
Appendices

Appendix A: Data QA and Well 1111 Step-Rate Test Data

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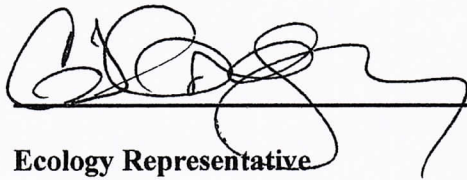
Quality Assurance Project Plan Eastside ASR Characterization Pumping Tests

Prepared for the
Walla Walla Basin Watershed Council
Milton Freewater, Oregon


Prepared by:
Northwest Land & Water, Inc.
Seattle, Washington
www.nlwinc.com
206.525.0049

February 29, 2016

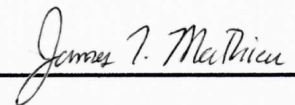
Approval Page for the Quality Assurance Project Plan Eastside ASR Characterization Pumping Tests


Ecology Representative

3/1/16
Date


WWBWC Representative

3/1/16
Date


Northwest Land & Water Representative

3/1/16
Date



**NORTHWEST
Land & Water, INC.**
Consulting in Hydrogeology

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1 About This Plan

This plan has been prepared using standard hydrogeologic practices for pumping tests and data analysis with the goal of estimating the hydraulic properties of the shallow alluvial aquifer beneath a portion of the Eastside area of Milton-Freewater, Oregon. This plan is intended to be used as the quality assurance project plan (QAPP) for the pumping test procedures and subsequent data analysis.

2 Distribution

One copy of this plan is on file with each of these entities: Ecology, Walla Walla Basin Watershed Council (WWBWC), and Northwest Land & Water (NLW). A copy will be available to the sub-contractor(s) should they participate in the pumping tests.

3 Background

The Eastside area of Milton-Freewater lies along the east bank of the Walla Walla River (WWR) approximately bounded to the south (upstream) by LeFore Road, to the north by Stateline Road (downstream). The area of focus for this current project—the Eastside Aquifer Storage and Recovery (ASR) project—is a subset of the Eastside area defined by LeFore Road to the south, Telephone Road to the east, Stiller Lane to the north (location of the ‘Frank’ well), and the WWR to the west (**Figure 1**).

Historic channelization of the WWR and decades of groundwater withdrawals for irrigation have locally depleted the uppermost alluvial aquifer beneath the Eastside area. This has reduced storage and groundwater levels which, in turn, has reduced the availability of water to local domestic and irrigation wells, and reduced groundwater discharge (baseflow) to the WWR and other local streams.

An Eastside ASR project would help replenish the uppermost aquifer making groundwater more available to local wells and seasonally to the WWR and other streams. In order to ascertain a suitable recharge site or sites for ASR, it is necessary to characterize the geologic and hydraulic properties of the aquifer in the Eastside area. Work in 2014 and 2015 included the drilling/construction of the five boreholes/monitoring wells (**Figure 1**). The logs from these moni-

toring wells (NLW, 2015) indicate substantial vertical and laterally variability in the sediment texture and variability in the depth and thickness of the shallow alluvial aquifer.

3.1 Hydrogeology

Specifically, the hydrostratigraphy encountered from ground to depth at the five boreholes (**Figure 1**) is summarized as follows:

- An upper layer of soil consisting of silt, locally with gravels, 2 to 6 feet thick
- An unsaturated zone of loose, and locally compact, silt and gravel, 20 to 60 feet thick
- A saturated zone of loose, and locally compact, silt, sand, and gravel, 5 to 35 feet thick; depth to water varies from approximately 20 to 65 feet.
- A dry to damp layer of very compact silt and gravel, over 20 feet thick

Two water-bearing zones were encountered at the GW_162/163 site (**Figure 1**). They are separated by an 11-foot thick, soft, clayey silt. This clayey silt is competent and extensive enough at this location to cause a difference in groundwater levels.

4 Pumping Tests and Analysis

Multiple pumping tests are proposed to characterize the hydraulic properties of the shallow alluvial aquifer and to understand its spatial variability. This will be accomplished by pumping existing irrigation wells and recording the groundwater level response in the monitoring wells (**Figure 1**). The goal is to obtain spatially distributed time-series data of pumping and corresponding groundwater level response. The data will be used to estimate aquifer parameters—parameters that will be ultimately be part of a feasibility analysis of ASR in the Eastside area.

4.1 Objectives

The pumping test and data analysis goals will be met through the following objectives and work flow approach:

- Select existing irrigation wells with well owner/operator buy-in and retrofitting wells, as needed, to collect pumping and water level data

- Pump the select irrigation wells prior to, and at beginning of this (2016) irrigation season with a request to other nearby irrigators to “not pump”, to the extent possible, during the pumping tests; monitor groundwater levels in five monitoring wells
- Remove water level data trends that may confound the aquifer parameter estimation; such confounding trends may result from WWR stage changes, irrigation wells pumping, and/or areal recharge
- Analyze the de-trended pumping test data to estimate aquifer parameters of transmissivity, hydraulic conductivity, storage coefficient, and specific storage

4.2 Methods

4.2.1 Select Irrigation Wells and Proposed Retrofit

Five irrigation wells selected for use as pumping test wells are shown in **Table 1**. Well owners for three of five have agreed to participate. We plan to discuss participation from two additional well owners during the week of February 29. Other work in progress includes assessing wellhead configurations and then retrofitting these wellheads to accommodate pumping and/or water level access equipment. For all wells except the Eastside school well, we would use the existing well pumps; for the Eastside school we will either use the existing pump or install larger capacity temporary pump. We anticipate knowing whether or not each of these five wells can be used as pumping test wells by March 4.

4.2.2 Pumping Tests, Data Collection, and Discharge Water

For each pumping test the pre-, during-, and post-pumping-test periods will include logging pumping rate and water level data according to the frequencies shown in **Table 2**. The pumping duration will vary from hours to a day and depend in part of the irrigator’s pumping schedule, where the water is discharged, and the effect the discharge water has on recharging the shallow (test-ed) aquifer. Other factors that will affect the pumping duration includes how long neighboring irrigators can “hold off” on pumping their irrigation wells.

Pumping rate data at each tested irrigation well will be logged using an ultrasonic “clamp-on” type of flow meter. The meter and model is:

- BM Technologie Industriali, Model TTFM100B-HH-NG

It will be installed 10 discharge pipe diameters downstream and 5 pipe diameters upstream of bends or non-smooth inner pipe surfaces. The Eastside school well test will also feature an orifice plate / manometer apparatus to measure flow rate.

Water level data in the pumping wells (assuming access can be configured) will be logged and measured using either:

- Aquistar PT2X Submersible Pressure/Temperature Smart Sensors

Or

- Van Essen Instruments Micro Divers

Water level data in the five existing ‘GW’ monitoring wells is currently being recorded using:

- Solinst Levelogger Model 3001 Pressure/Temperature Sensors

Water level data in the pumping and each GW wells will also be measured using a calibrated electronic sounder. These manual measurements will be made on a minute to hour frequency at the pumping well and the nearest GW monitoring well. Manual measurements will also be made at the other GW monitoring wells at least once during each of the pre-, during-, and post-pumping periods.

4.2.3 Data Trend Removal

To the extent necessary we will remove water level data trends observed in the pre-, during-, or post-pumping test data that are caused by stresses other than the pumping at each irrigation well. The goal is process the water level data so that pumping signal is apparent in the water level data, and that these data can be analyzed to estimate aquifer parameters. Different methods exist for accomplishes this—one such method include developing hydraulic response function and using these functions to deconvolved (i.e. remove the “noise” in the water level data).

We will graphically plot the data to examine the trends and then select an appropriate method to process the data.

4.2.4 Estimate Aquifer Parameters

Aquifer parameters of transmissivity, hydraulic conductivity, storage coefficient, and specific storage will be estimated using the “processed” data (if de-trending is necessary) or directly from the logged pumping rate and water level

data. We will use standard estimation methods with a time-series pumping rate history. Standard Theis or Jacob methods will likely suffice if tests are on the order of hours. However, if test durations are a day or longer and result water draining predominately from pore-space, then we will use unconfined aquifer methods to estimate transmissivity and specific yield.

Using the pumping well specific capacities, estimated aquifer parameters, and the hydrogeologic cross sections (developed under a separate project task) we will produce an assessment of sub-areas that have potential for successful storage of water. This assessment will include graphics (maps and cross sections) and a table showing criteria that ranks sub-areas for water storage within the Eastside focus area.

5 Data Quality

The primary data quality objective of accurate water level sensor data will be met by comparing manual water level measurements with the sensor logged data. The manual data will be plotted with the sensor data to verify that changes in water level for pre-, during-, and post-pumping period are consistently reflected in both the manual data and sensor data. For the Eastside school pumping test we will configure the discharge line with both the clamp-on meter and the orifice plate / manometer apparatus. This setup will provide a means of comparing pumping rate with two measurement methods.

6 Organization & Schedule

The following are the project participants and their respective roles:

Client:

Steven Patten, WWBWC
810 S. Main Street, Milton-Freewater, OR 97862
Phone 541-938-2170

Role: Provide area knowledge, field and technical support

Field and Data Analysis Project Manager:

Jim Mathieu, Northwest Land & Water, Inc.
6556 37th Ave NE, Seattle, WA 98115
Phone 206-525-0049

Role: Manage all field testing and data analysis

The field work for this project is expected to occur during March and April 2016. Data analysis and reporting will be complete by June 30, 2016.

7 Cited References

Northwest Land & Water, Inc, 2015. *Drilling and Monitoring Well Construction, Aquifer Storage and Recovery Feasibility Investigation*, Memorandum prepared for Walla Walla Basin Watershed Council, June 30, 2015

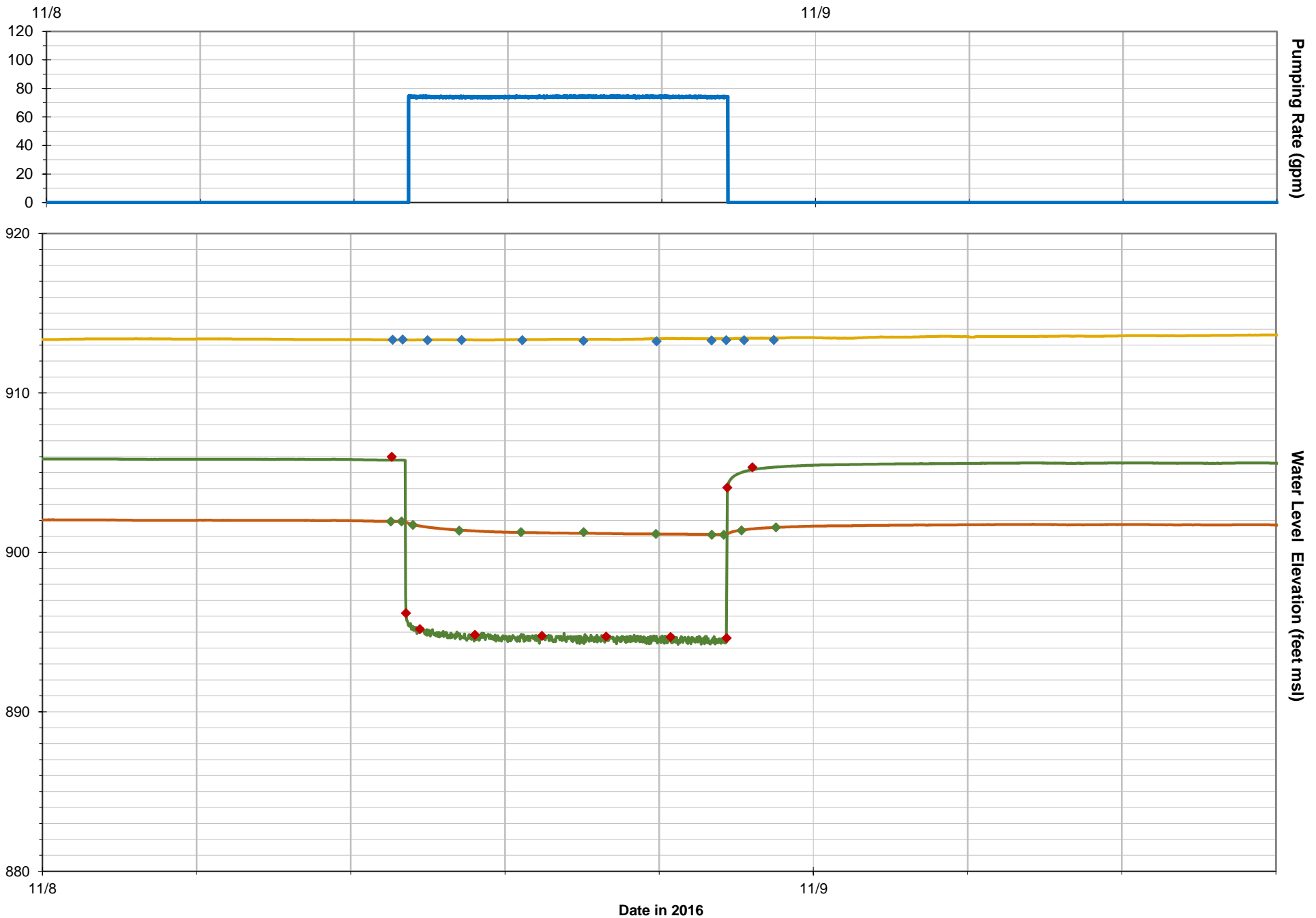
WDOE, 2004. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Publication No. 04-03-030, revision of Publication No. 01-03-003, July 2004, by Stewart M. Lombard and Cliff J. Kirchmer.

Table A1. Retrofit/Test Status as of January 2017 - Table 1. Existing Irrigation Wells, Proposed Retrofit, and Discharge Water Location

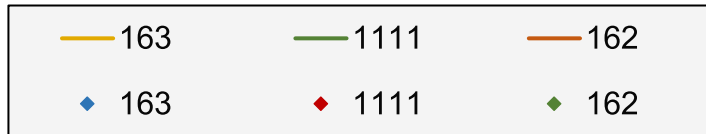
Well Log ID	Casing Diameter (in)	Depth to Water (ft)	Screen or Perf Top (ft)	Screen or Perf Bottom (ft)	Well Depth (ft)	Pumping Test #	Status of Well Retrofit or Pump Configuration	Discharge Water To:	Project Test
53647	8	34	80	110	120	1	Place 1-in ID access tube in well	Irrigation system or Adjacent field	No, owner declined
5239/5229	8	28	40	60	64	2	Placed 1-in ID access tube in well	Irrigation system	Yes, traditional
6475	10/8	100	100	240	240	3	Installed flow datalogger; access tube obstructed on downhole pump equipment	Irrigation system	Yes, passive
1111	8	33	90	95	95	4	Set temporary pump with 2 access tubes and Jwave flow meter	Adjacent field	Yes, traditional
50473	8	38	53	105	105	5	tbd after 2/29 site visit	Irrigation system	No, owner declined
56140	8	41	41	95	185	6	Used existing pump and manual water level access	Irrigation system, adjacent field	Yes, traditional
GW_152, 160,161,162, 163	2	varies, see well logs, App B				7	NA	NA	Yes, slug "in" and "out"
M4 and GW_152, 160,161,162, 163	2	varies, see well logs, App B				8	NA	NA	Yes, passive (HT)

NA - not applicable

tbd = to be determined



Well ID:



Sensor data

Manual data

Figure A1. Well 1111 Test QA:
Sensor v Manual Data

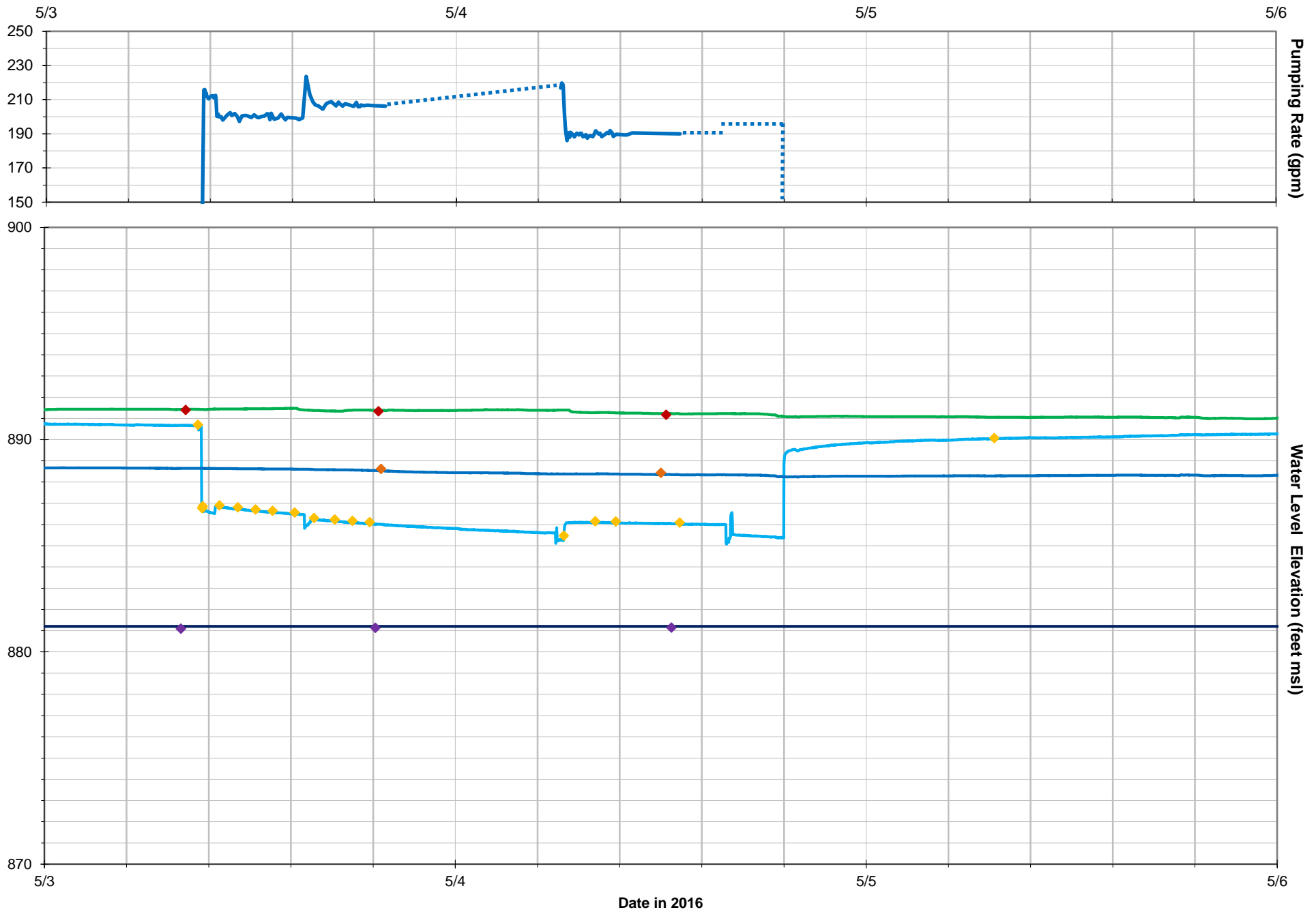
Eastside Milton-Freewater MAR / ASR
WWBWC



Table A2. Flow Rate Comparison: Jwave Ultrasonic Meter versus Drum & Stop Watch, Well 1111 Test

Date / Time	Jwave (gpm)	Drum & Watch (gpm)
11/8/2016 15:14:30	74.0	---
11/8/2016 15:20:00	---	80.0
11/8/2016 15:30:00	---	79.4
11/8/2016 15:31:30	74.1	---
11/8/2016 15:43:30	74.1	---
11/8/2016 15:46:00	---	78.8
11/8/2016 16:01:30	73.9	---
11/8/2016 16:05:00	---	80.1
11/8/2016 16:18:00	73.8	---
11/8/2016 16:20:00	---	81.4
Average Flow Rate	74.0	79.9
Flow Rate Difference	6.0	

Note: Drum was filled to 30 gallon calibration



Well ID:

— 5232	— 5239	— 161	— 5225
◆ 5232	◆ 5239	◆ 161	◆ 5225

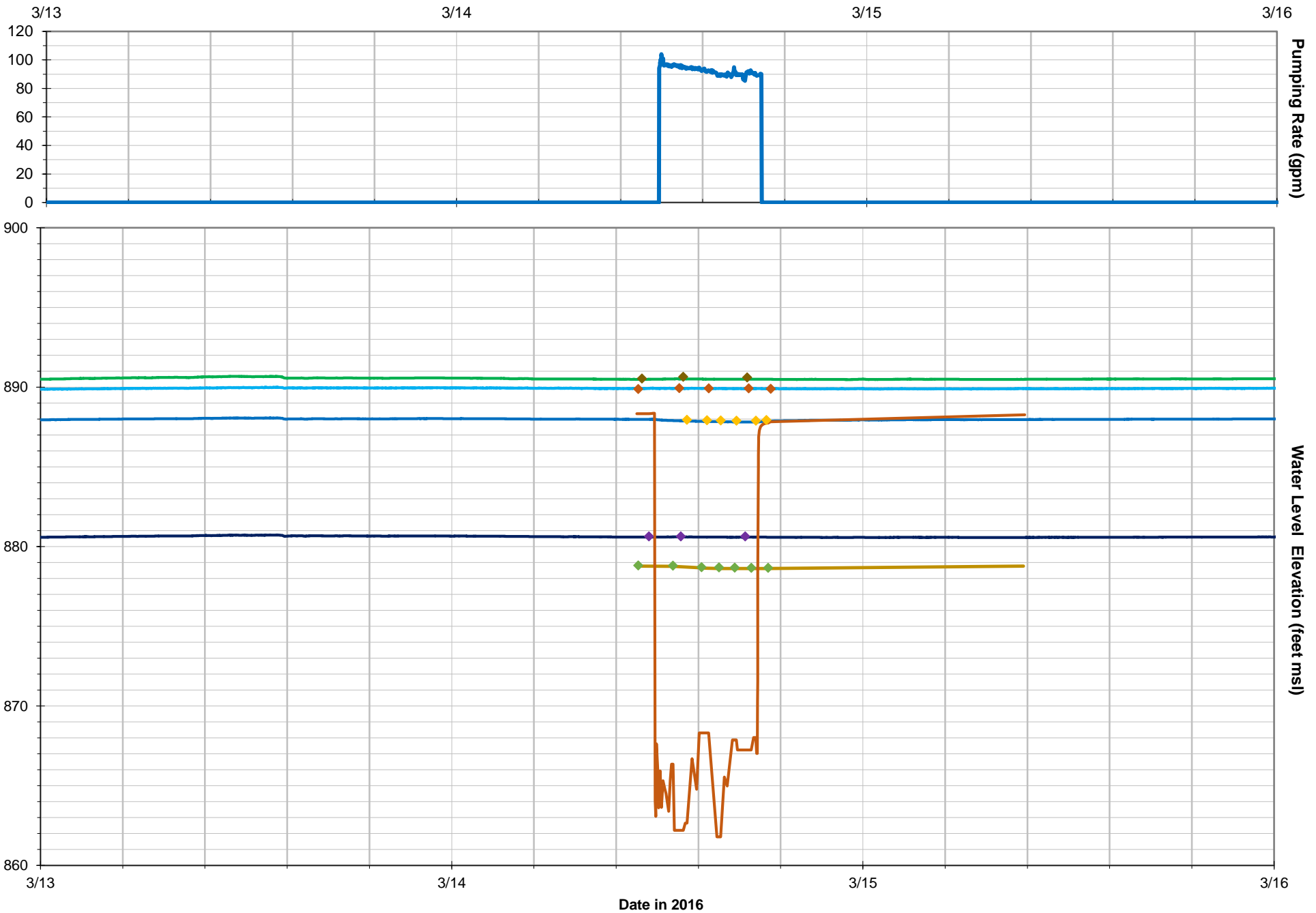
Sensor data

Manual data

**Figure A2. Well 5239 Test QA:
Sensor v Manual Data**

Eastside Milton-Freewater MAR / ASR
WWBWC





Well ID:

— 5225	— 161	— 5239	— 5232	— 5199	— 56140
◆ 5225	◆ 161	◆ 5239	◆ 5232	◆ 5199	

Sensor data

Manual data

**Figure A3. Well 56140 Test QA:
Sensor v Manual Data**

Eastside Milton-Freewater MAR / ASR
WWBWC



Table A3. Step-Rate Test Data, Well 1111 Test

Date / Time	Depth to Water (feet, bmp)	Pumping Rate, Jwave (gpm)	Note
11/7/2016 15:11:00	33.53	0.0	Static dtw
11/7/2016 15:14:00		7.7	Pump on
11/7/2016 15:15:00	34.18	↓	
11/7/2016 15:16:45	34.21		
11/7/2016 15:18:00	34.22		
11/7/2016 15:20:00		32.6	Q up
11/7/2016 15:21:00	37.00	↓	
11/7/2016 15:22:00	37.09		
11/7/2016 15:25:00	37.14		
11/7/2016 15:26:00	37.17		
11/7/2016 15:28:00		75.0	Q up
11/7/2016 15:29:00	44.00	↓	
11/7/2016 15:30:00	44.11		
11/7/2016 15:30:50	44.31		
11/7/2016 15:33:45	44.30		
11/7/2016 15:36:30			Pump off

Appendix B: Well Logs

Contents:

1. Cross Section A - A' Well Logs (UMAT....):
4566
4517
4581
4619
5656
56099
5805
GW_162
1111
GW_160
GW_152
6475
2. Cross Section B – B' Well Logs (UMAT....):
5197
5202
56217
5199
GW_161
56140
5239
5229
55991
5116
GW_152
3. Cross Section C – C' Well Logs (UMAT....):
5805
GW_162
GW_163
1111
4. Cross Section D – D' Well Logs (UMAT....):
5199
GW_161
56140
5239
5229
5225
5232

ORIGINAL
File Original and
Duplicate with the
STATE ENGINEER,
SALEM, OREGON

RECEIVED
NOV 5 1957
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT **UMAT 4517**
STATE OF OREGON

State Well No. **626N/35-25H V**
State Permit No. **382**

(1) OWNER:

Name **HENRY C STEWART**
Address **PI-Box 124
MILTON OREGON**

(2) LOCATION OF WELL:

County **umatilla** Owner's number, if any—
SE 1/4 NE 1/4 Section 25 T. 6 R. 35 W.M.
Bearing and distance from section or subdivision corner
**1580' South to 70' West from NE
Corner Section 25**

TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

(5) TYPE OF WELL:

Rotary Driven
Cable Jetted
Dug Bored

(6) CASING INSTALLED:

Threaded Welded
10 1/2" Diam. from 10' ft. to 34' ft. Gage
8" Diam. from 34' ft. to 45' ft. Gage *std pipe*

(7) PERFORATIONS:

Perforated? Yes No
Type of perforator used *cutting torch*
SIZE of perforations **1/4** in. by **1/4** in.
all Perforated

(8) SCREENS:

Well screen installed Yes No
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(9) CONSTRUCTION:

Well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.
Was a surface seal provided? Yes No To what depth? _____ ft.
Material used in seal—
Did any strata contain unusable water? Yes No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(10) WATER LEVELS:

Static level **10** ft. below land surface Date **Jan 20 1956**
Artesian pressure _____ lbs. per square inch Date _____

Log Accepted by:

[Signed] **Henry C Stewart** Date **Nov 4**, 1957
(Owner)

(11) WELL TESTS:

Drawdown is amount Water level is lowered below static level
Was a pump test made? Yes No If yes, by whom?
Yield: **120** gal./min. with **7** ft. drawdown after **5** hrs.
" " " " " "
" " " " " "
Bailer test **NO** gal./min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water **50** Was a chemical analysis made? Yes No

(12) WELL LOG:

Diameter of well **10** inches.
Depth drilled **45** ft. Depth of completed well **45** ft.
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
all gravel	from 10 ft	to Bottom of well
various size but mostly sand	to 1"	

Work started **Jan 20 1956** Completed **Feb 25 1957**

(13) PUMP:

Manufacturer's Name **PUMP PIPE + POWER CO**
Type: **SPRINKLER** H.P. **5HP**

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME **E M J Behrens** (Type or print)
Address **P.O. Box 111 Milton Ore**
Driller's well number _____

[Signed] _____ (Well Driller)
License No. _____ Date **11-4**, 1957

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM 10, OREGON
within 30 days from the date
of well completion.

RECEIVED
MAY 15 1968
STATE ENGINEER

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

UMAT
456de

State Well No. G^N/35-25
State Permit No. _____

(1) OWNER: SALEM, OREGON
Name M. L. Heidenrich
Address Route 1 - Box 122
Milton-Freewater, Oregon

(2) LOCATION OF WELL:
County Umatilla Driller's well number _____
1/4 Section 25 T. 6N R. 35 E. W.M.
Bearing and distance from section or subdivision corner _____

(3) TYPE OF WORK (check):
Well Deepening Reconditioning Abandon
Abandonment, describe material and procedure in Item 12.

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

(5) TYPE OF WELL:
Rotary Driven
Cable Jetted
Dug Bored

(6) CASING INSTALLED:
Threaded Welded
8" Diam. from 34 ft. to 187 ft. Gage 250
" Diam. from _____ ft. to _____ ft. Gage _____
" Diam. from _____ ft. to _____ ft. Gage _____

(7) PERFORATIONS:
Perforated? Yes No
Type of perforator used _____
Size of perforations in. by in.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.

(8) SCREENS:
Well screen installed Yes No
Manufacturer's Name _____ Model No. _____
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(9) CONSTRUCTION:
Well seal—Material used in seal _____
Depth of seal _____ ft. Was a packer used? _____
Diameter of well bore to bottom of seal _____ in.
Were any loose strata cemented off? Yes No Depth _____
Was a drive shoe used? Yes No
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.
Did any strata contain unusable water? Yes No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(10) WATER LEVELS:
Static level 10 ft. below land surface Date 4/14/63
Artesian pressure _____ lbs. per square inch Date _____

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom? Owner
Yield: 400 gal./min. with 5 ft. drawdown after 26 hrs.
" " " " " "
" " " " " "
" " " " " "
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water 52 Was a chemical analysis made? Yes No

(12) WELL LOG: Diameter of well below casing 8"
Depth drilled 187 ft. Depth of completed well 235 ft.
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Gravel, gray	48	51
Gray clay	51	77
Clay, yellow	77	90
Small gravel & gray clay	90	103
Gray clay	103	110
Red clay & fine sand	110	132
Gray clay	132	137
Gray clay & fine gravel	137	166
Blue clay & fine sand	166	235

Work started 3/20 1963. Completed 4/14 1963
Date well drilling machine moved off of well 4/14 1963

(13) PUMP:
Manufacturer's Name _____
Type: _____ H.P. _____

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME E. M. J. Behrens
(Person, firm or corporation) (Type or print)
Address P.O. Box 201 - Milton-Freewater, Oreg.
Drilling Machine Operator's License No. 124
[Signed] E.M.J. Behrens
(Water Well Contractor)
Contractor's License No. 229 Date 5/13, 1963.

STATE OF OREGON
WATER WELL REPORT
 (as required by ORS 537.765)

UMAT
 4581

JUN 06 1988

AUG - 5 1988

LA/35E-25

(1) OWNER:

Name Henry R Stewart
 Address 121 Box 124
 City Milton Freewater State OR Zip 97862

(2) TYPE OF WORK:

New Well Deepen Recondition Abandon

(3) DRILL METHOD

Rotary Air Rotary Mud Cable
 Other

(4) PROPOSED USE:

Domestic Community Industrial Irrigation
 Thermal Injection Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval Yes No Depth of Completed Well 80 ft.
 Explosives used Yes No Type _____ Amount _____

HOLE		SEAL		Amount
Diameter	From To	Material	From To	sacks or pounds
10	0 19	Bentonite	3 19	500
6	19 80			

How was seal placed: Method A B C D E

Other poured

Backfill placed from _____ ft. to _____ ft. Material _____

Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
6	1	59	290	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Liner: _____
 Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS:

Perforations Method NONE
 Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						<input type="checkbox"/>	<input type="checkbox"/>

(8) WELL TESTS: Minimum testing time is 1 hour

Pump Bailer Air Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
200		80	1 hr.

Temperature of water 57° Depth Artesian Flow Found _____

Was a water analysis done? Yes By whom NONE

Did any strata contain water not suitable for intended use? Too little

Salty Muddy Odor Colored Other NO

Depth of strata: _____

WATER RESOURCES DEPT. (9) LOCATION OF WELL by legal description:

County Umatilla Longitude _____
 Township 6 N or S, Range 35 E or W, WM.
 Section 25 A 0 1/4
 Tax Lot _____ Lot _____ Block _____ Subdivision _____
 Street Address of Well (or nearest address) same

(10) STATIC WATER LEVEL:

18 ft. below land surface. Date 4-20-88
 Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:

Depth at which water was first found 24

From	To	Estimated Flow Rate	SWL
24	36	10	

(12) WELL LOG:

Ground elevation _____

Material	From	To	SWL
Soil	0	6	
Clay & Gravel	6	24	
Sand Brn	24	36	
Cement Gravel	36	80	18

Date started 4-19-88 Completed 4-20-88

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

WWC Number _____
 Signed _____ Date _____

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 575
 Signed Charles J. Sumner Date 4-21-88

STATE ENGINEER
Salem, Oregon

UMAT
4619

Well Record

STATE WELL NO. 6N/35-25
COUNTY Umatilla
APPLICATION NO. GR-3838

OWNER: Ben M. Johnson

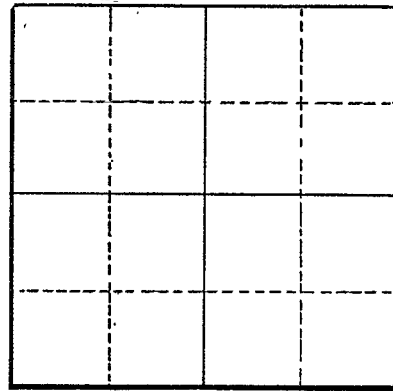
MAILING ADDRESS: Rt. 1, Box 125

LOCATION OF WELL: Owner's No. _____

CITY AND STATE: Milton-Freewater, Oregon

1/4 1/4 Sec. 25 T. 6 ^{N.} S., R. 35 ^{E.} W., W.M.

Bearing and distance from section or subdivision
corner 507 feet N. & 999 feet E. of center
of Sec. 25



Section 25

Altitude at well _____

TYPE OF WELL: Drilled Date Constructed 1915

Depth drilled 78 Depth cased 46

CASING RECORD:

6 3/4" steel from 0 to 46 feet

FINISH:

Unknown

AQUIFERS:

Unknown

WATER LEVEL:

16 feet

PUMPING EQUIPMENT: Type 3/2" centrifugal Fairbanks Morse H.P. 7 1/2
Capacity 250 G.P.M. Elec.

WELL TESTS:

Drawdown _____ ft. after _____ hours _____ G.P.M.

Drawdown _____ ft. after _____ hours _____ G.P.M.

USE OF WATER Irrigation Temp. _____ °F. _____, 19____

SOURCE OF INFORMATION GR-3838

DRILLER or DIGGER _____

ADDITIONAL DATA:

Log _____ Water Level Measurements _____ Chemical Analysis _____ Aquifer Test _____

REMARKS:

NOTICE TO WATER WELL CONTRACTOR

The original and first copy of this report are to be filed with the

WATER WELL REPORT

UMAT
5166

STATE ENGINEER, SALEM, OREGON 97310

within 30 days from the date of well completion.

RECEIVED

STATE OF OREGON
(Please type or print)

SEP 3 0 1975 Do not write above this line)

State Well No. 6N/36 E-17

State Permit No. _____

WATER RESOURCES DEPT.
SALEM, OREGON

(1) OWNER:

Name MARTIN BUCHANAN
Address Route #3 Stateline Rd.
Walla Walla, Wash. 99362

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Driven
Cable Jetted
Dug Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

CASING INSTALLED:

Threaded Welded
8" Diam. from 0 ft. to 106 ft. Gage 277
" Diam. from " ft. to " ft. Gage
" Diam. from " ft. to " ft. Gage

PERFORATIONS:

Perforated? Yes No

Type of perforator used _____

Size of perforations in. by in.
perforations from " ft. to " ft.
perforations from " ft. to " ft.
perforations from " ft. to " ft.

(7) SCREENS:

Well screen installed? Yes No

Manufacturer's Name _____
Type _____ Model No. _____
Diam. Slot size Set from " ft. to " ft.
Diam. Slot size Set from " ft. to " ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? Yes No If yes, by whom Contractor

Yield: 30 gal./min. with 32 ft. drawdown after 12 hrs.
20 " 24 " 12 "
" " " " "

Bafler test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m.

Temperature of water 62 Depth artesian flow encountered none ft.

(9) CONSTRUCTION:

Well seal—Material used cement grout
Well sealed from land surface to 105' ft.
Diameter of well bore to bottom of seal 12 in.
Diameter of well bore below seal 8 in.
Number of sacks of cement used in well seal 30 sacks
Number of sacks of bentonite used in well seal none sacks
Brand name of bentonite _____
Number of pounds of bentonite per 100 gallons of water _____ lbs./100 gals.
Was a drive shoe used? Yes No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? Yes No
Type of water? _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:

County Umatilla Driller's well number _____
Section 17 T. 6N R. 36 W.M.
Bearing and distance from section or subdivision corner _____

(11) WATER LEVEL: Completed well.

Depth at which water was first found 335-358 ft.
Static level 148 ft. below land surface. Date 9/19/75
Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG:

Diameter of well below casing 8"
Depth drilled 253 ft. Depth of completed well 358 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Top soil	0	50	
cement gravel	50	90	
Broken black rock	90	100	
Grey basalt	100	260	
Broken black basalt	260	295	
Broken brn. rock & clay	295	305	
Brkn. blk. rock & clay	305	315	
Brkn. blk., brn., & red rock, clay seams	315	335	
Brkn. blk rock (W.B.)	335	358	148

Work started 6/11 1975 Completed 9/19 1975
Date well drilling machine moved off of well 9/19/75 19

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] Thomas J. Parr Date 9/26, 1975
(Drilling Machine Operator)

Drilling Machine Operator's License No. 545

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name D. K. "DON" SMITH
(Person, firm or corporation) (Type or print)
Address Rt. 1 Box 116 Milton-Freewater, Ore

[Signed] D.K. Smith
(Water Well Contractor)

Contractor's License No. 204 Date 9/26/75, 19

**WATER WELL REPORT
STATE OF OREGON**

UMAT
5197

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APR 9 1984

State Well No. 6W/36E-30c6

WATER RESOURCES DEPT. State Permit No. _____
PLEASE TYPE or PRINT IN INK
SALEM, OREGON

(1) OWNER:

Name WAYNE HOCKETT
Address Rt 1 Box 148 D 2
City MILTON-FREEWATER State Ore

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Air Driven
Rotary Mud Dug
Cable Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other
Thermal Withdrawal Reinjection

(5) CASING INSTALLED:

Steel Threaded Plastic Welded
6" Diam. from 71 ft. to 59 ft. Gauge 0.250

LINER INSTALLED: None

(6) PERFORATIONS:

Perforated? Yes No
Type of perforator used _____
Size of perforations in. by in.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.

(7) SCREENS:

Well screen installed? Yes No
Manufacturer's Name _____ Model No. _____
Type _____
Diam. _____ Slot Size _____ Set from _____ ft. to _____ ft.
Diam. _____ Slot Size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level
W pump test made? Yes No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
Air test 100 gal./min. with drill stem at 123 ft. 1 hrs.
Bailer test gal./min. with ft. drawdown after hrs.
Discharge flow g.p.m.
Temperature of water 57° Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:

Special standards: Yes No
Well seal—Material used 16
Well sealed from land surface to _____ ft.
Diameter of well bore to bottom of seal _____ in.
Diameter of well bore below seal _____ in.
Number of sacks of cement used in well seal _____ sacks
How was cement grout placed?
Was pump installed? N.O. Type _____ HP _____ Depth _____ ft.
Was a drive shoe used? Yes No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? Yes No
Type of Water? _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:

County Umatilla Driller's well number _____
NW 1/4 SW 1/4 Section 30 T. 6N R. 36E W.M.
Tax Lot # _____ Lot _____ Blk _____ Subdivision _____
Address at well location: _____

(11) WATER LEVEL: Completed well.

Depth at which water was first found 110 ft.
Static level 12 ft. below land surface. Date _____
Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG:

Diameter of well below casing 6
Depth drilled 125 ft. Depth of completed well 125 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
GRAVEL	45	51	
BOTTOM GRAVEL	51	125	

Work started 3-21-1979 Completed 3-22-1979
Date well drilling machine moved off of well 3-22-1979

(unbonded) Water Well Constructor Certification (if applicable):
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] _____ Date _____, 19____

Bonded Water Well Constructor Certification:
Bond _____ Issued by: _____ Surety Company Name _____
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name LADD Horn Well Drilling
Address Rt 1 Box 148 Milton-Freewater, Ore 97868
[Signed] _____
Water Well Constructor
Date 3-30-1979

NOTICE TO WATER WELL CONSTRUCTOR
The original and first copy of this report
is to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

SP 45292-590

WATER WELL REPORT
STATE OF OREGON

WATER RESOURCES DEPARTMENT
SALEM, OREGON 97300
within 30 days from the date
of well completion.

(Please type or print)
(Do not write above this line)

State Well No. 6W/36E-30bb
State Permit No. _____

RECEIVED

UMAT 5199

JUN 15 1979

(1) OWNER:

Name L.E. Von Der Ahe
Address RT# 1 Box 145 SALEM, OREGON
Milton-Freewater, OR 97862

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Driven
Cable Jetted
Dug Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

CASING INSTALLED:

Threaded Welded
8" Diam. from plus 1 ft. to 130 ft. Gage 0.250
" Diam. from _____ ft. to _____ ft. Gage _____
" Diam. from _____ ft. to _____ ft. Gage _____

PERFORATIONS:

Perforated? Yes No.
Type of perforator used Torch
Size of perforations 3/8 in. by 14 in.
64 perforations from 90 ft. to 130 ft.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.

(7) SCREENS:

Well screen installed? Yes No
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " " "
" " " " "
Ballor test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water 54 Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:

Well seal—Material used Cement
Well sealed from land surface to 19 ft.
Diameter of well bore to bottom of seal 12 in.
Diameter of well bore below seal 8 in.
Number of sacks of cement used in well seal 5 sacks
How was cement grout placed? Pumped

Was a drive shoe used? Yes No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? Yes No
Type of water? _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:

County Umatilla Driller's well number _____
NW 1/4 NW 1/4 Section 30 T. 6N R. 36 E W.M.
Bearing and distance from section or subdivision corner _____

(11) WATER LEVEL: Completed well.

Depth at which water was first found 85 ft.
Static level 39 ft. below land surface. Date 3-3-79
Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG:

Diameter of well below casing 8
Depth drilled 150 ft. Depth of completed well 140 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
<u>Soil, Gravel</u>	<u>0</u>	<u>10</u>	
<u>Clay, Gravel Boulders</u>	<u>10</u>	<u>35</u>	
<u>Gravel, Boulders</u>	<u>35</u>	<u>85</u>	
<u>Cement Gravel & Boulders</u>	<u>85</u>	<u>150</u>	<u>39'</u>

RECEIVED

MAR 28 1979

WATER RESOURCES DEPT.
SALEM, OREGON

Work started 3-2-79 19 Completed 3-3-79 19
Date well drilling machine moved off of well 3-5-79 19

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] David Horn Date 3-7, 1979
(Drilling Machine Operator)
Drilling Machine Operator's License No. 1345

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name C.W. Summers Well Drilling
(Person, firm or corporation) (Type or print)
Address Rt # 73 Box 143-A-1 M & F OR 97862
[Signed] C.W. Summers
(Water Well Contractor)
Contractor's License No. 575 Date 3-7-79, 1979

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

WATER RESOURCES DEPARTMENT
SALEM, OREGON 97310
within 30 days from the date
of well completion.

UMAT
5700

WATER WELL REPORT

STATE OF OREGON

(Please type or print)

(Do not write above this line)

RECEIVED

APR 7 1977

Well No. *604/36E-30bc*

State Permit No. _____

WATER RESOURCES DEPT.
SALEM, OREGON

(1) OWNER:

Name *Virgel Ammons*
Address *Rt #1 Box 148-B
Milton Free Water, OR*

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Driven
Cable Jetted
Dug Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

(5) CASING INSTALLED:

Threaded Welded
6" Diam. from +1 1/2 ft. to 65 ft. Gage 0.250
" Diam. from _____ ft. to _____ ft. Gage _____
" Diam. from _____ ft. to _____ ft. Gage _____

(6) PERFORATIONS:

Perforated? Yes No.

Type of perforator used _____
Size of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

(7) SCREENS:

Well screen installed? Yes No

Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? Yes No If yes, by whom? *Same*
Flow: *60 gal./min. with 31 ft. drawdown after 1 hrs.*
" " " "
" " " "
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m.
Temperature of water *57°* Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:

Well seal—Material used _____
Well sealed from land surface to _____ ft.
Diameter of well bore to bottom of seal _____ in.
Diameter of well bore below seal _____ in.
Number of sacks of cement used in well seal _____ sacks
How was cement grout placed? _____

Was a drive shoe used? Yes No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? Yes No
Type of water? _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:

County *Umatilla* Driller's well number _____
SW 1/4 NW 1/4 Section 30 T. 6N R. 36E W.M.
Bearing and distance from section or subdivision corner _____

(11) WATER LEVEL: Completed well.

Depth at which water was first found *80 ft.*
Static level *32* ft. below land surface. Date _____
Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG:

Diameter of well below casing *6*

Depth drilled *105* ft. Depth of completed well *105* ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
<i>Cement, Gravel</i>	<i>45</i>	<i>52</i>	
<i>Clay, Gravel</i>	<i>52</i>	<i>61</i>	
<i>Cement, Gravel</i>	<i>61</i>	<i>105</i>	

Work started *3-22* 19 *77* Completed *3-25* 19 *77*
Date well drilling machine moved off of well *3-25* 19 *77*

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] *Clarence Sumner* Date *4-2*, 19 *77*
(Drilling Machine Operator)

Drilling Machine Operator's License No. *821*

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name *Suzy Mers Well Drilling*
(Person, firm or corporation) (Type or print)

Address *Rt #3 Box 143-A-1 MT, OR*

[Signed] *Clarence Sumner*
(Water Well Contractor)

Contractor's License No. *575* Date *4-2*, 19 *77*

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

WATER WELL REPORT RECEIVED

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date
of well completion.

STATE OF OREGON
(Please type or print)

JAN 5 1981 State Well No.

CON 36E-31bc

(Do not write above this line)

WATER RESOURCES DEPT
SALEM, OREGON

UMAD
5225

(1) OWNER:

Name Robert Leeper
Address 616 N EVANS
MILTON-FREEMAN, OR 97862

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Driven
 Jetted
 Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

(5) CASING INSTALLED:

Threaded Welded
10" Diam. from +1 ft. to 14 ft. Gage 250
8" Diam. from +1 1/2 ft. to 58 1/2 ft. Gage 250

(6) PERFORATIONS:

Perforated? Yes No.

Type of perforator used

Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:

Well screen installed? Yes No

Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

AIR test
a pump test made? Yes No If yes, by whom? some
Yield: 100 gal./min. with 3 ft. drawdown after 1 hrs.
" " " " "
" " " " "
Per test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.

Temperature of water 54 Depth artesian flow encountered ft.

(9) CONSTRUCTION:

Well seal—Material used Cement
Well sealed from land surface to 19 ft.
Diameter of well bore to bottom of seal 12 in.
Diameter of well bore below seal 8 in.
Number of sacks of cement used in well seal 8 sacks
How was cement grout placed? Pumped

Was a drive shoe used? Yes No Plugs Size: location ft.
Did any strata contain unusable water? Yes No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? Yes No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:

County Driller's well number
SW 1/4 NW 1/4 Section 31 T. 6N R. 36 E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.

Depth at which water was first found 70 ft.
Static level 54 ft. below land surface. Date 11-30-80
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing 8"

Depth drilled 100 ft. Depth of completed well 100 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Soil	0	15	
Gravel, Clay & Boulders	15	70	
Boulders	70	76	
Clay & Gravel	76	85	
Cement Gravel	85	100	54

Work started 11-25-1980 Completed 11-30-1980
Date well drilling machine moved off of well 11-30-1980

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] C. W. Lummus Date 12-29, 1980
(Drilling Machine Operator)

Drilling Machine Operator's License No. 821

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name Summers Well Drilling
(Person, firm or corporation) (Type or print)

Address Rt 3 Box 43 A1 Mt. St. OR

[Signed] C. W. Lummus
(Water Well Contractor)

Contractor's License No. 575 Date 12-29-1980

UMAT
5229

Well Record

OWNER: Lawrence W. Timmons

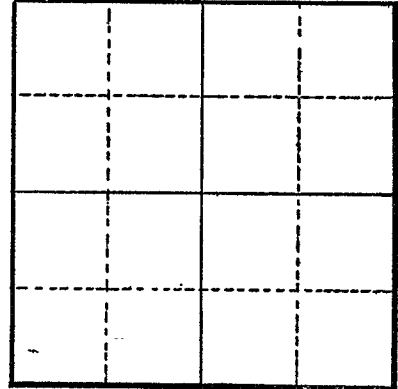
MAILING ADDRESS: RT. 1, Box 149

LOCATION OF WELL: Owner's No.

CITY AND STATE: Milton-Freewater, Oregon

1/4 1/4 Sec. 31 T. 6 N., R. 36 E., W.M.

Bearing and distance from section or subdivision corner



Section 31

Altitude at well

TYPE OF WELL: Dr. & DG Date Constructed 1927

Depth drilled 55 ft. Depth cased 20 ft.

CASING RECORD:

6 inch casing set in bottom of old dug well. 18 ft. below land surface.

FINISH:

Perforated

AQUIFERS:

WATER LEVEL:

18 ft.

PUMPING EQUIPMENT: Type Fairbanks Morse (Pressure system) H.P. 10
Capacity 400 G.P.M.

WELL TESTS:

Drawdown 4 ft. after _____ hours 400 G.P.M.

Drawdown _____ ft. after _____ hours _____ G.P.M.

USE OF WATER Dom. & irrigation Temp. _____ °F. 19.

SOURCE OF INFORMATION Belated registration statement

DRILLER or DIGGER Tom Walker

ADDITIONAL DATA:

Log _____ Water Level Measurements _____ Chemical Analysis _____ Aquifer Test _____

REMARKS:

Log: Black clay 0 to 15 ft.
Gravel 15 to 25 ft.
Yellow clay 25 to 35 ft.
Hard pan 35 to 50 ft.
Some coarse gravel-sand 50 to 55 ft.

RECEIVED
SEP 10 1961

UMAT
5232

STATE ENGINEER WATER WELL REPORT
SALEM, OREGON STATE OF OREGON

File Original and
First Copy with the
STATE ENGINEER,
SALEM, OREGON

State Well No. 6N/36-31 E
State Permit No.

(1) OWNER:
Name MARVIN TIMMONS
Address R1 Box 149
MILTON, Oregon

(2) LOCATION OF WELL:
County UMATILLA Owner's number, if any -
1/4 NW 1/4 Section T. 6N R. 36 E.W.M.
Bearing and distance from section or subdivision corner
From the SW corner of NW quarter
of sec. 31 664 ft East, then
180 ft North

(3) TYPE OF WORK (check):
New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 11.

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

(5) TYPE OF WELL:
Rotary Driven
Cable Jetted
Dug Bored

(6) CASING INSTALLED:
6" Diam. from 0 ft. to 46.5 ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? Yes No
Type of perforator used
SIZE of perforations in. by in.
..... perforations from ft. to ft.
..... perforations from ft. to ft.
..... perforations from ft. to ft.
..... perforations from ft. to ft.
..... perforations from ft. to ft.

(8) SCREENS:
Well screen installed Yes No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
In. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Was well gravel packed? Yes No Size of gravel:
Gravel placed from ft. to ft.
Was a surface seal provided? Yes No To what depth? ft.
Material used in seal -
Did any strata contain unusable water? Yes No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 46 ft. below land surface Date 9-4-61
Artesian pressure lbs. per square inch Date
Log Accepted by:
[Signed] Marvin Timmons Date 9-4, 1961
(Owner)

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 45 gal./min. with 2 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes No

(12) WELL LOG:
Diameter of well 6 inches.
Depth drilled 84 ft. Depth of completed well 84 ft.
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
SOIL - BROWN - SILTY	0	44
COARSE CONGLOMERATE	44	75
WATER - COURSE - MEDIUM - CONGLOMERATE	75	84

Work started Sept 9 1952 Completed Sept 16 1952

(13) PUMP:
Manufacturer's Name Peerless
Type Centrifugal H.P. 3

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME EARL G. SHORTRIDGE
(Person, firm, or corporation) (Type or print)
Address 19-3 BOX-348
MILTON - FREE WATER
Driller's well number
[Signed] Earl G. Shortridge
(Well Driller)
License No. 156 Date Sept 4 1961

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date
of well completion.

WATER WELL REPORT

STATE OF OREGON
(Please type or print)

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JUN - 6 1977

State Well No. 6N/36E-31bc

State Permit No. _____

UMAT
57239

(Do not write above this line) WATER RESOURCES DEPT.

SALEM, OREGON

(1) OWNER:

Name Mrs Lawrence Timmons
Address Rt #1 Box 149
Milton-Freewater, OR 97862

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Driven
Cable Jetted
Dug Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

CASING INSTALLED:

8" Diam. from 7.1 ft. to 6.4 ft. Gage 0.250
" Diam. from _____ ft. to _____ ft. Gage _____
" Diam. from _____ ft. to _____ ft. Gage _____

PERFORATIONS:

Perforated? Yes No.

Type of perforator used _____

Size of perforations in. by in.
6.4 perforations from 4.0 ft. to 6.0 ft.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.

(7) SCREENS:

Well screen installed? Yes No

Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? Yes No If yes, by whom?
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
" " " " "
" " " " "
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m.
Temperature of water _____ Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:

Well seal—Material used Ber to rite
Well sealed from land surface to _____ ft.
Diameter of well bore to bottom of seal 2.29 in.
Diameter of well bore below seal 8 in.
Number of sacks of cement used in well seal _____ sacks
How was cement grout placed?

Was a drive shoe used? Yes No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? Yes No
Type of water? _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:

County Umatilla Driller's well number _____
SW 1/4 NW 1/4 Section 31 T. 6N R. 36 E W.M.
Bearing and distance from section or subdivision corner _____

(11) WATER LEVEL: Completed well.

Depth at which water was first found 40 ft.
Static level 28 ft. below land surface. Date 5-18-77
Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG:

Diameter of well below casing 8
Depth drilled 87 ft. Depth of completed well 87 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Gravel & Boulders	25	27	
Gravel, med	27	40	
Gravel, cement	40	87	28

Work started 5-10-1977 Completed 5-17-1977
Date well drilling machine moved off of well 5-18-1977

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Charles W. Swann Date 5-23-1977
(Drilling Machine Operator)
Drilling Machine Operator's License No. 821

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name C.W. Swann Well Drilling
(Person, firm or corporation) (Type or print)
Address Rt #3 Box 143-A-1 7782, OR
[Signed] Charles W. Swann
(Water Well Contractor)
Contractor's License No. 575 Date 5-23-1977

STATE OF OREGON
WATER WELL REPORT
 (as required by ORS 537.765)

UMAT
 5656

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6N/35E/25ab
 (START CARD) # 30332

(1) OWNER:
 Name JERRY LARSON
 Address Rt 1 Box 125
 City McHone State OR Zip 97562

Well Number WATER RESOURCES
SALEM, OREGON

(9) LOCATION OF WELL by legal description:
 County Umatilla Latitude _____ Longitude _____
 Township 6 N of R, Range 35 E of W, WM.
 Section 25A 1/4 NE 1/4
 Tax Lot 900 Lot _____ Block _____ Subdivision _____
 Street Address of Well (or nearest address) same

(2) TYPE OF WORK:
 New Well Deepen Recondition Abandon

(3) DRILL METHOD
 Rotary Air Rotary Mud Cable
 Other _____

(4) PROPOSED USE:
 Domestic Community Industrial Irrigation
 Thermal Injection Other _____

(5) BORE HOLE CONSTRUCTION:
 Special Construction approval Yes No Depth of Completed Well 105 ft.
 Explosives used Yes No Type _____ Amount _____

HOLE			SEAL			Amount (sacks or pounds)
Diameter	From	To	Material	From	To	
14	0	19	13 in. diameter	0	19	27
10	19	105				

How was seal placed: Method A B C D E
 Other _____
 Backfill placed from _____ ft. to _____ ft. Material _____
 Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

Casing/Liner	Diameter	From	To	Gauge	Steel		Plastic		Welded		Threaded	
					□	□	□	□	□	□	□	□
Casing:	10	12	58	10.250	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Liner:	8	45	105		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Final location of shoe(s) 58

(7) PERFORATIONS/SCREENS:
 Perforations Method Sawed
 Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
65	105	3/16	240			<input type="checkbox"/>	<input checked="" type="checkbox"/>

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem at	Time
300		105	1 hr.

Temperature of water 57° Depth Artesian Flow Found _____
 Was a water analysis done? Yes By whom NO
 Did any strata contain water not suitable for intended use? Too little
 Salty Muddy Odor Colored Other _____
 Depth of strata: _____

(10) STATIC WATER LEVEL:
17 ft. below land surface. Date 3-23-92
 Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:
 Depth at which water was first found 72

From	To	Estimated Flow Rate	SWL
72	76	150	
90	105	150	17

(12) WELL LOG: Ground elevation _____

Material	From	To	SWL
Soil	0	3	
Soil & Gravel	3	14	
Boulders	14	17	
Cement Gravel	17	32	
Chal. Brn	32	41	
Cement Gravel	41	105	17

Date started 3-12-92 Completed 3-23-92

(unbonded) Water Well Constructor Certification:
 I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
 Signed _____ WWC Number _____
 Date _____

(bonded) Water Well Constructor Certification:
 I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
 Signed Clarence Sumner WWC Number 575
 Date 4-1-92

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

umat 5805
Start Card # W 26411

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6N/35E/36ab

PLEASE TYPE OR PRINT WATER RESOURCES DEPT. (for official use only)

(1) OWNER:
Name *Muriel Stolz*
Address *Rt 1 Box 136 D*
City *Milton Freewater* State *ORE*

(2) TYPE OF WORK (check):
New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL: (4) PROPOSED USE (check):
Rotary Air Driven Domestic Industrial Municipal
Rotary Mud Dug Irrigation Thermal: Withdrawal ReInjection
Cable Bored Piezometric Grounding Test

(5) CASING INSTALLED: Steel Plastic
Threaded Welded
" Diam. from ft. to ft. Gauge

LINER INSTALLED: Steel Plastic
Threaded Welded
6" Diam. from *-4* ft. to *233* ft. Gauge

(6) PERFORATIONS: Perforated? Yes No
Size of perforations *1026* in. by *7* in.
..... perforations from *65* ft. to *233* ft.
..... perforations from ft. to ft.
..... perforations from ft. to ft.

(7) SCREENS: Well screen installed? Yes No
Manufacturer's Name Model No.
Type Diam. Slot Size Set from ft. to ft.
Diam. Slot Size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom? *Driller*
Yield: *275* gal./min. with *163* ft. drawdown after *4* hrs.
Air test gal./min. with drill stem at ft. hrs.
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water *53°* Depth artesian flow encountered ft.

(9) CONSTRUCTION: Special standards: Yes No
Well seal—Material used ft.
Well sealed from land surface to ft.
Diameter of well bore to bottom of seal in.
Diameter of well bore below seal in.
Amount of sealing material sacks pounds
How was cement grout placed?
Was pump installed? Type HP Depth ft.
Was a drive shoe used? Yes No Plugs Size: location ft.
Did any strata contain unusable water? Yes No
Type of Water? depth of strata
Method of sealing strata off
Was well gravel packed? Yes No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL by legal description:
County *Umatilla* NW 1/4 NE 1/4 of Section *36* of
Township *6N* Range *35E* W.M.
(Township is North or South) (Range is East or West)
Tax Lot Lot Block Subdivision
MAILING ADDRESS OF WELL (or nearest address) *Rt 1 Box 136 D*
M-F, ORE

(11) WATER LEVEL of COMPLETED WELL:
Depth at which water was first found *22* ft.
Static level *22* ft. below land surface. Date *3-26-93*
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing *8"*
Depth drilled *58* ft. Depth of completed well *233* ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
<i>Brown silt & gravel</i>	<i>175</i>	<i>217</i>	<i>37</i>
<i>Brown silt & cobbles</i>	<i>217</i>	<i>230</i>	<i>22</i>
<i>Blue clay</i>	<i>230</i>	<i>233</i>	

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WATER RESOURCES DEPT.
SALEM, OREGON

Date work started *3-18-93* / completed *3-26-93*
Date well drilling machine moved off of well *3-26* 19 *93*

(unbonded) Water Well Constructor Certification (if applicable):
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] *Donald J. Harding* Date *3-26*, 19 *93*

(bonded) Water Well Constructor Certification:
Bond # *30382213* Issued by: *FIDELITY + DEPOSIT Co.*
(number) (Surety Company Name)
On behalf of *Harding Drilling Co.*
(type or print name of Water Well Constructor)

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
(Signed) *Raymond Harding*
(Water Well Constructor)
(Dated) *3-26-93*

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date
of well completion.

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STATE OF OREGON
WATER RESOURCES DEPT
SALEM, OREGON
APR 20 1981

PAGE #1.
State Well No. 6W 35E-36bc
State Permit No. _____

(1) OWNER:
Name Sam LeFore
Address Rt.1 Box 174 East side Rd.
Milton Freewater Oregon.

(2) TYPE OF WORK (check):
New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL: (4) PROPOSED USE (check):
Rotary Driven Domestic Industrial Municipal
Cable Jetted Irrigation Test Well Other
Dug Bored

(5) CASING INSTALLED:
10 " Diam. from 0 ft. to 40 ft. Threaded Welded
8 " Diam. from 20 ft. to 240 ft. Gage 0250
" Diam. from _____ ft. to _____ ft. Gage SCH 160

(6) PERFORATIONS:
Perforated? Yes No.
Type of perforator used Whole Saw
Size of perforations 1 in. by 1 in.
500 perforations from 100 ft. to 240 ft.

(7) SCREENS:
Well screen installed? Yes No
Manufacturer's Name _____ Model No. _____
Type _____ Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom?
Yield: 450 gal./min. with 26 ft. drawdown after 4 hrs.
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m.
Temperature of water 54 Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:
Well seal—Material used Cement
Well sealed from land surface to 28 ft.
Diameter of well bore to bottom of seal 12 in.
Diameter of well bore below seal 10 in.
Number of sacks of cement used in well seal 23 sacks
How was cement grout placed? pumped
Was a drive shoe used? Yes No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? Yes No
Type of water _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:
County Umitilla Driller's well number _____
SW 1/4 NN 1/4 Section 36 T. 6 R. 35E W.M.
Bearing and distance from section or subdivision corner
Tax Lot 1400 RT 1B 174
East side Rd

(11) WATER LEVEL: Completed well.
Depth at which water was first found 80 ft.
Static level 100 ft. below land surface. Date Jan 29-81
Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG: Diameter of well below casing 10
Depth drilled 243 ft. Depth of completed well 240 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Brown loam top soil	0	23	
Tan clay and boulders loose and cavy	23	34	
Brown hard pan with 2" to 4" rocks hard.	34	56	
Boulders 1 ft and larger in hard pan tan and brown in color.	56	68	
Yellow clay small gravel simi soft with a trace of sand in the clay.	68	79	
Blue clay muck	79	81	
Yellow sandy hard pan porous and waterbearing.	81	151	
Dark brown clay and gravel 1"-3" Soft.	151	159	
Grey clay Soft	159	164	
Black basalt	164	184	
Blue clay	184	223	continue

Work started 1-26-81 19 _____ Completed 1-29-81 19 _____
Date well drilling machine moved off of well 1-29-81 19 _____

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] _____ Date 1-29-81
(Drilling Machine Operator)
Drilling Machine Operator's License No. 1298

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Goral LaPorte Well Drilling
(Person, firm or corporation) (Type or print)
Address RR Rt 1 Box 101 M.F. Oregon
[Signed] _____
(Water Well Contractor)
Contractor's License No. 756 Date 1-29-81, 19 _____

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

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WATER WELL REPORT

Page # 2

APR 20 1981
WATER RESOURCES DEPARTMENT
SALEM, OREGON 97310

STATE OF OREGON
(Please type or print)

State Well No. 621/35E-36bc

WATER RESOURCES DEPT.
SALEM, OREGON
(Do not write above this line)

State Permit No.

(1) OWNER:

Name Sam LeFore Page # 2
Address

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Driven
Cable Jetted
Dug Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

CASING INSTALLED:

Threaded Welded
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

PERFORATIONS:

Perforated? Yes No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:

Well screen installed? Yes No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " " " "
" " " " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:

Well seal—Material used
Well sealed from land surface to ft.
Diameter of well bore to bottom of seal in.
Diameter of well bore below seal in.
Number of sacks of cement used in well seal sacks
How was cement grout placed?

Was a drive shoe used? Yes No Plugs Size: location ft.
Did any strata contain unusable water? Yes No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? Yes No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:

County Umatilla Driller's well number
SW 1/4 NW 1/4 Section 36 T. 6 R. 35E W.M.
Bearing and distance from section or subdivision corner
Tax lot 1400 Rt 1 Box 174
East side Rd

(11) WATER LEVEL: Completed well.

Depth at which water was first found ft.
Static level ft. below land surface. Date
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing
Depth drilled ft. Depth of completed well ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Continued from Page # 1.			
Broken Black basalt mixed with soft blue clay and small gravel	223	225	
Hard black basalt	225	226	
Broken black basalt with streaks of red and black cinder and lava rock in layers. Water bearing	226	233	
hard black basalt dense	233	235	
Broken and very porous lava rock water bearing			
very cavy	235	243	

Work started 19 _____ Completed 19 _____
Date well drilling machine moved off of well 19 _____

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] _____ Date 1-29-81, 19____
(Drilling Machine Operator)
Drilling Machine Operator's License No. 1298

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Goral M. LaPorte Well Drilling.
(Person, firm or corporation) (Type or print)
Address Rt 1 Box 401 M.F. Oregon
[Signed] _____ (Water Well Contractor)
Contractor's License No. 756 Date 1-29-81, 19____

STATE OF OREGON
WATER SUPPLY WELL REPORT
 (as required by ORS 537.765)

WELL I.D. # L82234
 START CARD # W194802

Instructions for completing this report are on the last page of this form.

(1) **LAND OWNER** Well Number _____
 Name JERRY ERB
 Address 84137 KIEL LANE
 City Milton Freewater State ORE Zip 97862

(2) **TYPE OF WORK**
 New Well Deepening Alteration (repair/recondition) Abandonment

(3) **DRILL METHOD:**
 Rotary Air Rotary Mud Cable Auger
 Other _____

(4) **PROPOSED USE:**
 Domestic Community Industrial Irrigation
 Thermal Injection Livestock Other _____

(5) **BORE HOLE CONSTRUCTION:**
 Special Construction approval Yes No Depth of Completed Well 123 ft.
 Explosives used Yes No Type _____ Amount _____

HOLE			SEAL			Back or pounds
Diameter	From	To	Material	From	To	
<u>10</u>	<u>0</u>	<u>24</u>	<u>Concrete</u>	<u>0</u>	<u>24</u>	<u>79</u>
<u>6</u>	<u>24</u>	<u>123</u>				

How was seal placed: Method A B C D E
 Other Poured
 Backfill placed from _____ ft. to _____ ft. Material _____
 Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) **CASING/LINER:**

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	<u>6</u>	<u>+1</u>	<u>80</u>	<u>.250</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Liner:	<u>5</u>	<u>74</u>	<u>123</u>	<u>1120</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Drive Shoe used Inside Outside None
 Final location of shoe(s) 80

(7) **PERFORATIONS/SCREENS:**
 Perforations Method Skill saw
 Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
<u>74</u>	<u>123</u>	<u>7-1/8</u>	<u>200</u>	<u>5"</u>		<input type="checkbox"/>	<input checked="" type="checkbox"/>

(8) **WELL TESTS: Minimum testing time is 1 hour**

Yield gal/min	Drawdown	Drill stem at	Time
<u>25</u>	<u>0</u>		<u>1</u> hr.

Temperature of water 57° Depth Artesian Flow Found _____
 Was a water analysis done? Yes By whom _____
 Did any strata contain water not suitable for intended use? Too little
 Salty Muddy Odor Colored Other _____
 Depth of strata: _____

(9) **LOCATION OF WELL by legal description:**
 County Umatilla Latitude _____ Longitude _____
 Township 6 or S Range 35 or W. WM.
 Section 36A SE 1/4 NE 1/4
 Tax Lot 02404 Lot _____ Block _____ Subdivision _____
 Street Address of Well (or nearest address) 84137 Kiel Lane

(10) **STATIC WATER LEVEL:**
69 ft. below land surface. Date 8-16-07
 Artesian pressure _____ lb. per square inch Date _____

(11) **WATER BEARING ZONES:**
 Depth at which water was first found _____

From	To	Estimated Flow Rate	SWL
<u>68</u>	<u>123</u>	<u>75</u>	<u>68</u>

(12) **WELL LOG:**
 Ground Elevation _____

Material	From	To	SWL
<u>Soil</u>	<u>0</u>	<u>24</u>	
<u>Gravel</u>	<u>24</u>	<u>62</u>	
<u>Clay + Gravel</u>	<u>62</u>	<u>68</u>	
<u>Sandy Gravel</u>	<u>68</u>	<u>74</u>	<u>68</u>
<u>Clay + Gravel</u>	<u>74</u>	<u>78</u>	<u>68</u>
<u>Gravel</u>	<u>78</u>	<u>123</u>	<u>68</u>

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AUG 23 2007

WATER RESOURCES DEPT
 SALEM, OREGON

Date started 8-2-07 Completed 8-16-07

(unbonded) **Water Well Constructor Certification:**
 I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
 Signed Blake Harding WWC Number 1869 Date 8-20-07

(bonded) **Water Well Constructor Certification:**
 I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
 Signed Mike Harding WWC Number 1639 Date 8-20-07

Umat
56099

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537 765)

WELL I.D. # L 82241
START CARD # W194812

Instructions for completing this report are on the last page of this form.

(1) LAND OWNER Well Number: _____
Name CHARLES ROBERTSON
Address 84500 EASTSIDE ROAD
City MULTON FREEWATER State ORE Zip 97862

(2) TYPE OF WORK
 New Well Deepening Alteration (repair/recondition) Abandonment

(3) DRILL METHOD:
 Rotary Air Rotary Mud Cable Auger
 Other _____

(4) PROPOSED USE:
 Domestic Community Industrial Irrigation
 Thermal Injection Livestock Other _____

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes No Depth of Completed Well 92 ft.
Explosives used Yes No Type _____ Amount _____

HOLE			SEAL			Material	From	To	Sack or pounds
Diameter	From	To	From	To					
10	0	21	3/4 Bentonite	0	21				24
6	21	92							

How was seal placed: Method A B C D E

Other Poured
Backfill placed from _____ ft. to _____ ft. Material _____
Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	1 1/2	68.5	1.250	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Liner:	5	62	92	.250	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Drive Shoe used Inside Outside None
Final location of shoe(s) 69.5

(7) PERFORATIONS/SCREENS:
 Perforations Method SKILL SAW
 Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
62	92	1/8 x 7	120	5"	1120	<input type="checkbox"/>	<input checked="" type="checkbox"/>

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem at	Flowing Time
25	0		1 hr

Temperature of water 55° Depth Artesian Flow Found _____
Was a water analysis done? Yes By whom _____
Did any strata contain water not suitable for intended use? Too little
 Salty Muddy Odor Colored Other _____
Depth of strata: _____

(9) LOCATION OF WELL by legal description:
County Umatilla Latitude _____ Longitude _____
Township 6 or S Range 35 or W. WM.
Section 36 NW 1/4 NE 1/4
Tax Lot 1001 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address) 84500 Eastside Rd

(10) STATIC WATER LEVEL:
45 ft. below land surface. Date 3-6-08
Artesian pressure _____ lb. per square inch Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found 56

From	To	Estimated Flow Rate	SWL
56	92	50	45

(12) WELL LOG:
Ground Elevation _____

Material	From	To	SWL
Soil and Cobbles	0	25	
Cemented Gravel	25	56	
Sand	56	63	45
Gravel-water	63	92	45

Date started 3-22-08 Completed 4-6-08

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
Signed Blake Harding WWC Number 1869 Date 3-7-08

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
Signed Mike Harding WWC Number 1639 Date 3-8-08

UMAT 56140

**STATE OF OREGON
WATER SUPPLY WELL REPORT**

(as required by ORS 537.765 & OAR 690-205-0210)

WELL LABEL # L 82245

START CARD # W194814

Instructions for completing this report are on the last page of this form.

(1) LAND OWNER Owner Well I.D. _____
 First Name _____ Last Name _____
 Company VONDERAHE, Inc.
 Address 401 PARKVIEW STREET
 City MILTON FREEWATER State ORE Zip 97862

(2) TYPE OF WORK New Well Deepening Conversion
 Alteration (repair/recondition) Abandonment

(3) DRILL METHOD
 Rotary Air Rotary Mud Cable Auger Cable Mud
 Reverse Rotary Other _____

(4) PROPOSED USE Domestic Irrigation Community
 Industrial/Commercial Livestock Dewatering Injection
 Thermal Other _____

(5) BORE HOLE CONSTRUCTION Special Standard: Yes (attach copy)
 Depth of Completed Well: 85 ft.

BORE HOLE			SEAL			Amount	GCS/lbs
Dia	From	To	Material	From	To		
12	0	19	Bentonite	0	19	35	
8	19	185					

How was seal placed: Method A B C D E
 Other Poured
 Backfill placed from _____ ft. to _____ ft. Material _____
 Filter pack from _____ ft. to _____ ft. Material _____ Size _____
 Explosives used: Yes Type _____ Amount _____

(6) CASING/LINER

Csng	Lintr	Dia	+	From	To	Gauge	Steel	Plastic	Welded	Thrd
X		8	X	2	99	.250	X		X	

Shoe Inside Outside Other Location of shoe(s) 99
 Temporary casing Yes Diameter _____ From _____ To _____

(7) PERFORATIONS/SCREENS
 Perforations Method Touch
 Screens Type _____ Material _____

Perf	Scrm	Csng	Lintr	Screen Dia	From	To	Screen/slot width	Slot length	# of slots	Tele/pipe size
X	X			8	41	95	1/4	7	216	

(8) WELL TESTS: Minimum testing time is 1 hour
 Pump Bailer Air Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
75	7	100	4
100	49	100	4 1/2

Temperature 54 °F Lab analysis Yes By _____
 Water quality concerns? Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)
 County Umatilla Twp 6 or S Range 36 or W W.M.
 Sec 31 NW 1/4 of the NW 1/4 Tax Lot 6900
 Tax Map Number _____ Lot _____
 Lat _____ " or _____ DMS or DD
 Long _____ " or _____ DMS or DD
 Street Address of Well (or nearest address)
84387 GRANT ROAD

(10) STATIC WATER LEVEL

Existing Well/Predeepening	Date	SWL (psi)	+	SWL (ft)
Completed Well	<u>4-21-08</u>			<u>41</u>

Flowing Artesian? Yes Dry Hole? Yes

WATER BEARING ZONES Depth water was first found 41

SWL Date	From	To	Est Flow	SWL (psi)	+	SWL (ft)
<u>4-18-09</u>	<u>41</u>	<u>100</u>	<u>100gpm</u>			<u>41</u>

(11) WELL LOG Ground Elevation _____

Material	From	To
Top soil	0	1
cobbles	1	48
gravel-sand	48	70
gravel-Brown clay	70	110
Brown clay	110	161
gray clay-sand	161	185

RECEIVED

MAY 29 2008

WATER RESOURCES DEPT.

SALEM, OREGON

Date Started 3-31-08 Completed 4-21-08

(unbonded) Water Well Constructor Certification
 I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1869 Date 4-21-08
 Signed Blake Harding

(bonded) Water Well Constructor Certification
 I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1639 Date 4-25-08
 Signed Mike Harding
 Contact Info. (optional)

STATE OF OREGON
WATER SUPPLY WELL REPORT

(as required by ORS 537.765 & OAR 690-205-0210)

WELL LABEL # L 95901

START CARD # W 194821

Instructions for completing this report are on the last page of this form.

(1) LAND OWNER Owner Well I.D. _____
 First Name Shannon Last Name Brownie
 Company _____
 Address 84672 GRANT ROAD
 City Milton Freewater State ORE Zip 97862

(2) TYPE OF WORK New Well Deepening Conversion
 Alteration (repair/recondition) Abandonment

(3) DRILL METHOD
 Rotary Air Rotary Mud Cable Auger Cable Mud
 Reverse Rotary Other _____

(4) PROPOSED USE Domestic Irrigation Community
 Industrial/Commercial Livestock Dewatering Injection
 Thermal Other _____

(5) BORE HOLE CONSTRUCTION Special Standard: Yes (attach copy)
 Depth of Completed Well 162 ft.

BORE HOLE			SEAL			Amount (Sck)/lbs
Dia	From	To	Material	From	To	
10"	0	25	Bentonite	0	25	14
6"	25	162				

How was seal placed: Method A B C D E
 Other pooured
 Backfill placed from _____ ft. to _____ ft. Material _____
 Filter pack from _____ ft. to _____ ft. Material _____ Size _____
 Explosives used: Yes Type _____ Amount _____

(6) CASING/LINER

Csng	Linr	Dia	+	From	To	Gauge	Steel	Plastic	Welded	Thrd
X		6"	X	1.5	69	1250	X		X	
	X	5"		60	162	1250		X	X	

Shoe Inside Outside Other Location of shoe(s) 69'
 Temporary casing Yes Diameter _____ From _____ To _____

(7) PERFORATIONS/SCREENS
 Perforations Method SKILSAW
 Screens Type _____ Material _____

Perf	Scrn	Csng	Linr	Screen Dia	From	To	Screen slot width	Slot length	# of slots	Tele/pipe size
X			X		70'	162	1/8"	7"	352	5"

(8) WELL TESTS: Minimum testing time is 1 hour
 Pump Bailer Air Flowing Artesian
 Yield gal/min 50 gpm Drawdown 6 Drill stem/Pump depth 130 Duration (hr) 2 hrs

Temperature 57 °F Lab analysis Yes By _____
 Water quality concerns? Yes (describe below)
 From _____ To _____ Description _____
RECEIVED
SEP 02 2008
WATER RESOURCES DEPT

(9) LOCATION OF WELL (legal description)
 County Umatilla Twp 60 or S Range 36 or W W.M.
 Sec 30 NW 1/4 of the SW 1/4 Tax Lot 1400
 Tax Map Number _____ Lot _____
 Lat _____ " or _____ DMS or DD
 Long _____ " or _____ DMS or DD
 Street Address of Well (or nearest address) 84672 Grant Road

(10) STATIC WATER LEVEL

Existing Well/Predeepening	Date	SWL (psi)	+	SWL (ft)
<u>Completed Well</u>	<u>8-21-08</u>			<u>63'</u>

Flowing Artesian? Yes Dry Hole? Yes

WATER BEARING ZONES Depth water was first found _____

SWL Date	From	To	Est Flow	SWL (psi)	+	SWL (ft)
<u>8-21-08</u>	<u>70</u>	<u>155</u>	<u>50 gpm</u>			<u>63'</u>

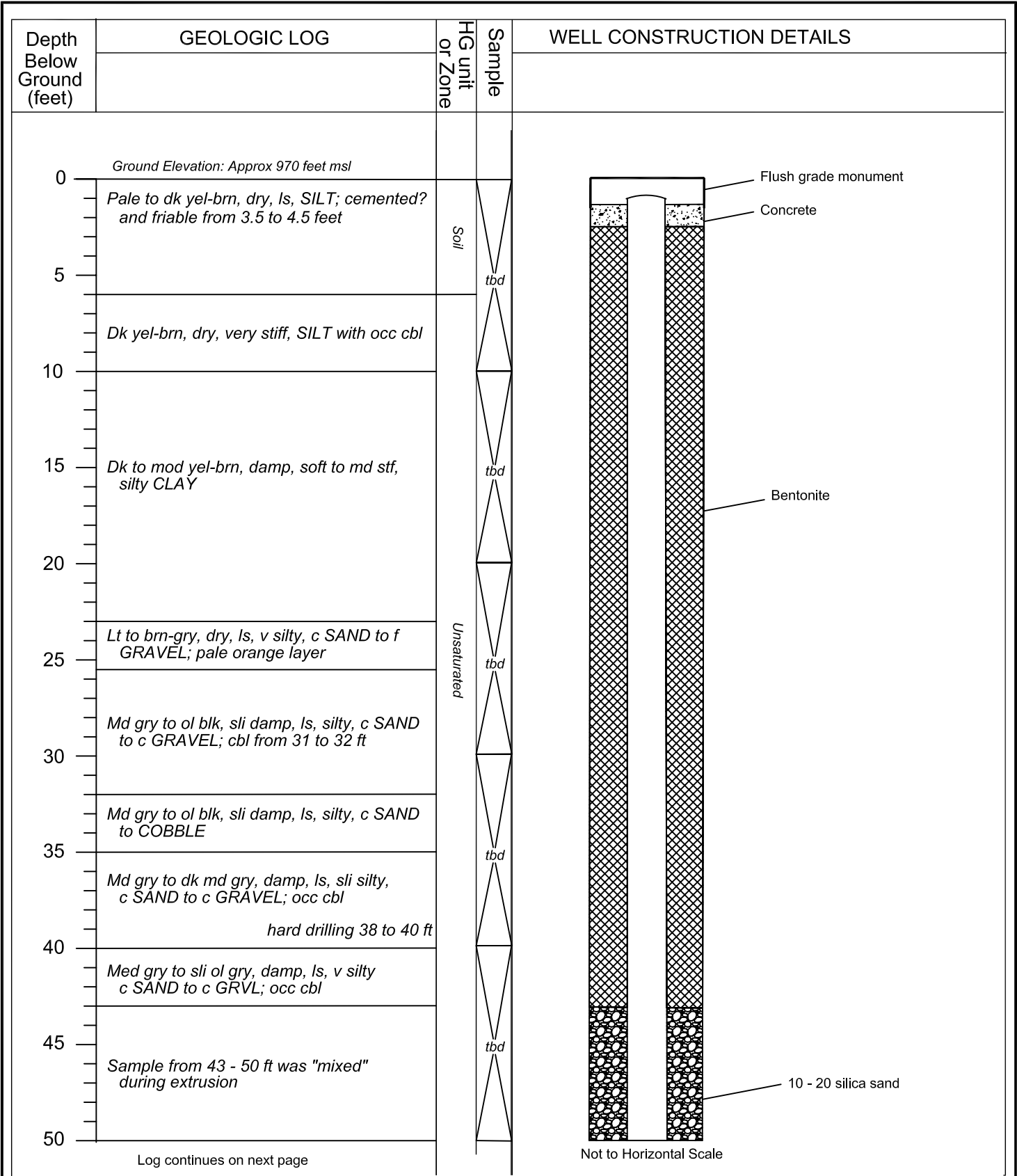
(11) WELL LOG Ground Elevation _____

Material	From	To
<u>Topsoil</u>	<u>0</u>	<u>7</u>
<u>clay-Brown</u>	<u>7</u>	<u>32</u>
<u>gravel-small clay Br</u>	<u>32</u>	<u>48</u>
<u>gravel-med</u>	<u>48</u>	<u>106</u>
<u>clay-Brown-gravel-sm</u>	<u>106</u>	<u>125</u>
<u>gravel-med sm</u>	<u>125</u>	<u>155</u>
<u>clay-Br-red-gravel-sm</u>	<u>155</u>	<u>162</u>

Date Started 8-6-08 Completed 8-21-08

(unbonded) Water Well Constructor Certification
 I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
 License Number 1589 Date 8-26-08
 Signed Gerald L. Harding

(bonded) Water Well Constructor Certification
 I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
 License Number 1639 Date 8-26-08
 Signed Mike Harding
 Contact Info. (optional) _____



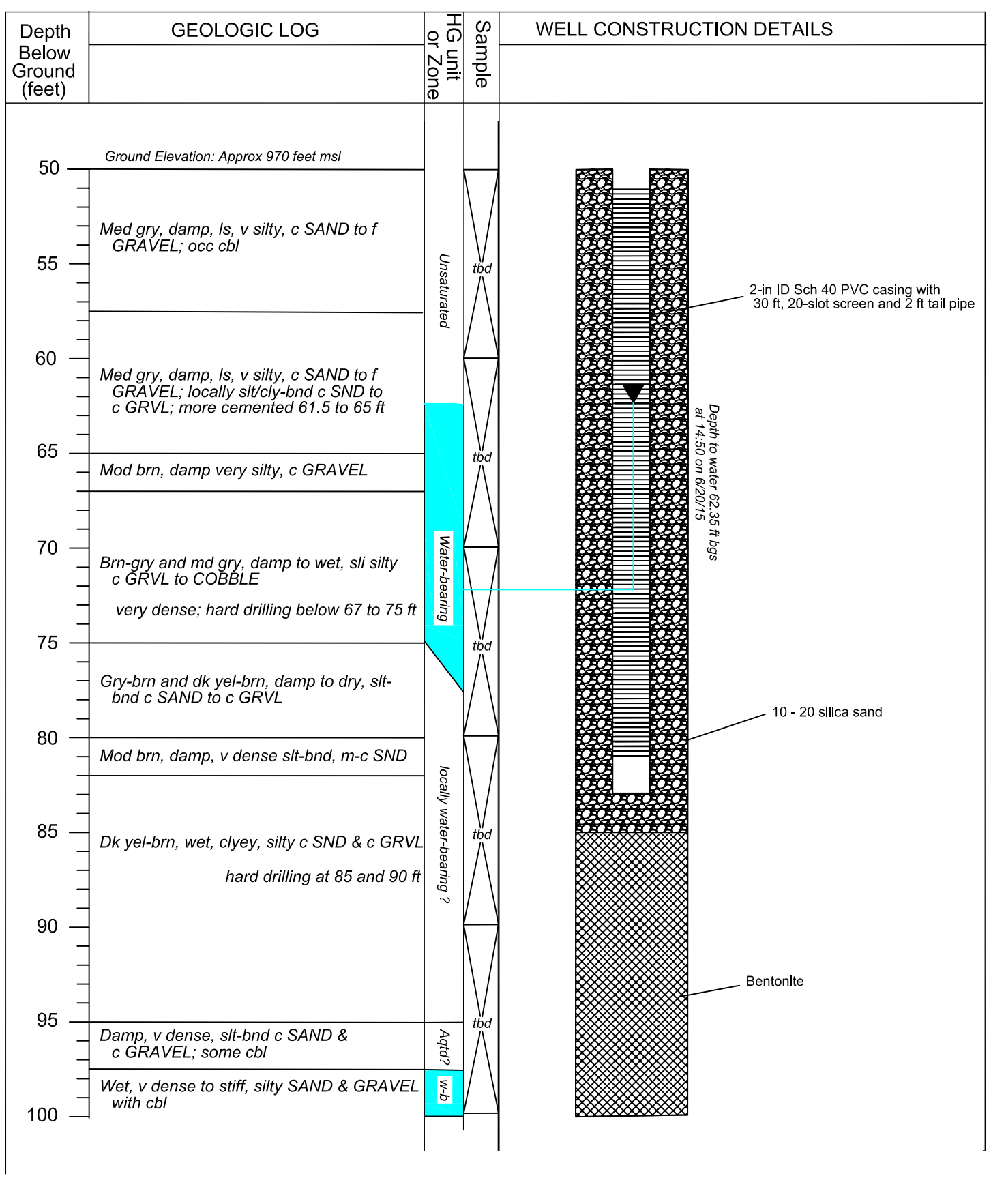
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka LF-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 1 of 3)
 GW_152 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

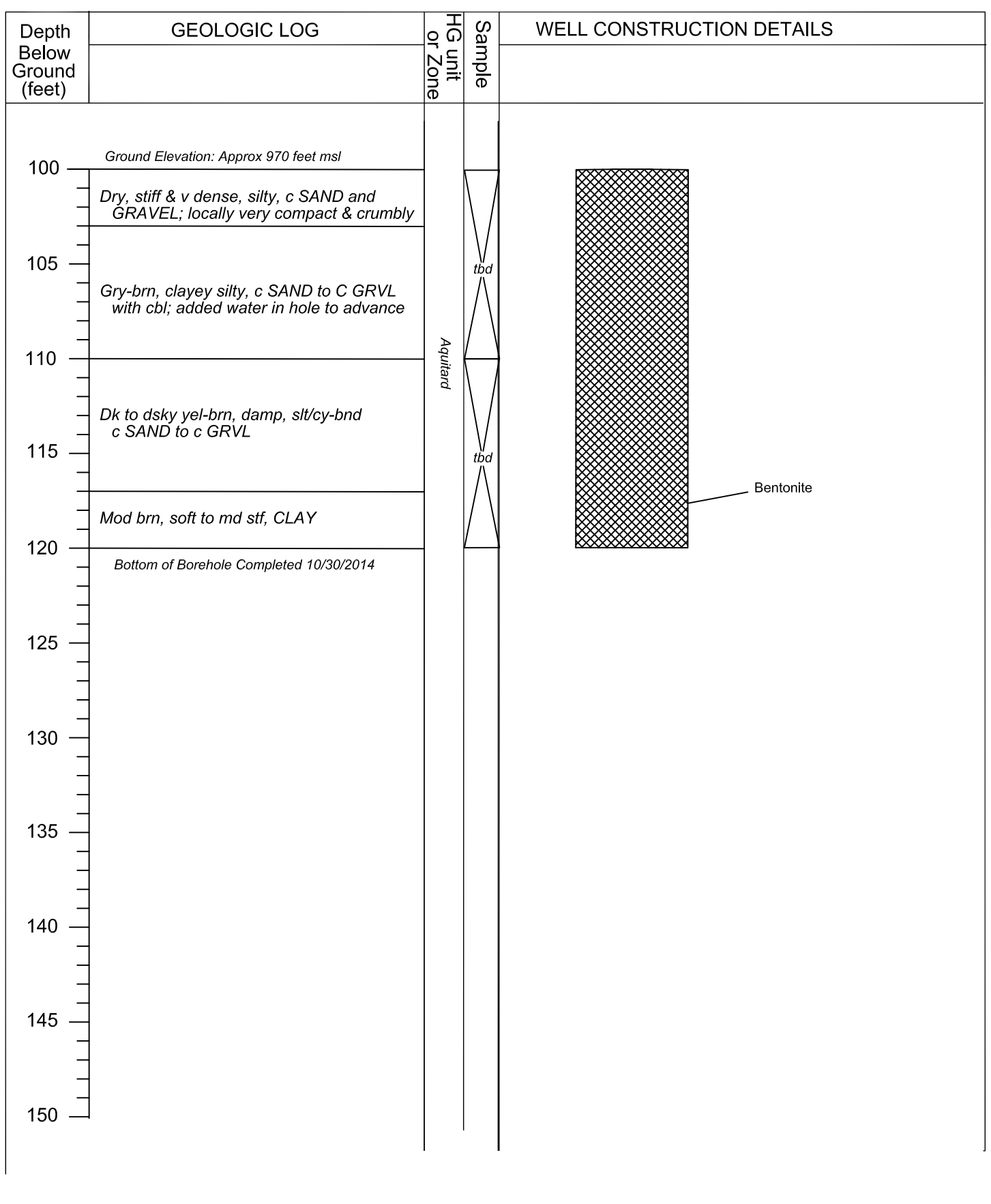
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_152; aka LF-1
 WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 2 of 3)
 GW_152 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





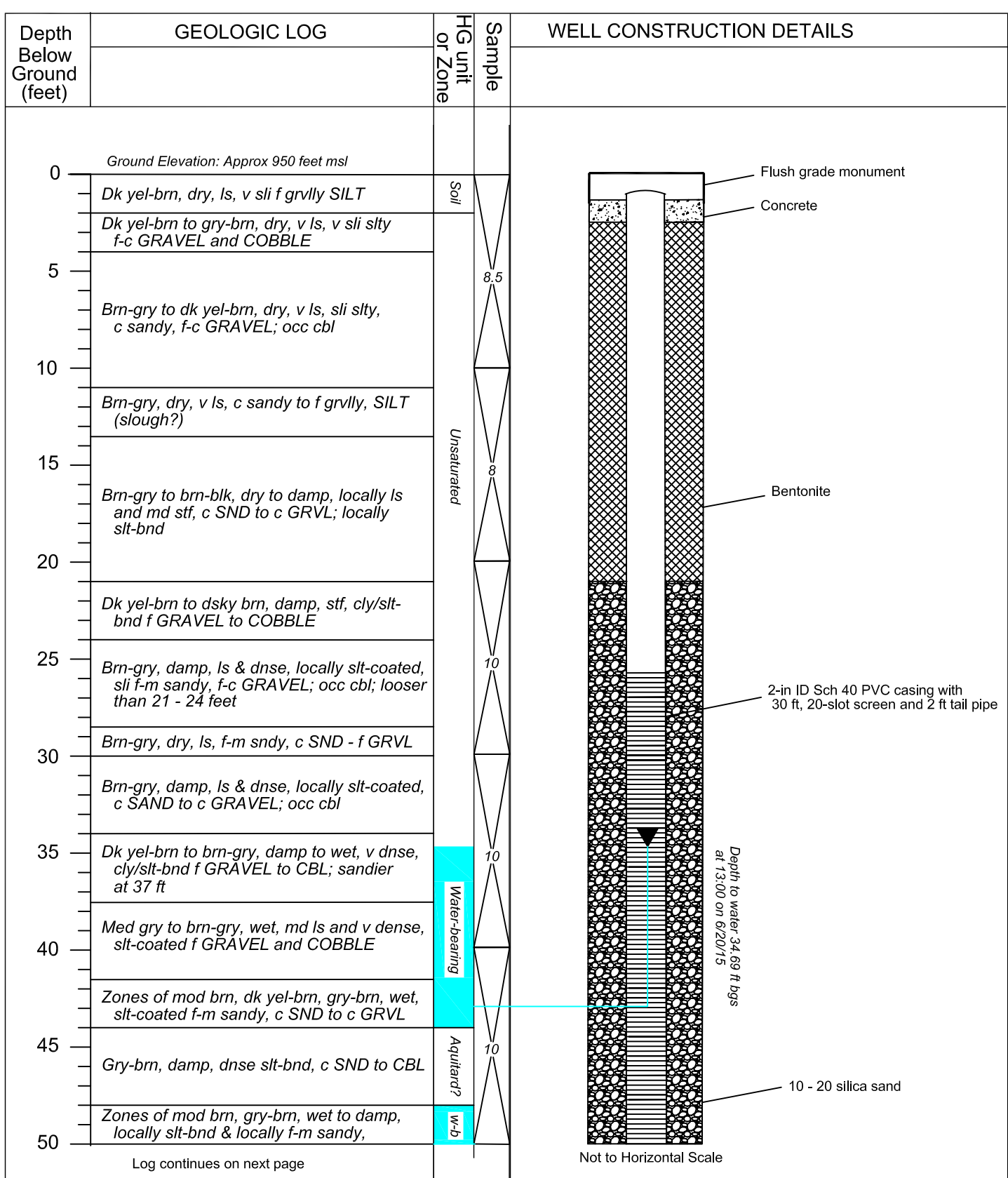
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka FL-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 3 of 3)
 GW_152 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





Log continues on next page

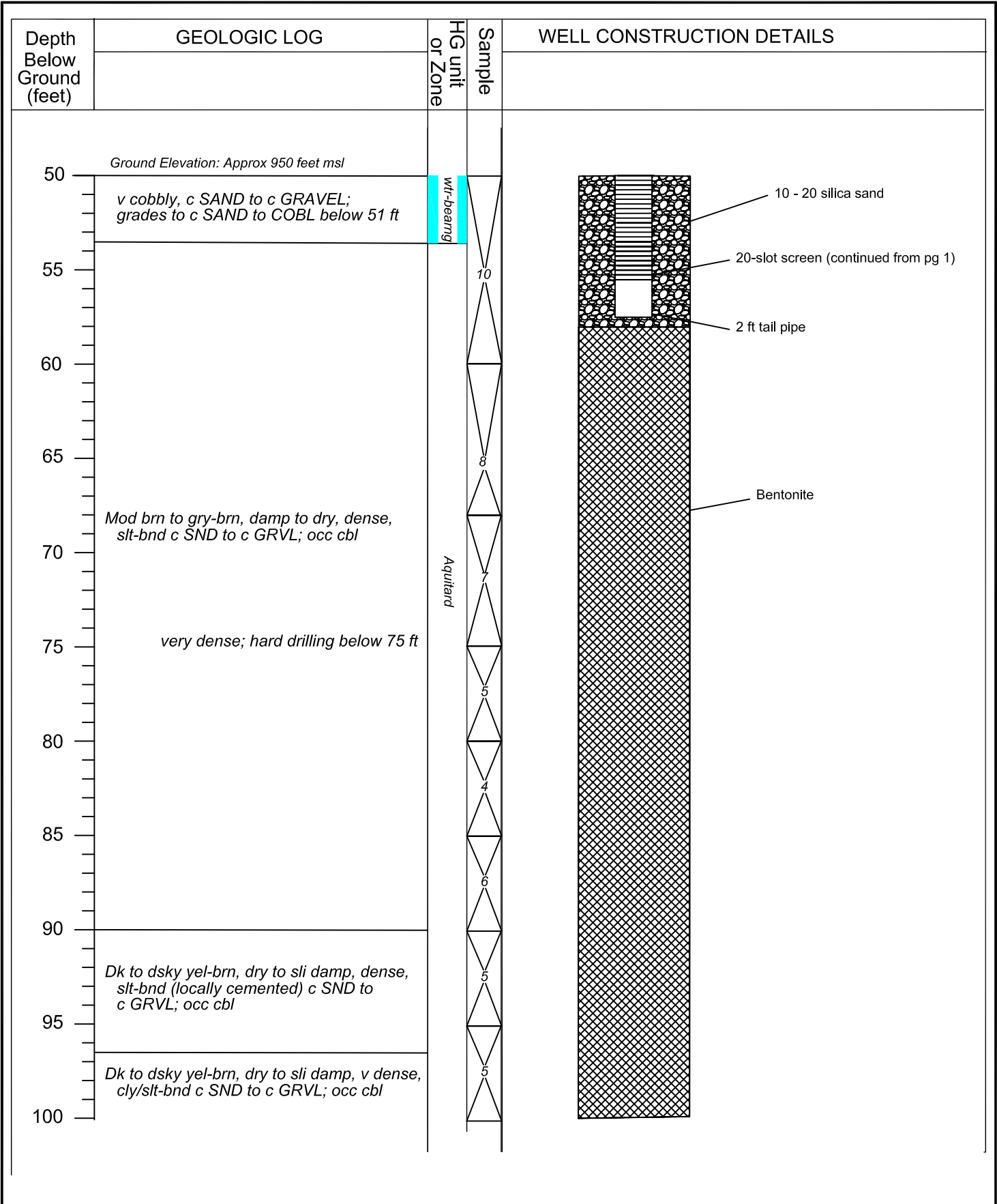
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SE 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_160; aka CR-1
 WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 1 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

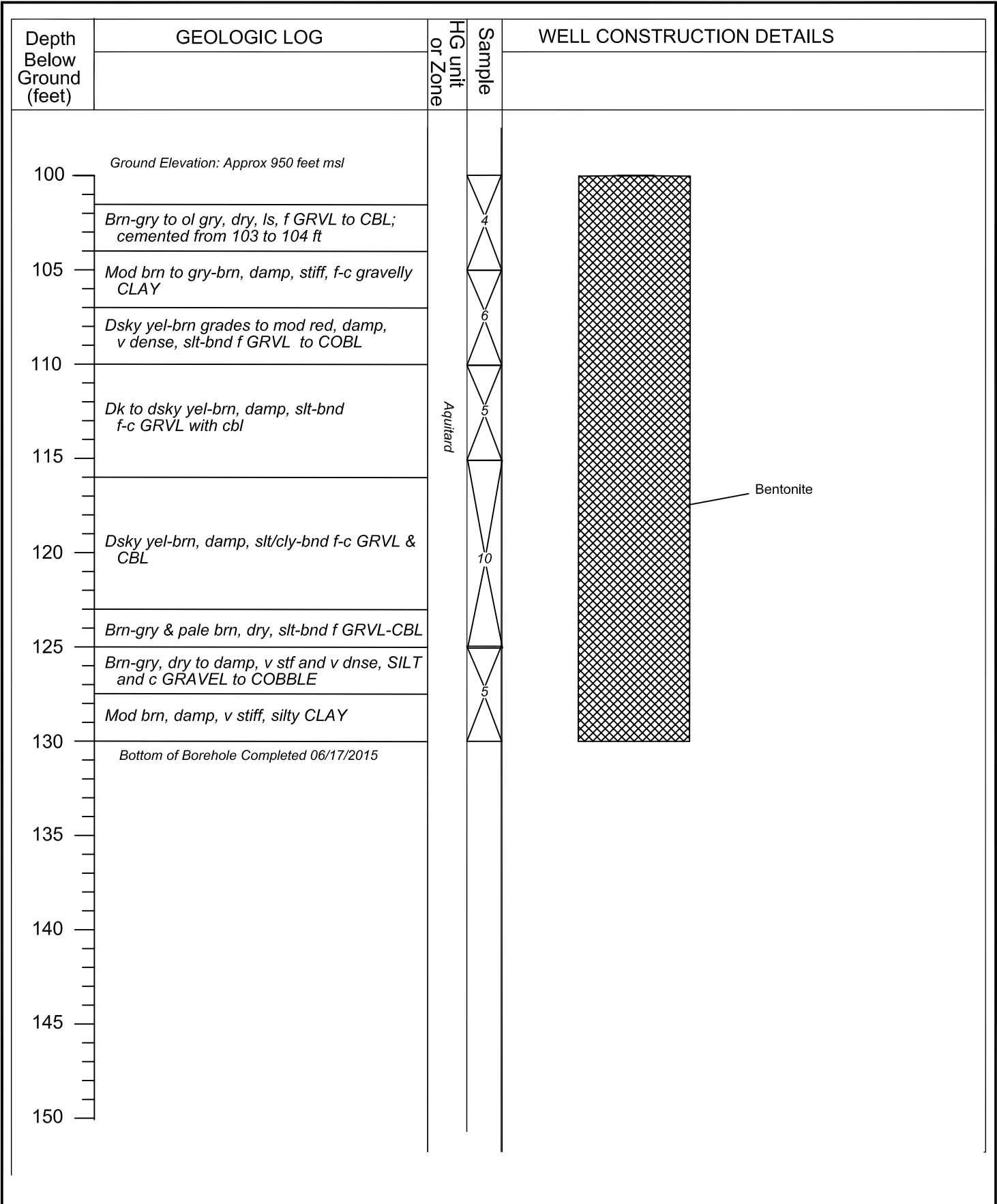
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_160; aka CR-1
 WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 2 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

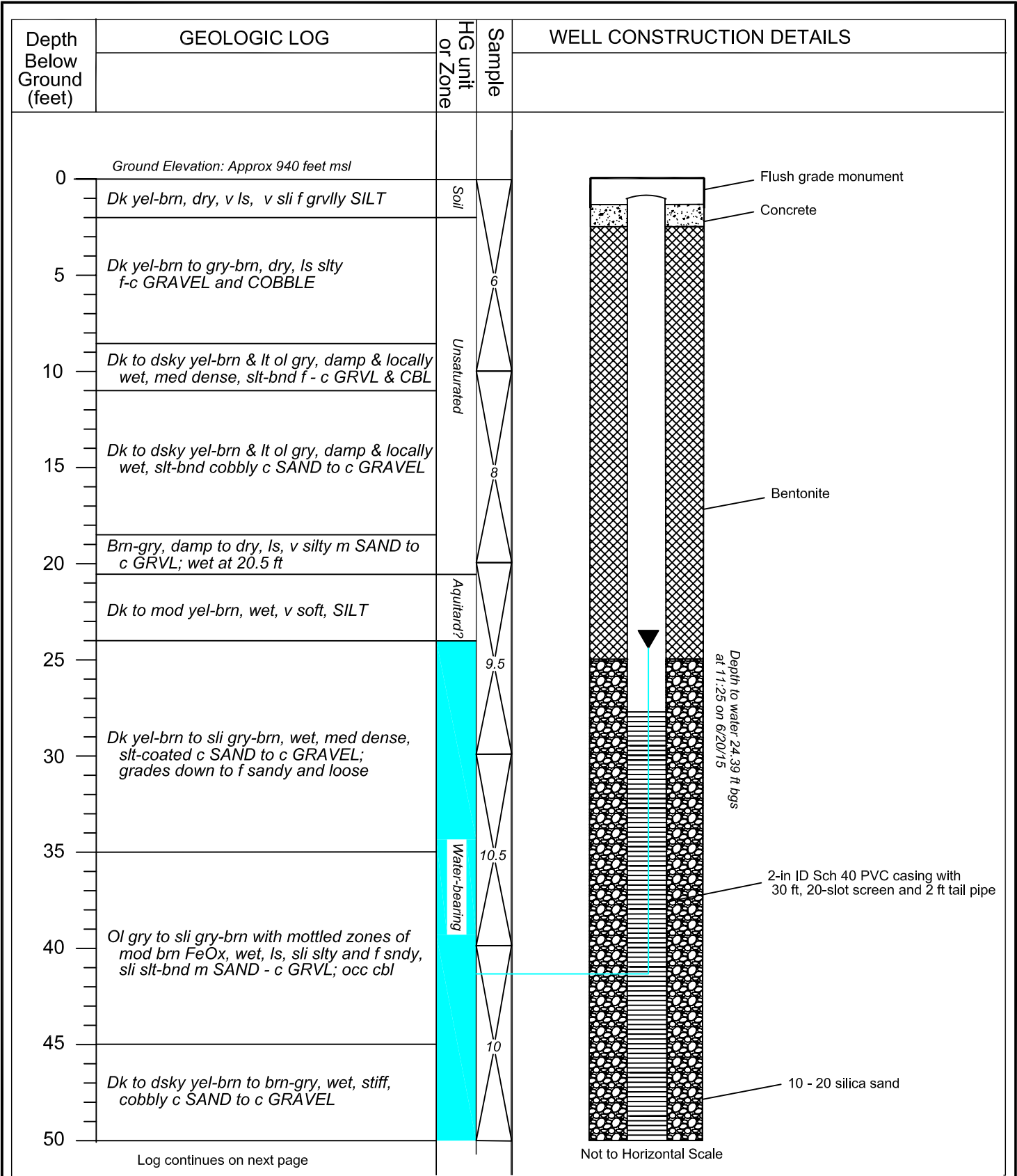
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_160; aka CR-1
 WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 3 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

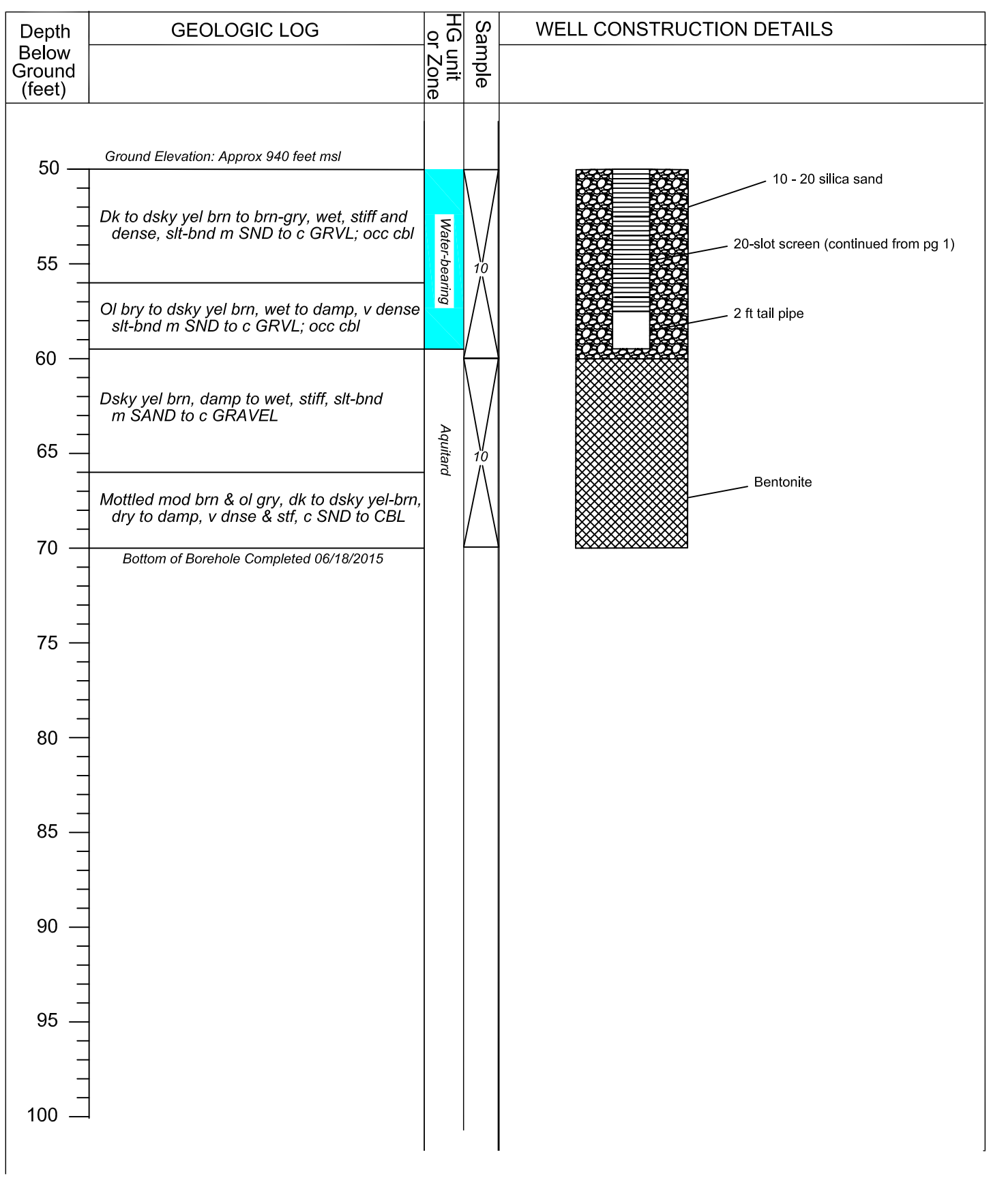
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: NW 1/4 NW 1/4 Sec 31 T6N, R36E
 WELL NAME: GW_161; aka JB-1
 WELL TAG & START CARD: L111672 & 1026740

Figure 4 (page 1 of 2)
 GW_161 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





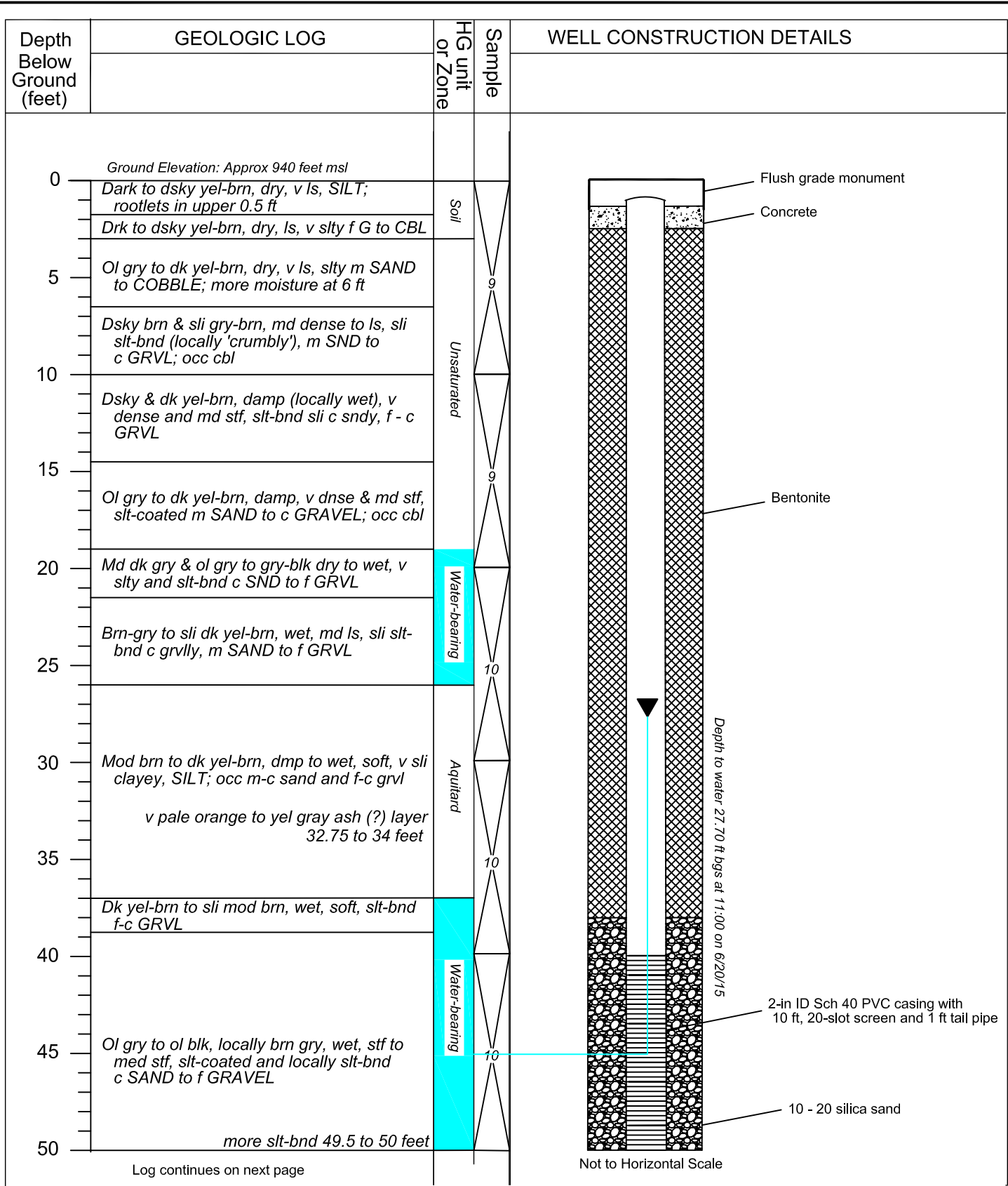
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 version 06/30/15

PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 NW 1/4 Sec 31 T6N, R36E
WELL NAME: GW_161; aka JB-1
WELL TAG & START CARD: L111672 & 1026740

Figure 4 (page 2 of 2)
 GW_161 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





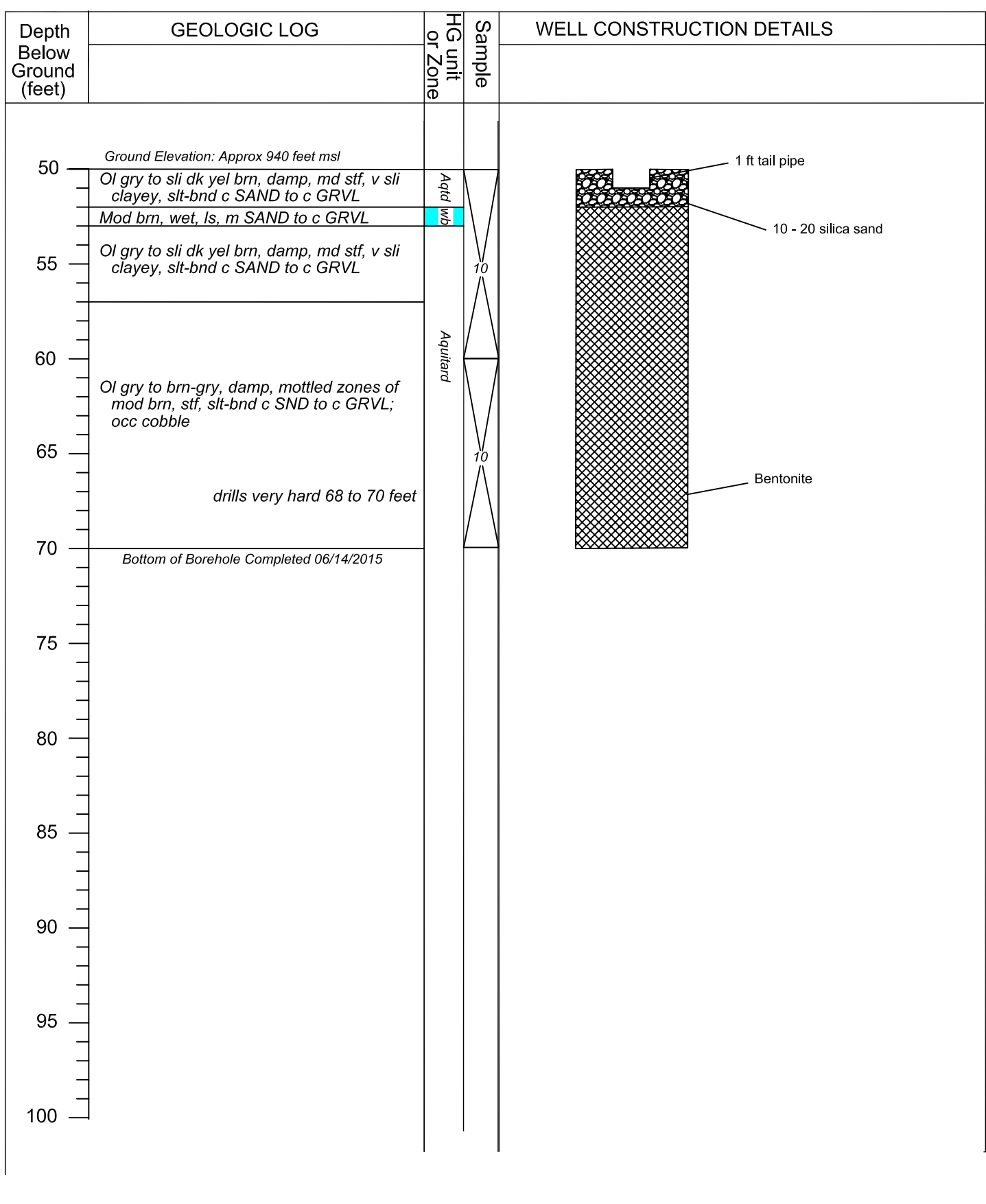
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_162; aka MFS-1
 WELL TAG & START CARD: L111673 & 1026828

Figure 5 (page 1 of 2)
 GW_162 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





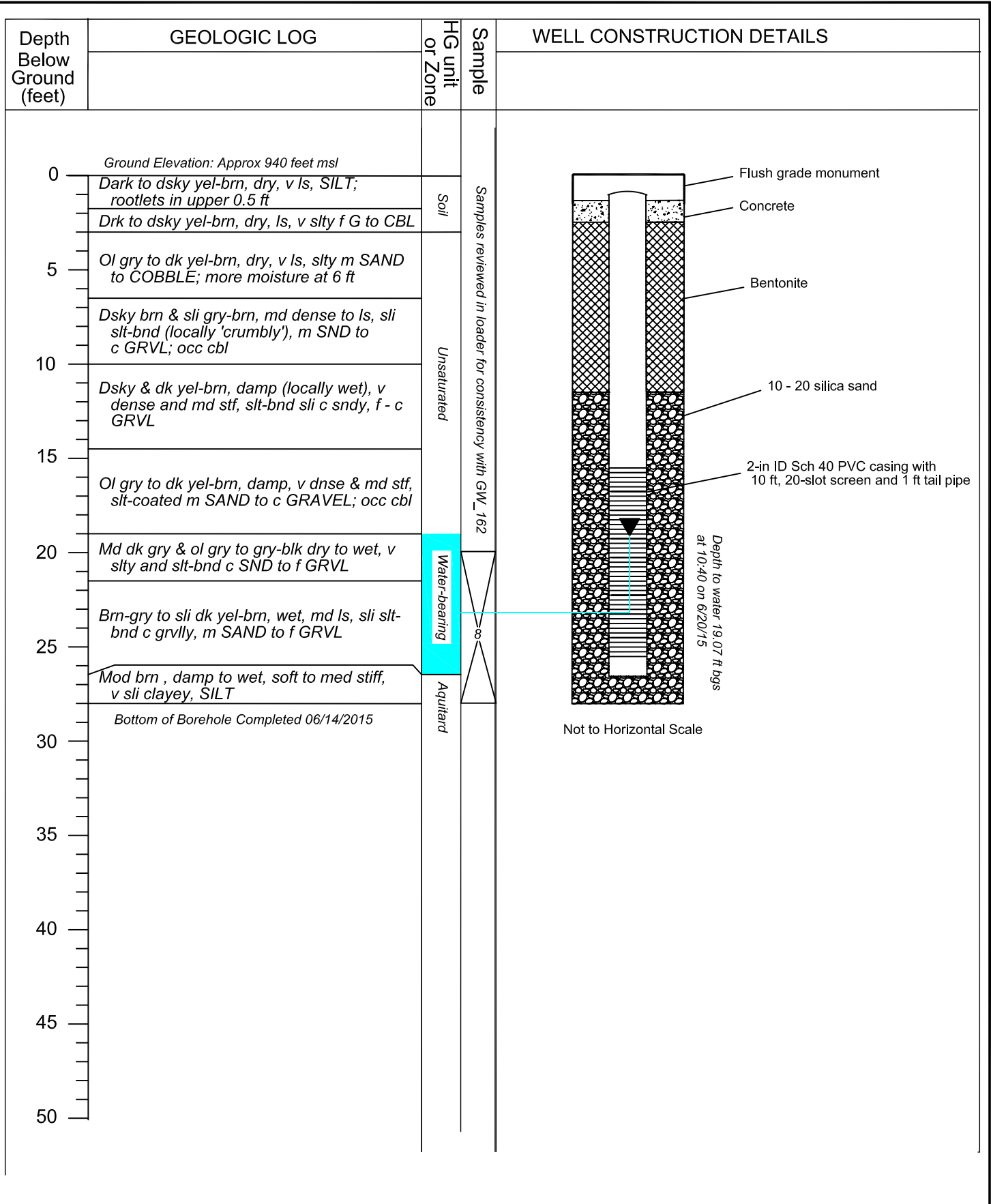
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_162; aka MFS-1
WELL TAG & START CARD: L111673 & 1026828

Figure 5 (page 2 of 2)
GW_162 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council





version 06/30/15
 C:\Projects\WWBWC\...GeoLog\AsBuilt_MFS-2(shallow)_pg1 of 2.dwg

PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_163; aka MFS-2
WELL TAG & START CARD: L112703 & 1026829

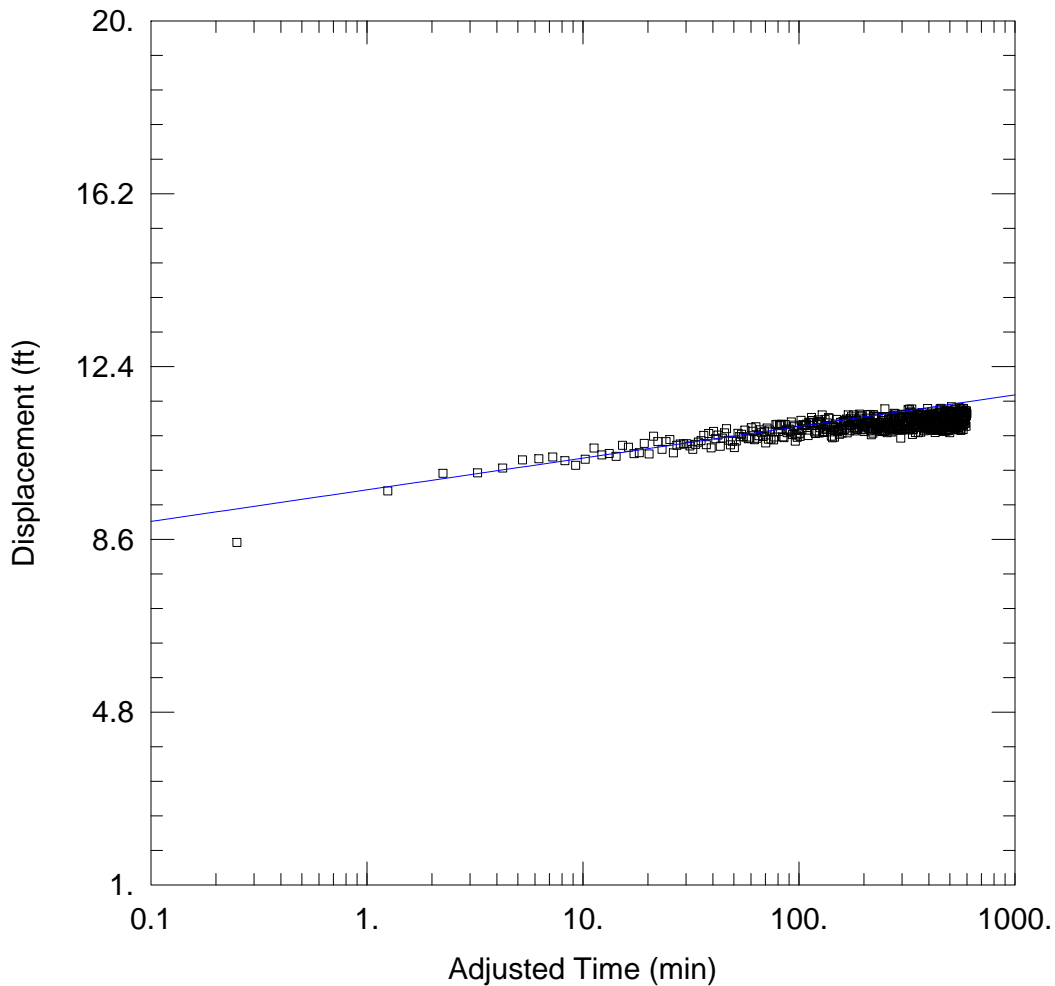
Figure 6 (page 1 of 1)
 GW_163 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council



Appendix C: Pumping and Slug Test Analysis Graphs

Figure C1. Well 1111 Drawdown



EASTSIDE SCHOOL WELL TEST

Data Set: C:\...\ESW_detrended_fullpene_earlytime_dd.aqt

Date: 03/11/17

Time: 15:48:40

PROJECT INFORMATION

Company: NLW

Client: WWBCW

Project: 1601

Location: Eastside

Test Well: 1111

Test Date: 11/9/16

AQUIFER DATA

Saturated Thickness: 5. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Observation Wells

Well Name	X (ft)	Y (ft)
ESW	0	0

Well Name	X (ft)	Y (ft)
□ ESW	0	0

SOLUTION

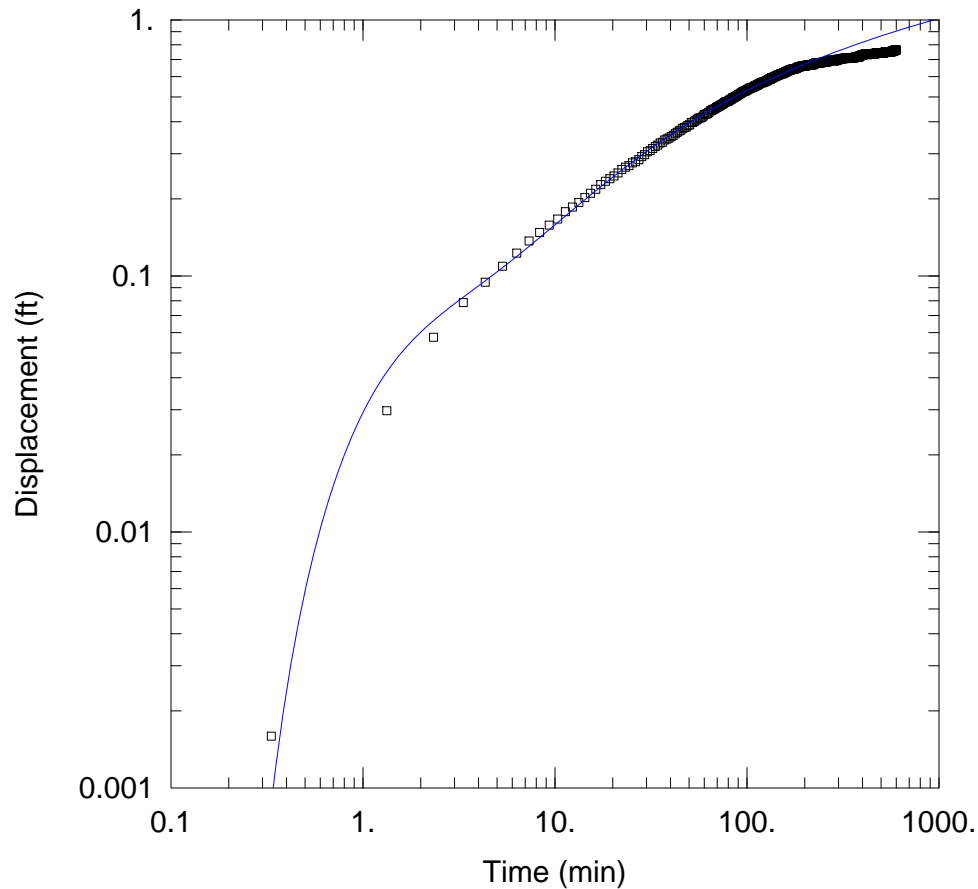
Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 2.809E+4 gal/day/ft

S = 6.359E-13

Figure C2. Well GW_162 Drawdown



LEAKY ANALYSIS

Data Set: C:\...\GW_162_detrended_dd.aqt
 Date: 03/11/17 Time: 16:48:34

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: ESW
 Test Date: 11/9/16

SOLUTION

Aquifer Model: Leaky
 Solution Method: Neuman-Witherspoon
 T = 2.809E+4 gal/day/ft
 S = 0.0001193
 r/B = 2.
 β = 0.5
 T2 = 1.11E+4 gal/day/ft
 S2 = 0.0008957

AQUIFER DATA

Saturated Thickness: 25.18 ft
 Aquitard Thickness (b'): 1. ft

Anisotropy Ratio (Kz/Kr): 1.
 Aquitard Thickness (b''): 1. ft

WELL DATA

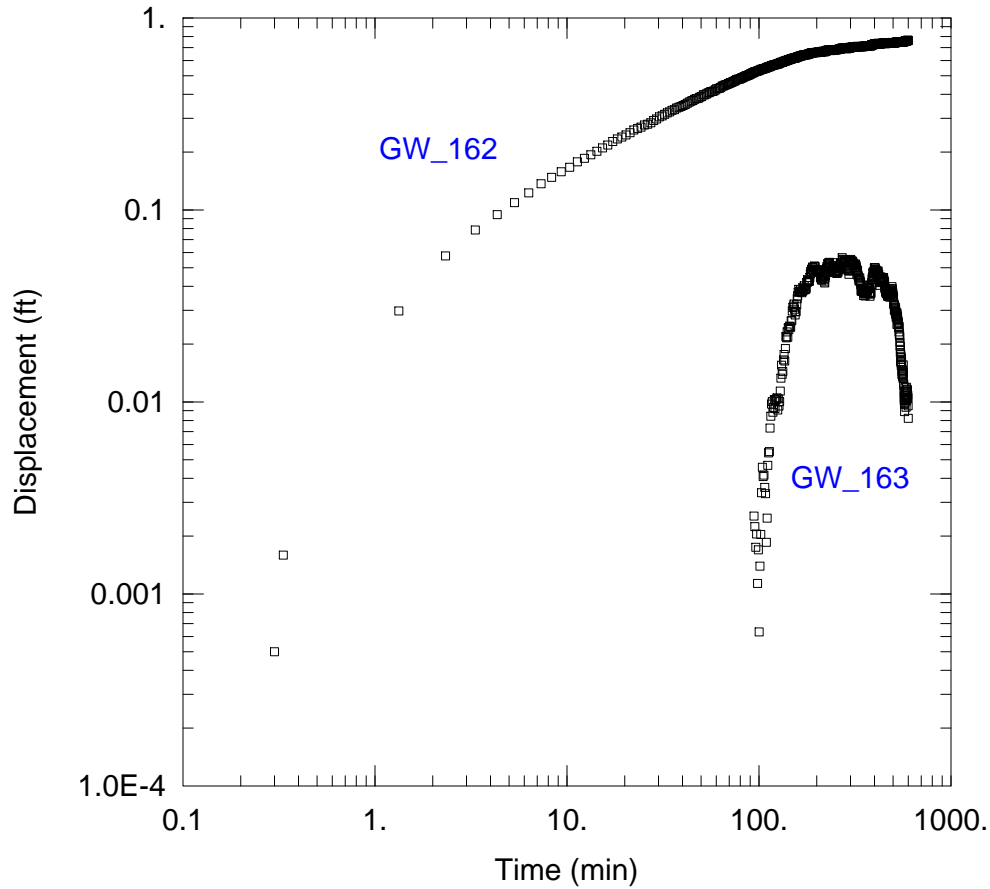
Pumping Wells

Well Name	X (ft)	Y (ft)
ESW	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ GW_162	0	261

Figure C3. Well GW_162 and ; K_163 Drawdown



DRAWDOWN IN GW_162 AND GW_163

Data Set: C:\...\GW_162_detrended_dd - GW_163_dd.aqt
 Date: 05/31/17 Time: 23:09:45

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: ESW
 Test Date: 11/9/16

AQUIFER DATA

Saturated Thickness: 5.4 ft
 Aquitard Thickness (b'): 1. ft

Anisotropy Ratio (Kz/Kr): 1.
 Aquitard Thickness (b''): 1. ft

WELL DATA

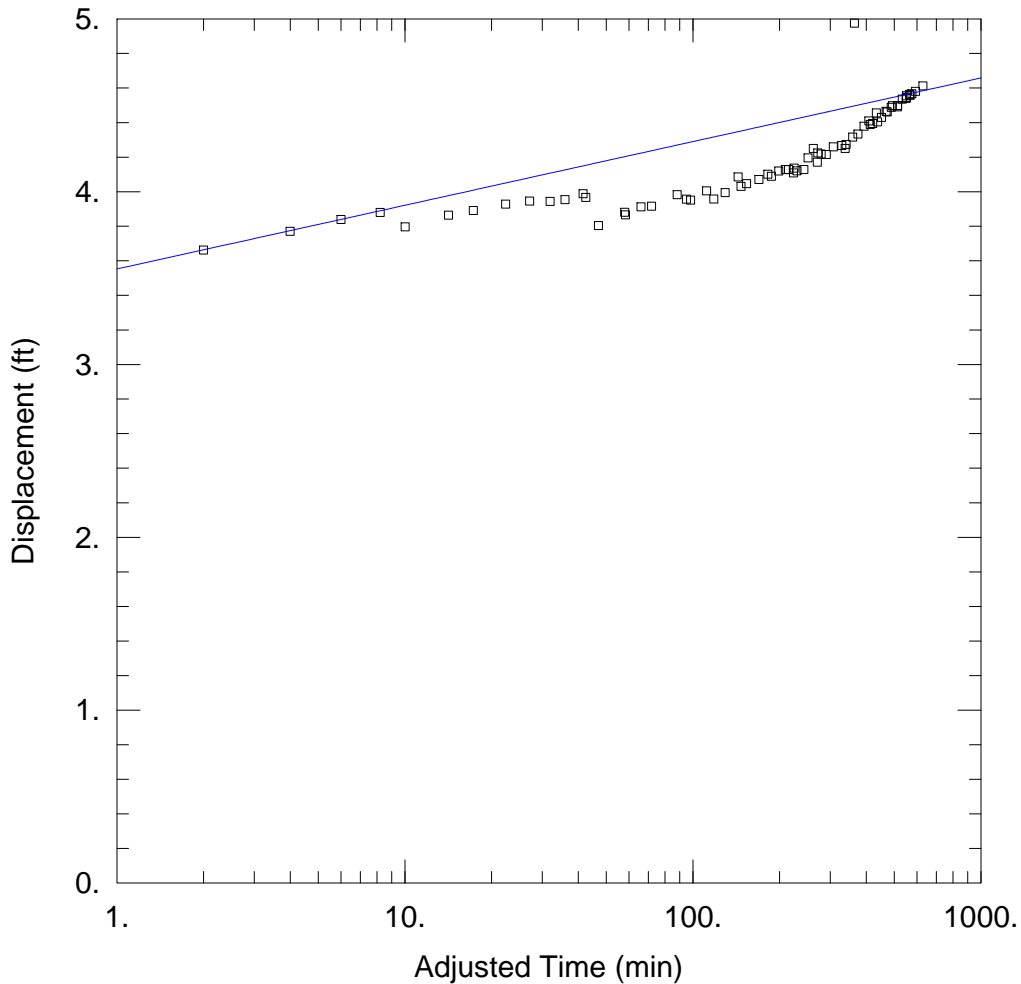
Pumping Wells

Well Name	X (ft)	Y (ft)
ESW	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ <u>GW_162</u>	0	261
□ <u>GW_163</u>	0	260

Figure C4. Well 5239 Drawdown



WELL 5239 TEST

Data Set: C:\...\Q_5239_DD_5239_CJ_early.aqt

Date: 03/28/17

Time: 16:24:50

PROJECT INFORMATION

Company: NLW

Client: WWBWC

Project: 1601

Location: M-F, OR

Test Well: 5239

Test Date: 5/3/16

AQUIFER DATA

Saturated Thickness: 20.7 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Observation Wells

Well Name	X (ft)	Y (ft)
5239	0	0

Well Name	X (ft)	Y (ft)
□ 5239	0	0

SOLUTION

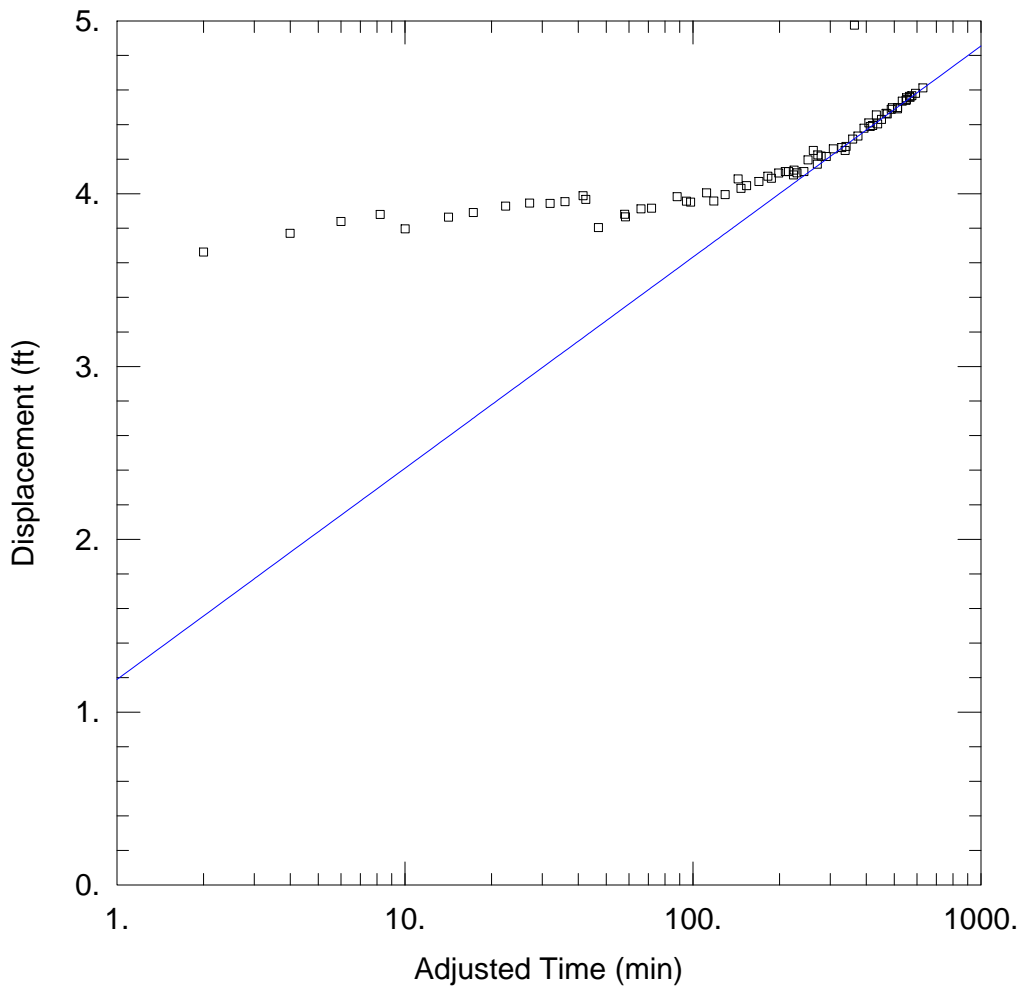
Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 1.476E+5 gal/day/ft

S = 7.813E-8

Figure C5. Well 5239 Drawdown



WELL 5239 TEST

Data Set: C:\...\Q_5239_DD_5239_CJ_late.aqt

Date: 03/28/17

Time: 16:26:37

PROJECT INFORMATION

Company: NLW

Client: WWBWC

Project: 1601

Location: M-F, OR

Test Well: 5239

Test Date: 5/3/16

AQUIFER DATA

Saturated Thickness: 20.7 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
5239	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ 5239	0	0

SOLUTION

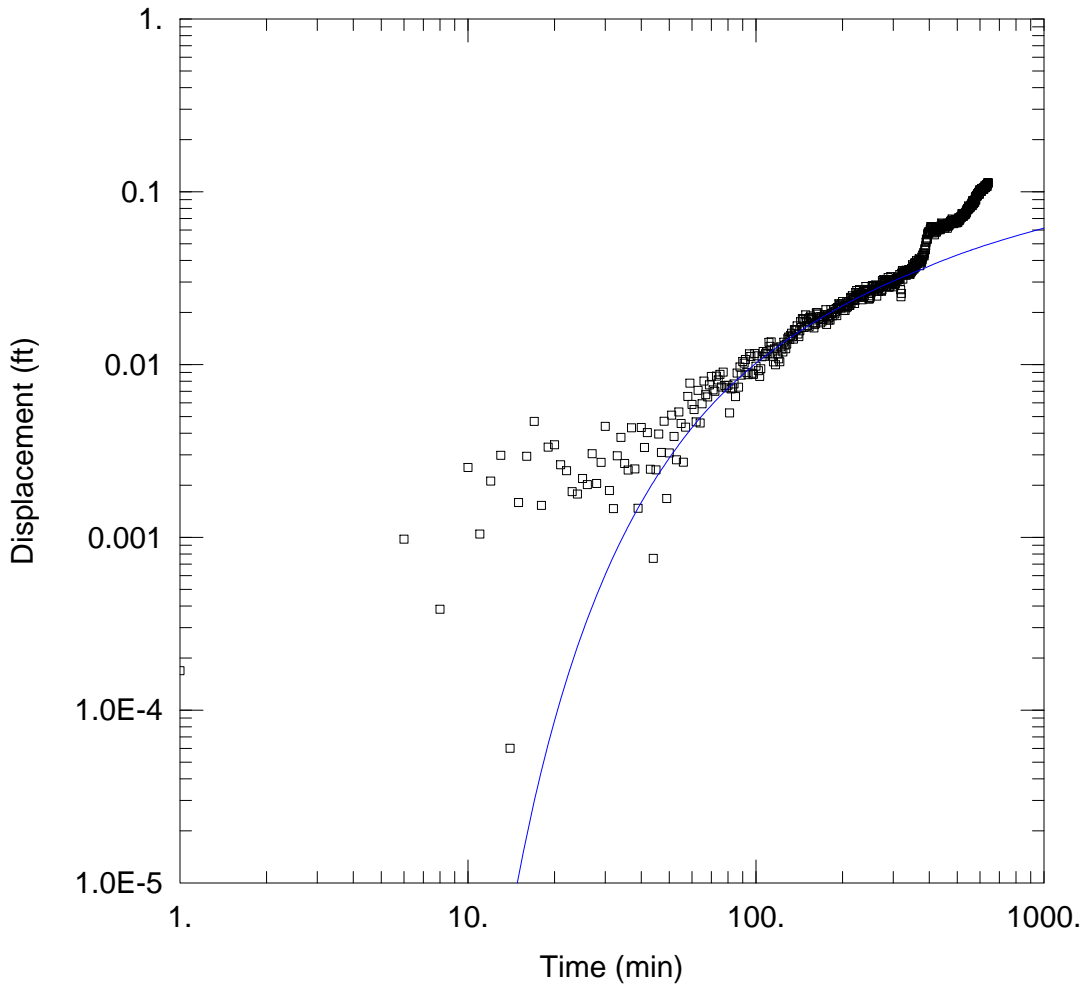
Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 4.452E+4 gal/day/ft

S = 10.98

Figure C6. Well GW_161 Drawdown, mid to late time



WELL 5239 TEST, 161 DRAWDOWN

Data Set: C:\...\Q_5239_DD_161_Theis_mid-late.aqt

Date: 03/28/17

Time: 17:37:23

PROJECT INFORMATION

Company: NLW

Client: WWBWC

Project: 1601

Location: M-F, OR

Test Well: 5239

Test Date: 5/3/16

WELL DATA

Pumping Wells

Observation Wells

Well Name	X (ft)	Y (ft)
Well 5239	0	0

Well Name	X (ft)	Y (ft)
□ GW_161	0	1099

SOLUTION

Aquifer Model: Confined

Solution Method: Theis

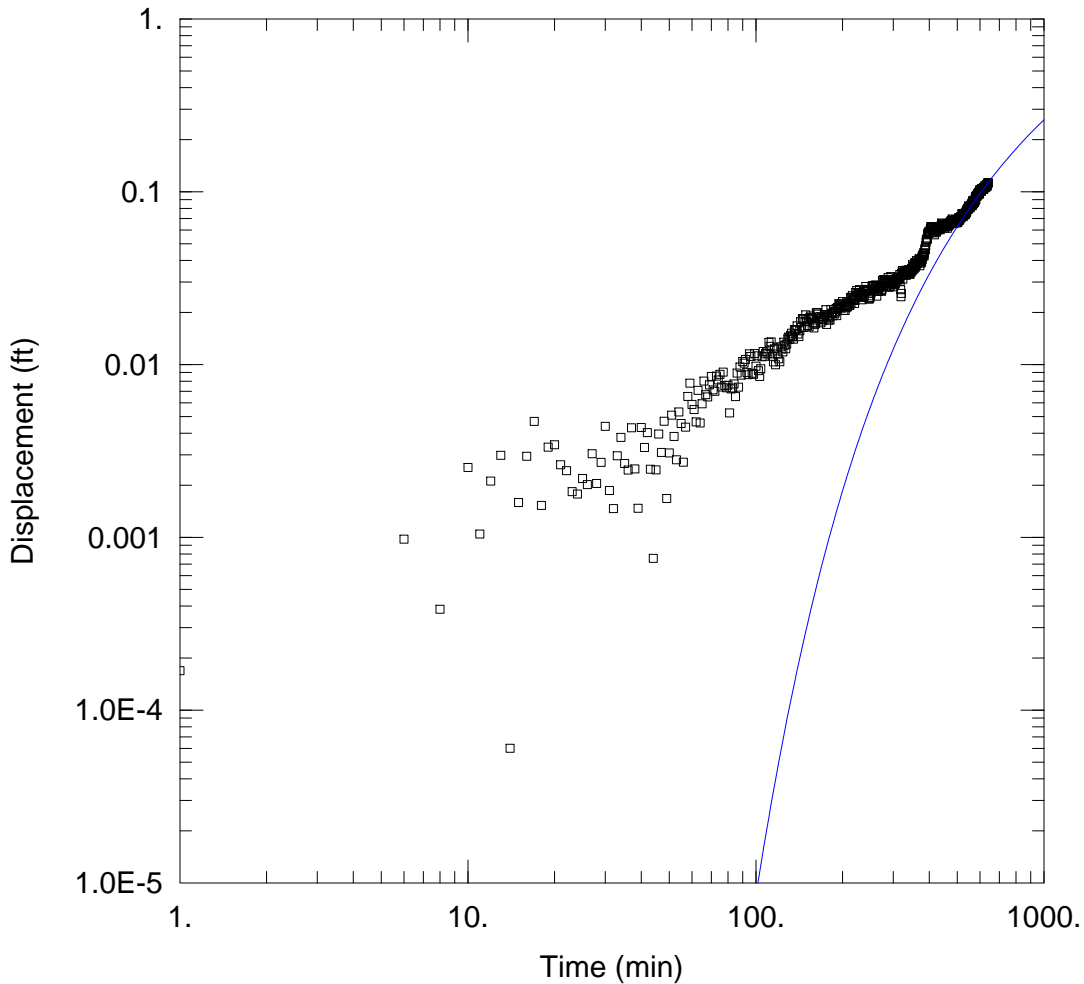
T = 8.128E+5 gal/day/ft

S = 0.01797

Kz/Kr = 1.

b = 37. ft

Figure C7. Well GW_161 Drawdown, late time



WELL 5239 TEST, 161 DRAWDOWN

Data Set: C:\...\Q_5239_DD_161_Theis_late.aqt

Date: 03/31/17

Time: 15:53:33

PROJECT INFORMATION

Company: NLW

Client: WWBWC

Project: 1601

Location: M-F, OR

Test Well: 5239

Test Date: 5/3/16

WELL DATA

Pumping Wells

Observation Wells

Well Name	X (ft)	Y (ft)
Well 5239	0	0

Well Name	X (ft)	Y (ft)
□ GW_161	0	1099

SOLUTION

Aquifer Model: Confined

Solution Method: Theis

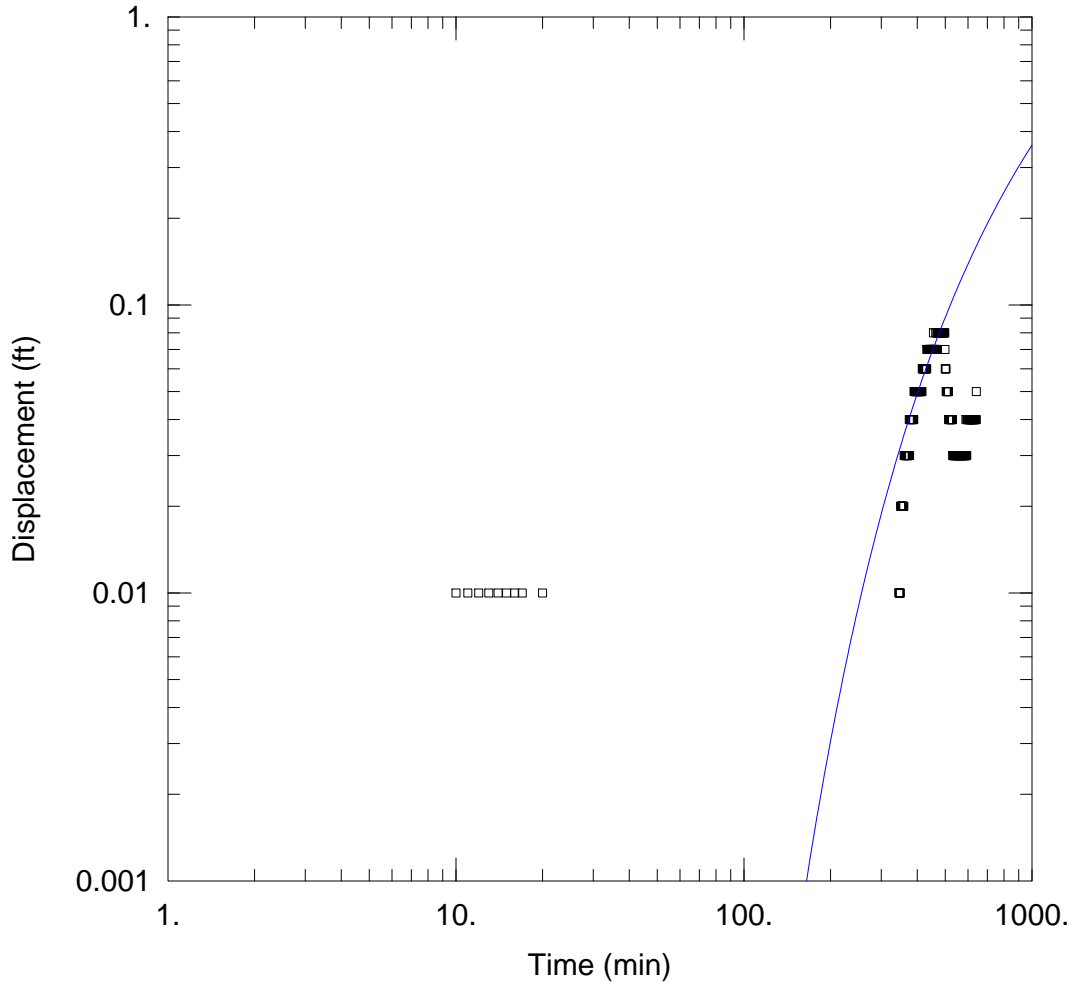
T = 2.268E+4 gal/day/ft

S = 0.006375

Kz/Kr = 1.

b = 37. ft

Figure C8. Well 5232 Drawdown



WELL 5239 TEST, 5232 DRAWDOWN

Data Set: C:\...\Q_5239_DD_5232_Theis.aqt

Date: 03/31/17

Time: 15:18:28

PROJECT INFORMATION

Company: NLW
 Client: WWBWC
 Project: 1601
 Location: M-F, OR
 Test Well: 5239
 Test Date: 5/3/16

WELL DATA

Pumping Wells

Observation Wells

Well Name	X (ft)	Y (ft)
Well 5239	0	0

Well Name	X (ft)	Y (ft)
□ Well 5232	1039	0

SOLUTION

Aquifer Model: Confined

Solution Method: Theis

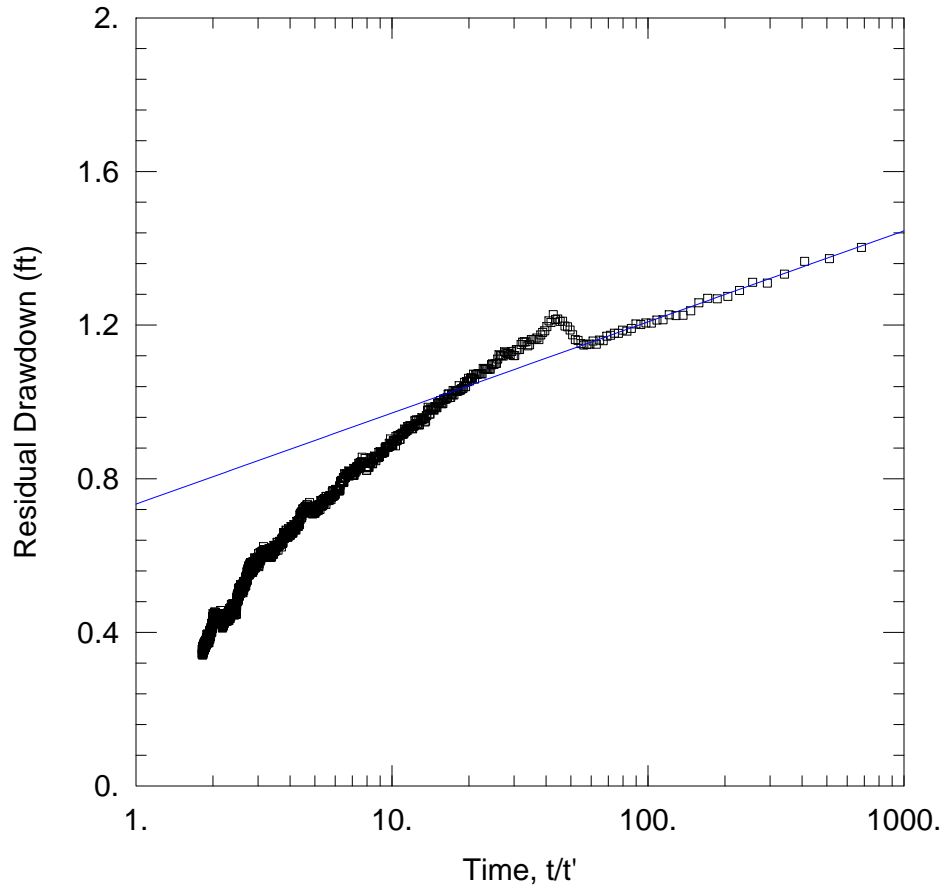
T = 1.775E+4 gal/day/ft

S = 0.005323

Kz/Kr = 1.

b = 9. ft

Figure C9. Well 5239 Recovery, early time (large t/t')



WELL 5239 TEST - RECOVERY

Data Set: C:\...\Q_5239_DD_5239_Recovery_early.aqt

Date: 06/10/17

Time: 16:04:42

PROJECT INFORMATION

Company: NLW

Client: WWBWC

Project: 1601

Location: M-F, OR

Test Well: 5239

Test Date: 5/3/16

SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 2.292E+5 gal/day/ft

S/S' = 0.000806

AQUIFER DATA

Saturated Thickness: 1. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

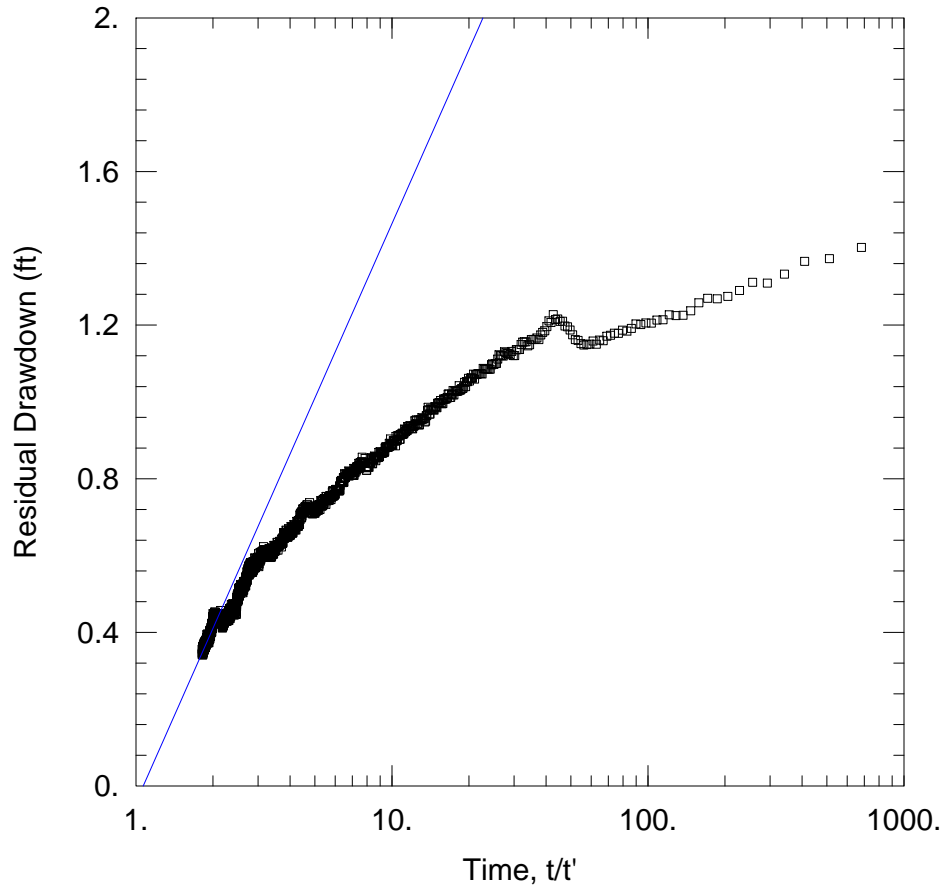
Pumping Wells

Well Name	X (ft)	Y (ft)
5239	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ 5239	0	0

Figure C10. Well 5239 Recovery, late time (small t/t')



WELL 5239 TEST - RECOVERY

Data Set: C:\...\Q_5239_DD_5239_Recovery_late.aqt
 Date: 06/10/17 Time: 16:01:45

PROJECT INFORMATION

Company: NLW
 Client: WWBWC
 Project: 1601
 Location: M-F, OR
 Test Well: 5239
 Test Date: 5/3/16

SOLUTION

Aquifer Model: Confined
 Solution Method: Theis (Recovery)
 $T = 3.607E+4$ gal/day/ft
 $S/S' = 1.068$

AQUIFER DATA

Saturated Thickness: 1. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

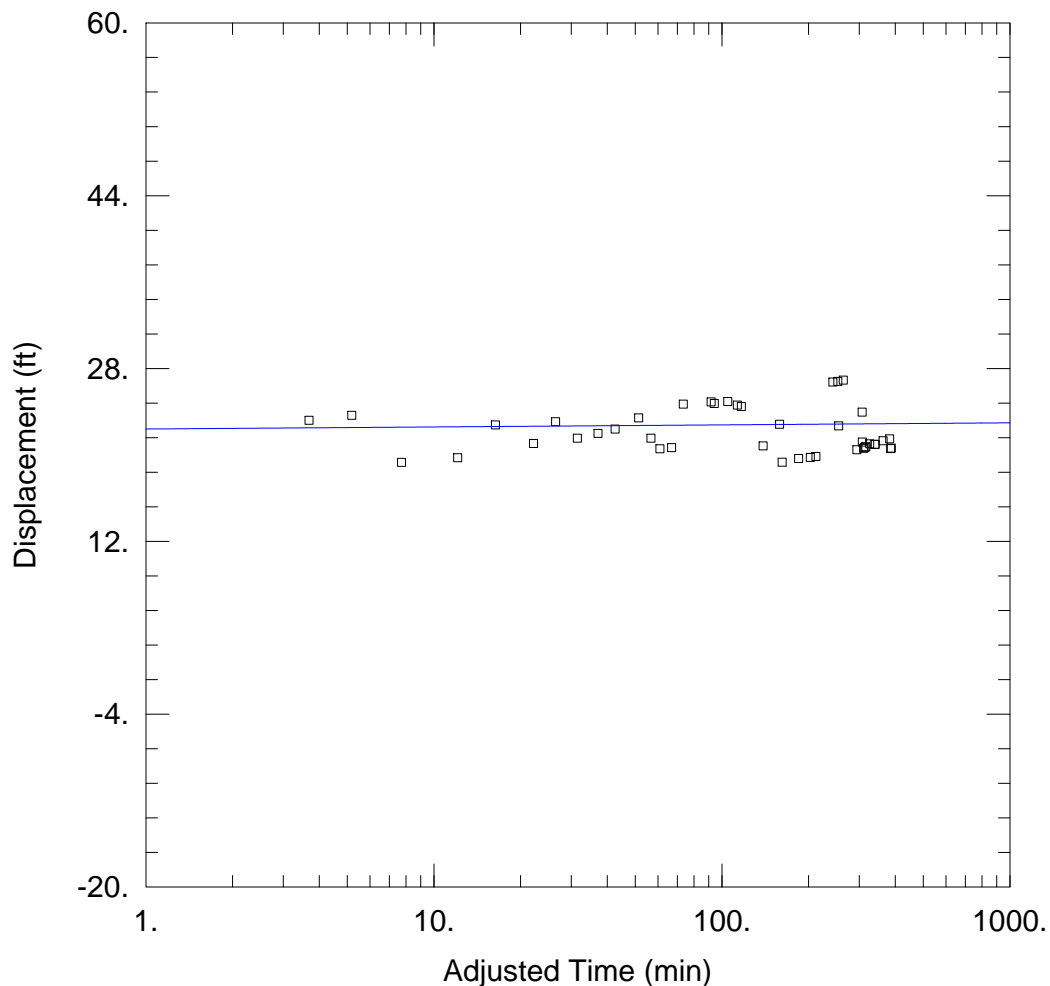
Pumping Wells

Well Name	X (ft)	Y (ft)
5239	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ 5239	0	0

Figure C11. Well 56140 Drawdown, early through late time



WELL TEST ANALYSIS

Data Set: C:\...\Q_vonderahe_new_DD_vonderahe_new.aqt
 Date: 06/24/16 Time: 18:43:36

PROJECT INFORMATION

Company: NLW
 Client: WWBWC
 Project: 1601
 Location: M-F, OR
 Test Well: Vonderahe_new
 Test Date: 3/14/16

AQUIFER DATA

Saturated Thickness: 1. ft Anisotropy Ratio (Kz/Kr): 1.

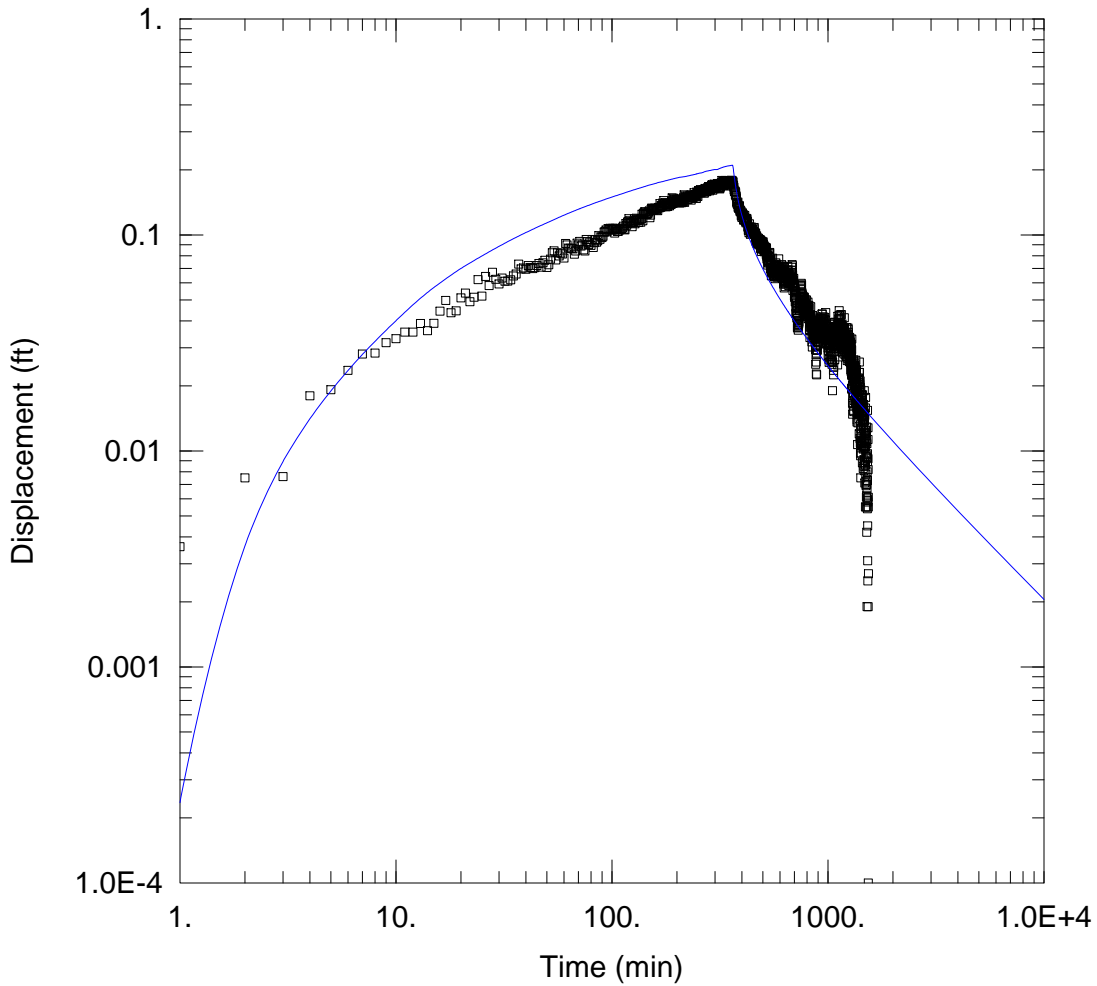
WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
Vonderahe_new	0	0	□ Vonderahe_new	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob
 T = 1.245E+5 gal/day/ft S = 1.207E-116

Figure C12. Well GW_161 Drawdown and Recovery, early dd and rec time



PUMPING TEST 56140

Data Set: C:\...\Q_56140_DD_GW_161_Theis_early.aqt

Date: 06/13/17

Time: 12:02:33

PROJECT INFORMATION

Company: NLW

Client: WWBWC

Project: 1601

Location: M-F, OR

Test Well: 56140

Test Date: 3/14/16

WELL DATA

Pumping Wells

Observation Wells

Well Name	X (ft)	Y (ft)
56140	0	0

Well Name	X (ft)	Y (ft)
□ GW_161	253	0

SOLUTION

Aquifer Model: Confined

Solution Method: Theis

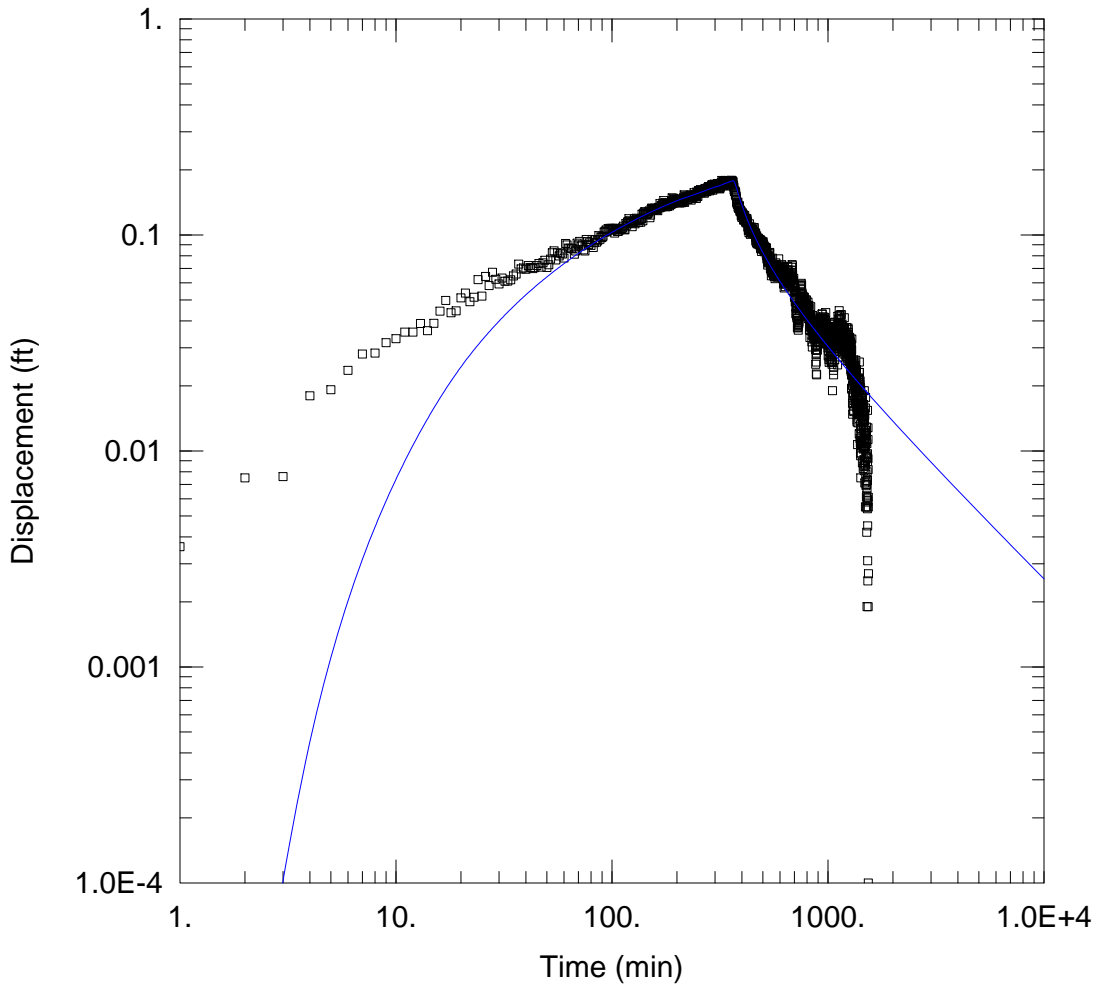
T = 1.901E+5 gal/day/ft

S = 0.004847

Kz/Kr = 1.

b = 41.2 ft

Figure C13. Well GW_161 Drawdown and Recovery, late dd and early rec time



PUMPING TEST 56140

Data Set: C:\...\Q_56140_DD_GW_161.aqt
 Date: 03/29/17

Time: 14:06:03

PROJECT INFORMATION

Company: NLW
 Client: WWBWC
 Project: 1601
 Location: M-F, OR
 Test Well: 56140
 Test Date: 3/14/16

WELL DATA

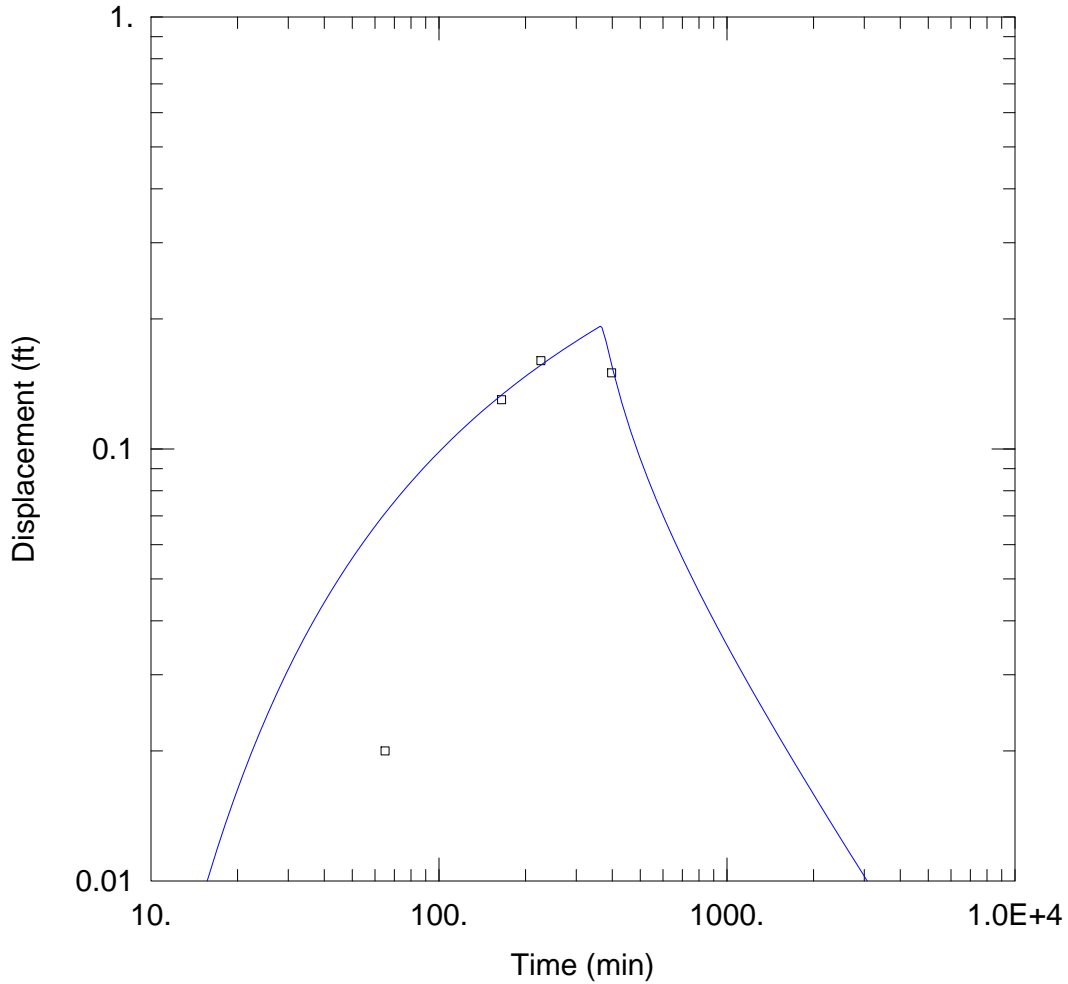
Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
56140	0	0	□ GW_161	253	0

SOLUTION

Aquifer Model: Confined
 T = 1.525E+5 gal/day/ft
 Kz/Kr = 1.

Solution Method: Theis
 S = 0.01401
 b = 41.2 ft

Figure C14. Well 5199 Drawdown and Recovery, late dd and early rec time



PUMPING TEST WELL 56140

Data Set: C:\...\Q_56140_DD_5199.aqt

Date: 06/13/17

Time: 10:36:05

PROJECT INFORMATION

Company: NLW

Client: WWBWC

Project: 1601

Location: M-F, OR

Test Well: 56140

Test Date: 3/14/16

WELL DATA

Pumping Wells

Observation Wells

Well Name	X (ft)	Y (ft)
5199	587	0

Well Name	X (ft)	Y (ft)
□ 5199	587	0

SOLUTION

Aquifer Model: Confined

Solution Method: Theis

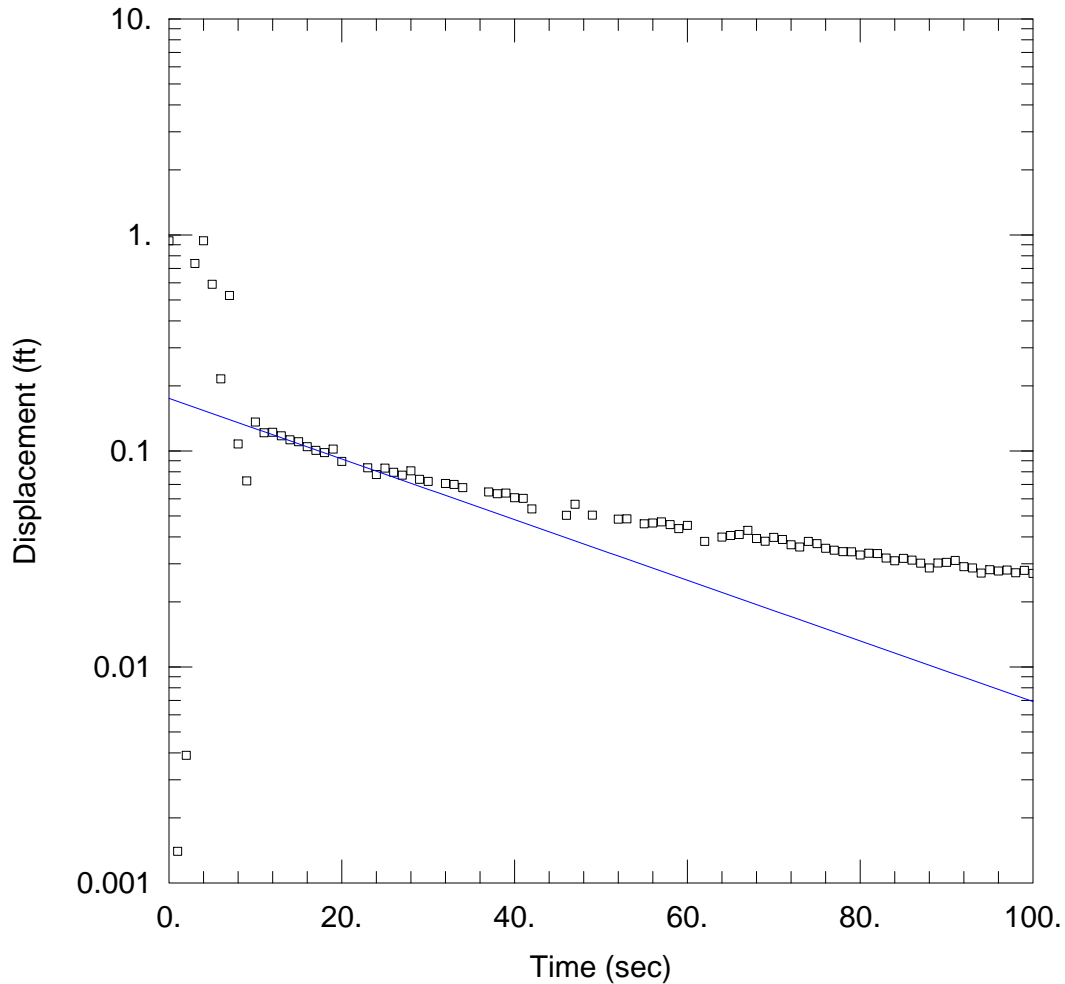
T = 1.402E+5 gal/day/ft

S = 1.154E+4

Kz/Kr = 1.

b = 85.6 ft

Figure C15. Well GW_152 Slug "In"



SLUG "IN" AT GW_152

Data Set: C:\1_Projects\WWBWC\Eastside\Slug Tests\Aqtesol\GW_152_SlugIn_2.aqt
 Date: 06/13/17 Time: 23:34:08

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: GW_152
 Test Date: 11/10/16

AQUIFER DATA

Saturated Thickness: 14.68 ft Anisotropy Ratio (Kz/Kr): 1.

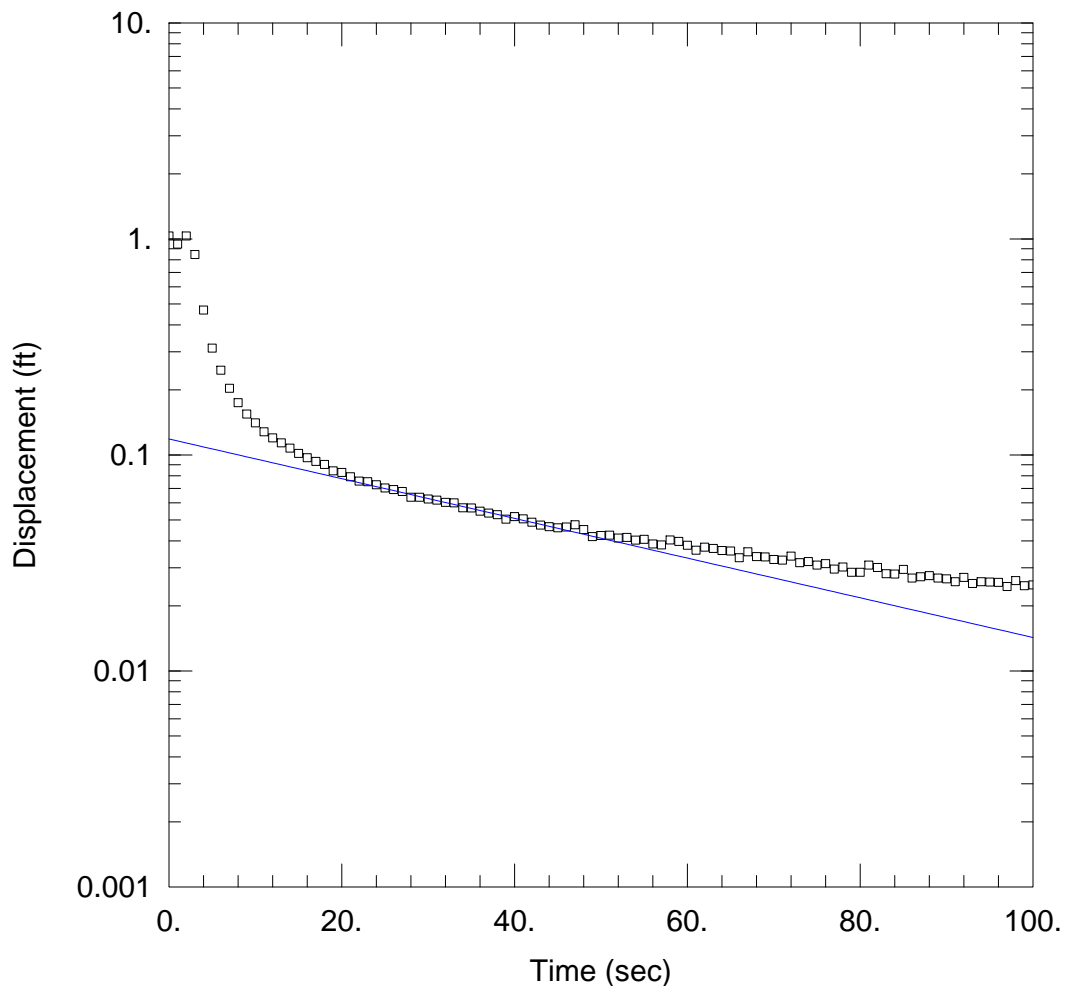
WELL DATA (GW_152)

Initial Displacement: 0.9401 ft Static Water Column Height: 19.9 ft
 Total Well Penetration Depth: 81. ft Screen Length: 30. ft
 Casing Radius: 0.086 ft Well Radius: 0.25 ft
 Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice
 K = 62.66 gal/day/ft² y0 = 0.1751 ft

Figure C16. Well GW_152 Slug "Out"



SLUG "OUT" AT GW_152

Data Set: C:\1_Projects\WWBWC\Eastside\Slug Tests\Aqtesol\GW_152_SlugOut_2.aqt
 Date: 06/13/17 Time: 23:55:02

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: GW_152
 Test Date: 11/10/16

AQUIFER DATA

Saturated Thickness: 14.68 ft Anisotropy Ratio (Kz/Kr): 1.

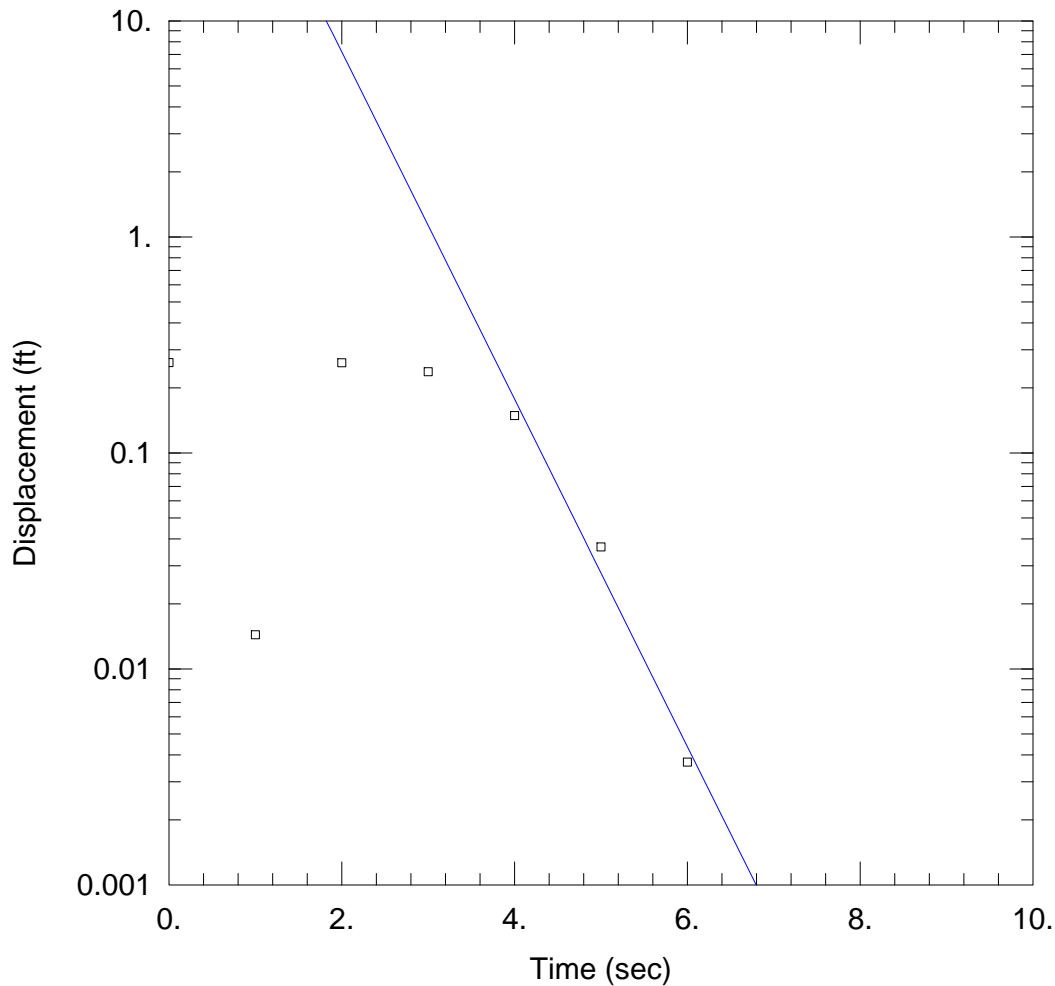
WELL DATA (GW_152)

Initial Displacement: 1.032 ft Static Water Column Height: 14.68 ft
 Total Well Penetration Depth: 81. ft Screen Length: 30. ft
 Casing Radius: 0.086 ft Well Radius: 0.25 ft
 Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice
 K = 41.03 gal/day/ft² y0 = 0.1185 ft

Figure C17. Well GW_160 Slug "Out"



SLUG "OUT" TEST AT GW_160

Data Set: C:\1_Projects\WWBWC\Eastside\Slug Tests\Aqtesol\GW_160_SlugOut_2.aqt
 Date: 06/14/17 Time: 00:15:20

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: GW_160
 Test Date: 11/17/16

AQUIFER DATA

Saturated Thickness: 16.47 ft Anisotropy Ratio (Kz/Kr): 1.

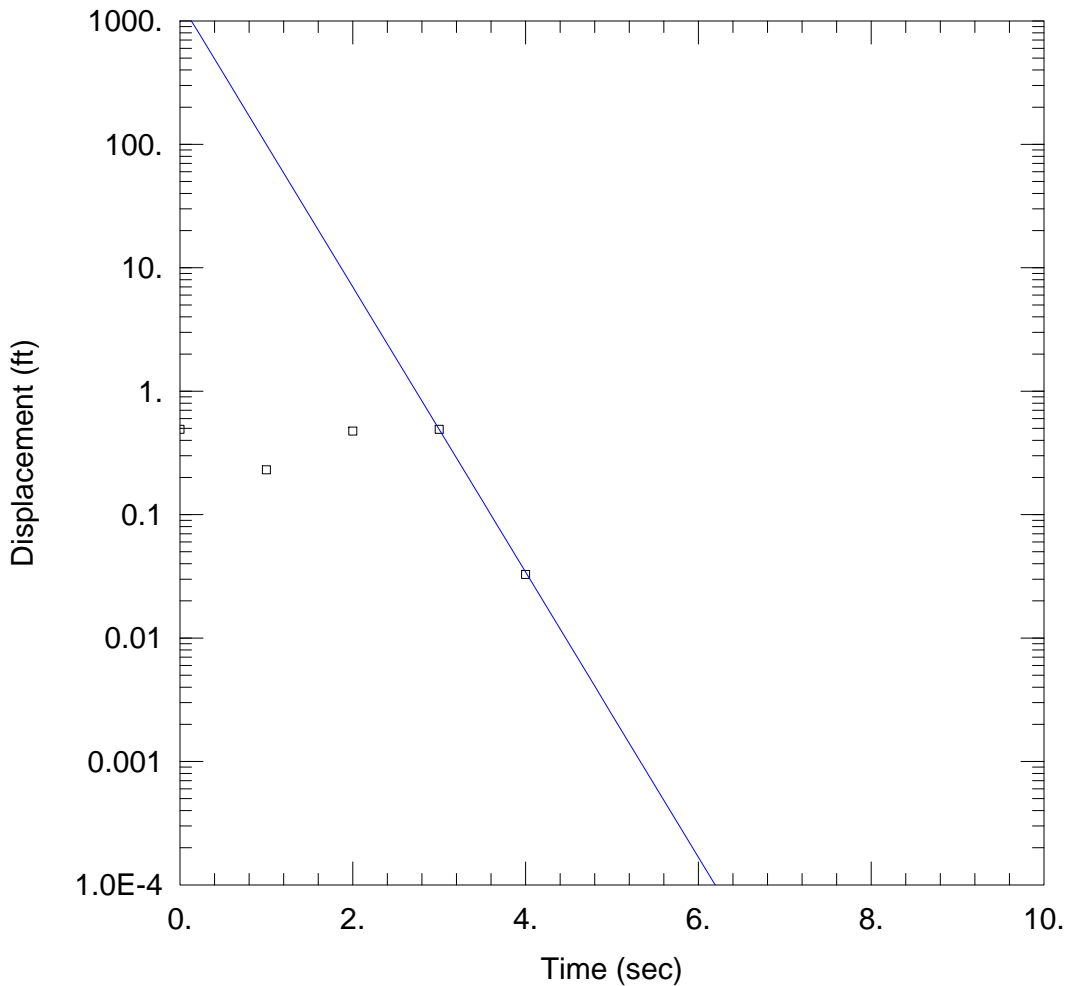
WELL DATA (GW_160)

Initial Displacement: 0.262 ft Static Water Column Height: 16.47 ft
 Total Well Penetration Depth: 55.5 ft Screen Length: 30. ft
 Casing Radius: 0.086 ft Well Radius: 0.25 ft
 Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
 K = 3051.4 gal/day/ft² y₀ = 291.5 ft

Figure C18. Well GW_161 Slug "Out"



SLUG "OUT" TEST AT GW_161

Data Set: C:\1_Projects\WWBWC\Eastside\Slug Tests\Aqtesol\GW_161_SlugOut3.aqt
 Date: 06/14/17 Time: 00:39:22

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: GW_161
 Test Date: 11/8/16

AQUIFER DATA

Saturated Thickness: 32.46 ft Anisotropy Ratio (Kz/Kr): 1.

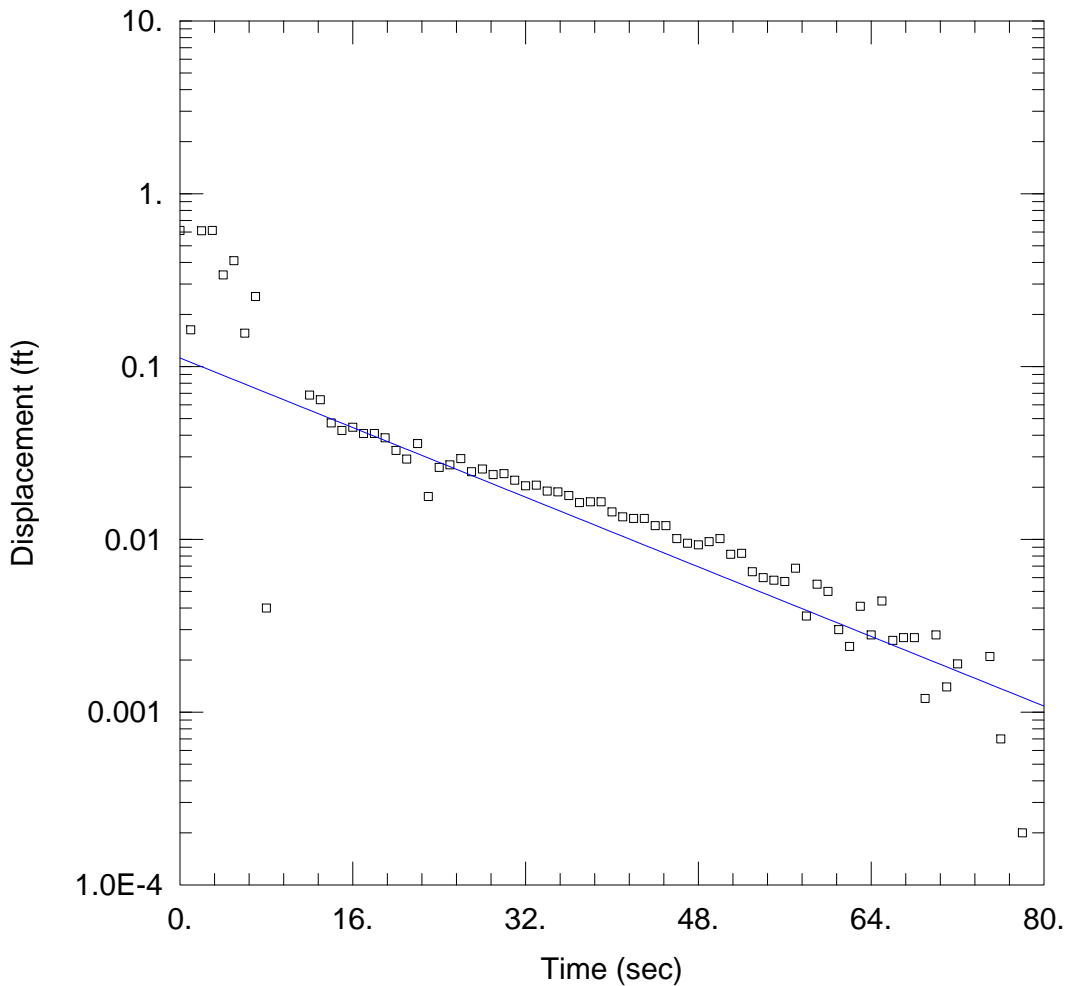
WELL DATA (GW_161)

Initial Displacement: 0.491 ft Static Water Column Height: 32.46 ft
 Total Well Penetration Depth: 57.5 ft Screen Length: 30. ft
 Casing Radius: 0.083 ft Well Radius: 0.25 ft
 Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined Solution Method: Bowser-Rice
 K = 2446.5 gal/day/ft² y₀ = 1424. ft

Figure C19. Well GW_162 Slug "In"



SLUG "IN" TEST AT GW_162

Data Set: C:\1_Projects\WWBWC\Eastside\Slug Tests\Aqtesol\GW_162_SlugIn_1.aqt
 Date: 06/15/17 Time: 12:03:48

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: GW_162
 Test Date: 11/16/16

AQUIFER DATA

Saturated Thickness: 16. ft Anisotropy Ratio (Kz/Kr): 1.

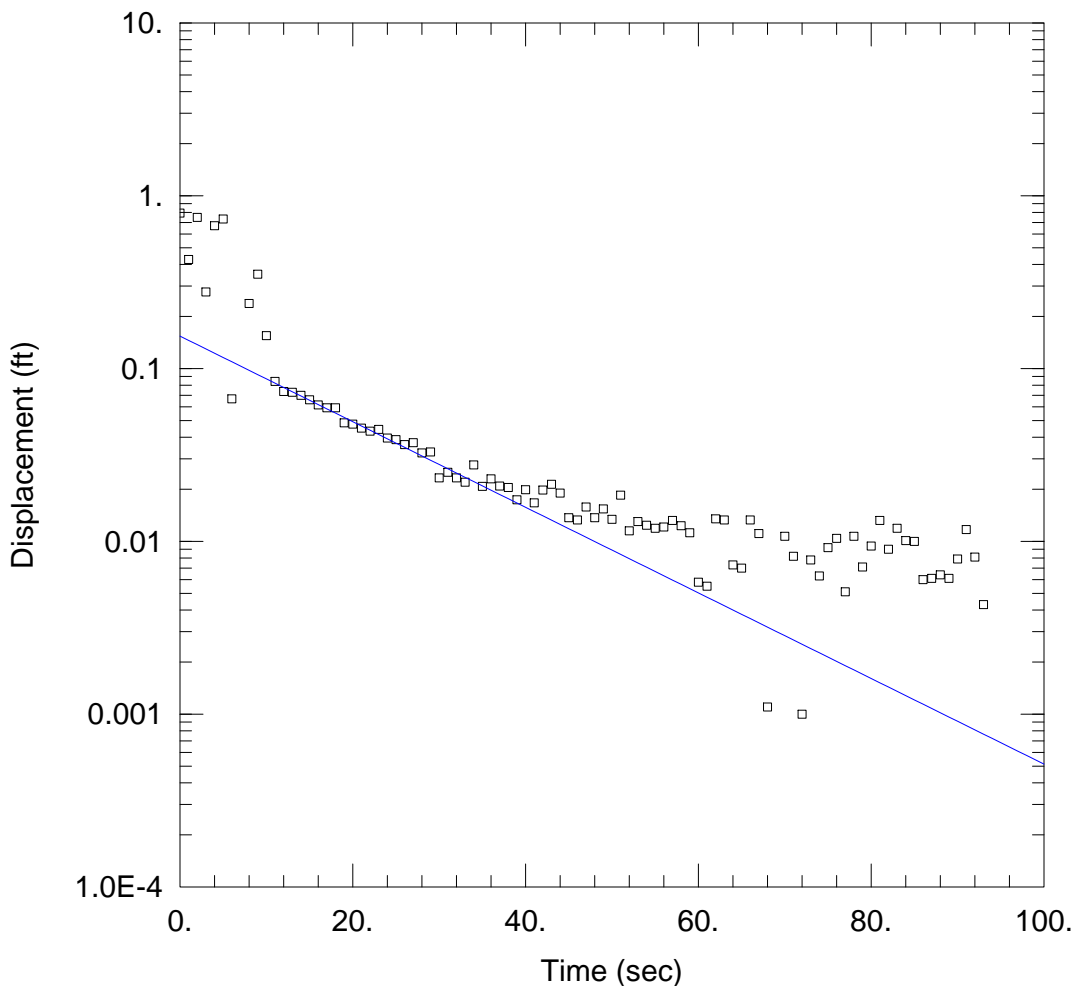
WELL DATA (GW_162)

Initial Displacement: 0.613 ft Static Water Column Height: 18.94 ft
 Total Well Penetration Depth: 50. ft Screen Length: 10. ft
 Casing Radius: 0.086 ft Well Radius: 0.25 ft
 Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined Solution Method: Bowser-Rice
 K = 149.7 gal/day/ft² y0 = 0.1121 ft

Figure C20. Well GW_162 Slug "Out"



SLUG "OUT" TEST AT GW_162

Data Set: C:\1_Projects\WWBWC\Eastside\Slug Tests\Aqtesol\GW_162_SlugOut_1.aqt
 Date: 06/15/17 Time: 12:05:52

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: GW_162
 Test Date: 11/16/16

AQUIFER DATA

Saturated Thickness: 16 ft Anisotropy Ratio (Kz/Kr): 1.

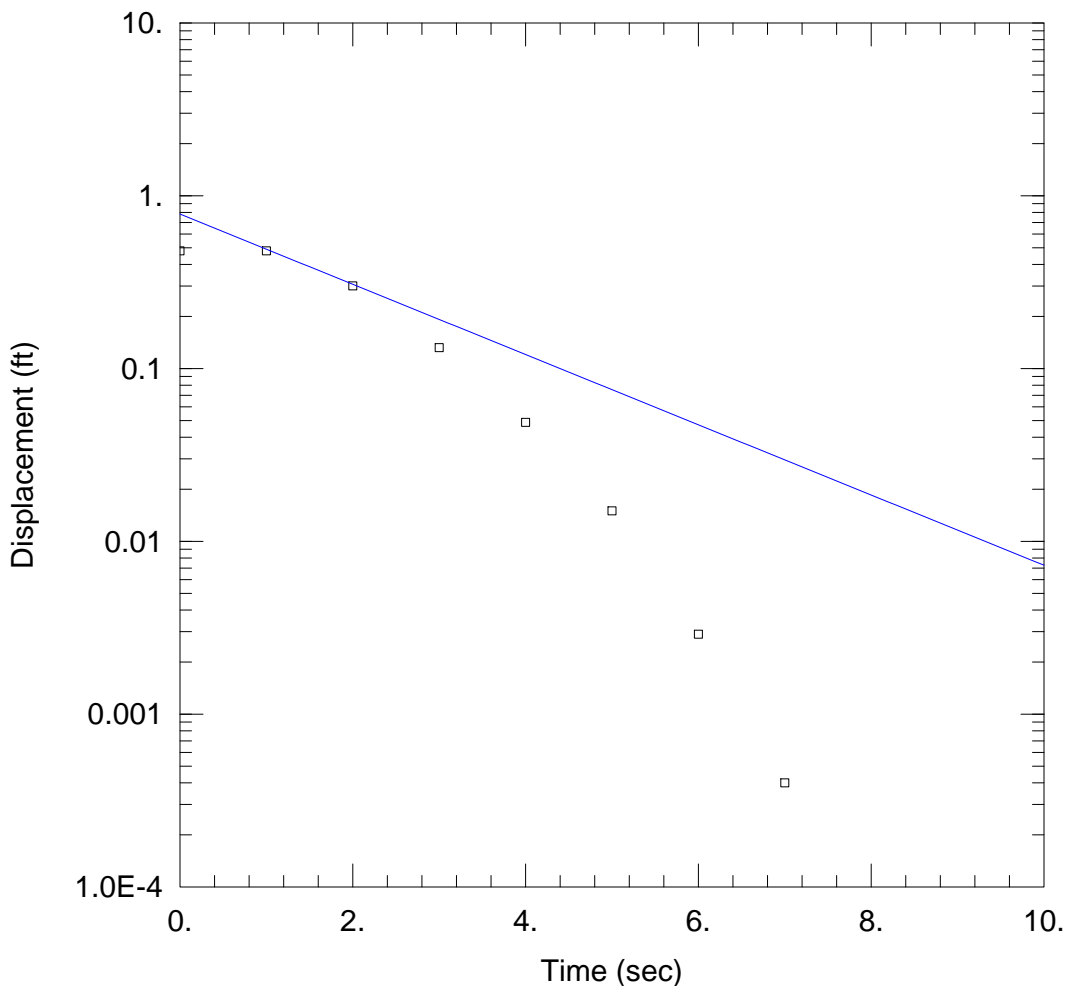
WELL DATA (GW_162)

Initial Displacement: 0.794 ft Static Water Column Height: 18.97 ft
 Total Well Penetration Depth: 50 ft Screen Length: 10 ft
 Casing Radius: 0.086 ft Well Radius: 0.25 ft
 Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice
 K = 147.3 gal/day/ft² y0 = 0.1541 ft

Figure C21. Well GW_163 Slug "Out"; low K estimate



SLUG "OUT" TEST AT GW_163

Data Set: C:\1_Projects\WWBWC\Eastside\Slug Tests\Aqtesol\GW_163_SlugOut_1_lo.aqt
 Date: 06/15/17 Time: 12:24:29

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: GW_163
 Test Date: 11/16/16

AQUIFER DATA

Saturated Thickness: 7.5 ft Anisotropy Ratio (Kz/Kr): 1.

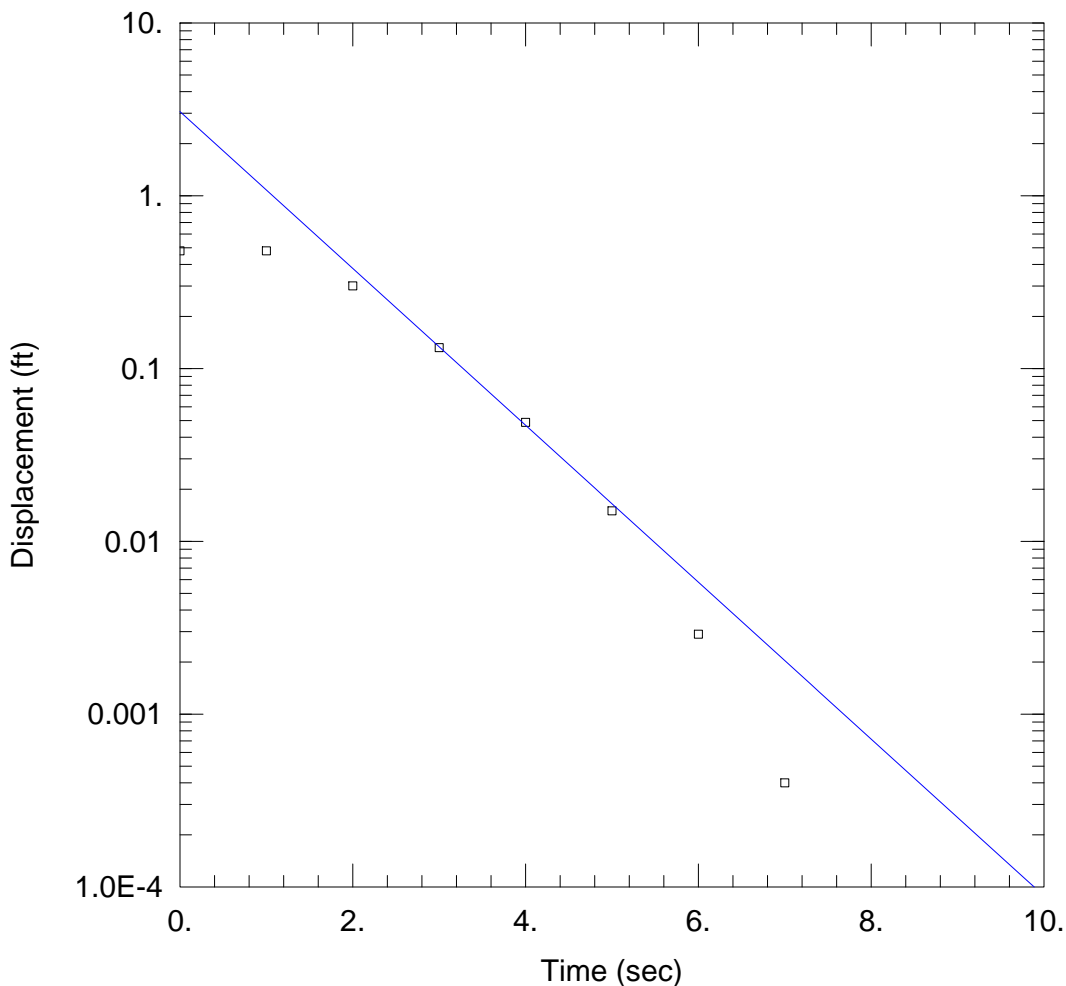
WELL DATA (GW_163)

Initial Displacement: 0.48 ft Static Water Column Height: 3.24 ft
 Total Well Penetration Depth: 25.5 ft Screen Length: 10. ft
 Casing Radius: 0.083 ft Well Radius: 0.25 ft
 Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice
 K = 1381.1 gal/day/ft² y₀ = 0.7829 ft

Figure C22. Well GW_163 Slug "Out"; high K estimate



SLUG "OUT" TEST AT GW_163

Data Set: C:\1_Projects\WWBWC\Eastside\Slug Tests\Aqtesol\GW_163_SlugOut_1_hi.aqt
 Date: 06/15/17 Time: 12:29:22

PROJECT INFORMATION

Company: NLW
 Client: WWBCW
 Project: 1601
 Location: Eastside
 Test Well: GW_163
 Test Date: 11/16/16

AQUIFER DATA

Saturated Thickness: 7.5 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (GW_163)

Initial Displacement: 0.48 ft Static Water Column Height: 3.24 ft
 Total Well Penetration Depth: 25.5 ft Screen Length: 10. ft
 Casing Radius: 0.083 ft Well Radius: 0.25 ft
 Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
 K = 3084.8 gal/day/ft² y₀ = 3.067 ft

Appendix D: Hydraulic Tomography Analysis Graphs / Maps

Hydraulic tomography (HT) is a method to estimate the spatial distribution of aquifer hydraulic properties. It is best used with pumping and pressure response testing whereby sequential aquifer tests are performed at multiple wells and the response measured at nearby wells. The degree to which the 3-dimensional distribution of aquifer parameters can be evaluated depends on the number of wells screened in different vertical intervals in the subsurface. Data sets from multiple tests are processed via a mathematical model. Having many sequential aquifer test data sets in a hydraulically connected aquifer(s) makes the (HT) parameter estimation better posed (mathematically) and the parameter results are more unique compared to traditional aquifer tests. This, in turn, can improve predictions of groundwater flow because the HT estimates are more accurate. Note: other “forcings”, e.g. river stage changes, and pressure responses can also be used with HT methods.

More information about HT is here:

Yeh, T. and S. Liu (2000), Hydraulic tomography: Development of a new aquifer test method, *Water Resour. Res.*, 36, 2095-2105.

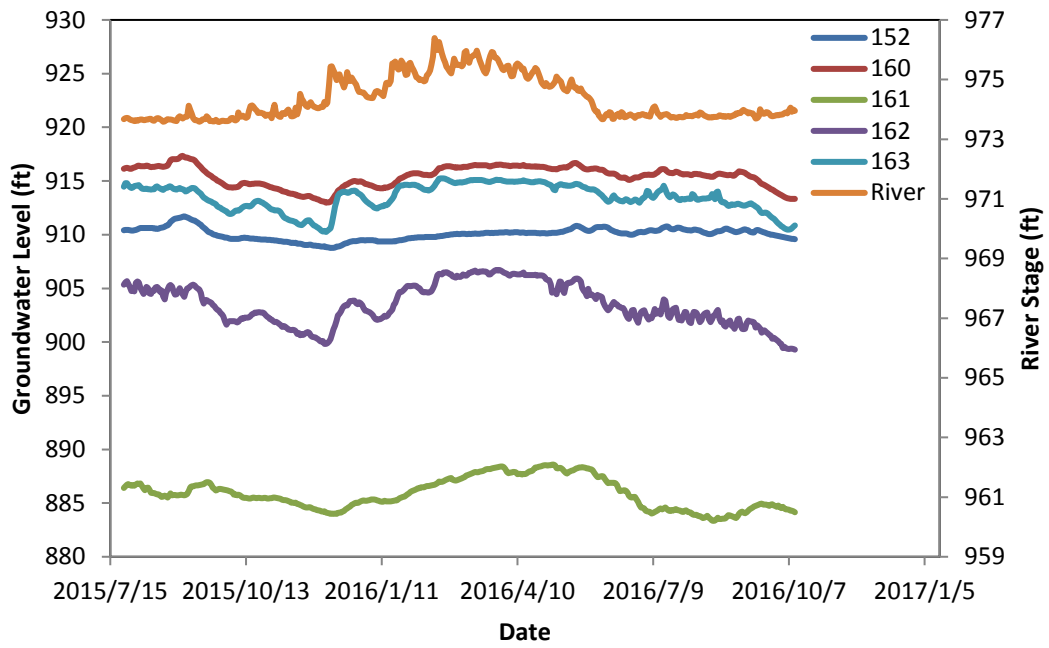
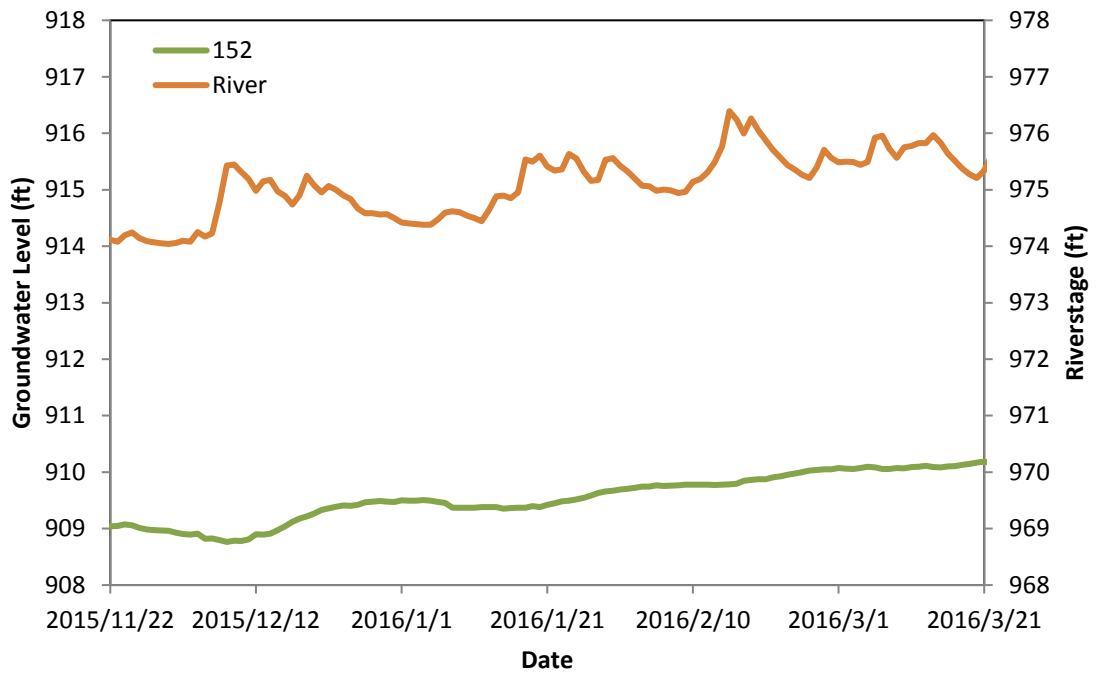
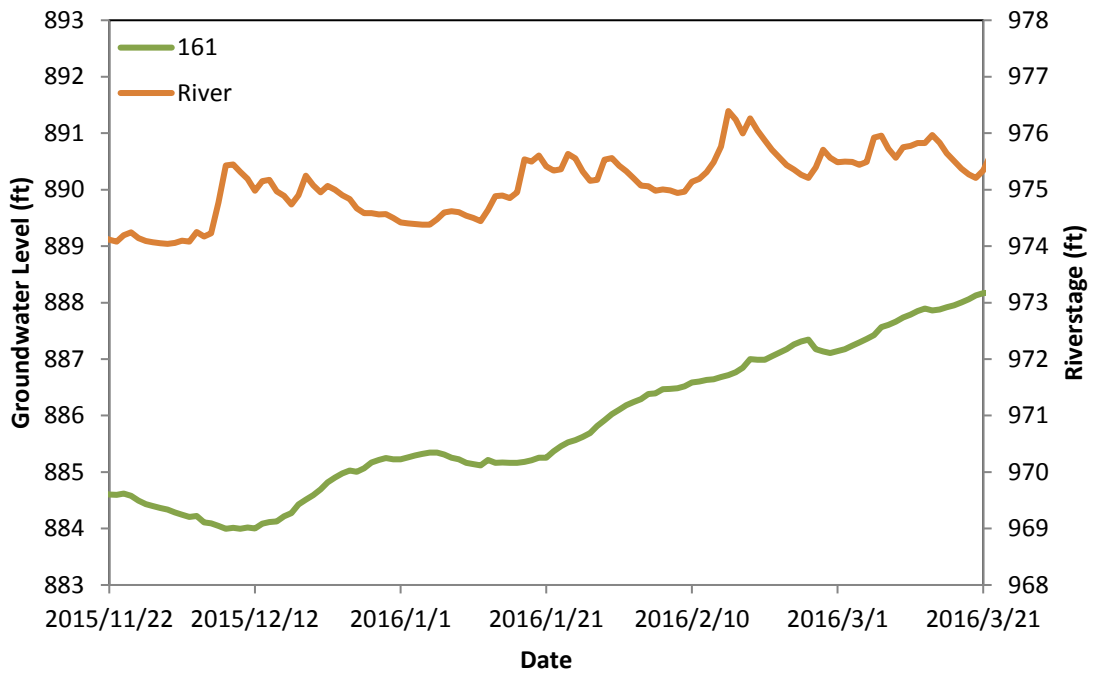
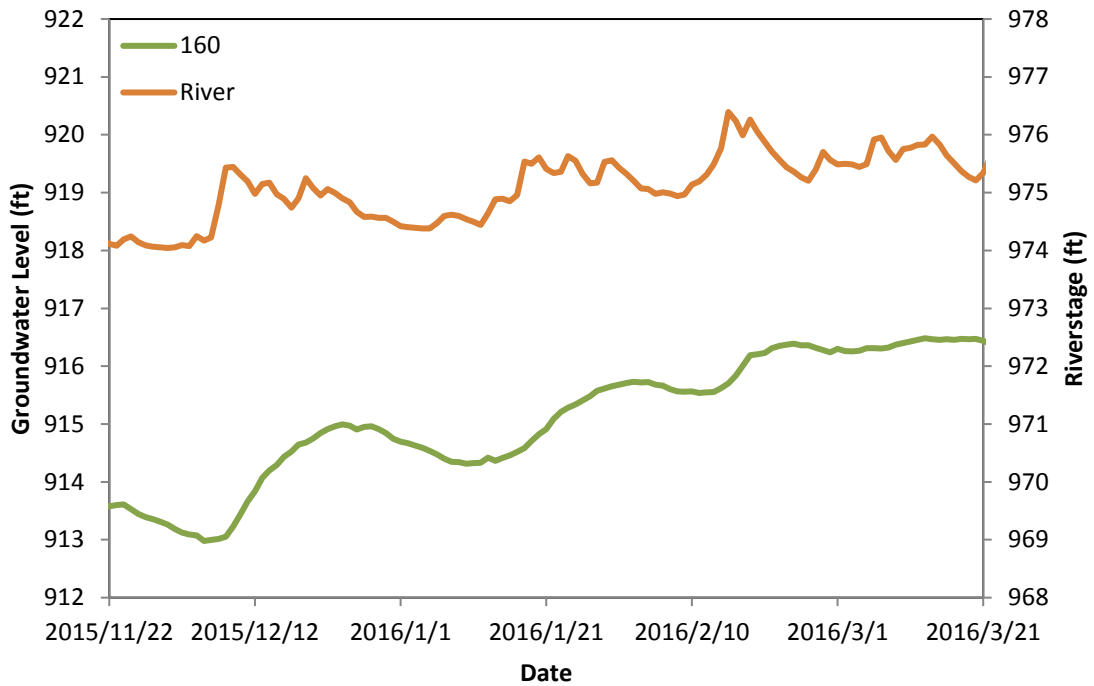


Figure 1. Available river stage and groundwater level time series.





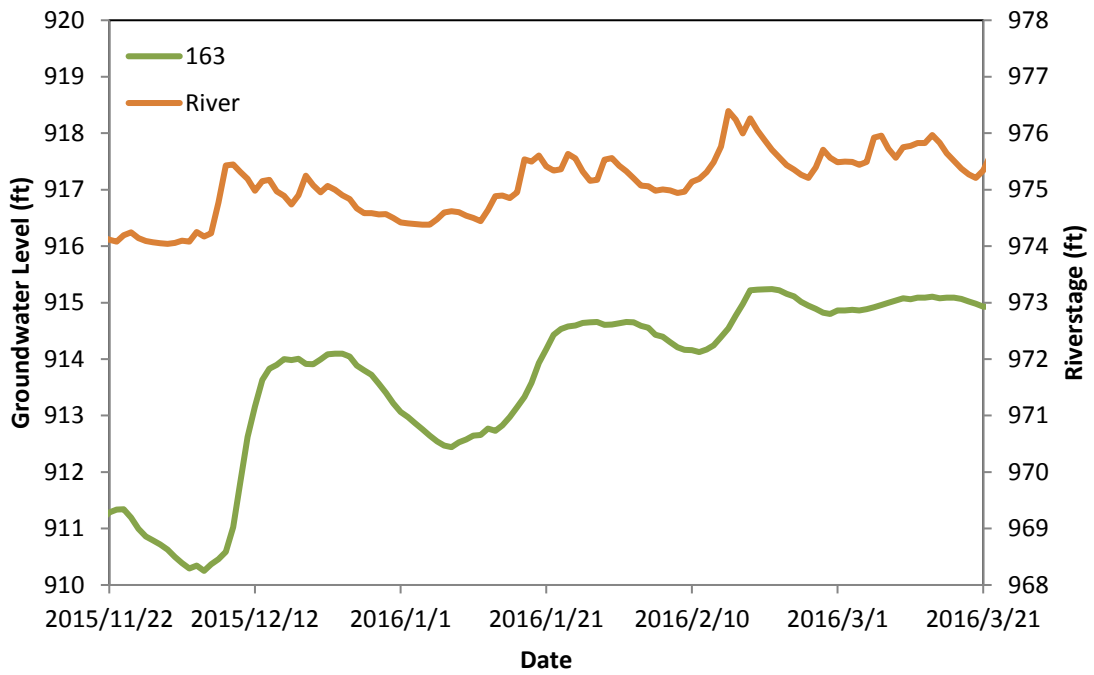
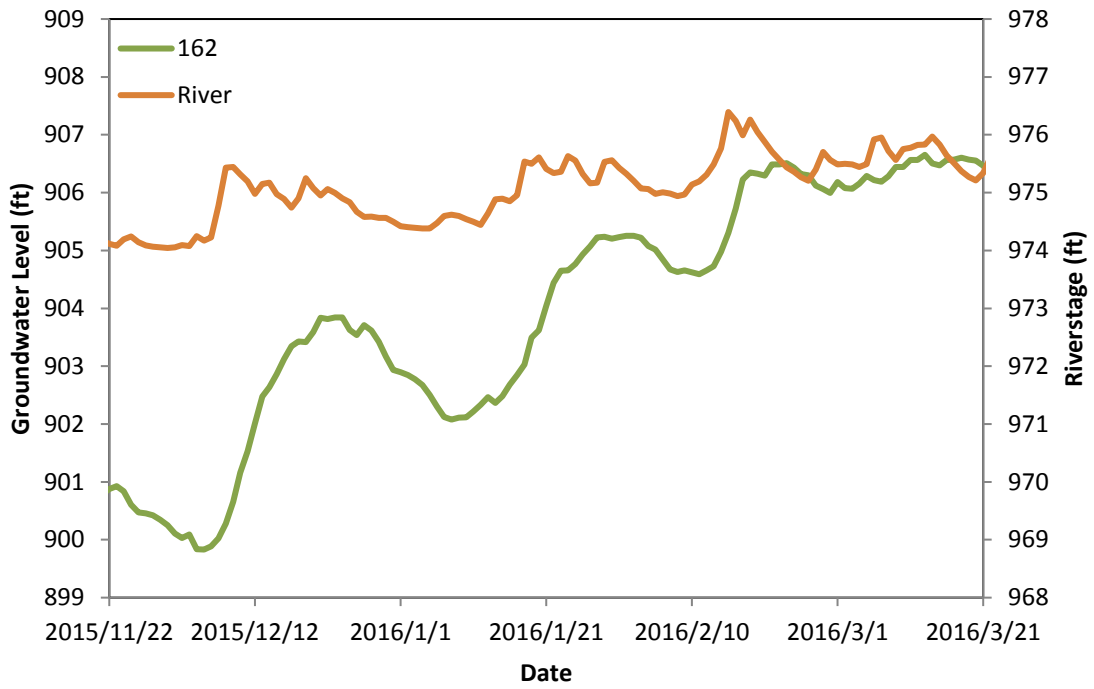


Figure 2. River stage and groundwater levels during 2015 winter and 2016 spring.

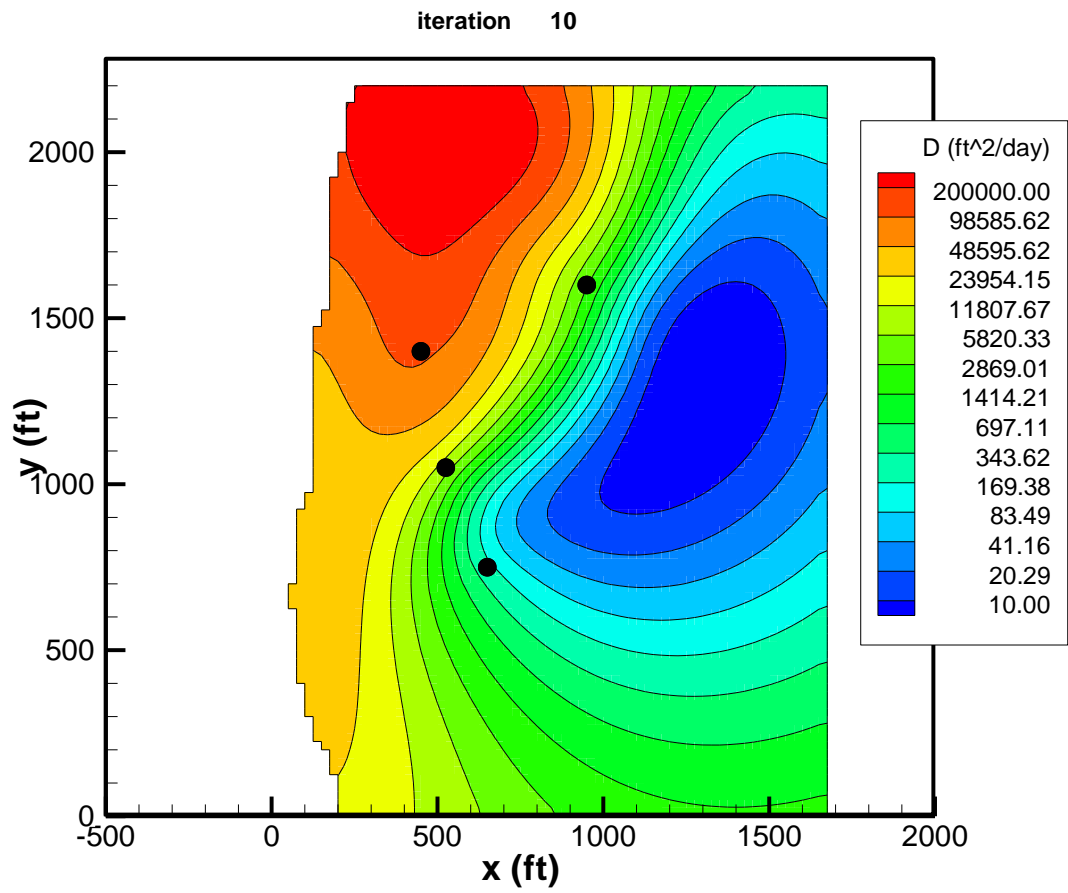


Figure 3 Estimated diffusivity field.

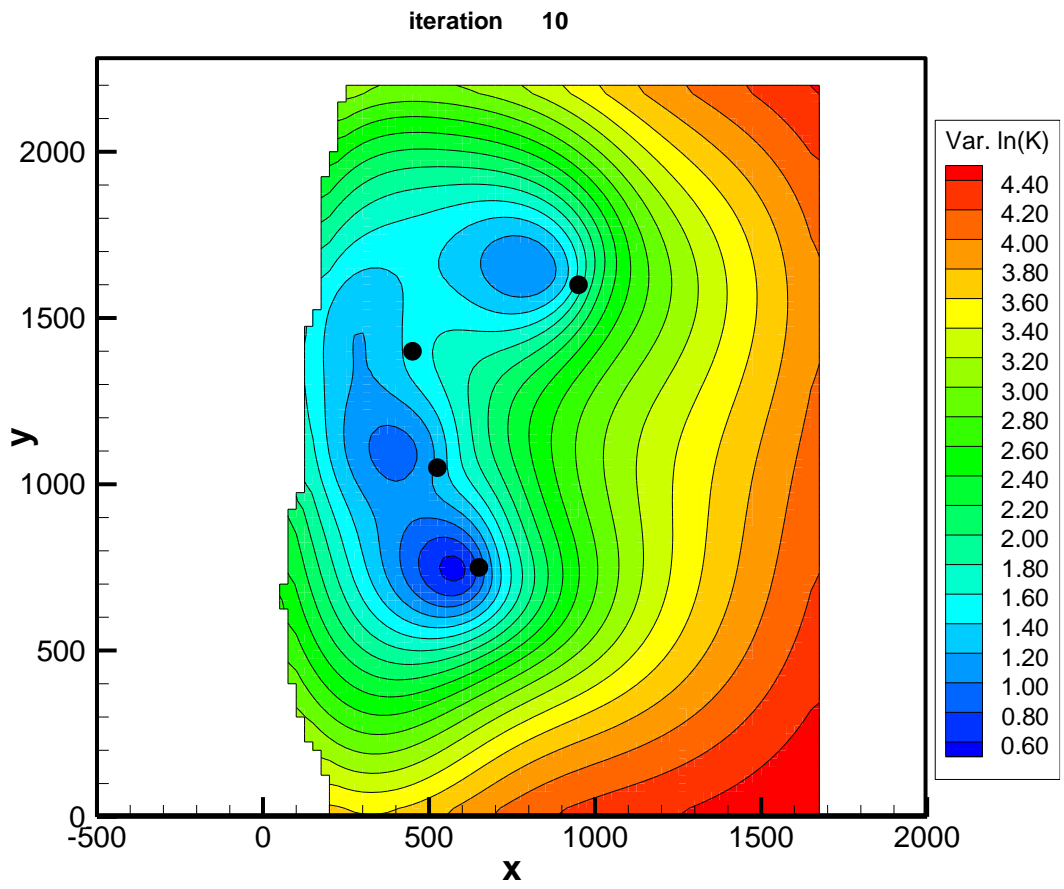


Figure 4. Variance (uncertainty) of estimated D.

Appendix E: Stable Isotope Results

Results grp'd

University of California-Davis Stable Isotope Facility
 One Shields Ave. Davis, CA 95616
 530-754-7517
 3/7/2018

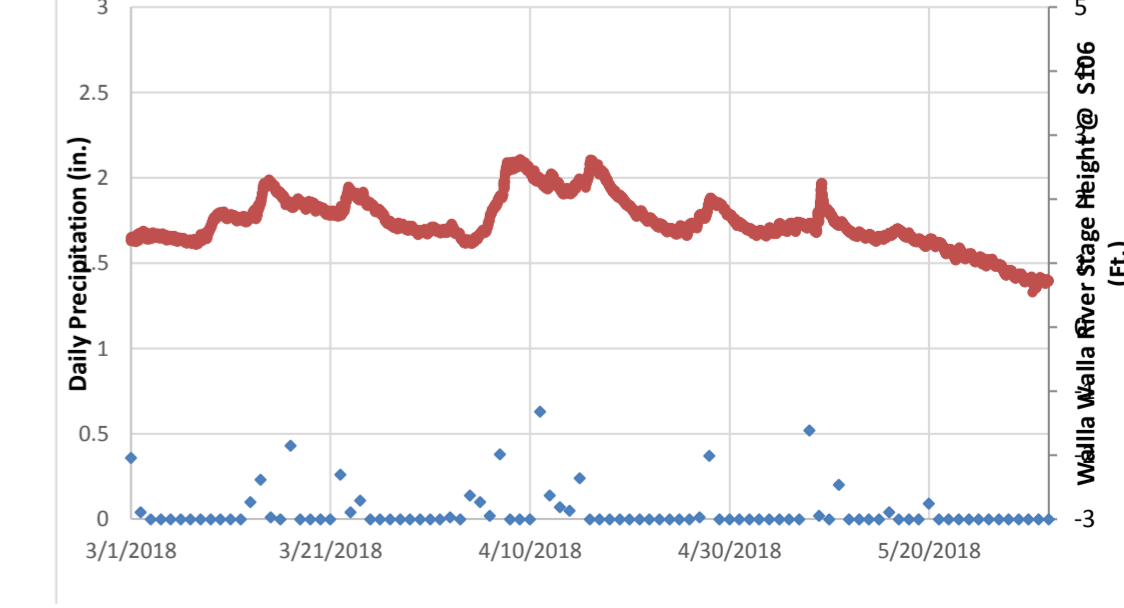
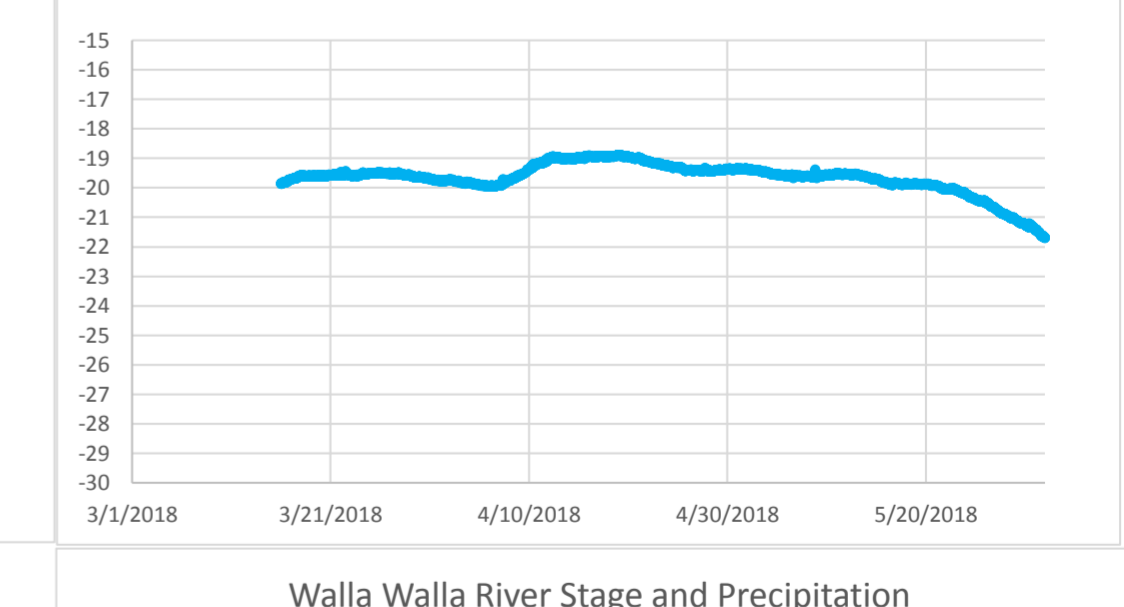
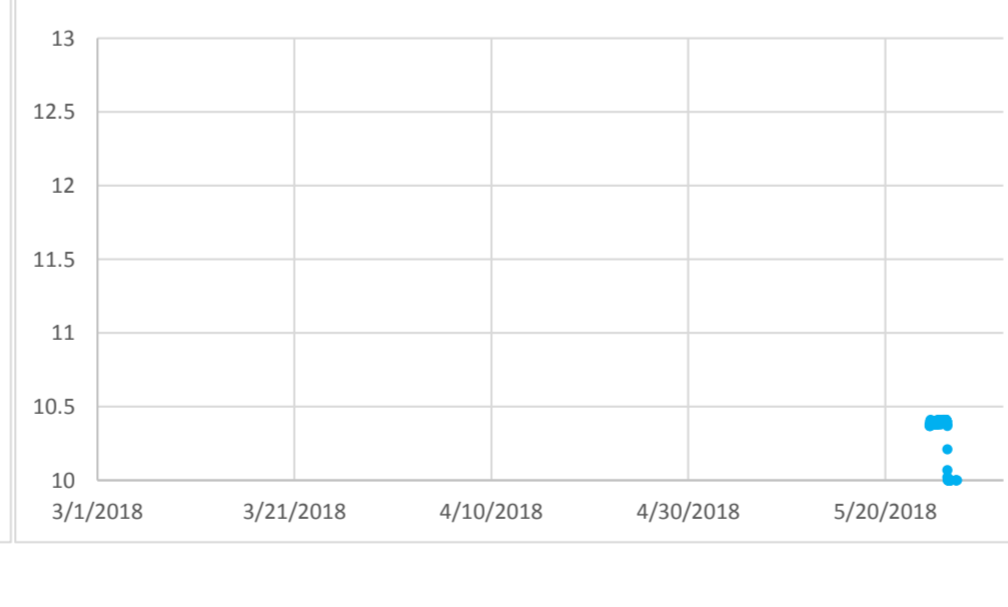
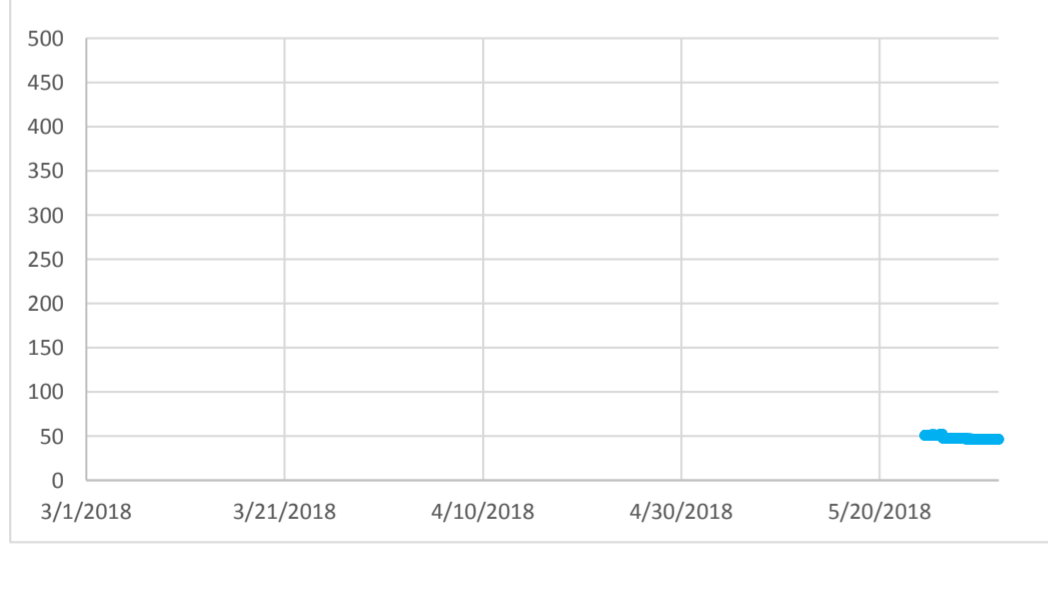
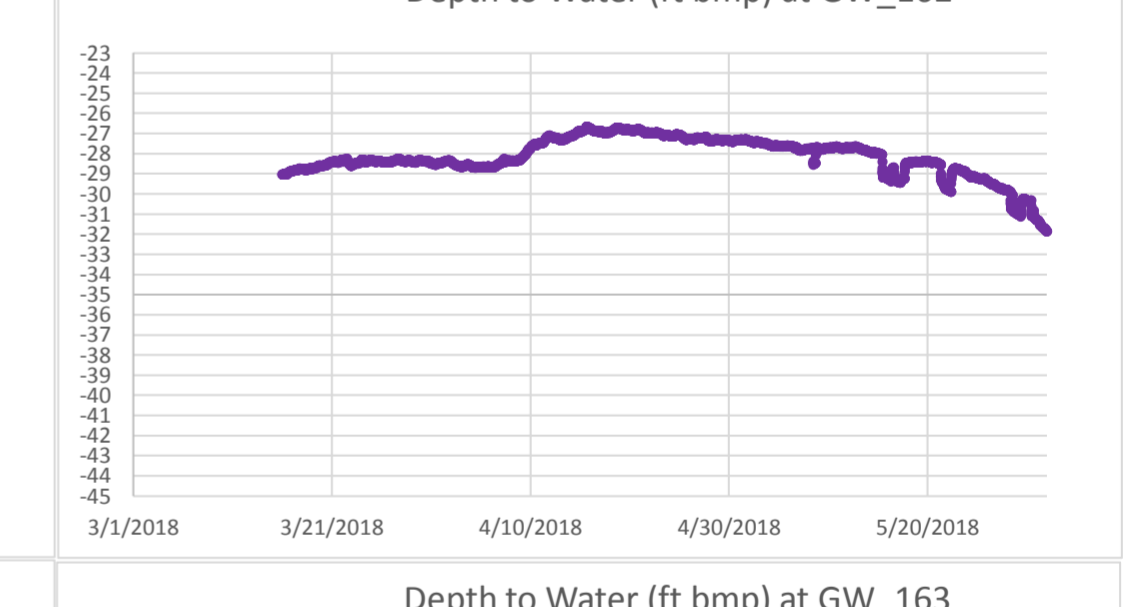
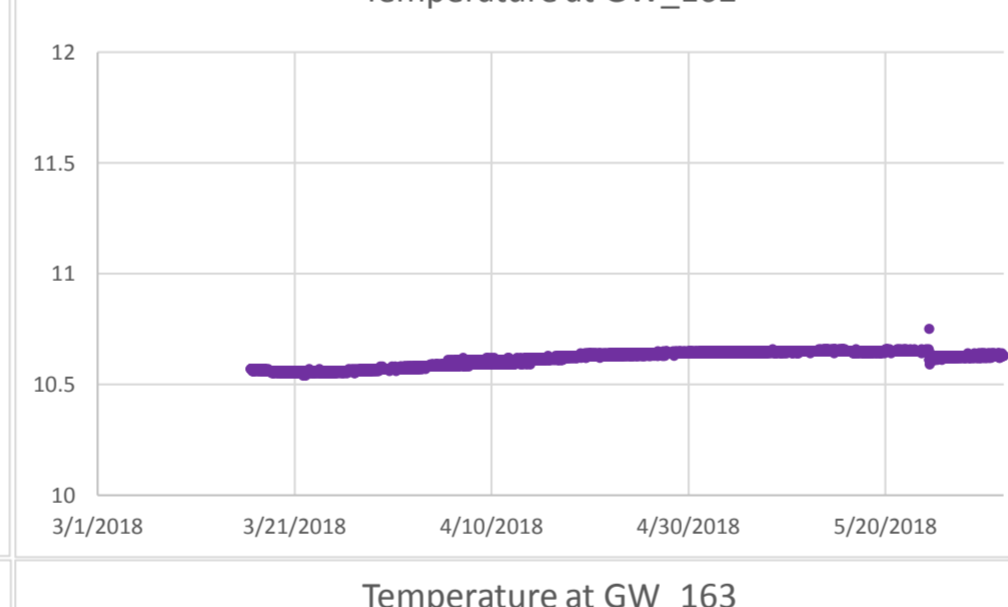
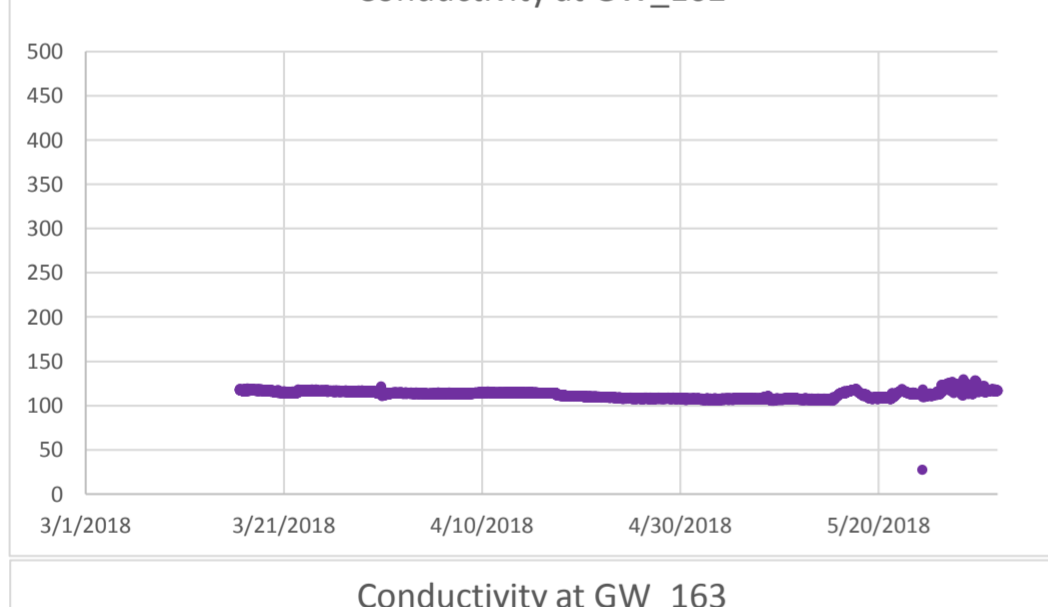
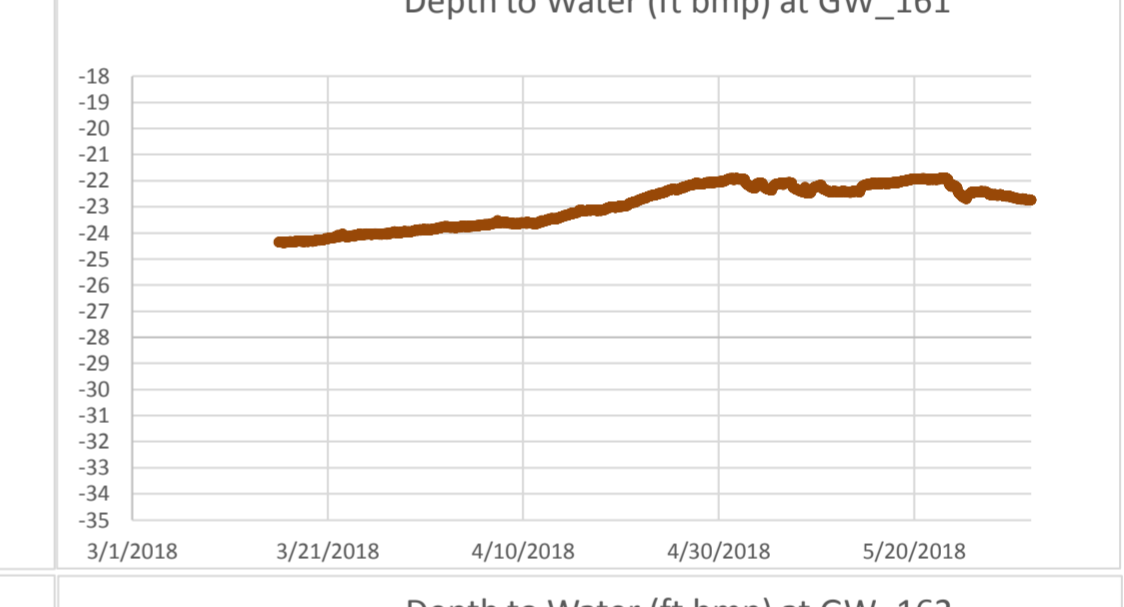
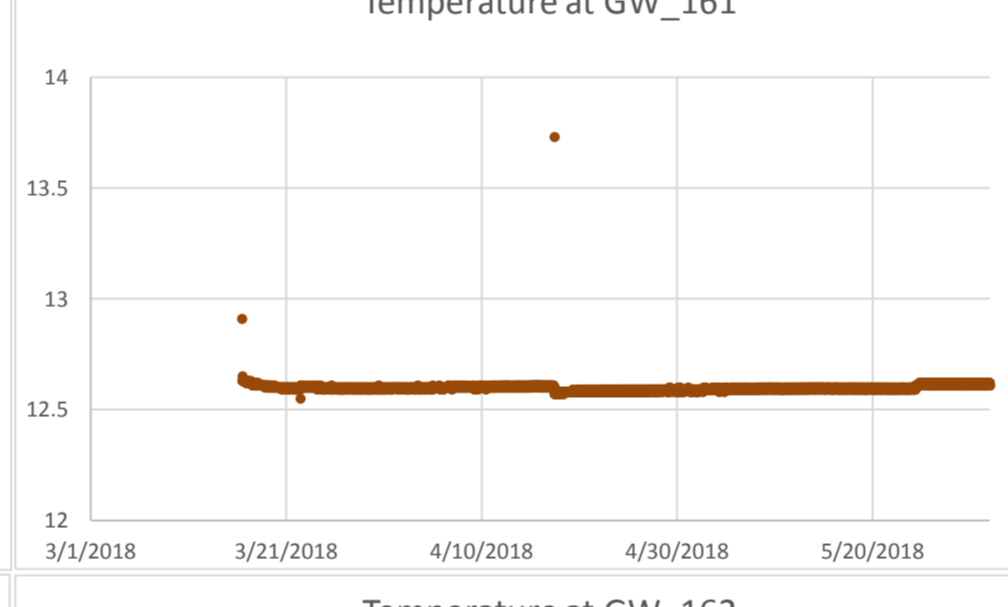
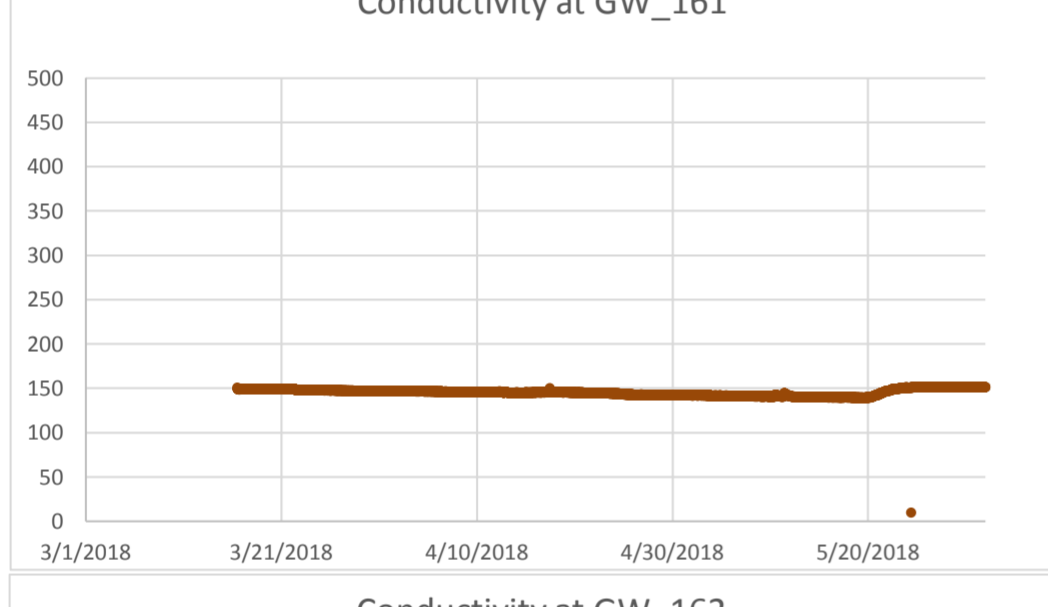
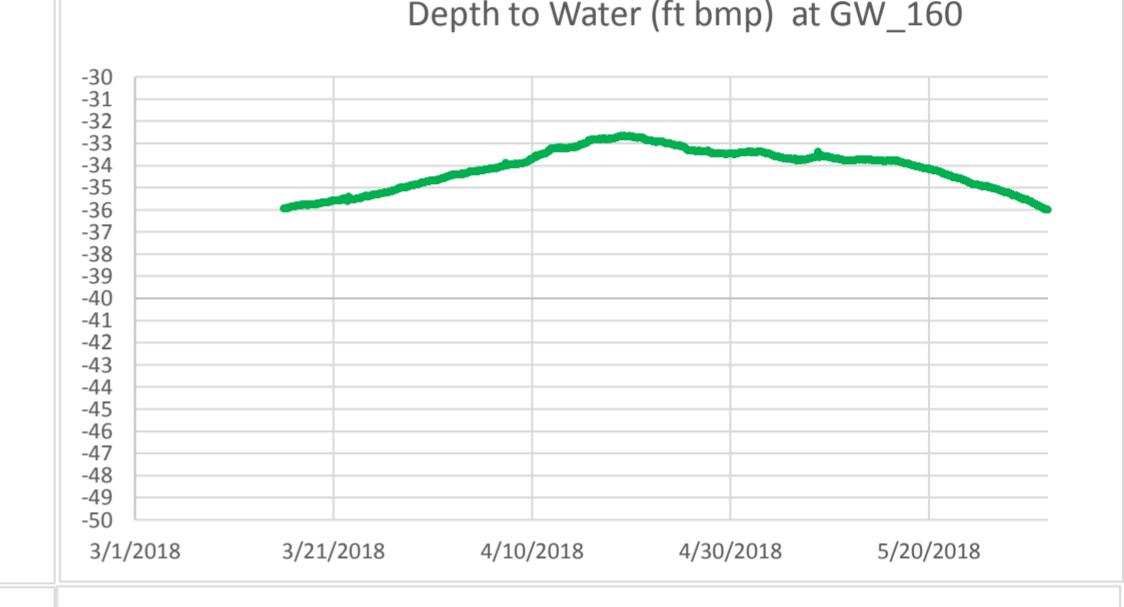
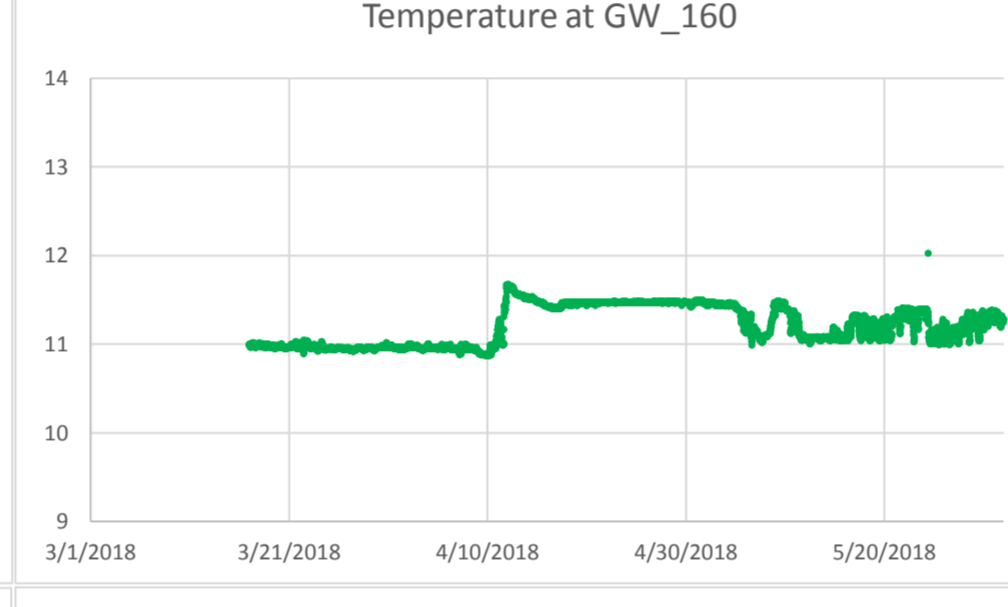
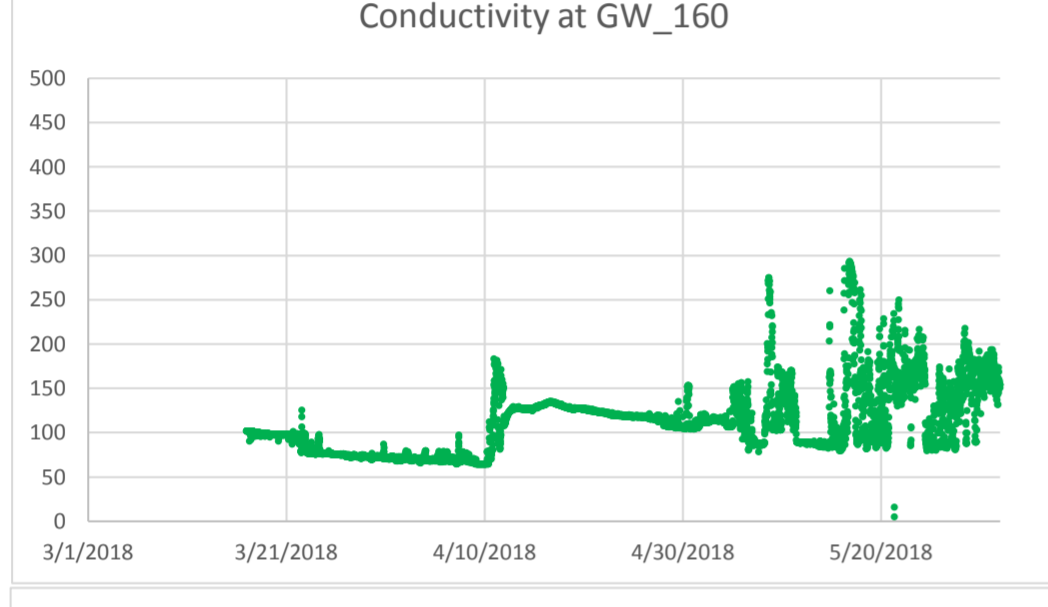
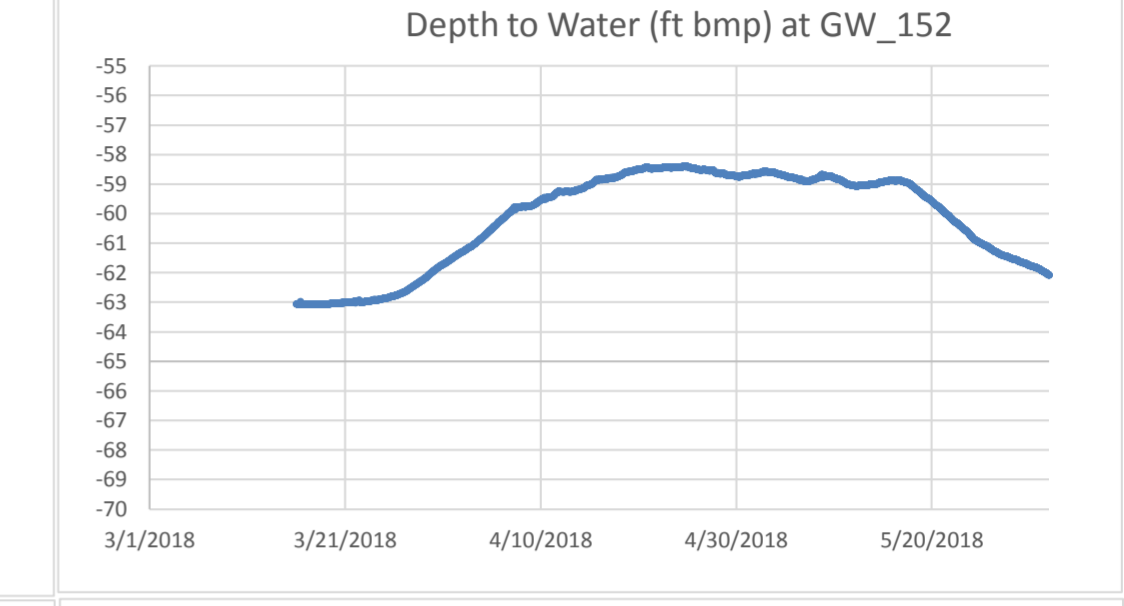
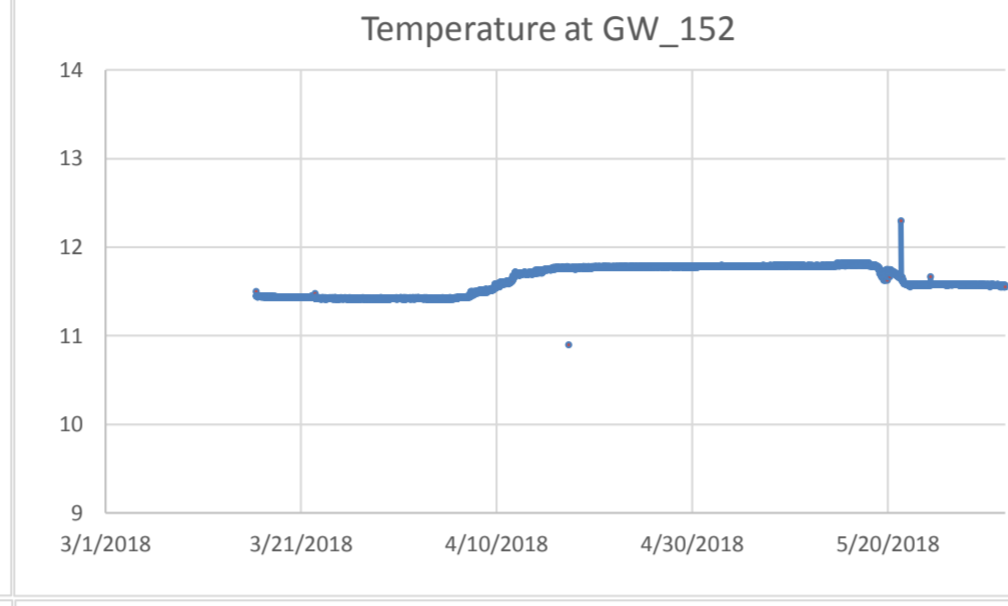
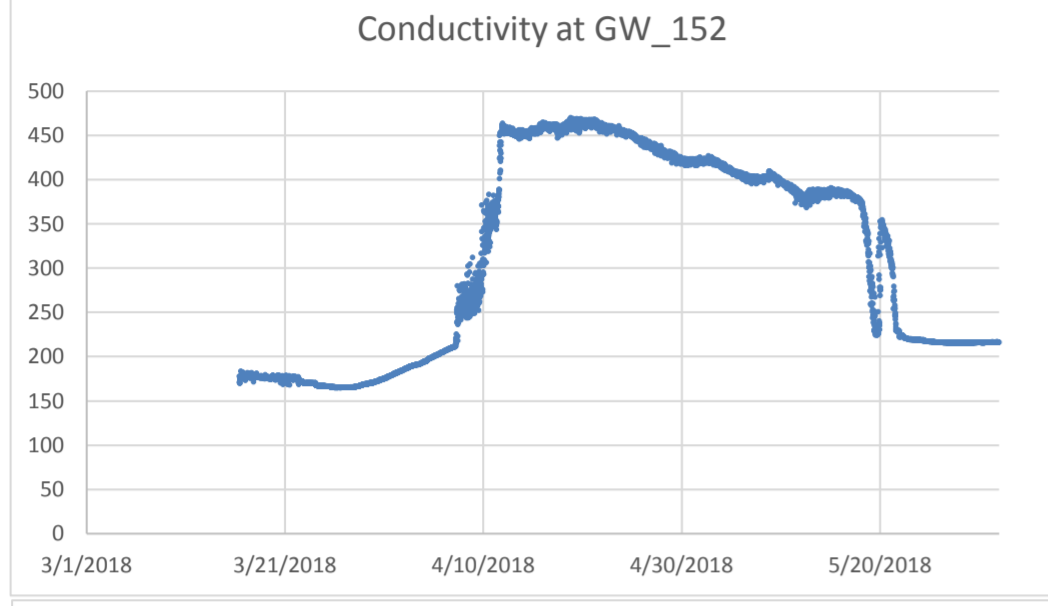
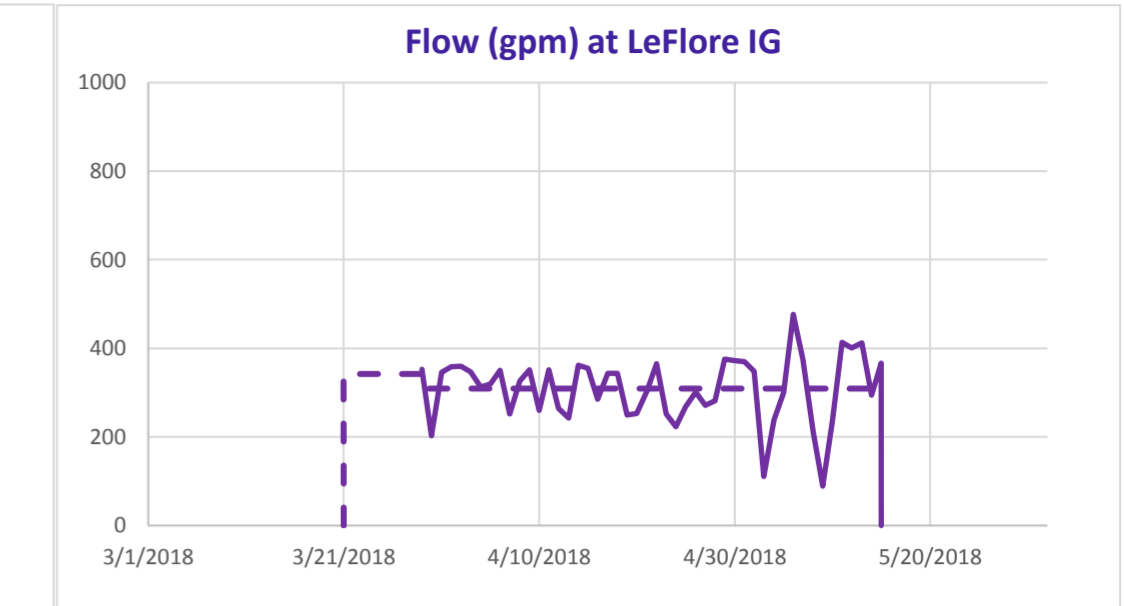
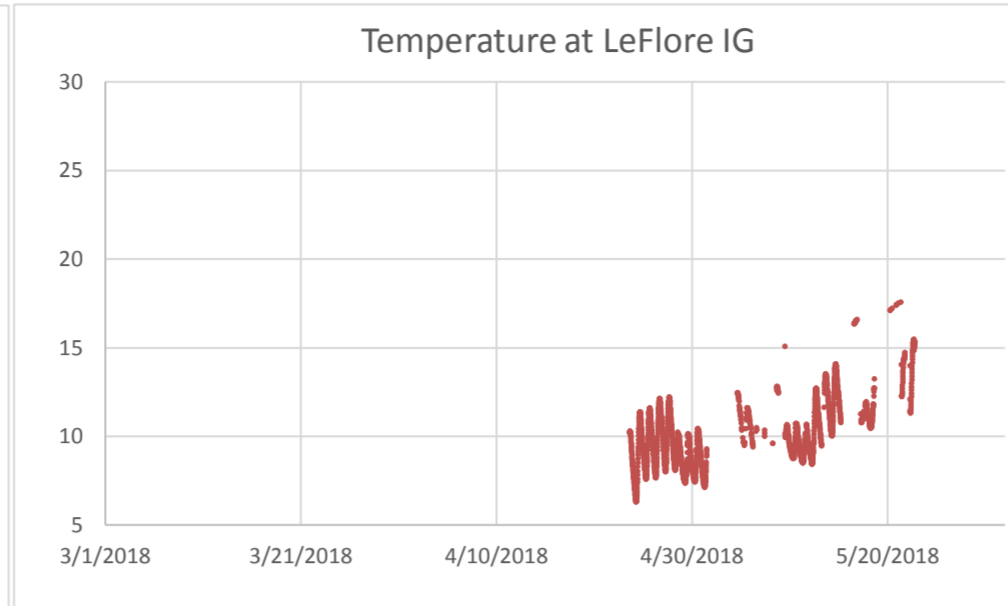
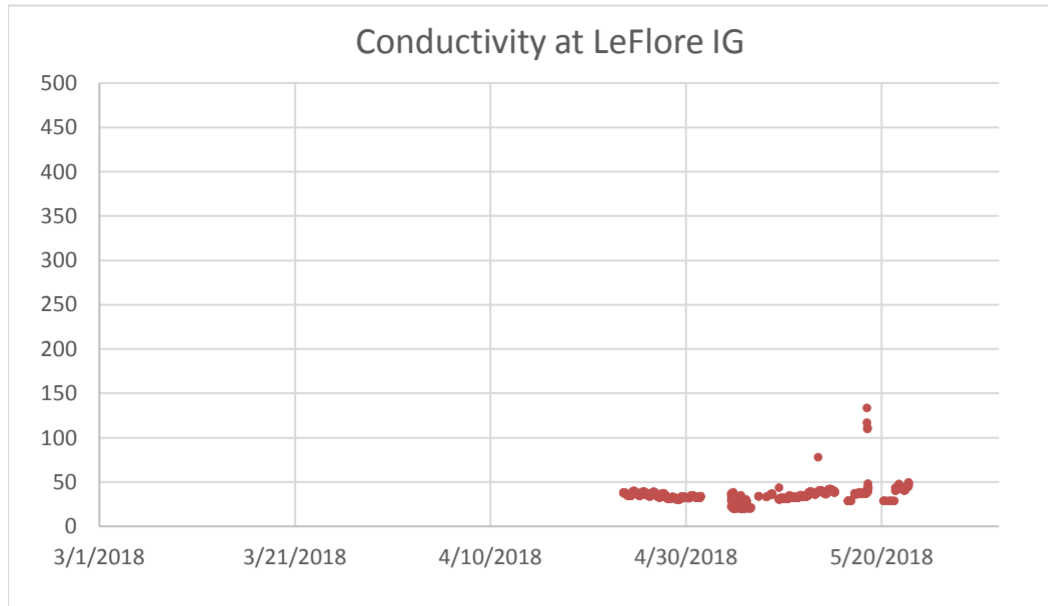
Northwest Land & Water, Inc.
 Eastside Aquifer Recharge
 Jim Mathieu
 206-525-0049
jim@nlwinc.com

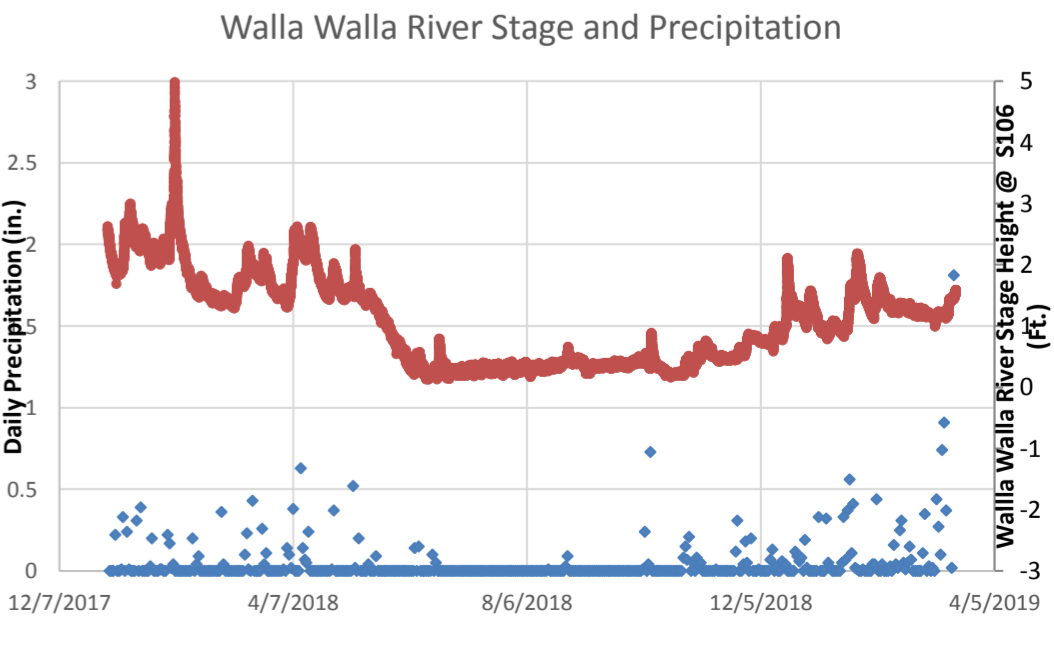
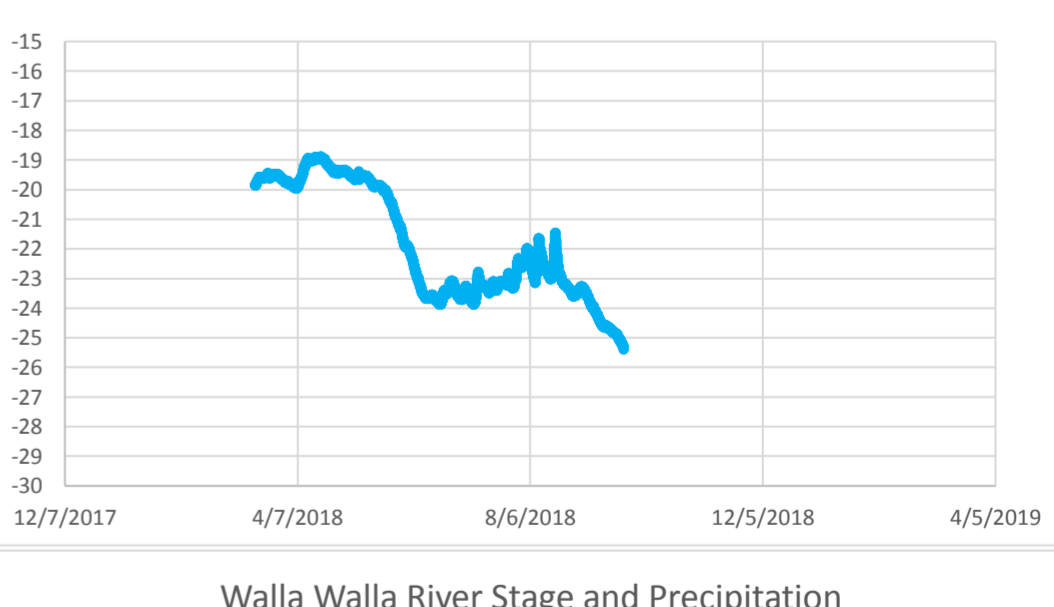
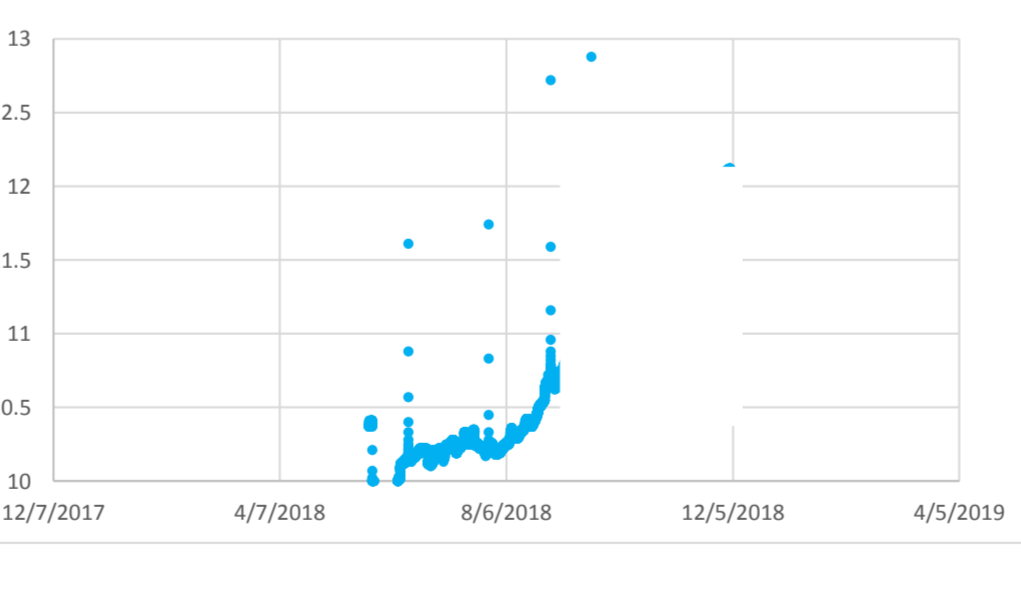
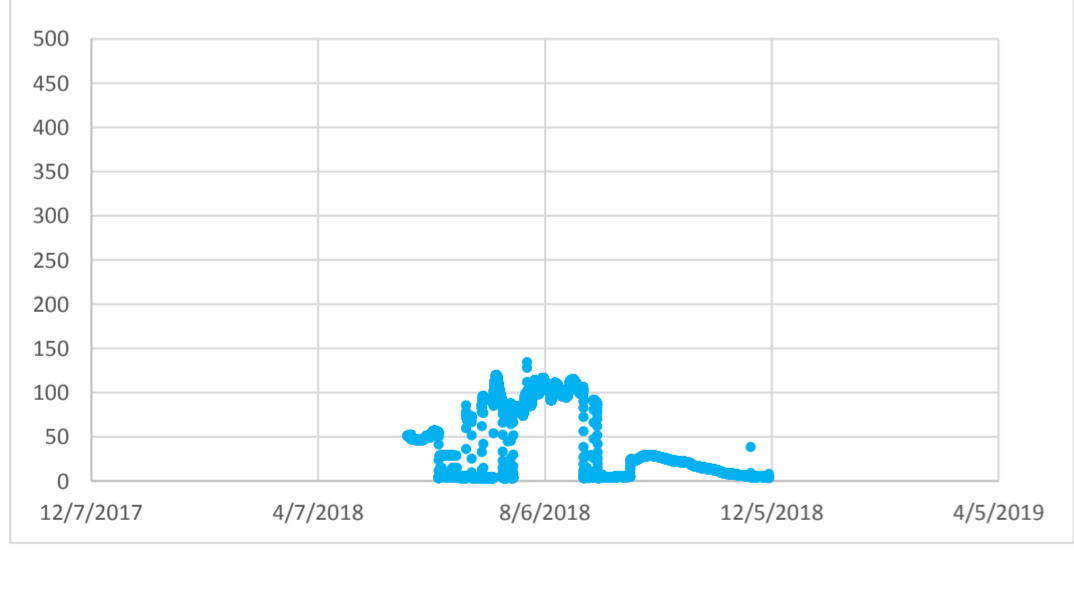
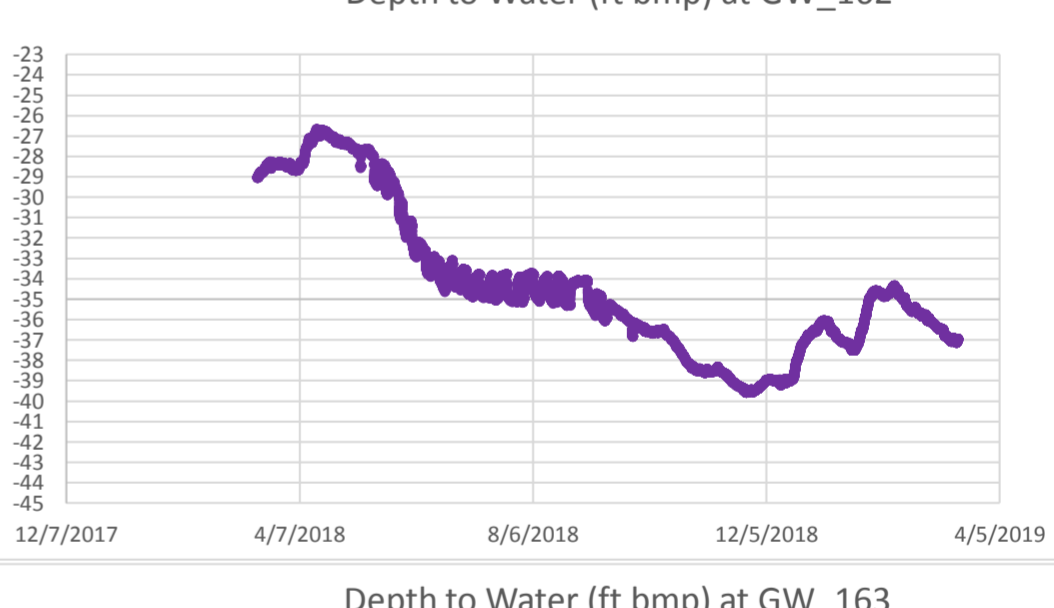
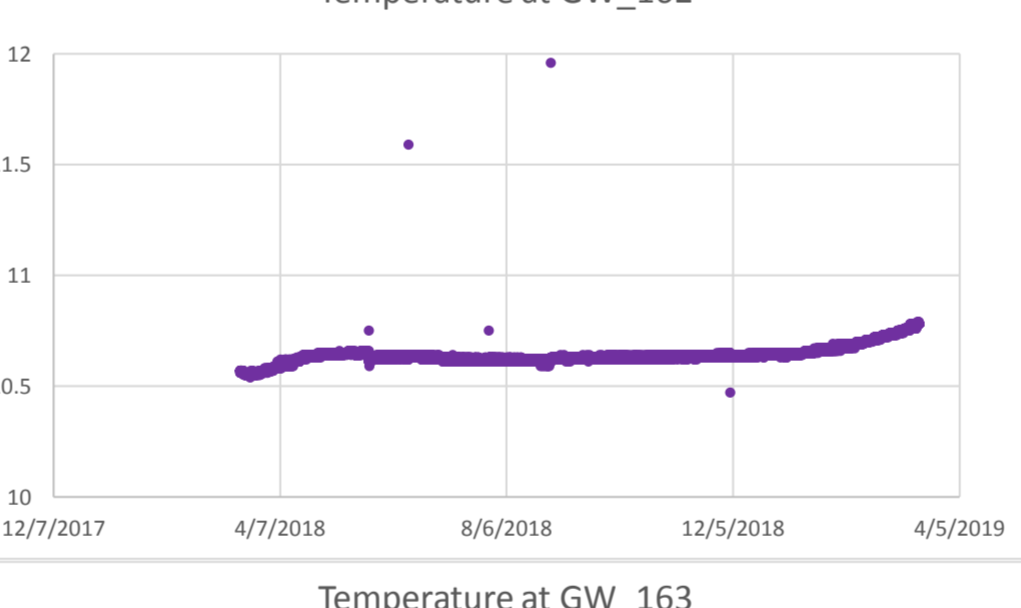
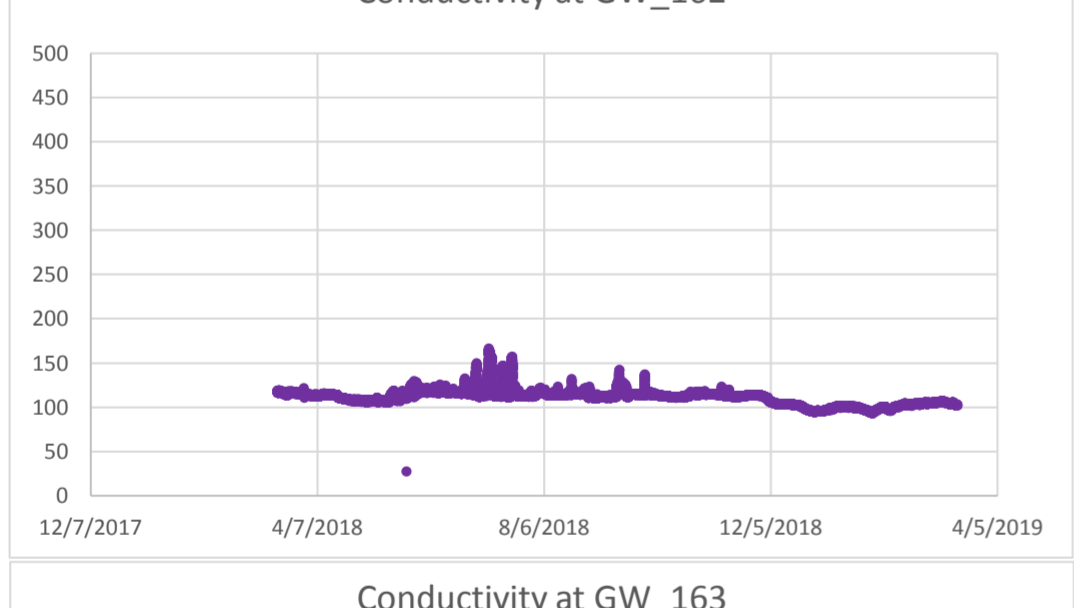
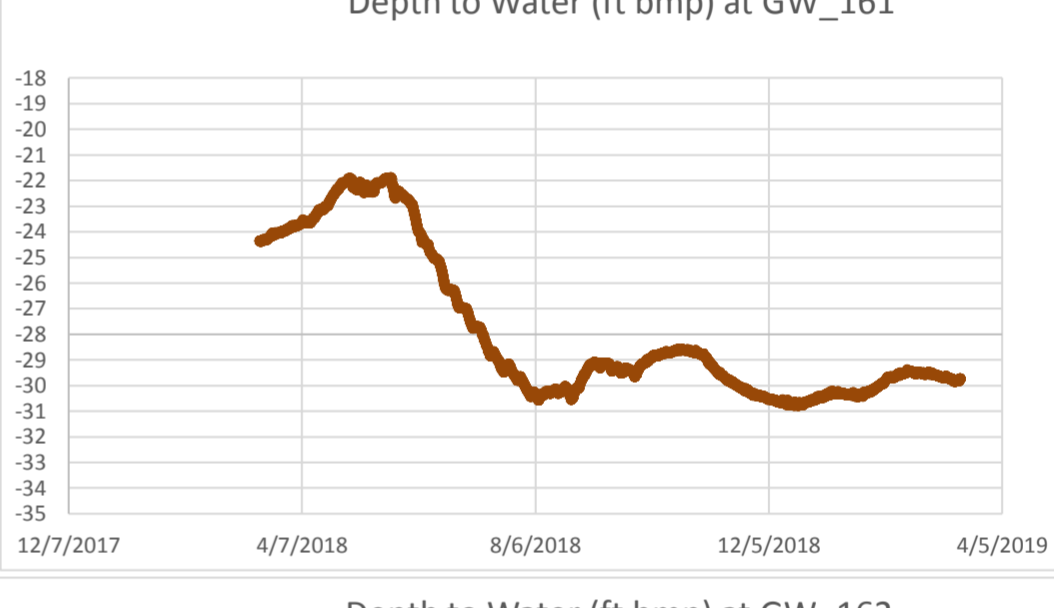
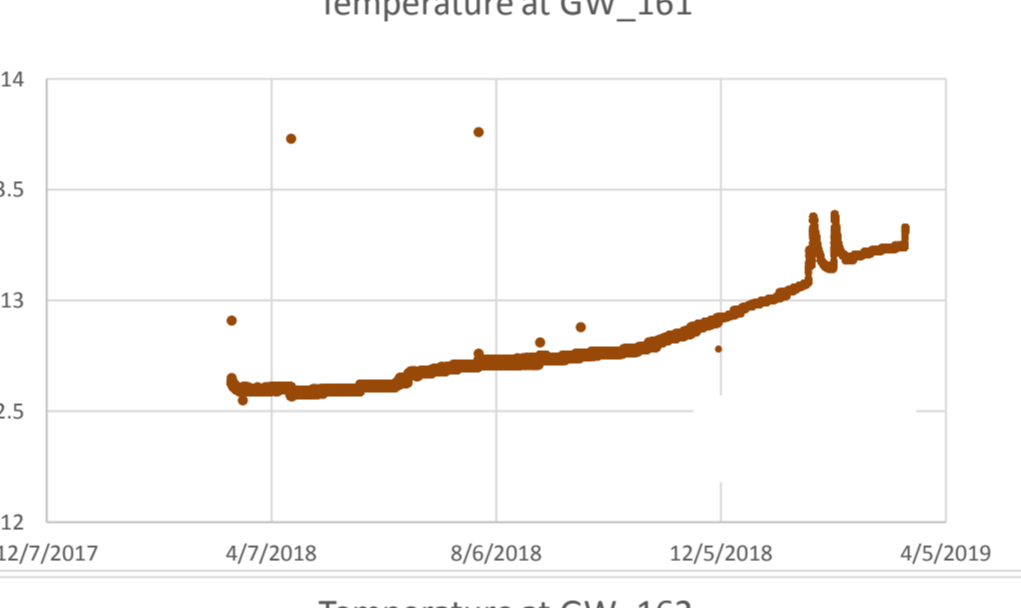
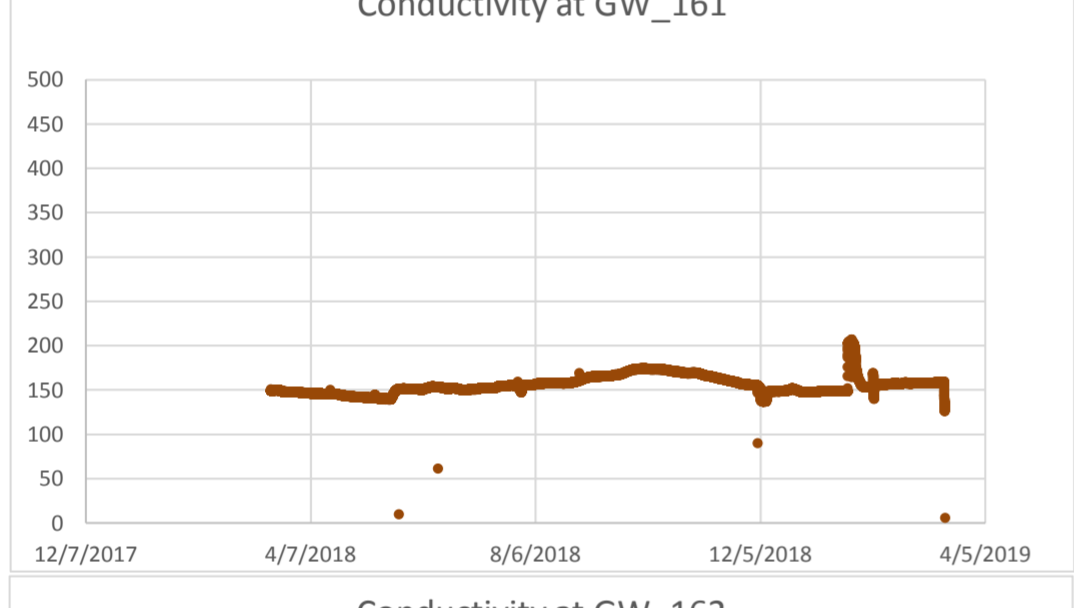
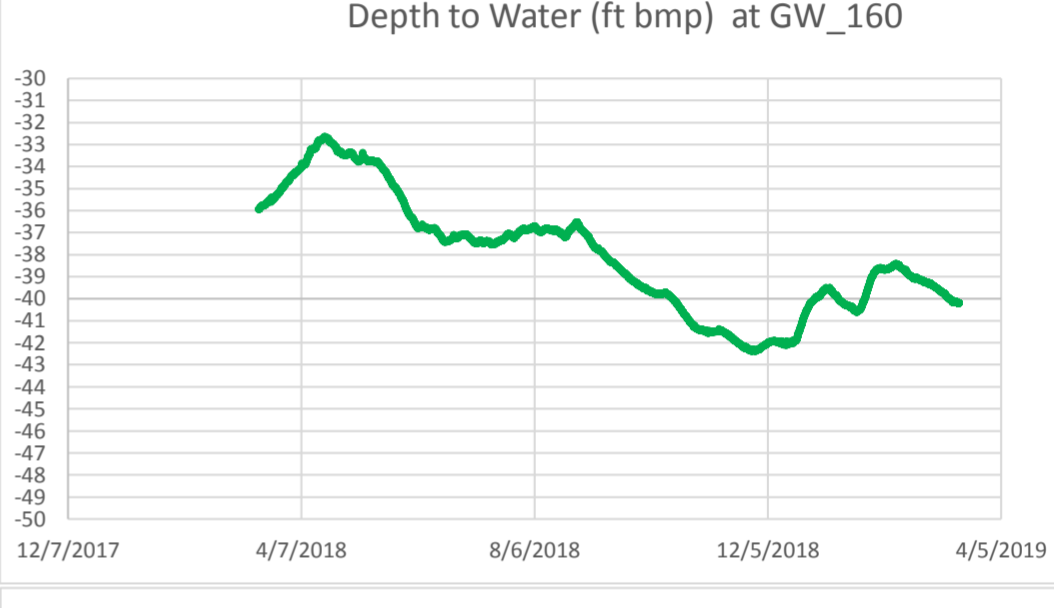
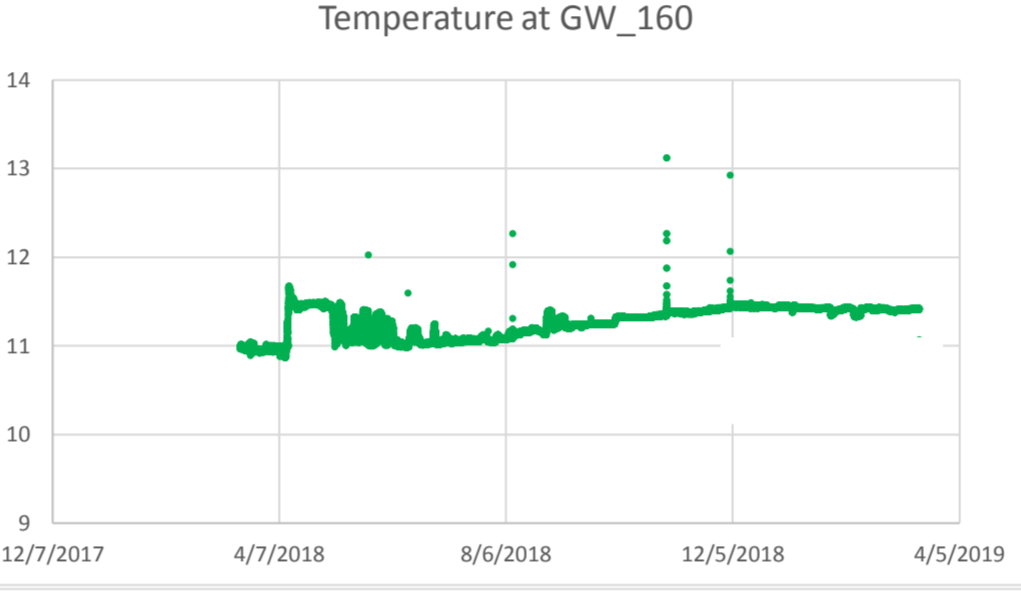
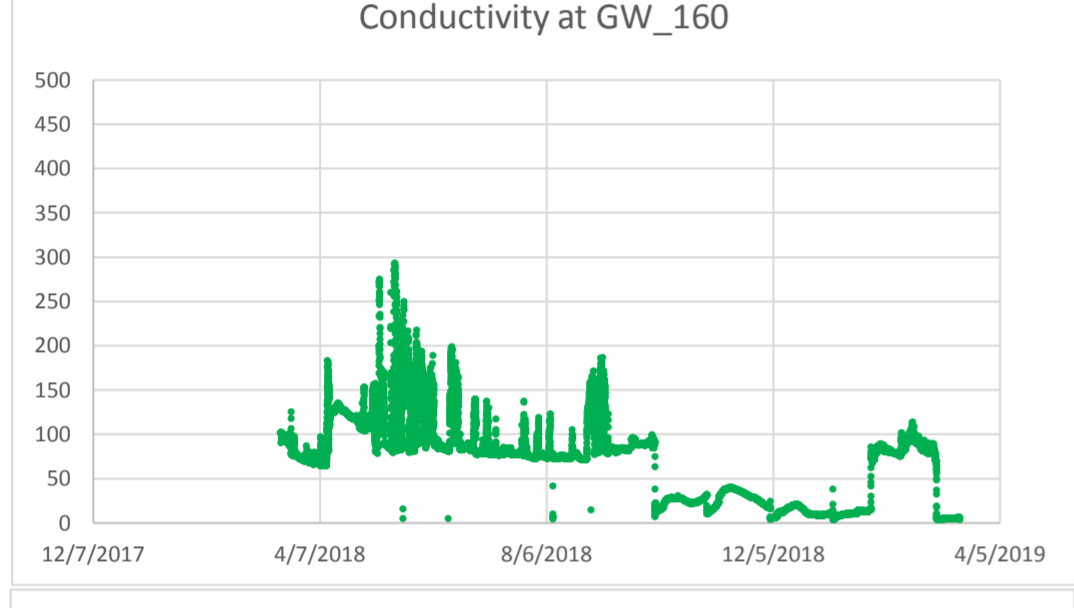
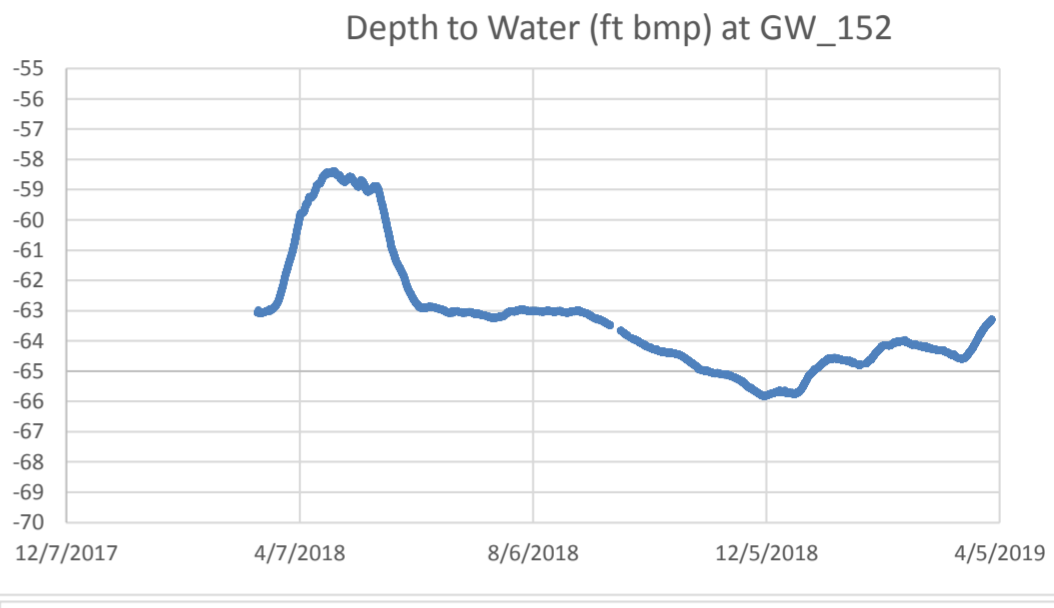
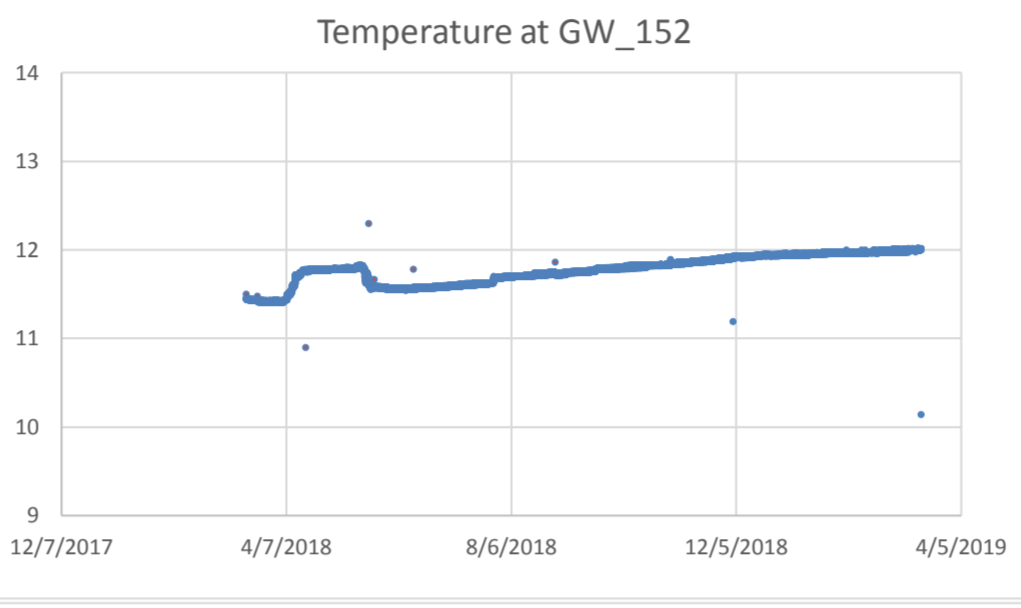
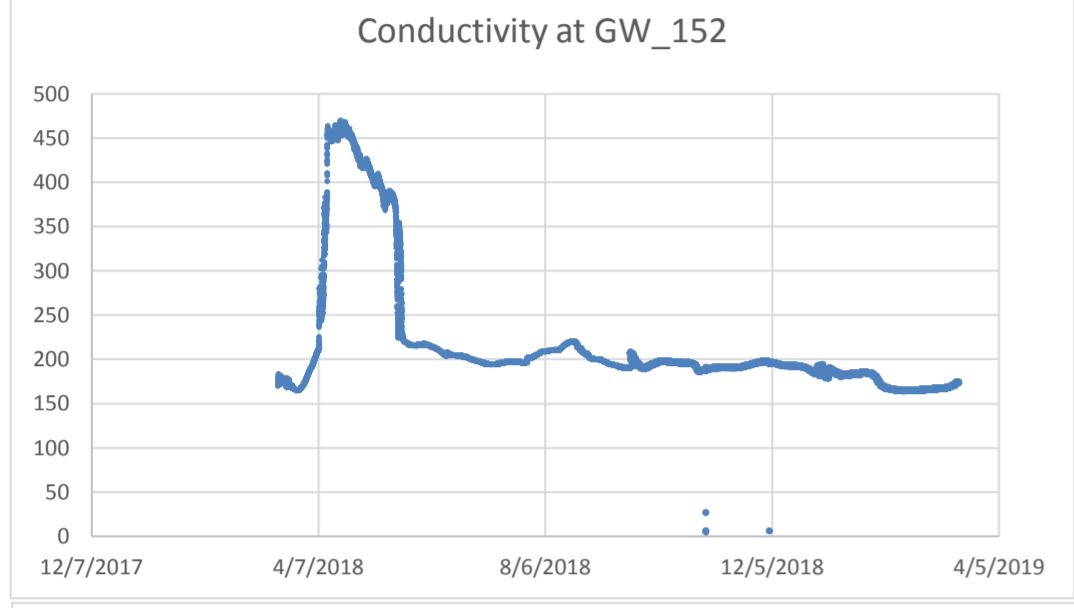
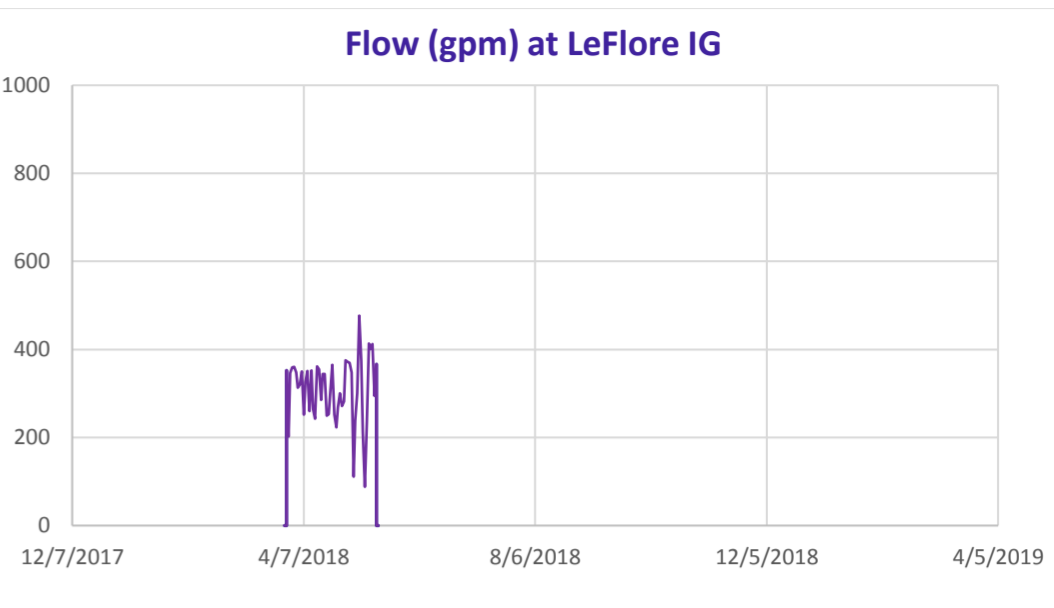
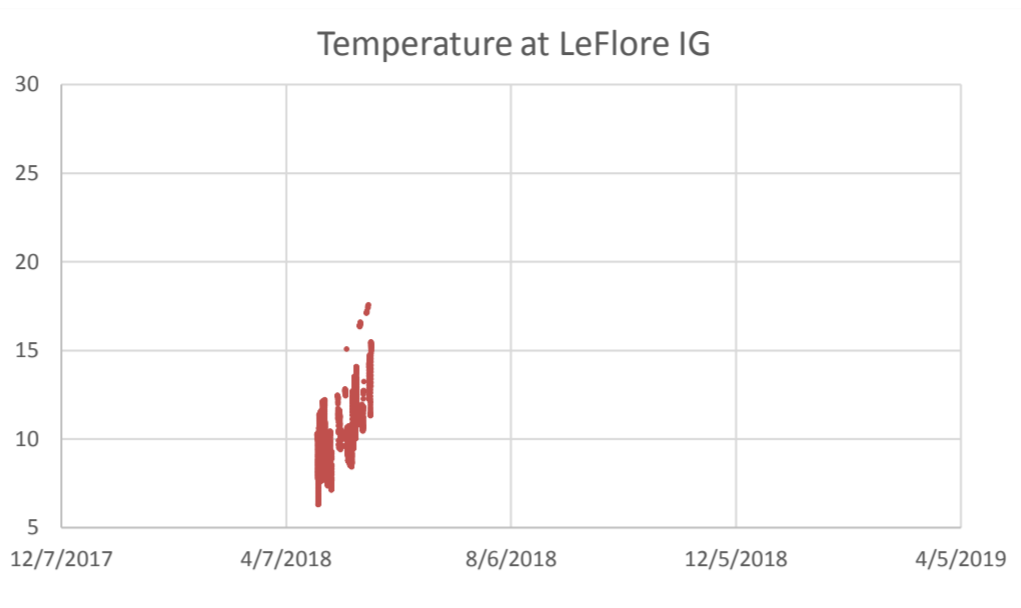
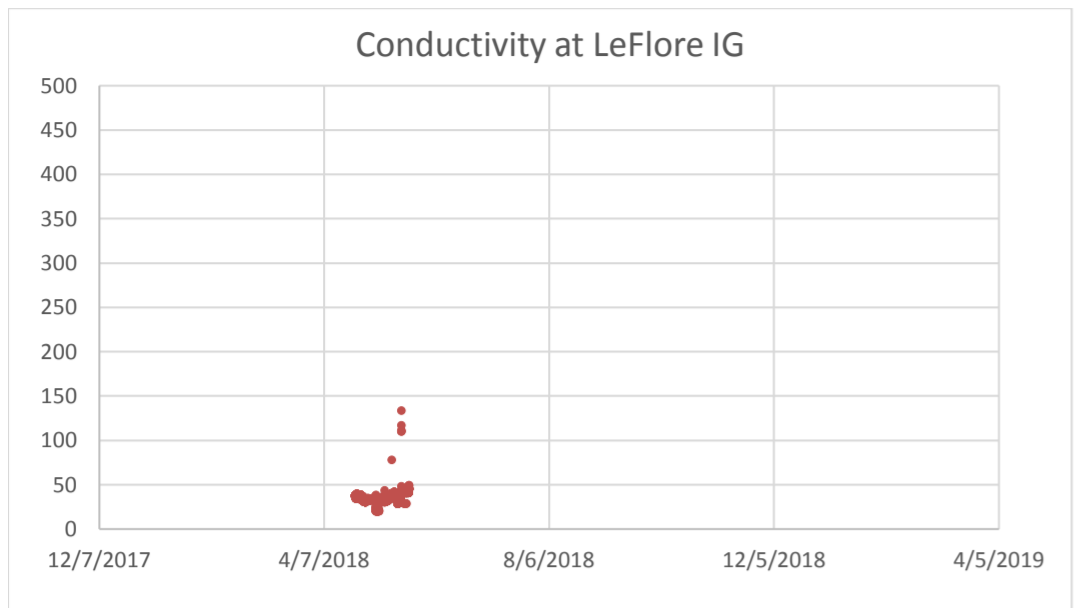
H₂O stable isotope analysis by laser spectroscopy (Los Gatos Research Instruments)

LabID	Sample ID	Site ID	VSMOW d ² H	VSMOW d ¹⁸ O
W-31011	75	I6475	-103.41	-14.18
W-31012	63	M163	-101.82	-13.79
W-31013	40	56140	-104.13	-13.93
W-31014	52	152	-103.91	-13.96
W-31015	39	5239	-102.29	-13.89
W-31016	62	162	-102.49	-13.99
W-31017	60	160	-103.72	-14.16
W-31020	61	161	-103.27	-13.94
W-31019	R1	R1	-101.34	-13.85
W-31021	R2	R2	-101.73	-14.12
W-31018	R3	R3	-102.63	-14.01

Internal check	d ² H per mil	d ¹⁸ O per mil
Known value	-26.65	-5.02
Mean	-26.35	-4.89
n =	6.00	6.00
1 SD	0.89	0.06

Appendix F: Time Series Graphs, Infiltration Gallery Test





Appendix G: Filled Project Template

DRAFT - WALLA WALLA BASIN INTEGRATED FLOW ENHANCEMENT STUDY

PRELIMINARY PROJECT PROPOSAL TEMPLATE

1. Title:
Eastside Milton-Freewater Alluvial MAR
and/or ASR

2. Proposal Preparer(s):
Steven Patten, Walla Walla Basin Watershed Council
Jim Mathieu, Northwest Land & Water

3. General Description of Proposal: *Identify the category(s) and briefly explain the proposed project (e.g. location, infrastructure requirements, maintenance requirements, connection to other new, ongoing or past projects, other stakeholders, various sizing or phasing, etc.).*

- a. Water Conservation & Infrastructure b. Aquifer Recharge & Aquifer Storage and Recovery
 c. Surface – Groundwater Source Switch d. Surface Water Storage e. Pump Exchange
 f. Water Right Transactions g. Point of Diversion Transfers h. Other

This proposed MAR and/or ASR project entails diverting WWR water from winter to early spring (up to 10 cfs for 100 days) via the existing Eastside (Milton-Freewater) pipeline at Nursery Bridge. This water would be conveyed to a site or sites that feature a combination of infiltration galleries, spreading basins, and/or other aquifer recharge infrastructure.

The recovery of recharged water in the Eastside area from spring through summer has potential to leave up to 7 cfs of WWR water instream during the irrigation season.

4. Source of Produced Water: *Mark all applicable and identify (water right number, shallow or deep basalt aquifer, stream name).*

a. Existing Water Right –

If the project is built as an MAR, it would require a new surface water right — a diversion of 10 cfs from the WWR from winter to spring. Initially, this would be achieved through a limited-license process rather than potentially migrating to a permanent water right.

If the project is built as an ASR, some or all of the Eastside surface water right of 5–7 cfs (June – September) could be transferred to a groundwater right for the recharged shallow alluvial aquifer after the pilot period for the initially limited license. A new surface water right would be needed for the difference between 10 cfs and the transferred right rate/volume. To recovery groundwater, a groundwater right would be required if some or all of the Eastside surface water right is not transferred to the alluvial aquifer.

b. Groundwater – If the project is built as an ASR, then the recovered groundwater will be a source of summer irrigation water.

X c. Surface Water – If the project is built as an ASR or MAR, then the WWR will be the source of recharge water, assuming minimum instream flows are met.

d. Other

5. Quantity/Timing/Location of Produced Water Instream: *Estimate average amount of water, when and where. Can project be considered at various sizes(flow outputs) and/or considered in phases?*

a. Acre-feet and/or Cubic-feet-per-second:

If the project is built as an ASR, up to an estimated 1,694 AF (7 cfs) will be left instream. A MAR would create an estimated 1,694 AF with instream benefits from reduced seepage loss in the WWR or direct groundwater returns to the WWR.

b. Timeframe(s):

June through September

c. Stream Reach Location(s):

Walla Walla River mainstem, river mile 46.6 (Nursery Bridge, M4) and downstream

d. UNKNOWN - Is more work (engineering/design/modeling, etc.) needed to estimate potential instream flow outputs of project? Will the results of this work be available within 1 year to inform potential flow outputs? Describe additional work needed and provide cost estimates.

Additional work is needed to assess the feasibility of ASR. This work includes installing monitoring wells and conducting pilot tests to evaluate the amount of recoverable water, the timing of recovery, optimal locations for recovery wells, and the need for a pipeline upgrade or extension. The initial project design and construction costs (below) need to be refined. The amount of recoverable water will determine the instream flow outputs (benefits) of the project.

Phase	MAR	ASR	Item	Estimated Cost Range...	
				From	To
I	√	√	Characterization & Monitoring	Complete	Complete
II	√	√	Monitoring Wells (2 new +1 retrofit) & Equipment	\$ 20,000	\$ 20,000
	√	√	Pilot Testing Using Existing Gallery; Water Sampling / Tracking, Modeling / Analysis	\$ 20,000	\$ 60,000
	√	√	Development & Design	\$ 10,000	\$ 15,000
	√	√	Project Land Purchase after Substantial Land "Donation"	\$ 10,000	\$ 25,000
	√	√	Construction of Basins/Galleries and Soil/Water Testing	\$ 40,000	\$ 60,000
	√	√	Pipeline Upgrade / Extension to Recharge Site & Survey	\$ 275,000	\$ 400,000
III	-	√	Recovery Wellfield Modeling & Analysis	\$ 20,000	\$ 50,000
	-	√	Recovery Wells (5): Design, Construct, Test, Instrument	\$ 426,250	\$ 426,250
	-	√	Pipeline Upgrade / Extension to Recovery Wells	\$ 550,000	\$ 1,350,000
Total MAR Costs				\$ 375,000	\$ 580,000
Total ASR Costs				\$ 1,371,250	\$ 2,406,250

6. Ability to Protect Produced Water Instream: *Briefly explain how the produced water will be quantified, monitored and protected instream or why it is not currently protectable.*

a. YES - Protection under existing regulations expected to WW River mouth or in limited reach? It may be possible to exchange an existing surface water right for stored ASR water, similar to a reservoir or Columbia River Exchange project. Water would be stored underground in the Eastside subbasin and it could then be recovered in exchange for irrigators' WWR rights (which would be left instream). Bi-state protection would be the same as for other exchange projects that are currently underway by Oregon and Washington agencies. The exchange option would require a new winter / spring water right from the WWR to allow for ASR activities and a second permit to withdraw the stored water.

b. NO or c. UNKNOWN – Results and implementation of flow protection study likely necessary to ensure flow protection.

7. Cost Estimates: *Provide known and estimated costs to develop and implement the project.*

a. Project Development and Design:

Phase II for MAR and ASR, from \$40,000 to \$100,000 (includes small project land purchase)

Phase III for ASR, from \$20,000 to \$50,000

b. Project Construction:

Phase II for MAR and ASR, from \$355,000 to \$540,000

Phase III for ASR, from \$976,250 to \$532,500

c. Construction cost per AF and/or CFS:

MAR through Phase II recharges 10 cfs to the alluvial aquifer

ASR through Phase III leaves 7 cfs instream on the WWR mainstem; recovers 7 cfs for irrigation

Phase II for MAR from \$150/AF to \$220/AF

Phase III (extension to ASR) *additional* cost from \$580/AF to \$1,050/AF and \$139K/CFS to \$254K/CFS

d. Project Annual O&M:

For MAR, ~\$20K

For ASR, ~\$60K

c. UNKNOWN - Need engineering/design work to estimate costs

Costs for some items in Phase II and all items in Phase III will need to be refined as the project progresses.

8. Secured Costs: *Has any funding been secured in the past or currently and what is source?*

Yes, past and current funding has been obtained from OWEB, OWRD, and WDOE.

9. Other Potential Project Advantages: *In addition to helping address flow targets and basin-wide flow issues (Endangered Species Act, Tribal Water Rights, Clean Water Act, etc.), briefly explain other potential benefits (e.g. reduced O&M costs, restores/mimics ecological processes, cropping flexibility,)*

MAR (through Phase II)

- Provides additional winter/spring habitat for water fowl (infiltration basin)
- MAR water adds flow to downgradient surface water bodies (needs quantification through modeling and monitoring)

- Cools down-gradient surface water bodies (Clean Water Act target)
- Has the potential to reduce O&M costs over time based on results and by rolling monitoring into a programmatic approach
- Mimics floodplain processes in a constrained alluvial fan system (WWR)
- Has the potential to benefit habitat restoration in WWR side channels and with levee setback

ASR (through Phase III)

- Same as above for MAR (through Phase II)
- Uses existing Eastside pipeline to distribute recovery water and minimizes conveyance construction impacts to residents

10. Other Potential Project Disadvantages: *Briefly explain the potential drawbacks of the proposal (e.g. reduced GW supply - recharge mitigation need, increased O&M costs, legal implications)*

- MAR project water, as currently operated, cannot be protected.
- There may be competition for winter/spring water supplies.

11. Project Status: *Identify whether the proposed project is a past, ongoing, or new project, and briefly explain its status, including the requested role of the flow study in further consideration of the project.*

a. NEW PROJECT b. ONGOING PROJECT c. PAST PROJECT

Phase I, characterization and monitoring, is complete. An infiltration gallery has been set up to receive WWR water via the Eastside pipeline. This infiltration gallery, with some additional monitoring wells, would be a good pilot test to evaluate the aquifer response to infiltration, storage, and groundwater movement; if favorable, these results will further advance the viability of expanding MAR via basins or adding galleries. ASR feasibility may also be demonstrated if sufficient water is recharged during this pilot testing.

12. Estimated Time Frame to Implement Project?

Phase II will be completed in 2019. Phase III, if selected, will be completed by 2022.

Appendix H: Prior Project Memoranda



Memorandum

Date: June 30, 2015
To: Steven Patten, Environmental Scientist, Walla Walla Basin Watershed Council (WWBWC)
From: Jim Mathieu, RG, Northwest Land & Water, Inc. (NLW)
Re: Drilling and Monitoring Well Construction, Aquifer Storage and Recovery (ASR) Feasibility Investigation, Eastside Milton-Freewater, OR

INTRODUCTION

This memorandum documents initial ASR work conducted to investigate the relatively shallow (70 to 130 feet below ground) hydrostratigraphy and the construction of long-term monitoring wells in the “Eastside” area of Milton-Freewater. The area of investigation shown on **Figure 1** occupies the flat and locally undulating topography east of the mainstem Walla Walla River. The WWBWC would like to better understand the subsurface hydraulic properties and groundwater flow conditions of the Eastside area; we understand the goal is to store “surplus” river water in the subsurface and eventually recover it to use for irrigation and affect groundwater conditions for river baseflow augmentation.

The Eastside pipeline that is currently used by irrigators would serve as the conveyance line to deliver water from the river to potential aquifer storage sites.

DRILLING METHODOLOGY & RESULTS

Five boreholes were drilled by Holt Services, Inc., in October 2014 and June 2015. They were completed as 2-inch ID monitoring wells in accordance with Oregon’s monitoring well standards (OWRD, *OAR 690-240*). These wells will allow WWBWC to monitor groundwater levels and temperature over the long term and to sample water quality (as needed) at locations within the shallow unconfined aquifer and other water-bearing zones.

Sonic Drilling

Methodology. One borehole was drilled at each of three sites (GW_152, _160, _161) and two boreholes were drilled at one additional site (GW_162, _163). To investigate the stratigraphy and occurrence of groundwater at these sites, the sonic drilling method — specifically, a Terra Sonic International 150 Compact Crawler — was used. This machine cores a 4-inch continuous sample while casing a 6-inch diameter borehole. As such, the core sample, which is extruded in 5- or 10-foot sections, provides information about the stratigraphy and relative moisture conditions from ground to the total borehole depth. During drilling, the water level was measured frequently to observe changes as different water-bearing or low-permeable zones were penetrated. The samples were placed in core boxes and stored by WWBWC. We anticipate having a geology student review the core samples in more detail at a later date.

Results. The results of drilling and logging are shown on the detailed geologic logs in **Figures 2–6**. In general, the hydrostratigraphy encountered from ground to depth at each of the four sites included the following:

- An upper layer of soil consisting of silt, locally with gravels, 2–6 feet thick
- An unsaturated zone of loose, and locally compact, silt and gravel, 20–60 feet thick
- An saturated zone of loose, and locally compact, silt, sand, and gravel, 5–35 feet thick
- A dry to damp layer of very compact silt and gravel, over 20 feet thick

Two water-bearing zones were encountered at the GW_162/163 site (**Figure 1**). They are separated by an 11-foot thick, soft, clayey silt. This clayey silt is competent and extensive enough at this location to cause a difference in groundwater levels.

Monitoring Well Construction

Methodology. Standard practices were used to construct the monitoring wells. Each of the five boreholes was screened (0.020-inch slot) within water-bearing zones. An annular filter pack (10-20 silica sand) was placed as each 6-inch casing was extracted and seal materials were subsequently installed. Each well was finished with a flush-grade steel monument. The wells were developed for 1–2.5 hours using a DC purge pump.

Results. The five monitoring wells are being equipped with Solinst Levellogger Edge water level / temperature sensors to collect data that will provide important information about the groundwater system:

- Localized and seasonal fluctuations of the shallow (water table) aquifer at each of the four sites

- The relationship between the shallow aquifer and underlying water-bearing zone at the GW_162/163 site
- The direction and magnitude of the hydraulic gradient in this area

The initial groundwater water level data (**Figures 2 – 6**) suggest that sites GW_152 and GW_160, which have larger unsaturated thicknesses, could accept more water than sites GW_161 and GW_162/163, which lie to the northeast and northwest, respectively. The infiltration capacity would need to be tested at these sites to confirm this observation.

RECOMMENDATIONS

Monitoring & Baseline Data Collection

We recommend that WWBWC conduct the following tasks:

- Survey the elevations and locations of the monitoring wellheads to provide an accurate datum for water-level measurements.
- Collect continuous water-level data at a high frequency (for example, hourly) for 2 weeks; then download and review the data to confirm that the sensor is functioning properly and assess whether the collection frequency should be modified.
- Measure water levels manually during each visit to the monitoring wells (quarterly, at a minimum) and compare these measurements to the sensor data.
- Collect groundwater samples prior to infiltration activities in the Eastside area, whether at the LeFore infiltration facility or elsewhere (pilot or permanent infiltration/recharge), to provide “baseline” water quality data.

Investigation of ASR Feasibility

The WWBWC should consider conducting the following future work:

- Identify existing irrigation wells that could be pumped for aquifer testing. The five monitoring wells should be used as observation wells during testing. This would allow WWBWC to calculate hydraulic parameters for the shallow water-table aquifer.
- If existing wells are unsuitable, as an alternative, approach a landowner about constructing a high-capacity well that could be used for aquifer testing.
- Develop a better understanding of the Eastside hydrostratigraphy in the vicinity of the five monitoring wells by creating a conceptual model using software such as Viewlog. This would entail incorporating select digitized wells (from the OWRD database, shown in **Appendix A**) into the model and using it to construct several cross-sections that illustrate subsurface conditions in the Eastside groundwater

system. The conceptual model framework should be compatible with pre-processing software for creating layers for a future numerical model.

- Engage with landowners in the area between and near GW_152 and GW_160 who would be amenable to allowing the WWBWC to construct a pilot or permanent infiltration facility (basin/pond or gallery) or the construction/operation of an injection well.

SUPPORTING INFORMATION

List of Figures & Appendix

Figure 1: Well Location Map, Eastside Milton-Freewater

Figure 2: GW_152 Geologic Log & Monitoring Well As-Built

Figure 3: GW_160 Geologic Log & Monitoring Well As-Built

Figure 4: GW_161 Geologic Log & Monitoring Well As-Built

Figure 5: GW_162 Geologic Log & Monitoring Well As-Built

Figure 6: GW_163 Geologic Log & Monitoring Well As-Built

Appendix A: Supplemental OWRD Database Well Logs

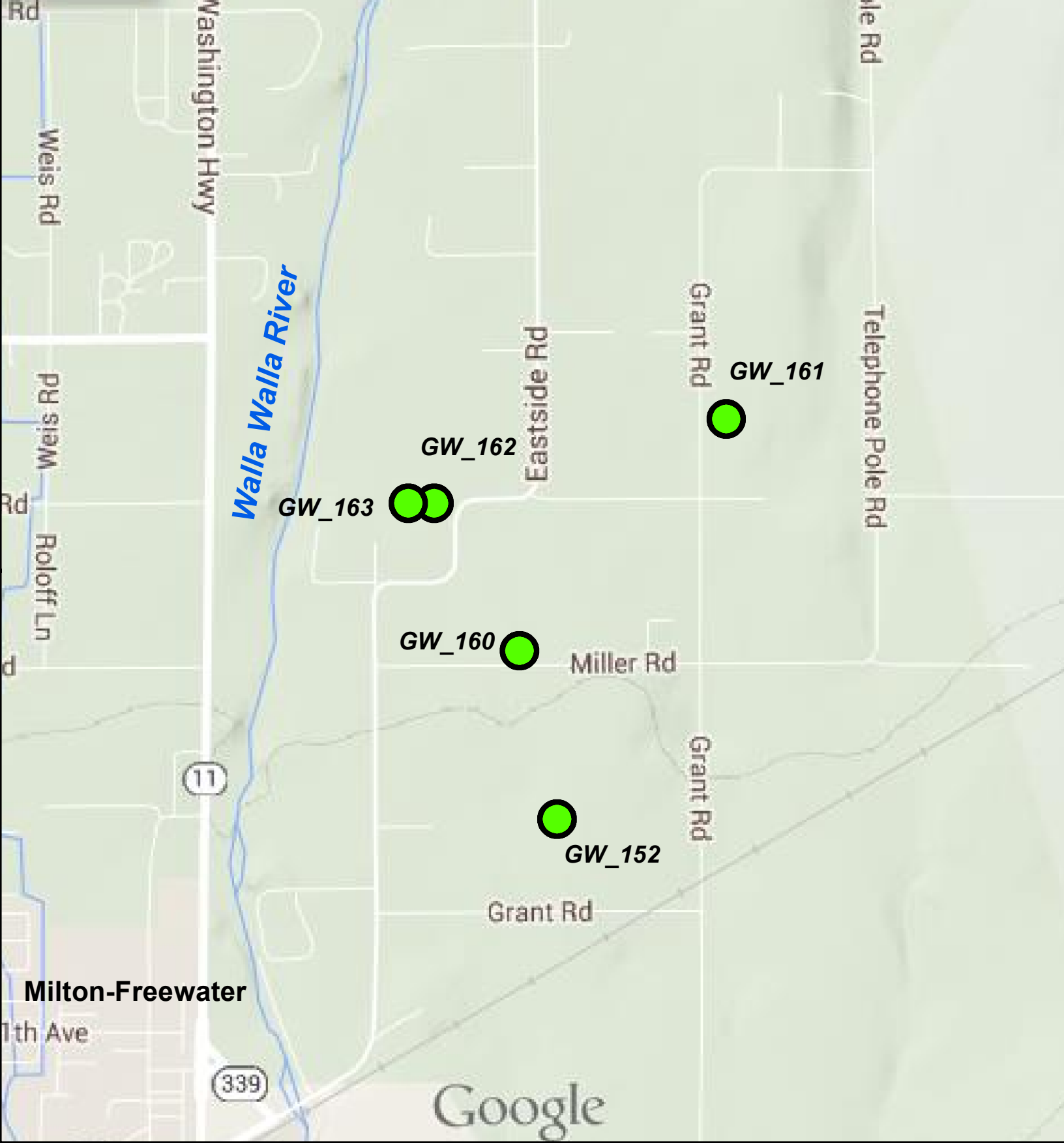
Reference

Oregon Water Resources Department, *OAR 690-240, Construction, Maintenance, Alteration, Conversion and Abandonment of Monitoring Wells, Geotechnical Holes and Other Holes in Oregon.*

Warranty / Disclaimer

Our professional services were performed, our findings obtained, and this memorandum prepared in accordance with generally accepted hydrogeologic practices at this time and in this area, exclusively for the use of the WWBWC. This warranty is in lieu of all other warranties, expressed, or implied.

Figures

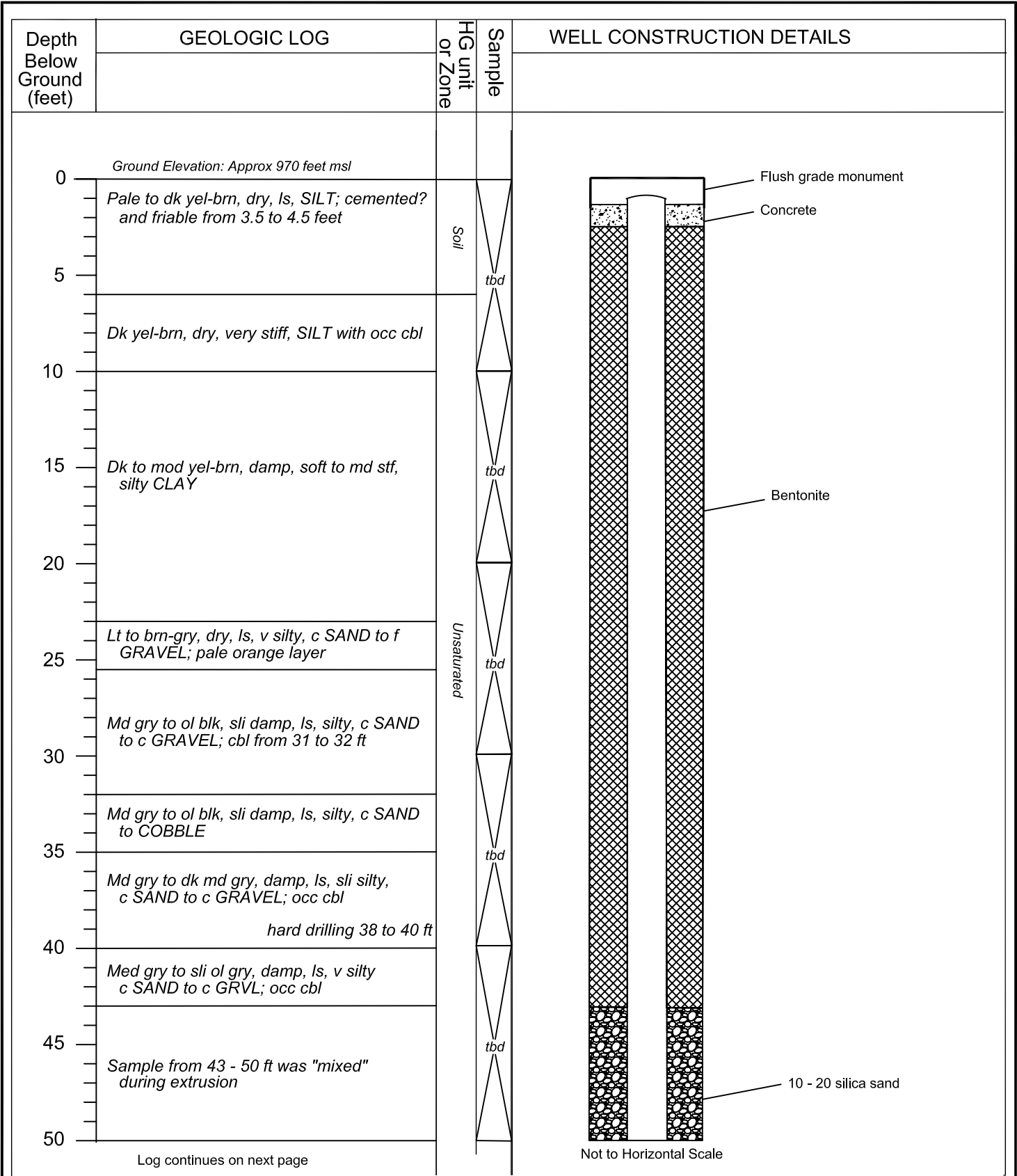


 Monitoring Well



Figure 1.
Well Location Map

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council



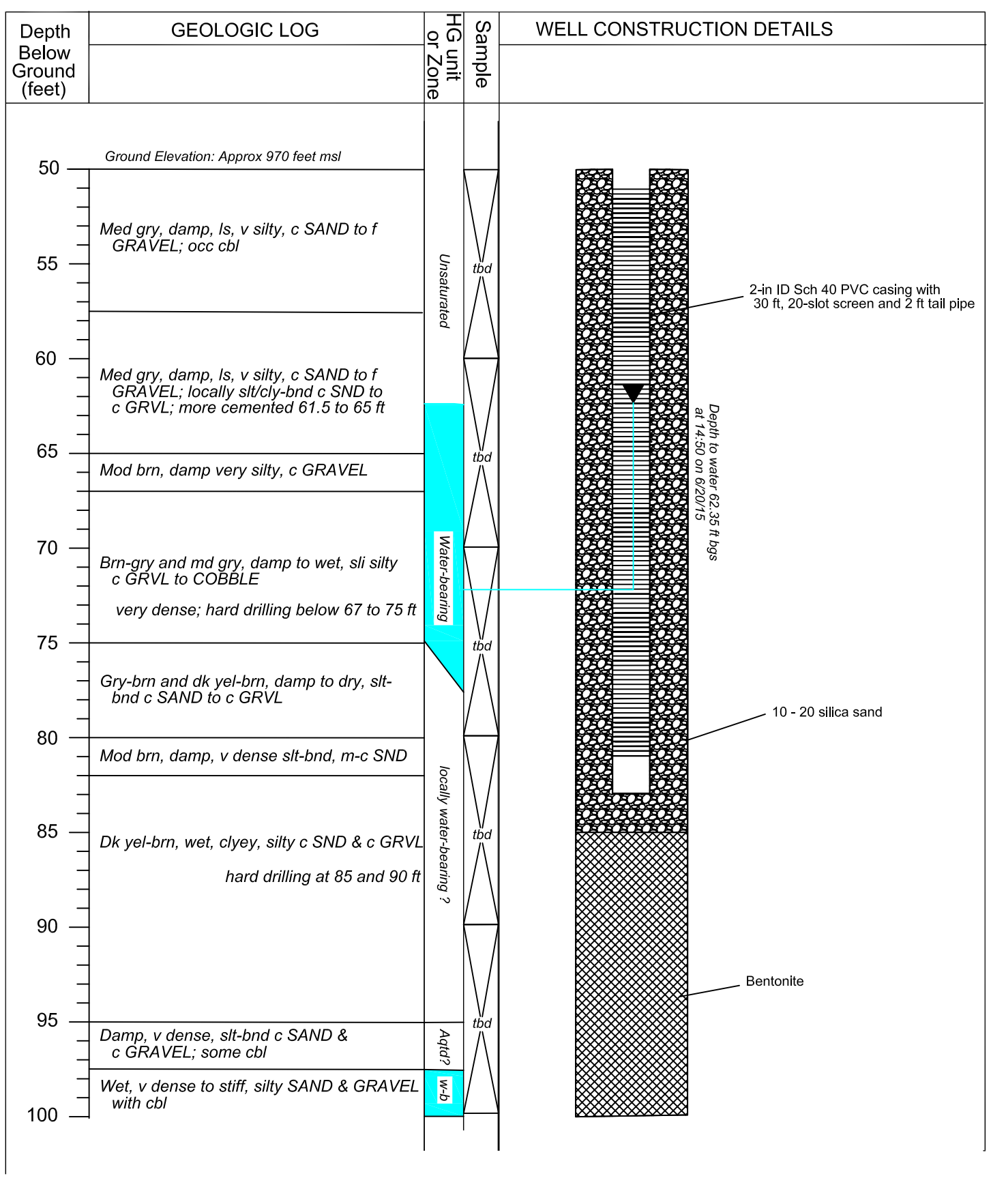
version 06/30/15
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka LF-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 1 of 3)
 GW_152 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





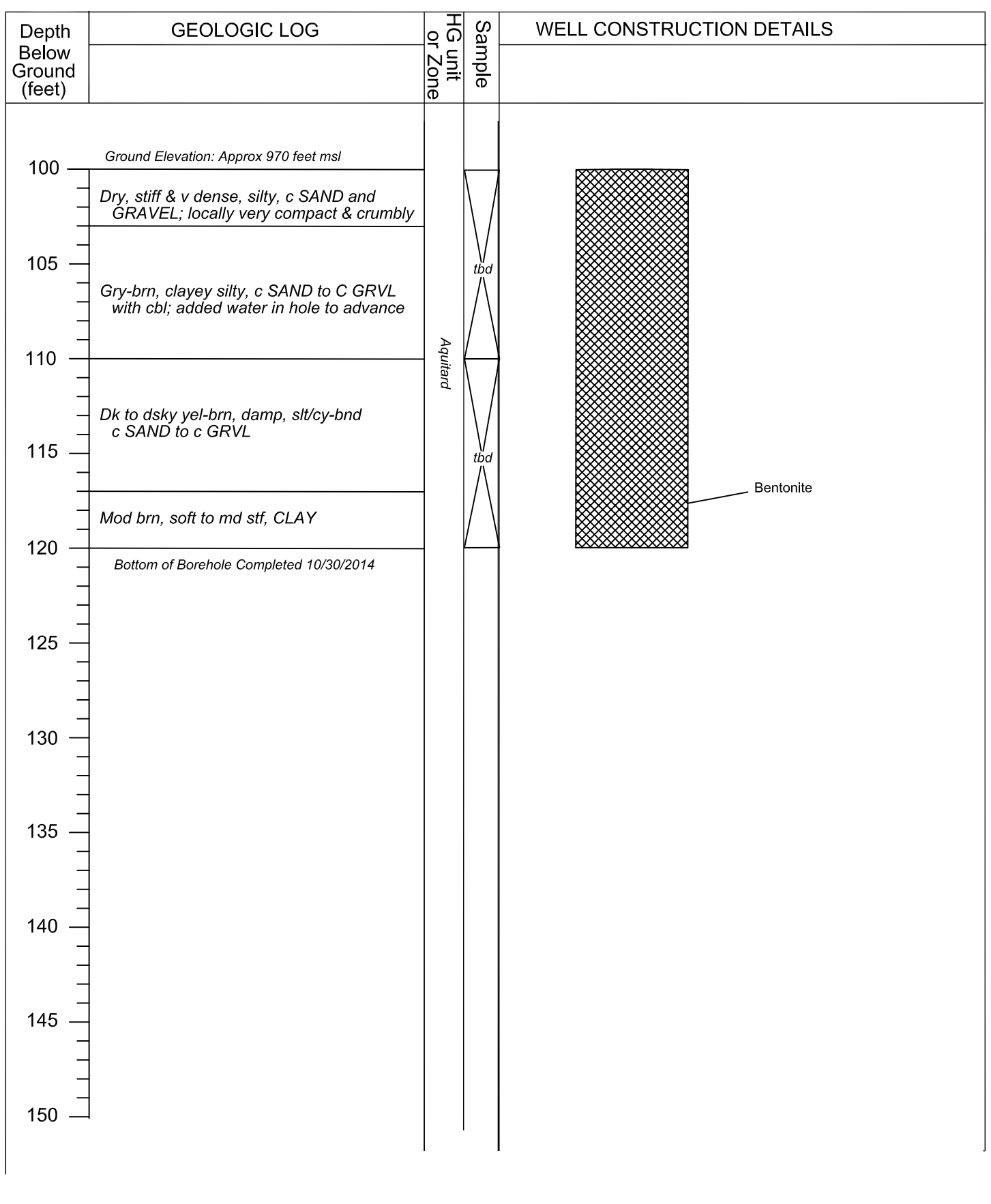
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka LF-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 2 of 3)
 GW_152 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





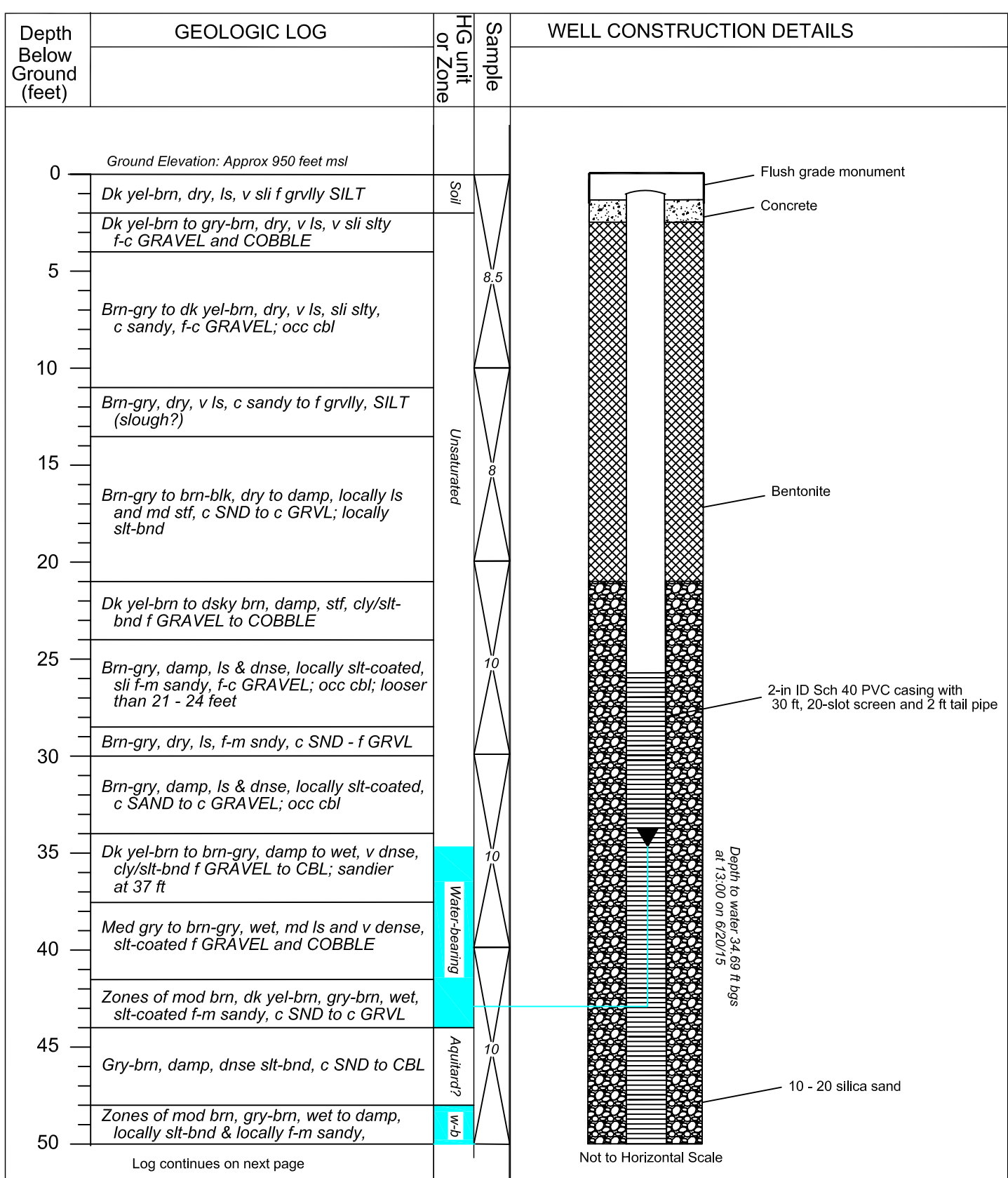
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka FL-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 3 of 3)
 GW_152 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





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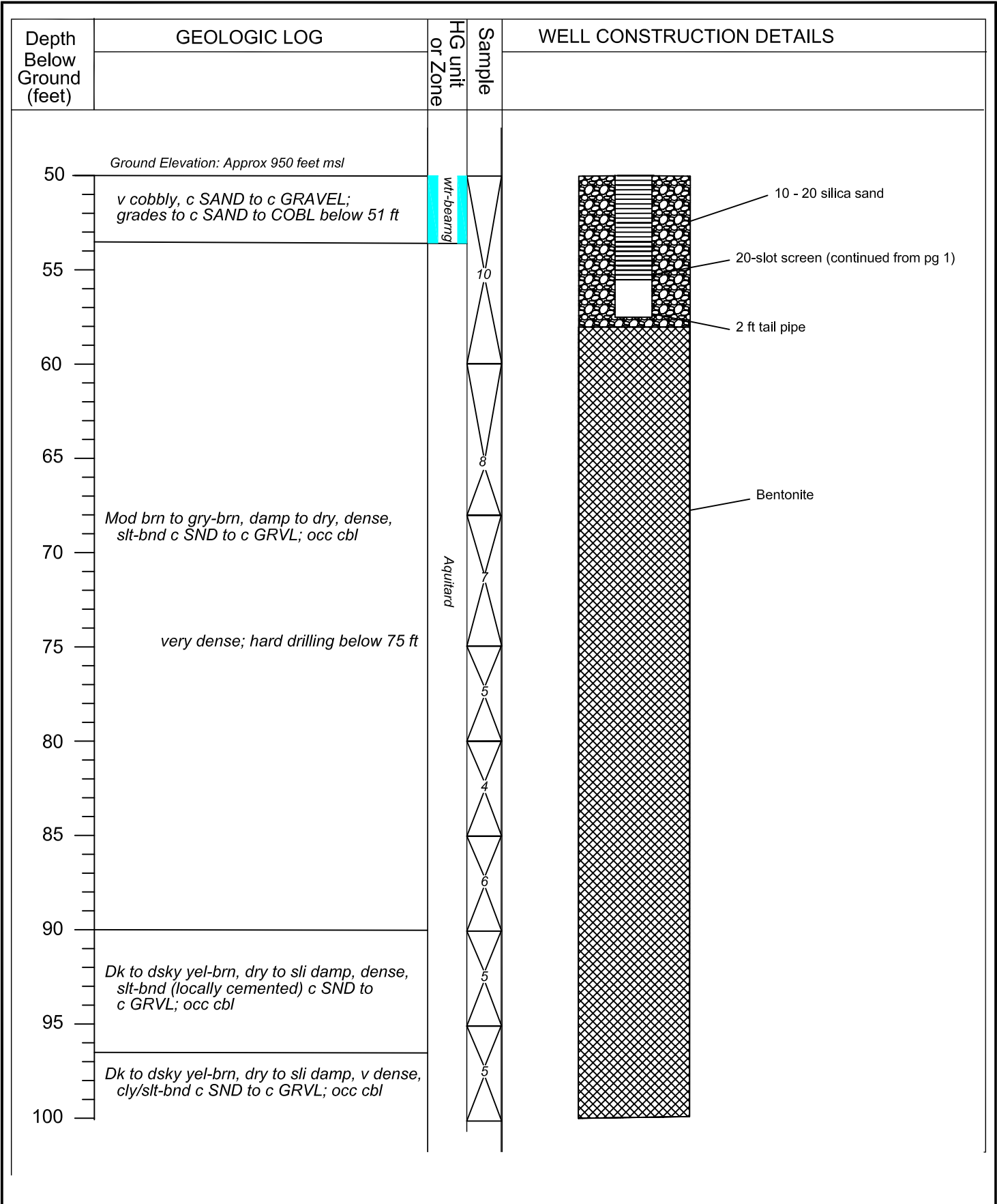
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SE 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_160; aka CR-1
 WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 1 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

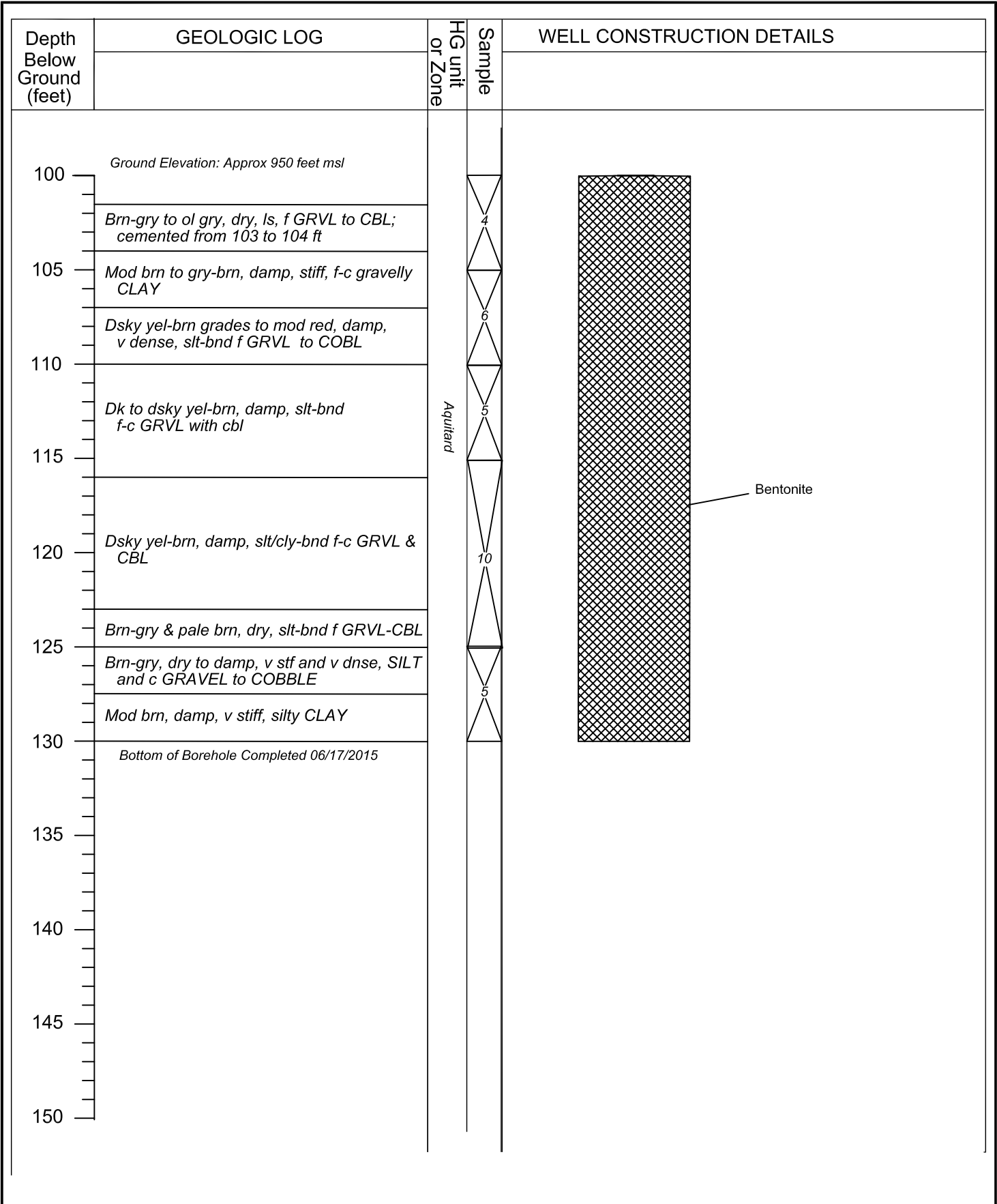
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 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_160; aka CR-1
 WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 2 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





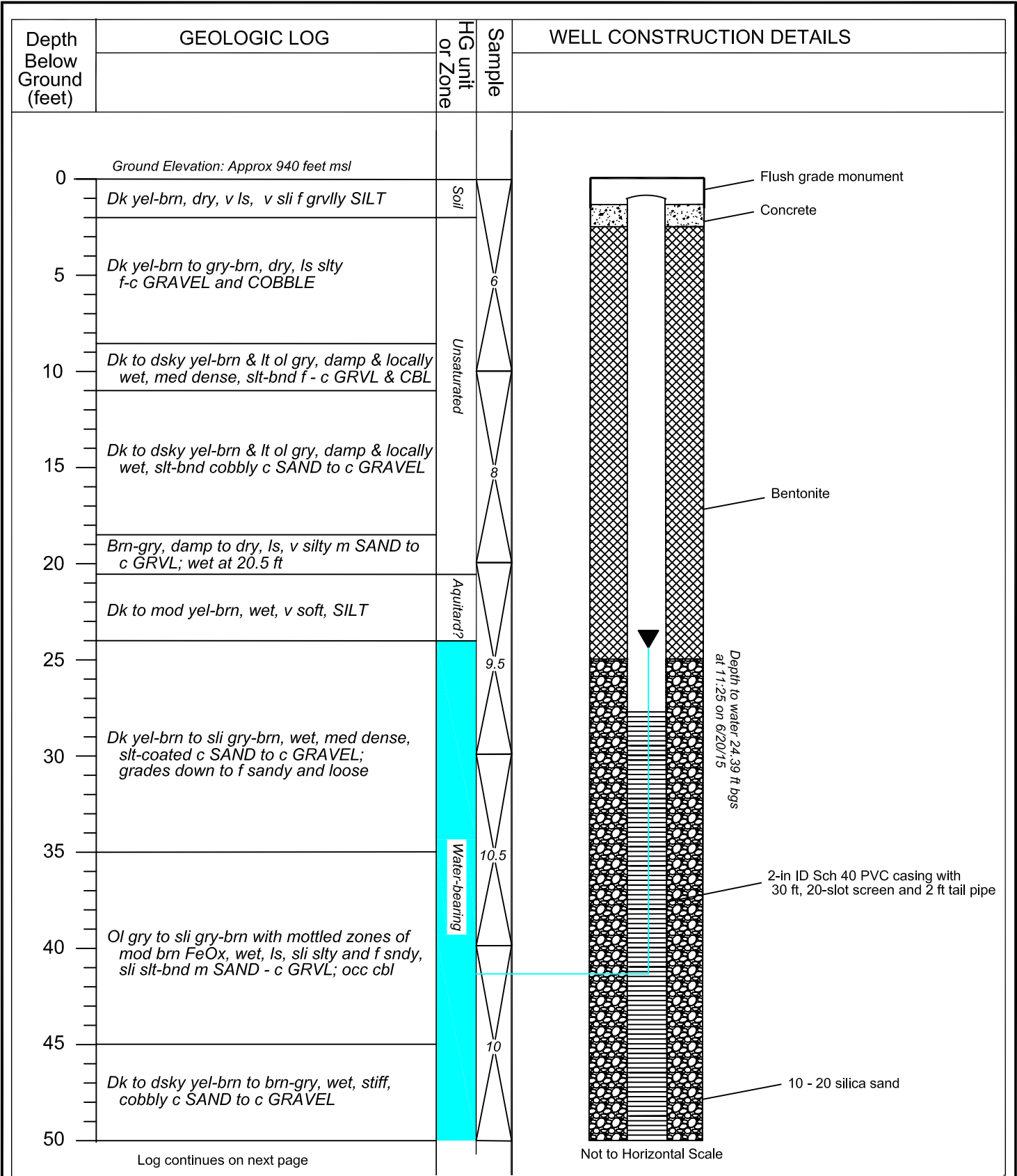
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FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_160; aka CR-1
WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 3 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

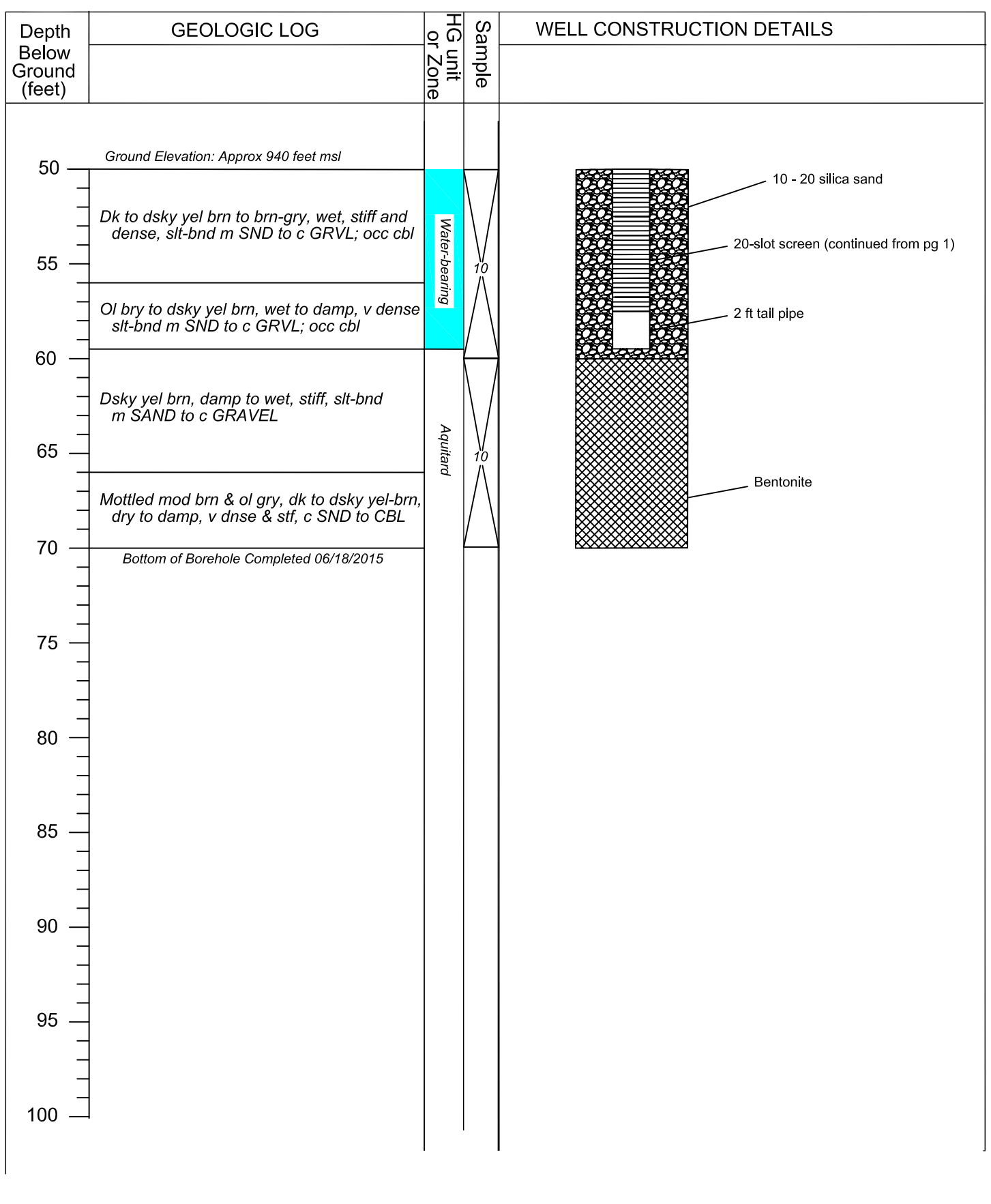
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: NW 1/4 NW 1/4 Sec 31 T6N, R36E
 WELL NAME: GW_161; aka JB-1
 WELL TAG & START CARD: L111672 & 1026740

Figure 4 (page 1 of 2)
 GW_161 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

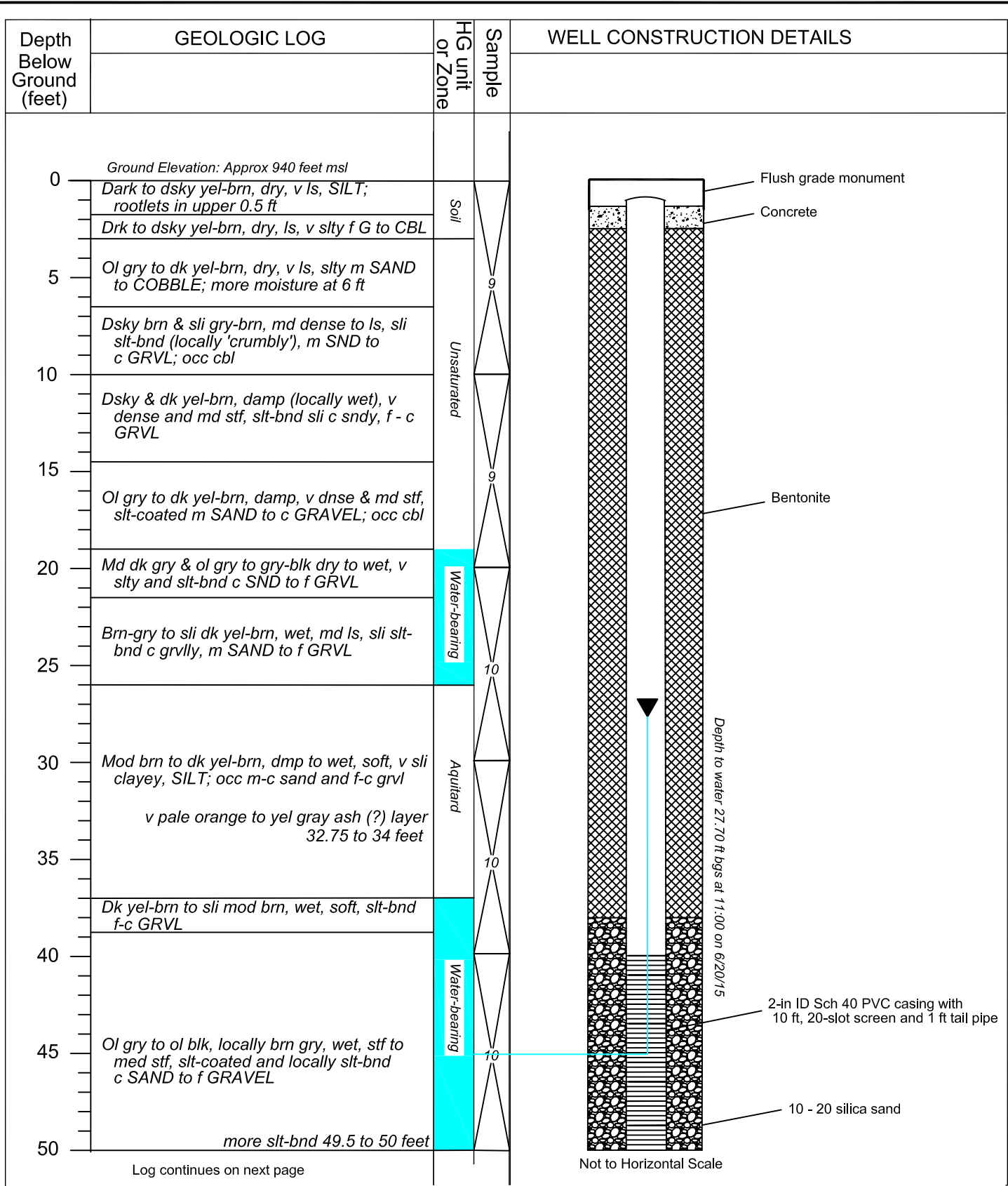
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: NW 1/4 NW 1/4 Sec 31 T6N, R36E
 WELL NAME: GW_161; aka JB-1
 WELL TAG & START CARD: L111672 & 1026740

Figure 4 (page 2 of 2)
 GW_161 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





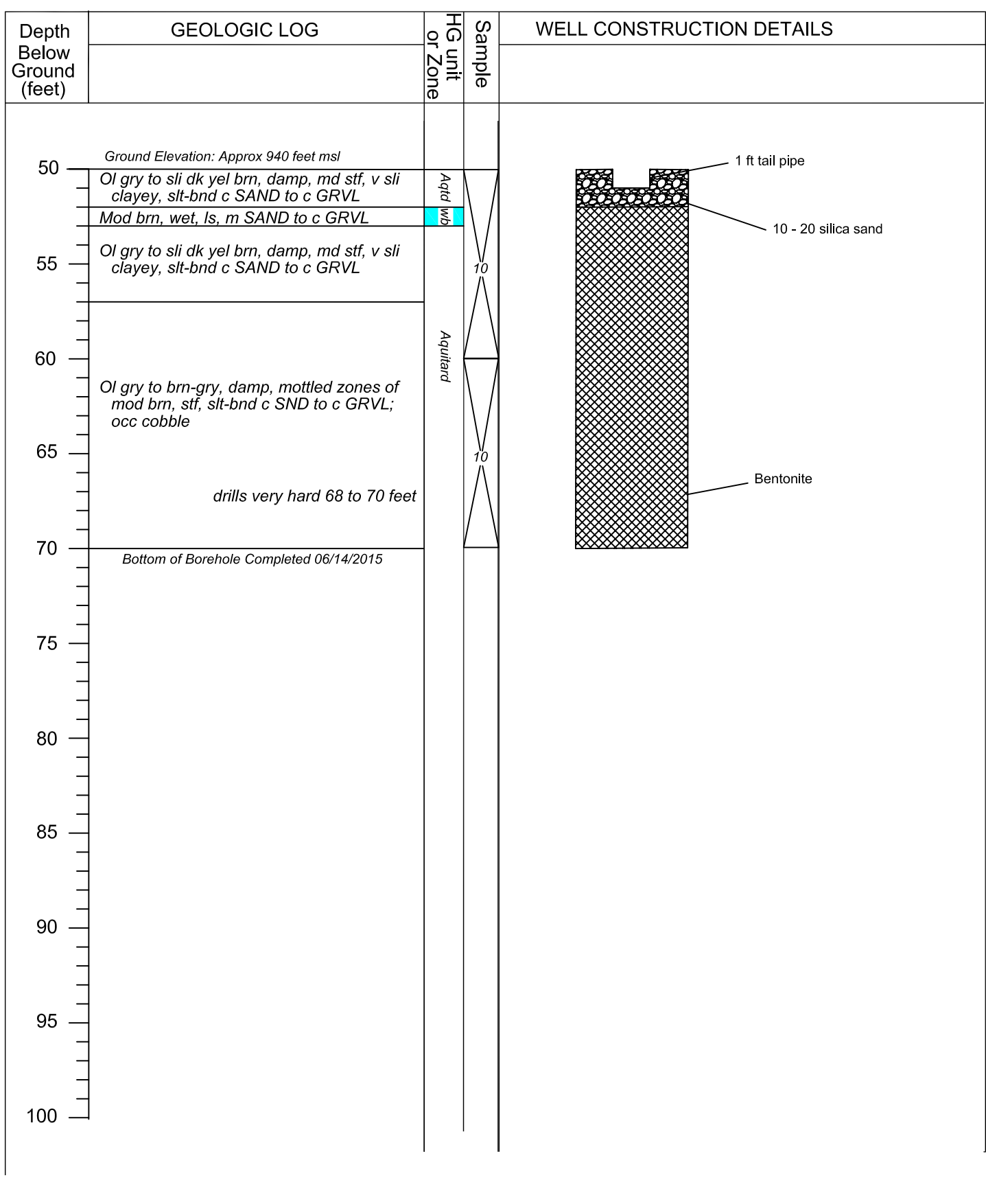
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_162; aka MFS-1
 WELL TAG & START CARD: L111673 & 1026828

Figure 5 (page 1 of 2)
 GW_162 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





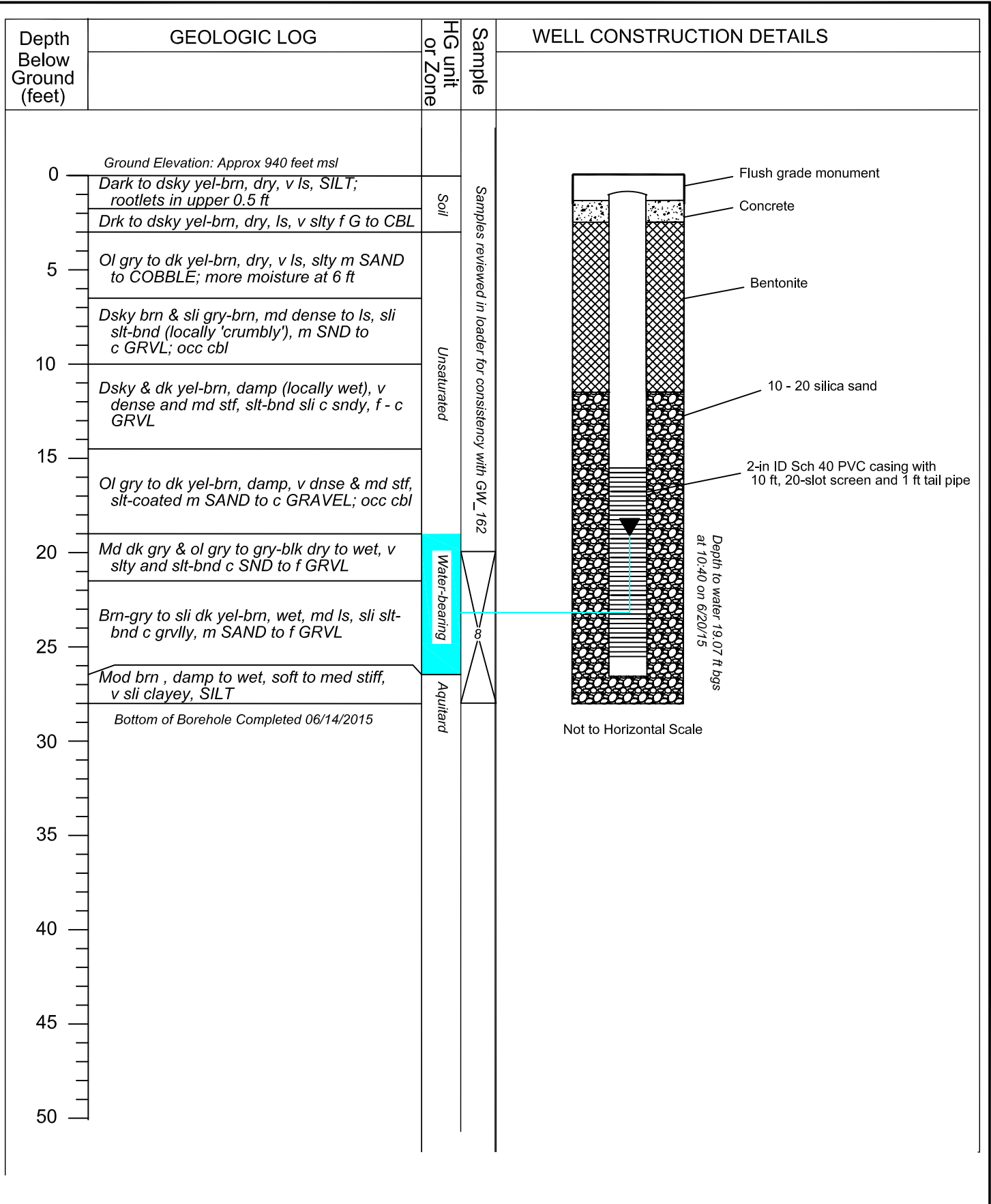
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 version 06/30/15

PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_162; aka MFS-1
WELL TAG & START CARD: L111673 & 1026828

Figure 5 (page 2 of 2)
 GW_162 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15
 C:\Projects\WWBWC\...GeoLog\AsBuilt_MFS-2(shallow)_pg1 of 2.dwg

PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_163; aka MFS-2
WELL TAG & START CARD: L112703 & 1026829

Figure 6 (page 1 of 1)
 GW_163 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council



Appendix A

T6NR35E-Section 25		T6NR35E-Section 36		T6NR36E-Section 31		T6NR36E-Section 30	
UMAT	4516	UMAT	6	UMAT	4846	UMAT	5192
UMAT	4517	UMAT	5116	UMAT	4848	UMAT	5197
UMAT	4518	UMAT	5117	UMAT	4849	UMAT	5198
UMAT	4519	UMAT	5118	UMAT	50068	UMAT	5199
UMAT	4520	UMAT	5119	UMAT	4847	UMAT	5200
UMAT	4521	UMAT	5121	UMAT	4850	UMAT	5201
UMAT	4523	UMAT	5122	UMAT	4851	UMAT	5202
UMAT	4524	UMAT	5123	UMAT	4852	UMAT	5204
UMAT	4525	UMAT	5124	UMAT	54770	UMAT	5205
UMAT	4526	UMAT	5125			UMAT	5206
UMAT	4527	UMAT	5126			UMAT	5211
UMAT	4528	UMAT	5127			UMAT	5221
UMAT	4529	UMAT	5128			UMAT	5222
UMAT	4531	UMAT	5130			UMAT	5223
UMAT	4532	UMAT	5131			UMAT	6457
UMAT	4533	UMAT	5132			UMAT	6458
UMAT	4534	UMAT	5133			UMAT	5203
UMAT	4536	UMAT	5136			UMAT	5207
UMAT	4537	UMAT	5137			UMAT	5208
UMAT	4538	UMAT	5141			UMAT	5209
UMAT	4539	UMAT	5144			UMAT	5210
UMAT	4540	UMAT	5147			UMAT	5212
UMAT	4541	UMAT	5148			UMAT	5213
UMAT	4543	UMAT	5149			UMAT	5214
UMAT	4544	UMAT	5151			UMAT	5216
UMAT	4549	UMAT	5155			UMAT	5217
UMAT	4550	UMAT	5156			UMAT	5218
UMAT	4551	UMAT	5157			UMAT	5219
UMAT	4552	UMAT	5158			UMAT	5220
UMAT	4563	UMAT	5347			UMAT	54736
UMAT	4565	UMAT	5358			UMAT	55459
UMAT	4570	UMAT	5370			UMAT	55712
UMAT	4573	UMAT	5377			UMAT	56217
UMAT	4574	UMAT	5787				
UMAT	4576	UMAT	5805				
UMAT	4577	UMAT	5825				
UMAT	4579	UMAT	5965				
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UMAT	4585	UMAT	6475				
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UMAT	4599	UMAT	5065				
UMAT	4600	UMAT	5120				
UMAT	4601	UMAT	5129				
UMAT	4602	UMAT	5134				
UMAT	4603	UMAT	5138				
UMAT	4604	UMAT	5139				
UMAT	4605	UMAT	5140				
UMAT	4606	UMAT	5142				
UMAT	4607	UMAT	5143				
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UMAT	4609	UMAT	5146				
UMAT	4610	UMAT	5150				
UMAT	4611	UMAT	5152				
UMAT	4612	UMAT	5153				
UMAT	4613	UMAT	5154				
UMAT	4614	UMAT	5159				
UMAT	4615	UMAT	5259				
UMAT	4616	UMAT	51666				
UMAT	4617	UMAT	6473				
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UMAT	5269	UMAT	54325				
UMAT	5655	UMAT	54391				

T6NR35E-Section 25**T6NR35E-Section 36**

UMAT	5656	UMAT	54473
UMAT	5958	UMAT	54494
UMAT	6434	UMAT	54841
UMAT	6435	UMAT	55207
UMAT	6511	UMAT	55248
UMAT	4522	UMAT	55614
UMAT	4583	UMAT	55991
UMAT	50519	UMAT	56033
UMAT	50723	UMAT	56077
UMAT	50731	UMAT	56099
UMAT	50942	UMAT	56162
UMAT	51072	UMAT	56201
UMAT	51947		
UMAT	4535		
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UMAT	4572		
UMAT	4575		
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UMAT	4580		
UMAT	4582		
UMAT	4584		
UMAT	4586		
UMAT	4591		
UMAT	4592		
UMAT	4593		
UMAT	4594		

Draft Memorandum

Date: June 24, 2016

To: Steven Patten, Environmental Scientist, Walla Walla Basin Watershed Council (WWBWC)

From: Jim Mathieu, RG, Northwest Land & Water, Inc. (NLW)

Re: Interim Results of Hydrostratigraphic Assessment and Pumping Tests, Aquifer Storage and Recovery (ASR) Feasibility Investigation, Eastside Milton-Freewater, OR

INTRODUCTION

This memorandum documents our progress on an ASR investigation for the relatively shallow alluvial-fluvial aquifer beneath the “Eastside” area of Milton-Freewater. It builds on our previous memorandum that summarizes the drilling and construction of five monitoring wells (NLW, 2015). We plan to continue characterizing the Eastside area through spring 2017 and issue a final report, which will be substantially more detailed and comprehensive than this memo, in June 2017.

The area of investigation shown on **Figure 1** occupies the flat and locally undulating topography east of the mainstem Walla Walla River. The WWBWC would like to better understand the subsurface hydraulic properties and groundwater flow conditions of the Eastside area. The ultimate goal of this project is to store surplus river water in the subsurface and recover it for irrigation while raising groundwater levels to augment river baseflow. The Eastside pipeline that is currently used by irrigators would serve as the conveyance line to deliver water from the river to potential aquifer storage sites.

HYDROSTRATIGRAPHIC ASSESSMENT

Methodology

We used data from 15 wells for this investigation: five wells that we constructed (NLW, 2015) plus 10 additional wells, which were selected because of their potential for pumping or monitoring and for their geographic locations throughout the study area. **Appendix A** contains logs for these wells. Well log data was digitized and incorporated into a project database constructed using Viewlog, a tool that not only allows us to

organize and interpret subsurface data but also produces images that are useful for visualization. The well log data included:

- Borehole drilled depth
- Texture of sediment or rock layer
- Relative permeability based on texture
- Water bearing zones
- Well construction depth
- Open interval (screen or perforations)
- Water level

Eleven of the wells and one river gage station were surveyed by WWBWC using the methods described in **Appendix B**.

Results

Two cross sections were constructed using Viewlog, as shown in **Figures 2 and 3**. The cross section alignments are shown on **Figure 1** (note: alignment C-C' is mapped but its cross section is not included in this memo). In general, the sections show the following hydrostratigraphy, in order of increasing depth:

- An unsaturated zone of loose, locally compact silt and gravel, 20–60 feet thick, that thins from south to north
- A saturated zone of loose, locally compact silt, sand, and gravel, 5–35 feet thick
- A dry to damp (locally wet) layer of very compact silt/clay and gravel, over 20 feet thick and locally underlain by a 5- to 20-foot clay layer
- Hard and fractured (water-bearing) basalt

At the local scale, groundwater may be separated by a low permeable layer. This is the case for the two water-bearing zones encountered at the GW_162/163 site (162 and 163 on **Figure 1**), which are separated by an 11-foot-thick layer of soft, clayey silt. This clayey silt is competent and extensive enough at this location to cause a difference in groundwater levels of about 9 feet.

HYDRAULIC PROPERTIES

Methodology

To obtain data for estimating hydraulic properties, we conducted pumping tests at two irrigation wells and a “passive test” at a third well.

Pumping tests. Pumping tests were conducted at irrigation wells 56140 and 5239 on March 14 and May 3–4, respectively. The rate and duration of these tests was designed to accommodate the irrigator so he could apply the pumped water to a field or orchard. Pumping rates were measured using a BM Technologie ultrasonic flow meter, which was strapped to the discharge line at each well. Groundwater levels were monitored in observation wells located at distances ranging from 200 to 2,500 feet from the pumped well using nonvented Solinst sensors compensated for barometric pressure. At one location, irrigation well 5239, a micro-Diver sensor was used. Manual water level measurements were also made using Waterline and Solinst sounders.

Passive test. For the “passive” test, irrigation well 6475 was equipped with a Seametrics DL-76W datalogger to record continuous flow measurements from an existing Seametrics AG2000-400-GPM-AF flow meter. This test was conducted from May 9 to June 3, 2016. Groundwater level was recorded in nearby GW_152 using a Solinst sensor. Manual water level measurements were also made in GW_152 using a Waterline sounder.

Results

Well 56140. The hydrograph for this test (**Figure 4**) shows a response in both the pumped well and in well GW_161, located approximately 250 feet away. No other response is discernable in other observation wells. A preliminary analysis of the GW_161 response indicates a transmissivity of 150,000 gallons per day per foot (gpd/ft) and storage coefficient of 0.01 (**Appendix C**). Analysis of the manual data from the pumped well indicates a transmissivity of 125,000 gpd/ft (**Appendix C**).

Well 5239. The hydrograph for this test (**Figure 5**) shows a response in the pumped well — but none significant in the observation wells except possibly for wells 161 and 5232. These subtle responses will be evaluated further to attribute them to well 5239 pumping or not. A preliminary analysis of the early time response in well 5239 indicates a transmissivity of 125,000 gpd/ft (**Appendix C**). Note that the drawdown trend steepens after approximately 250 minutes, suggesting an aquifer boundary. This response will be further analyzed and discussed in subsequent reporting.

Well 6475. The hydrograph for the “passive” test (**Figure 6**) shows a small undulating trend in GW_152. Wells 6475 and GW_152 are being currently monitored as the irrigation season ramps up. Assessment of a hydraulic relationship between these two wells, if discernible, will be made after substantial summer irrigation followed by reduced pumping in fall 2016.

RECOMMENDATIONS

We recommend conducting the following ongoing tasks through winter 2017:

Hydrostratigraphy

- Digitize data for wells in Oregon’s database that can accurately located — at least to the tax lot or parcel, but ideally with an air photo — and integrate it into the project database (Viewlog).
- Survey the elevations and locations of selected wells added to the project database.
- Develop more detailed cross sections to show the potential hydrostratigraphic controls on the storage and movement of recharged water.

Hydraulic Properties

- Using the detailed cross sections and conceptual model, identify locations where additional hydrostratigraphic information and/or monitoring is needed. Develop a plan to construct additional wells or piezometers or to equip existing unused wells.
- Continue to identify existing irrigation wells that could be used for aquifer testing so hydraulic parameters can be estimated for the shallow water-table aquifer.
- Investigate the use of Walla Walla River stage to estimate aquifer parameters.

Pilot Testing

- Engage with landowners in the area between and near GW_152 and GW_160 who would be amenable to the construction of a pilot or permanent infiltration facility (basin/pond, injection well, or gallery).

SUPPORTING INFORMATION

List of Table, Figures & Appendices

Figure 1: Well Location Map, Eastside Milton-Freewater

Figure 2: Cross Section A – A’

Figure 3: Cross Section B – B’

Figure 4: Hydrograph for Wells Monitored, Pumped Well 56140, March 14, 2016

Figure 5: Hydrograph for Wells Monitored, Pumped Well 5239, May 3-4, 2016

Figure 6: Hydrograph for Well GW_152, Pumped Well 6475, May 2016

Appendix A: Well Logs

Appendix B: Survey Report

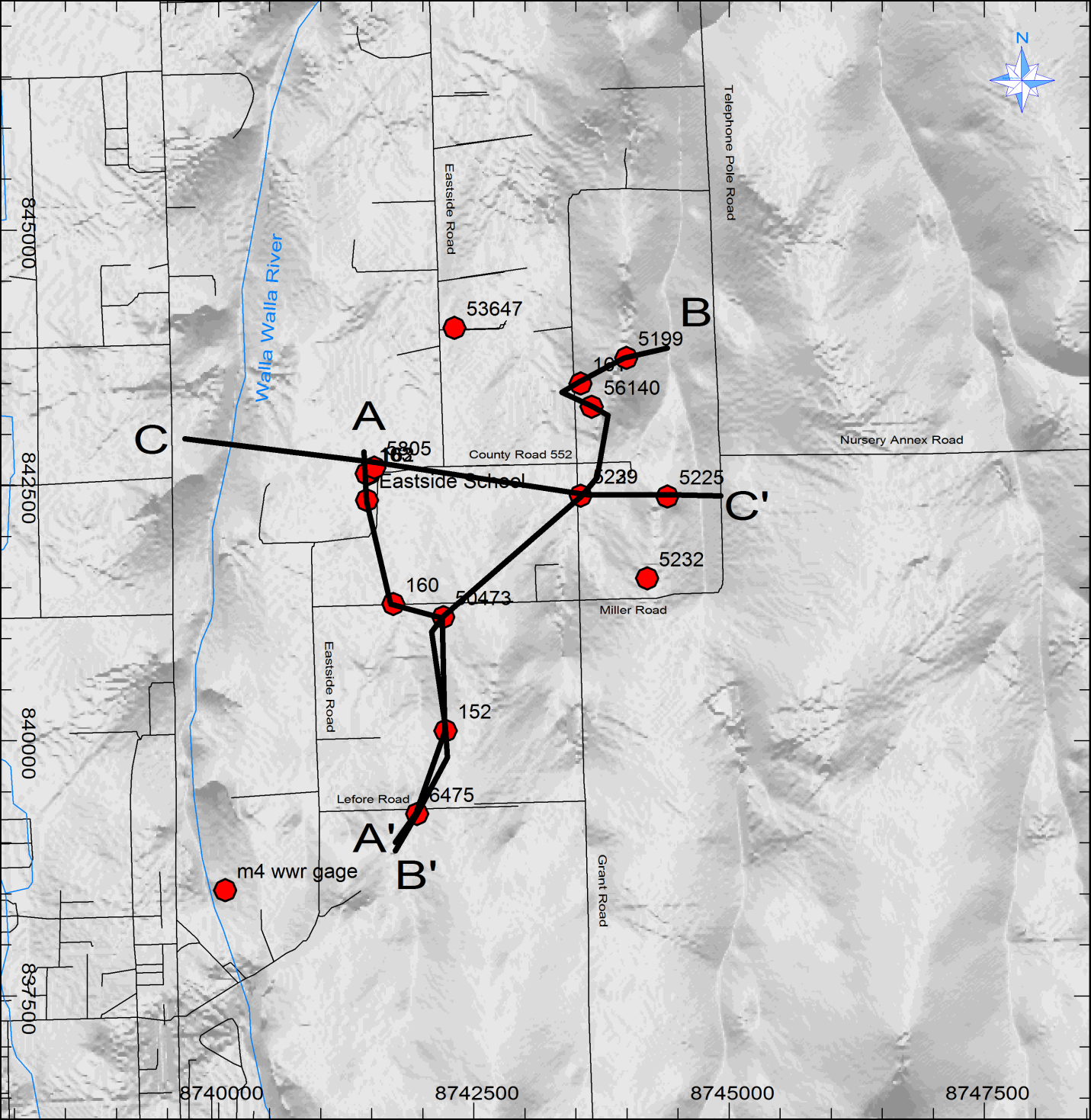
Appendix C: Pumping Test Analyses

Reference

Northwest Land & Water, 2015, *Drilling and Monitoring Well Construction, Aquifer Storage and Recovery (ASR) Feasibility Investigation, Eastside Milton-Freewater, OR*, Memorandum to WWBWC, dated June 30, 2015

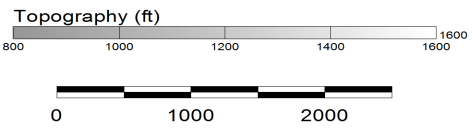
Warranty / Disclaimer

Our professional services were performed, our findings obtained, and this memorandum prepared in accordance with generally accepted hydrogeologic practices at this time and in this area, exclusively for the use of the WWBWC. This warranty is in lieu of all other warranties, expressed, or implied.



Legend:

- Wells
- Rivers
- Roads

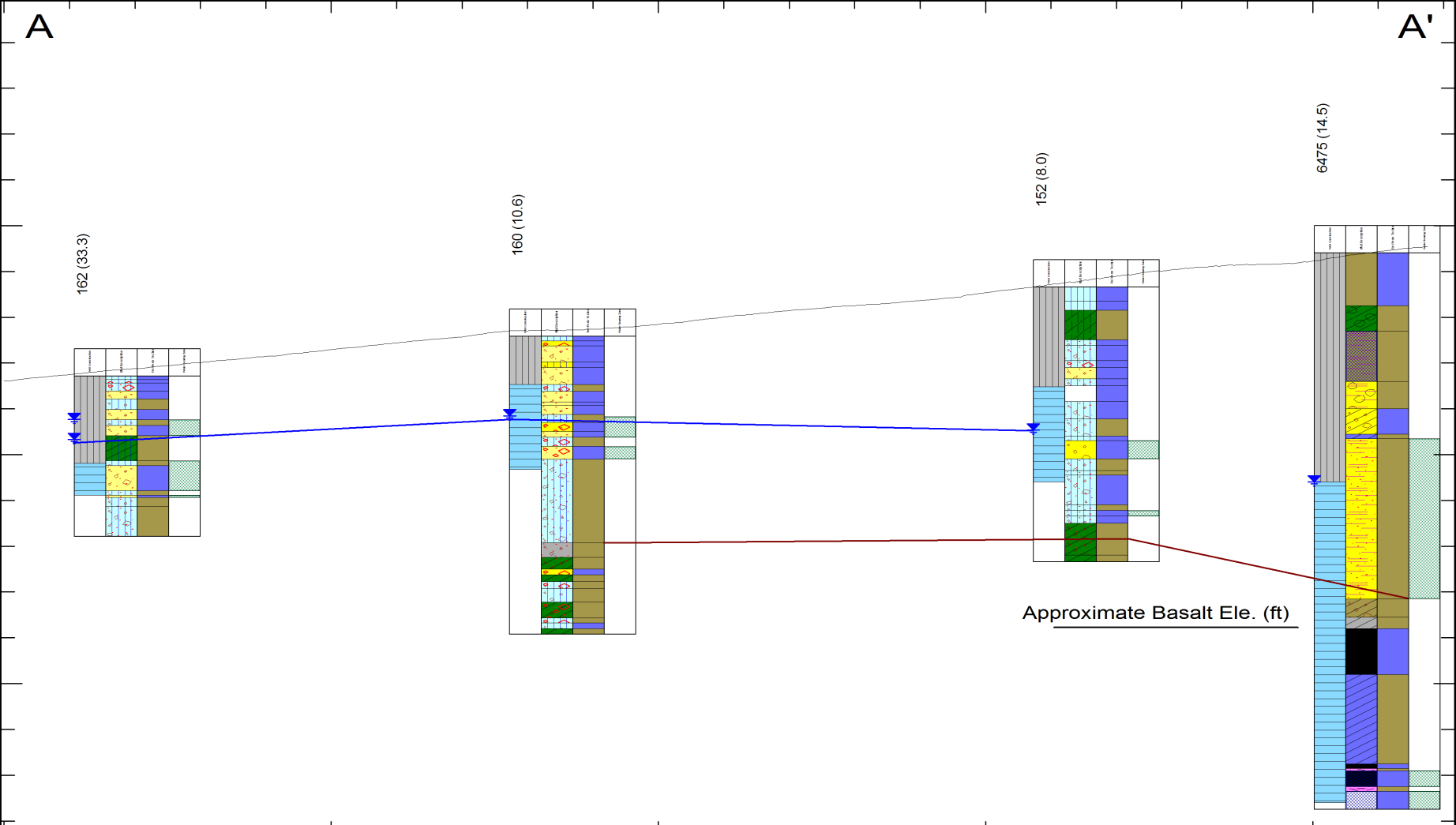


Draft Figure 1
Cross Section Alignments



A

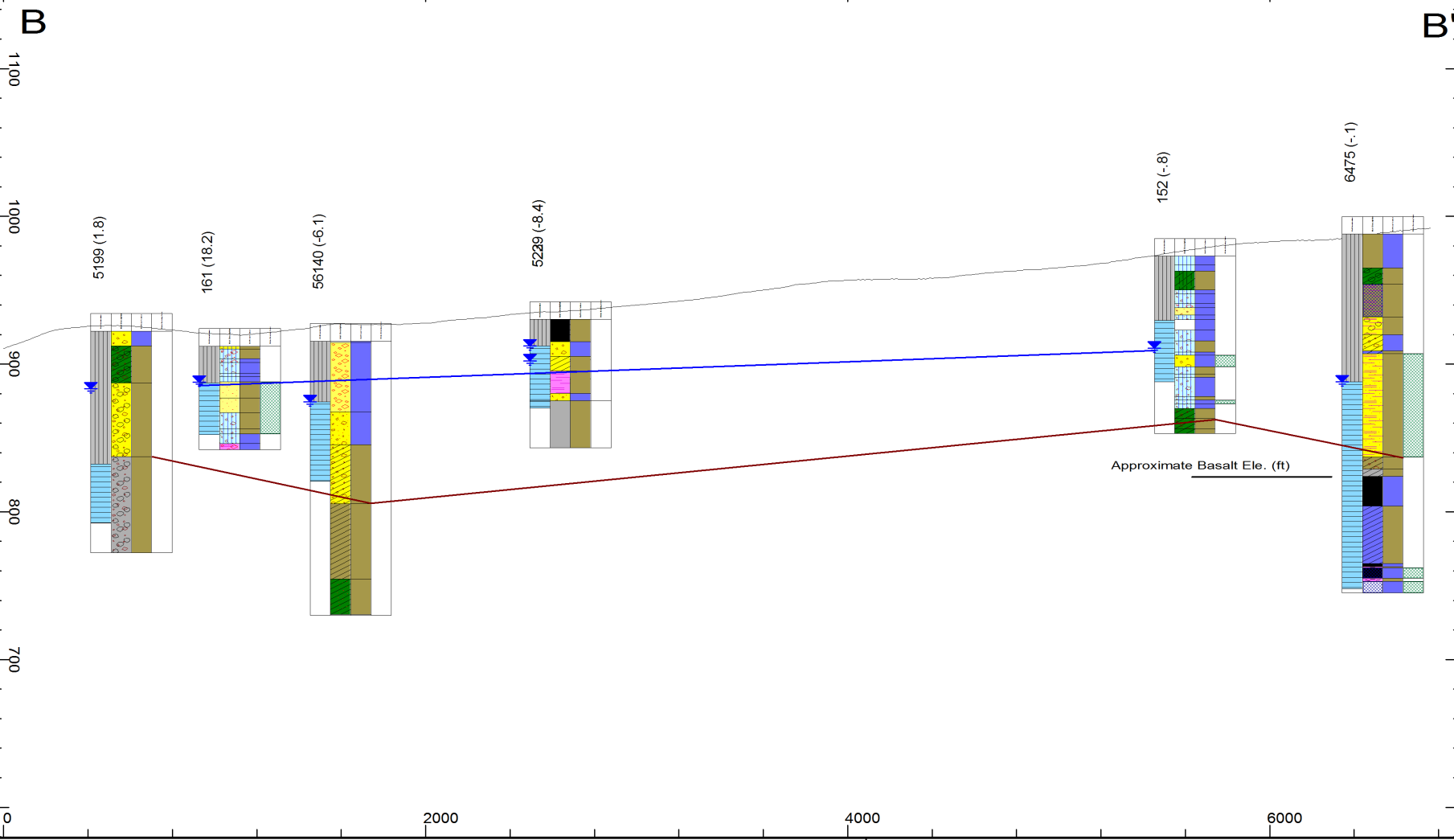
A'



- Legend:**
- ▼ Head Elevation (ft)
 - Projection of surface onto section
 - Topography (ft)
 - Water Table
 - Permeability Separation (Above: Higher, Below: Lower)

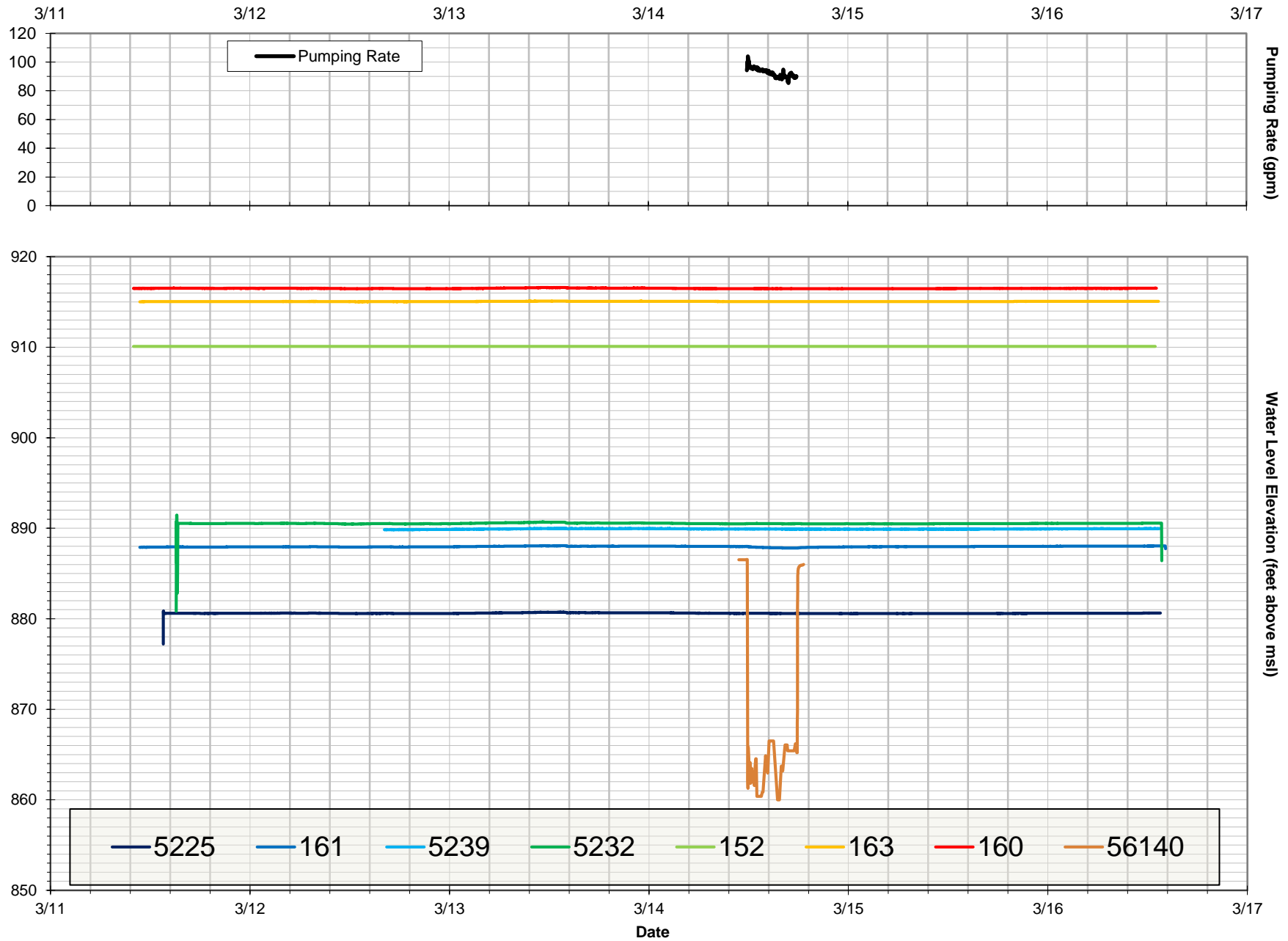
Draft Figure 2
Cross Section A





Draft Figure 3
Cross Section B

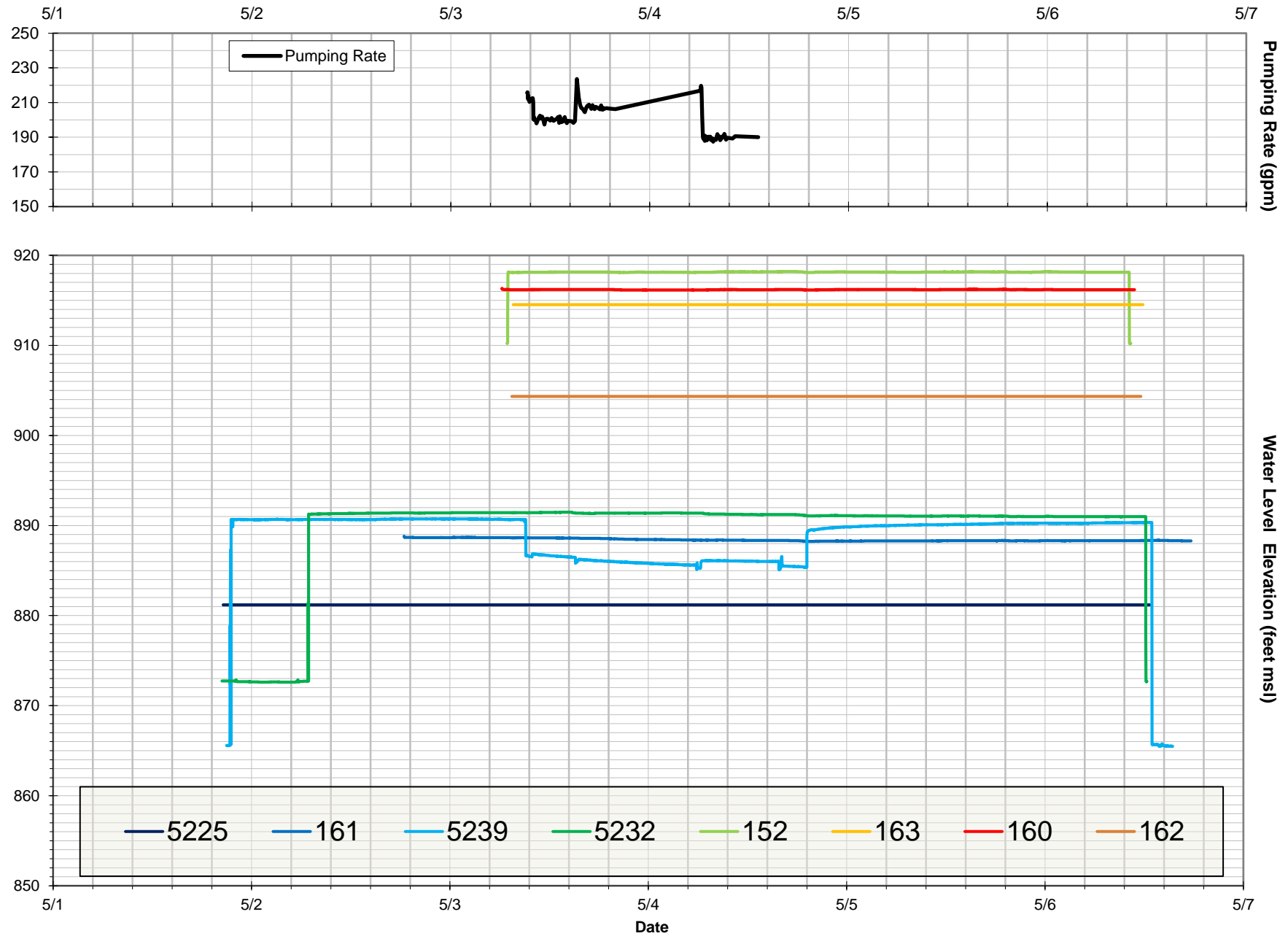




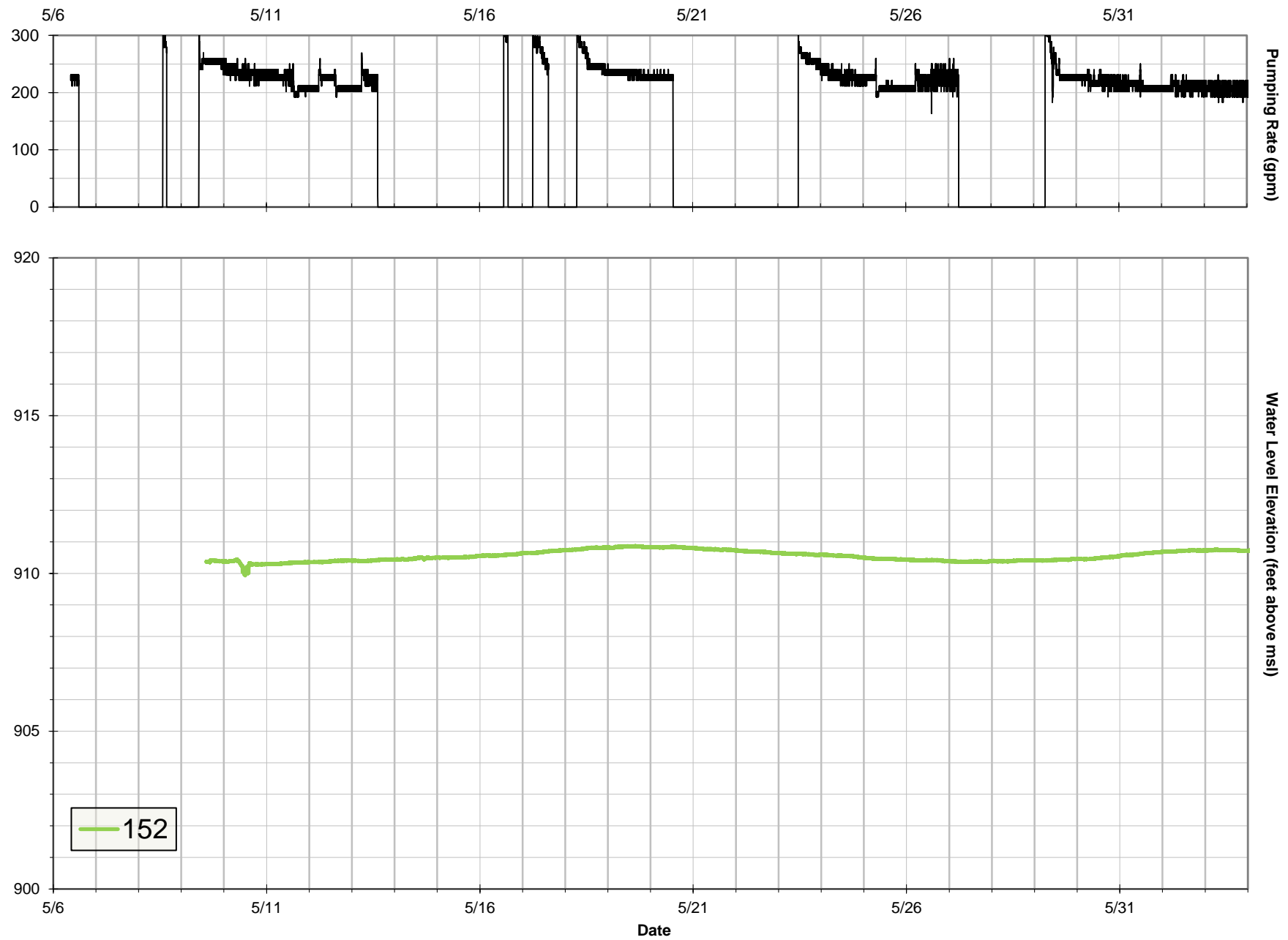
Draft Figure 4. Hydrographs for Wells Monitored, Pumped Well 56140, March 14, 2016

March 2016 Pumping Test
 Eastside Milton Freewater ASR
 WWBWC





Draft Figure 5. Hydrographs for Monitored Wells, Pumped Well 5239, May 3 - 4, 2016



Draft Figure 6. Hydrograph for Well GW_152, Pumped Well 6475, May 9 - June 3, 2016

May - June Monitoring
 Eastside Milton Freewater ASR
 WWBWC



NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

RECEIVED
WATER WELL REPORT

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date
of well completion.

STATE OF OREGON

JAN 5 1981 State Well No.

CON 36E-31bc

(Please type or print)

(Do not write above this line)

WATER RESOURCES DEPT
SALEM, OREGON

UMAD
5225

(1) OWNER:

Name Robert Leeper
Address 616 N EVANS
MILTON-FREEMAN, OR 97862

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Driven
Jetted
Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

(5) CASING INSTALLED:

Threaded Welded
10" Diam. from +1 ft. to 14 ft. Gage 250
8" Diam. from +1 1/2 ft. to 58 1/2 ft. Gage 250

(6) PERFORATIONS:

Perforated? Yes No.

Type of perforator used

Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:

Well screen installed? Yes No

Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

AIR test
a pump test made? Yes No If yes, by whom? some
Yield: 100 gal./min. with 3 ft. drawdown after 1 hrs.
" " " " "
" " " " "
Per test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.

Temperature of water 54 Depth artesian flow encountered ft.

(9) CONSTRUCTION:

Well seal—Material used Cement
Well sealed from land surface to 19 ft.
Diameter of well bore to bottom of seal 12 in.
Diameter of well bore below seal 8 in.
Number of sacks of cement used in well seal 8 sacks
How was cement grout placed? Pumped

Was a drive shoe used? Yes No Plugs Size: location ft.
Did any strata contain unusable water? Yes No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? Yes No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:

County Driller's well number
SW 1/4 NW 1/4 Section 31 T. 6N R. 36 E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.

Depth at which water was first found 70 ft.
Static level 54 ft. below land surface. Date 11-30-80
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing 8"

Depth drilled 100 ft. Depth of completed well 100 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Soil	0	15	
Gravel, Clay & Boulders	15	70	
Boulders	70	76	
Clay & Gravel	76	85	
Cement Gravel	85	100	54

Work started 11-25-1980 Completed 11-30-1980
Date well drilling machine moved off of well 11-30-1980

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] C.W. Lummus Date 12-29, 1980
(Drilling Machine Operator)

Drilling Machine Operator's License No. 821

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name Summers Well Drilling
(Person, firm or corporation) (Type or print)

Address Rt 3 Box 43 A1 Mt. St. OR

[Signed] C.W. Lummus
(Water Well Contractor)

Contractor's License No. 575 Date 12-29-1980

UMAT
5229

Well Record

STATE WELL NO. 6N/36E-31
COUNTY Umatilla
APPLICATION NO.

OWNER: Lawrence W. Timmons

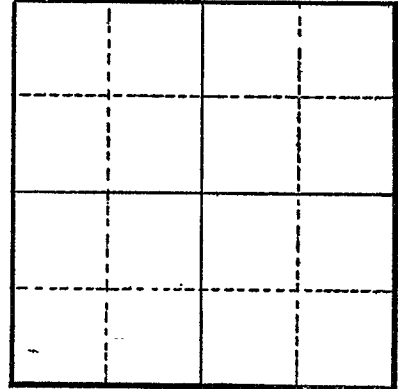
MAILING ADDRESS: RT. 1, Box 149

LOCATION OF WELL: Owner's No.

CITY AND STATE: Milton-Freewater, Oregon

1/4 1/4 Sec. 31 T. 6 N., R. 36 E., W.M.

Bearing and distance from section or subdivision corner



Section 31

Altitude at well

TYPE OF WELL: Dr. & DG Date Constructed 1927

Depth drilled 55 ft. Depth cased 20 ft.

CASING RECORD:

6 inch casing set in bottom of old dug well. 18 ft. below land surface.

FINISH:

Perforated

AQUIFERS:

WATER LEVEL:

18 ft.

PUMPING EQUIPMENT: Type Fairbanks Morse (Pressure system) H.P. 10
Capacity 400 G.P.M.

WELL TESTS:

Drawdown 4 ft. after _____ hours 400 G.P.M.

Drawdown _____ ft. after _____ hours _____ G.P.M.

USE OF WATER Dom. & irrigation Temp. _____ °F. 19.

SOURCE OF INFORMATION Belated registration statement

DRILLER or DIGGER Tom Walker

ADDITIONAL DATA:

Log _____ Water Level Measurements _____ Chemical Analysis _____ Aquifer Test _____

REMARKS:

Log: Black clay	0 to 15 ft.
Gravel	15 to 25 ft.
Yellow clay	25 to 35 ft.
Hard pan	35 to 50 ft.
Some coarse gravel-sand	50 to 55 ft.

5

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

umat
5805
Start Card #
W 26411

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MAR 31 1993

6N/35E/36ab

PLEASE TYPE OR PRINT WATER RESOURCES DEPT.

(for official use only)

(1) OWNER:

Name Muriel Stolz
Address Rt 1 Box 136 D
City Milton Freewater State ORE

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Air Driven
Rotary Mud Dug
Cable Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Thermal: Withdrawal Rejection
Other: Piezometric Grounding Test

(5) CASING INSTALLED:

Steel Plastic
Threaded Welded

....." Diam. from ft. to ft. Gauge
....." Diam. from ft. to ft. Gauge

LINER INSTALLED:

Steel Plastic
Threaded Welded

6" Diam. from 4 ft. to 233 ft. Gauge

(6) PERFORATIONS:

Perforated? Yes No

Size of perforations 1/8 in. by 7 in.
1026 perforations from 65 ft. to 233 ft.
..... perforations from ft. to ft.
..... perforations from ft. to ft.

(7) SCREENS:

Well screen installed? Yes No

Manufacturer's Name Model No.
Type
Diam. Slot Size Set from ft. to ft.
Diam. Slot Size Set from ft. to ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? Yes No If yes, by whom? Driller
Yield: 275 gal./min. with 163 ft. drawdown after 4 hrs.

Air test gal./min. with drill stem at ft. hrs.
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water 53° Depth artesian flow encountered ft.

(9) CONSTRUCTION:

Special standards: Yes No

Well seal—Material used
Well sealed from land surface to ft.
Diameter of well bore to bottom of seal in.
Diameter of well bore below seal in.
Amount of sealing material sacks pounds
How was cement grout placed?
Was pump installed? Type HP Depth ft.
Was a drive shoe used? Yes No Plugs Size: location ft.
Did any strata contain unusable water? Yes No No
Type of Water? depth of strata

Method of sealing strata off
Was well gravel packed? Yes No Size of gravel:
Gravel placed from ft. to ft.

NOTICE TO WATER WELL CONSTRUCTOR
The original and first copy of this report are to be filed with the

(10) LOCATION OF WELL by legal description:

County Umatilla NW 1/4 of Section 36 of
Township 6N Range 35E W.M.
(Township is North or South) (Range is East or West)
Tax Lot Lot Block Subdivision
MAILING ADDRESS OF WELL (or nearest address) Rt 1 Box 136 D
M-F, ORE

(11) WATER LEVEL of COMPLETED WELL:

Depth at which water was first found 22 ft.
Static level 22 ft. below land surface. Date 3-26-93
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing 8"

Depth drilled 58 ft. Depth of completed well 233 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Brown silt & gravel	175	217	37
Brown silt & cobbles	217	230	22
Blue clay	230	233	

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APR 16 1993

WATER RESOURCES DEPT
SALEM, OREGON

Date work started 3-18-93 / completed 3-26-93
Date well drilling machine moved off of well 3-26 19 93

(unbonded) Water Well Constructor Certification (if applicable):

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] Donald J. Harding Date 3-26, 19 93

(bonded) Water Well Constructor Certification:

Bond # 30382213 Issued by: FIDELITY + DEPOSIT Co.
(number) (Surety Company Name)

On behalf of Harding Drilling Co
(type or print name of Water Well Constructor)

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief

(Signed) Raymond Harding
(Water Well Constructor)

(Dated) 3-26-93

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

SP*46866-690

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date
of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

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APR 20 1981

PAGE #1.
State Well No. 6W 35E-36bc
State Permit No. _____

(1) OWNER:
Name Sam LeFore
Address Rt.1 Box 174 East side Rd.
Milton Freewater Oregon.

(2) TYPE OF WORK (check):
New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL: (4) PROPOSED USE (check):
Rotary Cable Dug Driven Jetted Bored Domestic Industrial Municipal Irrigation Test Well Other

CASING INSTALLED:
10" Diam. from 0 ft. to 40 ft. Threaded Welded
8" Diam. from 20 ft. to 240 ft. Gage 0250
" Diam. from _____ ft. to _____ ft. Gage SCH 160

PERFORATIONS:
Perforated? Yes No.
Type of perforator used Whole Saw
Size of perforations 1 in. by 1 in.
500 perforations from 100 ft. to 240 ft.

(7) SCREENS:
Well screen installed? Yes No
Manufacturer's Name _____ Model No. _____
Type _____ Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom?
Yield: 450 gal./min. with 26 ft. drawdown after 4 hrs.
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m.
Temperature of water 54 Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:
Well seal—Material used Cement
Well sealed from land surface to 28 ft.
Diameter of well bore to bottom of seal 12 in.
Diameter of well bore below seal 10 in.
Number of sacks of cement used in well seal 23 sacks
How was cement grout placed? pumped

Was a drive shoe used? Yes No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? Yes No
Type of water _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:
County Umitilla Driller's well number _____
SW 1/4 NN 1/4 Section 36 T. 6 R. 35E W.M.
Bearing and distance from section or subdivision corner
Tax Lot 1400 RT 1B 174
East side Rd

(11) WATER LEVEL: Completed well.
Depth at which water was first found 80 ft.
Static level 100 ft. below land surface. Date Jan 29-81
Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG: Diameter of well below casing 10
Depth drilled 243 ft. Depth of completed well 240 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Brown loam top soil	0	23	
Tan clay and boulders loose and cavy	23	34	
Brown hard pan with 2" to 4" rocks hard.	34	56	
Boulders 1 ft and larger in hard pan tan and brown in color.	56	68	
Yellow clay small gravel simi soft with a trace of sand in the clay.	68	79	
Blue clay muck	79	81	
Yellow sandy hard pan porous and waterbearing.	81	151	
Dark brown clay and gravel 1"-3" Soft.	151	159	
Grey clay Soft	159	164	
Black basalt	164	184	
Blue clay	184	223	continue

Work started 1-26-81 19 _____ Completed 1-29-81 19 _____
Date well drilling machine moved off of well 1-29-81 19 _____

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] _____ Date 1-29-81
(Drilling Machine Operator)
Drilling Machine Operator's License No. 1298

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Goral LaPorte Well Drilling
(Person, firm or corporation) (Type or print)
Address RR Rt 1 Box 101 M.F. Oregon
[Signed] _____
(Water Well Contractor)
Contractor's License No. 756 Date 1-29-81, 19 _____

(1) OWNER:

Name Sam LeFore Page # 2
Address _____

(2) TYPE OF WORK (check):

New Well Deepening Reconditioning Abandon
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary Driven
Cable Jetted
Dug Bored

(4) PROPOSED USE (check):

Domestic Industrial Municipal
Irrigation Test Well Other

CASING INSTALLED:

Threaded Welded
_____ " Diam. from _____ ft. to _____ ft. Gage _____ ft.
_____ " Diam. from _____ ft. to _____ ft. Gage _____ ft.
_____ " Diam. from _____ ft. to _____ ft. Gage _____ ft.

PERFORATIONS:

Perforated? Yes No.
Type of perforator used _____
Size of perforations in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

(7) SCREENS:

Well screen installed? Yes No
Manufacturer's Name _____
Type _____ Model No. _____
Diam. Slot size _____ Set from _____ ft. to _____ ft.
Diam. Slot size _____ Set from _____ ft. to _____ ft.

(8) WELL TESTS:

Drawdown is amount water level is lowered below static level
Was a pump test made? Yes No If yes, by whom? _____
Yield: gal./min. with ft. drawdown after hrs.
" " " " " " " " " " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water _____ Depth artesian flow encountered _____ ft.

(9) CONSTRUCTION:

Well seal—Material used _____
Well sealed from land surface to _____ ft.
Diameter of well bore to bottom of seal _____ in.
Diameter of well bore below seal _____ in.
Number of sacks of cement used in well seal _____ sacks
How was cement grout placed? _____

Was a drive shoe used? Yes No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? Yes No
Type of water _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? Yes No Size of gravel: _____
Gravel placed from _____ ft. to _____ ft.

(10) LOCATION OF WELL:

County Umatilla Driller's well number _____
SW 1/4 NW 1/4 Section 36 T. 6 R. 35E W.M.
Bearing and distance from section or subdivision corner
Taxlot 1400 Rt 1 Box 174
East Side Rd

(11) WATER LEVEL: Completed well.

Depth at which water was first found _____ ft.
Static level _____ ft. below land surface. Date _____
Artesian pressure _____ lbs. per square inch. Date _____

(12) WELL LOG:

Diameter of well below casing _____
Depth drilled _____ ft. Depth of completed well _____ ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Continued from Page # 1.			
Broken Black basalt mixed with soft blue clay and small gravel	223	225	
Hard black basalt	225	226	
Broken black basalt with streaks of red and black cinder and lava rock in layers. Water bearing	226	233	
hard black basalt dense	233	235	
Broken and very porous lava rock water bearing			
very cavy	235	243	

Work started _____ 19 _____ Completed _____ 19 _____
Date well drilling machine moved off of well _____ 19 _____

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] _____ Date 1-29-81, 19_____
(Drilling Machine Operator)
Drilling Machine Operator's License No. 1298

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Goral M. LaPorte Well Drilling.
(Person, firm or corporation) (Type or print)
Address Rt 1 Box 501 M.F. Oregon
[Signed] _____
(Water Well Contractor)
Contractor's License No. 756 Date 1-29-81, 19____

UMAT
50473

MAR - 5 1997

WELL I.D.# 105072

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

(START CARD) # W90209

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number _____
Name Jimmy Bier, Harold Bier, Buddy Bier
Address Rt 4 Box 743
City Milton-Freewater State Or Zip 97862

(2) TYPE OF WORK
 New Well Deepening Alteration (repair/recondition) Abandonment

(3) DRILL METHOD:
 Rotary Air Rotary Mud Cable Auger
 Other _____

(4) PROPOSED USE:
 Domestic Community Industrial Irrigation
 Thermal Injection Livestock Other _____

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes No Depth of Completed Well 105 ft.
Explosives used Yes No Type _____ Amount _____

HOLE			SEAL			Sacks or pounds
Diameter	From	To	Material	From	To	
12"	0	22	Bentonite	0	22	1600 lbs

How was seal placed: Method A B C D E
 Other _____

Backfill placed from 0 ft. to 22 ft. Material Bentonite
Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing: 8	+1.5	67	250	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Liner: 6" PVC	53	105 ^s	40	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Final location of shoe(s) 67' from surface

(7) PERFORATIONS/SCREENS:

Perforations Method Saw
 Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
53	105	4" x	3/16	6"		<input type="checkbox"/>	<input checked="" type="checkbox"/>
				6/ft		<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>

(8) WELL TESTS: Minimum testing time is 1 hour

Pump Bailer Air Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
125	11 feet		1 hr.
125	11 feet		4 hr

Temperature of water 54 Depth Artesian Flow Found _____
Was a water analysis done? Yes By whom _____
Did any strata contain water not suitable for intended use? Too little
 Salty Muddy Odor Colored Other _____
Depth of strata: _____

LOCATION OF WELL by legal description:
County Umatilla Latitude _____ Longitude _____
Township 6 (N or S Range 35 (E or W. WM.
Section 36 NW 1/4 SE 1/4
Tax Lot 00200 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address) Rt 1 Box 158
Miller Rd.; Milton-Freewater, Or. 97862

(10) STATIC WATER LEVEL:
38 ft. below land surface. Date 3/1/97
Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found _____

From	To	Estimated Flow Rate	SWL
66	94	200+	38
99	105	100+	38

(12) WELL LOG:
Ground Elevation 950

Material	From	To	SWL
Large Gravel	0	18	0
Cemented Gravel	18	66	0
Gravel (Water)	66	94	38'
Brown Clay & Gravel	94	99	
Gravel (Water)	99	105	38'

Date started 1/22/97 Completed 3/1/97

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number _____
Signed _____ Date _____

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 374
Signed *Thomas R. ...* Date 3/1/97

UMAT
53647

NOV 08 1999

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WATER RESOURCES DEPT.
SALEM, OREGON

WELL I.D. # 30335
START CARD # 4121223

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number 2
Name Jim Frank
Address 53630 Stiller Lane
City Milton Freewater State OR Zip 97162

(2) TYPE OF WORK
 New Well Deepening Alteration (repair/recondition) Abandonment

(3) DRILL METHOD:
 Rotary Air Rotary Mud Cable Auger
 Other

(4) PROPOSED USE:
 Domestic Community Industrial Irrigation
 Thermal Injection Livestock Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes No Depth of Completed Well 120 ft.
Explosives used Yes No Type _____ Amount _____

HOLE			SEAL			Sacks or pounds
Diameter	From	To	Material	From	To	
12"	0	18	Bentnite	0	18	2500#
8"	18	120				

How was seal placed: Method A B C D E
 Other Poured
Backfill placed from _____ ft. to _____ ft. Material _____
Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing: 8"	1	119	280	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Liner:				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(7) PERFORATIONS/SCREENS:

Perforations Method cutting torch
 Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tube/pipe size	Casing	Liner
80'	110'	1/8"	120	3/8"		<input checked="" type="checkbox"/>	<input type="checkbox"/>

(8) WELL TESTS: Minimum testing time is 1 hour

Pump Bailor Air Flowing Artesian
Yield gal/min 50 gpm Drawdown 2' Drill stem at _____ Time 1 hr.

Temperature of water 49° Depth Artesian Flow Found _____
Was a water analysis done? Yes By whom _____
Did any strata contain water not suitable for intended use? Too little
 Salty Muddy Odor Colored Other sand
Depth of strata: 45-65'

(9) LOCATION OF WELL by legal description:
County Umatilla Latitude _____ Longitude _____
Township 6 N or S Range 35 E or W. WM.
Section 36 A NW 1/4 NB 1/4
Tax Lot 300 Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address) 53630 Stiller Lane
Milton Freewater OR 97162

(10) STATIC WATER LEVEL:
34' ft. below land surface. Date 11-1-99
Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found 46'

From	To	Estimated Flow Rate	SWL
46	65	5 gpm	46
70	120	100 gpm	34

(12) WELL LOG:
Ground Elevation _____

Material	From	To	SWL
clay - lean - black	0	5	0
cobbles large	5	26	0
cobbles small/clay-br.	26	31	0
cobbles small	31	46	0
sand med. - water	46	65	45
gravel - fine Br clay	65	69	45
clay - brown - gravel - fine	69	80	45
cobbles small/clay brown	80	105	34
cobbles - med.	105	120	34

Date started 10-18-1999 Completed 11-1-1999
(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
Signed Gerald H Harding WWC Number 1598 Date 11-1-99

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
Signed Mike Harding WWC Number 1639 Date 11-2-99

UMAT 56140

**STATE OF OREGON
WATER SUPPLY WELL REPORT**

(as required by ORS 537.765 & OAR 690-205-0210)

WELL LABEL # L 82245

START CARD # W194814

Instructions for completing this report are on the last page of this form.

(1) LAND OWNER Owner Well I.D. _____
 First Name _____ Last Name _____
 Company VONDERAHE, Inc.
 Address 401 PARKVIEW STREET
 City MILTON FREEWATER State ORE Zip 97962

(2) TYPE OF WORK New Well Deepening Conversion
 Alteration (repair/recondition) Abandonment

(3) DRILL METHOD
 Rotary Air Rotary Mud Cable Auger Cable Mud
 Reverse Rotary Other _____

(4) PROPOSED USE Domestic Irrigation Community
 Industrial/Commercial Livestock Dewatering Injection
 Thermal Other _____

(5) BORE HOLE CONSTRUCTION Special Standard: Yes (attach copy)
 Depth of Completed Well: 85 ft.

BORE HOLE			SEAL			Amount	GCS/lbs
Dia	From	To	Material	From	To		
12	0	19	Bentonite	0	19	35	
8	19	185					

How was seal placed: Method A B C D E
 Other Poured
 Backfill placed from _____ ft. to _____ ft. Material _____
 Filter pack from _____ ft. to _____ ft. Material _____ Size _____
 Explosives used: Yes Type _____ Amount _____

(6) CASING/LINER

Csng	Lintr	Dia	+	From	To	Gauge	Steel	Plastic	Welded	Thrd
X		8	X	2	99	.250	X		X	

Shoe Inside Outside Other Location of shoe(s) 99
 Temporary casing Yes Diameter _____ From _____ To _____

(7) PERFORATIONS/SCREENS
 Perforations Method Touch
 Screens Type _____ Material _____

Perf	Scrm	Csng	Lintr	Screen Dia	From	To	Screen/slot width	Slot length	# of slots	Tele/pipe size
X		X		8	41	95	1/4	7	216	

(8) WELL TESTS: Minimum testing time is 1 hour
 Pump Bailer Air Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
75	7	100	4
100	49	100	4 1/2

Temperature 54 °F Lab analysis Yes By _____
 Water quality concerns? Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)
 County Umatilla Twp 6 or S Range 36 or W W.M.
 Sec 31 NW 1/4 of the NW 1/4 Tax Lot 6900
 Tax Map Number _____ Lot _____
 Lat _____ " or _____ DMS or DD
 Long _____ " or _____ DMS or DD
 Street Address of Well (or nearest address)
84387 GRANT ROAD

(10) STATIC WATER LEVEL

Existing Well/Predeepening	Date	SWL (psi)	+	SWL (ft)
Completed Well	<u>4-21-08</u>			<u>41</u>

Flowing Artesian? Yes Dry Hole? Yes

WATER BEARING ZONES Depth water was first found 41

SWL Date	From	To	Est Flow	SWL (psi)	+	SWL (ft)
<u>4-18-09</u>	<u>41</u>	<u>100</u>	<u>100gpm</u>			<u>41</u>

(11) WELL LOG Ground Elevation _____

Material	From	To
Top soil	0	1
cobbles	1	48
gravel-sand	48	70
gravel-Brown clay	70	110
Brown clay	110	161
gray clay-sand	161	185

RECEIVED

MAY 29 2008

WATER RESOURCES DEPT.
SALEM, OREGON

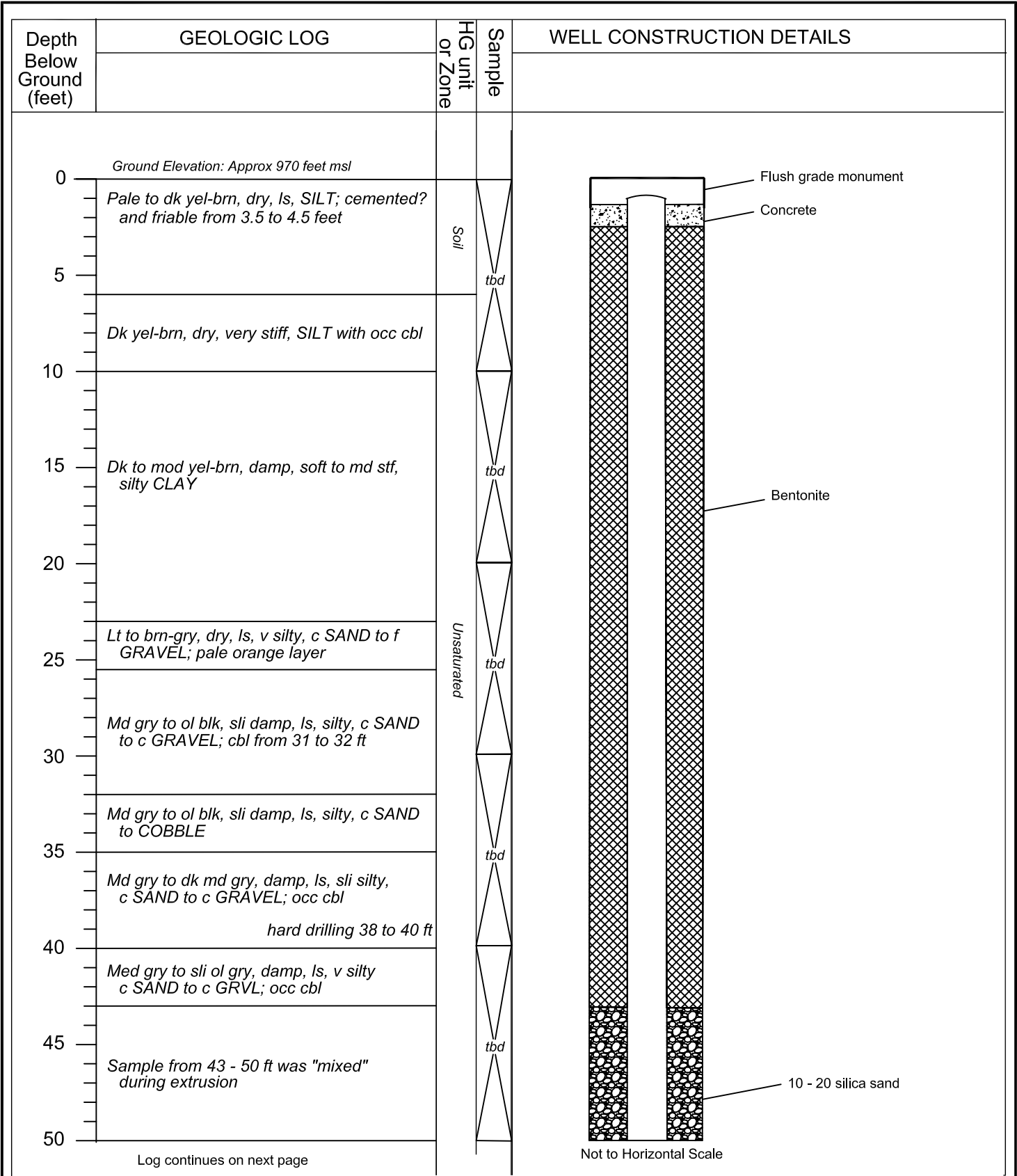
Date Started 3-31-08 Completed 4-21-08

(unbonded) Water Well Constructor Certification
 I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1869 Date 4-21-08
 Signed Blake Harding

(bonded) Water Well Constructor Certification
 I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1639 Date 4-25-08
 Signed Mike Harding
 Contact Info. (optional)



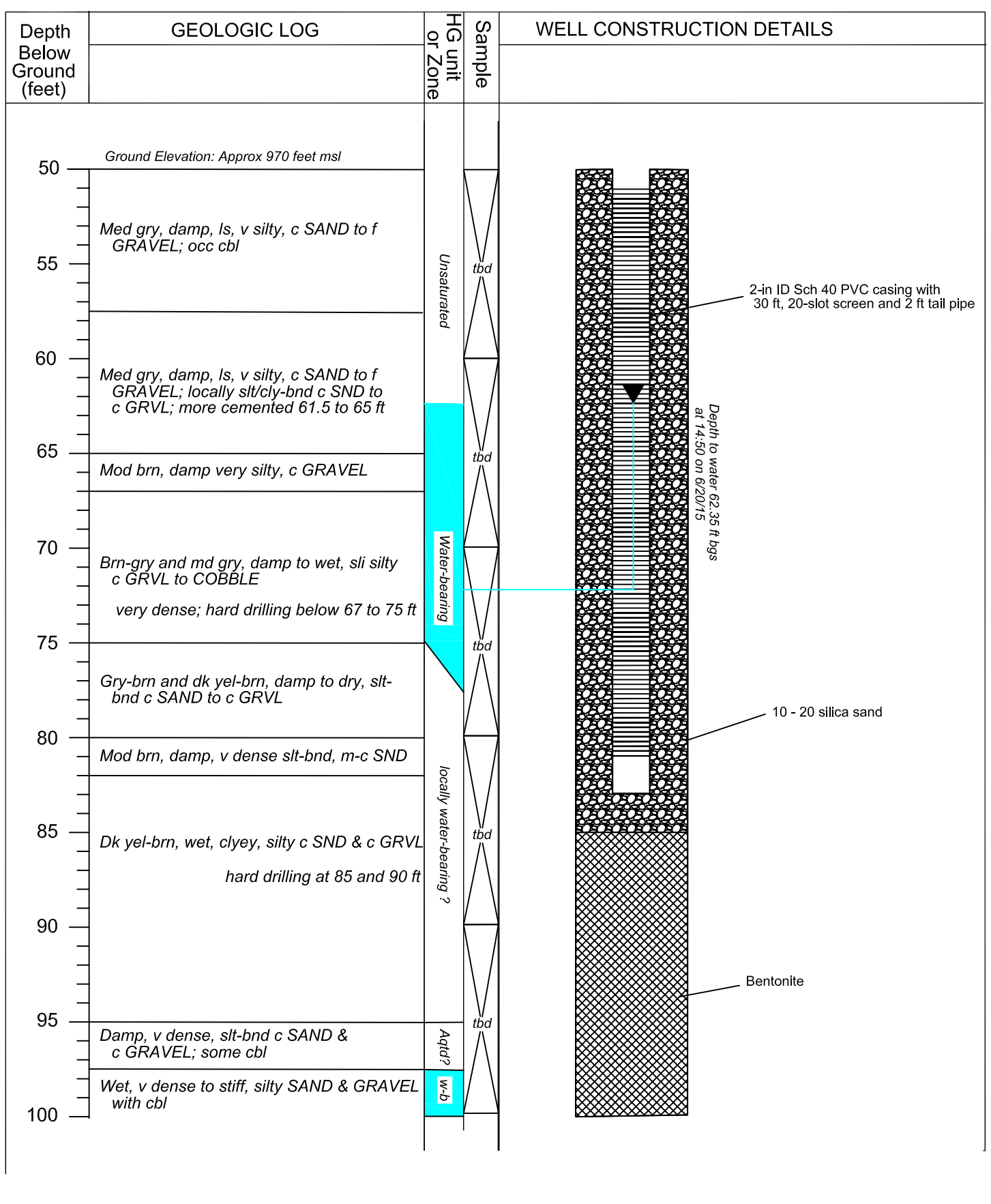
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C:\Projects\WWBWC\...Geol.Log&Asbull_LF-1pg1of3.dwg

PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka LF-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 1 of 3)
GW_152 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





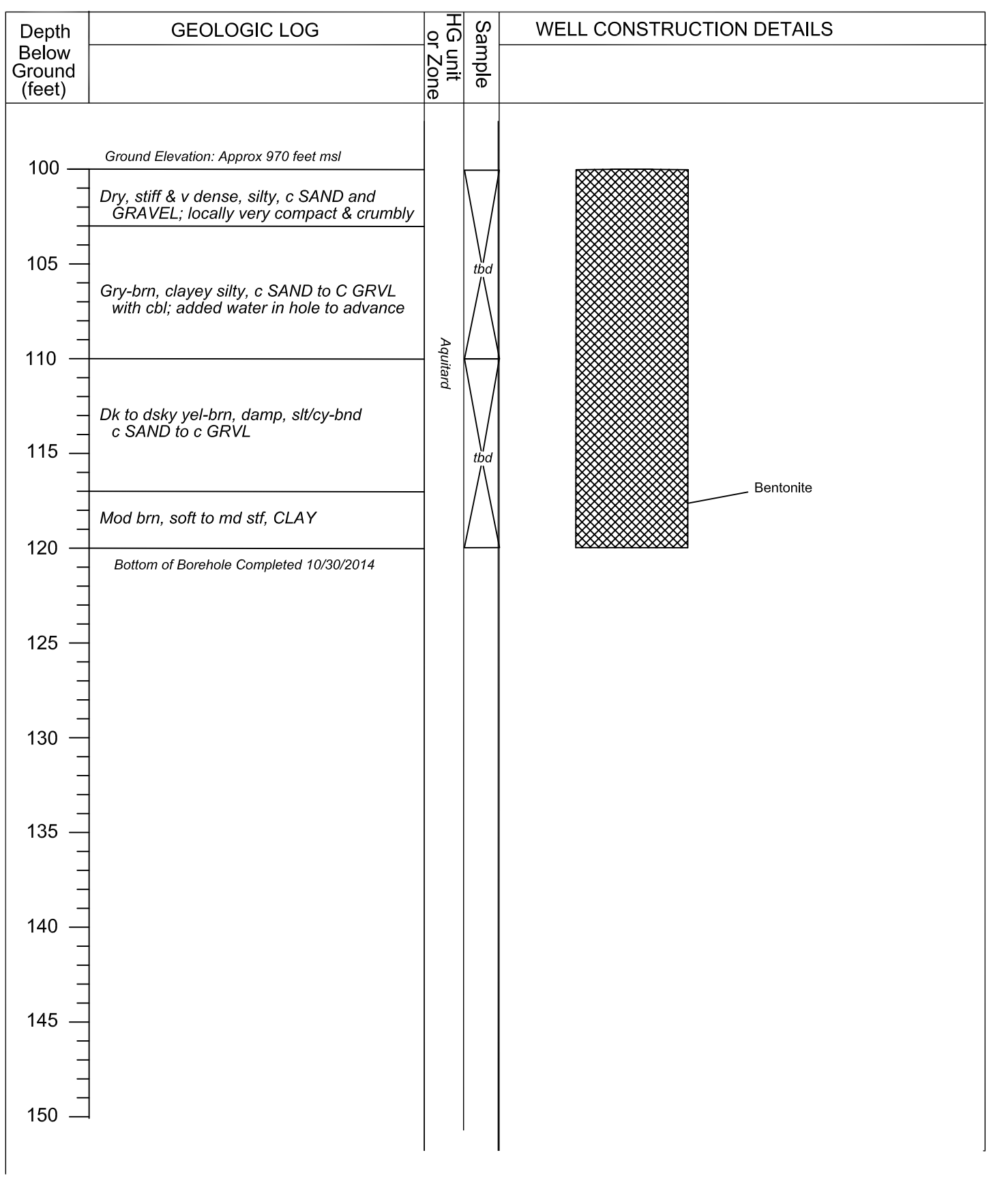
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DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_152; aka LF-1
WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 2 of 3)
 GW_152 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

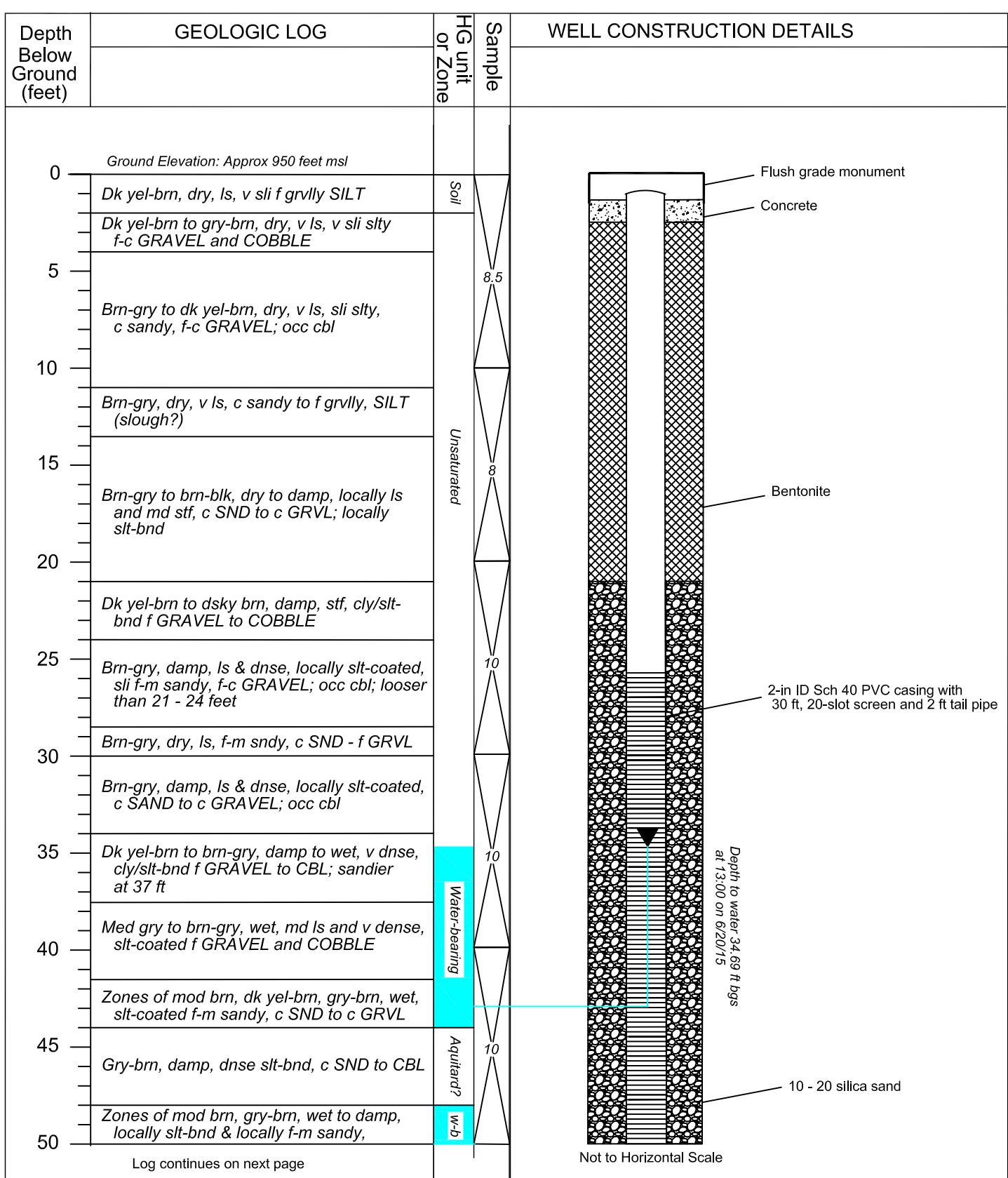
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: NW 1/4 SE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_152; aka FL-1
 WELL TAG & START CARD: L111668 & 1024795

Figure 2 (page 3 of 3)
 GW_152 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





Log continues on next page

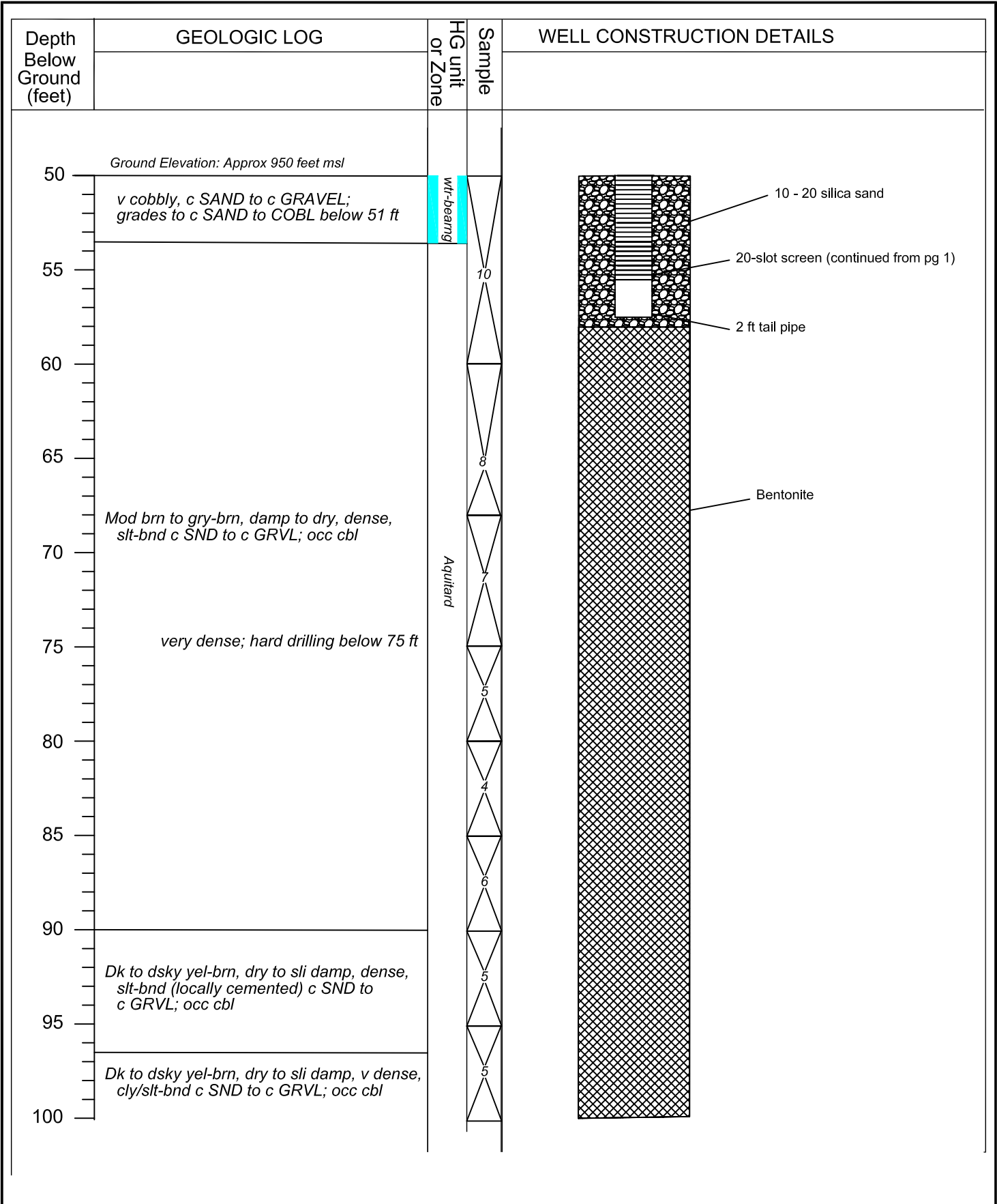
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SE 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_160; aka CR-1
 WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 1 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

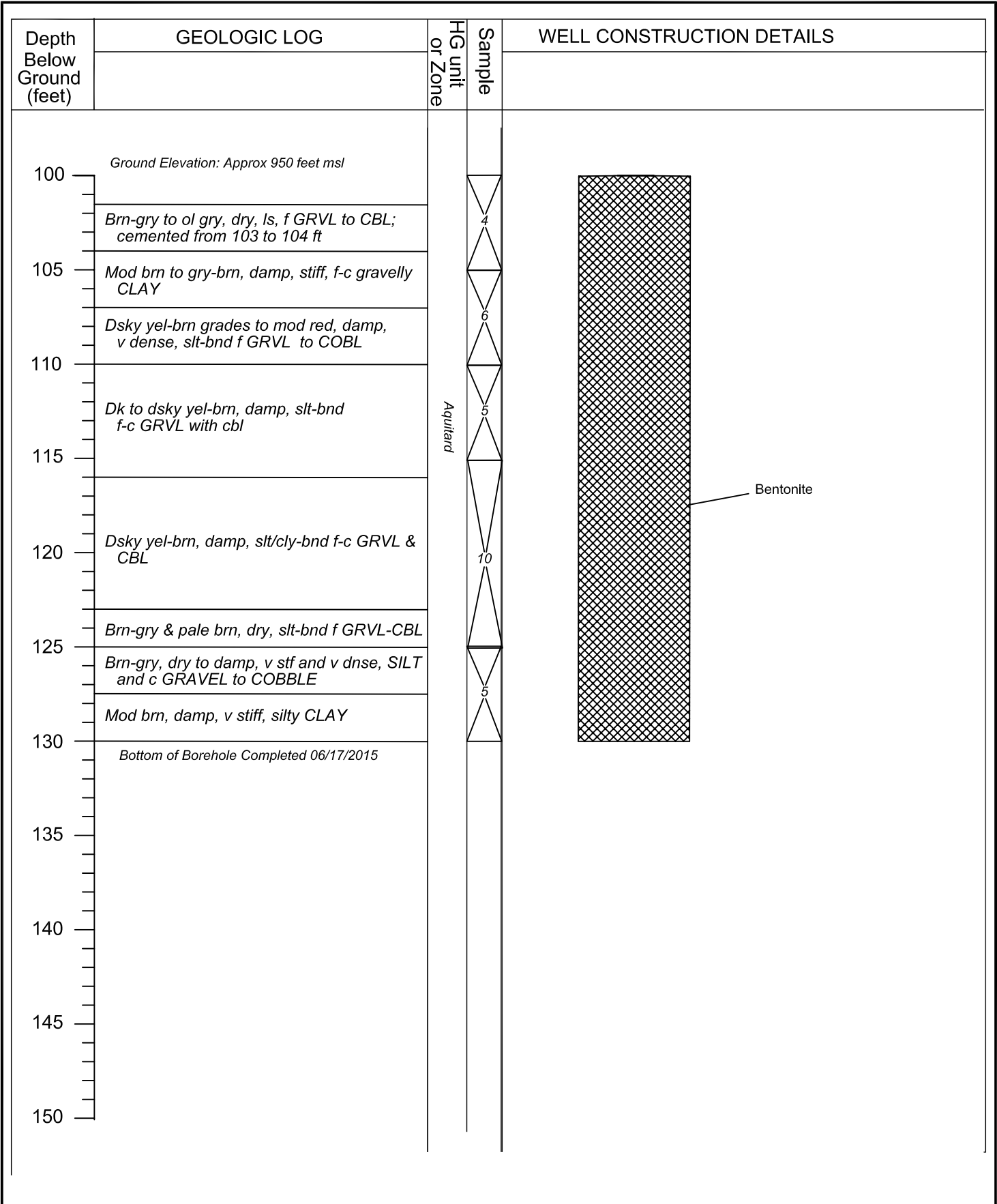
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_160; aka CR-1
 WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 2 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





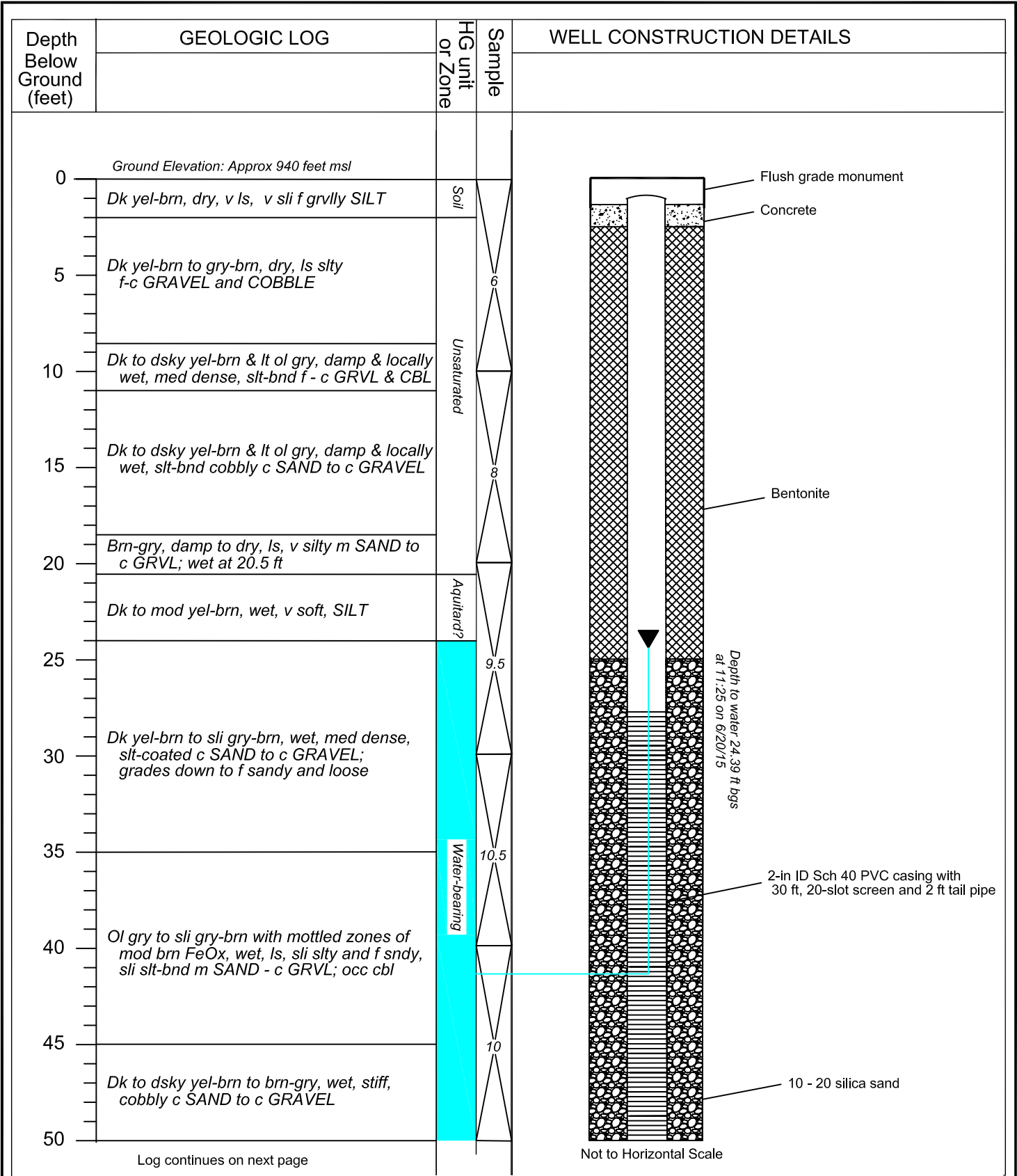
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_160; aka CR-1
WELL TAG & START CARD: L111671 & 1026739

Figure 3 (page 3 of 3)
 GW_160 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





version 06/30/15

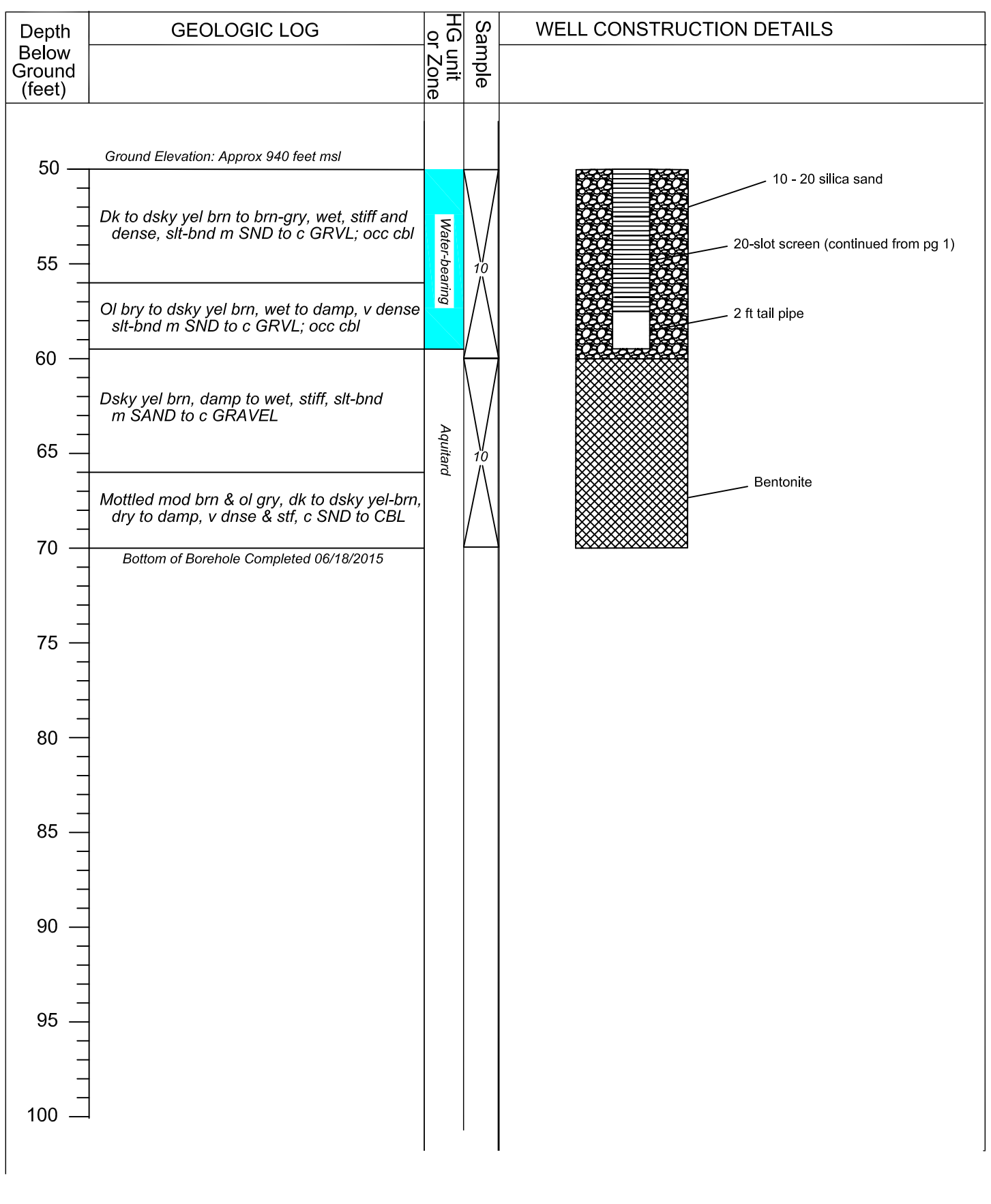
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 NW 1/4 Sec 31 T6N, R36E
WELL NAME: GW_161; aka JB-1
WELL TAG & START CARD: L111672 & 1026740

Figure 4 (page 1 of 2)
GW_161 Geologic Log & Monitoring Well As-Built

Eastside Milton-Freewater, OR
Walla Walla Basin Watershed Council





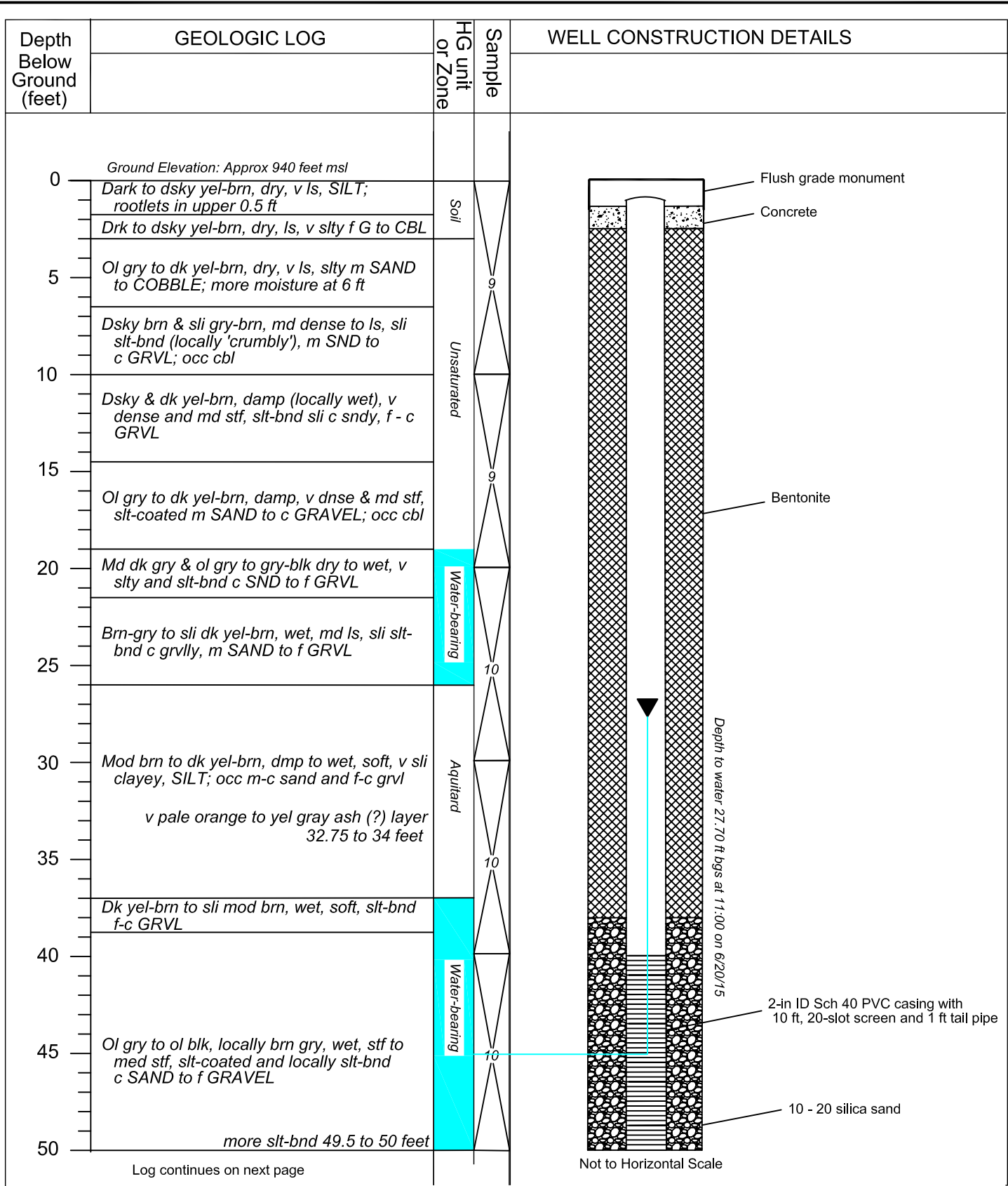
version 06/30/15
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PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: NW 1/4 NW 1/4 Sec 31 T6N, R36E
WELL NAME: GW_161; aka JB-1
WELL TAG & START CARD: L111672 & 1026740

Figure 4 (page 2 of 2)
 GW_161 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





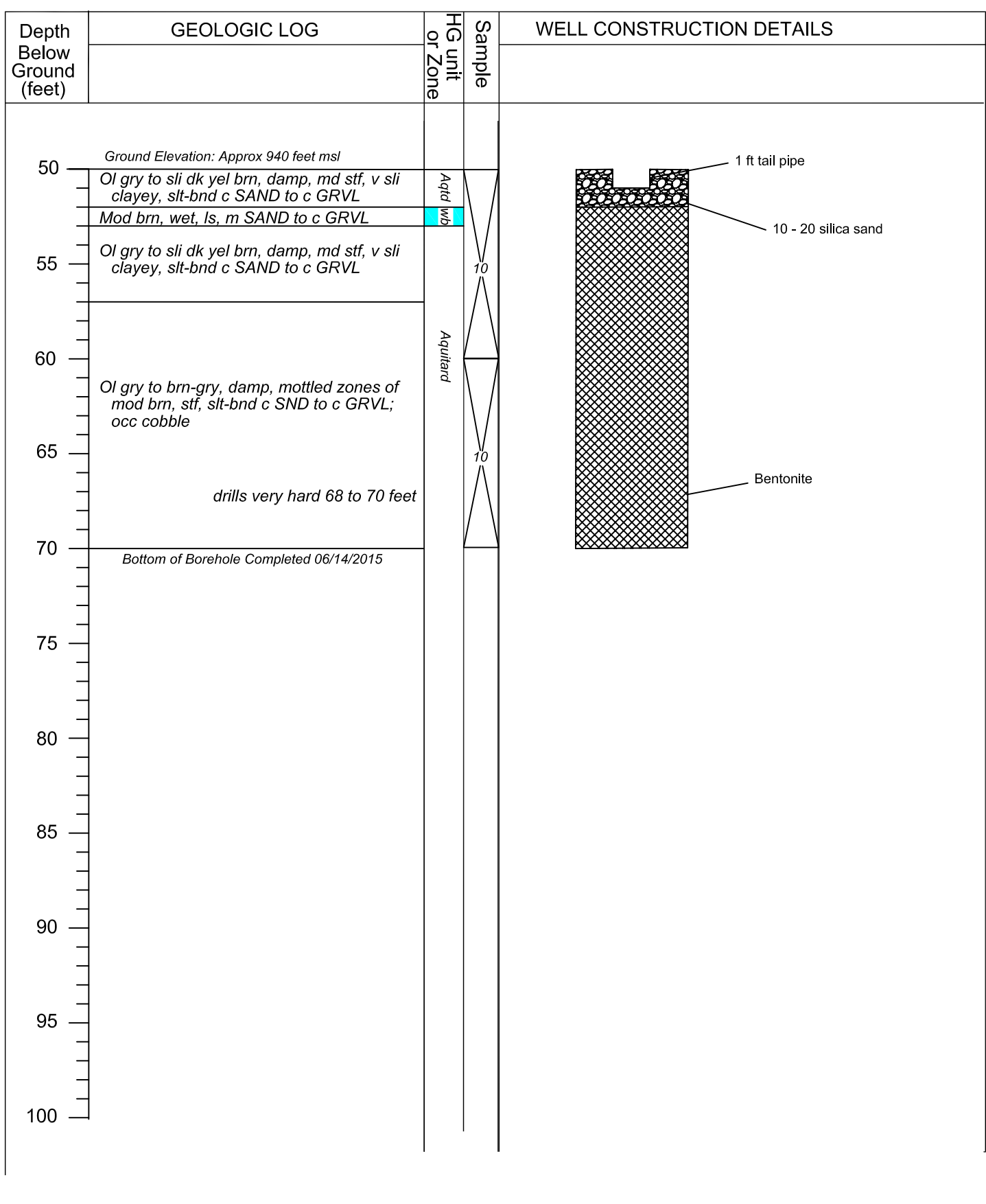
version 06/30/15
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PROJECT NAME: Eastside ASR Feasibility
 DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
 DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
 FIRM: Holt Services, Inc
 CONSULTING FIRM: Northwest Land & Water, Inc
 REPRESENTATIVE: Jim Mathieu, Hydrogeologist
 LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
 WELL NAME: GW_162; aka MFS-1
 WELL TAG & START CARD: L111673 & 1026828

Figure 5 (page 1 of 2)
 GW_162 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





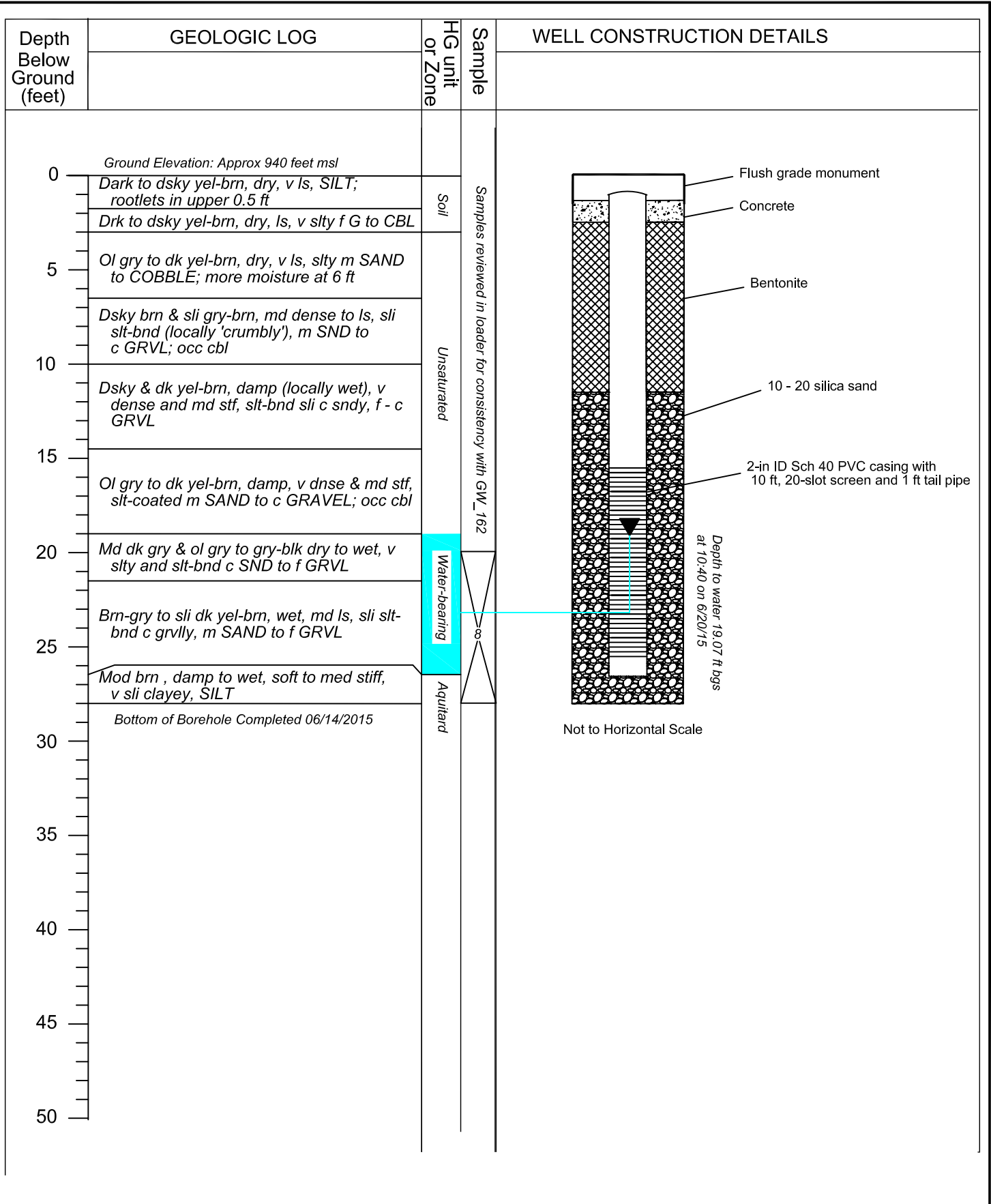
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 version 06/30/15

PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_162; aka MFS-1
WELL TAG & START CARD: L111673 & 1026828

Figure 5 (page 2 of 2)
 GW_162 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council





C:\Projects\WWBWC\...GeoLog\AsBuilt_MFS-2(shallow)_P01012.dwg
 version 06/30/15

PROJECT NAME: Eastside ASR Feasibility
DRILLING METHOD: Sonic, 6-inch casing, 4-inch sample
DRILLER: Pete Rosenberg (driller), Jacob, Josh (helpers)
FIRM: Holt Services, Inc
CONSULTING FIRM: Northwest Land & Water, Inc
REPRESENTATIVE: Jim Mathieu, Hydrogeologist
LOCATION: SW 1/4 NE 1/4 Sec 36 T6N, R35E
WELL NAME: GW_163; aka MFS-2
WELL TAG & START CARD: L112703 & 1026829

Figure 6 (page 1 of 1)
 GW_163 Geologic Log &
 Monitoring Well As-Built

Eastside Milton-Freewater, OR
 Walla Walla Basin Watershed Council



Eastside ASR Characterization Pumping Test GPS Survey Report

DRAFT Report



Steven Patten – Sr. Environmental Scientist

Submitted: June 2016

In Cooperation with:



Overview

The Walla Walla Basin Watershed Council conducted a survey-grade GPS survey of surface and groundwater monitoring sites in the spring of 2016 to establish accurate coordinates and elevations for the Eastside ASR Characterization Pumping Test project. Establishing an accurate location (longitude/latitude and elevation) of each monitoring site is vital for analyzing data accurately from each of the pumping tests. The survey included pumping wells, monitoring wells and river stage location.

Methods

The Walla Walla Basin Watershed Council utilized a set of survey-grade GPS units. These survey-grade GPS units (Magellan ProMark 3) were used to establish location and elevation for pumping wells, monitoring wells and river stage locations. The ProMark 3 measures locations with an accuracy of 5 centimeters or less (if given the correct conditions). Two units were used, a BASE unit and a ROVR unit. Both units used 2 meter SECO rods. The BASE unit was set up at established control points that were tied back to published control points. At each control point, a stake with a screw on top was put into the ground so the BASE station could be placed in the same location each time it was set up (Figure 1). The BASE unit was started first and allowed to run during surveying activities without interruption. The ROVR unit was set up and placed on the monitoring site. Well locations were either measured at ground surface (for purpose built monitoring wells – see Figure 2) or at the measurement point (for non-purpose built monitoring/pumping wells – see Figure 3). River stage locations were measured at the bottom of the staff gauge (see Figure 4). Data were downloaded and post-processed using GNSS Solutions software. Data were processed in UTM 11N, NAD83 Spatial Reference System with units of meters. Data were imported into ArcGIS and displayed visually for a quality check of the data and to create a map.

Summary

The GPS survey provided accurate location and elevation information for pumping, monitoring and river stage monitoring sites for the Eastside ASR Characterization Pumping Test project. Establishing extremely accurate locations (average of <1.5 cm accuracy for horizontal confidence) and elevations (average of <1.0 cm accuracy for vertical confidence) for monitoring sites allows for better analysis of pumping test data. LIDAR flight information is available for most of the project area, which may be utilized for additional analysis.



Figure 1. BASE unit located at HBDIC Aquifer Recharge Project site. Notice the bottom of the BASE unit is on a stake with a screw (green circle) for accuracy when repeatedly setting up the BASE unit.



Figure 2. Typical location for GPS measurement at purpose built groundwater monitoring locations.

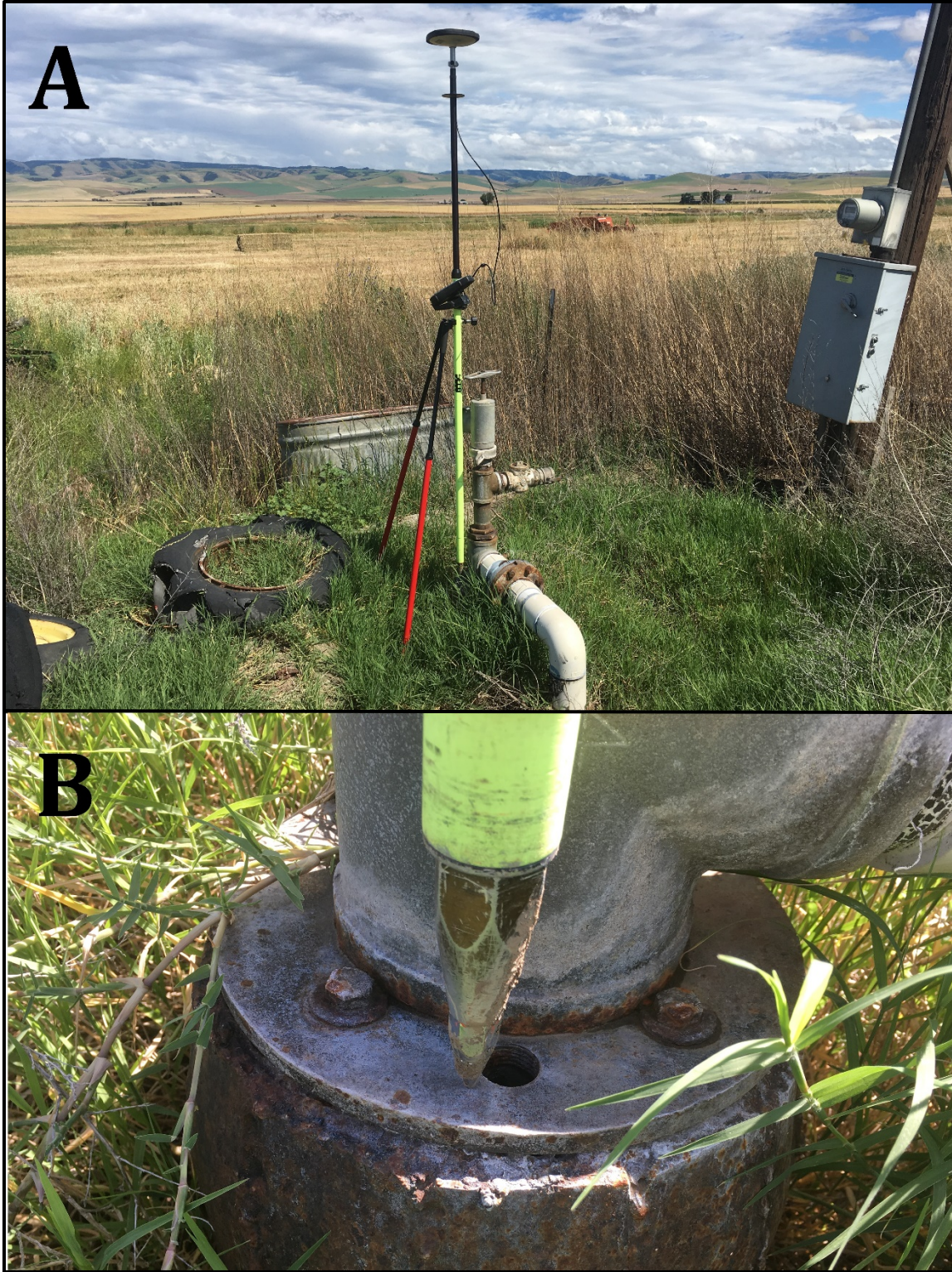


Figure 3. Typical location for GPS measurement at non-purpose built groundwater monitoring and pumping well locations. A – Well head and survey equipment. B – Tip of survey rod at measurement point



Figure 4. Typical location for GPS measurement at river stage monitoring site. GPS would be placed next to the staff gauge and on the stream/canals substrate. Staff gauge reading and water depth (on survey rod) were also recorded.

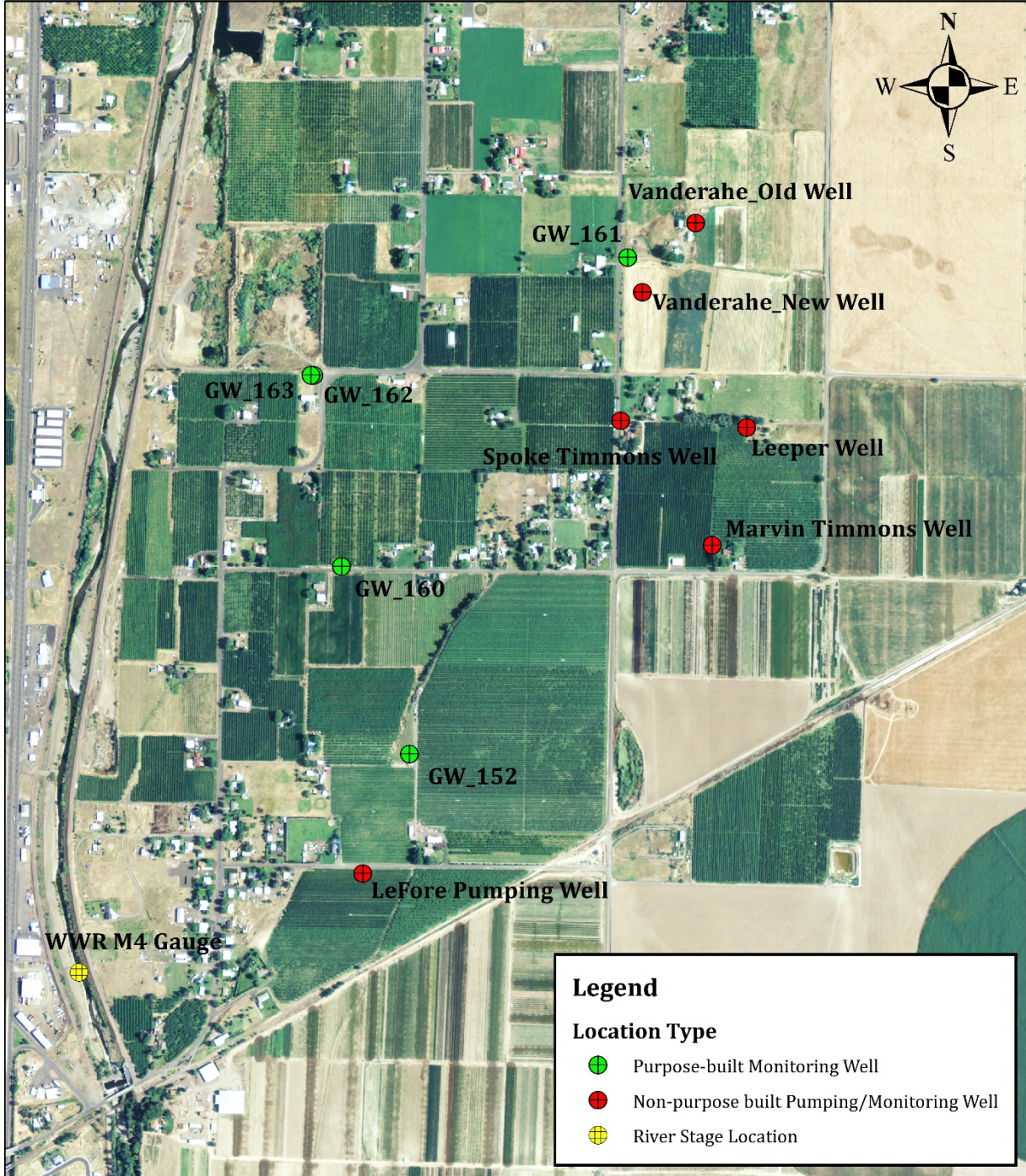
Appendix A – GPS Survey Results

Name	East (meters)	North (meters)	Elevation (meters)	Constraints	Surv_Horz_Conf	Surv_Height_Conf	Type	Warning	TOG_Adjustment
LeFore Pumping Well	393191.362	5089327.026	301.147	No constraints	0.003	0.002	Logged Point	No	(+) 0.10 feet
Marvin Timmons Well	393907.356	5089999.746	288.345	No constraints	0.108	0.07	Logged Point	No	None
Leeper Well	393978.022	5090240.809	286.299	No constraints	0.004	0.002	Logged Point	No	None
Spoke Timmons Well	393719.995	5090254.791	283.53	No constraints	0.004	0.003	Logged Point	No	(+) 0.2 feet
Vanderahe_New Well	393764.138	5090518.286	279.059	No constraints	0.003	0.003	Logged Point	No	None
Vanderahe_Old Well	393873.662	5090659.709	281.111	No constraints	0.003	0.004	Logged Point	No	None
GW_152	393286.724	5089571.48	296.604	No constraints	0.015	0.011	Control Point	No	(-) 0.26 feet
GW_160	393147.417	5089956.004	290.045	No constraints	0.003	0.003	Logged Point	No	(-) 0.33 feet
GW_161	393734.325	5090589.237	278.018	No constraints	0.003	0.004	Logged Point	No	(-) 0.35 feet
GW_162	393090.749	5090347.905	284.768	No constraints	0.003	0.003	Logged Point	No	(-) 0.32 feet
GW_163	393084.789	5090347.965	284.814	No constraints	0.003	0.003	Logged Point	No	(-) - .22 feet
WWR M4 Gauge	392609.137	5089124.399	296.576	No constraints	0.014	0.009	Logged Point	No	None

Survey Datum Info: UTM 11N, NAD83-CORS96, units = meters

Appendix B – Survey Map

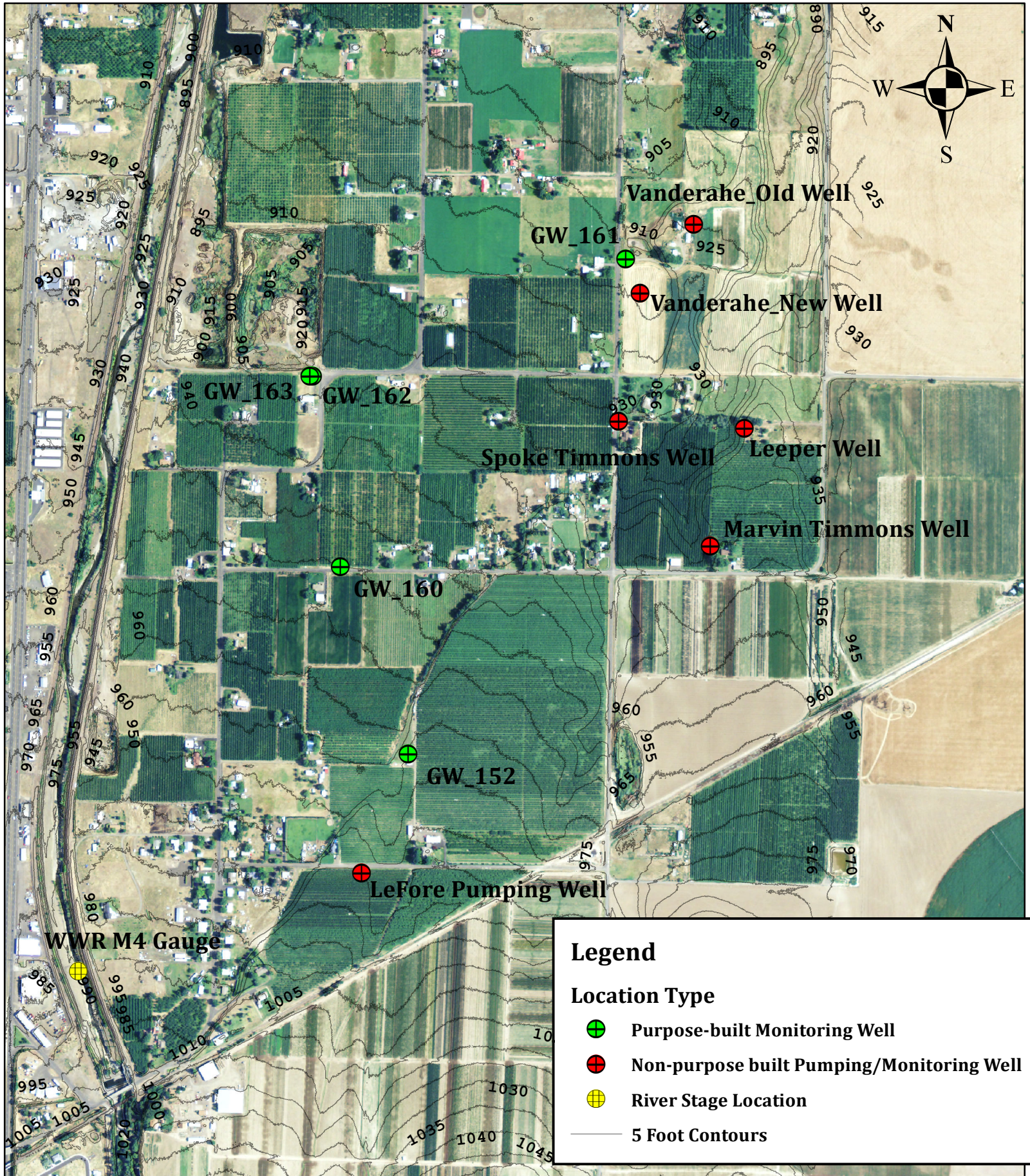
Eastside ASR Characterization Pumping Test GPS Survey Map



0 0.1 0.2 0.4 0.6 Miles



Eastside ASR Characterization Pumping Test GPS Survey Map



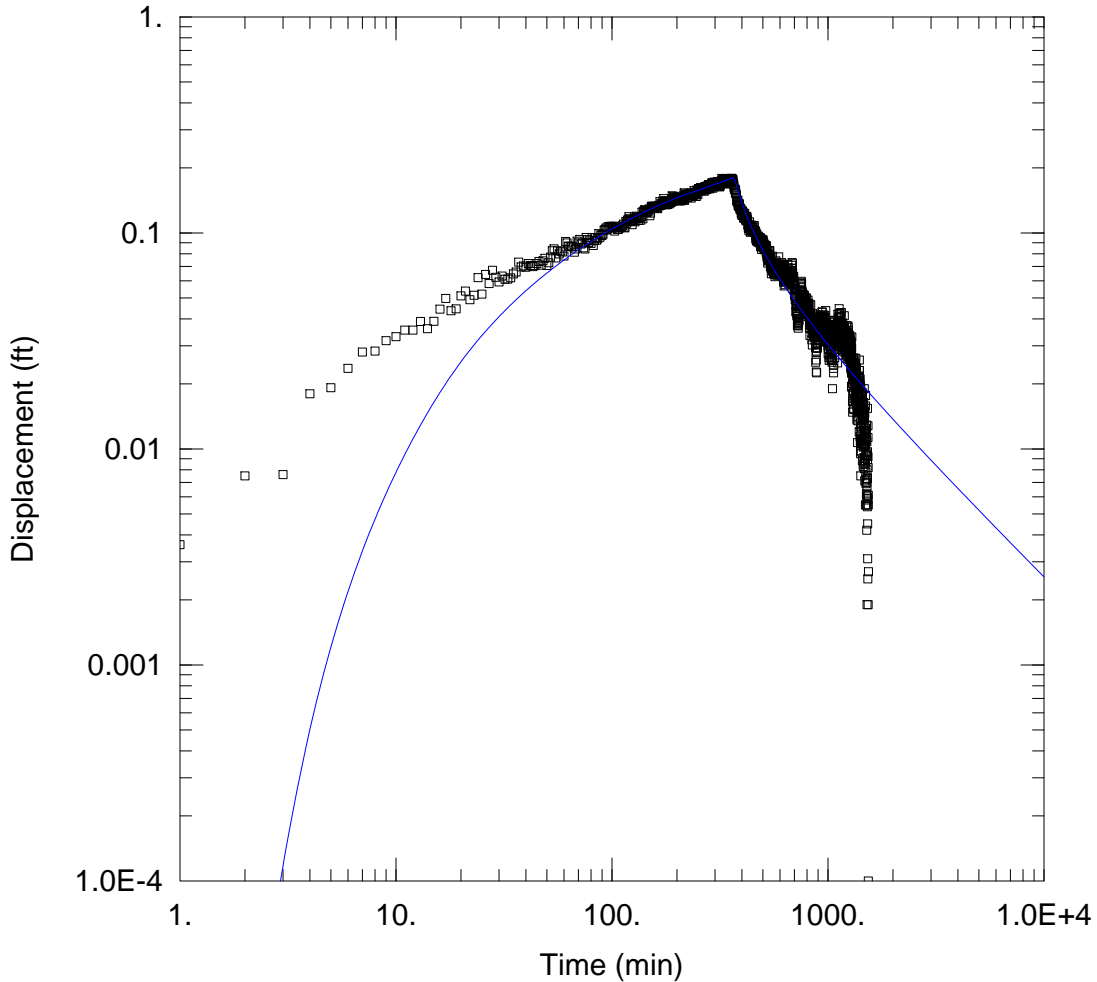
Legend

Location Type

- ⊕ Purpose-built Monitoring Well
- ⊕ Non-purpose built Pumping/Monitoring Well
- ⊕ River Stage Location
- 5 Foot Contours



Appendix C



Well 56140 EASTSIDE AQUIFER CHARACTERIZATION

Data Set: C:\...\Q_ DD_GW_161.aqt

Date: 05/04/16

Time: 20:43:22

PROJECT INFORMATION

Company: NLW
 Client: WWBWC
 Project: 1601
 Location: M-F, OR
 Test Well: **Well 56140**
 Test Date: 3/14/16

WELL DATA

Pumping Wells

Observation Wells

Well Name	X (ft)	Y (ft)
Well 56140	0	0

Well Name	X (ft)	Y (ft)
□ GW_161	250	0

SOLUTION

Aquifer Model: Confined

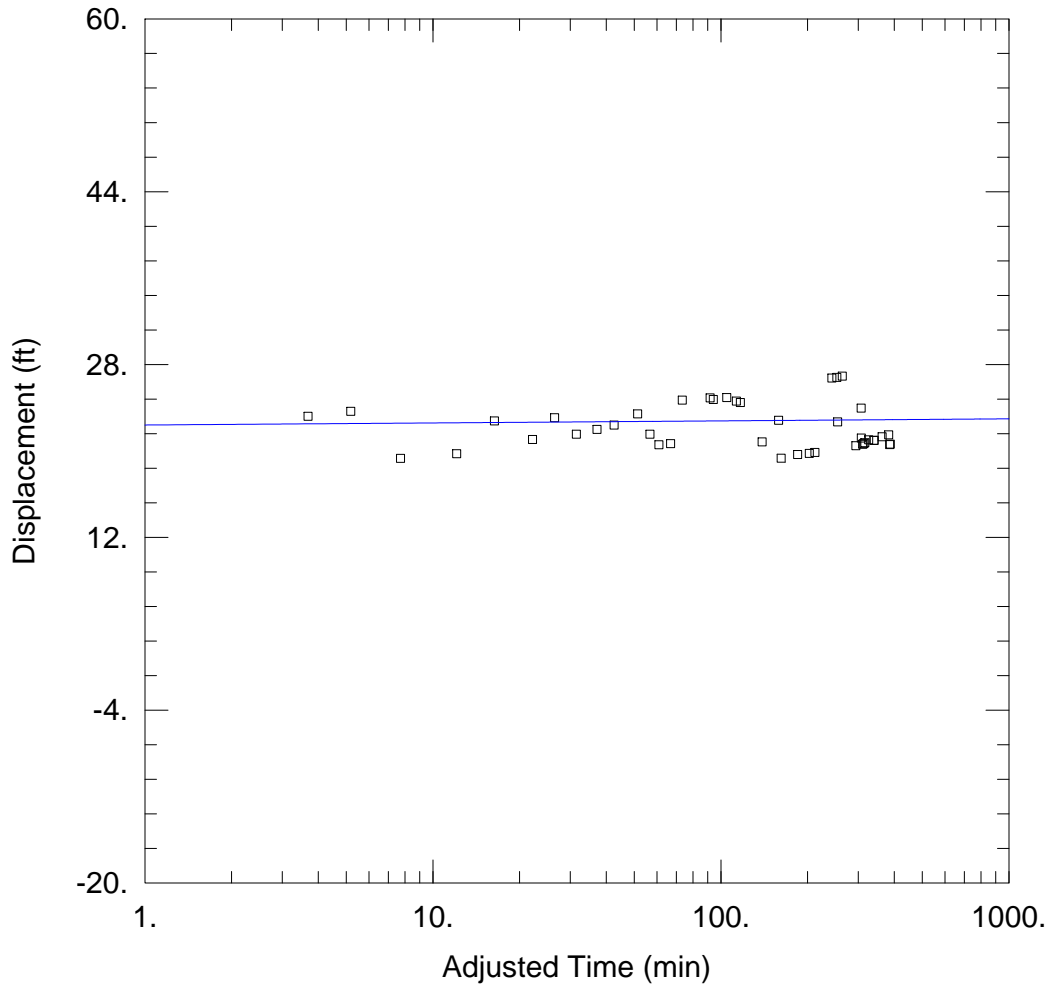
Solution Method: Theis

T = 1.525E+5 gal/day/ft

S = 0.01401

Kz/Kr = 1.

b = 35. ft



WELL TEST ANALYSIS

Data Set: C:\...\Q_ _new_DD_ Well 56140 .aqt
 Date: 06/24/16 Time: 18:43:36

PROJECT INFORMATION

Company: NLW
 Client: WWBWC
 Project: 1601
 Location: M-F, OR
 Test Well: Well 56140
 Test Date: 3/14/16

AQUIFER DATA

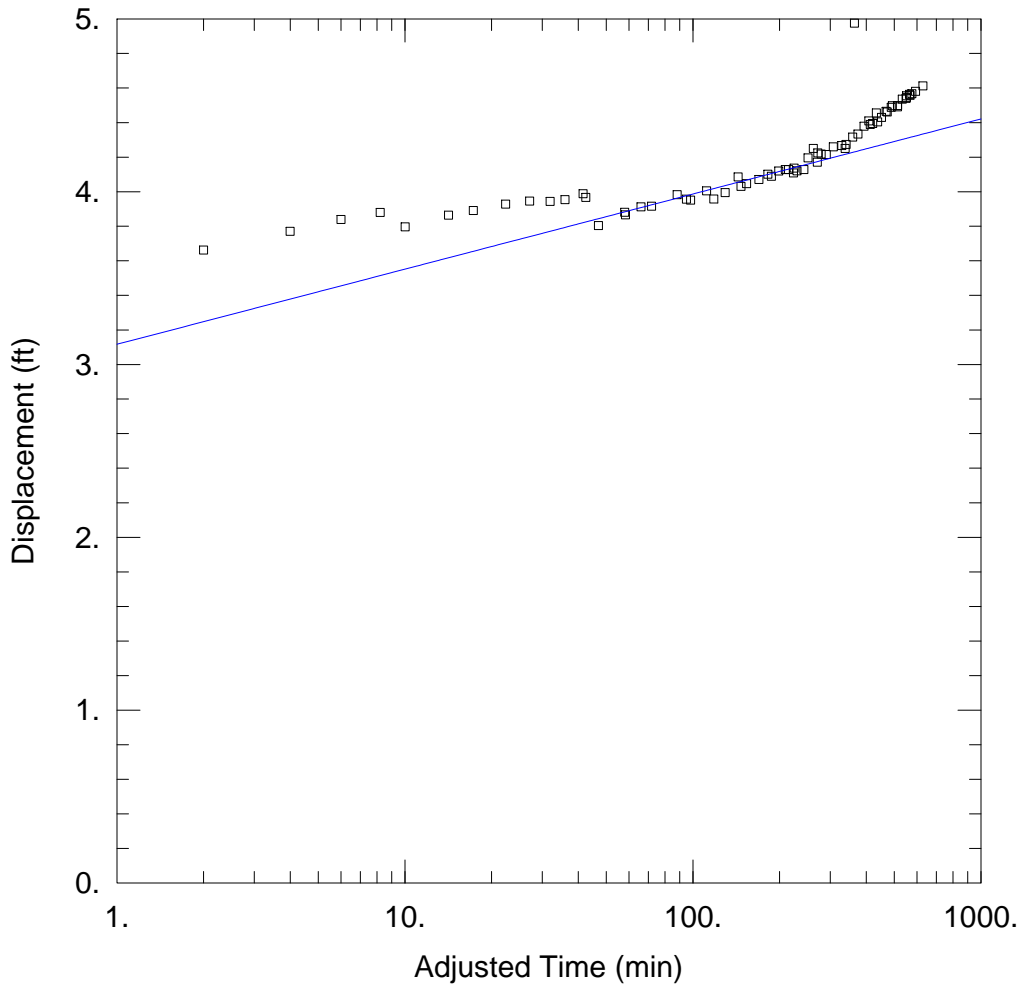
Saturated Thickness: 1. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
Well 56140	0	0	Well 56140	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob
 T = 1.245E+5 gal/day/ft S = 1.207E-116



EASTSIDE AQUIFER CHARACTERIZATION

Data Set: C:\...\Q_ **Well 5239** _DD_ **Well 5239** .aqt
 Date: 05/04/16 Time: 20:46:12

PROJECT INFORMATION

Company: NLW
 Client: WWBWC
 Project: 1601
 Location: M-F, OR
 Test Well: **Well 5239**
 Test Date: 5/3/16

AQUIFER DATA

Saturated Thickness: 1. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
Well 5239	0	0	□ Well 5239	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob
 T = 1.251E+5 gal/day/ft S = 1.761E-6

Appendix I: Mullan J., 1858

MAP OF
MILITARY RECONNAISSANCE

FROM
FORT DALLES, OREGON, VIA FORT WALLAH WALLAH,

TO
FORT TAYLOR, WASHINGTON TERRITORY,

made under direction of CAPT. A. HUMPHREYS, U.S. Top^g Eng^r,

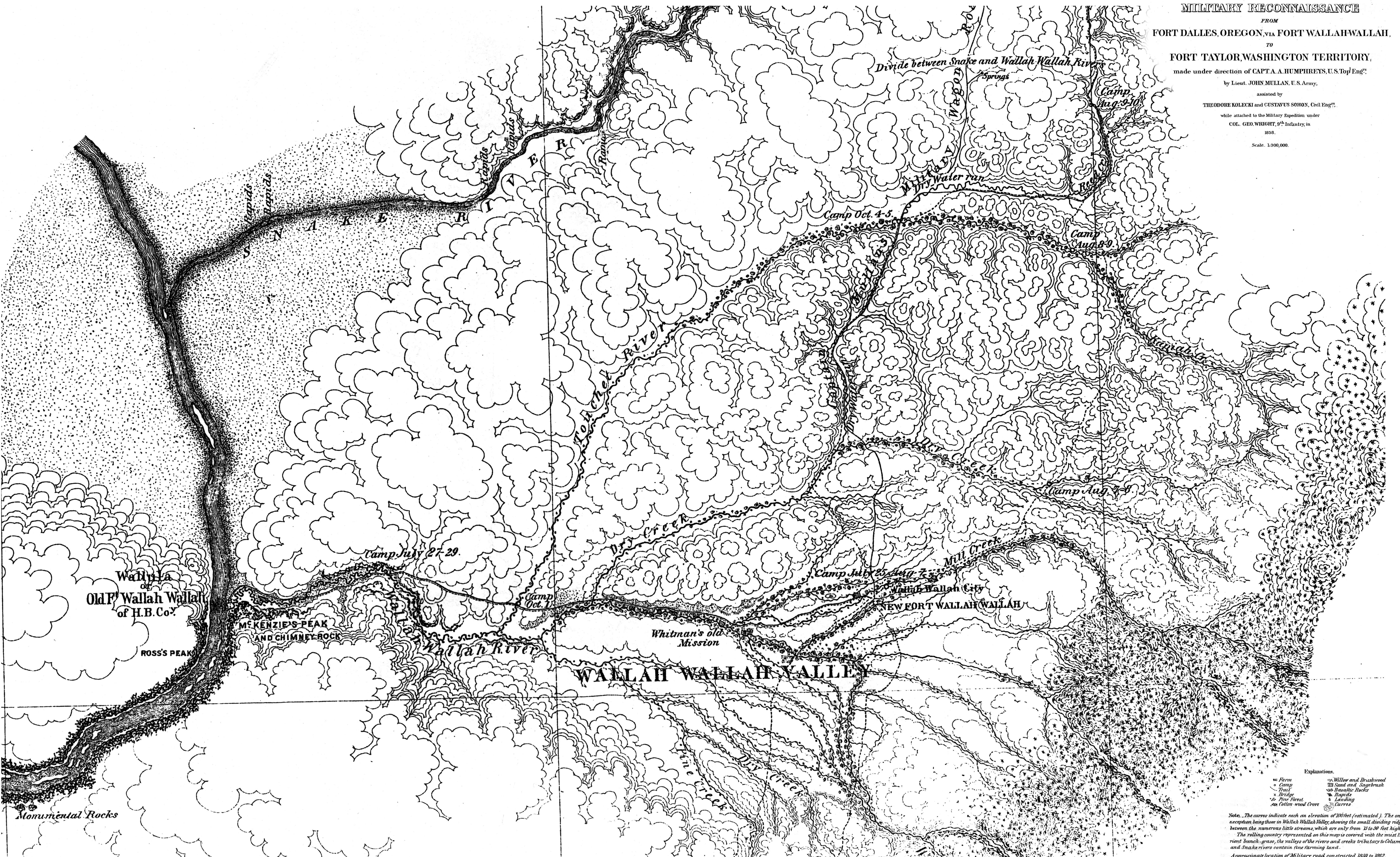
by Lieut. JOHN MULLAN, U.S. Army,

assisted by
THEODORE KOLECKI and CUSTANUS SOHON, Civil Eng^r;

while attached to the Military Expedition under

COL. GEO. WRIGHT, 9th Infantry, in
1858.

Scale: 1:300,000.



Monumental Rocks

- Explanations.
- o Firm
 - o Camp
 - o Trail
 - x Bridge
 - o Pine Forest
 - o Landing
 - o Carves
 - o Willow and Drakewood
 - o Sand and Sagebrush
 - o Basaltic Rocks
 - o Granite
 - o Landing
 - o Carves

Note. The curves indicate each an elevation of 100 feet (estimated). The only exception being those in Wallah Wallah Valley, showing the small dividing ridges between the numerous little streams, which are only from 15 to 30 feet high.

The rolling country represented on this map is covered with the mixed tuze-riant bunch-grass; the valleys of the rivers and creeks tributary to Columbia and Snake rivers contain fine farming land.

Approximate location of Military road constructed 1859 to 1862.