



Well #11 Pump Test Report

Test Conducted October 2009

Mammoth Community Water District

Forrest Cross, P.E.

December 6, 2011

Purpose

Mammoth Community Water District (MCWD) is evaluating the feasibility of developing Monitoring Well #11 into a production well. In order to determine the possible yield of the well, a 72 hour pump test was completed. The results of the test are discussed below.

Background

Well #11 was initially completed in July of 1988. The well includes a 10-inch diameter steel casing to 367 ft, 8-inch uncased bore from the bottom of the casing to 500 ft below ground surface(bgs), and 6 inch open bore from 500 ft to 600 ft. bgs. Appendix F contains the well completion report of the existing Well 11. A 48 hour pump test was conducted and Ken Schmidt submitted a report on July 18, 1988 with the results of the pump test, see Appendix G. His conclusion was that the well could produce approximately 500gpm with a pumping level of 300ft below ground level. He also stated that there was no groundwater level influence between Well #11 and Wells #10, 10M, and 11M, see Figure 1 for well locations. This indicated the yield from Well 11 did not influence the shallow groundwater levels (above 60 ft) in the surrounding Mammoth Meadows area, nor the deep confined aquifer that Well 10 pumped from. At the time, Well #11 was not developed into a production well for MCWD. See Figure 2 for the location of Well 11 and the nearby production and monitoring wells noted in this report.

Well #11 has been used as a monitoring well since it was drilled in 1988. The well has artesian flow during most years. Water samples of well #11 show the water quality is excellent. See Appendix E for water quality data.

Pump Test

In October of 2009, MCWD conducted another pump test on Well #11 in order to reevaluate the possible production rate of the well. A 72-hour constant rate pump test was conducted October 13-16.

Prior to the start of the pump test, the casing in Well #11 was brushed for 6 hours and swabbed for 6 hours. Since the well had been sitting idle for over 20 years there was some corrosion inside the wellbore. The brushing and swabbing cleaned the entire section of well casing, including the perforated section of the well. Video logs were completed before and after in order to determine the effectiveness of the brushing and swabbing.

For one week prior to the pump test, production Wells #6 and #10 were turned off. It is believed that Well #11 is in a different aquifer than Wells #6 and 10, but in order to make sure there was not any influence from these production wells, they were taken out of service and the aquifer was allowed to recover for one week prior to testing.

Carson Pump of Carson City Nevada performed the work. They initially were going to use a 100hp motor and 6" column pipe for the test. The 6" column pipe could not fit down the casing. There was enough of a bend in the casing within the first 60 feet that they were unable to get their equipment down the well. So, they returned with 4" column pipe and were able to get the pump and motor set at a depth of 400 feet below ground surface.

Based on information from Ken Schmidt's 1988 report, a constant rate of 400gpm was chosen for the test. The initial test was started on October 12th at 9:15 am. The well was under artesian flow conditions at the start of the test, an estimate of the artesian flow rate was not made before the start of the pump test. The test was shut down at 3:10pm because the water level was still dropping rapidly and it didn't seem like it would level out before getting too close to the pump and motor. The pump was shut off and the well was allowed to recover overnight. The well did not completely recover and start artesian flow again. The water level was approximately 18" below the top of the well casing.

The test was restarted at 8:30am on October 13th at a rate of 300gpm. Flow rate was adjusted by a gate valve on the outlet of the discharge and flow was measured with a 4" flow meter. The discharge from the well was piped approximately 3,000 feet away to the surface ponds on Snowcreek golf course. Drawdown in the well was measured with a data logger and manually by Carson Pump.

The test was completed on October 16th at 8:30am. A recovery period of 24 hours was also logged with the data logger and manual reads were taken during the first 60 minutes of recovery.

The aquifer transmissivity was calculated graphically and using the computer software AQTESOLV. Using the graphical method, the transmissivity is 1,584 gpd/ft during the pumping portion of the test. Both the manual reads and the data from the data logger were compared and are consistent. The software program used the Thies method and produced 1492gpd/ft for the data logger data and 1646gpd/ft for the manual data. The transmissivity calculated from the recovery data is very similar at 1,467 gpd/ft. These numbers are similar to the numbers from the 1988 Schmidt report of 1,920 gpd/ft.

The specific capacity of the well for a flow rate of 300gpm is 1.22 gpm/ft. If the specific capacity is used to empirically estimate the transmissivity, a rate of 2420gpd/ft is obtained. This is higher than the values calculated from the pump test data. Since the values calculated from the pump test drawdown data and recovery data are similar they should be viewed as a more accurate measurement.

Water levels were also measured in wells #10 and #11M prior to, during, and after the testing period. Well #10 is a production well 700 feet deep, see Appendix F for well completion reports. Well #11M is a shallow monitoring well located approximately 300 feet southeast of Well #11. There are two other monitoring wells in the vicinity of Well #11 that were not able to be used during the course of the pump test. Well #10M is a shallow well that was dry during the time of the pump test, therefore water level data was not available. Well #12 was not used because there was a blockage in the casing and water level data could not be obtained.

The water level in Well #10 increased 11.86ft in the week prior to the pump test, as expected when pumping is stopped for this duration, following several months of regular operation. The water level in

Well #10 was not affected by the pump test. See Appendix A for water levels at the various wells during the 1 week pre-test conditions, Appendix C for the water levels during the 72 hour pump test, and Appendix D for the water levels during the 24 hour recovery period.

Water levels in well #11M decreased in the week prior to the test by .4 ft. During the test, the water level fluctuated between 21.53 ft and 21.8 ft below ground surface. There was a slight drop initially then an increase. Water level fluctuations are not correlated to the pumping of Well #11.

Well #11 recovered to 74 ft bgs within the first hour after the test pump was stopped. After 24 hours, the well had recovered to 13 ft bgs. A permanent cap was welded onto the top of the casing after completion of the test and it was not observed when the well began artesian flow again.

Since the wells used as monitoring wells during the pump test did not show any influence from pumping Well #11 at 300gpm, only the measurements from Well #11 were used to calculate the transmissivity values.

Discussion

The results of the 72 hour constant rate pump test on Well #11 were similar to the results of the 1988 48 hour pump test Ken Schmidt conducted. The transmissivity values were slightly lower during the 2009 72 hour pump test. The well screen is not in new condition anymore and could have affected the results. Therefore, it is possible that the lower values were due to changes and partial blockages of the slots in the screened section of the casing and not due to different aquifer conditions or characteristics.

The well was able to reach a stable pumping level of approximately 248 feet bgs after 72 hours with a pumping rate of 300gpm. The pumping level is below the top of the slotted section of casing, which runs from 170-360 feet bgs. If there was contributing flow in the upper portion of the slotted casing, there would be cascading water in the well. The partial blockage of some of the slots may affect the amount of water that can enter the well casing through the slotted section of casing.

The pumping of Well #11 did not have any effect on water levels in Well #6, #10 or #11M, indicating that future pumping of Well #11 will not have any significant affect on either the aquifer levels in wells #6 and #10 or on the shallow aquifer. These results are similar to results from the 1988 Ken Schmidt pump test results.

The existing well casing does not appear to be suitable for use as a future production well. There are signs of degradation to the casing, especially in the area of the slotted casing. Even after physical rehabilitation that included brushing and swabbing the casing, there are signs of the slots being corroded and smaller in size. This can be seen on the video log that was conducted by Carson Pump. Also, there is a bend or restriction of some sort in the casing near the top of the existing well that would not allow 6" column pipe to be inserted. The 4" column pipe was able to be inserted past the restriction, but 4" pipe might create greater head losses than preferable for a production well.

Conclusion

Well #11 could be pumped at a rate of approximately 300-400 gpm. In order to develop a production well, a new well will need to be completed since there are issues with the current well casing. The aquifer Well #11 penetrates is hydraulically isolated from the aquifer that Wells #6 and 10 pump from, based on the pump test results and the water quality differences between the wells. Developing Well #11 into a production well should not affect the water levels or production rates of Wells #6 and 10.

Next Steps

Options for the Well #11 site include keeping it as a monitoring well or developing it into a production well. Developing a production well at the Well #11 site would require proper environmental documentation and review, permitting, civil site planning, well design and treatment.

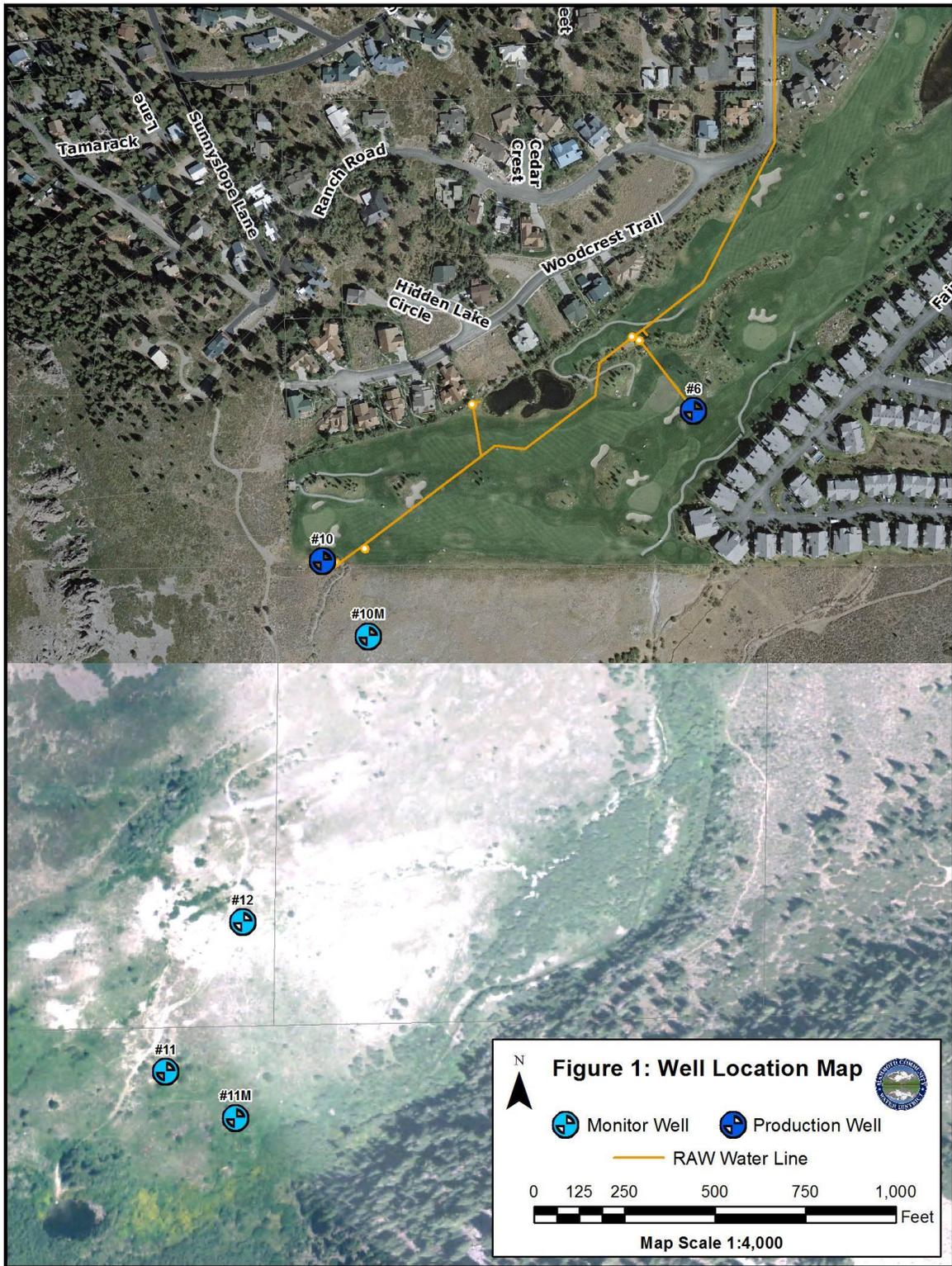
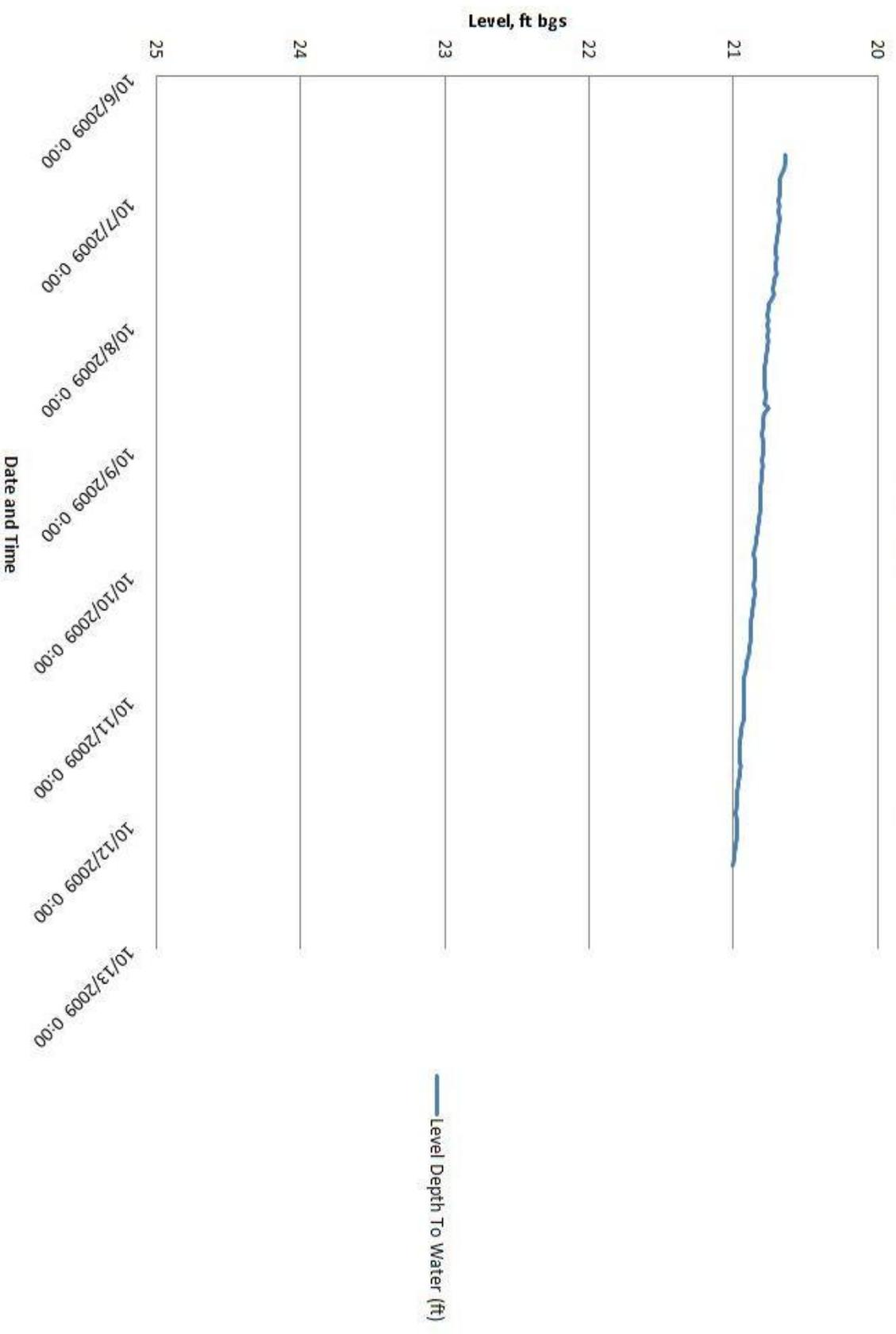


Figure 1: Well Location Map

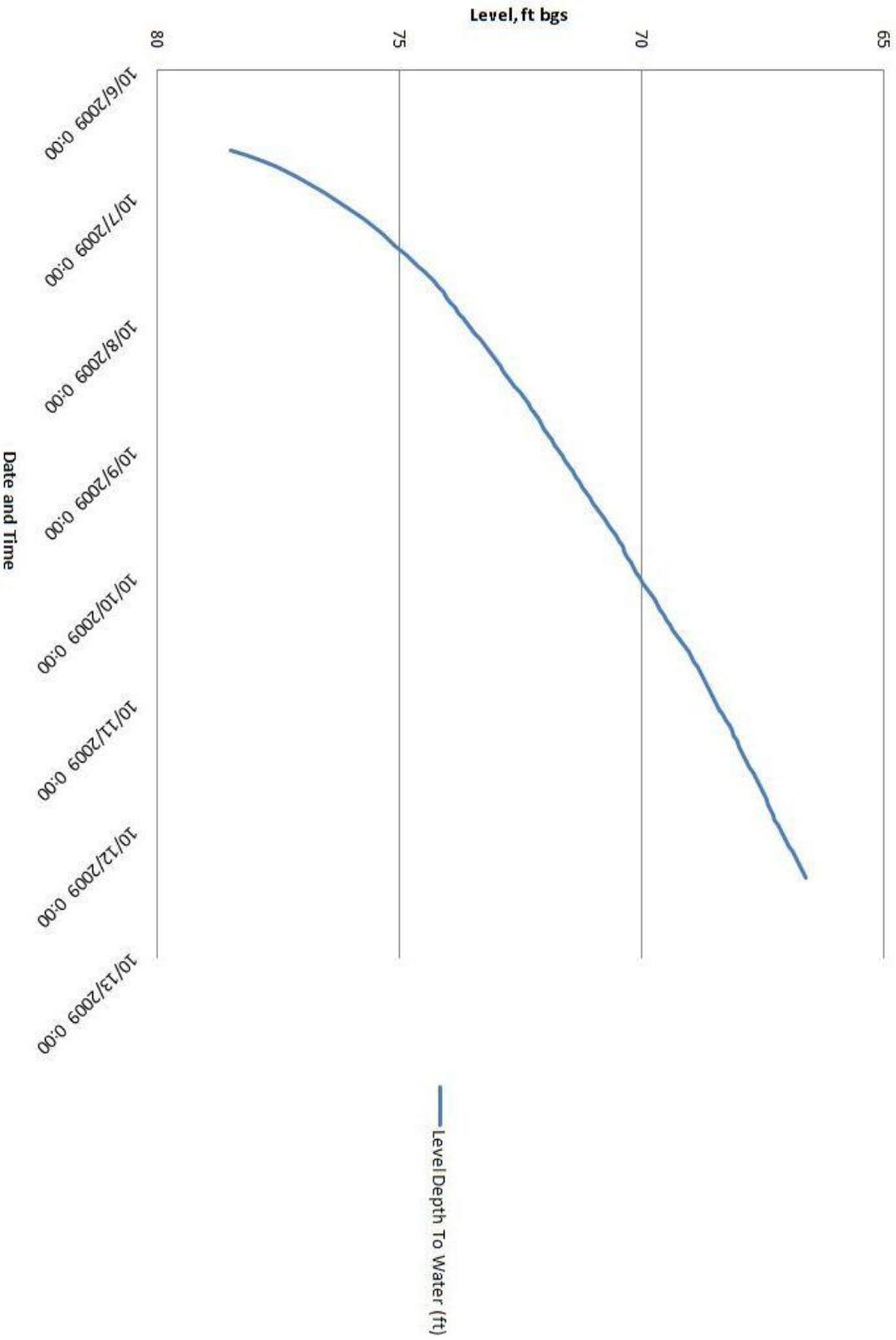
Appendix A: Pre-test Water Levels

10/6/2009 – 10/12/2009

Well #11M Pre-test Level



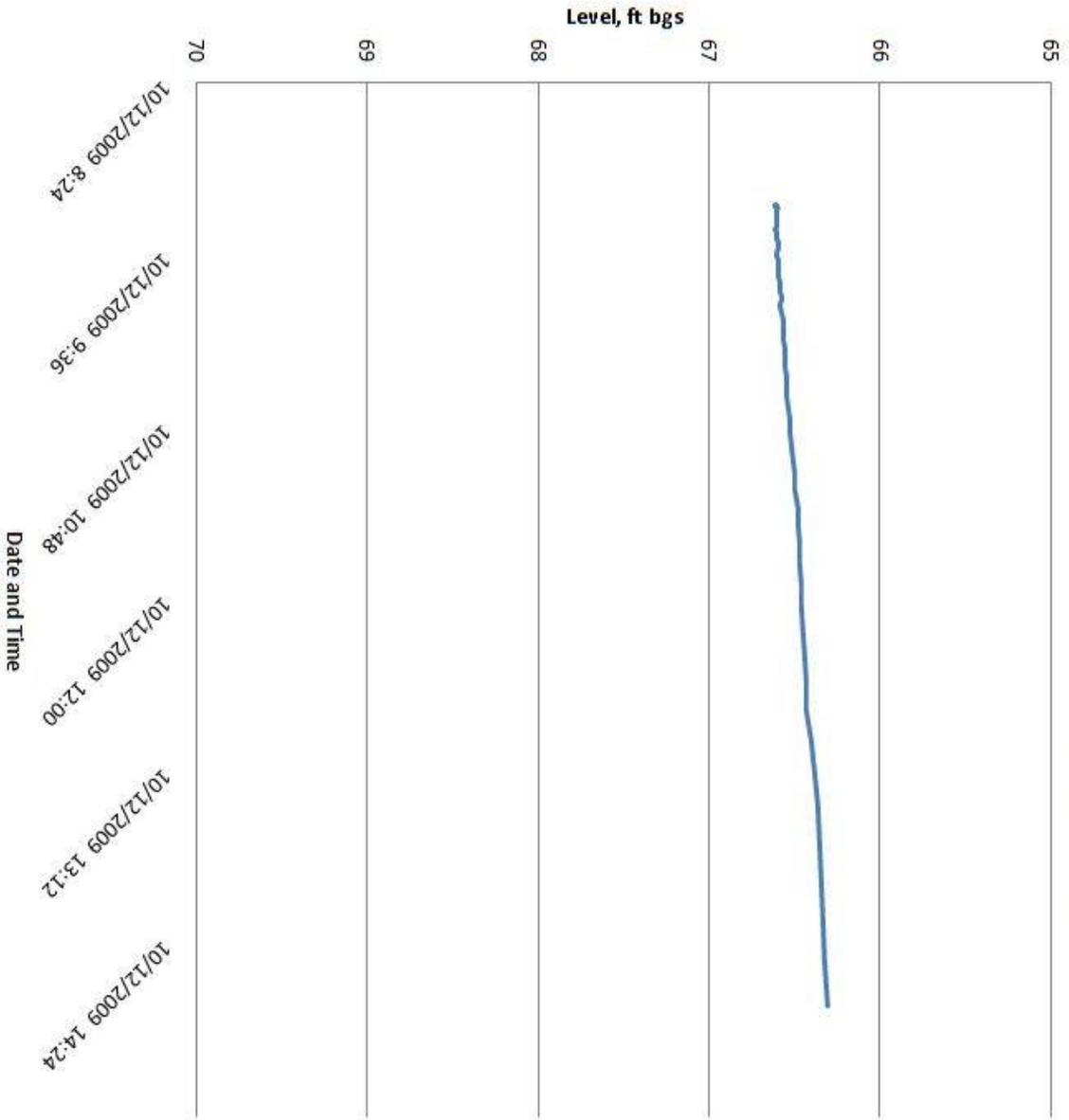
Well #10 Pre-test Water Level



Appendix B: Pumping Water Level

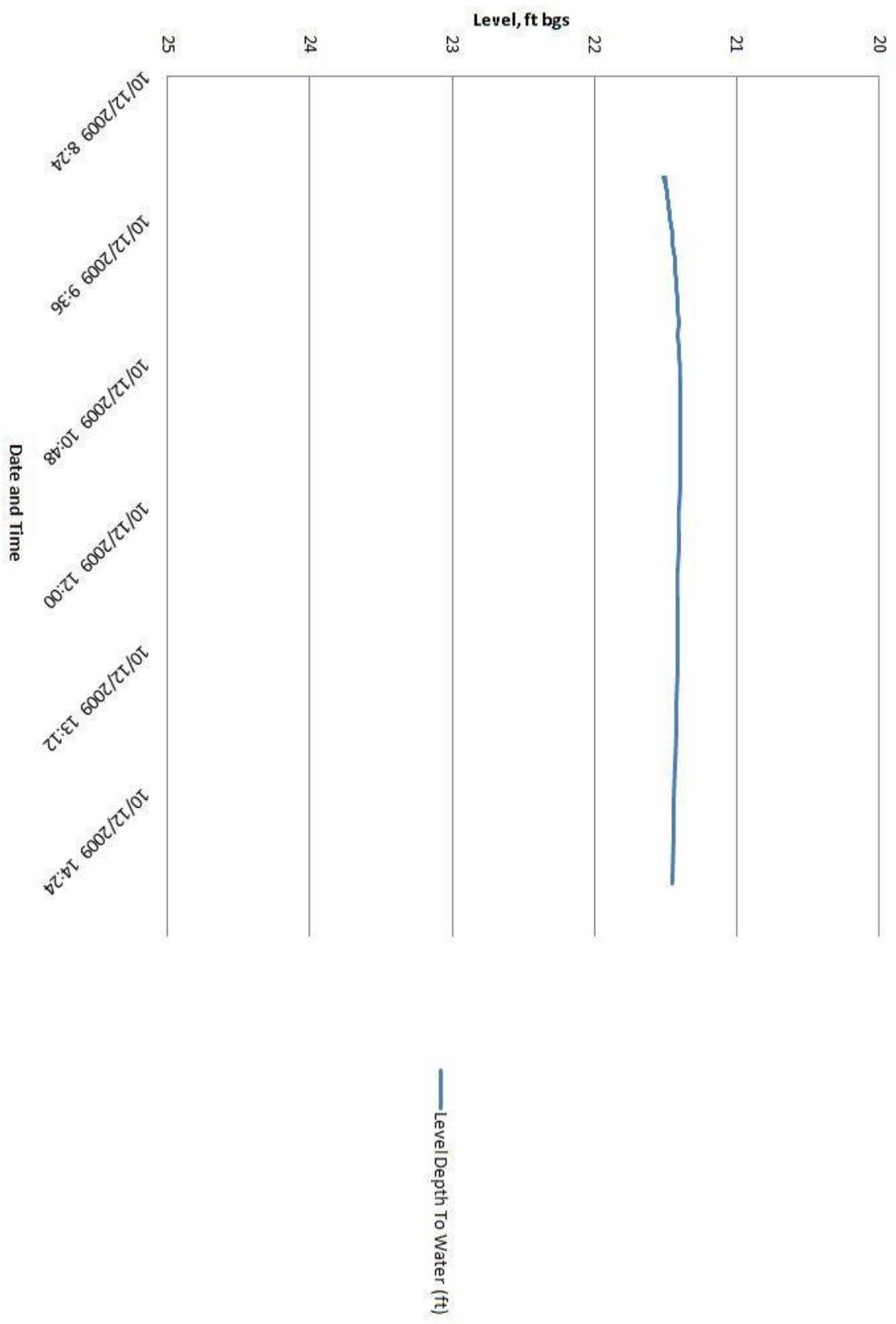
10/12/2011

Well #10 Level



— Level Depth To Water (ft)

Well #11M Level

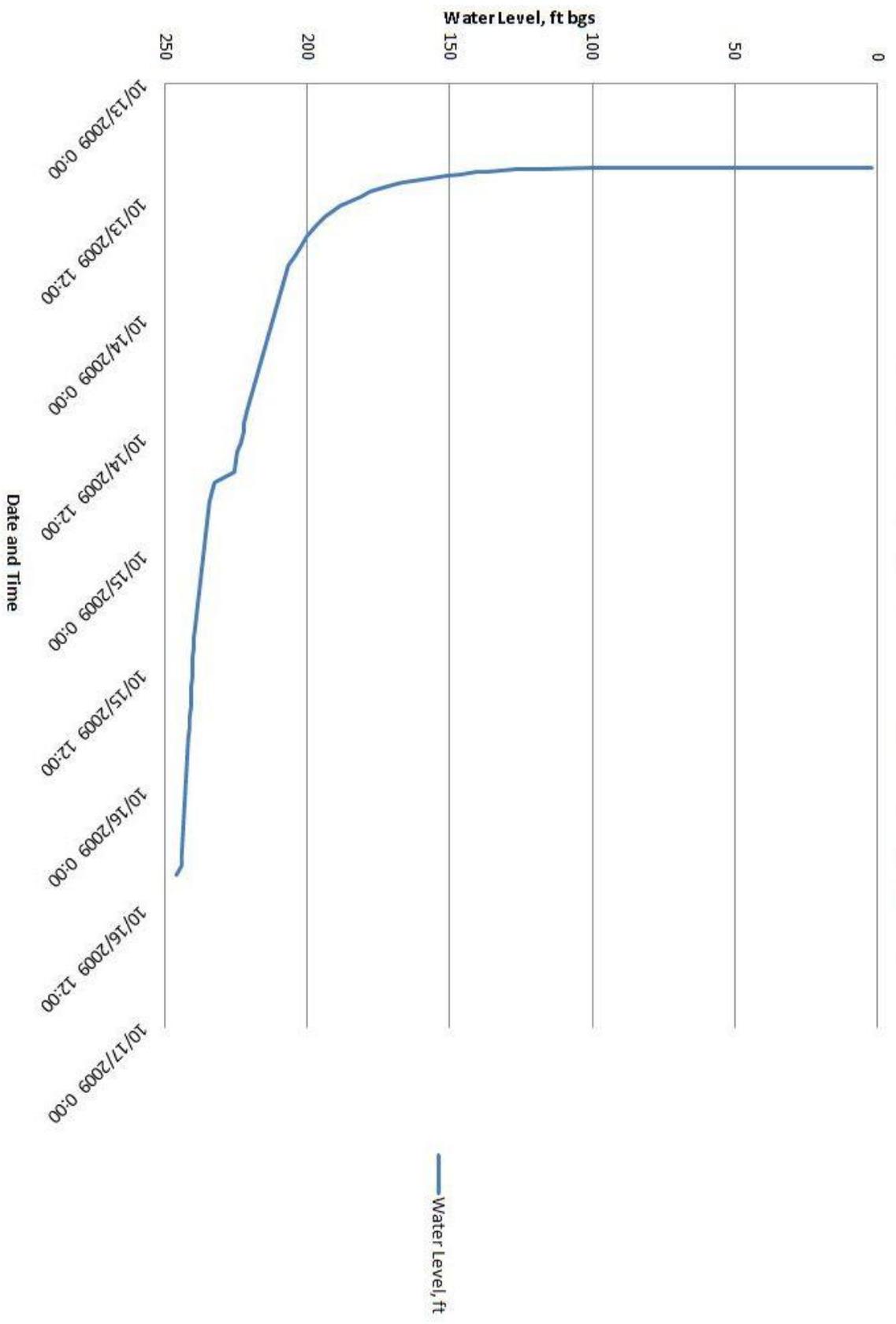


— Level Depth To Water (ft)

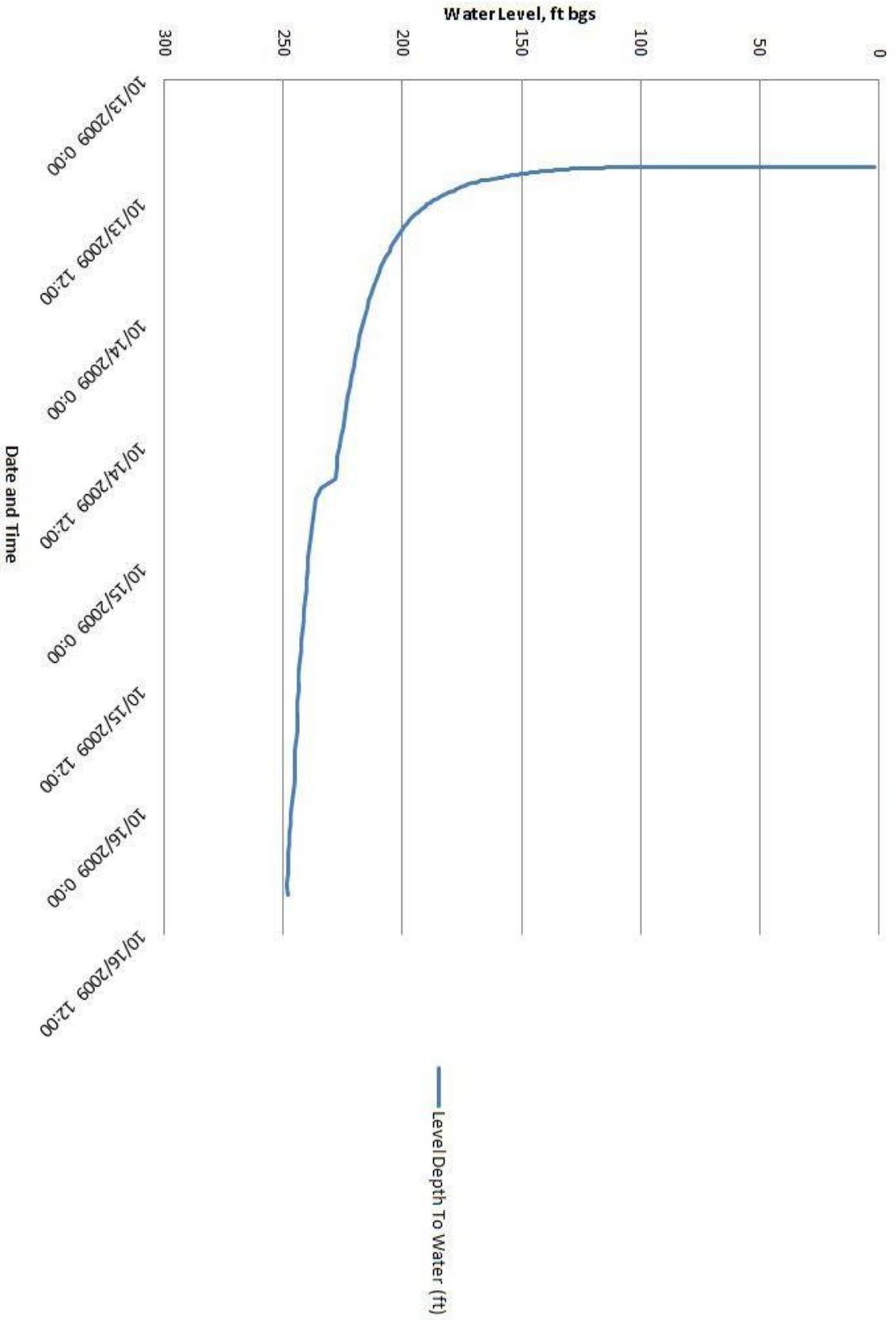
Appendix C: Pumping Water Level

10/13/2011 – 10/16/2011

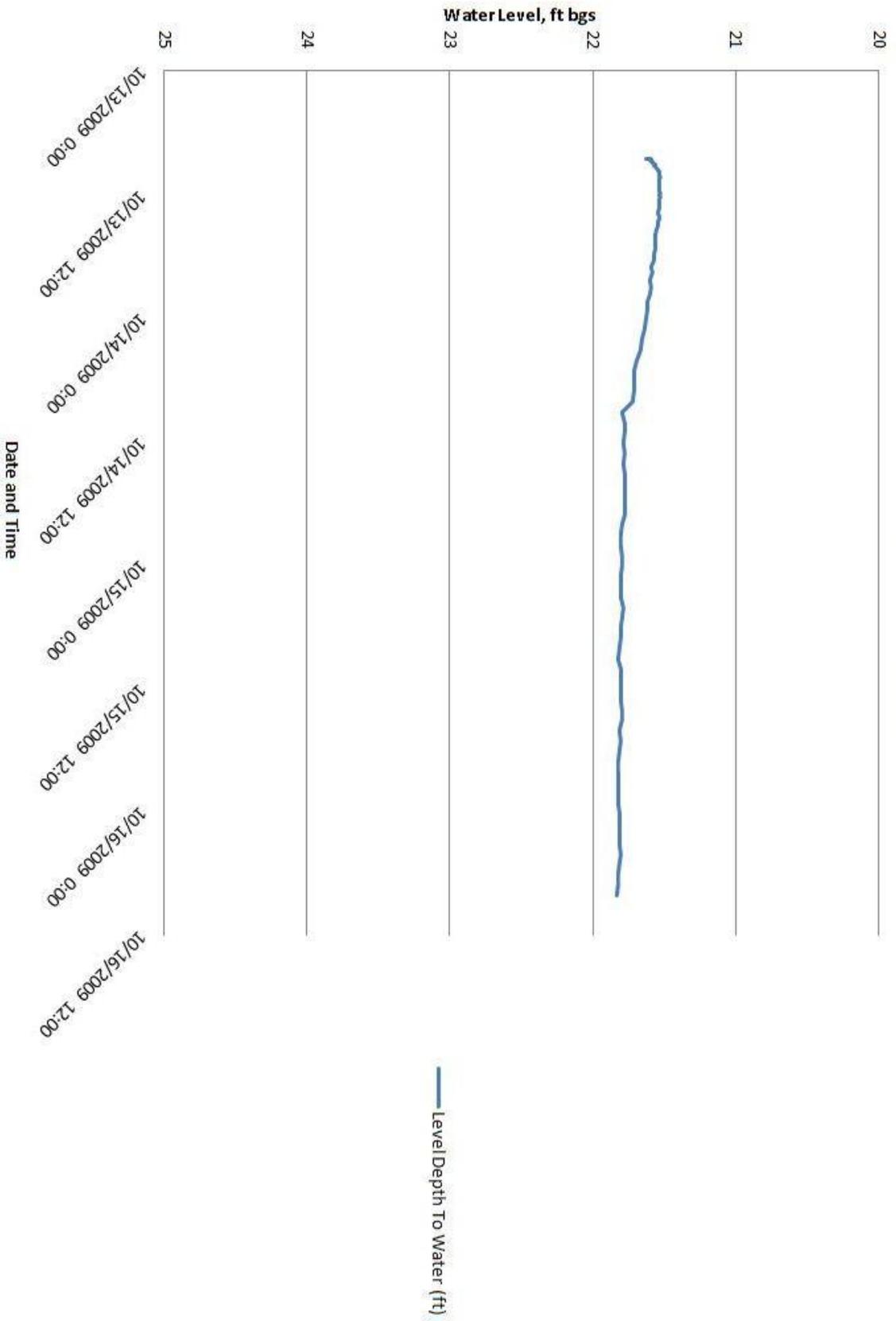
Well #11 Pumping Level - Carson Pump Data



Well #11 Pumping Level



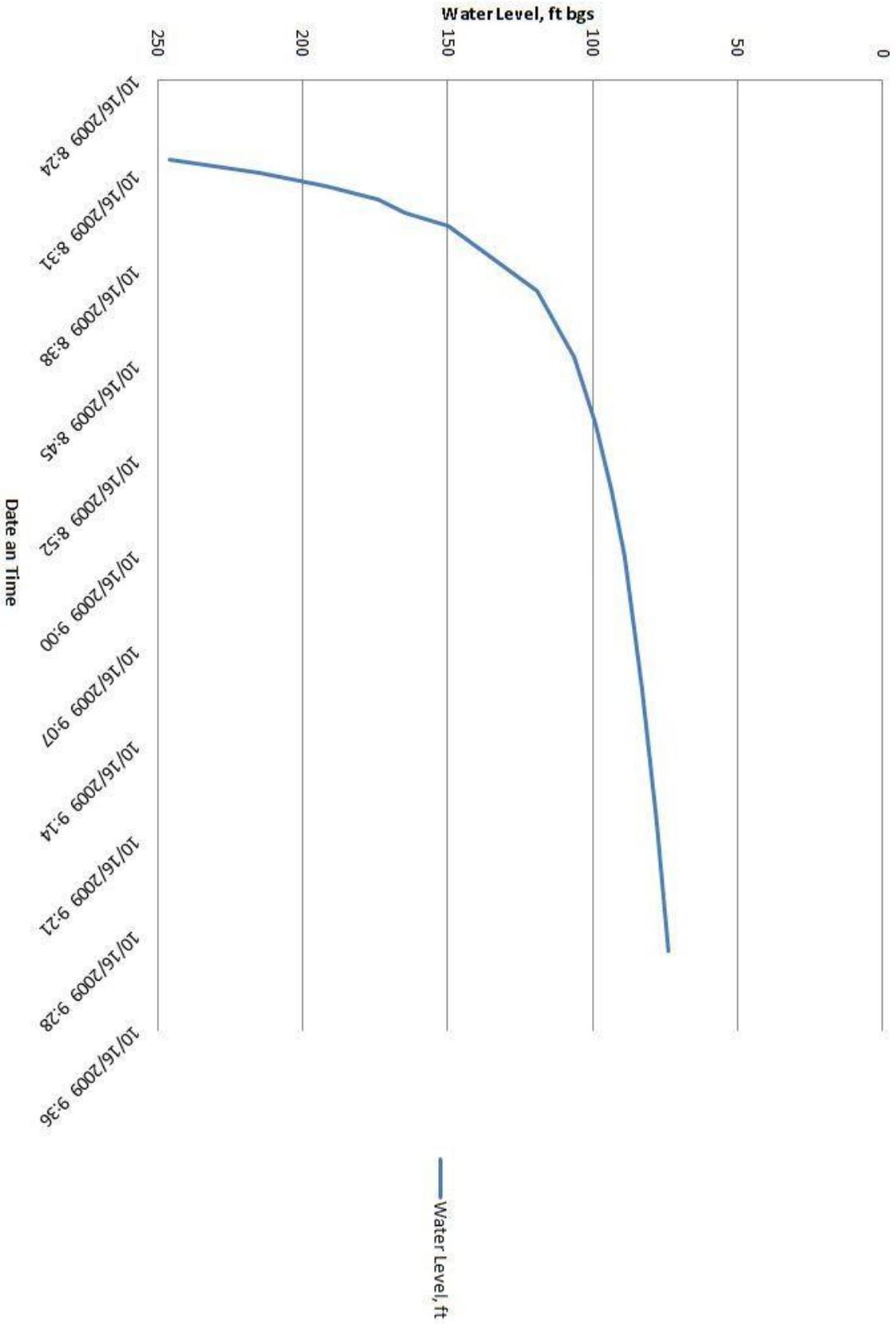
Well #11M Water Level



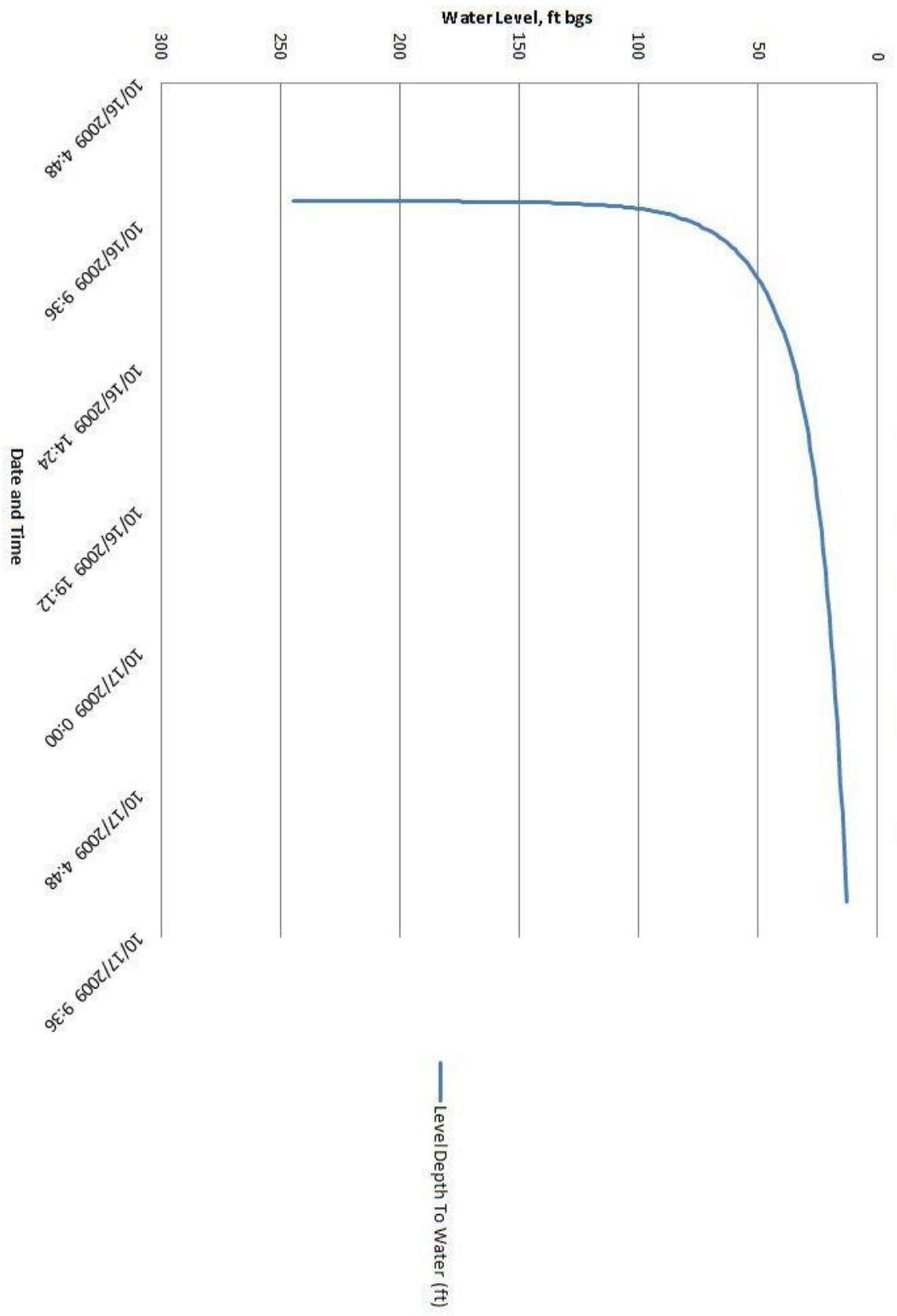
Appendix D: Water Level Recovery Period

10/16/2011 – 10/20/2011

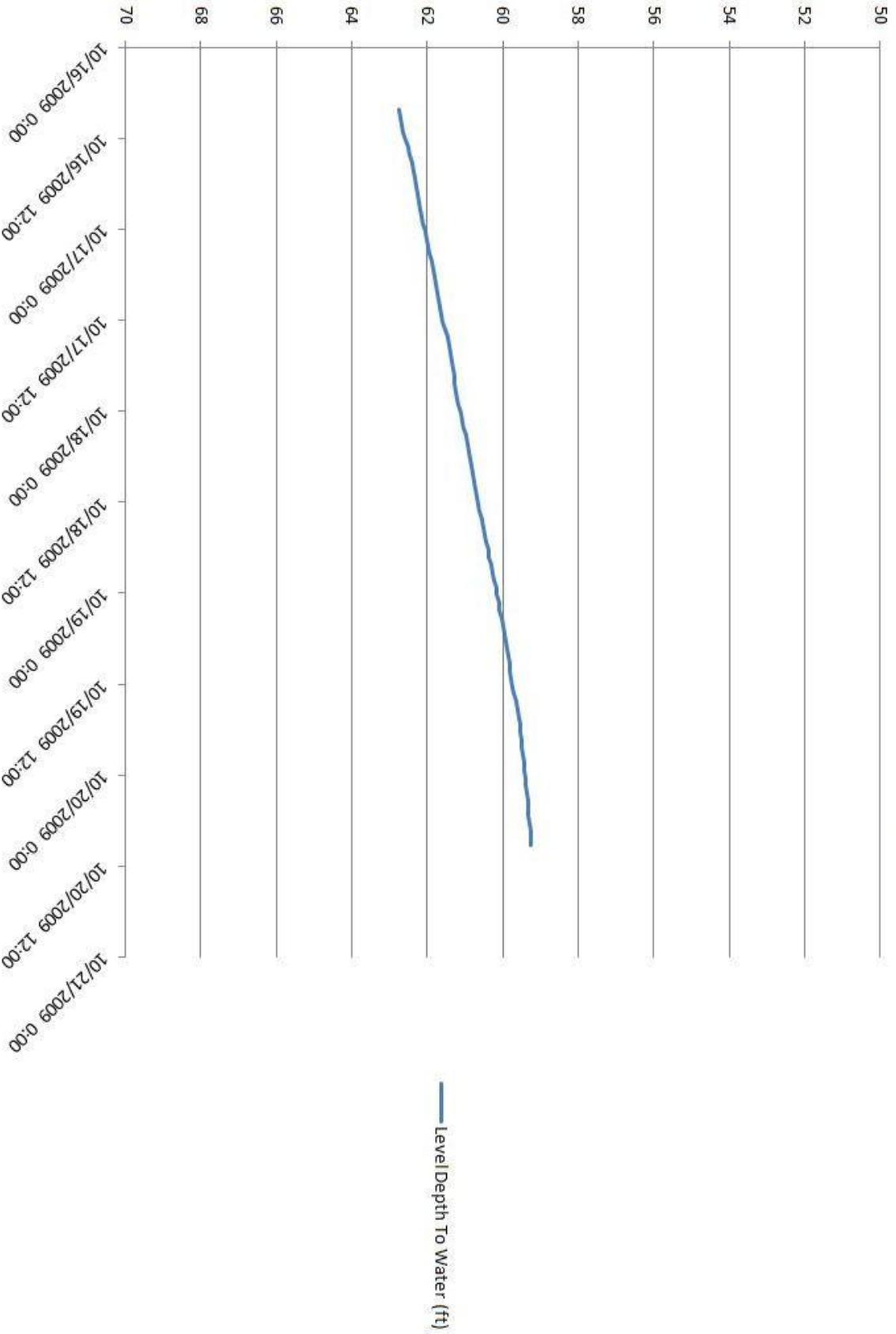
Well #11 Water Level - Recovery Period - Carson Pump Data



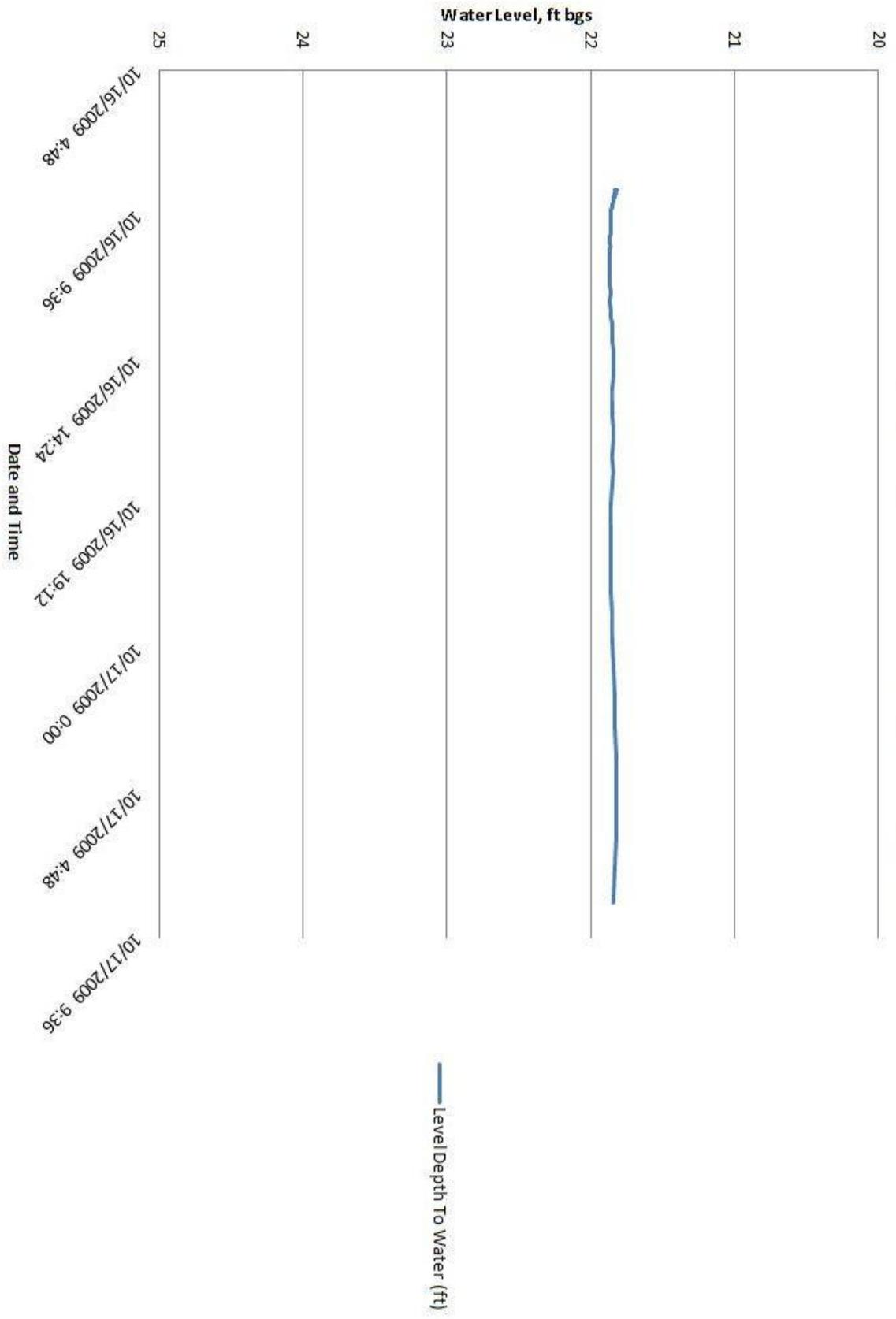
Well #11 Water Level - Recovery Period



Well #10 Water Level - Recovery Period



Well #11M Water Level - Recovery Period



Appendix E: Water Quality Data

Well #11 Water Quality - October 2009

pH	7.8	
Specific Conductance	120	umhos/cm
TDS	75	mg/L
Arsenic	7.4	ug/L
Iron	1100	ug/L
Manganese	30	ug/L
Total Hardness	35	mg/L
Calcium	12	mg/L
Magnesium	1.3	mg/L
Sodium	9.6	mg/L
Potassium	1.4	mg/L
Total Alkalinity	53	mg/L
Bicarbonate	65	mg/L
Sulfate	2.5	mg/L
Flouride	0.3	mg/L
Nitrate	1.1	mg/L

Appendix F: Well Completion Logs

Well #11 Completion Log

TRIPPLICATE
Owner's Copy

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

*GS need to send - JJK 7/25
copy to USFS Do not fill in 7/25*

No. **276411**

No. of Intent No. 242349
L Permit No. or Date 26-88-23

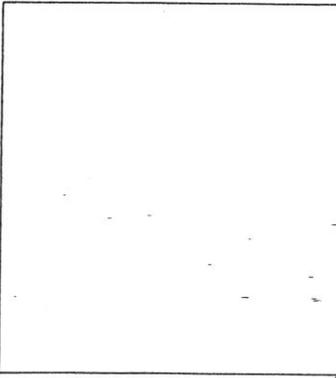
State Well No. _____
Other Well No. _____

(1) OWNER: Name Mammoth County Water District
Address Post Office Box 597
City Mammoth Lakes, California ZIP 93546

(12) WELL LOG: Total depth 600 ft. Completed depth 600 ft

(2) LOCATION OF WELL (See instructions):
County Mono Owner's Well Number #11
Well address if different from above _____
Township 4-S Range 27-E Section 10
Distance from cities, roads, railroads, fences, etc. Approx. 2400' south of the end of Tamarack Road

from ft.	to ft.	Formation (Describe by color, character, size or material)
0'	10'	Brown & white-fine to medium-sand & silt
10'	35'	black & brown coarse sand
35'	60'	black & red-fine to coarse-sand
60'	90'	fine sand & gravel to 3cm
90'	100'	brown medium to coarse sand & gravel to 3cm
100'	150'	gravel to 3cm
150'	200'	brown medium to coarse sand & gravel to 2cm
200'	221'	brown fine to medium sand & gravel to 2cm
221'	340'	brown consolidated fine to medium sand & gravel to 2cm
340'	350'	brown fine to medium sand
350'	430'	granite bedrock
430'	450'	fractured granite rock, cuttings coarser, some weathering
450'	600'	granite bedrock



(3) TYPE OF WORK:
New Well Deepening
Reconstruction
Reconditioning
Horizontal Well
Destruction (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic
Irrigation
Industrial
Test Well
Municipal
Other (Describe)

WELL LOCATION SKETCH

(5) EQUIPMENT:
Rotary Reverse
Cable Air
Other Bucket

(6) GRAVEL PACK:
Yes No Size _____
Diameter of bore _____
Packed from _____ to _____

(7) CASING INSTALLED:
Steel Plastic Concrete

(8) PERFORATIONS:
Type of perforation or size of screen _____

From ft.	To ft.	Dia. (in.)	Gage or Wall	From ft.	To ft.	Slot size
0	50	12-3/4"	.250			
51	367	10" OD	.250	170	360	3/16"

Bit Sizes 8-3/4" to 500', 6-1/8" to 600'

(9) WELL SEAL:
Was surface sanitary seal provided? Yes No If yes, to depth 50 ft.
Were strata sealed against pollution? Yes No Interval _____ ft.
Method of sealing pumped cement grout

Work started 6-2 1988 Completed 7-8 1988

(10) WATER LEVELS:
Depth of first water, if known _____ ft.
Standing level after well completion _____ ft.

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

(11) WELL TESTS:
Was well test made? Yes No If yes, by whom? Kenneth D. Schmidt
Type of test Pump Bailor Air lift
Discharge 465 gal/min after 48 hours
Water temperature 52°
Chemical analysis made? Yes No If yes, by whom? Kenneth D. Schmidt
Was electric log made Yes No If yes, attach copy to this report

Signed Kenneth D. Schmidt (Well Driller)
NAME Johnson Drilling Co.
(Person, firm, or corporation) (Typed or printed)
Address 23489 E. Kings Canyon
Reedley, Ca. ZIP 93654
License No. 245802 Date of this report 7-15-88

Well #11M Completion Log

Well #11M = Well #11A

DUPLICATE
to comply with
local requirements

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 276405

Notice of Intent No. 242313
Local Permit No. or Date By Client

State Well No. _____
Other Well No. _____

(1) OWNER: Name Mammoth County Water District
Address P.O. Box 597
City Mammoth Lakes, California ZIP 93546

(12) WELL LOG: Total depth 43 ft Completed depth 43 ft
from ft to ft Formation (Describe by color, character, size or material)
0'-18' white pumice
18'-43' glacial til

(2) LOCATION OF WELL (See instructions):
County Mono Owner's Well Number MW#11
Well address if different from above _____
Township 4-S Range 27-E Section 10
Distance from cities, roads, railroads, fences, etc. Approx. 300' East Of Well #11

(3) TYPE OF WORK:
New Well Deepening
Reconstruction
Reconditioning
Horizontal Well
Destruction (Describe destruction materials and procedures in Item 12)
(4) PROPOSED USE:
Domestic
Irrigation
Industrial
Test Well
Municipal
Other Observation
(Describe)

WELL LOCATION SKETCH

(5) EQUIPMENT: Rotary <input checked="" type="checkbox"/> Reverse <input type="checkbox"/> Cable <input type="checkbox"/> Air <input checked="" type="checkbox"/> Other <input type="checkbox"/> Bucket <input type="checkbox"/>		(6) GRAVEL PACK: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Size <u>3/8"</u> Diameter of bore <u>8-3/4"</u> Packed from <u>5</u> to <u>43</u> ft	
(7) CASING INSTALLED: Steel <input type="checkbox"/> Plastic <input checked="" type="checkbox"/> Concrete <input type="checkbox"/> From ft. <u>41</u> To ft. <u>43</u> Dia. (in) <u>4"</u> Gauge or Wall <u>Sch. 40</u>		(8) PERFORATIONS: Type of perforation or size of slot From ft. <u>5</u> To ft. <u>43</u> Slot size <u>.020</u>	

(9) WELL SEAL:
Was surface sanitary seal provided? Yes No If yes, to depth 5 ft
Were strata sealed against pollution? Yes No Interval _____ ft
Method of sealing continuous pour including stab

Work started 6-21 19 88 Completed 6-22 19 88

(10) WATER LEVELS:
Depth of first water, if known _____ ft
Stagnant level after well completion _____ ft

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

(11) WELL TESTS:
Was well test made? Yes No If yes, by whom? _____
Type of test Pump Bailor Air lift
Depth to water at start of test _____ ft At end of test _____ ft
Discharge _____ gal/min after _____ hours Water temperature _____
Chemical analysis made? Yes No If yes, by whom? _____
Was electric log made Yes No If yes, attach copy to this report

Signed _____ (Well Driller)
NAME Johnson Drilling Co.
(Person, firm, or corporation) (Typed or printed)
Address 23489 E. Kings Canyon
City Reedley, Ca. ZIP 93654
License No. 245802 Date of this report 7-7-88

Well #10 Completion Log

TRIPPLICATE
Owner's Copy

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in

No. **258588**

Notice of Intent No. 237799
Local Permit No. or Date 26-87-17

State Well No. _____
Other Well No. _____

(1) OWNER: Name Mammoth County Water District
Address Post Office Box 597
City Mammoth Lakes, California ZIP 93546

(2) LOCATION OF WELL (See instructions):
County Mono Owner's Well Number 10
Well address if different from above _____
Township 4-S Range 27-E Section SF4 Sec. 3
Distance from cities, roads, railroads, fences, etc.
2700' west & 100' north of section corner

(12) WELL LOG: Total depth 700 ft. Completed depth 700 ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0'- 9'	boulders w/some sand
9'- 23'	dark brown volcanic rock
23'- 24'	fractured volcanic rock
24'- 64'	massive black volcanic rock w/some quartz
64'- 77'	bright red, clay-rich weathered rock w/some black volcanic rock fragments
77'- 91'	brown, clay rich weathered rock w/some black volcanic rock fragments
91'- 122'	massive gray black volcanic rock
122'- 133'	fractured volcanic rock
133'- 138'	massive gray black volcanic rock
138'- 148'	fractured volcanic rock
148'- 162'	massive black volcanic rock
162'- 170'	fractured volcanic rock
170'- 177'	massive black volcanic rock
177'- 188'	weathered volcanic rock, red-brown weathering
188'- 196'	massive black volcanic rock
196'- 213'	fractured volcanic rock
213'- 306'	massive black volcanic rock
306'- 327'	light brown fine sandy silt and clay
327'- 364'	slightly fractured black volcanic rock
364'- 435'	massive black volcanic rock
435'- 467'	red brown clay, silt, and fine to coarse sand
467'- 508'	brown fine sand w/some silt
508'- 517'	brown clay
517'- 540'	brown fine sand w/some silt & clay
540'- 550'	tan, slight yellow fine sand & silt w/clay
550'- 570'	grading back to brown color & less clay
570'- 660'	brown fine sand & silt w/little clay
660'- 700'	brown fine sand & silt w/more clay

(3) TYPE OF WORK:
New Well Deepening
Reconstruction
Reconditioning
Horizontal Well
Destruction (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic
Irrigation
Industrial
Test Well
Municipal
Other (Describe)

WELL LOCATION SKETCH

(5) EQUIPMENT:
Rotary Reverse
Cable Air
Other Bucket

(6) GRAVEL PACK:
Yes No
Diameter of bore _____
Packed from _____ ft. to _____ ft.

(7) CASING INSTALLED:
Steel Plastic Concrete
From ft. To ft. Dia. in. Gage or Wall in. From ft. To ft. Slot size

0	4	16"	188			
0	52	12-3/4"	250			
+4	136	10"	250	136	376	100

(8) PERFORATIONS:
Type of perforation or size of screen

(9) WELL SEAL: (SEE SECTION 12 FOR BALANCE OF CASTING)
Was surface sanitary seal provided? Yes No If yes, to depth 52 ft.
Were strata sealed against pollution? Yes No Interval _____ ft.
Method of sealing pumped cement grout

(10) WATER LEVELS:
Depth of first water, if known 15.7 ft.
Standing level after well completion _____ ft.

(11) WELL TESTS:
Was well test made? Yes No If yes, by whom? Johnson Drilling
Type of test Pump Butler Air lift
Depth to water at start of test 15.7 ft. At end of test 39.8 ft.
Discharge 808 gal/min after 43 hours. Water temperature 56.0 F.
Chemical analysis made? Yes No If yes, by whom? Kenneth D. Schmidt
Was electric log made Yes No If yes, attach copy to this report

BALANCE OF CASTING:
376'-380' 10" to 6-5/8" Taper Section
380'-420' 6-5/8" .100 Slot, blue brass Screen
420'-540' 6-5/8" .040 Slot, 304 Stainless Screen
540'-700' 6-5/8" .025 Slot, 304 Stainless Screen

Work started 9-8 1987. Completed 10-28 1987
WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signed Patrick A. [Signature] (Well Driller)
NAME: Johnson Drilling Co.
(Person, firm, or corporation) (Typed or printed)
Address 23489 E. Kings Canyon
City Reedley, Ca. ZIP 93654
License No. 245802 Date of this report 11-18-87

Appendix G: Ken Schmidt 1988 Report

1102 4/25
1/25/85

KENNETH D. SCHMIDT AND ASSOCIATES
GROUNDWATER QUALITY CONSULTANTS
600 WEST SHAW, SUITE 250
FRESNO, CALIFORNIA 93704
TELEPHONE (209) 224-4412

July 18, 1988

Mr. Jim Kuykendall
General Manager
Mammoth County Water District
P. O. Box 597
Mammoth Lakes, CA 93546

Re: Pump Test on Well No. 11

Dear Jim:

Following is a report on the results of the 48-hour pump test on new Well No. 11. Johnson Drilling, Inc. drove a 10-inch diameter casing to a depth of 367 feet, and then drilled an uncased 6-inch diameter hole to a total depth of 600 feet. This hole was later reamed to 8 inches in diameter down to a depth of 500 feet. The ten-inch casing was perforated from 170 to 360 feet. A 4-inch diameter, Schedule 40 PVC cased observation well was installed about 300 feet east of the new well. It was drilled to a depth of 43 feet. A gravel pack was placed in the 8-inch hole up to a depth of five feet, and a five-foot surface seal then emplaced. A similar type observation well was installed about 200 feet east of new well No. 10. The casing in this well was perforated from 7 to 27 feet in depth, primarily opposite unconsolidated deposits over-lying basalt.

Pumping commenced at 6:47 AM on July 6, 1988. The well was flowing an estimated 25 gpm prior to pumping. The pumping rate was initially measured with a 4 1/2-inch orifice in the eight-inch discharge line. After the first three steps, the orifice was changed to a 5-inch for the remainder of the test. Depth to water was measured with a two-line electric sounder inside a specially installed access tube. The water was piped a sufficient distance away from the pumped well and nearby observation well so as to not interfere with the test. Water levels were also measured in new Well No. 10 and the two shallow observation wells during the drawdown and recovery periods.

Well No. 11 was pumped for about three hours at an average rate of 210 gpm, for the next three hours at 320 gpm, for the next three hours at 455 gpm, for the next three and one-half hours at 515 gpm, and for the rest of the test at an average of 500 gpm. The well was pumped continuously except for an eight minute shutdown when the orifice plate was changed. An average

KENNETH D. SCHMIDT AND ASSOCIATES
GROUNDWATER QUALITY CONSULTANTS

Mr. Jim Kuykendall
July 18, 1988
Page 2

of 465 gpm was pumped during the test. Following is information on pumping water levels and specific capacities for the test:

<u>Pumping Rate (gpm)</u>	<u>Time (hours)</u>	<u>Pumping Level (feet)</u>	<u>Specific Capacity (gpm/ft)</u>
210	3.0	73.7	2.8
320	3.0	130.9	2.4
455	3.0	199.3	2.3
515	3.5	248.4	2.1
499	35.5	296.7	1.7

The water temperature was 52°F throughout the test and the electrical conductivity ranged from about 90 to 100 micromhos at 25°C. The electrical conductivity was thus substantially less than in water from Wells No. 6 and 10. The pH was 7.9 to 8.0 during most of the pumping period.

Aquifer transmissivity was determined from drawdown measurements during the first step to be 1,680 gpd per foot. Water-level recovery was measured in Well No. 11 for about one day. After one day of recovery, depth to water was 7.7 feet. After three days of recovery, the well was again flowing. Corrected recovery measurements for Well No. 11 indicated a transmissivity of 1,920 gpd per foot, which is considered to be the best value for the test. This value is about 5% of that obtained at Wells No. 6 and 10, which tap highly fractured basalt. If most of this water was produced from the glacial till (as opposed to the underlying fractured rock), the transmissivity value obtained from the test would indicate an average permeability of about 10 gpd per square foot.

Measurements in the shallow observation well near Well No. 11 indicated no response during pumping of Well No. 11. Depth to water was 15.7 feet prior to pumping Well No. 11 and 15.6 feet at the end of the pumping period. Four and one-half hours after pumping stopped, depth to water in this observation well was 15.7 feet. Thus there was no impact of pumping Well No. 11 during the two-day test on the shallow observation well.

Depth to water in Well No. 10 was 10.8 feet prior to pumping and 10.9 feet at the end of the pumping period. After about five hours of recovery, depth to water was 10.8 feet. Thus water levels in this well showed no

KENNETH D. SCHMIDT AND ASSOCIATES
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significant response due to pumping of Well No. 11. A water-level recorder was installed in the shallow observation well near Well No. 10. Depth to water was 15.31 feet prior to pumping and was 15.37 feet at the end of the pumping period. This small change is not believed to be significant in terms of the accuracy of measurements and barometric pressure changes during the test. Copies of the pump test measurements are attached.

It appears that about 500 gpm can be pumped from this well. It is advisable to install a liner in this well since pumping levels can be expected to be near 300 feet. The permanent pump could then be set at about 370 feet in depth. Please call me if you have any questions.

Sincerely Yours,


Kenneth D. Schmidt

KDS:lia