-1 (see Attachment 4). Boundaries in AQTESOLV were enabled as shown in Figure 4-1 to represent Big Lost River Valley. As depicted in Figure 4-1 and listed in Table 4-2 the model is 15,250 ft wide and 38,000 ft long. Because the Big Lost River Valley is bounded by mountains consisting of Paleozoic and Mesozoic sedimentary rock that do not provide as much water compared to the unconsolidated valley fill, the east and west boundaries are set as impermeable or "no flow" boundaries. Because it is known from regional ground water mapping that the direction of ground water flow is down the axis of the valley (Crosthwaite, et al., 1970) it is assumed that pumping of the Parkinson Well would not be able to pull water upgradient from the south beyond the model domain. The southern boundary is specified as a no-flow boundary. Water is allowed to enter the model domain only through the north boundary. These boundary conditions are



conservative, that is, it is expected that pumping will cause less drawdown than predicted using these boundary conditions.

Figure 4-2 shows the AQTESOLV[®] output plot of the forward calculation for the Parkinson well pumping at 1800 gpm constantly for 6 months (April 15 to Oct 15). At the end of the time period the predicted drawdown is estimated to be about 14 feet in the Parkinson well. The calculated drawdown for a well ¼ mile to the north (Fenton Well) is about 4 ft. The calculated drawdown for a well ¼ mile to the east and a little south (Toone Well) is 4 ft. This calculation over predicts the amount of drawdown to be expected in the nearby wells because 1) Parkinson will never pump his well 24/7 for 6 months, 2) no water is allowed to enter the model as inflow of water from the mountain fronts to the east and west and 3) no water is allowed to enter the top of the model from river and canal leakage. This model can be thought of as a drought case, that is, the amount of recharge entering the domain is at a minimum similar to a drought. Only valley underflow from the north end of the domain recharges the model.

River-Aquifer Interactions

The Big Lost River runs to the west of the Parkinson well and there is some concern that additional drawdown in the aquifer might reduce aquifer recharge to the river or cause more seepage to occur from the river to the aquifer. An examination of water levels measured during the pumping test indicates that either possibility is unlikely given the unsaturated zone separating the bottom of the river channel from the top of the aquifer. When the Parkinson Well was drilled in May of 1977 the static water level was reported as 20 ft below land. During May, June and July of 2011 the depth to water in the Parkinson Well was 32 ft below land surface. The depth to water in the observation well was measured as 25 ft below land surface. In both locations, tens of feet separate the top of the aquifer from land surface (i.e. the bottom of the river channel). This means that in this reach of the river, water from the aquifer is not flowing into the river. It is not possible for the Parkinson Well to impact or decrease flow in the river due to the separation between the bottom of the river channel and the top of water table aquifer.

The winter and spring of 2011 has been one of the wettest in recent memory and the Big Lost River was observed to be flowing. There is no doubt that in many reaches of the river and probably in the reach near the Parkinson Well that river water leaks through the gravelly river bottom to the underlying aquifer. However, additional pumping by Parkinson under this water right will not cause an increase in the leakage through the river bed. It should be noted that most of the time water does not flow in this reach of the Big Lost River. When there is no flow in the river there can be no interaction between the river and the aquifer. It is clear that additional pumping of the Parkinson Well will have no impact on flow of the Big Lost River.

Drought Considerations

As described earlier, water levels in the aquifer can be greatly affected by fluctuations in flow in the Big Lost River and precipitation. To estimate the reasonable range in natural aquifer fluctuations that might occur in this area a search was made of the USGS on-line water level data base (<http://nwis.waterdata.usgs.gov/nwis/gwlevels>) for wells nearby or in the same general location within the Big Lost River Valley as the Parkinson Well, which is near the center and near the channel of the Big Lost River. Unfortunately, the USGS data base has very few wells that have more than one measurement in this area. The exception is a well in Moore that was



measured regularly from 1985 to 1987. The water levels from this well are plotted with the flow of water in the Big Lost River in Figure 3. As can be seen in the Figure 3 the period of 1985 to 1987 followed one of the wettest periods on record, the early to mid 1980's. Water levels in the Moore Well peaked at a depth of 6 ft below surface and then dropped rapidly to about 19 ft at the end of the record. Because there is not a full record of depth to water measurements for a well in this area the data in Figure 3 are doubled to estimate drought conditions. Other wells near the margins of the valley can be found that have more declines during droughts, but pumping tests in these areas indicate that the aquifer is confined near the margins and therefore more sensitive to droughts. The confined conditions at the margins of the valley are thought to be caused by alluvial fans and over bank deposits that created laterally extensive clay layers, which reduce the aquifer storativity (Bassick and Jones, 1993).

In order to evaluate the drawdown to neighboring wells under drought conditions, a second simulation was performed using a value of transmissivity reduced in proportion to the thinning of the aquifer by drought. In this case drought conditions are considered to lower the water table by 40 feet, reducing the thickness of the aquifer to 160 ft from 200 ft. This reduces the transmissivity by 20% to $2.8 \times 10^4 \text{ ft}^2/\text{day}$. The storativity remains the same, 0.12, because it is independent of aquifer thickness. Figure 4-3 is an AQTESOLV plot using the reduced transmissivity. As can be seen the drought conditions increase drawdown in the Parkinson well by 3 ft from 14 ft to 17 ft. However, drawdown in the neighboring wells does not change much from normal to drought conditions, the drawdown goes from just under 4 ft to just over 4 ft.

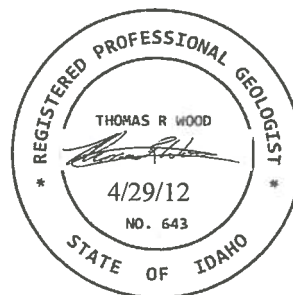
Conclusions

The data and analyses considered for this water right transfer included regional studies of the geology and the hydrogeology, a pumping test, pumping test data analysis, predictive modeling of pumping impacts to neighboring wells, historical water levels and a predictive analysis considering the impacts from drought. It is my professional opinion that Mr. Parkinson's water right transfer application will not excessively impact his neighbors' right to divert water, nor will it impact flow in the Big Lost River. For several reasons I believe that the drawdown predicted by the modeling presented in this report over estimates the actual drawdown to be expected. These reasons for over predicting drawdown include: 1) Mr. Parkinson will never pump continuously at the maximum rate for 180 days; 2) the Paleozoic/Mesozoic rocks of the mountains are not totally impermeable and will provide some water to the system, thus reducing drawdown, and 3) several canals and the Big Lost River are within the domain of the model and no credit for leakage from these surface water bodies is taken in the model. All of these factors will reduce the predicted drawdown presented here.

Please do not hesitate to call me if you have any questions about this letter or the calculations presented.

Respectfully,

Thomas R. Wood, PhD, PG





cc

Mr. Ralph Parkinson, 2253 North 3100 West, Arco, ID 83213

References

- Bassick, M.D. and M.J. Jones, 1992, Aquifer-Test Results, Direction of Ground-Water Flow, and 1984-90 Annual Ground-Water Pumpage for Irrigation, Lower Big Lost River Valley, Idaho, Water Resources Investigation Report 92-4006.
- Crosthwaite, E. G., C. A. Thomas, and K.L. Dyer, 1970, Water Resources in the Big Lost River Basin, South-Central Idaho, Open-File Report 70-93, U.S. Geological Survey.
- Freeze, R.A. and J.A. Cherry, 1979, Groundwater, ISBN 0-13-365312-9, Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632.
- Johnson, G. S., D. R. Ralston and L.L. Mink, 1991, "Ground-Water Pumping Impacts on Surface Water Irrigation Diversions from Big Lost River", Idaho Water Resources Research Institute, December, 1991.
- Mundorff, M.J., E. G. Crosthwaite and C. Kilburn, 1964, "Ground Water for Irrigation in the Snake River Basin in Idaho", Geological Survey Water-Supply Paper 1654.
- Skipp, B, L.G. Snider, S.U. Janecke, and M.A. Kuntz, 2009, "Geologic Map of the Arco 30x60 Minute Quadrangle, Idaho, Geologic Map 47, Idaho Geologic Survey.
- Szczepanowski, S.P., 1982, "Review of Ground-Water Conditions in the Big Lost River Valley", Idaho Department of Water Resources

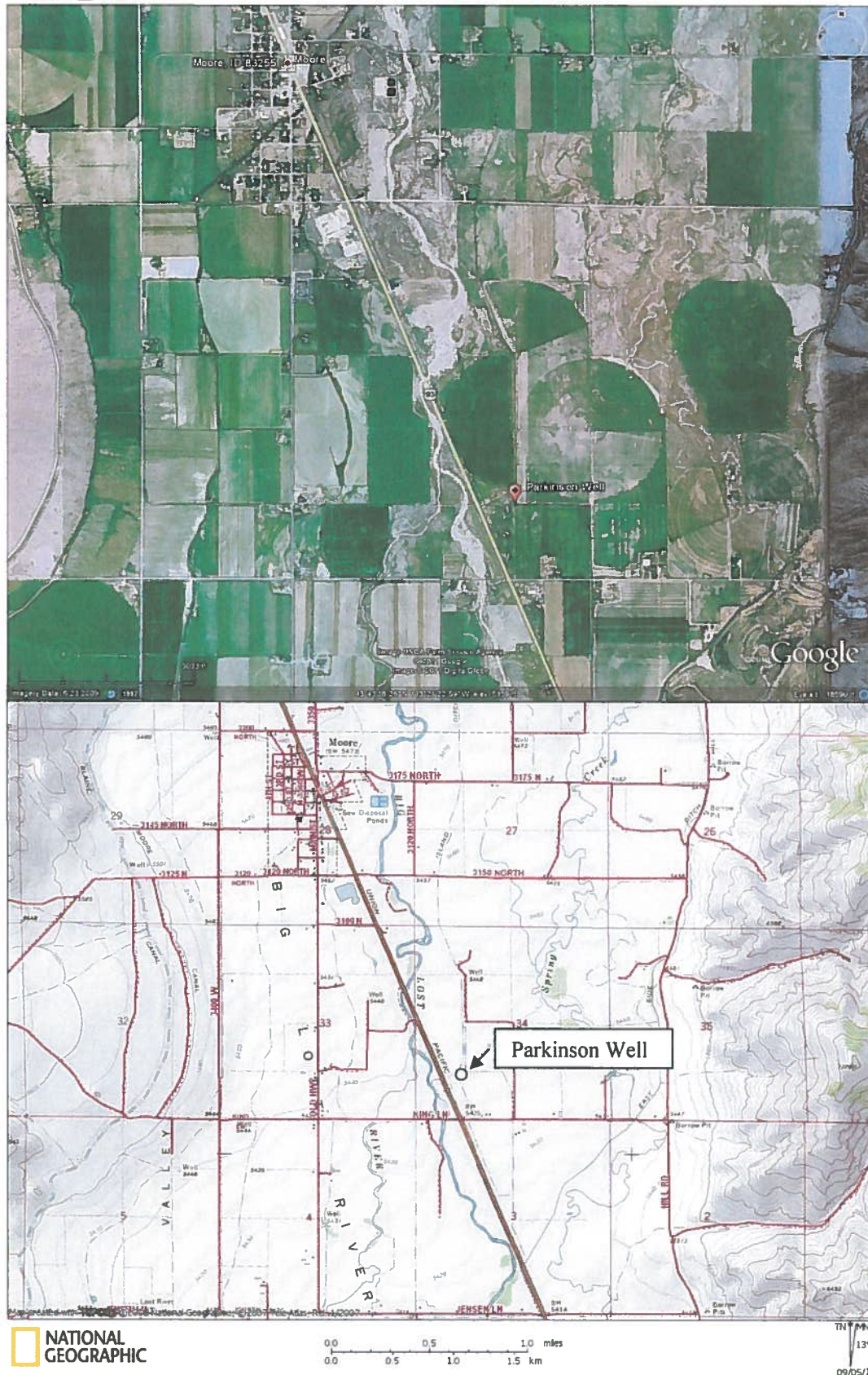


Figure 1 Google Earth image (upper) and topographic map (lower) of the Parkinson location.

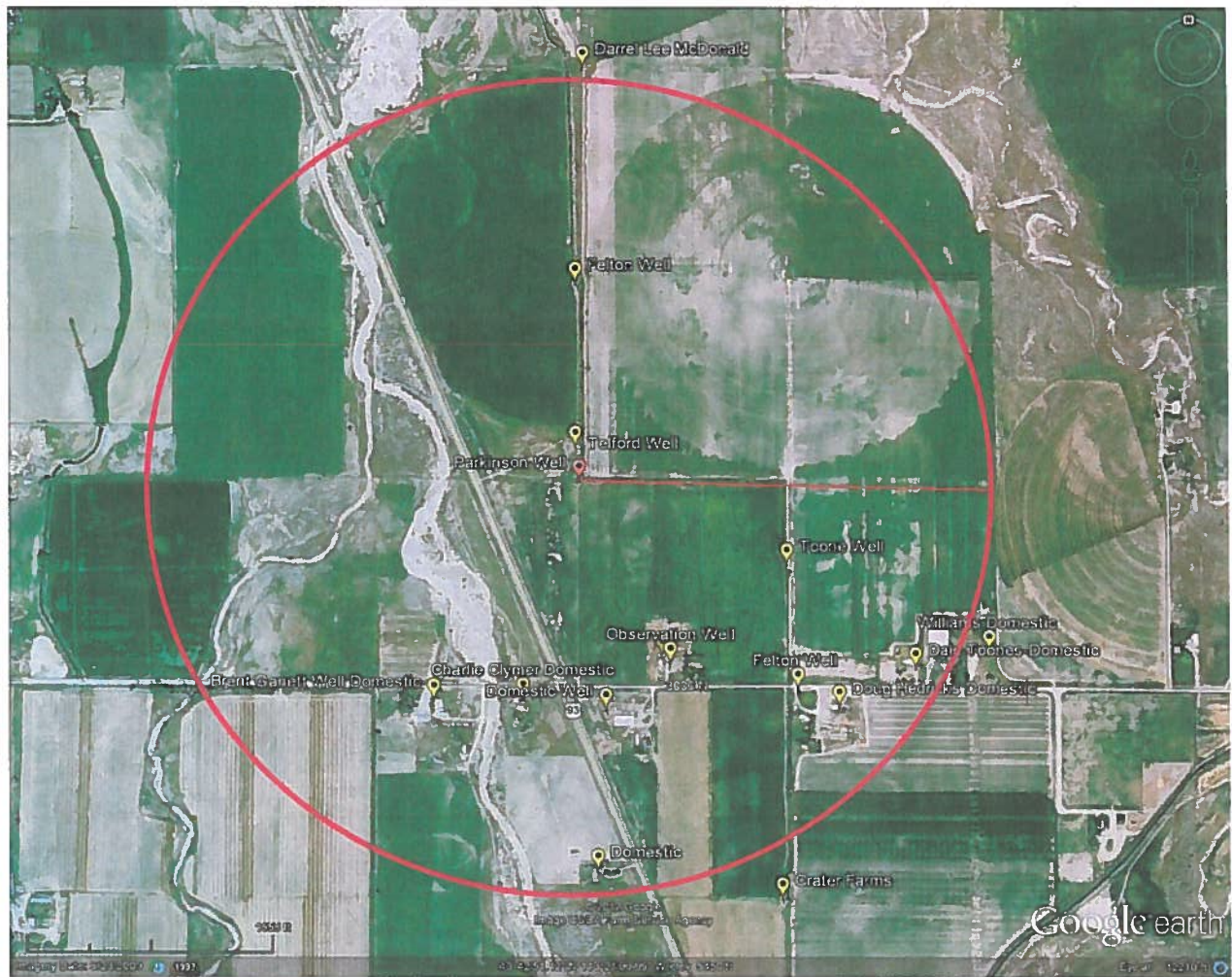


Figure 2 Google Earth image of area with a red circle of $\frac{1}{2}$ mile radius. Well locations are approximate, based on well driller's logs and other information.

**Flow in Big Lost River Near Arco (1960 to 2011)
Compared to Depth to Water in Well 05n26e-28dca2 (1985 to 1987)**

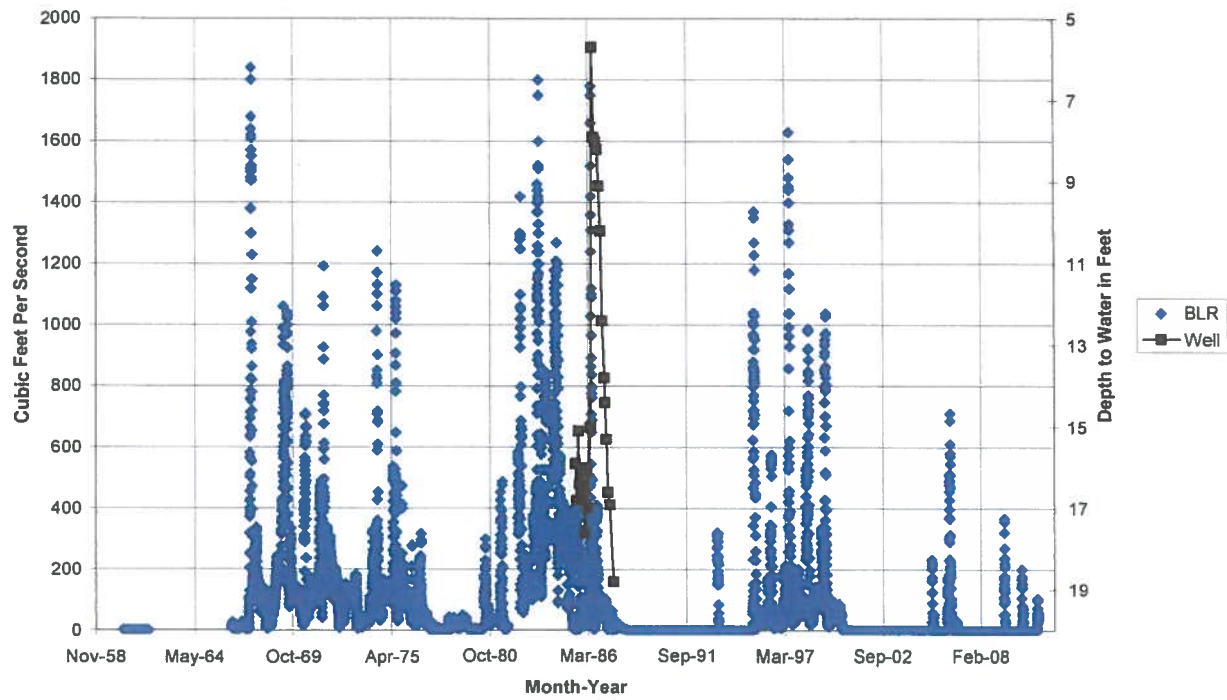


Figure 3 Flow of water in the Big Lost River (left hand axis) compared to water levels in a Well in Moore (right hand axis).



Attachment 1

WELL LOGS



Clearwater Geosciences, LLP
Ground Water Development and Exploration

USE TYPEWRITER OR
BALL POINT PEN

State of Idaho
Department of Water Resources

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

RECEIVED
SEP 27 1977

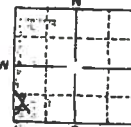
1. WELL OWNER Name <u>RALPH S. PARKINSON</u> <u>JAMES S. BARCOCK</u> Address <u>ARCO IDAHO 83213</u> Owner's Permit No. <u>34-7176</u>		7. WATER LEVEL Department of Water Resources Eastern District Office Static water level <u>20</u> feet below land surface Flowing? ☐ Yes ☒ No G.P.M. flow Temperature <u>90.0</u> ° F. Quality <u>good</u> Artesian closed-in pressure <u> </u> p.s.i. Controlled by ☐ Valve ☐ Cap ☐ Plug																																																											
2. NATURE OF WORK ☒ New well ☐ Deepened ☐ Replacement ☐ Abandoned (describe method of abandoning)		8. WELL TEST DATA ☒ Pump ☐ Baller ☐ Other Discharge G.P.M. <u>4200</u> Draw Down <u>50'</u> Hours Pumped <u>9</u>																																																											
3. PROPOSED USE ☐ Domestic ☒ Irrigation ☐ Test ☐ Other (specify type) ☐ Municipal ☐ Industrial ☐ Stock ☐ Waste Disposal or Injection		9. LITHOLOGIC LOG <u>042745</u> <table border="1"><thead><tr><th rowspan="2">Hole Diam.</th><th colspan="2">Depth</th><th rowspan="2">Material</th><th colspan="2">Water</th></tr><tr><th>From</th><th>To</th><th>Yes</th><th>No</th></tr></thead><tbody><tr><td>20"</td><td>0</td><td>5</td><td>SPIL</td><td></td><td></td></tr><tr><td></td><td>5</td><td>15</td><td>GRAVEL</td><td></td><td></td></tr><tr><td></td><td>15</td><td>26</td><td>CLAY + GRAVEL</td><td></td><td></td></tr><tr><td></td><td>26</td><td>70</td><td>SAND + GRAVEL</td><td></td><td></td></tr><tr><td></td><td>70</td><td>77</td><td>CLAY</td><td></td><td></td></tr><tr><td></td><td>77</td><td>110</td><td>SAND + GRAVEL</td><td></td><td></td></tr><tr><td></td><td>110</td><td>118</td><td>SANDY CLAY</td><td></td><td></td></tr><tr><td></td><td>118</td><td>160</td><td>SAND + GRAVEL</td><td></td><td></td></tr></tbody></table>		Hole Diam.	Depth		Material	Water		From	To	Yes	No	20"	0	5	SPIL				5	15	GRAVEL				15	26	CLAY + GRAVEL				26	70	SAND + GRAVEL				70	77	CLAY				77	110	SAND + GRAVEL				110	118	SANDY CLAY				118	160	SAND + GRAVEL		
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20"	0	5	SPIL																																																										
	5	15	GRAVEL																																																										
	15	26	CLAY + GRAVEL																																																										
	26	70	SAND + GRAVEL																																																										
	70	77	CLAY																																																										
	77	110	SAND + GRAVEL																																																										
	110	118	SANDY CLAY																																																										
	118	160	SAND + GRAVEL																																																										
4. METHOD DRILLED ☒ Cable ☐ Rotary ☐ Dug ☐ Other																																																													
5. WELL CONSTRUCTION Diameter of hole <u>20</u> inches Total depth <u>160</u> feet Casing schedule: ☒ Steel ☐ Concrete Thickness <u>2.50</u> inches Diameter <u>20</u> inches From <u>1</u> feet To <u>160</u> feet Was casing drive shoe used? ☒ Yes ☐ No Was a packer or seal used? ☐ Yes ☒ No Perforated? ☒ Yes ☐ No How perforated? ☒ Factory ☐ Knife ☒ Torch Size of perforation <u>1/8</u> inches by <u>9</u> inches Number <u>1836</u> From <u>4</u> feet To <u>150</u> feet <u>3500</u> perforations <u>30</u> feet <u>120</u> feet <u>720</u> perforations <u>30</u> feet <u>120</u> feet Well screen installed? ☐ Yes ☒ No Manufacturer's name <u> </u> Type <u> </u> Model No. <u> </u> Diameter <u> </u> Slot size <u> </u> Set from <u> </u> feet to <u> </u> feet Diameter <u> </u> Slot size <u> </u> Set from <u> </u> feet to <u> </u> feet Gravel packed? ☐ Yes ☒ No Size of gravel <u> </u> Placed from <u> </u> feet to <u> </u> feet Surface seal depth <u>20</u> Material used in seal ☐ Cement grout ☐ Pudding clay ☒ Well cuttings Sealing procedure used ☐ Shurry pit ☐ Temporary surface casing ☐ Overbore to seal depth																																																													
6. LOCATION OF WELL Sketch map location must agree with written location.  Subdivision Name <u> </u> Lot No. <u> </u> Block No. <u> </u> County <u>BUTTE</u> <u>SW 1/4 SW 1/4 Sec. 34 T. 5 N. R. 26 E. 1/4</u>		10. Work started <u>May 9/77</u> finished <u>May 27/77</u>																																																											
		11. DRILLERS CERTIFICATION Firm Name <u>Laithrie Well Drilling</u> Firm No. <u>226</u> Address <u>PO Box 319</u> Date <u>9/24/77</u> Signed by (Firm Official) <u>J. T. Laithrie</u> and <u>J. T. Laithrie</u> (Operator) <u>3664</u>																																																											

Figure 1-1 Well log for the original Parkinson Well.



JAN 20 2010

WELL DRILLER'S REPORT

Use Typewriter or Ballpoint pen

Office Use Only
Inspected by: _____
Twp _____ Rge _____ Sec _____
_____ 1/4 _____ 1/4 _____ 1/4
Lat: : : Long: : :

Other IDWR NO. D0056967

City: Arco State: ID Zip 83213

Twp 5 ☒ North ☐ South
Rge 28 ☒ East ☐ West
Sec 34 1/4 SW 1/4 SW 1/4
10 Acres 40 Acres 160 Acres
Gov't Lot _____ County Butte
Lat: 43 42.862 Lon: 113 21.086

City: Arco

(Give at least name of Road + Distance to Road or Landmark)

Lot No.	Blk No.	Subd. Name:
---------	---------	-------------

☐ Domestic Thermal ☐ Municipal Infection ☐ Monitor Other ☒ Irrigation

☐ New Well ☒ Modify ☐ Abandonment ☐ Other Deepen

☐ Air Rotary ☒ Cable ☐ Mud Rotary ☐ Other _____

SEAL/FILTER PACK		AMOUNT		Method Annular
	From	To		
Deepen				

Was drive shoe used?	☒ Yes	☐ No	Shoe Depth(s)	-249
----------------------	---	-----------------------------	---------------	------

Was drive shoe seal tested? ☒ Yes ☐ No

Dia.	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
16"	-153	-249	0.25	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of headpipe: _____ Length of Tailpipe: _____

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
-160	-244	3/16"	2400		Steel	☒	☐
						☐	☐
						☐	☐

46	ft below ground	Artesian Pressure:	lb
----	-----------------	--------------------	----

Describe access port or control devices: Well Cap

☐ Pump ☐ Baller ☒ Air ☐ Flowing Artesian

Yield	Drawdown	Pumping Level	Time

Water Temp	Cold	Bottom hole temp
------------	------	------------------

Water Quality test or comments:

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Y	N
20	0	159	Existing 20" casing		
16	159	169	Sand & Gravel	X	
16	169	178	Clay		X
16	178	227	Gravel	X	
16	227	232	Sand & Small Gravel	X	
16	232	242	Gravel	X	
16	242	246	Clay & Gravel	X	
16	246	249	Gravel & Sand	X	
			Cut 16" casing off at -153'		
			-153 to -160 .250 blank		
			-160 to -244 .375 Perf		
			-244 to -249 .25 blank		
			Plugged bottom of hole with rock and		
			cement from -239 to -249.		

Completed Depth: 239 ft

Date Started: 11/01/09

Date Completed: 12/24/09

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm: Independent Drilling BF Firm No. 343

Firm Official: [Signature] Date: 1/14/2010

Supervisor/Operator: _____ Date: 1/14/2010

Figure 1-2 Parkinson Well log for modification by Independent Drilling in 2010.



Attachment 2

WATER RIGHTS



Clearwater Geosciences, LLP
Ground Water Development and Exploration

Table 2-1 Water right point of diversions in within ½ mile of Parkinson Well.

Record	Basin	Sequence	Suffix	Version	Basis	Status	Priority Date	Diversion Rate	Source List	Water Uses	Owner List
5N 26E S34 SE											
1	34	2422			Decreed	Active	6/9/1961	2.4	GROUND WATER	IRRIGATION	SOWARDS, NORMAN K (Current); SOWARDS, W T (Current)
2	34	10050			Decreed	Active	1892-01-01	0.07	GROUND WATER	DOMESTIC, STOCKWATER	RATHBUN, MILDRED (Current); RATHBUN, WAYNE (Current)
3	34	10051			Decreed	Active	2/15/1980	0.06	GROUND WATER	DOMESTIC, STOCKWATER	RATHBUN, MILDRED (Current); RATHBUN, WAYNE (Current)
4	34	10869			Decreed	Active	3/1/1989	0.04	GROUND WATER	DOMESTIC, STOCKWATER	SOWARDS, NORMAN K (Current)
5	34	10871			Decreed	Active	6/15/1980	0.2	GROUND WATER	IRRIGATION	SOWARDS, NORMAN K (Current)
6	34	12045			Decreed	Active	12/31/1930	0.04	GROUND WATER	DOMESTIC	MAYNARD, CHERI (Current)
7	34	12047			Decreed	Active	9/16/1989	0.04	GROUND WATER	DOMESTIC	HAYS, MARY M (Current)
5N 26E S24 SW											
1	34	2480	A		Decreed	Active	5/1/1986	0.79	GROUND WATER	IRRIGATION	MC DONALD, DARRELL E (Current); MC DONALD, NANCY M (Current)
2	34	7028	A		Decreed	Active	8/1/1972	4.3	GROUND WATER	IRRIGATION	MC DONALD, DARRELL E (Current); MC DONALD, NANCY M (Current)
3	34	7037			Decreed	Active	5/4/1973	12	GROUND WATER	IRRIGATION	TELFORD LANDS LLC (Current)
4	34	7176			Decreed	Active	5/29/1977	7.8	GROUND WATER	IRRIGATION	PARKINSON FARMS (Current)
5	34	7234			Decreed	Active	8/15/1979	1.66	GROUND WATER	IRRIGATION	MC DONALD, DARRELL E (Current); MC DONALD, NANCY M (Current)
6	34	10345			Decreed	Active	1885-06-01	0.04	GROUND WATER	DOMESTIC, STOCKWATER	BABCOCK, COLLEEN (Current); BABCOCK, JAMES S (Current)
7	34	12368			Decreed	Active	8/1/1985	3.75	GROUND WATER	IRRIGATION	PARKINSON FARMS (Current)
5N 26E S34 SE NW											
1	34	2302			Decreed	Active	2/28/1953	3.14	GROUND WATER	IRRIGATION	SOWARDS, NORMAN K (Current)
2	34	7228			Decreed	Active	5/3/1979	0.98	GROUND WATER	IRRIGATION	SOWARDS, NORMAN K (Current)
5N 26E S34 SW NW											
1	34	2284	B		Decreed	Active	8/14/1957	1.5	GROUND WATER	IRRIGATION	FELTON FARMS LLC (Current)
5N 26E S34 SW SE											
1	34	10050			Decreed	Active	1892-01-01	0.07	GROUND WATER	DOMESTIC, STOCKWATER	RATHBUN, MILDRED (Current); RATHBUN, WAYNE (Current)
2	34	10051			Decreed	Active	2/15/1980	0.06	GROUND WATER	DOMESTIC, STOCKWATER	RATHBUN, MILDRED (Current); RATHBUN, WAYNE (Current)
5N 26E S34 NW SE											
None											
5N 26E S33 SE SE											
None											
5N 26E S33 NE SE											
None											
4N 26E S3 NW NW											
1	34	10444			Decreed	Active	5/15/1989	0.04	GROUND WATER	DOMESTIC	CLIMER, CAROL I (Current); CLIMER, CHARLES R (Current)
2	34	10846			Decreed	Active	1884-12-31	0.04	GROUND WATER	DOMESTIC	BAIRD, STELLA H (Current); BAIRD, WILLIAM L (Current)
3	34	10850			Decreed	Active	8/31/1987	0.04	GROUND WATER	DOMESTIC	HARVEY, JACK D (Current); HARVEY, NANCY L (Current)
4N 26E S3 NE NW											
None											
4N 26E S4 NE NE											
None											



Attachment 3

Pumping Test Data



Table 3-1 Flow data for Parkinson Well during pumping test.

Date	Time	Q, gpm	min	Q, gpm
28-Jul	3:28 PM	5400	0	5400
	3:29 PM	5518	1	5518
	3:30 PM	5400	2	5400
	3:31 PM	5350	3	5350
	3:32 PM	5400	4	5400
	3:33 PM	5400	5	5400
	3:34 PM	5450	6	5450
	3:35 PM	5425	7	5425
	3:37 PM	5400	9	5400
	3:40 PM	5350	12	5350
	3:43 PM	5350	15	5350
	3:49 PM	5340	21	5340
	3:56 PM	5390	28	5390
	4:07 PM	5328	39	5328
	7:15 PM	5270	227	5270
	11:20 PM	5240	472	5240
29-Jul	3:25 AM	5210	717	5210
	7:20 AM	5220	952	5220
	11:20 AM	5155	1192	5155
	3:30 PM	5105	1442	5105
	7:10 PM	5125	1662	5125
	11:00 PM	5135	1892	5135
30-Jul	3:00 AM	5130	2132	5130
	7:00 AM	5130	2372	5130
	11:30 AM	5080	2642	5080
	3:10 PM	5060	2862	5060
	7:00 PM	5080	3092	5080
1-Aug	12:05 PM	5045	5557	5045

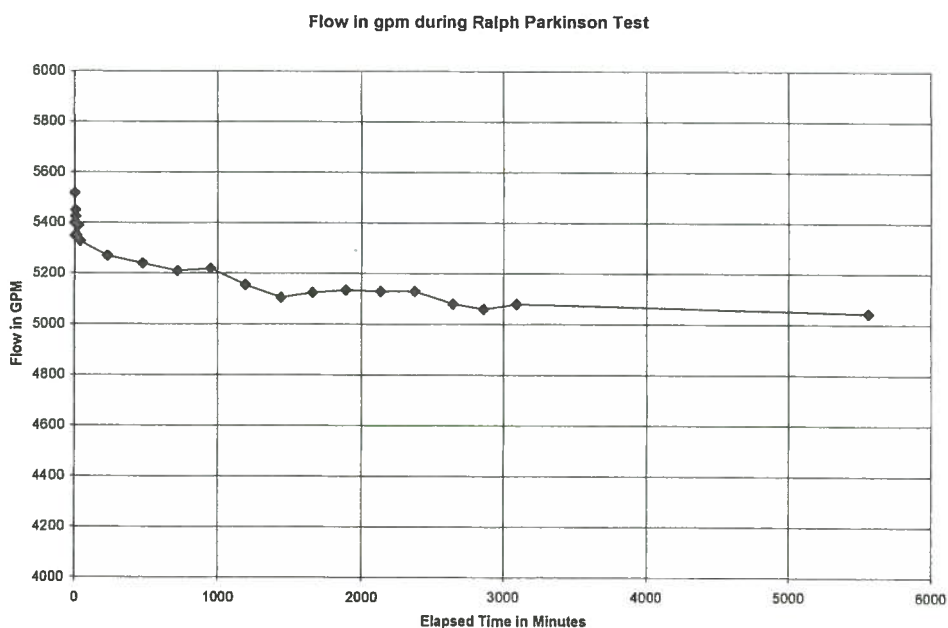


Figure 3-1 Plot of flow data.

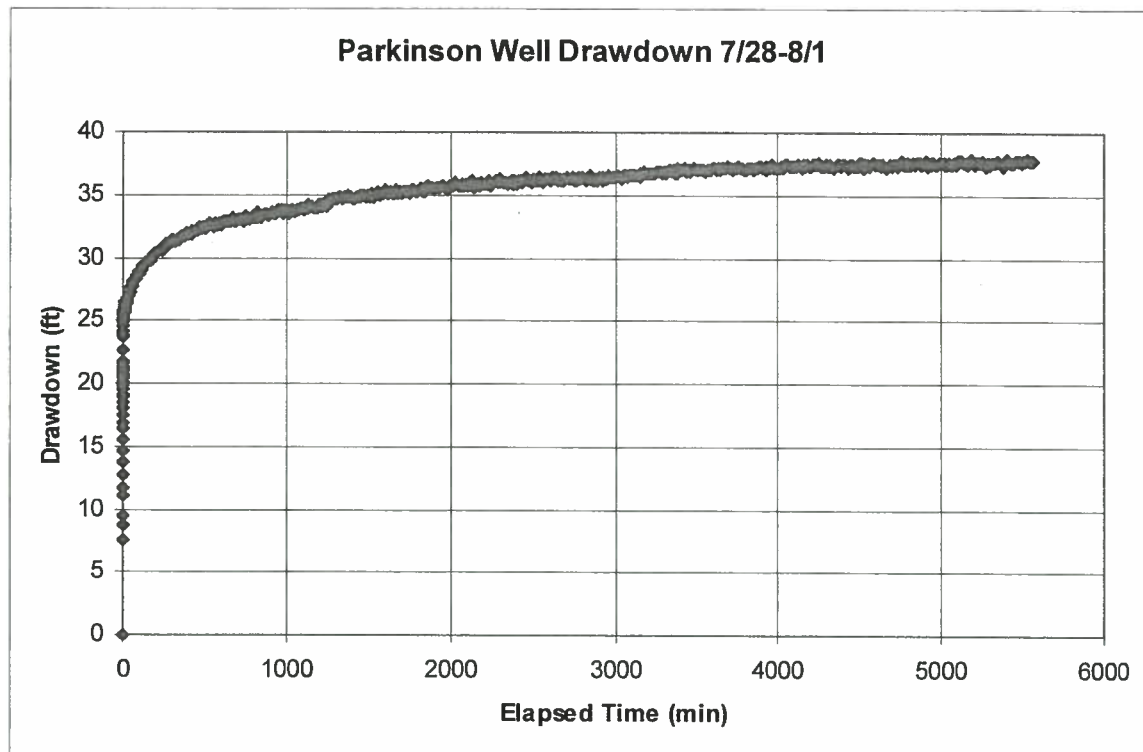


Figure 3-2. Plot of entire data set for pumping test of the Ralph Parkinson Irrigation well.

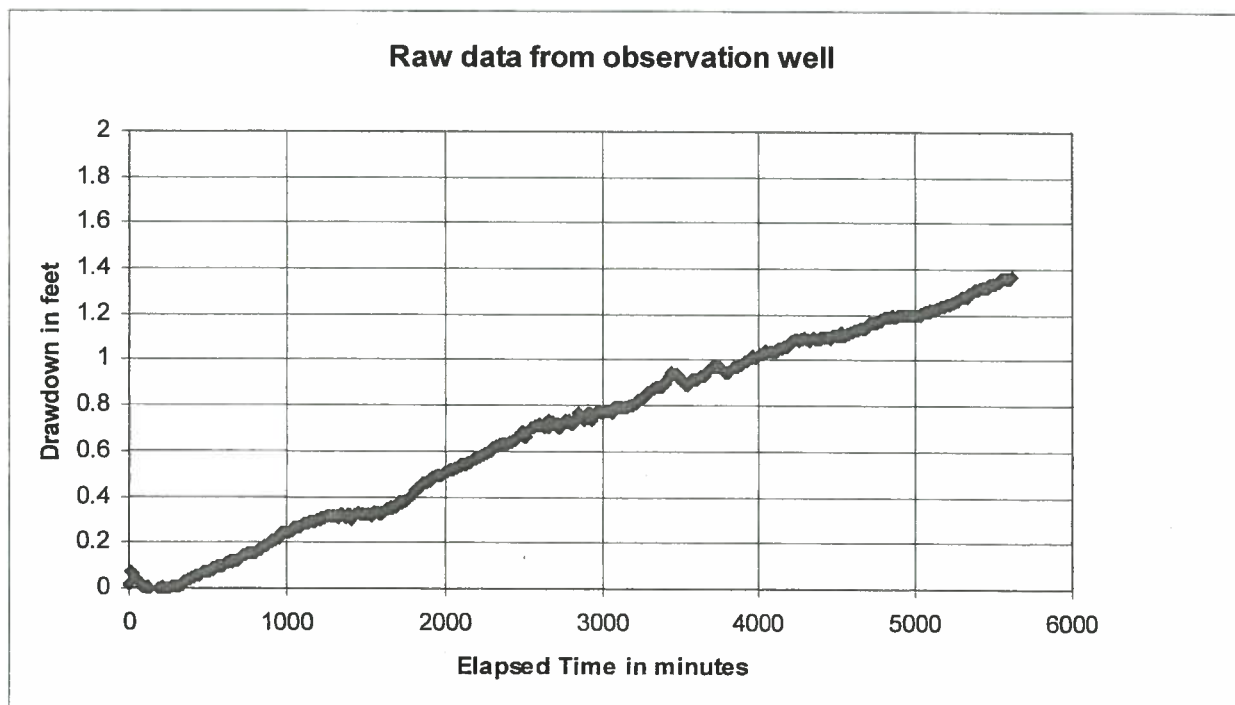


Figure 3-3. Plot of data from observation well.

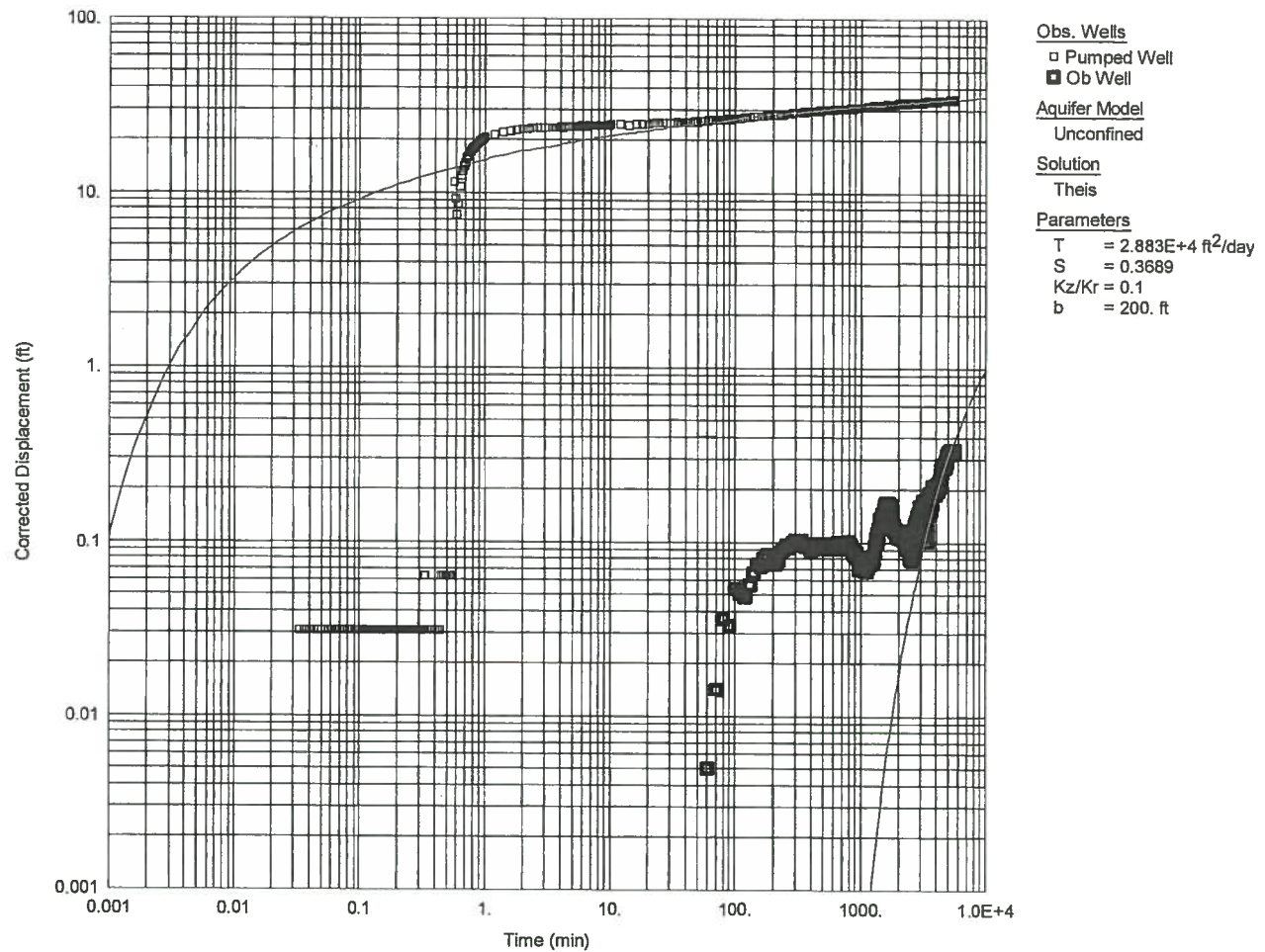


Figure 3-4 Theis unconfined solution matched to well data.

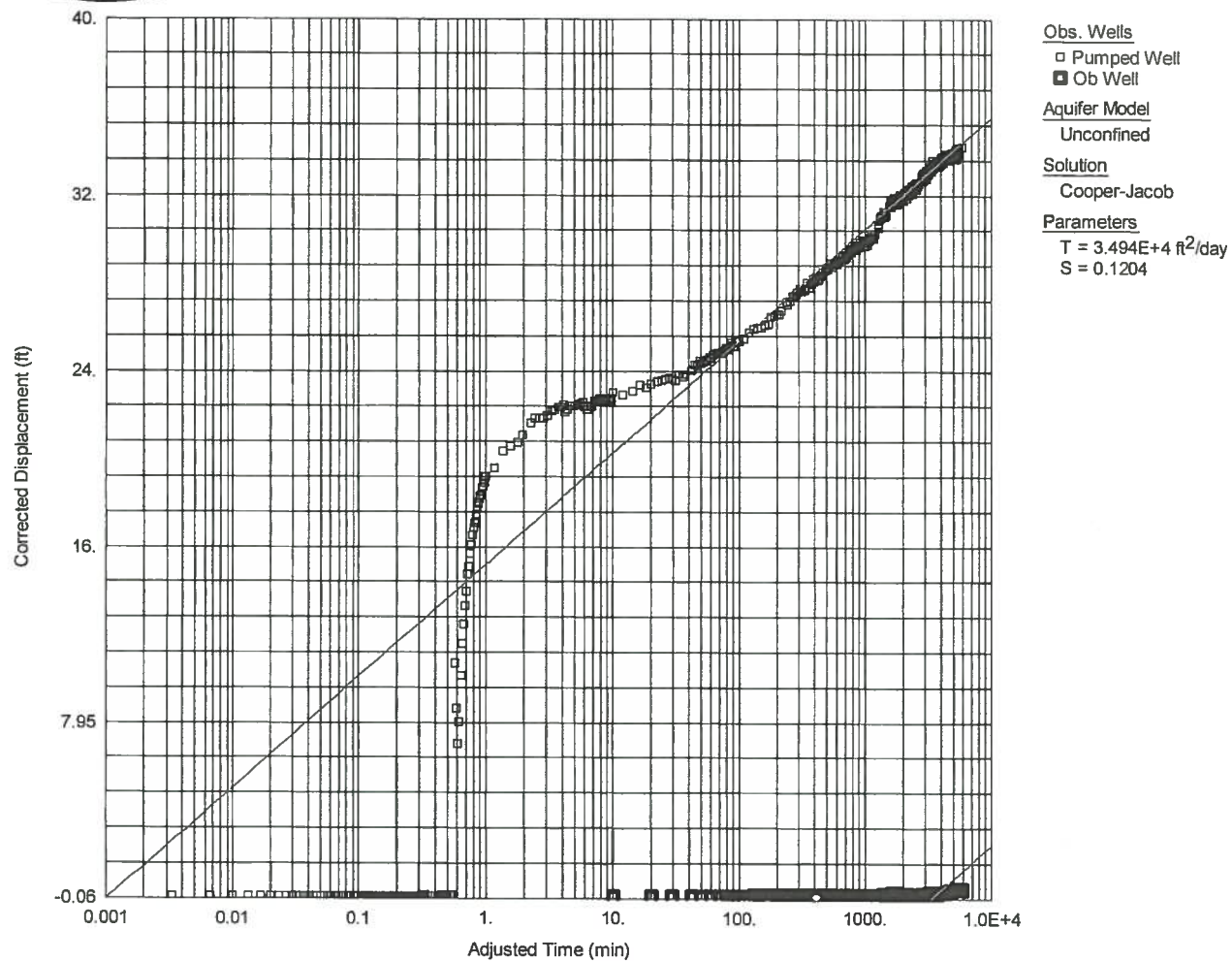


Figure 3-5 Cooper-Jacob unconfined solution matched to well data.



Attachment 4

AQUIFER IMPACT ANALYSIS



Table 4-1 Table of values used in AQTESOLV simulation.

Parameter	Value	Unit
Tranmissivity	35,000	ft ² /d
Storativity	0.12	unitless
Flow Rate	900	gpm
Duration	259,200	min
Total volume	716	ac-ft
aquifer thickness (b)	200	ft
kz/Kr	0.1	na

Table 4-2 Table of locations for various boundary corners and wells used in the AQESOLV simulation.

Location	x	y
NW Corner	0	38000
NE Corner	15250	38000
SW Corner	0	0
SE Corner	15250	0
Parkinson POD	9500	21600

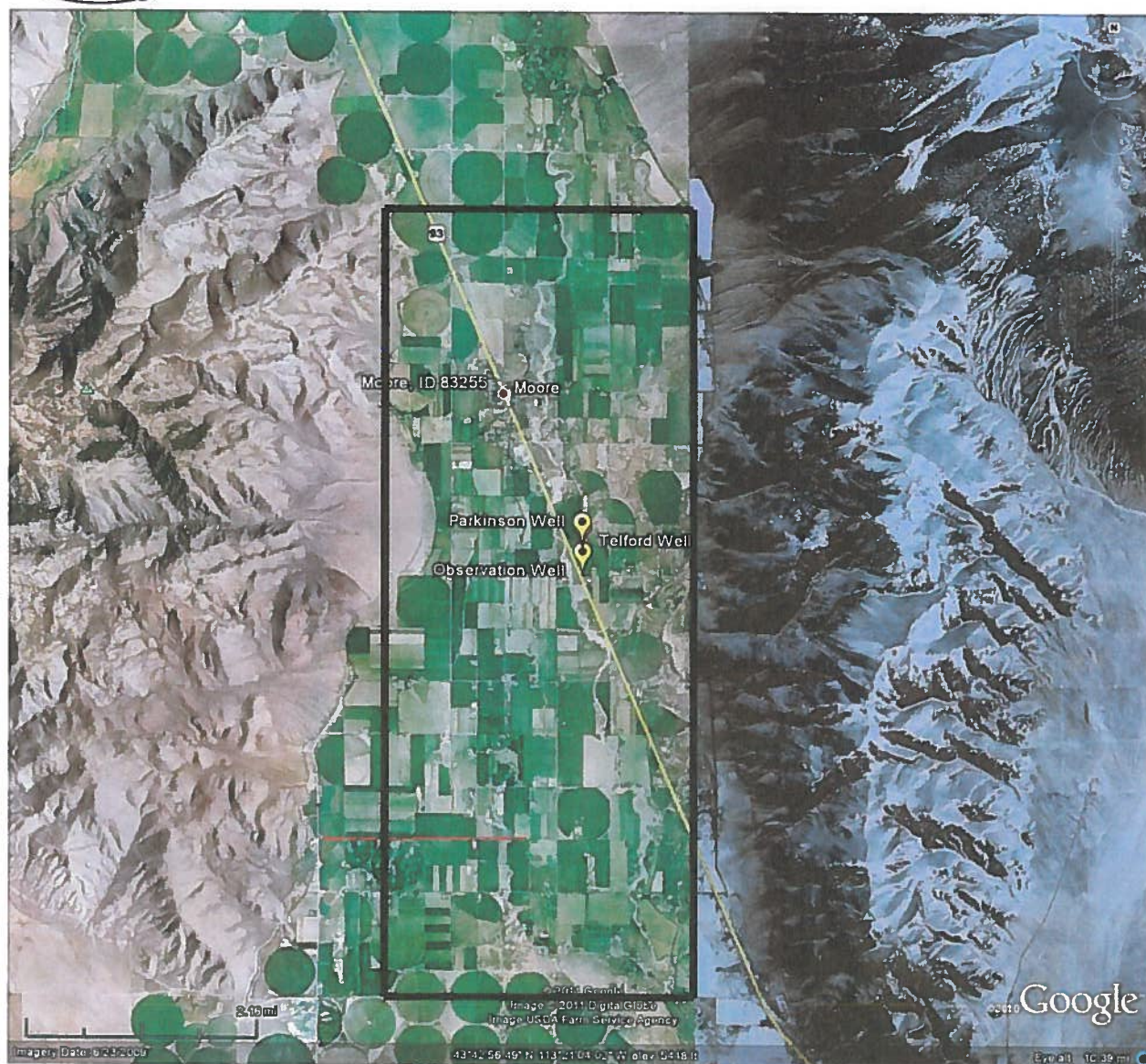


Figure 4-1 Outline of the boundaries used in the AQTESOLV forward solution calculation. Note for scale that the red line is 10,000 ft long.

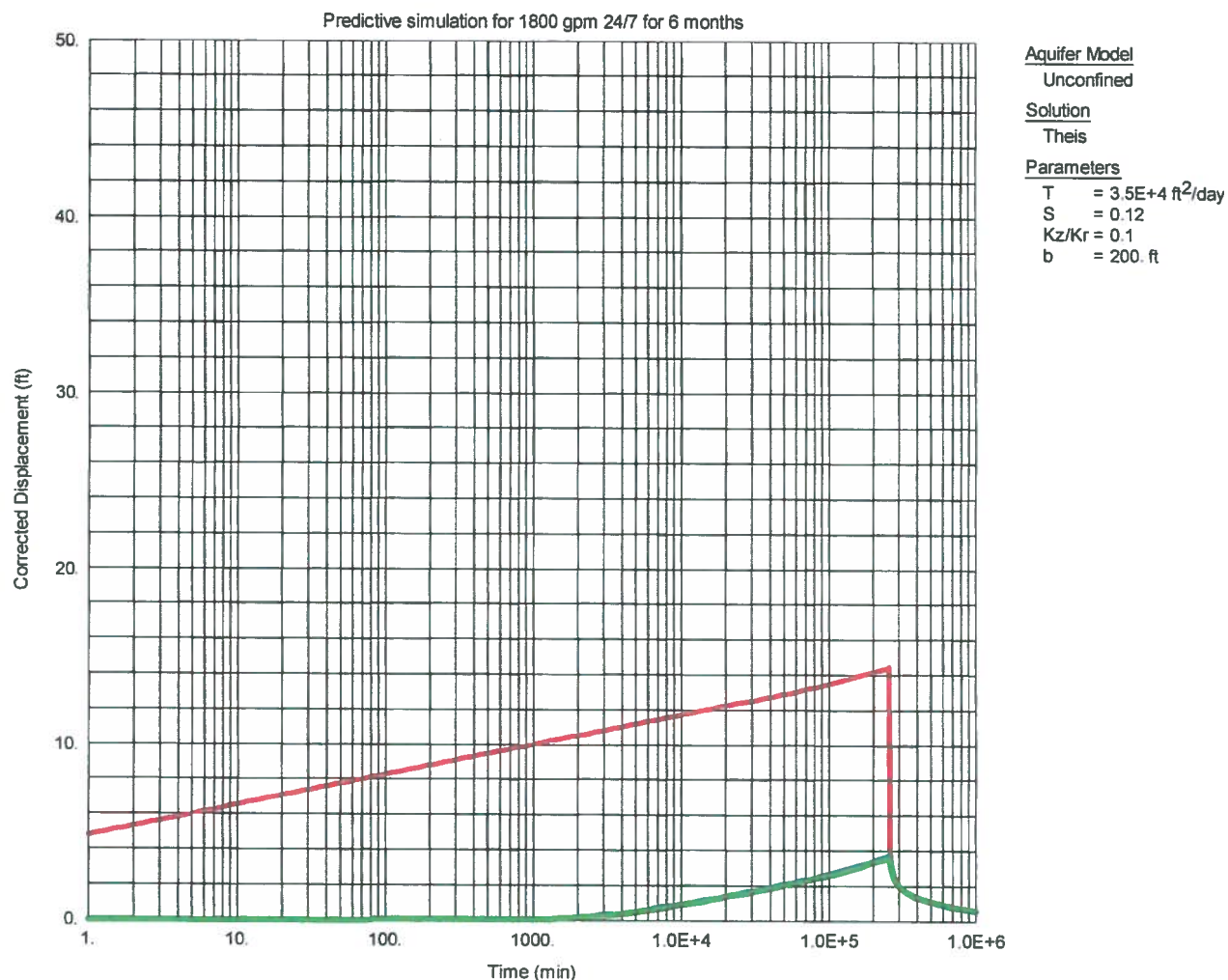


Figure 4-2 Predictive plot of drawdown at 1800 gpm for the full period of use 180 days. The red line is for the water level in the Parkinson Well, blue line is the water level predicted in a well ¼ mile north (Felton Well), and the green line is the water level in a well ¼ mile to the east and 250 ft south of the Parkinson Well (Toone Well).

Key to line colors

- Green Imaginary well ¼ mile east of the Parkinson Well
- Blue Imaginary well ¼ mile north of the Parkinson Well
- Red Parkinson Well

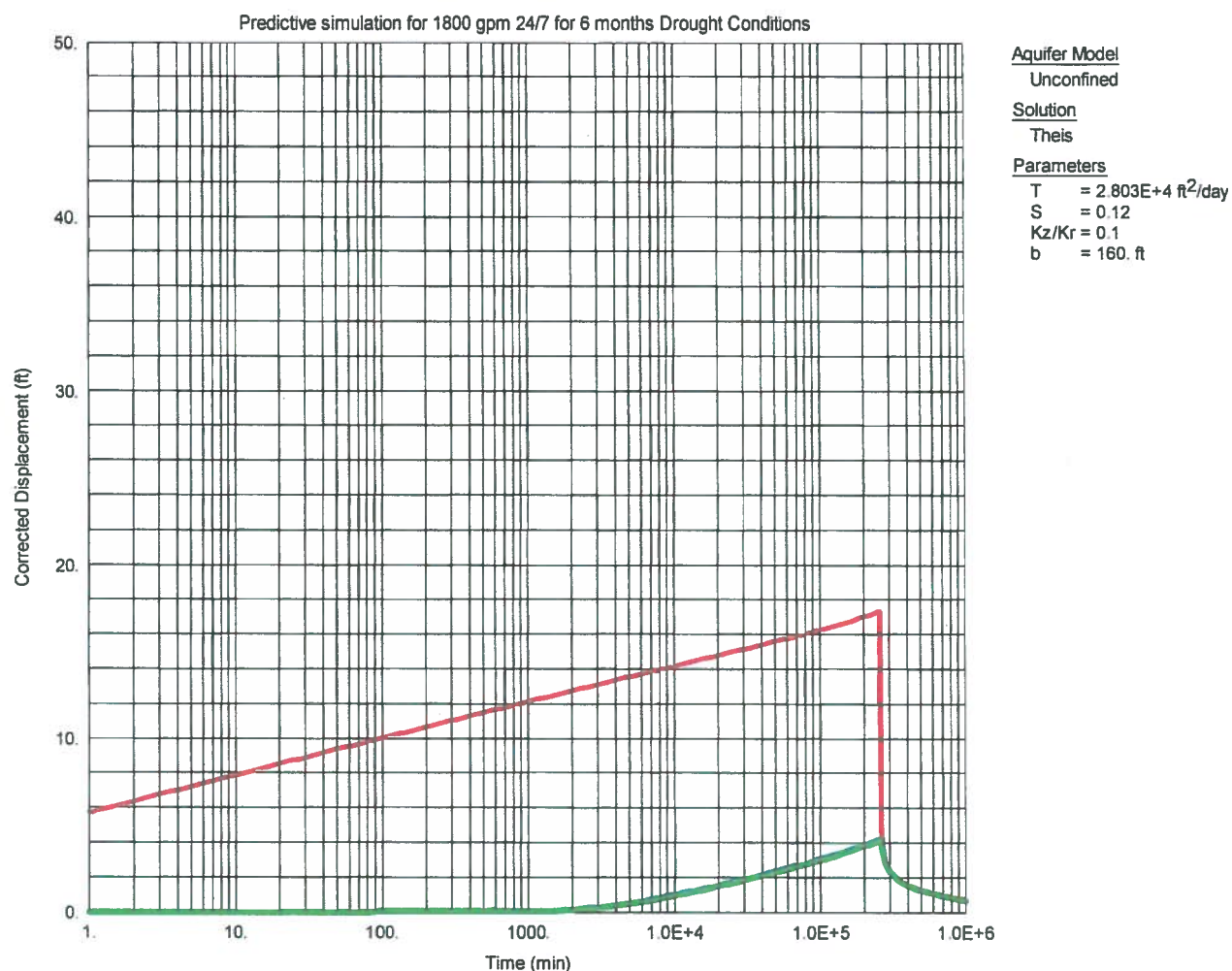


Figure 4-3 Sensitivity to drought - Predictive plot of drawdown at 1800 gpm for the full period of use 180 days using a transmissivity lowered by 20%, representing potential decline in the aquifer levels in this area due to drought. The red line is for the water level in the Parkinson Well, blue line is the water level predicted in a well ¼ mile north (Felton Well), and the green line is the water level in a well ¼ mile to the east and 250 ft south of the Parkinson Well (Toone Well).

Key to line colors

Green Imaginary well ¼ mile east of the Parkinson Well
Blue Imaginary well ¼ mile north of the Parkinson Well
Red Parkinson Well