WDOE Monitoring Well Installation Results

April 18, 2013

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RHS

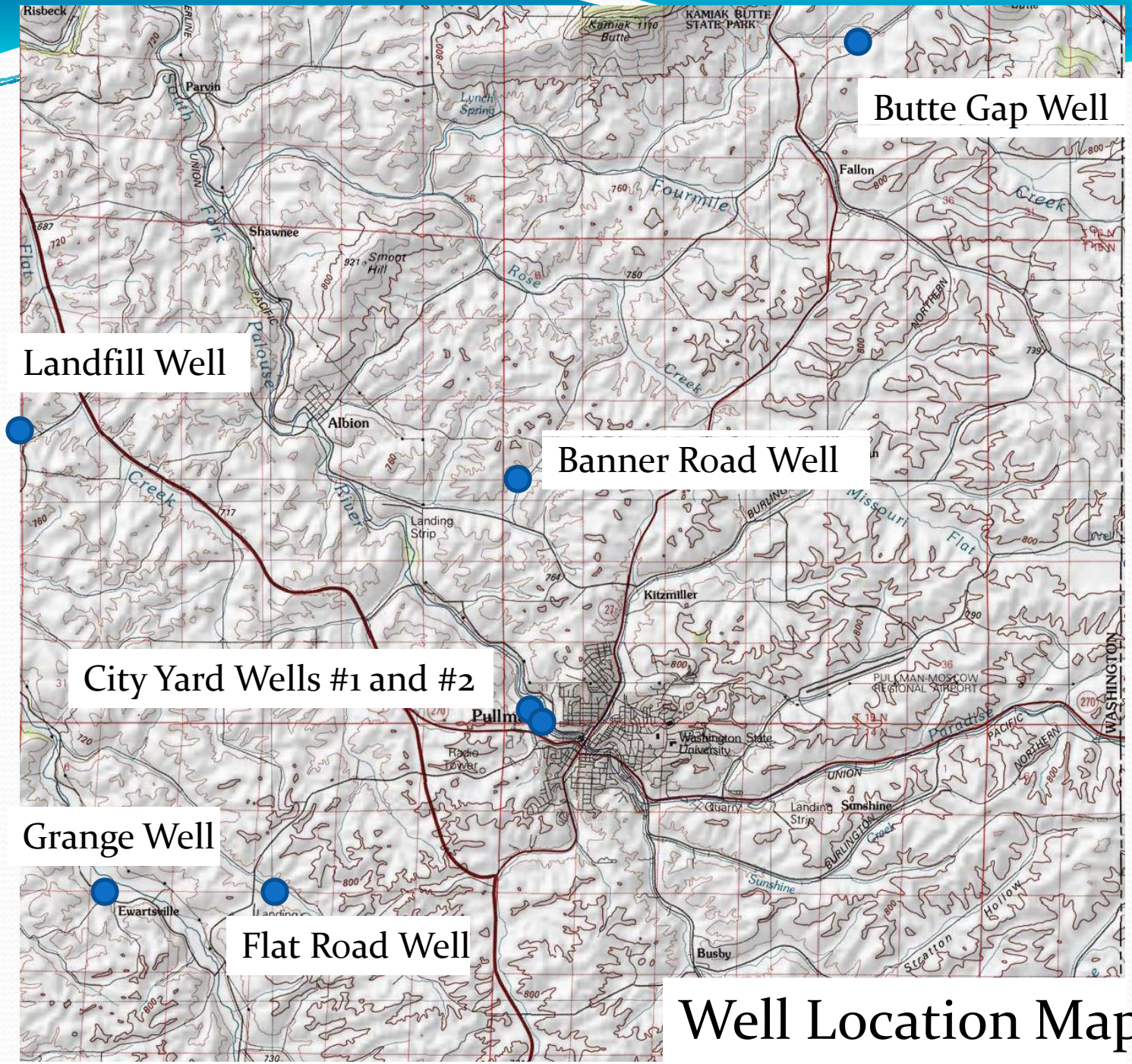
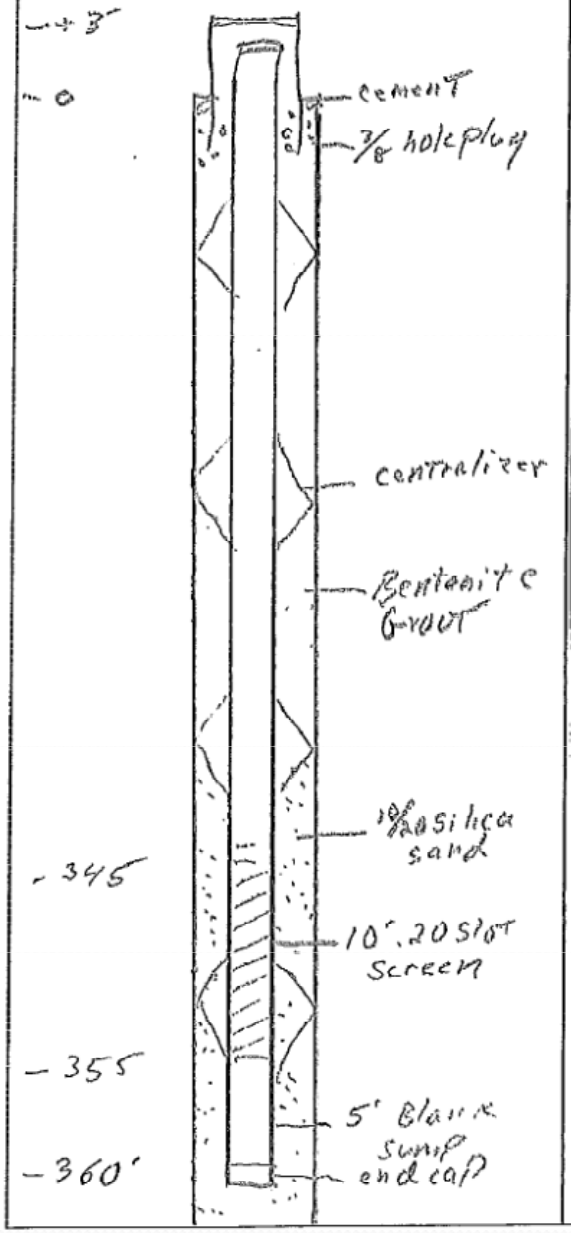

Butte Gap Well
Landfill Well
Banner Road Well
City Yard Wells #1 and #2
Grange Well
Flat Road Well
Well Location Map
Risbeck
Parvin
Shawnee
Albion
Fallon
Kitzmiller
Pullman
Ewartsville
Busby
Sunshine
Landing Strip
Radio Tower
Quarry
Washington State University
PULLMAN-MOSCOW REGIONAL AIRPORT
KAMIAK BUTTE STATE PARK
Kamiak Butte
Lynch Spring
Smoot Hill
Fourmile Creek
Rose Creek
Missouri Flat Creek
Paradise Creek
Sunshine Hollow
Stratton
South Fork Palouse River
Flat Creek
UNION PACIFIC
BURLINGTON NORTHERN
WASHINGTON

Photo of drilling operation at the Grange Site

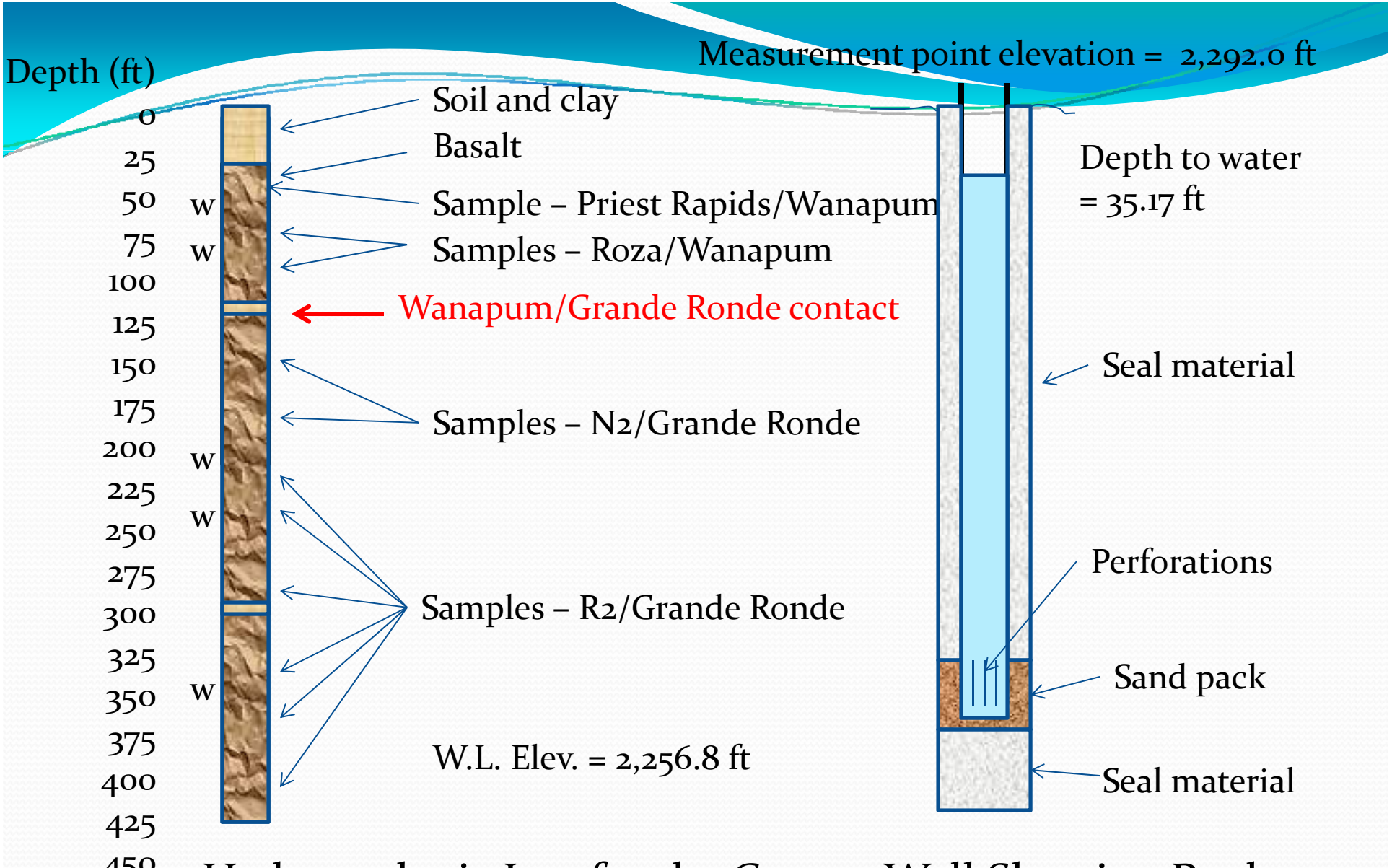
Photo of Grange Site After Well Completion

Construction Design	Well Data	Formation Description
	6" Well Casing +3 to 3' 2" PVC sch. 80 +3 to 360' 10' .20 slot PVC Screen -345 to -355' Centralizers every 40' Cement 0 to 3' Bentonite Grout -5 to 340' 10/20 Silica Sand -350 to 365' Pea Gravel -365 to 370' 3/8 Holeplug -370 to 421'	0 - 3 Top Soil 3 -33 Tan Clay 33-55 Black Med. Basalt 55-60 Fractured Basalt w/10gpm 60-77 Black Basalt 77-79 Fractured Basalt w/20 gpm 79-210 Black Basalt 210-213 Fractured Basalt w/50+gpm 213-245 Black Basalt 245-250 Broken Red Basalt w/100 +gpm 250-345 Black Basalt 345-356 Red Broken Basalt 356-421 Black Basalt

Data for the Grange Well from the H2O Well Services

- 0-5 feet: Topsoil; mostly silt and clay; dark brown to black.
- 5-40 feet: Loess; brown to dark brown silt and clay; some basalt gravel in bottom 10-15 feet (25 to 40-foot depth); increasing moisture with depth; there may have been a sampling error as the 8-inch diameter temporary surface casing hit refusal/rock at 33 feet; samples show silt to 40 feet.
- 40-55 feet: Basalt; light gray to gray; fine grained; sparse small vesicles; coarse chips (up to 3/4 to 1 inch).
- 50-90 feet: Basalt; gray to dark gray; fine/medium grained; some visible olivine and plagioclase phenocrysts (1-2 millimeters(mm)); vesicles in upper 5-10 feet; smaller chips than previous interval (up to 0.5 inch); water at 55 feet.
- 90-120 feet: Basalt; dark gray to black; abundant vesicles in top ~20 feet; olivine (1-3 mm) and plagioclase (up to 4 mm) phenocrysts; some gray/green and blue/green alteration and weathering in chips.
- 120-125 feet: Clay; interbed; dark gray and red; dull with some small pieces of basalt.
- 125-210 feet: Basalt; light gray to dark gray; mostly fine grained; vesicles in upper 20 feet; some chips show secondary weathering and clay mineralization; mostly massive.

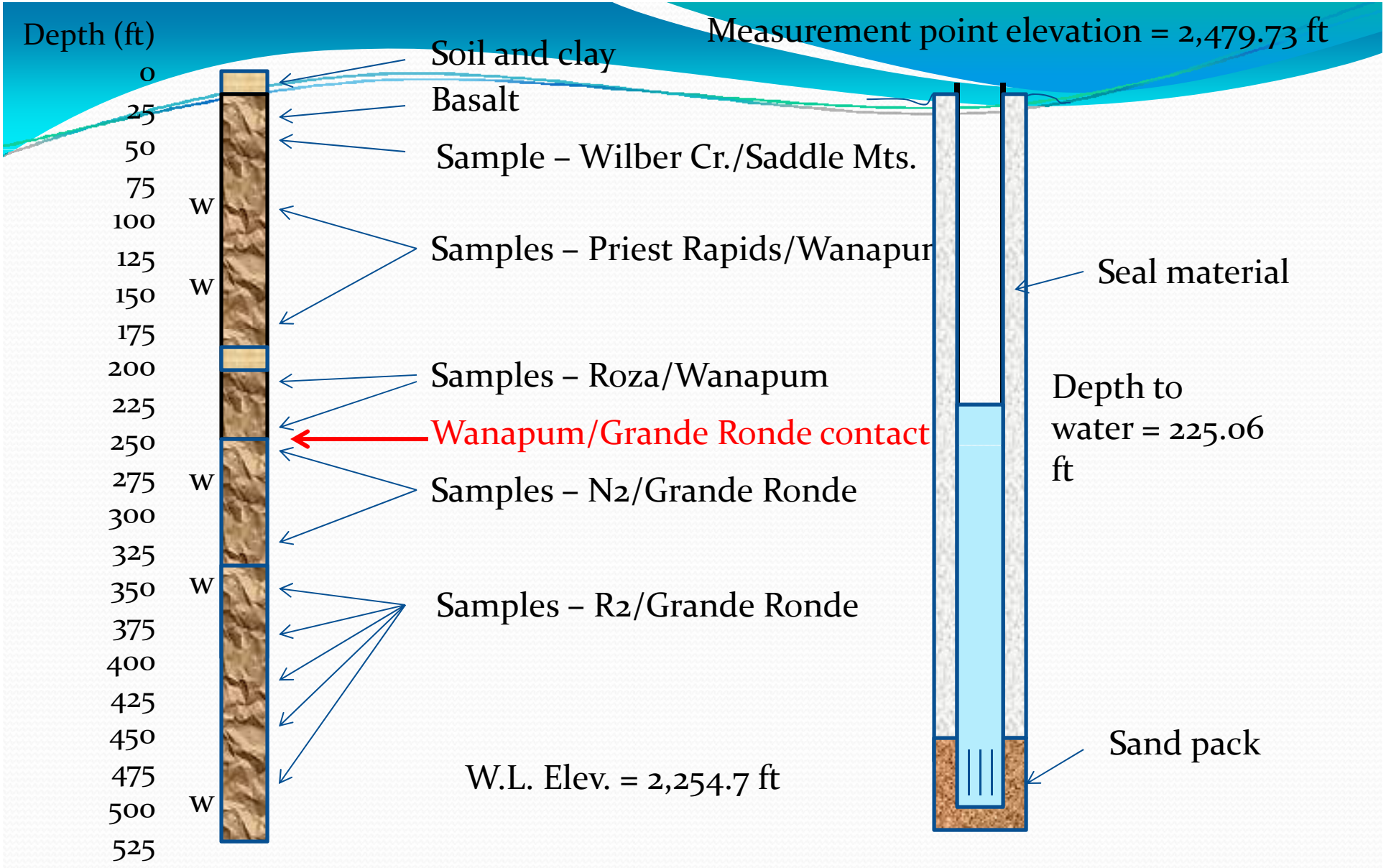
Partial Geologist's Log of the Grange Well



Hydrogeologic Log for the Grange Well Showing Rock Sample Depths and Well Construction Details (w = water producing zone)

Photo of drilling operation at the Flat Road Site

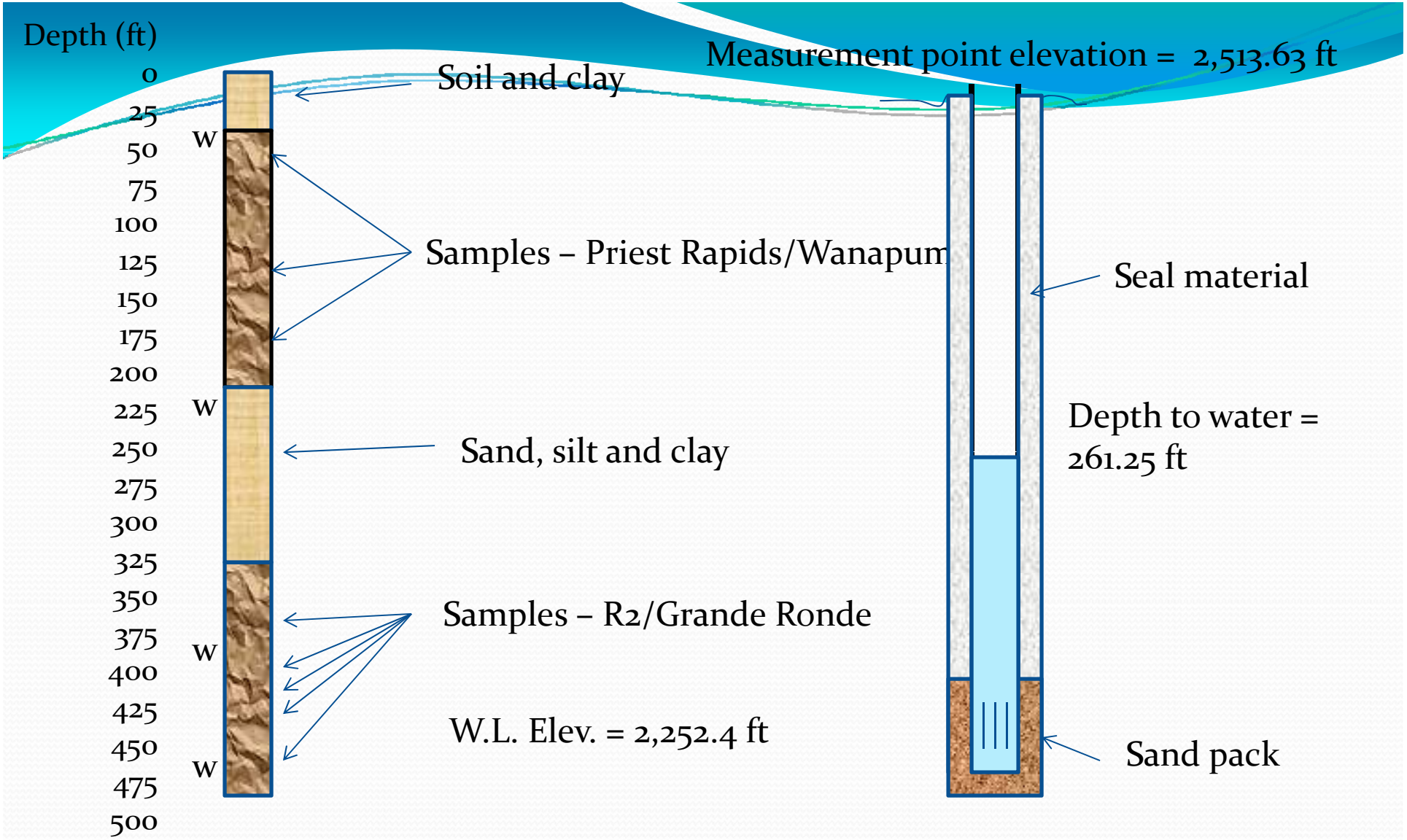
Photo of Flat Road Site After Well Completion



Hydrogeologic Log for the Flat Road Well Showing Rock Sample Depths and Well Construction Details

Photo of drilling operation at the Butte Gap Site

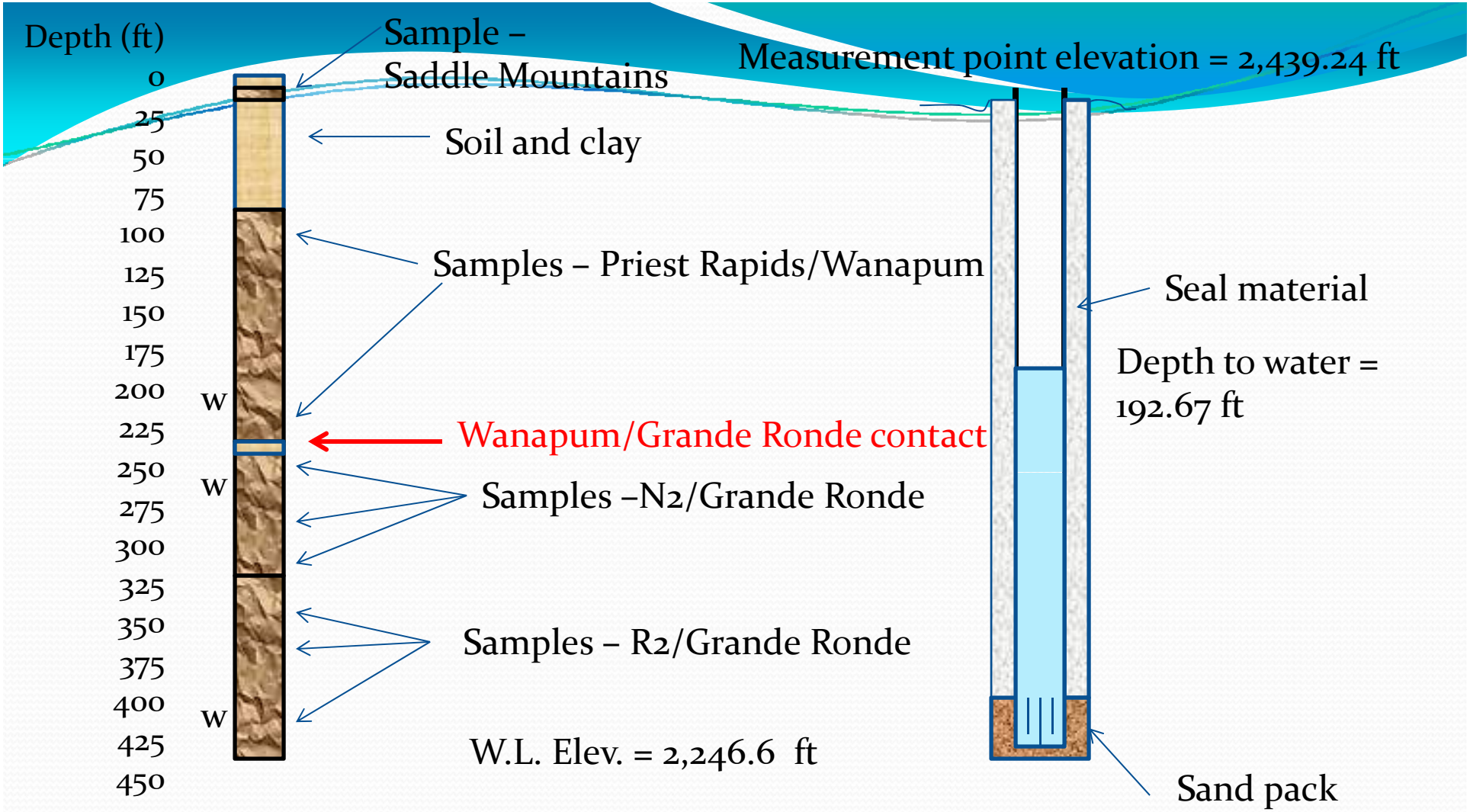
Photo of Butte Gap Site After Well Completion



Hydrogeologic Log for the Butte Gap Well Showing Rock Sample Depths and Well Construction Details

Photo of drilling operation at the Banner Road Site

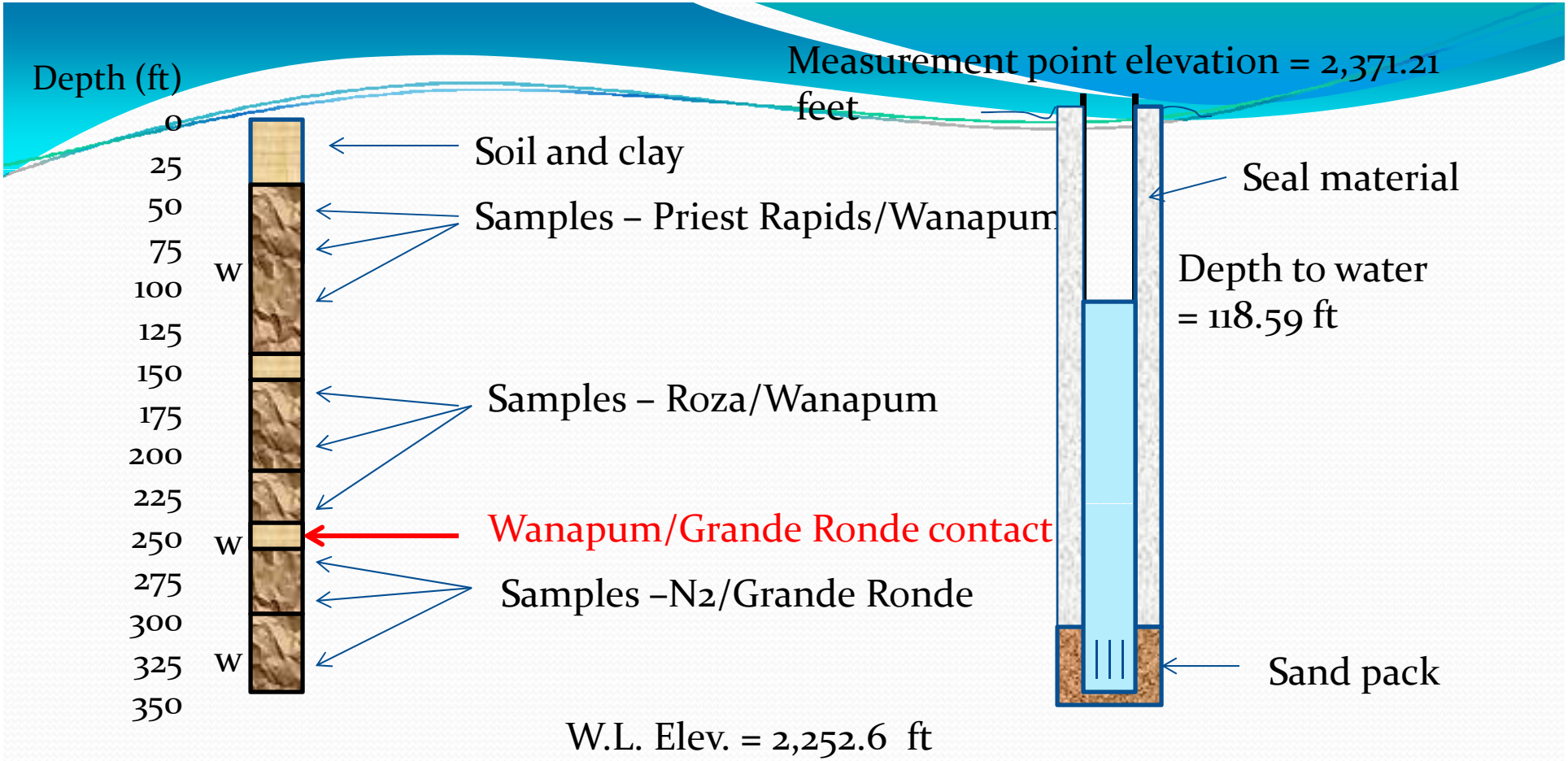
Photo of Banner Road Site After Well Completion



Hydrogeologic Log for the Banner Road Well Showing Rock Sample Depths and Well Construction Details

Photo of drilling operation at the Landfill Site

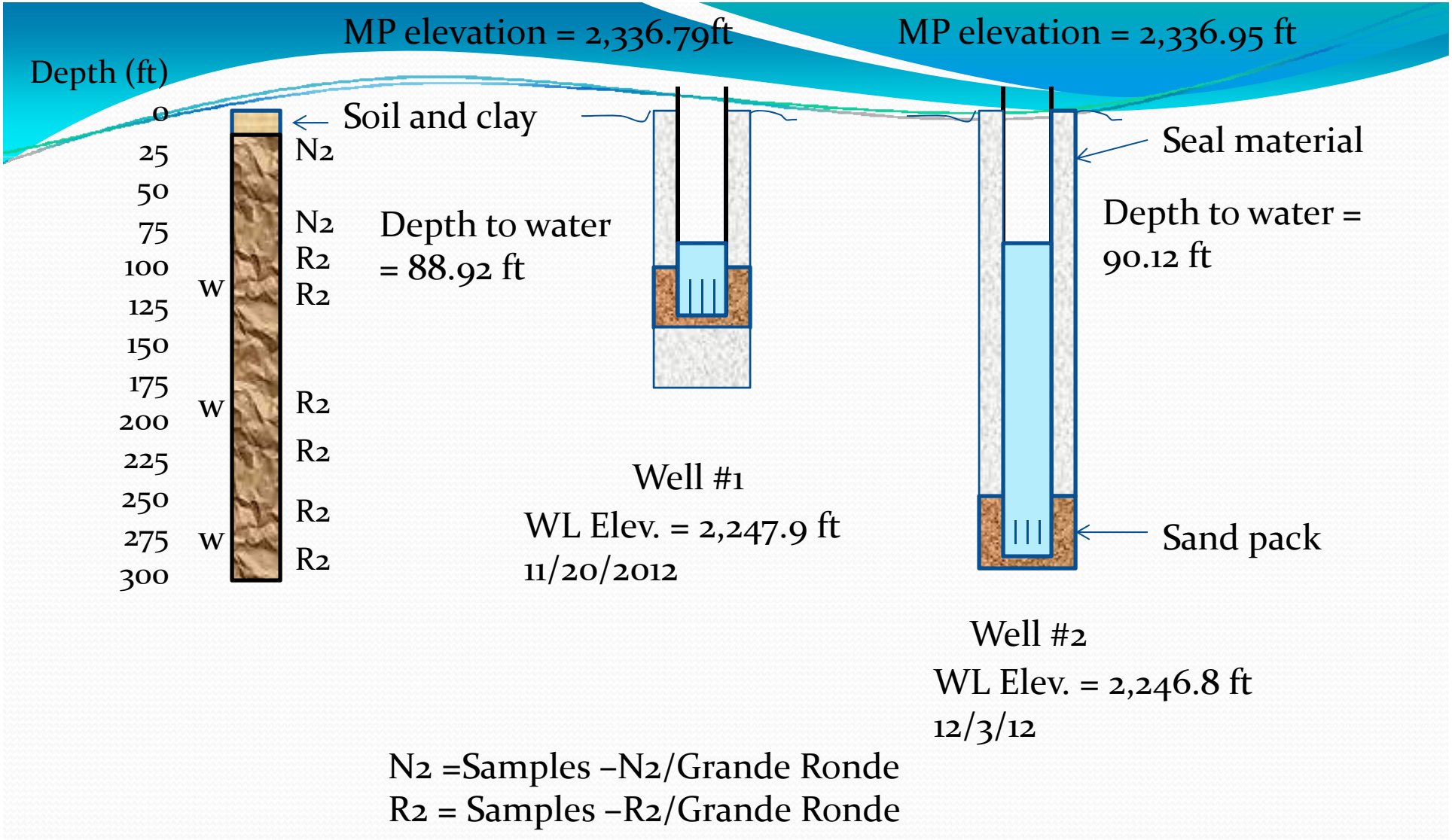
Photo of Landfill Site After Well Completion



Hydrogeologic Log for the Landfill Well Showing Rock Sample Depths and Well Construction Details (w = water producing zones)

Photo of drilling operation for City Yard well #2

Photo of City Yard Site After Completion of Both Wells

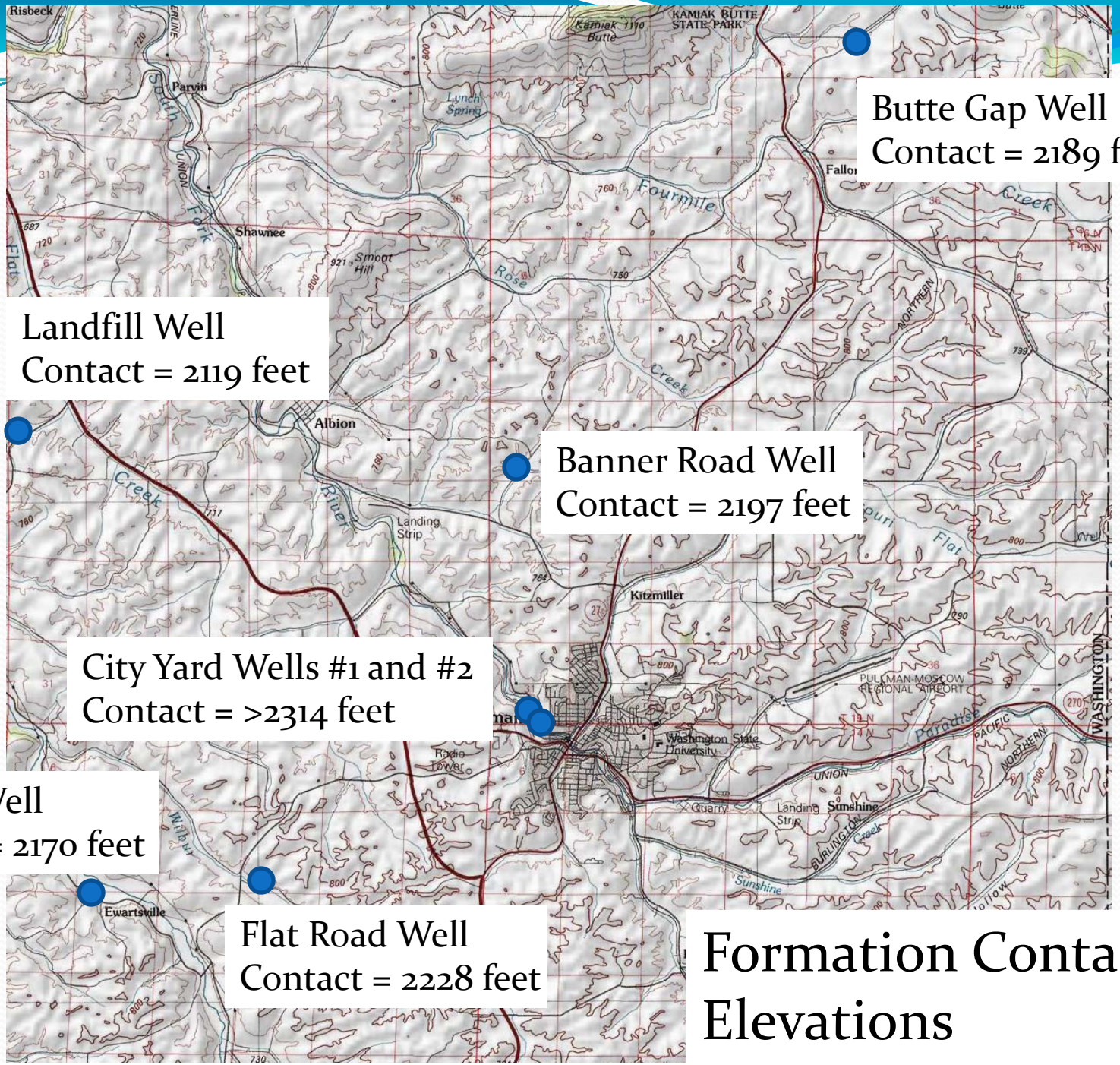


Hydrogeologic Logs for the City Yard Wells #1 and #2 showing Rock Sample Depths for Well #2 and Well Construction Details

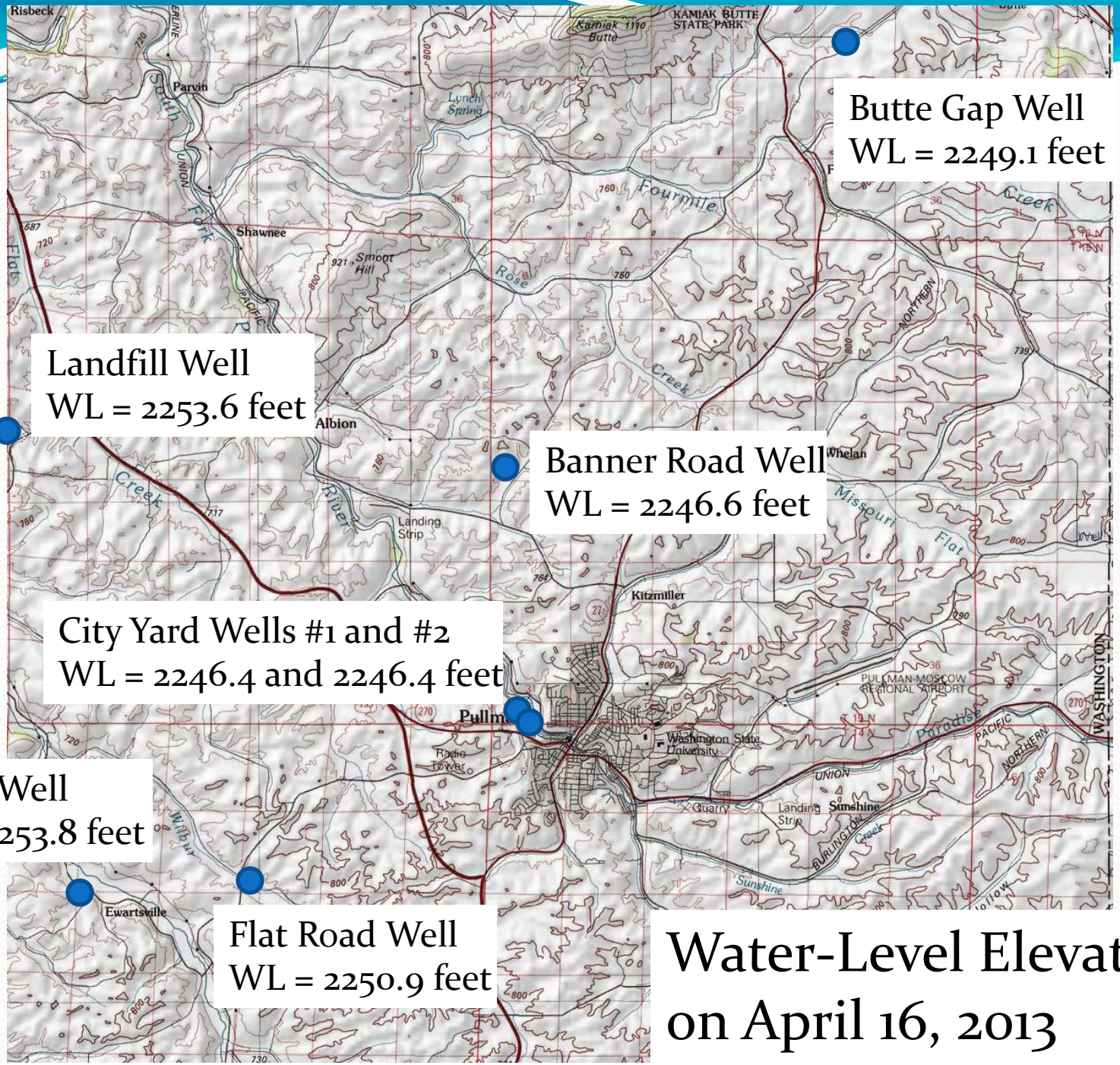
Well Name	Casing Elevation	DTW	W.L. Elev	Meas. Date	DTW	W.L. Elev	Meas. Date
	(ft)	(ft)	(ft)		(ft)	(ft)	
Grange	2291.96	35.2	2256.8	9/27/2012	38.18	2253.8	4/16/2013
Flat Road	2479.73	225.1	2254.7	9/27/2012	228.81	2250.9	4/16/2013
Butte Gap	2513.63	261.3	2252.4	10/8/2012	264.53	2249.1	4/16/2013
Banner Road	2439.24	192.7	2246.6	10/26/2012	192.62	2246.6	4/16/2013
Landfill	2371.21	118.6	2252.6	11/20/2012	117.64	2253.6	4/16/2013
City Yard #1	2336.79	88.9	2247.9	11/20/2012	90.42	2246.4	4/16/2013
City Yard #2	2336.95	90.1	2246.8	12/3/2012	90.58	2246.4	4/16/2013

Well Name	Land Elevation	Screen Depth	Screen Elev.
	(ft)	(ft)	(ft)
Grange	2290	350	1940
Flat Road	2478	495	1983
Butte Gap	2512	472	2040
Banner Road	2437	418	2019
Landfill	2369	323	2046
City Yard #1	2332	115	2217
City Yard #2	2332	285	2047

Well Name	W/GR Contact Depth	Elev. Contact	WL-Contact	Contact-Screen
	(ft)	(ft)	(ft)	(ft)
Grange	120	2170	87	230
Flat Road	250	2228	27	245
Butte Gap	323	2189	64	149
Banner Road	240	2197	49	178
Landfill	250	2119	133	73
City Yard #1	>18	>2314	-66	>162
City Yard #2	>18	>2314	-66	>282



Formation Contact Elevations



Water-Level Elevations on April 16, 2013

Conclusions and Recommendations

- Seven wells have been constructed that allow monitoring of ground-water levels within the lower aquifer hosted by the Grande Ronde Formation.
- The wells have water-level elevations in the range of 2,246 to 2254 feet as measured on April 16, 2013. The lowest water-level elevations are in the general vicinity of Pullman.
- The top of the Grande Ronde Formation is about 100 feet higher at the City Yard wells than the other wells and the Wanapum Formation is not present at this site.

Conclusions and Recommendations

- The topography on the top of the Grande Ronde Formation does not appear to impact ground-water levels.
- Information gained from the Butte Gap well supports the hypothesis that the lower aquifer is laterally continuous from the Palouse area to the Pullman-Moscow area.

Conclusions and Recommendations

- The downward hydraulic gradient between the upper aquifer in the Wanapum Formation to the lower aquifer in the Grande Ronde Formation is much less at the Grange well than the other wells. The elevation of the water level in the Grange well is approximately the same as the elevation of Union Flat Creek near the well.
- Consideration should be given to the construction of one or more new wells based on analysis of about 6 months to 1 year of temporal water-level data from the network of wells.