HYDROGEOLOGIC ASSESMENT

Knight-Dillacort Area of High Prairie, WRIA 30

Prepared for: Klickitat County Department of Natural Resources

Project No. 090045-017B-01 • July 27, 2015

Aspect CONSULTING

earth + water

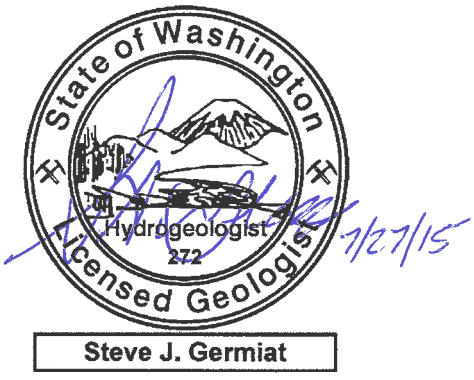
HYDROGEOLOGIC ASSESMENT

Knight-Dillacort Area of High Prairie, WRIA 30

Prepared for: Klickitat County Department of Natural Resources

Project No. 090045-017B-01 • July 27, 2015

Aspect Consulting, LLC



Steve J. Germiat

Steve Germiat, LHG, CGWP
Principal Hydrogeologist
sgermiat@aspectconsulting.com

W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Hydrogeologic Assesment Report - Knight Dillacort.docx

Contents

List of Tables

List of Figures

List of Appendices

1 Introduction and Background

Water level monitoring initiated in the High Prairie area of the Klickitat River Watershed, Water Resource Inventory Area (WRIA) 30 (Figure 1), has documented trends of declining groundwater levels in three wells within the monitoring network. This information was initially documented in the 2011 report entitled Hydrologic Information Report Supporting Water Availability Assessment, High Prairie Study Area (Aspect, 2011), which was presented to a meeting of the High Prairie community in August 2011. Following two additional years of water level monitoring in the High Prairie well network, the water level declines in the previously identified wells were documented to persist, although one showed signs of stabilizing (Aspect, 2013). The observed water declines are limited to wells located within the portion of High Prairie between Knight Canyon and Dillacort Canyon ("Knight-Dillacort area"; Figure 1).

Residents of High Prairie have contacted Klickitat County periodically over the past few years to express concerns regarding wells and declining water levels in the area. In July of 2014, the High Prairie Community Council wrote a letter to the Klickitat County (County) Board of Commissioners expressing concerns regarding declining water levels and wells being deepened within an area near the intersection of Centerville Highway and Mount Adams View Road (High Prairie Community Council, 2014). Some of the wells identified in the letter were being monitored as part of the High Prairie well monitoring network, and some were not.

In response, the County engaged Aspect Consulting LLC (Aspect) to compile the available information regarding local hydrogeology, the well monitoring program, and the water level declines that had been measured. In December 2014, Aspect and the County participated in a meeting of High Prairie residents to present the technical information, answer questions, and discuss a path forward.

As an outcome of the December 2014 meeting, the County authorized Aspect to conduct a supplemental hydrogeologic assessment of the Knight-Dillacort area focused on identifying potential cause(s) of the observed declines, evaluating available information on the deeper aquifer system as a viable source for water supply, and, depending on identified cause(s) of the declines, assisting the County with identifying actions that can be taken to address the issue. This report presents the results of the hydrogeologic assessment for the Knight-Dillacort area.

Subsequent sections of this report are organized as follows:

- Section 2: Hydrogeologic Setting;
- Section 3: Groundwater Level Trends Over Time;
- Section 4: Assessment of Causes for Water Level Declines;
- Section 5: Assessment of Deeper Aquifer Zones in Study Area;
- Section 6: Conclusions and Recommendations; and

- Section 7: References.

2 Hydrogeologic Setting

A detailed discussion of the hydrogeologic setting for the High Prairie study area is provided in Aspect (2011). This section provides an overview of the hydrogeologic information most pertinent to the groundwater conditions of the Knight-Dillacort area.

Figures 2 and 3 are subsurface cross sections oriented east-west and north-south, respectively, across the Knight-Dillacort study area and the surrounding area of High Prairie. Figure 1 depicts the locations of the cross sections[1]. The location of the Knight-Dillacort area is shown on each cross section for reference. The cross sections were developed using well logs from Ecology's well log database, Washington Department of Natural Resources (DNR) regional 1:100,000 geologic mapping, and available information from other studies. The cross sections integrate the following data from each well log: location of well to the nearest quarter-quarter section; well depth; cased interval[2]; static water level; depth and thickness of geologic units encountered; water-bearing zones, if reported; and the surface elevation from the United States Geological Survey (USGS) digital elevation model (DEM). Each cross section depicts the inferred distribution of geologic units, reported water-bearing zones, mapped geologic structures, and wells along its alignment. For each well on the cross section, the figures also present the water level, well yield (in gallons per minute [gpm]), and, if available, specific capacity (gpm yield/feet of drawdown at that yield) that were reported at the time of drilling by the driller on the well log. The cross sections have 10-fold vertical exaggeration, meaning that depicted slopes in surface topography and geologic layering are 10 times greater than reality.

2.1 Aquifer Units

Water wells in the study area generally completed within the bedrock units of the Columbia River Basalt Group (CRBG), with some wells completed in the Dalles Formation, both of which are described below. Although there are pockets of unconsolidated deposits found at the surface in the study area, these units are not expected to be a significant source of groundwater due to their limited continuity and thickness. The primary water-bearing geologic units (aquifer units) in the study area are described below.

[1] These cross sections B-B' and C-C', while modified for this report, were initially presented in Aspect (2011). Cross section A-A' from that 2011 report is located outside the focus area of this report, so is not included. However, we retain the B-B' and C-C' designations in this report to avoid confusion if referencing back to the 2011 report.

[2] The well's cased portion is not open to adjacent formation and the uncased portion is open to the formation.

2.1.1 Columbia River Basalts (Wanapum and Grande Ronde)

The CRBG units are regionally continuous and in the study area have a collective thickness of several thousand feet. The Wanapum basalt formation is consistently present beneath the study area, except where removed by erosion within incised drainages (Klickitat River, Dillacort Canyon, Wheeler Canyon, and Swale Creek), and to the south of the Columbia Hills thrust fault, where it was uplifted and eroded. Where present, the Wanapum basalt is relatively thick, with thicknesses ranging between 500 and 900 feet based on the cross sections (Figures 2 and 3).

The Wanapum formation consists of three separate members (from youngest to oldest [shallowest to deepest]) - the Priest Rapids Roza, and Frenchman Springs - each of which is present within the study area (see Figures 2 and 3). Each member is described briefly below.

- **The Priest Rapids member (Mv[wpr])** is generally exposed at the surface across the majority of the study area. However, as depicted on the cross sections it is commonly absent (eroded away) within deeper drainages and is absent south of the Columbia Hills thrust fault. Where present, the Priest Rapids member is typically 100 to 300 feet thick. Few wells are completed solely in this shallowest basalt unit.
- **The Roza member (Mv[wr])** is commonly exposed at the surface along the flanks of the major drainages. The Roza member is absent to the south of the southern thrust fault. Where present north of the Columbia Hills thrust fault, the Roza member can be as much as 150 feet thick. Some wells appear to be producing principally from this unit.
- **The Frenchman Springs member (Mv[wfs])** is also generally exposed at the surface in the major drainages and their respective tributaries. The Frenchman Springs member is also absent immediately south of the Columbia Hills thrust fault. Where present, the Frenchman Springs member generally ranges between 450 and 600 feet in thickness across the study area. Numerous wells in the study area are drilled into the Frenchman Springs, with water bearing zones reported at depths of roughly 600 feet below ground, as depicted on Figure 2.

The Grande Ronde formation underlies the Wanapum basalt. The Grande Ronde basalt is present beneath the entire study area, but is generally exposed at the surface only at the base of deeply incised drainages and where it has been uplifted immediately south of the Columbia Hills thrust fault as illustrated in cross section on Figure 3. As the cross sections indicate, there are numerous wells open to and withdrawing groundwater from both the Wanapum and Grande Ronde basalts, but very few wells are completed solely in the Grande Ronde, except where it is exposed in the vicinity of the Klickitat River or other deep drainages, or to the south of the Columbia Hills thrust fault. In the latter area, wells T03/R13-27 and T03/R13-27Q1 are completed solely in the Grande Ronde basalt and are included in the water level monitoring network. These wells have reported static water levels ranging between 100 and 265 feet bgs and driller-reported yields of about 15 gpm.

2.1.2 Groundwater Occurrence in Basalt Aquifer Systems

Throughout the Columbia Basin, groundwater in the CRBG occurs primarily within the tops of the individual flows (flow tops) that became vesicular (porous) as gas bubbles escaped the flows during cooling, and/or within the fractured flow bottoms (sometimes referred to as pillows). Flow tops and bottoms – collectively referred to as interflow zones – are usually porous and permeable, and therefore transmit water more readily than the intervening massive portions of the basalt flow interior, which generally constitute flow barriers, except where fractured. In addition, terrestrial sediments can be deposited between the underlying flow top and overlying flow bottom during time periods between basalt flows. These sediments are collectively considered part of the Ellensburg formation (Mc[e]) and can be either relatively permeable or impermeable; depending on composition, thickness, and lateral extent (Brown, 1979).

Based on the cross sections and the individual well logs, the water-bearing interflow zones in the study area have thicknesses ranging between 10 and 80 feet. However, both the lateral continuity and thickness of the water-bearing interflow zones are highly variable. This leads to variability in depths and productivity of water wells throughout the study area.

2.1.3 Dalles Formation

Geologically younger than the CRGB, the Dalles Formation (Mc[d]) consists of thickly bedded volcaniclastic and sedimentary deposits, which can be as much as 250 feet thick in the study area. Where the Dalles Formation is present at the surface, wells appear to be drilled through it into the underlying Wanapum basalt, indicating the basalt is the principal source of water (e.g., see wells T3/R13-22C1 and T3/R13-27B1 on Figure 3).

2.2 Geologic Structures

The major geologic structures (faults and folds) in the project area, taken from DNR regional geologic mapping, are identified on Figure 1 and the cross sections (Figures 2 and 3). The geologic structures, along with topography (incised canyons) described above, have a substantial effect on the groundwater flow regime within the study area.

Regional north-south compression of the earth's crust that began during the deposition of the Grand Ronde basalt approximately 16 million years ago created the regionally extensive southwest-northeast trending Yakima Fold Belt, which includes the Columbia Hills ridge on the southern edge of the study area (Reidel et al., 1989). This compression resulted in the formation of the numerous southwest-northeast trending folds (synclines [troughs] and anticlines [ridges]) and the associated reverse and thrust faults (older rocks are slid upward over younger rocks) found in the region including the study area. The Columbia Hills thrust fault, with several hundred feet of low-angle vertical displacement, is likely associated with the formation of the Columbia Hills. The several southwest-northeast trending geologic structures across the study area are shown on Figure 1.

Superimposed upon the major southwest-northeast trending structures within the study area are numerous northwest-southeast trending normal faults (younger rocks are slid downward over older rocks) and strike-slip faults (rocks are slid laterally past each other), likely created from a rotational component of the same north-south compression that resulted in the southwest-northeast trending structures (Reidel et al., 1989).

In the subsurface, folds and faults may represent partial or complete barriers to lateral groundwater flow, laterally compartmentalizing flow within the study area. Newcomb (1969) theorized that tight anticlinal folding of basalt forms breccia (broken rock) and fine-grained fault gouge between the individual flows near the axis of an anticline, which decreases the transmissivity of the basalt and impedes groundwater flow across the anticlinal crest. In addition, due to the folding and upwarping of the individual flows in the creation of the anticlinal crest, higher heads are needed for groundwater to flow over this crest. If significant vertical displacement occurs across faults to offset the water-bearing interflow zones, the faults may act as impermeable barriers to lateral groundwater flow. Fault gouge may also decrease the permeability of the interflow zones in the vicinity of faults including strike-slip faults where horizontal displacement occurs. The Warwick Fault (strike-slip), cutting across the northeast corner of High Prairie (Figure 1), is documented to be a barrier to lateral groundwater flow in the basalt aquifer system to the east of it within Swale Valley.

2.3 Groundwater Recharge

As described above, the isolation of the High Prairie area by deep canyons and geologic structures limits lateral groundwater movement to replenish groundwater withdrawn by pumping. Therefore, the source of groundwater to the basalt aquifers is largely limited to vertical recharge within the footprint of High Prairie. Recharge of basalt aquifer systems may occur where interflow zones exposed at the surface or where covered only by thin units, and/or through open fractures/faults. Recharge water can move downward to deeper aquifer zones via fractures/faults with vertical permeability and/or where lower-permeability zones pinch out depositionally or from prior erosion or tectonic offset.

Relying on estimates from a prior USGS regional hydrologic modeling assessment (Bauer and Vaccaro, 1990), Aspect (2011) estimated an average recharge rate of 7.5 inches per year, or 22,250 acre-feet per year, across the entire High Prairie study area. The recharge occurs predominantly to the shallowest aquifer zones; however, there is a strong downward vertical gradient between aquifer zones in the High Prairie area (described below), which can allow the shallower aquifer zones to gradually recharge deeper zones.

While there has not been a detailed assessment of differences in recharge to the various aquifer zones of High Prairie, groundwater quality analyses were performed as part of this assessment to estimate the age of groundwater withdrawn from shallower versus deeper wells as an indirect means to evaluate groundwater recharge from shallower to deeper aquifer zones. The groundwater quality investigation is described below in Section 5.1.

2.4 Groundwater Flow

In general, groundwater in the basalt aquifer system is expected to flow regionally away from anticlinal axes, in the direction of regional geologic dip of the basalt flows, and towards major surface water bodies (Steinkampf, 1989). During the formation of an anticline, the compression of the various basalt flows leads to both the folding and uplift of the respective flows. Erosion of the upper flows exposes the lower flows at the surface, thus allowing for the areal recharge of the respective flow. For this reason, groundwater

generally flows away from these topographically higher points of recharge and down the geologic dip.

Aspect (2011) mapped groundwater elevations and thus inferred lateral groundwater flow directions for the collective Wanapum basalt aquifer system beneath High Prairie. While there is variability in the measured groundwater elevations across the entire area, the mapping indicates the highest groundwater elevations generally occur in the area near Laurel Fault (Figure 1) and along the southern portion of Schilling Road east of it (topographically higher area which is also a surface water divide). The groundwater elevation data indicate that groundwater in the Wanapum basalt west of Laurel Fault flows to the southwest towards the Klickitat River. East of Laurel Fault, there appears to be a groundwater divide along the western extension of the Horseshoe Bend anticline: north of the anticline groundwater flows to the north-northwest towards Wheeler Canyon and south of the anticline, it flows to the south-southeast towards Swale Creek canyon. While a regional groundwater flow regime was defined from the groundwater elevation mapping, the numerous geologic structures across the area can impede flow and create highly complex flow regime on the local scale.

The water level data from wells completed in vertically distinct aquifer zones indicate a consistent downward vertical gradient across High Prairie – i.e., the groundwater levels of the wells completed in the upper zones are higher than the groundwater levels of the wells completed in the lower zones. Based on the cross sections (Figures 2 and 3), groundwater levels (heads) are in the range of 200 to 400 feet lower in the deeper Grande Ronde basalt than in the shallower Wanapum basalt. The layered nature of the basalts, with thin permeable interflow zones (aquifer zones) separated vertically by thick layers of low permeability massive basalt (aquitards restricting flow), allows the large head differences between shallower and deeper zones to persist. If the aquitard layers were not present, the heads in shallower and deeper aquifer zones would equilibrate and vertical gradients would not exist.

3 Groundwater Level Trends Over Time

In 2007, the High Prairie well network was established with 14 wells for water level measurements. In 2010, the network was expanded to 23 wells. Water level measurements have typically been collected twice per year, in the spring and fall. In spring 2015, seven additional wells, including several wells in the deeper aquifer, were added to the network. Table 1 provides information for the current well network; all of the wells monitored to date are included, although some wells are no longer participating. The 23 wells monitored since 2010 were professionally surveyed by County staff (location and wellhead elevation); the wells added in spring 2015 are not yet surveyed. Table 2 provides the water level data collected from the network wells from 2007 through spring 2015. To date, 17 rounds of water level measurements have been collected from the High Prairie well network.

Based on the well network measurements over the past 5 to 8 years, water levels are generally stable in 20 of 23 wells covering the majority of High Prairie. This is illustrated

visually by the groundwater hydrographs (groundwater elevations versus time) representing the long-term water level measurements (Figure 4).

As noted on Figure 4 and in prior reports, three wells with documented water level declines include wells T03/R13-20N1[3], T03/R13-22C1, and T03/R13-22P1, all located in the Knight-Dillacort area. Wells -22C1 and -22P1 are located within roughly ¼ mile of each other in the eastern portion of the Knight-Dillacort area, whereas well -20N1 is located toward the western side of the area (Figure 1).

On the west end of the area, well T3/R13-20N1 (520 feet deep) showed a water level decline on the order of 40 feet from the start of its monitoring in summer 2010 until spring 2012, but since then has shown more than 15 feet of water level rise as of spring 2015 (Figure 4). Discussions with the owner of well -20N1 indicates they have been actively conserving water and managing their pumping schedule so as to accommodate a well of limited yield. The adjacent well T3/R13-20N2 (530 feet deep) showed a decline on the order of 30 feet between the first two measurements (winter 2010 and winter 2011), but since then has exhibited water level rise on the order of 70 feet, far surpassing the first (winter 2010) measured water level elevation (Figure 4).

Based on the measured data, the -20N1 and -20N2 wells do not demonstrate ongoing water level declines in the western portion of the Knight-Dillacort area.

Conversely, water level continue to decline in the eastern end of the Knight-Dillacort area as of the spring 2015 measurements. In that area, wells -22C1 and -22P1 showed stable water levels between 2007 (start of monitoring) and spring 2009. Since then, water level declines on the order of 57 and 39 feet, respectively, have been measured from spring 2009 through spring 2015 with no indication of trend reversal (Table 2). In 2014, the High Prairie Community Council (2014) reported that a cluster of wells in this same general area was experiencing severely declining water levels, and that several had deepened their wells as a result.

Figure 5 illustrates in pink the parcels where water level declines have been reported – either measured in the aforementioned network wells highlighted on the figure or by anecdotal information from the local community. Parcels where wells have been deepened since 2010, based on Ecology's well log records, are outlined in red on Figure 5.

Other wells within the Knight-Dillacort area do not show water level declines based on the available data, namely wells T03/R13-21M1, -27, -27Q1, -28B1, and -28L1 (Figure 4; Figure 5). Of these wells, well -21M1 is 520 feet deep and the others range in depth from 90 to 310 feet (Table 2). Wells -27 and -27Q1 are located south of the Columbia Hills thrust fault (Figure 1) and are likely hydraulically isolated from the basalt aquifer to the north where the declines are occurring.

[3] The local well number designations used are based on location information (quarter-quarter section) in Ecology's online well log database and may not be accurate. Locations of wells in the monitoring network have been surveyed and are accurate on the maps.

Figure 6 presents a pair of hydrographs illustrating the measured water level declines in wells -22C1 and -22P1. Based on the measurements collected twice per year, well -22C1 has experienced a decline of approximately 57 feet between 2009 and 2015, whereas well -22P1, located to the north, experienced a decline of approximately 39 feet in the same time period. As stated above, both wells showed generally stable water levels from their start of monitoring in 2007 through spring 2009. Well -22C1 initially showed a 13-foot decline between the spring and fall 2009 monitoring events, whereas well -22P1 showed a smaller initial decline (4 feet) between fall 2009 and spring 2010 measurements. Both wells show an accelerated rate of decline over time, as noted on Figure 6:

- At well -22C1, a 23-foot decline was measured in the 3-year period between 2009 and 2012 (7.9 feet/year) followed by a 33-foot decline in the 3-year period between 2012 and 2015 (11.0 feet/year).
- At well -22P1, a 13-foot decline was measured in the 5-year period between 2009 and 2014 (2.5 feet/year) followed by a 26-foot decline in the 1-year period between 2014 and 2015 (26 feet/year).

Based on the collective information available, we conclude that large ongoing water level declines are localized to the shallow aquifer in the eastern portion of the Knight-Dillacort area as documented by wells -22C1 and -22P1 located within approximately ¼ mile of each other; therefore, that area has been the focus of this assessment. The following section evaluates potential causes of the observed declines in the eastern portion of the Knight-Dillacort area.

4 Assessment of Causes for Water Level Declines

As outlined in Section 2, the topographic incisement and numerous regional geologic structures combine to have a substantial effect on the groundwater flow regime within the High Prairie area including the Knight-Dillacort area. High Prairie as a whole is incised on three sides (east, north, and west) by the Swale Creek and Klickitat River canyons, and it is bounded on the south by the collection of large-scale geologic structures forming the Columbia Hills. Superimposed on this isolated upland are numerous geologic structures that cut across the area, as depicted on Figure 1. The Knight-Dillacort area is further constrained by Knight Canyon and Dillacort Canyon on the southwest and northeast, respectively. The topographic canyons incise through the shallower aquifer zones, whereas it is believed that the regional geologic structures penetrate and form hydraulic barriers through the entire CRBG sequence. This combination of naturally occurring features can create compartmentalized blocks of basalt aquifer with limited lateral continuity, which, in turn, limits lateral flow of groundwater to replenish groundwater withdrawn by pumping within an aquifer block.

In short, the hydrogeologic setting of High Prairie makes it sensitive to overpumping (overdraft) of the groundwater resource.

Despite that, the available data indicate that groundwater levels across most of High Prairie appear stable across the 8-year period of monitoring in the well network (Figure

4), indicating that the current level of pumping across most of the area is sustainable. The substantial ongoing declines in groundwater levels observed over the past 6 years are limited to the shallow aquifer within the eastern portion of the Knight-Dillacort area. Possible causes for these localized declines include changes to precipitation and/or changes to groundwater withdrawals from the shallow aquifer resulting from numbers of wells constructed or deepened. Each possibility is examined below.

4.1 Precipitation Changes (Climate Change)

Trends in precipitation (and thus recharge) over the past 6 years relative to prior conditions are evaluated by review of annual precipitation data from the National Oceanic and Atmospheric Administration (NOAA) Weather Observation Stations in Goldendale (Station Nos. 453222 and 453226). Based on location, elevation, and surrounding topography, the Goldendale stations are assumed to be the most representative of the actual precipitation for the Knight-Dillacort study area. While the magnitude of precipitation at Goldendale will be different from High Prairie, the trends over time (above or below normal) should be similar.

The upper plot on Figure 7 presents both the annual precipitation and the calculated 16.9-inch mean annual precipitation at Goldendale for the 83-year period of record (1931 through 2014), excluding several years for which much data are missing. In addition, a cumulative departure from the mean annual precipitation is presented in the lower plot on Figure 7. The cumulative departure analysis adds the inches above or below the average precipitation for each year into a running total, and thereby illustrates longer-term drought or wet periods. While the values of the cumulative departure (i.e. numbers on the y-axis) depend on the year the analysis is started, the trend of above- or below-normal (shape of the curve) does not depend on the year started.

The annual precipitation data indicate that while there is substantial inter-annual variability in precipitation over the period of record, the long-term trend is generally stable. Since 2009, precipitation has been within a few inches of normal with the exception of 2013 which was 6.8 inches below normal. If precipitation were a causal factor, we would expect to see water level declines across all of High Prairie, which is not the case as described above.

Based on the information, we conclude that changes in precipitation are not a cause of the localized water level declines observed in the eastern Knight-Dillacort area.

4.2 Well Construction and Deepening in Area

The Knight-Dillacort area generally has a higher population density and thus higher well density than other areas of High Prairie. Figure 8 graphically depicts the numbers of wells by quarter-quarter section within and around the Knight-Dillacort area, based on records in Ecology's online well log database as of early 2015.

While there are many wells reported in and around the area of documented water level declines (around Adams View Road), there is an equal or greater density of wells reported in areas just to the west and southwest, where there is no indication of long-term declines from either monitoring data or anecdotal information from the community (see

Figure 5). Based on this information, the number (density) of wells by itself does not correlate with the location of documented water level declines.

There are no known significant changes in water use within the eastern Knight-Dillacort area corresponding in time to the observed declines (since 2009). However, there has been a steady increase in numbers of wells installed in the area, and an increase in the numbers of wells deepened to seek a more reliable source of water. These factors are evaluated below.

4.2.1 Well Installations Over Time

As illustrated on Figure 8, there are numerous wells installed within the Knight-Dillacort area and, based on Ecology's well log records, wells in the area have been installed consistently over the past few decades. Figure 9 depicts the numbers of wells installed per year between 1970 and 2014 within the 4-section area encompassing the eastern Knight-Dillacort area (Sections 21, 22, 27, and 28 of Township 3 North Range 13 East); the cumulative number of wells installed over time is also shown as the red line. The number of wells installed per year are plotted relative to the y-axis on the left side of the plot (0 to 7), whereas the cumulative number of wells installed since 1970 are plotted relative to the y-axis on the right side of the plot (0 to 70).

Ecology's records indicate that 70 wells have been installed in the 4-section area since 1970, with 0 to 3 wells installed during most years and 5 or more wells installed during a few years. This pattern is the same during the years of 2007 through 2014 (0 to 3 wells per year), so there is no indication of increased numbers of new wells in the area during the time period of measured water level declines.

If cumulative withdrawal of groundwater from increasing numbers of wells in the area were a cause of water level declines, we would expect declines to be a more widespread phenomenon across the entire 4-section area. Instead, the declines appear to be highly localized as described above.

Based on the distribution and timing of the measured water level declines relative to well installations, the total number of wells in the area does not appear to be a cause of the observed declines.

4.2.2 Deepening of Wells Over Time

Figure 5 depicts the parcels within the Knight-Dillacort area where wells have been reportedly been deepened since 2010. All of the well deepenings occur in the eastern area where the water level declines are measured.

Based on Ecology's well log database, Figure 10 depicts the numbers of wells deepened per year between 1970 and 2014 within the same four Sections 21, 22, 27, and 28 of Township 3 North Range 13 East; the cumulative number of wells deepened over time is also shown as the red line. The number of wells deepened per year are plotted relative to the y-axis on the left side of the plot (0 to 5), whereas the cumulative number of wells deepened since 1970 are plotted relative to the y-axis on the right side of the plot (0 to 10).

Ecology's records indicate that ten wells have been deepened in the 4-section area since 1970: none during the 1970s, one during the 1980s, two during the 1990s, one during the 2000s, and six during the 2010s with 4 of those 6 occurring in 2014 (Figure 10).

There is a strong spatial correlation between locations of recent (since 2010) well deepenings and locations of shallow aquifer wells showing recent water level declines in the eastern Knight-Dillacort area (Figure 5). There is also a strong correlation between timing of the recent well deepenings and timing of the water level declines in that area as measured at network wells -22C1 and -22P1, as illustrated on Figure 11. The fact that well -22C1 is located closer to the deepened wells and showed an earlier onset and greater magnitude of water level decline, relative to well -22P1 (Figure 10), further strengthens the recent well deepenings as a cause for the declines.

As discussed in Section 2, there is a strong downward hydraulic gradient (a few hundred feet of head difference) between shallower and deeper aquifer zones throughout High Prairie including the Knight-Dillacort area. Therefore, there is a driving hydraulic force for groundwater to naturally move downward from shallower to deeper aquifer zones. However, the thick layers of low-permeability massive basalt (aquitards) vertically separating the basalt interflow aquifer zones greatly restrict downward movement of groundwater. If not for that vertical permeability restriction, the heads in the various aquifer zones would equilibrate, eliminating vertical gradients.

When a borehole is drilled through the basalt aquitard layers without sealing off the interflow (aquifer) zones it creates a permeable conduit for groundwater to move downward from shallower to deeper aquifer zones. Appendix B presents well logs for the 21 wells in Ecology's database that were installed to depths of 400 feet or greater within Sections 21, 22, 27, and 28 of Township 3 North Range 13 East; this includes wells drilled to that depth initially and formerly shallow wells that were deepened. Based on our review of the recorded well construction information, only one of the 21 deeper wells in the area documents sealing off of shallower aquifer zones. Several of the wells have liners installed, but the liners are designed only to prevent borehole collapse; they do not seal tightly against the borehole[4] so they do not prevent vertical water movement in the annular space outside of them. The one deeper well where sealing off of a shallower aquifer zone is documented on the well log, is located in the SW¼ of the NE¼ of Section 27 (well 27G, not in the monitoring network); this well was deepened from a depth of 330 to 680 feet in 2014 (formation had caved in between depths of 280 and 330 feet prior to deepening). The well log documents the presence of cascading water at a depth of 290 feet, which was sealed off using a shale trap with bentonite grout installed between the liner and borehole wall.

The cumulative effect of several wells drilled into deep aquifer zones without sealing off shallow aquifer zones can be a gradual draining of the shallow aquifer zone(s) into the deeper aquifer zone(s). Based on the collective available information described above, we conclude that this phenomenon is the primary reason for the localized water level declines in the shallow aquifer of the eastern Knight-Dillacort area.

[4] Liner is typically 4.5-inch-diameter light-gage steel casing within a 6-inch borehole.

5 Assessment of Deeper Aquifer Zones in Study Area

In light of the substantial water level declines in the shallower aquifer system of the eastern Knight-Dillacort area, and the fact that several wells had been deepened in the past few years, a primary point of interest from the December 2014 meeting of High Prairie residents was the viability of the deeper aquifer system as a water supply source. Little information is available regarding the deeper aquifer zones, including no data regarding their water level trends, in the general area of the observed shallow aquifer declines. Of the seven wells added to the well monitoring network in 2015 as part of this assessment, four are greater than 400 feet deep (Table 1), so future monitoring of local water level trends in the deeper aquifer zones can be conducted.

The following subsections present data from groundwater quality testing conducted as one means to assess recharge to the deeper aquifer zone, followed by a discussion of the available information regarding reported well yields in the study area.

5.1 Groundwater Quality Testing to Assess Groundwater Age and thus Recharge

As stated in Section 2.3, groundwater quality analyses were performed as part of this assessment to estimate the age of groundwater withdrawn from shallower versus deeper wells as an indirect means to evaluate groundwater recharge from shallower to deeper aquifer zones.

In April 2015, Aspect received owner permission and collected groundwater samples from six wells located in the eastern part of the Knight-Dillacort area where water level declines are documented (discussed above). An attempt was made to select both shallower and deeper wells for comparative analysis of groundwater quality between shallower and deeper aquifer zones in the immediate area. As depicted on Figure 12, the four shallower wells sampled were -22P1 (280 feet deep), -27A2 (220 feet deep), -27C1 (168 feet deep), and -28B1 (220 feet deep), and the two deeper wells sampled were -27D4 (634 feet deep) and -27D6 (410 feet deep).

Aliquots of the six groundwater samples were submitted to Analytical Resources Inc. (ARI) of Seattle, Washington, for analysis of conventional water quality parameters including common cations (calcium, magnesium, potassium, and sodium), common anions (bicarbonate [alkalinity], chloride, and sulfate), fluoride, nitrate, and silicon. In addition, an aliquot of each sample was submitted to Beta Analytic Inc. of Miami, Florida, for radiocarbon (Carbon-14 isotope) dating analysis.

The following subsections describe the information and interpretation regarding conventional water quality parameters and for the radiocarbon dating. The groundwater analytical data are presented in Table 3, which also lists the depth of wells sampled. Appendix A includes the laboratory reports for the two data sets (conventionals and radiocarbon dating).

5.1.1 Conventional Water Quality Parameter Data

CRBG groundwater chemistry evolves with greater residence time in the aquifer. In very general terms, recently recharged groundwater is typically dominated by calcium (Ca) and magnesium (Mg) cations and the bicarbonate anion (HCO_3) – i.e., a Ca-Mg-HCO_3 type water. As groundwater moves along its regional flow path, spending greater time in contact with the basalt matrix, dissolution and hydrolysis of selected minerals and precipitation of other secondary minerals (e.g. clays) within the basalt matrix commonly remove calcium and magnesium in exchange for sodium, resulting in higher sodium concentrations in solution. The water-rock reactions also precipitate from solution into the basalt matrix carbonate, silica, and potassium (K), and can release from the basalt matrix into solution chloride, fluoride, and hydroxyl (thus raising groundwater pH). With very long residence times, the oldest CRBG groundwaters can therefore evolve to an oxygen-depleted, alkaline, sodium chloride (Na-Cl) type water with elevated fluoride concentrations (Hearn et al, 1990; Riedel et al, 2002; CBGWMA, 2009b).

Detected fluoride concentrations were the same (0.2 mg/L) in five of six wells sampled, thus no trend with well depth is apparent; the detected fluoride concentrations are an order of magnitude below the 4.0 mg/L drinking water standard. The field-measured groundwater pH was comparable for the six wells (7.0 to 8.2, neutral to slightly alkaline), also without any apparent correlation to well depth (Table 3).

Figure 13 is a "Piper plot" graphically depicting the common ion (cation and anion) data for the six water samples. The shallower wells (< 300 feet deep) and deeper wells (> 400 feet deep) are depicted with different colored symbols on the figure. The lower left triangle on the Piper plot displays the relative proportion of each major cation (Ca, Ng, K, Na), and the lower right triangle displays the relative proportion of each major anion (HCO_3, Cl, and sulfate (SO_4)) [5] in the samples. The position of the samples' cation and anion proportions are then projected onto the upper diamond-shaped plot as a means to represent the major ion composition (combined cations and anions) for each sample as a single point. Differences in major ion composition would be expected for younger versus older groundwaters as outlined above (e.g., evolution from a predominantly Ca-Mg water type to a predominantly Na water type). If deeper wells represent older (more chemically evolved) groundwaters, samples from the deeper wells would be expected to cluster toward the lowermost corner of the upper diamond of the Piper plot.

As indicated on Figure 13, a trend in groundwater composition (major ions) is not apparent from the Piper plot. All of the samples represent a Ca-Mg-dominant water type, which suggests relatively little water-rock interaction.

Another approach to assess the major ion data is the cation ratio, which is calculated as the sum of sodium and potassium concentrations divided by the sum of the four major cation concentrations (i.e., [Na+K]/[Na+K+Ca+Mg]). In theory, groundwaters with greater residence time in basalt aquifers should be more Na-rich and therefore have

[5] The plot includes HCO_3 plus carbonate (CO_3) on one axis; however, CO_3 is essentially absent in the samples (Table 3) so only the HCO_3 is relevant.

higher cation ratios (CBGWMA, 2009b). If greater well depth equates to older and more geochemically evolved groundwater, cation ratio would increase with well depth.

The upper plot on Figure 14, depicting cation ratio as a function of well depth for the six samples, does not indicate that trend. In fact, the five wells excluding the deepest (-27D4, 634 feet deep) suggest the opposite trend – cation ratio generally decreasing with depth – with the most geochemically evolved groundwater being in the 220-foot-deep well -28B1. The deepest well -27D4 is a clear outlier from the other data (much lower cation ratio than expected). We infer that, because the two deeper well (-27D4 and -27D6) boreholes are open to shallower and deeper aquifer zones[6], the water sampled from those wells represents a mixture of groundwater from shallow and deeper aquifer zones.

As stated above, silica[7] concentrations in CRBG groundwater can decrease with greater residence time as a result of silica being incorporated into secondary minerals, thus removed from groundwater. The lower plot on Figure 14, depicting silicon concentrations as a function of well depth, follows that trend for five of the six wells. The deepest well (-27D4) is again an outlier from the other samples (much higher silicon concentration than expected), which, again, is inferred to reflect a mixed groundwater quality. There is no drinking water standard for silicon.

In theory, higher chloride concentrations are indicative of an older (geochemically evolved) groundwater, as stated above. The six samples do not show a clear trend of chloride concentrations versus well depth (upper plot on Figure 15). The 220-foot-deep well -28B1 had the highest detected chloride concentration (13.1 mg/L), like it had the highest cation ratio. Detected chloride concentrations in the other five wells are similar (2.5 to 4.6 mg/L), with no clear correlation to well depth. The detected chloride concentrations are an order of magnitude below the 250 mg/L secondary drinking water standard based on aesthetics (taste).

Nitrate is typically associated with surface processes (including fertilizers and septic systems), therefore higher nitrate concentrations would be expected in groundwater from shallower aquifers. The lower plot on Figure 15 depicts the six wells' nitrate concentrations as a function of well depth, which may indicate that trend generally but not clearly. Nitrate was not detected (< 0.1 mg/L) in samples from wells -22P1 (280 feet deep) and -27D6 (410 feet deep). The detected nitrate concentrations in the other four wells ranged from 0.2 to 1.0 mg/L, with all being an order of magnitude below the 10 mg/L drinking water standard. The highest nitrate concentration was detected in well -28B1, which also had the anomalously high chloride detection (described above) and the highest measured water temperature (13.9° C; Table 3). Well -27C1 (168 feet deep) had the second highest detected concentrations of both nitrate (0.9 mg/L) and chloride (4.6 mg/L) (Table 3). High nitrate in combination with high chloride can be indicative of septic system effluent; however, radiocarbon dating data indicates that groundwater from

[6] Well -27D4 (634 feet deep) has a 4.5-inch-diameter liner extending to 350 feet, but the liner does not seal off the nominal 6-inch borehole in which it is set.

[7] Silica refers to a combination of silicon and oxygen (e.g. quartz), but the laboratory analyzes for the element silicon.

that well is a few thousand years old, thus precluding septic as a cause (discussed below in Section 5.1.2).

In summary, the water quality data from shallower versus deeper wells do not demonstrate the patterns of water quality change that are observed regionally in the CRBG, where deeper wells tap into older and thus more geochemically evolved groundwater. We expect that is largely due to the fact that the two deeper wells sampled in the study area are open across both shallower and deeper aquifer zones, so their samples likely reflect a blend of groundwater quality from the various zones.

5.1.2 Radiocarbon Age Dating

The six groundwater samples were submitted for radiocarbon age dating, which is commonly used to estimate the age of carbon-containing materials that are less than approximately 50,000 years old. Radiocarbon, or carbon-14, is an unstable isotope of carbon that is naturally produced in the atmosphere and converts to the stable carbon-12 and/or carbon-13 isotopes over time, with a half-life of approximately 5,730 years. The analytical method determines the proportion of unstable carbon-14 to stable carbon-12 or carbon-13 isotopes and estimates the age based on comparison of the measured isotope ratios to reference samples (the older the sample, the less carbon-14 will remain). Inorganic carbon present in the groundwater samples is the material dated for this assessment. Radiocarbon dates are rounded by the laboratory to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. Table 3 presents for each sample the measured fraction of carbon-14 (“modern carbon”) with the reported error range (+/-), and the resulting estimated radiocarbon age and error range in years. The upper plot on Figure 16 presents the estimated radiocarbon ages as function of well depth.

As presented in Table 3 and Figure 16, the estimated age of the groundwater sampled from the six wells ranges from approximately 3,560 to 7,570 years. In other words, all of the groundwater sampled in this assessment is older than 3,500 years. Samples from five of the six wells show a general trend of increasing age with increasing well depth, but the deepest well (-27D4, 634 feet deep) is an outlier to that trend, like it is an outlier for other geochemical indicators as discussed above. Mixing of groundwater from shallower and deeper aquifer zones is a likely explanation for that outlier result.

This range of age values is consistent with measurements of groundwater age within the CRBG elsewhere in the Columbia Basin (ranging from a few thousand to several tens of thousands of years; Douglas et al, 2007; CBGWMA, 2009). The age data indicate relatively long flow paths, and thus residence times, for recharge water to reach the aquifer zones being tapped for water supply by these wells. Note that the estimated 5,920-year age for groundwater from well -28B1 indicates that that well’s elevated nitrate and chloride concentrations are not attributable to septic systems (generated near surface in past decade), as was mentioned above as a possibility.

The lower plot on Figure 16 presents cation ratio as a function of radiocarbon age, with the expectation that older groundwater (longer residence time) should have a greater cation ratio. The sample data do not show that trend. In fact, the opposite trend is

generally indicated for five of six wells (including deepest well -27D4), but with well -28B1 being an outlier relative to the other five wells.

5.2 Reported Well Yields

Driller's logs commonly present information on well yield (gallons per minute [gpm]) as measured from the driller's air lift well development conducted on newly installed or deepened wells. Air lifting is conducted primarily to remove from the well accumulated sediment and turbid water generated during drilling. The air lifting is commonly conducted for time periods of 1 to 4 hours and the reported information on flow rate may not be accurate nor representative of a well's true yield since it is short term and it is controlled by the air pressure generated by the driller's air compressor. A permanent pump placed in the well may yield lesser or greater quantities of groundwater than the rate reported on the driller's log. Nevertheless, in the absence of more reliable data, the yield data reported on the drillers' logs is readily available information from nearly all of the wells in the study area, so is worth evaluating for general patterns with respect to both geographic location and well depth (aquifer zone).

The yield of a well is controlled both by the transmissivity of the aquifer zone(s) adjacent to the well and the available drawdown[8] within the well, the latter being a function largely of the artesian pressure within the aquifer zone(s) supplying the well. The depth at which the pump is set is also a factor in well yield, but that is not a function of the aquifer productivity or well construction and it is not typically reported on driller's logs, so is not considered in this evaluation.

The upper plot on Figure 17 plots the depth to water reported at time of drilling (on driller's log) versus the well total depth for all wells in the 4-section area encompassing the eastern Knight-Dillacort area (Sections 21, 22, 27, 28 of T03N/R13E). The data show a clear pattern of deeper static water levels with increasing well depth. Shallower static water levels could occur in deeper wells if the deeper aquifer zones tapped by the deeper wells had great excess pressure (artesian pressure). The data indicate that such highly pressurized deep aquifer zones are not present to the depths of drilling (approximately 700 feet) within the study area.

The lower plot on Figure 17 presents the wells' available drawdown as a function of well depth. While there is considerable variability among wells, there is an overall pattern of greater available drawdown with greater well depth. However, the general trend of the data is considerably less than a 1:1 slope; in other words, for the majority of wells, drilling an extra X feet in well depth does not return the same X feet in available drawdown. Nevertheless, the generally greater available drawdown afforded by deeper wells overall suggests that somewhat greater yields should be available in deeper wells in the study area, if deeper aquifer zones are equally transmissive to shallow aquifer zones, which is not known.

While there is in general somewhat greater available drawdown in deeper wells of the study area, the reported well yields do not show a clear trend with well depth. The upper plot on Figure 18 presents the reported well yields as a function of well depth, which

[8] The length of water column within the well (static water level depth minus well depth).

demonstrates considerable variability with no clear trend overall. Because well depth is a function of the ground surface elevation that the well is drilled from (to reach a specific aquifer zone), the lower plot on Figure 18 presents the same reported well yields as a function of the elevations of the well bottoms, which normalizes changes in ground surface elevation; there is no clear trend of reported yield versus the well's bottom elevation. As stated above, the well yields reported on driller's logs may not be representative of yields that the wells would produce with a permanent pump installed.

While the existing information on well yields is of limited reliability, it does not indicate that deeper aquifer zone(s) beneath the study area are more productive (higher yielding) than the shallower aquifer zones.

Figure 19 presents the reported well yield data in plan view for the 4-section area, without consideration of well depth. Listed for each quarter-quarter section are the number of reported wells and the minimum, average, and maximum reported well yields for those wells. Each quarter-quarter section is color coded based on the maximum reported yield. Notwithstanding the caveats on reliability of the yield data reported on driller's logs, the available data indicate an area with yields of 100 gpm or higher in the northern quarter-quarter sections of Sections 27 and 28. Review of the well log information also indicates no correlation between the reported yields of the wells and the years they were installed (Figure 20).

6 Conclusions and Recommendations

Although the natural hydrogeologic setting of High Prairie limits recharge to the groundwater aquifers and thus makes the area sensitive to groundwater depletion from overpumping, water level monitoring conducted since 2010 or earlier indicates that groundwater levels are generally stable over time across the vast majority of High Prairie. However, within a localized eastern portion of the Knight-Dillacort area, near Adams View Road, substantial and ongoing declines in water levels have been measured in two wells since 2009, and the rates of declines have accelerated in the past few years.

The observed water level declines do not appear to be related to the increased total number of wells in the area. Rather, based on multiple lines of evidence, the accelerating declines appear to be related to recent deepening of several wells in the immediate area of the declining wells. During the deepening process, the shallow aquifer zone(s) do not appear to have been sealed off to prevent vertical movement of water (cascading water) from the shallow aquifer zone(s) within the deepened well. Consequently, it appears that the deepened wells have been gradually draining groundwater from the shallow aquifer zone(s) in which the declining wells are completed.

Little information is currently available regarding the deeper aquifer system within the eastern Knight-Dillacort area, but deeper wells in the area were added to the well monitoring network as part of this assessment so monitoring for water level trends can continue into the future. There is no consistent evidence that the local deeper aquifer zone is more productive than the shallower aquifer zones.

Based on these conclusions, we provide the following recommendations:

- Retrofit the deepened wells in the area of declines to seal off the shallower aquifer zones and prevent cascading water. We expect that this would not create a rapid recovery of the declines that have already occurred, but it should curb further declines in affected wells and limit expansion of the area of decline.
- Continue the High Prairie water level monitoring program with regular evaluation of the data to watch for changes in groundwater levels over time. The value of the monitoring program is evident by now having the data that document the localized groundwater declines and provide a basis to diagnose their cause. We recommend that additional wells be added to the network, as practical, to provide greater coverage of areas lacking monitoring, and, where possible, to monitor water levels in shallower and deeper aquifer zones.
- Implement voluntary water conservation measures throughout High Prairie, particularly limiting outdoor water use.

7 References

Aspect, 2011, Hydrologic Information Report Supporting Water Availability Assessment, High Prairie Study Area, WRIA 30, June 30, 2011.

Aspect, 2013, Hydrologic Information Report Addendum Supporting Water Availability Assessments, Swale Creek, Little Klickitat, High Prairie, Columbia Tributaries, and Appleton Study Areas, WRIA 30, June 28, 2013.

Bauer, H.H., and Hansen, A.J. Jr., 2000, Hydrology of the Columbia Plateau Regional Aquifer System, Washington, Oregon, and Idaho, USGS Water-Resources Investigation Report 96-4106.

Bauer, H.H. and J.J. Vaccaro, 1990, Estimates of Ground-Water Recharge to the Columbia Plateau Regional Aquifer System, Washington, Oregon, and Idaho, for Predevelopment and Current Land-Use Conditions, USGS Water-Resources Investigations Report 88-4108.

Brown, J.C., 1979, Geology and Water Resources of Klickitat County, Water Supply Bulletin No, 50, p. 1 - 413.

Columbia Basin Groundwater Management Area (CBGWMA), 2009a, Groundwater Geochemistry of the Columbia River Basalt Group Aquifer System: Columbia Basin Groundwater Management Area of Adam, Franklin, Grant, and Lincoln Counties, Washington, June 2009.

Columbia Basin Groundwater Management Area (CBGWMA), 2009b, A Summary of Columbia River Basalt Group Physical Geology and its Influence on the Hydrogeology of the Columbia River Basalt Aquifer System: Columbia Basin Groundwater Management Area of Adam, Franklin, Grant, and Lincoln Counties, Washington, June 2009.

Douglas, A.A., J.L, Osiensky, and C.K. Keller, 2007, Carbon-14 Dating of Ground Water in the Palouse Basin of the Columbia River Basalts, Journal of Hydrology, v. 334, pp. 502-512.

Hansen, Jr. A.J., J.J. Vaccaro and H.H. Bauer, 1994, Ground-Water Flow Simulation of the Columbia Plateau Regional Aquifer System, Washington, Oregon, and Idaho, U.S. Geological Survey Water-Resources Investigations Report 91-4187.

Hearn, P.P, W.C. Steinkampf, L.D. White, and J.R. Evans, 1990, Geochemistry of Rock-Water Interactions in Basalt Aquifers of the Columbia River Plateau, in Doe, B.R., editor, Proceedings of a U.S. Geological Survey Workshop on Environmental Geochemistry, USGS Circular 10933, pp. 63-68.

High Prairie Community Council, 2014, Letter from Mike Richards to Klickitat County Board of Commissioners regarding declining water levels in area near intersection of Centerville Highway and Mount Adams View Road, July 22, 2014.

Newcomb, R.C.,1969, Effect of Tectonic Structure on the Occurrence of Ground Water in the Basalt of the Columbia River Group of the Dalles Area Oregon and Washington, USGS Professional Paper 383-C.

Reidel, S.P., Fecht, K.R., Hagood, M.C., and Tolan, T.L., 1989, The Geologic Evolution Of The Central Columbia Plateau, in Reidel, S.P., and Hooper, P.R., eds, Volcanism And Tectonism In The Columbia River Flood-Basalt Province: Boulder, Colorado, Geological Society of America, Special Paper 239.

Riedel, S.P., V.G. Johnson, and F.A. Spane, 2002, Natural Gas Storage in Basalt Aquifers of the Columbia Basin, Pacific Northwest USA: A Guide to Site Characterization, Pacific Northwest National Laboratory, August 2002.

Steinkampf, W.C., 1989, Water-Quality Characteristics of the Columbia River Regional Aquifer System in Parts of Washington, Oregon, and Idaho, USGS Water-Resources Investigation report 87-4242.

Limitations

Work for this project was performed for the Klickitat County Department of Natural Resources (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

TABLES

Table 1 - Groundwater Level Monitoring Network for High Prairie

Hydrogeologic Assessment Knight-Dillacort Area

Ecology Well Log Data				Well Survey Data			
TRS Label	Well Log Date	Dia. (in)	Depth (ft)	Northing[1] (SPS 83; ft)	Easting[1] (SPS 83; ft)	Top of Casing Elevation[2] (NAVD 88; ft)	Comments as of Spring 2015
Wells in Original Monitoring Network							
T03/R13-3B1	11/12/86	6	76	162902.9	1472929.6	2011.17	
T03/R13-3R1	4/15/87	6	745	159389.4	1472760.9	2146.99	No longer monitored due to numerous obstructions in the well.
T03/R13-4L1	10/25/95	6	620	160519.0	1464962.0	2126.25	
T03/R13-11M1	8/31/94	6	524	155087.0	1474093.1	2037.44	
T03/R13-14A1	10/16/92	6	500	152621.1	1478289.8	2181.16	
T03/R13-14G1	7/7/95	6	500	151451.4	1476350.7	2085.99	
T03/R13-14G2	2/28/07	6	458	151661.4	1476308.2	2082.02	
T03/R13-14J	5/30/90	6	460	149010.8	1477037.7	2000.84	Located under bird house. Owner does not have well log. Well log chosen based on water level.
T03/R13-15L1	8/13/87	6	105	149748.7	1470418.5	1885	Limited access, remove expansion bolt. Airline installed to unknown depth. GPS Location; Google Earth elevation.
T03/R13-20N1	11/22/94	6	520	144704.4	1457869.5	1452.74	Airline installed at approximate depth of 520 ft.
T03/R13-20N2	7/15/04	6	530	144430.9	1458080.8	1427.90	Well Tag: AKL-875
T03/R13-21M1	7/11/97	6	520	145315.8	1463014.1	1745.30	Sonic water level indicator not accurate.
T03/R13-21P1	5/6/94	6	200	139938.4	1465005.9	1569.93	
T03/R13-22C1	5/9/02	6	225	143235.9	1470655.1	1777.48	
T03/R13-22P1	10/19/95	6	280	144550.2	1470944.8	1763.36	
T03/R13-23L1	5/30/81	6	449	145104.1	1475387.6	1808.08	Originally had an airline installed at depth of 140 ft. Access port later installed (May/June 2010).
T03/R13-27	8/7/08	6	165	140168.2	1469338.5	1747.10	Well Tag: APT-283
T03/R13-27Q1	10/27/93	6	310	138228.3	1471376.8	1996.03	
T03/R13-28B1	9/7/94	6	220	143022.4	1466216.1	1622.75	
T03/R13-28F1	11/4/03	6	335	140751.7	1464326.2	1527.26	Well Tag: AHK-331 2 wells; well not currently in use is monitored.
T03/R13-28L1	12/27/72	8	90	141586.1	1465563.3	1498.67	
T03/R14-18N1	5/20/97	6	695	149041.9	1484973.1	2153.66	
T04/R14-31L1	10/12/00	6	506	167675.2	1486274.0	1785.85	No longer wants to participate in monitoring program.
Wells Added During this Study (2015)							
T03/R13-24C1	5/30/1997	6	560	147297	1480932	NA	Well Tag: AAG-918
T03/R13-27A2	8/13/1998	6	220	142706	1472370	NA	Well Tag: ACX-768
T03/R13-27C1	7/30/2002	6	168	142810	1470134	NA	Well Tag: AGB-465
T03/R13-27D4	10/8/2001	6	634	142393	1470381	NA	Well Tag: AGM-070
T03/R13-27D5	2/17/2010	6	665	142756	1469398	NA	Well Tag: AFQ-965
T03/R13-27D6	7/11/2014	6	410	143353	1471194	NA	Well Tag: BIF-979
T03/R13-28C2	5/9/1990	6	160	141541	1464199	NA	

Note: The wells added in 2015 have not been surveyed at the time of this report. The cooridantes (northing/easting) are from GPS.
NA: Surveyed elevation not available at time of this report.

Table 2 - Groundwater Level Data from Monitoring Network

Hydrogeologic Assessment Knight-Dillacort Area

Ecology Well Log Data		June 2007 Measurements			November 2007 Measurements			April 2008 Measurements			December 2008 Measurements			April 2009 Measurements			December 2009 Measurements			May/June 2010 Measurements		
Ecology Well Log ID	TRS Label	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments
Wells in Original Monitoring Network																						
140432	T03/R13-3B1	203.6	1807.5		-	-	Well box frozen shut	-	-	No permission	207.2	1804.0		205.6	1805.6		206.2	1805.0		204.5	1806.7	
141250	T03/R13-3R1	549.5	1597.5		549.7	1597.3		549.7	1597.3		549.7	1597.3		549.4	1597.6		549.0	1598.0		-	-	Not monitored
377250	T03/R13-4L1	-	-		-	-		-	-		-	-		-	-		-	-		524.7	1601.6	
141715	T03/R13-11M1	115.1	1922.3		115.1	1922.4		115.2	1922.2		116.1	1921.4		115.4	1922.0		114.8	1922.6		115.5	1921.9	
139955	T03/R13-14A1	435.4	1745.7		434.4	1746.8		435.2	1746.0		434.2	1747.0		435.8	1745.4		-	-	Not monitored	434.8	1746.4	
377252	T03/R13-14G1	195.1	1890.9		196.0	1890.0		197.4	1888.6		197.0	1889.0		196.4	1889.6		196.8	1889.2		195.1	1890.9	
477832	T03/R13-14G2	173.2	1908.8		174.5	1907.6		177.6	1904.4		180.5	1901.6		181.1	1900.9		-	-	Unstable water level	176.8	1905.2	
136943	T03/R13-14J	-	-		-	-		-	-		-	-		-	-		-	-		323.4	1677.5	Rising water level
145893	T03/R13-15L1	-	-		-	-		-	-		-	-		-	-		-	-		13.4	1871.6	
144433	T03/R13-20N1	-	-		-	-		-	-		-	-		-	-		-	-		462.0	990.7	
384137	T03/R13-20N2	-	-		-	-		-	-		-	-		-	-		-	-		436.5	991.4	Rising water level
143160	T03/R13-21M1	-	-		-	-		-	-		-	-		-	-		-	-		492.4	1252.9	
145685	T03/R13-21P1	-	-		-	-		-	-		-	-		-	-		-	-		179.5	1390.5	Rising water level
335153	T03/R13-22C1	162.2	1615.3		161.3	1616.2		160.7	1616.8		161.9	1615.6		162.0	1615.5		175.0	1602.5		182.0	1595.5	
377254	T03/R13-22P1	139.5	1623.8	Unstable water level	139.7	1623.7		140.2	1623.2		139.7	1623.7		139.6	1623.8		140.9	1622.5		145.3	1618.1	
139217	T03/R13-23L1	75.3	1732.8	Airline measurement	-	-	Not monitored	-	-	Not monitored	-	-	Not monitored	-	-	Not monitored	-	-	Not monitored	41.7	1766.4	
556399	T03/R13-27	-	-		-	-		-	-		-	-		-	-		-	-		87.6	1659.5	
139404	T03/R13-27Q1	262.3	1733.7		261.4	1734.6		262.2	1733.8		261.8	1734.2		261.4	1734.6		260.0	1736.0		261.4	1734.6	
143537	T03/R13-28B1	141.2	1481.6		145.8	1477.0		141.8	1480.9		145.1	1477.6	Rising water level	141.4	1481.3		143.8	1478.9		142.0	1480.7	
372465	T03/R13-28F1	-	-		-	-		-	-		-	-		-	-		-	-		107.3	1420.0	
139337	T03/R13-28L1	21.4	1477.3	Rising water level	25.2	1473.5		20.4	1478.2		24.4	1474.3	Rising water level	21.0	1477.7		23.0	1475.7		19.4	1479.3	
354742	T03/R14-18N1	516.7	1637.0		518.3	1635.4		517.9	1635.7		519.5	1634.2		518.3	1635.3		-	-	Not monitored	518.6	1635.1	
302764	T04/R14-31L1	267.1	1518.7		265.4	1520.5		264.9	1521.0		265.2	1520.7		265.9	1520.0		264.8	1521.1		-	-	No permission
Wells Added in 2015																						
144057	T03/R13-24C1	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
418100	T03/R13--27A2	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
341503	T03/R13--27C1	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
316087	T03/R13--27D4	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
648556	T03/R13--27D5	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
923889	T03/R13--27D6	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
146705	T03/R13--28C2	-	-		-	-		-	-		-	-		-	-		-	-		-	-	

Table 2 - Groundwater Level Data from Monitoring Network

Hydrogeologic Assessment Knight-Dillacort Area

Ecology Well Log Data		November/December 2010 Measurements			April 2011 Measurements			November/December 2011 Measurements			April-June 2012 Measurements			October/November 2012 Measurements			April 2013 Measurements			November 2013 Measurements		
Ecology Well Log ID	TRS Label	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments
Wells in Original Monitoring Network																						
140432	T03/R13-3B1	214.6	1796.6		212.5	1798.7		211.5	1799.6		212.5	1798.7		206.0	1805.2		205.0	1806.2		204.9	1806.3	
141250	T03/R13-3R1	-	-	Not monitored	-	-	Not monitored	-	-	Not monitored	-	-	Not monitored	-	-	Not monitored	-	-	Not monitored	-	-	Not monitored
377250	T03/R13-4L1	524.2	1602.1		524.8	1601.4		524.7	1601.6		524.0	1602.3		524.2	1602.1		523.9	1602.3		-	-	No access - road too wet
141715	T03/R13-11M1	115.7	1921.8		115.8	1921.6		115.7	1921.7		114.4	1923.0		114.7	1922.7		114.7	1922.7		113.2	1924.2	
139955	T03/R13-14A1	436.1	1745.1		436.5	1744.6		439.5	1741.7		435.8	1745.4		436.4	1744.8		436.4	1744.7		439.1	1742.0	
377252	T03/R13-14G1	197.2	1888.8		197.6	1888.4		197.0	1889.0		196.4	1889.6		195.9	1890.1		196.3	1889.7		195.8	1890.2	
477832	T03/R13-14G2	182.7	1899.3		182.7	1899.4		181.6	1900.4		181.6	1900.4		181.5	1900.6		186.8	1895.3		183.1	1898.9	
136943	T03/R13-14J	322.3	1678.5		320.5	1680.4		-	-	No Permission	-	-	No Permission	-	-	No Permission	-	-	No Permission	-	-	
145893	T03/R13-15L1	11.4	1873.6		-	-	No Permission	-	-	Airline 23 psi	14.6	1870.4	Airline 26 psi	19.6	1865.4	Airline 24 psi	14.9	1870.1	Airline 26 psi	17.3	1867.8	Airline 25 psi
144433	T03/R13-20N1	478.4	974.3		478.4	974.3		492.2	960.5		506.1	946.6	Airline 6 psi	496.9	955.8	Airline 10 psi	496.9	955.8	Airline 10 psi	496.9	955.8	Airline 10 psi
384137	T03/R13-20N2	326.2	1101.7		343.0	1084.9	Rising water level	355.9	1072.0	Airline 58 psi	449.4	978.5	(Pump on) Airline 20 psi	341.4	1086.5	Airline 64 psi	399.4	1028.5	(Recovering) Airline 40 psi	315.4	1112.5	
143160	T03/R13-21M1	492.5	1252.8		489.3	1256.0		486.3	1259.0		485.1	1260.2	Airline 4 psi	484.0	1261.3	Airline 8 psi	483.0	1262.3	Airline 8.5 psi	482.0	1263.3	
145685	T03/R13-21P1	179.0	1390.9		177.1	1392.8		178.5	1391.4		177.9	1392.0		179.2	1390.7		178.1	1391.8		-	-	No permission
335153	T03/R13-22C1	185.0	1592.5		185.7	1591.8		188.1	1589.4		185.7	1591.8		193.8	1583.7		196.4	1581.1		205.1	1572.4	
377254	T03/R13-22P1	146.4	1617.0		150.6	1612.8		148.1	1615.3		149.2	1614.2		150.1	1613.3		151.0	1612.4		151.6	1611.8	
139217	T03/R13-23L1	38.6	1769.5		37.5	1770.6		38.4	1769.7		42.1	1766.0		39.1	1768.9		38.4	1769.7		40.0	1768.1	
556399	T03/R13-27	88.7	1658.4		87.6	1659.5		87.8	1659.3		86.9	1660.2		88.6	1658.5		88.5	1658.6		89.5	1657.6	
139404	T03/R13-27Q1	262.4	1733.6		263.3	1732.7		263.0	1733.0		263.3	1732.7		263.0	1733.0		264.0	1732.0		263.5	1732.5	Well head icy - lots of negative pressure
143537	T03/R13-28B1	143.2	1479.6		139.4	1483.3		141.0	1481.8		137.9	1484.8		147.9	1474.8		143.2	1479.5		144.4	1478.3	
372465	T03/R13-28F1	100.7	1426.6		95.8	1431.5		97.0	1430.3		94.3	1433.0		-	-	No Permission	-	-	No Permission	-	-	No Permission
139337	T03/R13-28L1	22.6	1476.1		18.6	1480.1		20.6	1478.1		17.6	1481.0		27.1	1471.5		22.1	1476.6		23.7	1475.0	
354742	T03/R14-18N1	519.1	1634.6		518.7	1635.0		-	-	No Permission	-	-	No Permission	-	-	No Permission	-	-	No Permission	520.0	1633.6	
302764	T04/R14-31L1	-	-	Not monitored	-	-	Not monitored	-	-	No Permission	-	-	No Permission	-	-	No Permission	-	-	No Permission	-	-	No Permission
Wells Added in 2015																						
144057	T03/R13-24C1	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
418100	T03/R13--27A2	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
341503	T03/R13--27C1	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
316087	T03/R13--27D4	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
648556	T03/R13--27D5	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
923889	T03/R13--27D6	-	-		-	-		-	-		-	-		-	-		-	-		-	-	
146705	T03/R13--28C2	-	-		-	-		-	-		-	-		-	-		-	-		-	-	

Table 2 - Groundwater Level Data from Monitoring Network

Hydrogeologic Assessment Knight-Dillacort Area

Ecology Well Log Data		April 2014 Measurements			November 2014 Measurements			April 2015 Measurements		
Ecology Well Log ID	TRS Label	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments	Depth to Water (ft bTOC)	GW Elevation[2] (ft)	Comments
Wells in Original Monitoring Network										
140432	T03/R13-3B1	204.0	1807.2		216.1	1795.1	Not static	-	-	No permission
141250	T03/R13-3R1	-	-	Not monitored	-	-	No permission	-	-	No permission; no contact info -**discontinue monitoring**
377250	T03/R13-4L1	523.6	1602.6		523.8	1602.5		520.1	1606.2	access issues; Sonic usually inaccurate
141715	T03/R13-11M1	112.6	1924.8		111.4	1926.0		112.2	1925.2	Sonic OK.
139955	T03/R13-14A1	435.5	1745.6		436.5	1744.7	Not static	429.4	1751.8	
377252	T03/R13-14G1	194.7	1891.3		~~142.4~~	-	Measurement ~50 ft higher than normal; likely measurement error	193.9	1892.1	
477832	T03/R13-14G2	182.3	1899.8		182.5	1899.5		181.5	1900.5	
136943	T03/R13-14J	316.9	1683.9		-	-	No permission	-	-	No permission
145893	T03/R13-15L1	16.1	1868.9	Airline 25.5 psi	15.1	1869.9	Airline 24.5 psi	13.1	1871.9	
144433	T03/R13-20N1	492.3	960.5	Airline 12 psi	492.3	960.5	Airline 12 psi	486.5	966.2	Airline 14.5 psi
384137	T03/R13-20N2	**286.6**	1141.3	Airline 88.5 psi; non-static	-	-	No permission	284.1	1143.8	
143160	T03/R13-21M1	480.8	1264.5		-	1266.2	Airline 9 psi; waterline access issues	479.1	1266.2	Airline 9.0 psi
145685	T03/R13-21P1	179.8	1390.2		180.5	1389.5		178.6	1391.3	
335153	T03/R13-22C1	207.4	1570.1		217.2	1560.3		218.8	1558.7	
377254	T03/R13-22P1	152.3	1611.1		173.9	1589.5		178	1585	Reading provided by well owner.
139217	T03/R13-23L1	-	-	Airline 37.5 psi	39.4	1768.6	Airline 38 psi	33.2	1774.9	
556399	T03/R13-27	89.0	1658.1		88.8	1658.3		91.0	1656.1	
139404	T03/R13-27Q1	264.6	1731.5		259.9	1736.1		266.4	1729.6	
143537	T03/R13-28B1	142.0	1480.7		142.4	1480.3		143.0	1479.7	
372465	T03/R13-28F1	-	-	No Permission	-	-	No permission	-	-	No permission; no contact info -**discontinue monitoring**
139337	T03/R13-28L1	21.0	1477.7		23.9	1474.7	Not static	20.9	1477.8	
354742	T03/R14-18N1	519.0	1634.6	Sonic inaccurate	~~312.8~~	-	Waterline access issues; Sonic likely inaccurate	~~248.8~~	-	Sonic likely inaccurate (248.8 deep, 61.9 normal); use waterline only
302764	T04/R14-31L1	-	-	No Permission	-	-	No permission	-	-	**Discontinue monitoring;** no contact info -
Wells Added in 2015										
144057	T03/R13-24C1	-	-		-	-		333.6		Not static, sonic ok
418100	T03/R13--27A2	-	-		-	-		173.4		Tape stuck at 150', used sonic
341503	T03/R13--27C1	-	-		-	-		148.9		Sonic no good
316087	T03/R13--27D4	-	-		-	-		-		Cannot acces well, port too small to fit tape. Sonic no good
648556	T03/R13--27D5	-	-		-	-		457.7		Sonic no good
923889	T03/R13--27D6	-	-		-	-		207.9		Sonic no good
146705	T03/R13--28C2	-	-		-	-		-		Removed well cap, water shot out

Notes:

[1] Northing and Easting coordinates are in Washington South State Plane coordinate system (NAD 1983 datum).

[2] Elevations are in NAVD88 vertical datum.

[3] Blank cell in Depth to Water column indicates that the well was not yet included in the monitoring network.

[4] See Table 1 regarding survey of wells added in 2015.

Table 3 - Groundwater Quality Analytical Results, April 2015

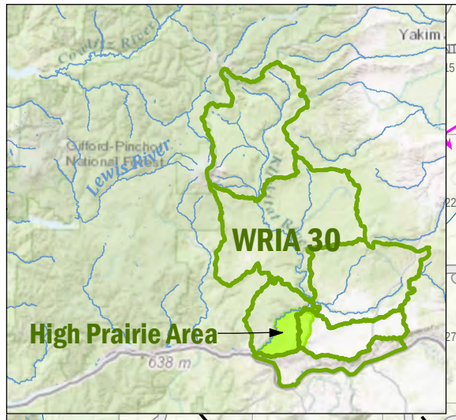
Knight-Dillacort Area Hydrogeologic Assessment

Analyte	22P1 280 ft deep 4/15/2015	27A2 220 ft deep 4/15/2015	27C1 168 ft deep 4/15/2015	27D4 634 ft deep 4/15/2015	27D6 410 ft deep 4/15/2015	28B1 220 ft deep 4/15/2015
Conventionals						
Common Cations						
Calcium in mg/L	24.4	16.1	21	22.2	23.5	19.8
Magnesium in mg/L	15.4	7.88	9.91	11.6	14.0	11.4
Potassium in mg/L	3.4	2.4	2.3	3.2	2.6	2.6
Sodium in mg/L	11.7	8.8	11.6	11.2	11.3	14.6
Cation Ratio (calculated)	0.28	0.32	0.31	0.30	0.27	0.36
Common Anions						
Alkalinity in mg/L as CaCO3	129	88.8	113	124	138	103
Bicarbonate in mg/L as CaCO3	129	88.8	113	124	138	103
Carbonate in mg/L as CaCO3	1 U	1 U	1 U	1 U	1 U	1 U
Hydroxide in mg/L as CaCO3	1 U	1 U	1 U	1 U	1 U	1 U
Chloride in mg/L	3.2	2.6	4.6	3.8	2.5	13.1
Sulfate in mg/L	21.0	1.7	1.6	3.4	3.8	7.0
Other Constituents						
Fluoride in mg/L	0.2	0.2	0.2	0.2	0.2	0.4
Nitrate in mg-N/L	0.1 U	0.4	0.9	0.2	0.1 U	1.0
Silicon in mg/L	22.1	27.0	28.5	23.4	19.7	26.1
Carbon 14 Isotope Parameters						
fMDN (fraction modern carbon) with error range	0.4756 +/- 0.0018	0.6010 +/- 0.0022	0.6420 +/- 0.0024	0.5386 +/- 0.0020	0.3897 +/- 0.0014	0.4786 +/- 0.0018
Radiocarbon Age in Years	5,970	4,090	3,560	4,970	7,570	5,920
Estimated Error in Radiocarbon Age (Years +/-)	20	10	10	20	30	20
Field Parameters						
Temperature in deg C	9.3	9.7	12.6	12.5	12.8	13.9
Specific Conductance in uS/cm	282	178	223	237	257	254
Dissolved Oxygen in mg/L	8.9	5.4	8.7	3.8	0.1	4.2
pH in pH units	8.2	7.0	7.5	7.7	8.1	7.6
ORP in mV	94	102	89	88	82	86
Turbidity in NTU	1	7	1	3	14	1

Radiocarbon age estimates rounded to nearest 10 years.

U: Not detected at associated reporting limit.

FIGURES



High Prairie Well Network

- Monitoring Started 2015
- 3B1 Monitored Since 2010 or Earlier
- Cross Section
- Knight-Dillacort Study Area
- High Prairie Area
- Roads
- Township/Range
- 8 Sections

Folds (Washington DNR 1:100K mapping)

- Anticline (dashed where inferred). Sawteeth on upper plate.
- Syncline (dashed where inferred). Bar and ball on downthrown block.
- Monocline, anticlinal bend (dashed where inferred).

Faults (Washington DNR 1:100K mapping)

- Thrust fault (dashed where inferred).
- Normal fault (dashed where inferred).
- Fault, unknown offset (dashed where inferred).
- Strike-slip fault (dashed where inferred; arrows show relative motion)

High Prairie Well Monitoring Network and Knight-Dillacort Study Area

Knight-Dillacort Area Hydrogeologic Assessment
WRIA 30, Washington

Aspect CONSULTING	JUL-2015	BY: JMS / PPW	FIGURE NO. 1
	PROJECT NO. 090045-17B	REV BY: EAC	

GIS Path: T:\projects_8\WRIA30\090045-178 Knight\Dillacourt_HighPrairie\Delivered\Knight_Dillacourt\Hydrogeo Assessment\01_GW Level_Mon_Net.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 7/21/2015 || User: ecumbaker || Print Date: 7/21/2015

B West — B' East

High Prairie

Knight-Dillacort Study Area

Elevation in Feet (NGVD)

2400 / 2100 / 1800 / 1500 / 1200 / 900 / 600 / 300 / 0

0 / 3000 / 6000 / 9000 / 12000 / 15000 / 18000 / 21000 / 24000

T03NR13E-19R2 Offset: 1328' S
T03NR13E-20M1 Offset: 36' N
T03NR13E-20P1 Offset: 1335' N
T03NR13E-20K2 Offset: 44' N
T03NR13E-20J3 Offset: 48' N
T03NR13E-21M1 Offset: 51' S
T03NR13E-21L1 Offset: 58' S
T03NR13E-21Q1 Offset: 1349' N
T03NR13E-22N1 Offset: 1356' N
T03NR13E-22P2 Offset: 1361' N
T03NR13E-23M1 Offset: 77' N
T03NR13E-23L1 Offset: 70' N
T03NR13E-23H1 Offset: 1252' S
T03NR13E-24F1 Offset: 1264' N
T03NR13E-24G1 Offset: 1268' N
T03NR13E-24J2 Offset: 50' S
T03NR14E-19M1 Offset: 43' N
T03NR14E-19F1 Offset: 1271' N
T03NR14E-19J1 Offset: 0
T03NR14E-20N1 Offset: 1304' S
T03NR13E-19K1 Offset: 8' N
T03NR13E-19L1 Offset: 14' N

Klickitat River

Dillacort Canyon

Intersection Cross Section C-C'

Laurel Fault (Right-Lateral Strike-Slip)

Swale Creek

QMc

Mc (d)

Mv (wpr)

Mv (wr)

Mv (wfs)

Mv (g)

WB

5/- 12/- 15/- 20/- 20/- 30/- 20/- 20/- 25/- 20/0.13 100/- 28/- 50/- 3/- 7/0.07 15/- 15/- 50/- 40/- 20/- 85/-

?

Vertical Exaggeration = 10X
Scale: 1" = 3000' Horiz.
1" = 300' Vert.

0 3,000 6,000
Feet

Legend

- QMc - Continental sedimentary rocks
- Mc (d) - Dalles Formation
- Mc (e) - Ellensburg formation
- Mv (wpr) - Wanapum basalt, Priest rapids
- Mv (wr) - Wanapum basalt, Rosa
- Mv (wfs) - Wanapum basalt, Frenchman Springs
- Mv (g) - Grand Ronde Basalt
- Cased Borehole
- Open or Screened Borehole
- WB - Water Bearing Zone on drillers log
- Water level on drillers log
- 20/0.13 - Well Yield (gpm) from Driller's Log/Specific Capacity (gpm/ft)
- Fault/Fold

Note: Cross section originally presented in Aspect (2011)

Geologic Cross Section B-B'

Knight-Dillacort Hydrogeologic Assessment
WRIA 30, Washington

Aspect Consulting	JUL-2015	BY: DFR/SCC	FIGURE NO. 2
	PROJECT NO. 090045	REVISED BY: SCC	

CAD Path: Q:\WRIA\090045 WRIA 30\2015-07 Knight-Dillacort Hydrogeologic Assessment\090045-BB.dwg Cross Section B-B' || Date Saved: Jul 24, 2015 10:47am || User: scudd

C North — South C'

Knight-Dillacort Study Area

Intersection Cross Section A-A'

Laurel Fault (Right-Lateral Strike-Slip)

Dillacort Canyon

Intersection Cross Section B-B'

Thrust Fault

T03NR13E-3K1 Offset: 5' E

T03NR13E-3Q1 Offset: 8' E

T03NR13E-10L1 Offset: 1290' W

T03NR13E-15C1 Offset: 1274' W

T03NR13E-15P1 Offset: 1283' E

T03NR13E-22P1 Offset: 1332' W

T03NR13E-22P2 Offset: 1332' W

T03NR13E-22C1 Offset: 1290' W

T03NR13E-27B1 Offset: 25' E

T03NR13E-27G1 Offset: 17' W

T03NR13E-27K1 Offset: 9' W

T03NR13E-27Q1 Offset: 0

Mv (wpr)

Mv (wr)

Mv (wfs)

Mv (gr)

Qls

Mc (d)

3/-

8/0.08

18/-

10/-

10/-

25/-

10/-

30/-

20/-

11/-

15/-

15/-

85/-

2700

2400

2100

1800

1500

1200

Elevation in Feet (NGVD)

0 3000 6000 9000 12,000 15,000 18,000 21,000 24,000

Distance in Feet

Legend

- Qls - Landslide
- QMc - Continental Sedimentary Rocks
- Mc (d) - Dalles Formation
- Mc (e) - Ellensburg Formation
- Mv (wpr) - Wanapum Basalt, Priest Rapids
- Mv (wr) - Wanapum Basalt, Rosa
- Mv (wfs) - Wanapum Basalt, Frenchman Springs
- Mv (gr) - Grand Ronde Basalt
- Cased Borehole
- Open or Screened Borehole
- Deepened Well
- WB - Water Bearing Zone on Drillers Log
- Water Level on Drillers Log
- Water Level (2014)
- 20/0.13 - Well Yield (gpm) from Driller's Log/Specific Capacity (gpm/ft)
- Fault/Fold

Note: Cross section is modified from that presented in Aspect (2011)

Vertical Exaggeration = 10X
Scale: 1" = 2000' Horiz.
1" = 200' Vert.

0 2000 4000 Feet

Geologic Cross Section C-C'

Knight-Dillacort Hydrogeologic Assessment
WRIA 30, Washington

Aspect Consulting	JUL-2015	BY: DFR/SCC	FIGURE NO. 3
	PROJECT NO. 090045	REVISED BY: SCC	

CAD Path: Q:\WRIA\090045 WRIA 30\2015-07 Knight-Dillacort Hydrogeologic Assessment\090045-CC Detail.dwg Cross Section CC' (2) || Date Saved: Jul 21, 2015 11:54am || User: scudd

Notes:
Any depth-to-water measurements from Table 6 which had non-static water levels were not included in the hydrographs.

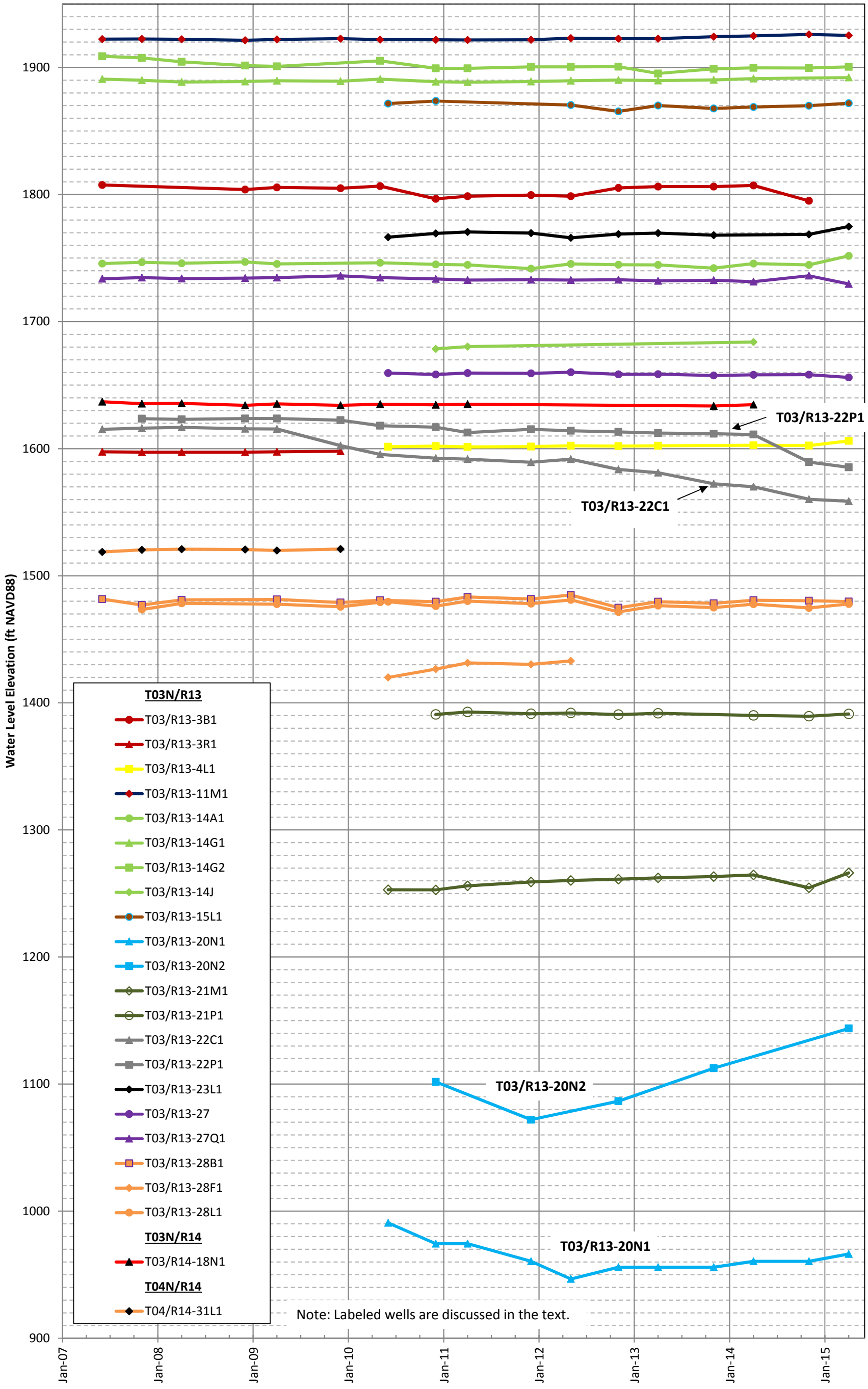
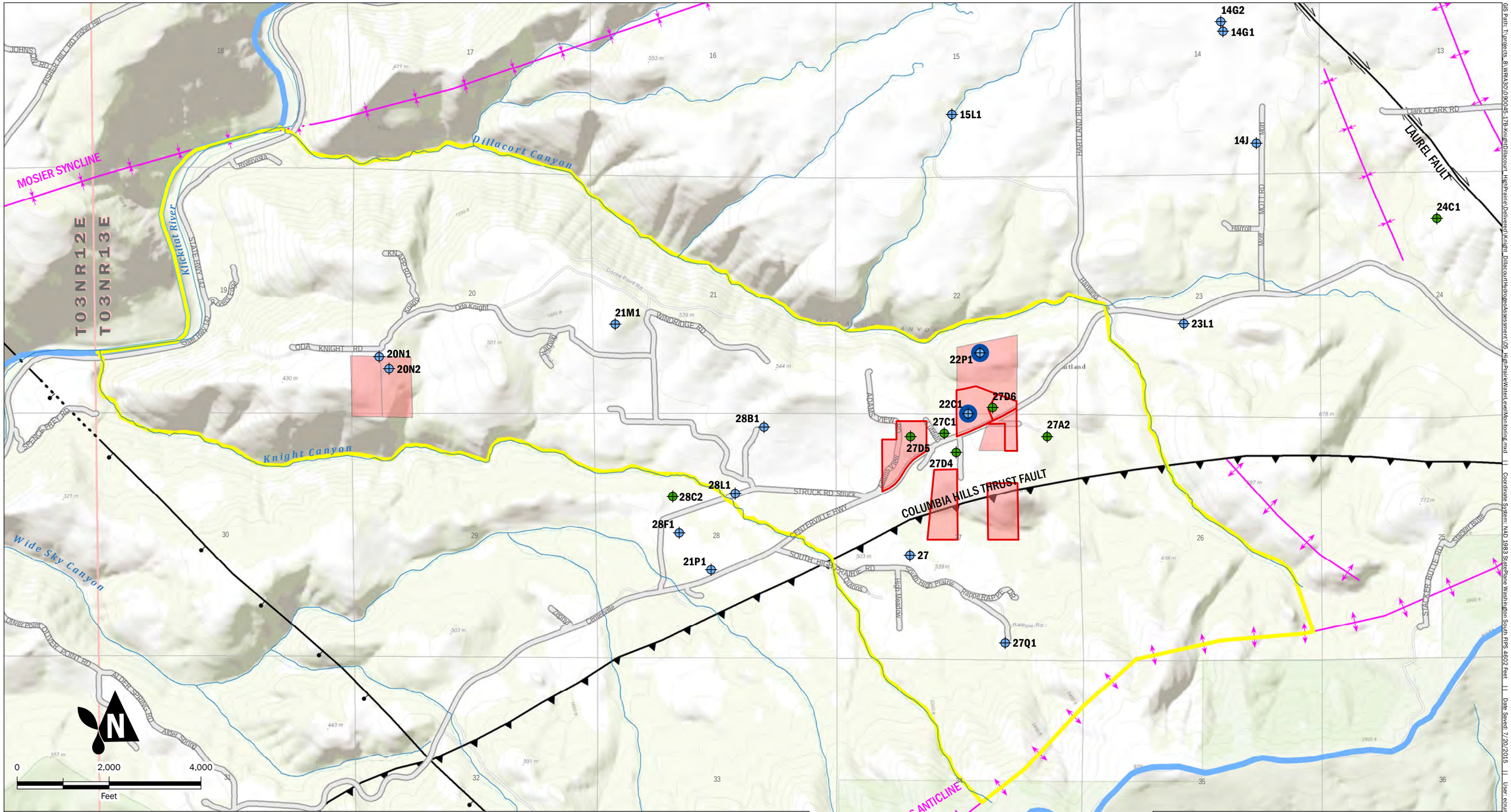


Figure 4 - High Prairie Monitoring Network Water Level Hydrographs
Hydrogeologic Assessment
Knight-Dillacort Area of High Prairie



High Prairie Well Network

- Monitoring Started 2015
- 3B1 Monitored Since 2010 or Earlier
- Monitoring Network Well with Documented Ongoing Water Level Decline
- Knight-Dillacort Study Area
- High Prairie Area
- Parcels with Well Deepened Since 2010
- Parcels with Observed Decline in Groundwater Level or Yield
- Roads
- Township/Range
- 8 Sections

Folds (Washington DNR 1:100K mapping)

- Anticline (dashed where inferred).
- Syncline (dashed where inferred).
- Monocline, anticlinal bend (dashed where inferred).

Faults (Washington DNR 1:100K mapping)

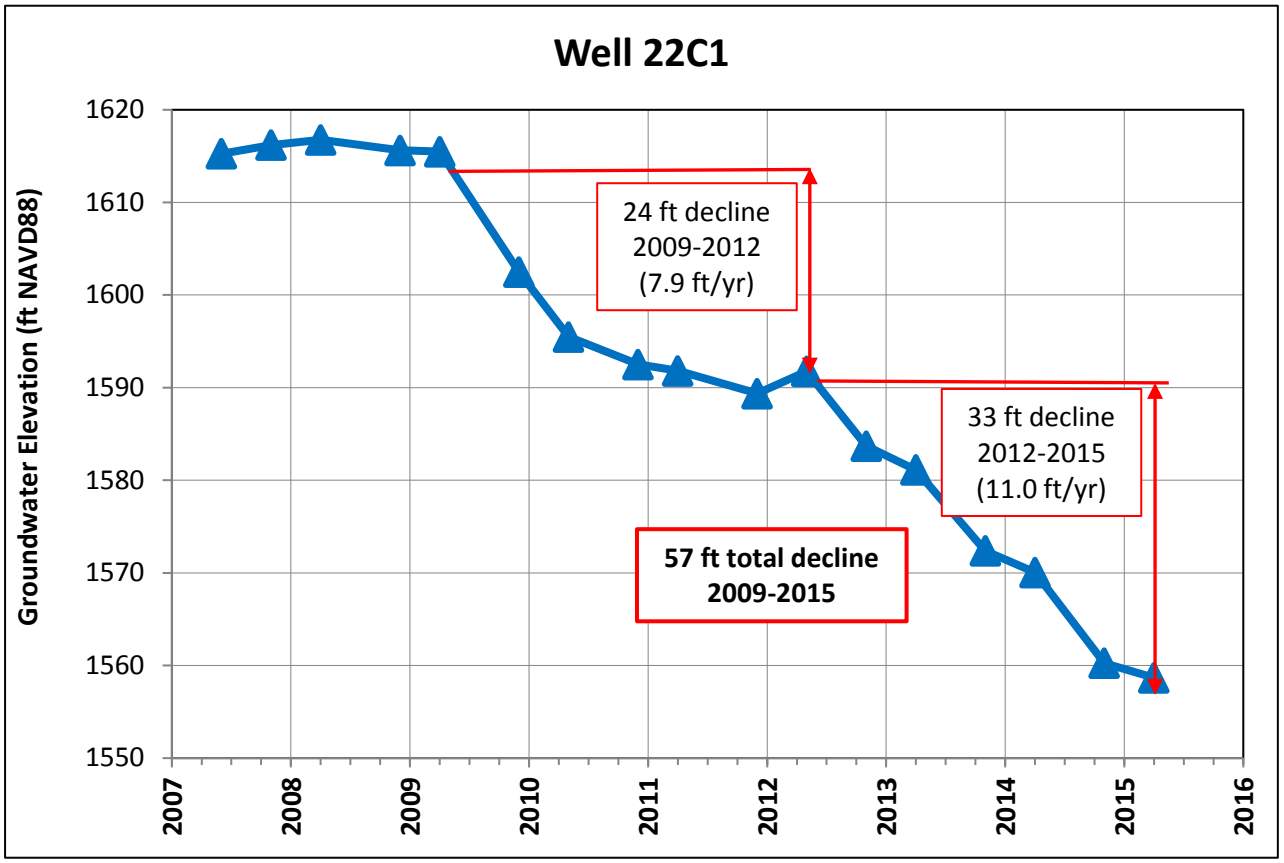
- Thrust fault (dashed where inferred). Sawteeth on upper plate.
- Normal fault (dashed where inferred). Bar and ball on downthrown block.
- Fault, unknown offset (dashed where inferred).
- Strike-slip fault (dashed where inferred; arrows show relative motion)

Areas with Reported Groundwater Declines and Recently Deepened Wells

Knight-Dillacort Area Hydrogeologic Assessment
WRIA 30, Washington

Aspect Consulting	JUL-2015	BY: JMS / PPW	FIGURE NO. 5
	PROJECT NO. 090045-17B	REVISED BY: EAC	

GIS Path: T:\projects_8\WRIA30\090045-178 Knight\Dillacourt_HighPrairie\Delivered\Knight_Dillacourt\Hydrogeo Assessment\06_HighPrairieWellsLevelMonitoring.mxd | | Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet | | Date Saved: 7/20/2015 | | User: ecrumbaker | | Print Date: 7/21/2015



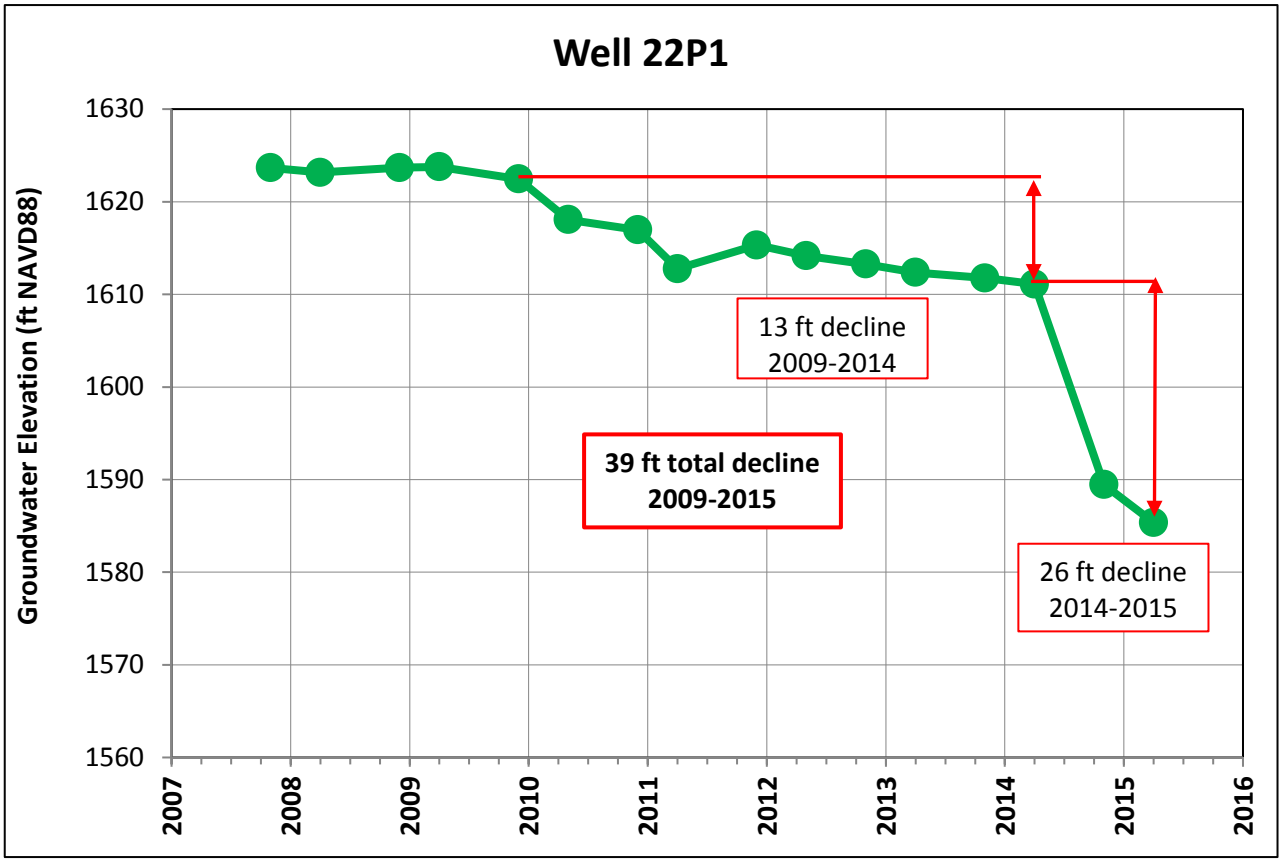
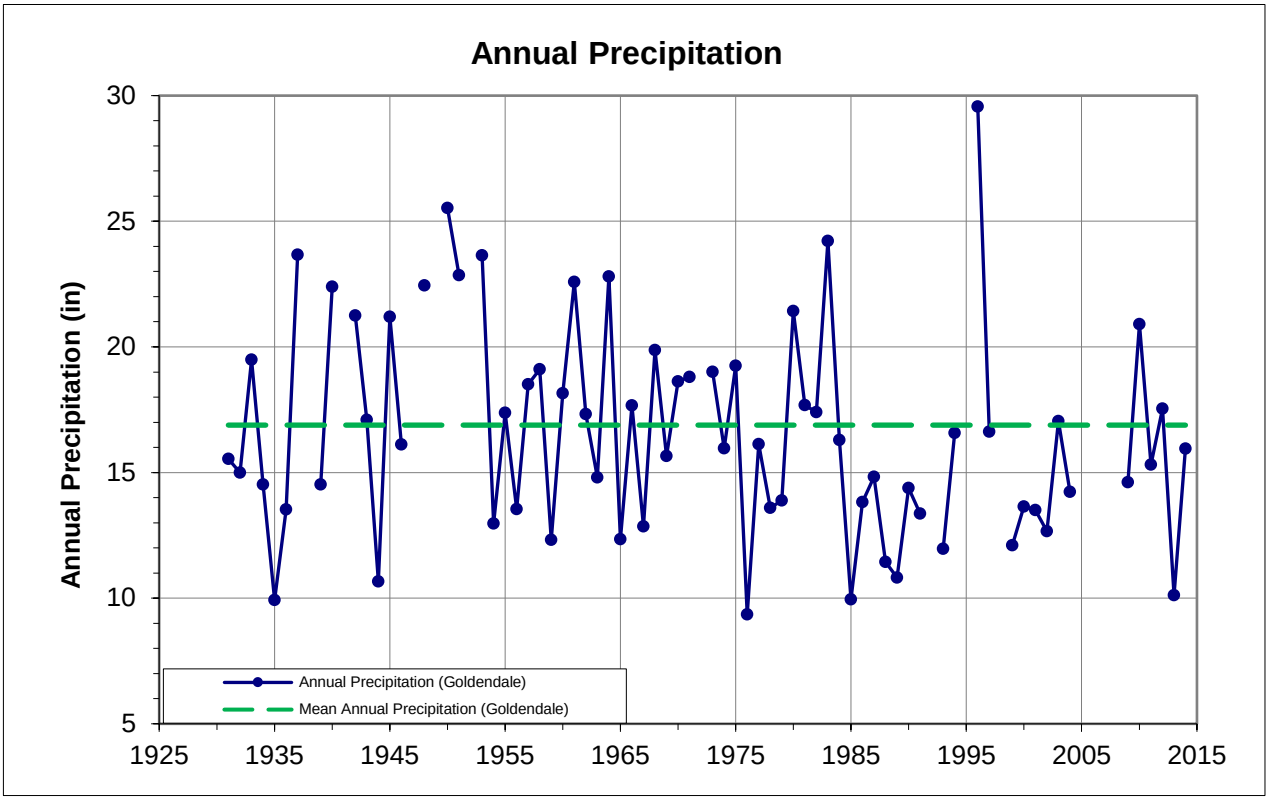
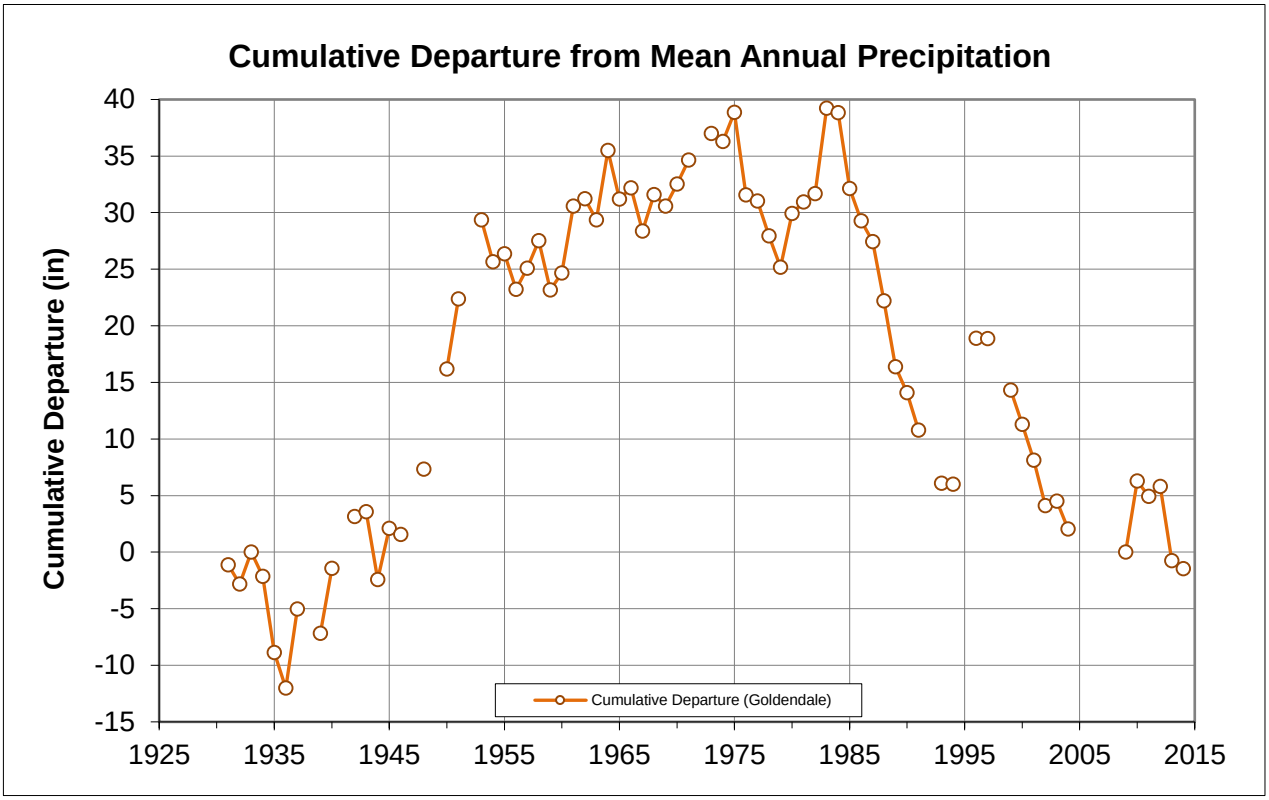


Figure 6
Measured Water Level Declines, Eastern Knight-Dillacort Area

Aspect Consulting
7/27/2015
W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Tables & Figures\Tables 1&2 + Figs 4 6-7 9-11.xlsx





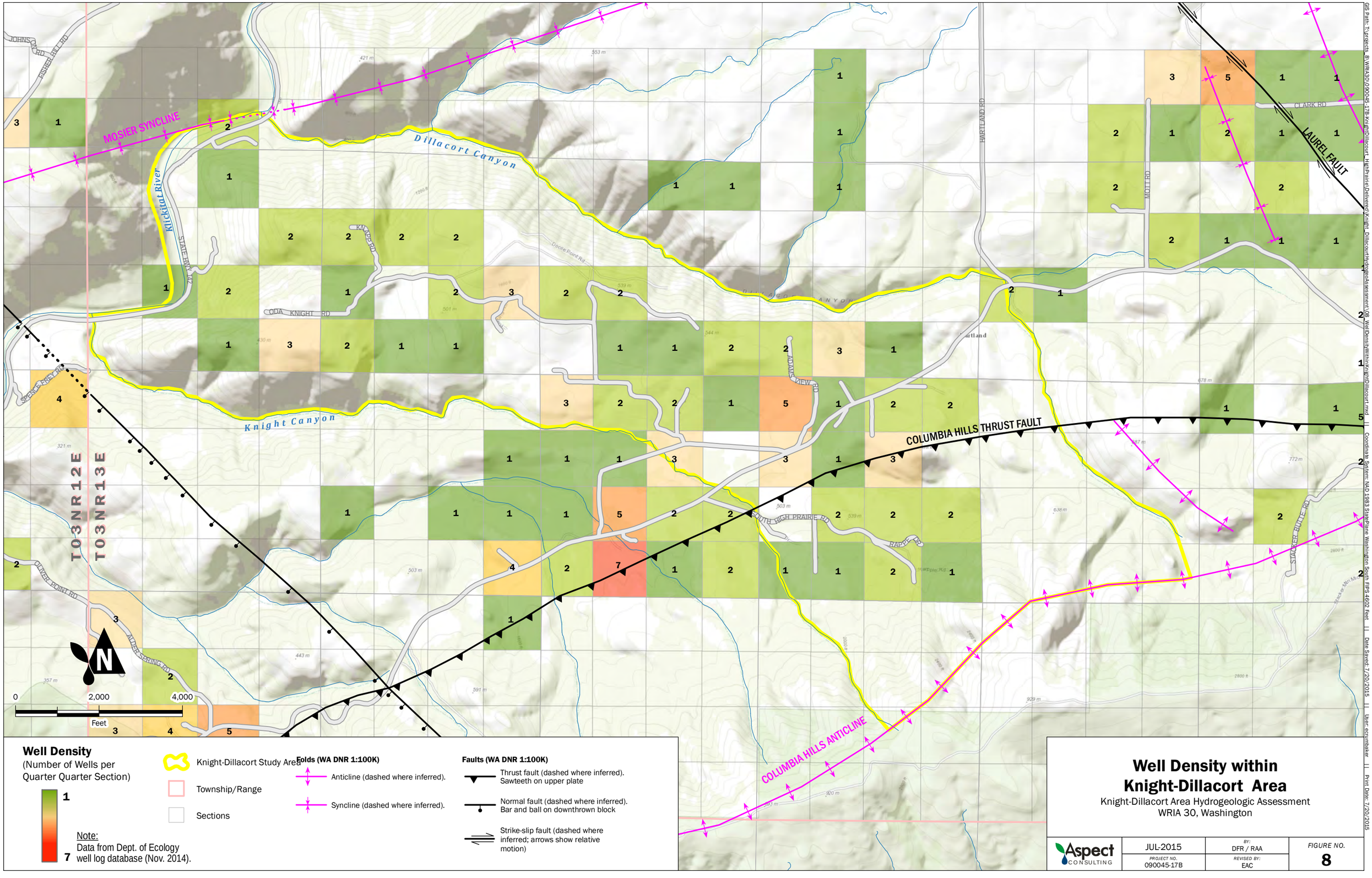
Notes:

Considered most applicable and reliable for evaluating long-term trends for High Prairie, the annual precipitation data are from Goldendale station (NOAA #453222) and Goldendale 2E station (NOAA #453226). While the magnitude of preciptation will be different from High Prairie, the trends (above or below normal) should be comparable.

Individual months with more than 5 days of missing data were not used for either monthly or annual statistics.

Aspect Consulting
7/27/2015
W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Tables & Figures\ Tables 1&2 + Figs 4 6-7 9-11.xlsx

Figure 7
Long-Term Precipitation Trends



Well Density
(Number of Wells per Quarter Quarter Section)

1 — 7

Note:
Data from Dept. of Ecology well log database (Nov. 2014).

- Knight-Dillacort Study Area
- Township/Range
- Sections

Folds (WA DNR 1:100K)

- Anticline (dashed where inferred).
- Syncline (dashed where inferred).

Faults (WA DNR 1:100K)

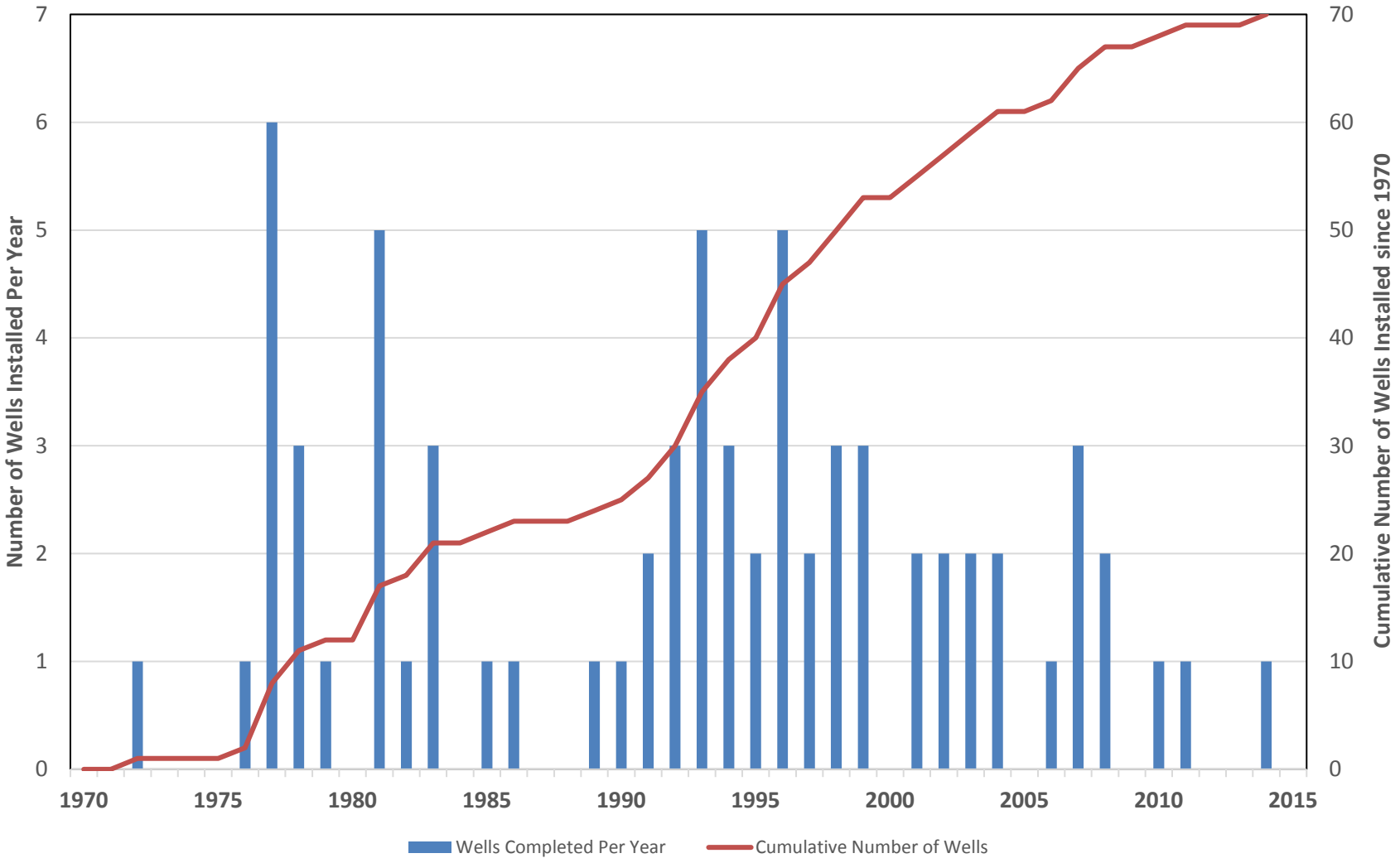
- Thrust fault (dashed where inferred). Sawteeth on upper plate
- Normal fault (dashed where inferred). Bar and ball on downthrown block
- Strike-slip fault (dashed where inferred; arrows show relative motion)

Well Density within Knight-Dillacort Area

Knight-Dillacort Area Hydrogeologic Assessment
WRIA 30, Washington

Aspect CONSULTING	JUL-2015	BY: DFR / RAA	FIGURE NO. 8
	PROJECT NO. 090045-17B	REVISED BY: EAC	

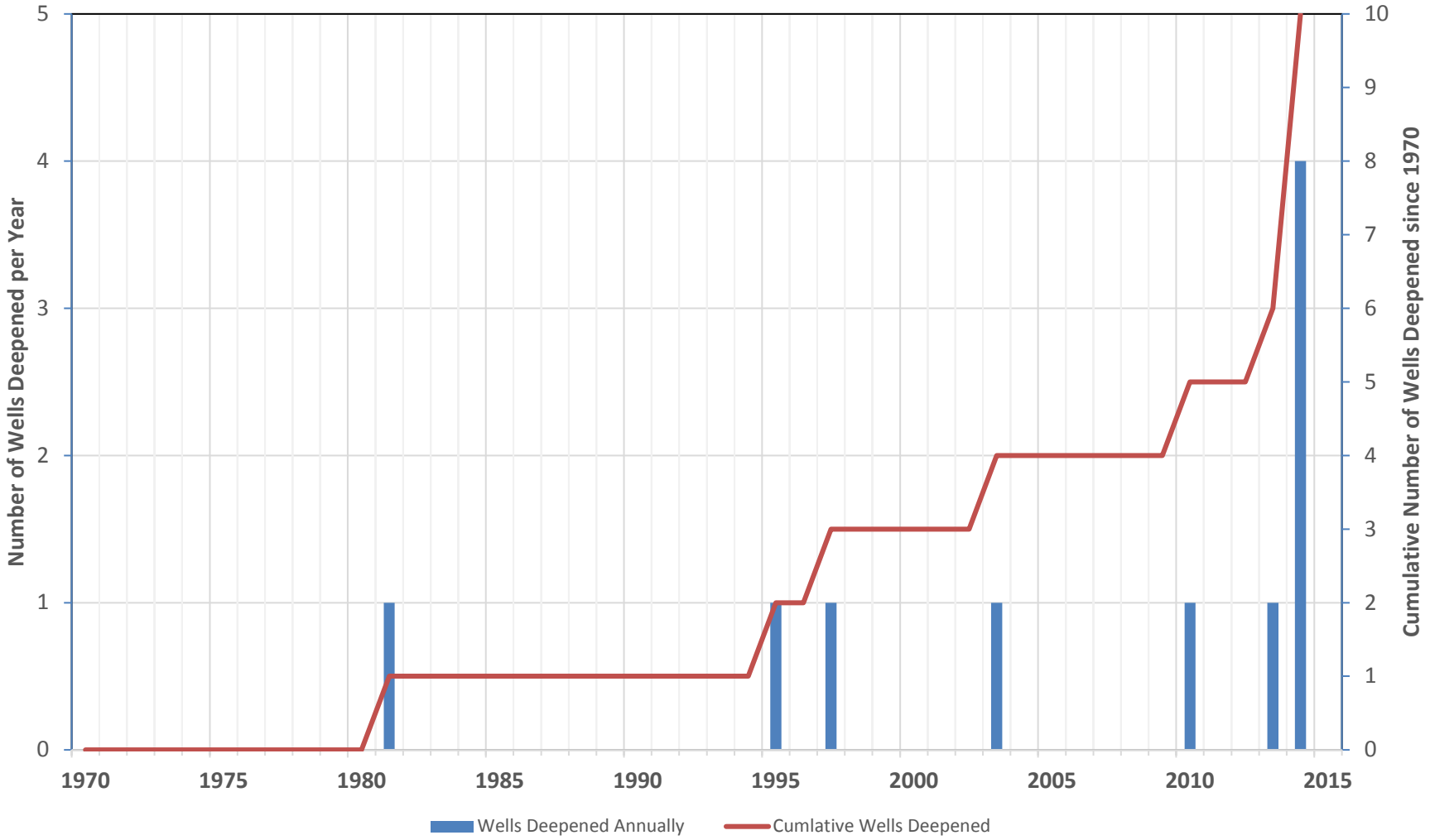
GIS Path: T:\projects_8\WRIA30\090045-178 Knight\Dillacourt_Hgl\Prairie\Delivered\Knight_Dillacourt\Hydrogeo Assessment\06_Well Density\Within\Knight\Dillacourt.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 7/20/2015 || User: eccumbaker || Print Date: 7/20/2015



Wells within Sections 21, 22, 27, and 28 of Township 3 North Range 13 East. Data based on Ecology well log database.

Aspect Consulting
7/27/2015
W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Tables & Figures\Tables 1&2 + Figs 4 6-7 9-11.xlsx

Figure 9
Number of Well Installations Over Time



Wells within Sections 21, 22, 27, and 28 of Township 3 North Range 13 East. Data based on Ecology well log database.

Aspect Consulting
7/27/2015
W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Tables & Figures\Tables 1&2 + Figs 4 6-7 9-11.xlsx

Figure 10
Number of Wells Deepened Over Time

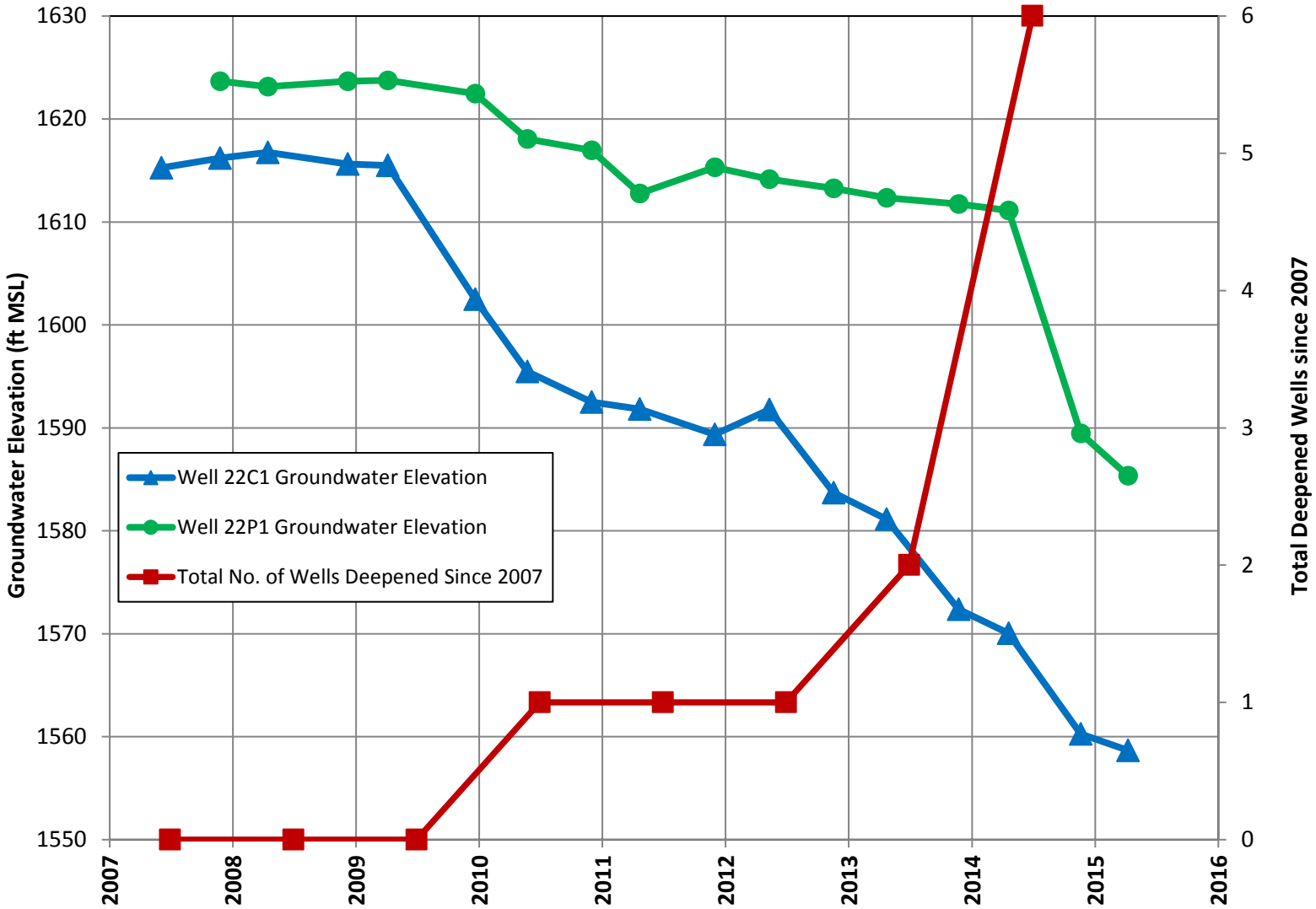
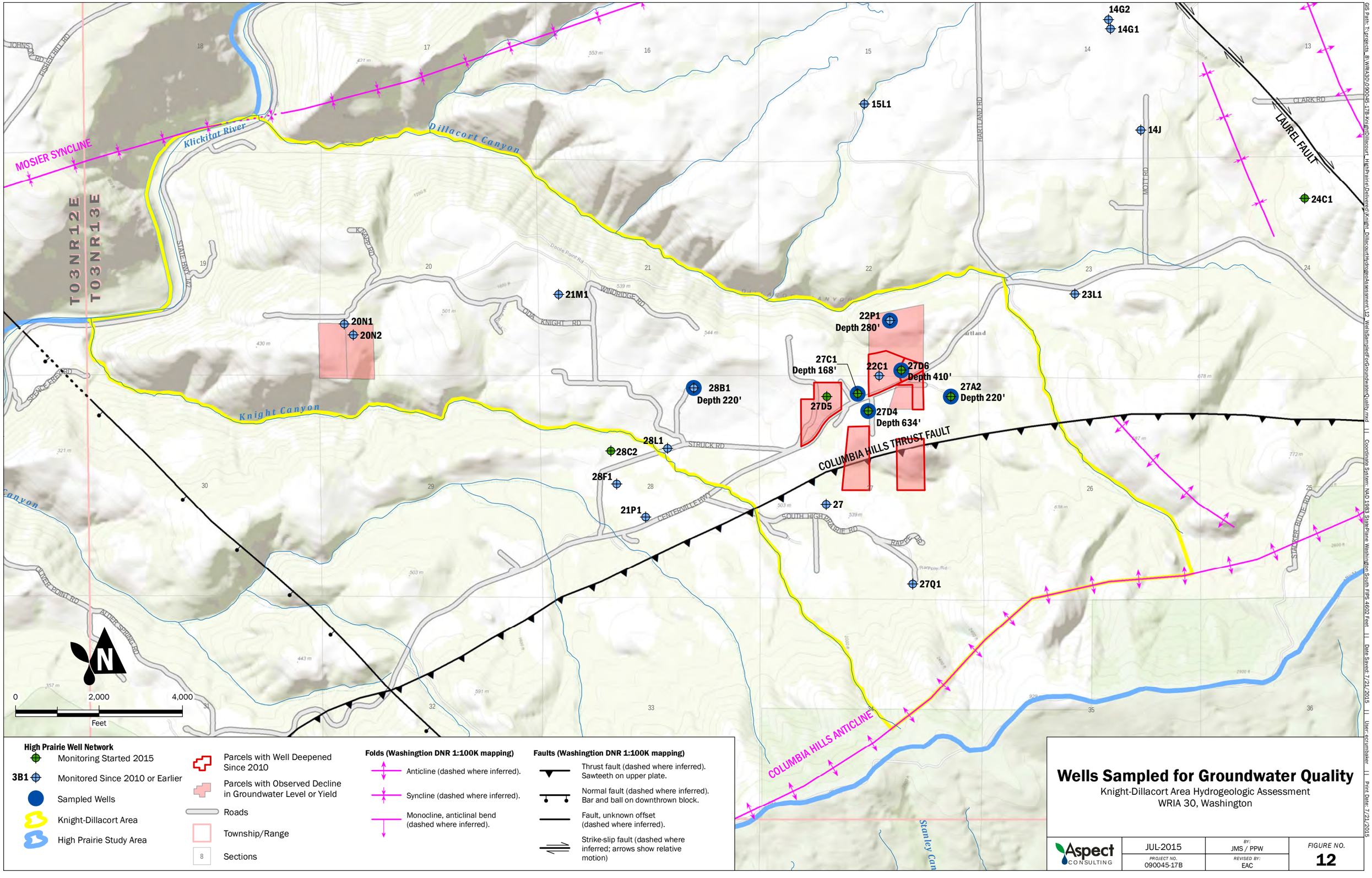


Figure 11
Timing of Water Level Declines and Local Well Deepenings



High Prairie Well Network

- Monitoring Started 2015
- 3B1 Monitored Since 2010 or Earlier
- Sampled Wells
- Knight-Dillacort Area
- High Prairie Study Area
- Parcels with Well Deepened Since 2010
- Parcels with Observed Decline in Groundwater Level or Yield
- Roads
- Township/Range
- 8 Sections

Folds (Washington DNR 1:100K mapping)

- Anticline (dashed where inferred).
- Syncline (dashed where inferred).
- Monocline, anticlinal bend (dashed where inferred).

Faults (Washington DNR 1:100K mapping)

- Thrust fault (dashed where inferred). Sawteeth on upper plate.
- Normal fault (dashed where inferred). Bar and ball on downthrown block.
- Fault, unknown offset (dashed where inferred).
- Strike-slip fault (dashed where inferred; arrows show relative motion)

Wells Sampled for Groundwater Quality

Knight-Dillacort Area Hydrogeologic Assessment
WRIA 30, Washington

Aspect Consulting	JUL-2015	BY: JMS / PPW	FIGURE NO. 12
	PROJECT NO. 090045-17B	REVISED BY: EAC	

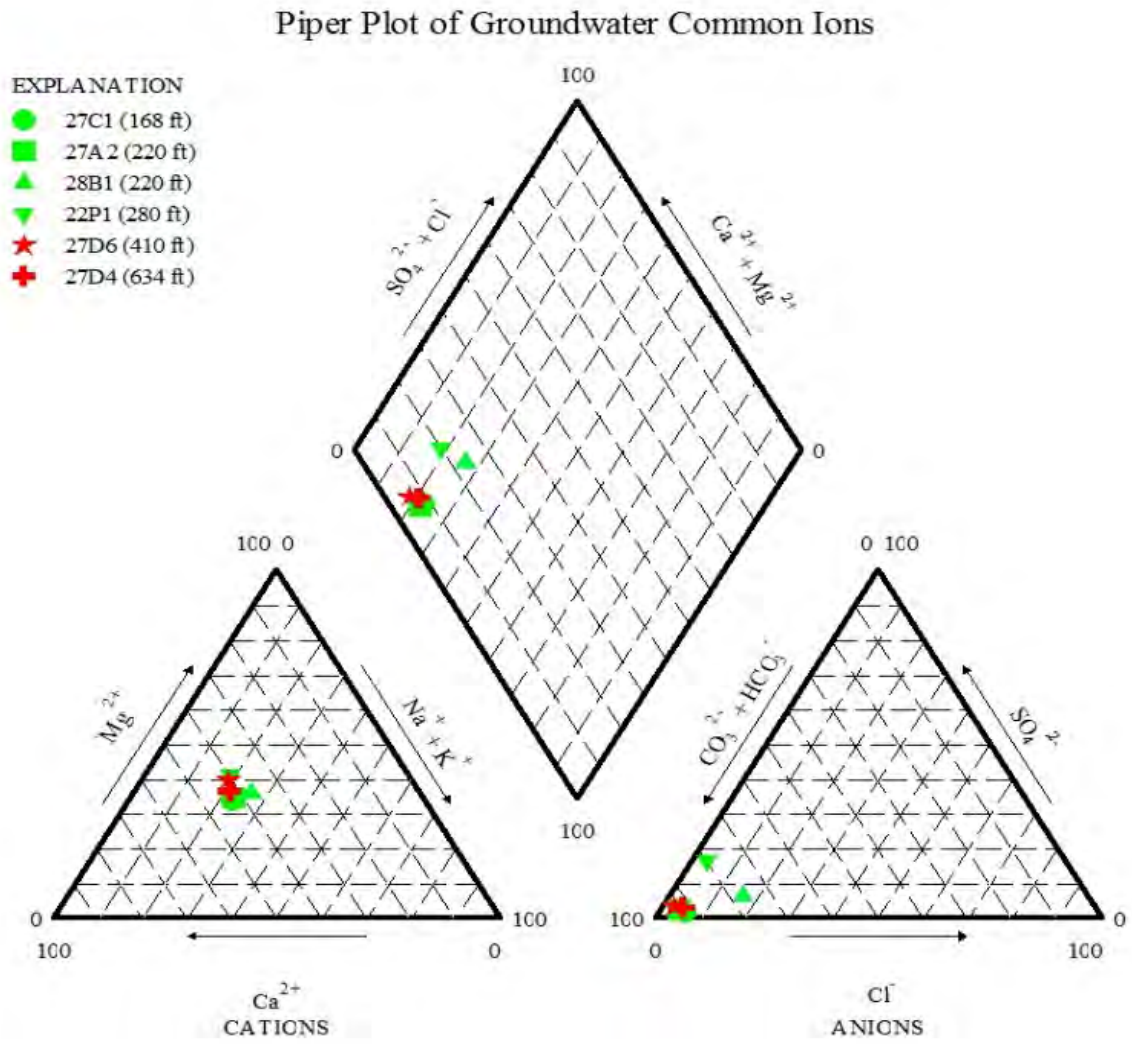
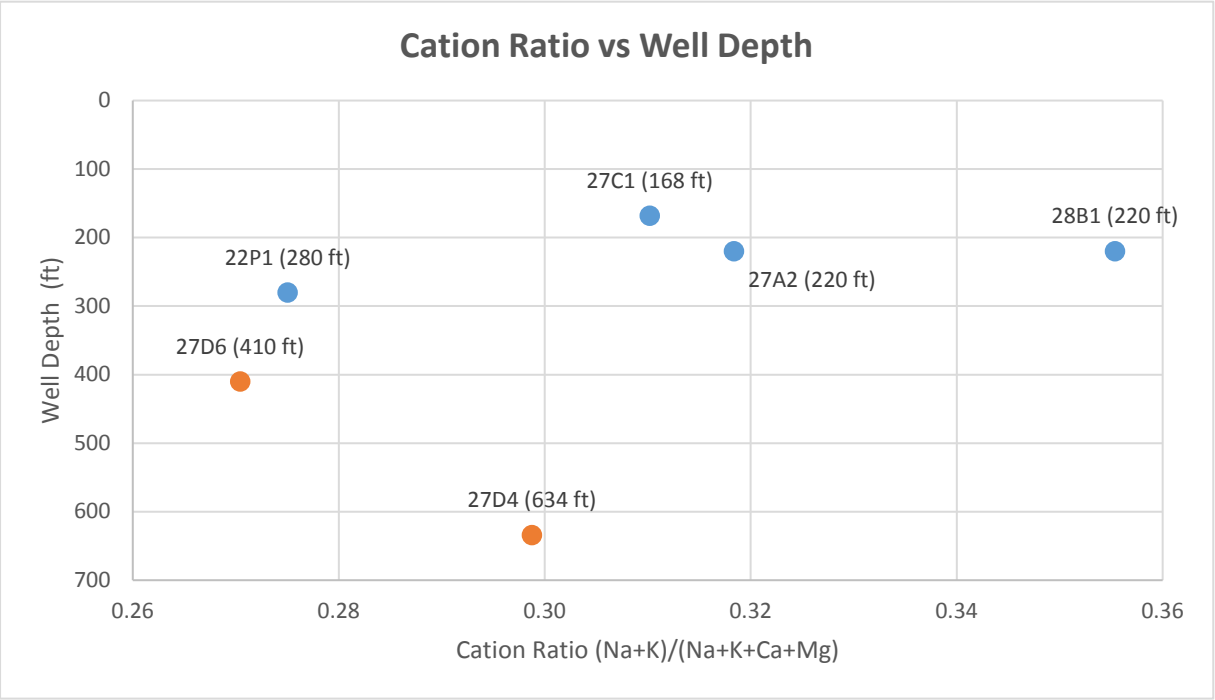


Figure 13
Piper Plot of Groundwater Common Ion Concentrations



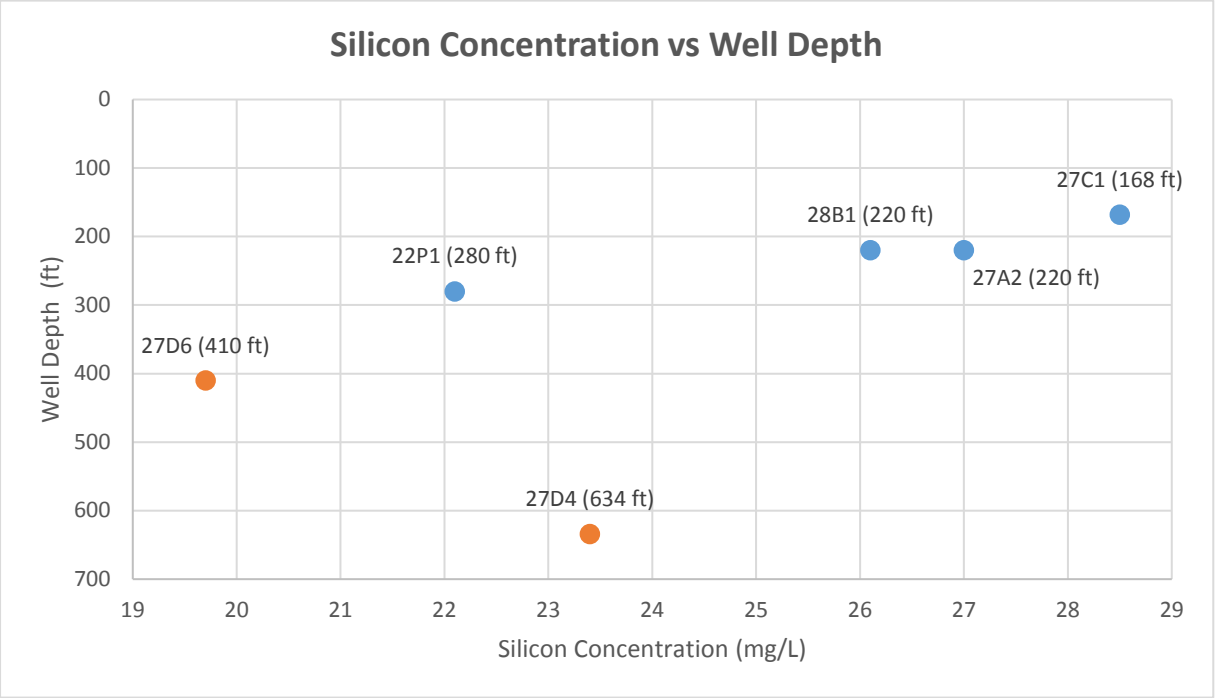
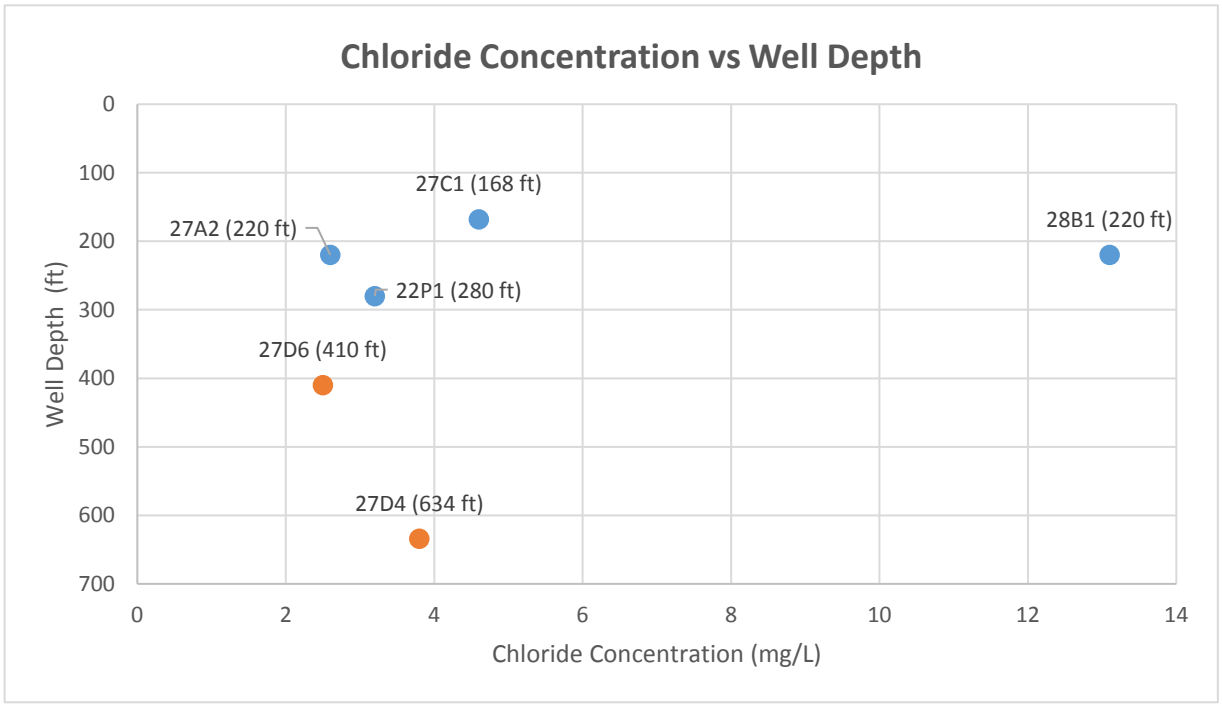
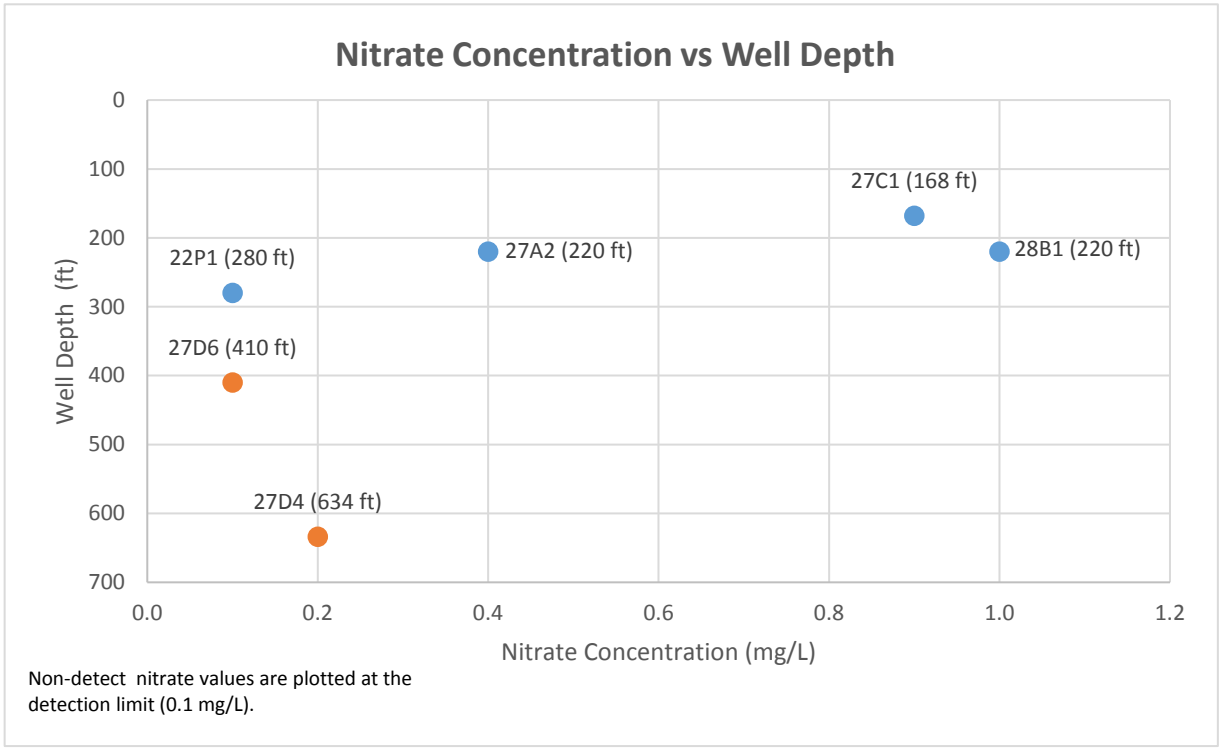


Figure 14
Groundwater Cation Ratios and Silicon Concentrations vs Well Depth

Aspect Consulting
7/27/2015
W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Tables & Figures\Table 3 + Figs 13 14 15 16 GW Quality.xlsx

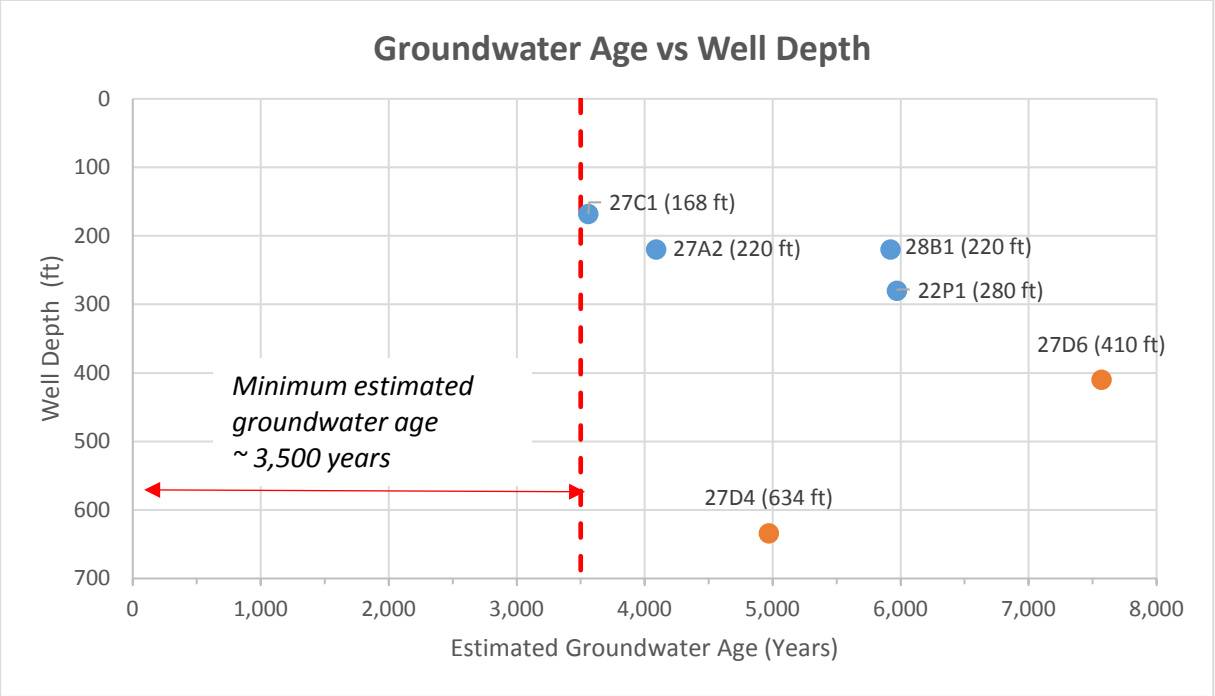




Non-detect nitrate values are plotted at the detection limit (0.1 mg/L).

Figure 15
Groundwater Chloride and Nitrate Concentrations vs Well Depth

Aspect Consulting
7/27/2015
W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Tables & Figures\Table 3 + Figs 13 14 15 16 GW Quality.xlsx



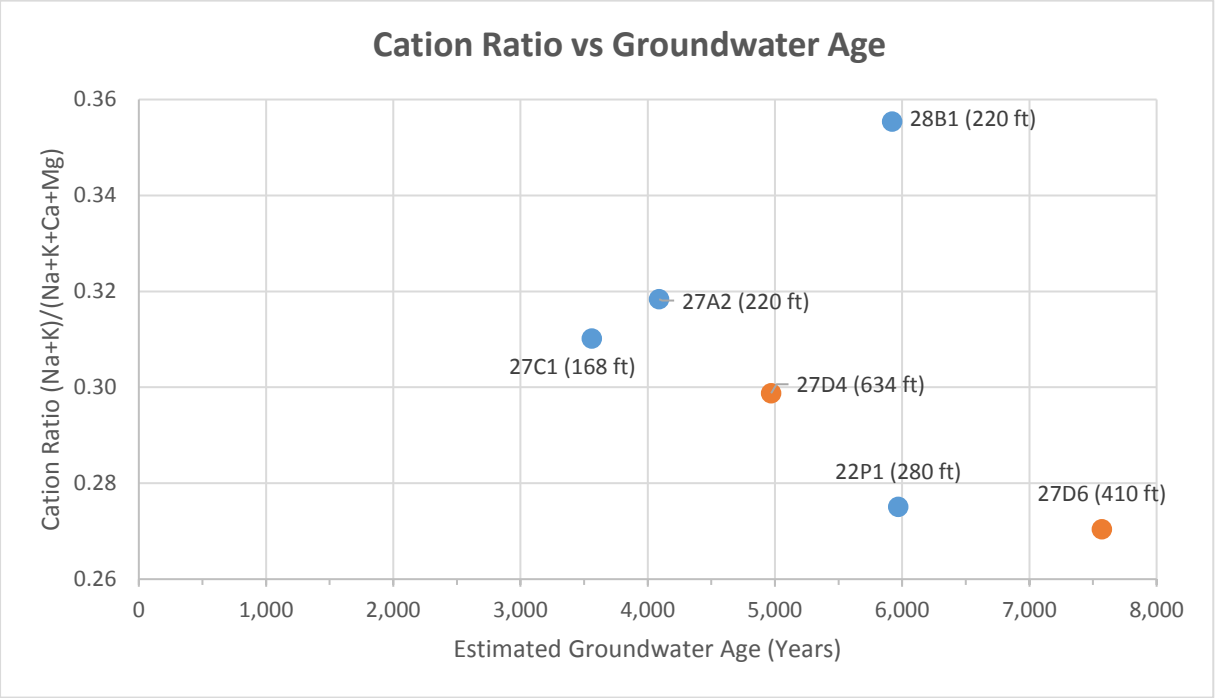
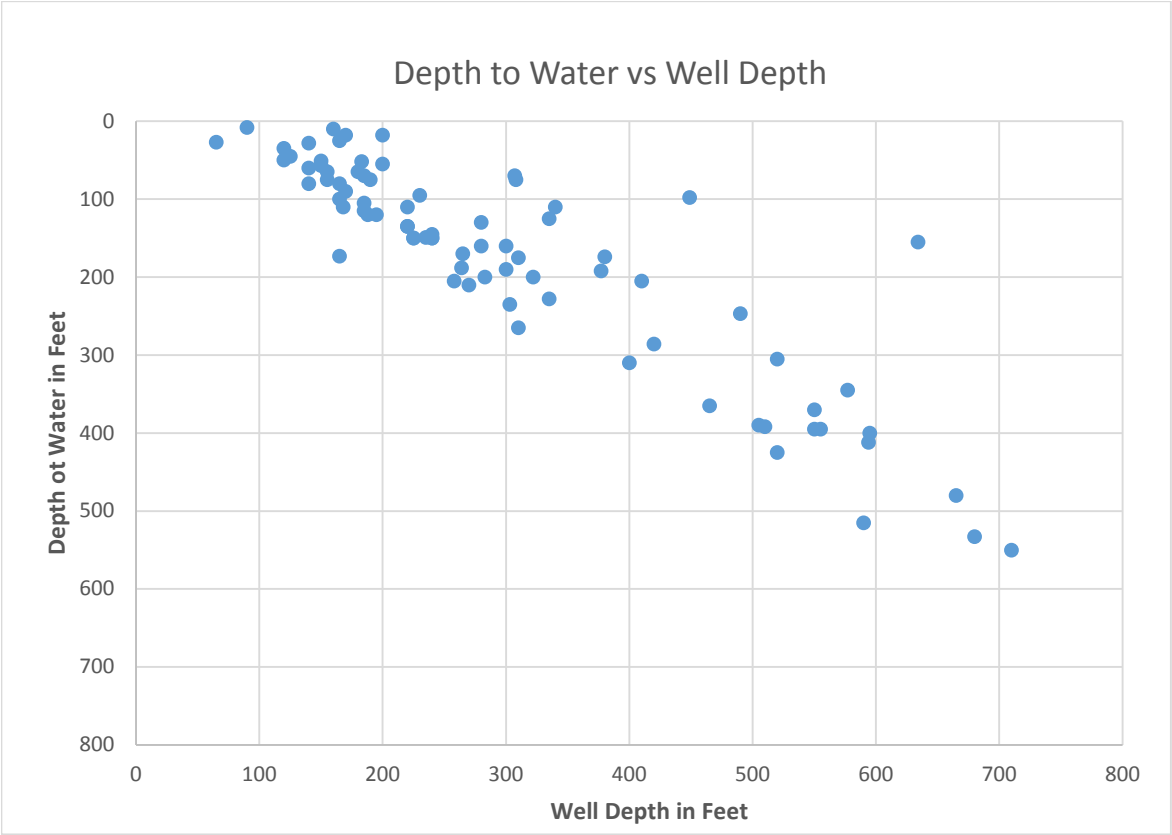


Figure 16
Groundwater Age vs Well Depth and Cation Ratio

Aspect Consulting
7/27/2015
W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Tables & Figures\Table 3 + Figs 13 14 15 16 GW Quality.xlsx



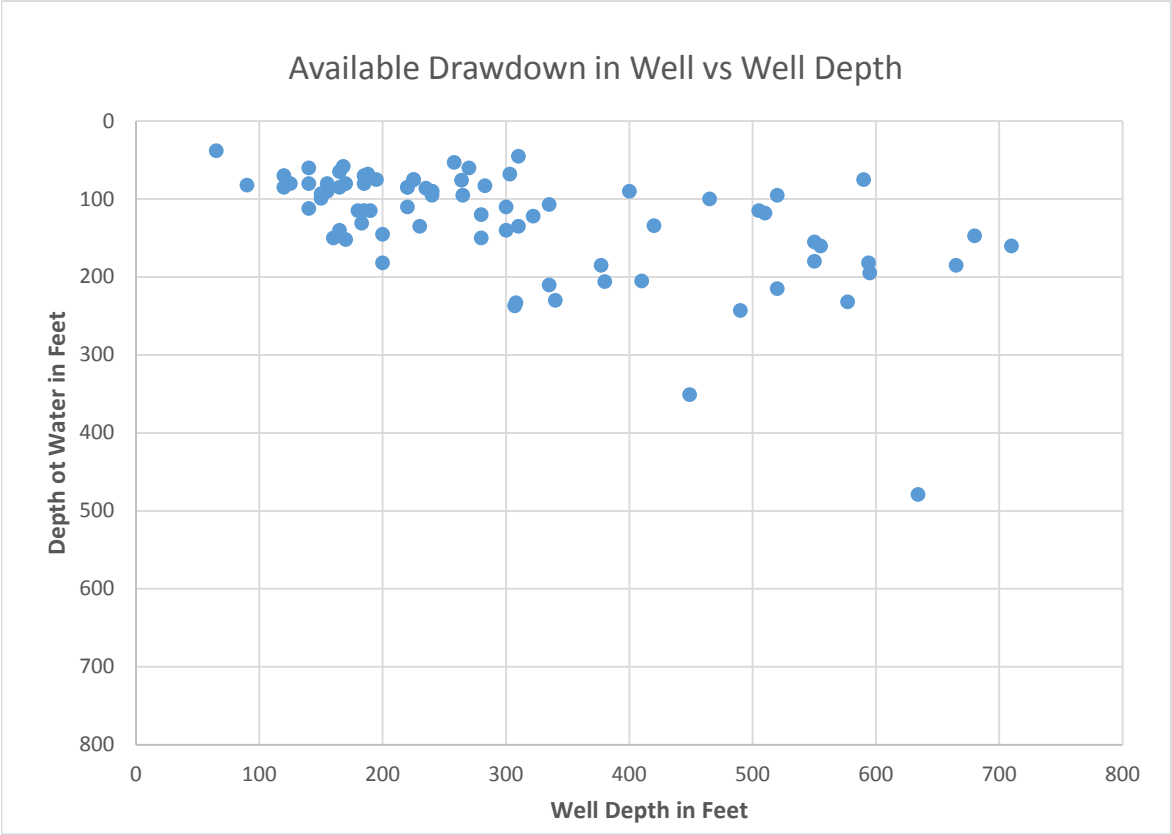
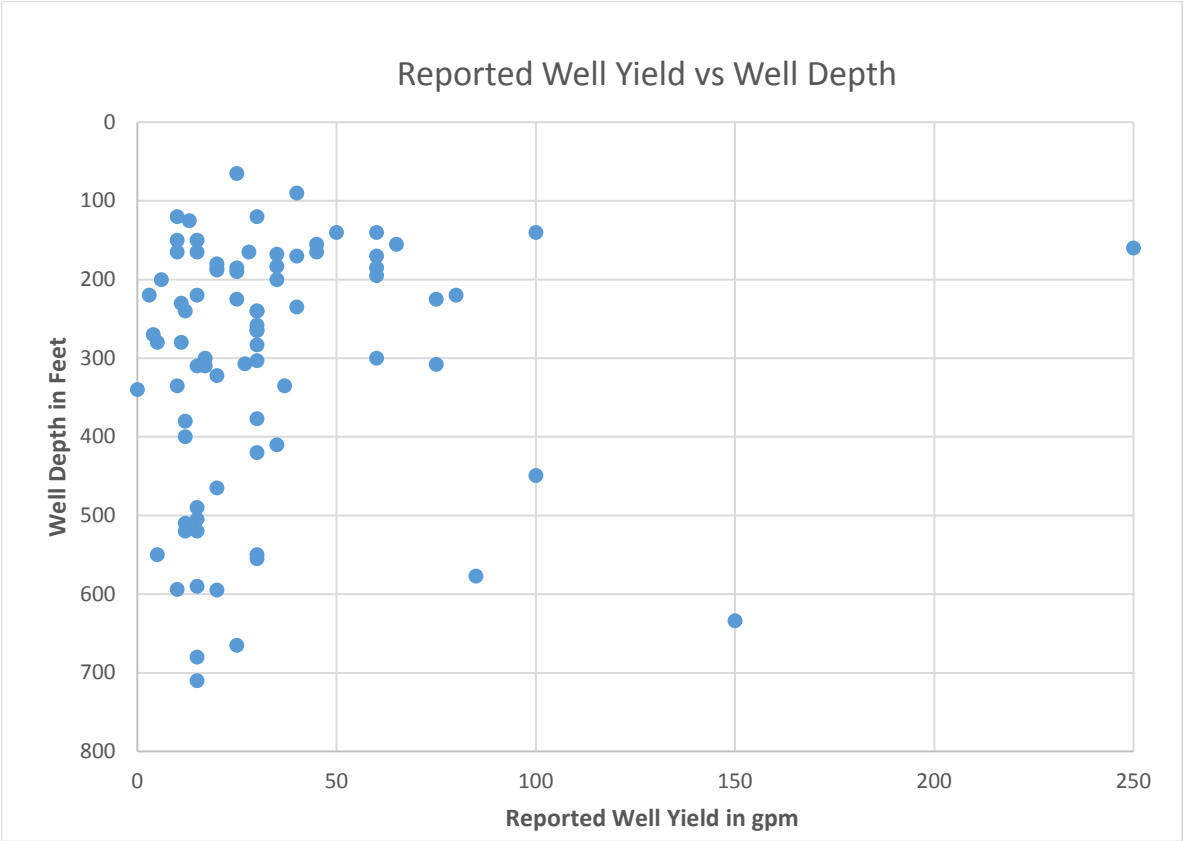


Figure 17
Well Available Drawdown vs Well Depth



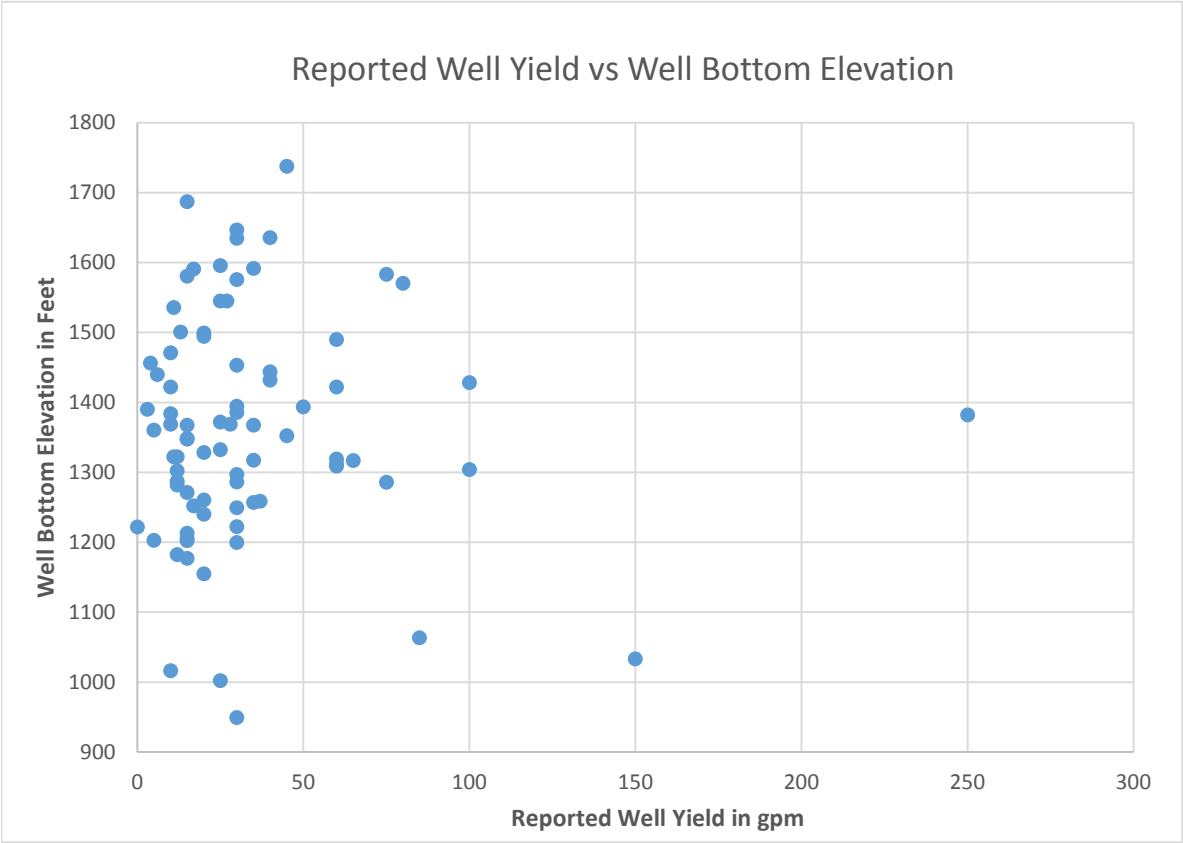
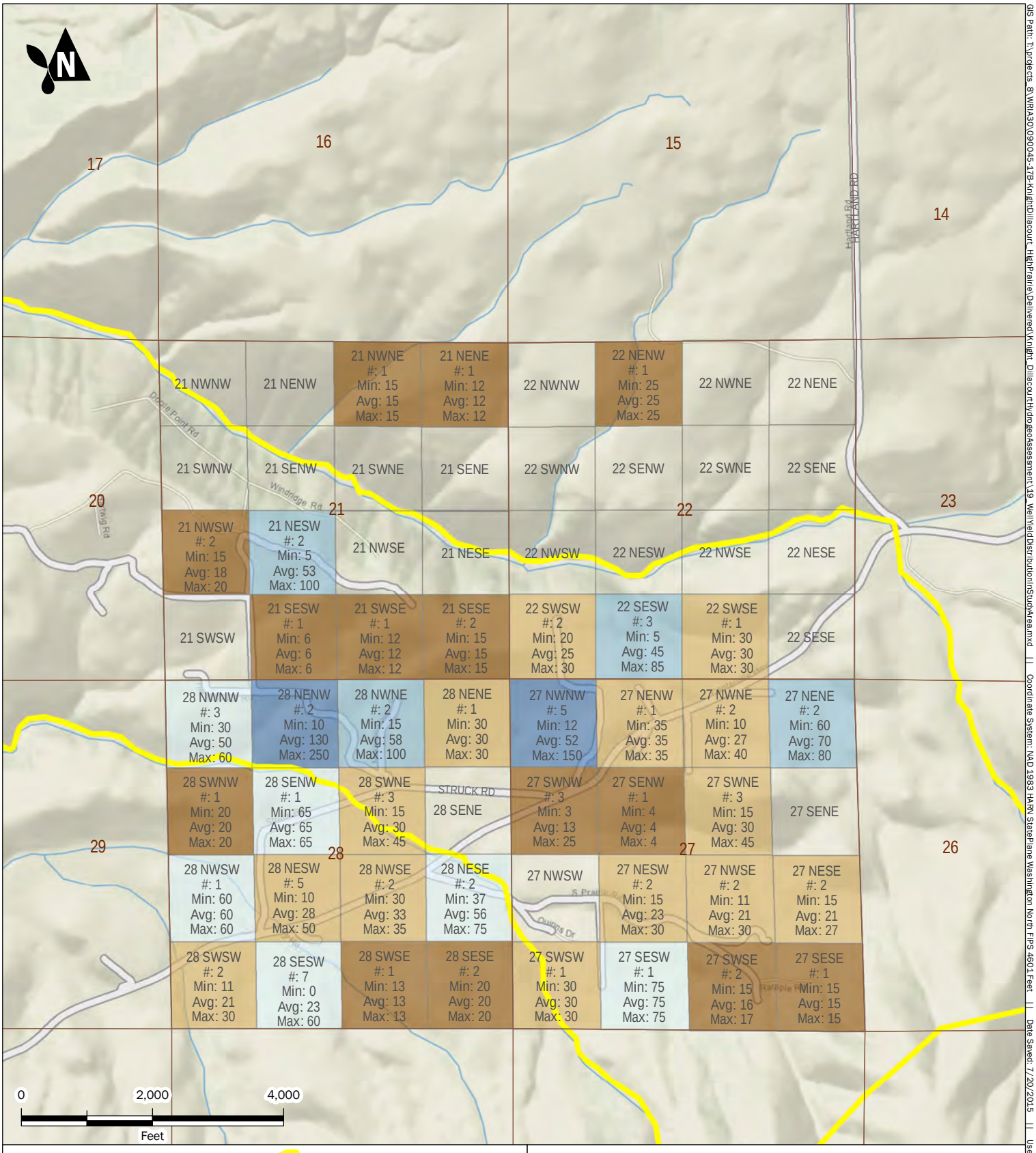


Figure 18
Reported Well Yield vs Well Depth



Maximum Yield (gallons/minute)

- NA
- < 25
- 25 - 50
- 50 - 75
- 75 - 100
- 100 - 250

- Knight-Dillacort Study Area
- Township & Range
- Sections
- Roads

Well Yield Data by Quarter-Quarter Section as Reported on Driller's Logs
Quarter-quarter section designation
#: No. of wells
Min: Minimum yield (gpm)
Avg: Average Yield (gpm)
Max: Maximum Yield (gpm)

Quarter-quarter sections are color coded by reported maximum yield.

Reported Well Yield Distribution in Study Area

Knight-Dillacort Area Hydrogeologic Assessment
WRIA 30, Washington

Aspect Consulting	JUL-2015	BY: MML / EAC	FIGURE NO. 19
	PROJECT NO. 090045-17B-01	REVISED BY: ---	

GIS Path: T:\projects_8\WRIA30\090045-17B-KnightDillacourt_HighPrairie\Delivered\Knight_DillacourtHydrogeoAssessment\19_WellYieldDistributionInStudyArea.mxd || Coordinate System: NAD 1983 HARN StatePlane Washington North FIPS 4601 Feet || Date Saved: 7/20/2015 || User: eorumbaker || Print Date: 7/22/2015

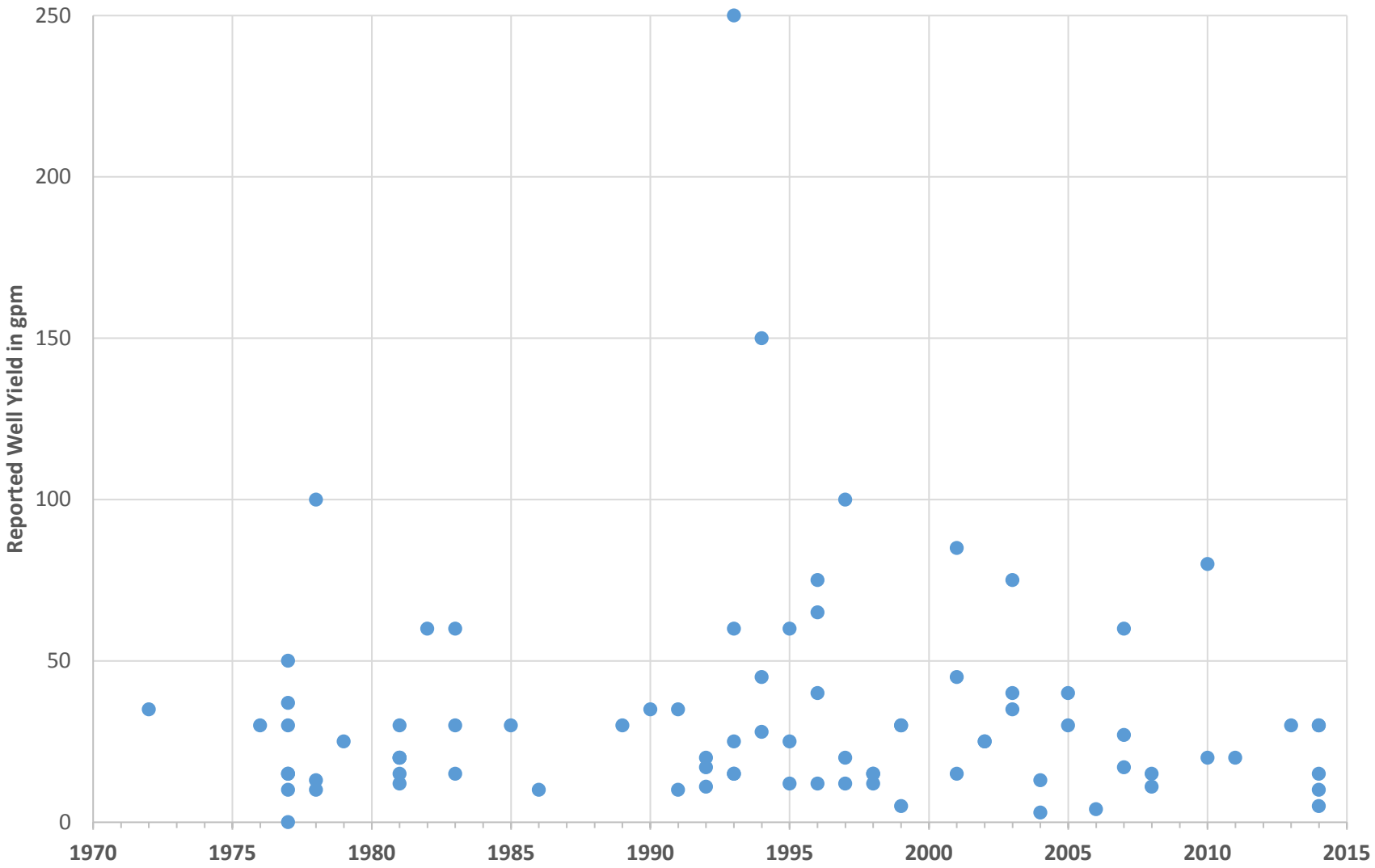


Figure 20
Reported Well Yield vs Year of Well Installation

Aspect Consulting
7/27/2015
W:\090045 WRIA 31 Phase 4\Deliverables\Hydrogeologic Assessment\Tables & Figures\Fig 20.xlsx

APPENDIX A

Laboratory Certificates of Analysis for Groundwater Analyses

Analytical Resources, Incorporated
Analytical Chemists and Consultants

28 April 2015

Dave Rugh
Aspect Consulting
401 Second Avenue South, Suite 201
Seattle, WA 98104

RE: WRIA 30, 070024
ARI Job: AEL6

Dear Dave:

Please find enclosed the original chain of custody (COC) record and the final results for the samples from the project referenced above. Analytical Resources, Inc. accepted six water samples on April 16, 2015. The samples were analyzed for Total metals, dissolved silicon and conventional parameters as requested.

No analytical complications were noted.

An electronic copy of these reports and all associated raw data will be kept on file at ARI. If you have questions or require additional information. please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Mark D. Harris
Project Manager
206/695-6210
markh@arilabs.com

Enclosures

cc: file AEL6

MDH/mdh

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: AEL6	Turn-around Requested	Page 1	of 1
ARI Client Company: Aspect Consulting	Phone 206-838-5837	Date 4/16/15	Ice Present?
Client Contact: Dave Rugh		No of Coolers	Cooler Temps:
Client Project Name: ~~WRIA 30~~ WRIA 30			
Client Project #: 070024	Samplers: SMB		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No Containers	Analysis Requested: Ca, Mg, Na, K, Cl, F	SO4, NO3	Dissolved Si	S.O2	Alkalinity				Notes/Comments
27A2-041515	4/15/15	0855	water	4	X	X	X	X	X				
27D6-041515	"	1040	"	"	"	"	"	"	"				
28B1-041515	"	1220	"	"	"	"	"	"	"				
22P1-041515	"	1345	"	"	"	"	"	"	"				
27C1-041515	"	1510	"	"	"	"	"	"	"				
27D4-041515	"	1620	"	"	"	"	"	"	"				

Comments/Special Instructions	Relinquished by (Signature)	Received by (Signature)	Relinquished by (Signature)	Received by (Signature)
Samples placed in bags due to streaking labels. Bags have sample ID written on front.	Simon Butler	Rick Nelson		
	Printed Name: Simon Butler	Printed Name: Rick Nelson	Printed Name	Printed Name
	Company: Aspect	Company: ARI	Company	Company
	Date & Time: 4/16/15 1150	Date & Time: 4/16/15 1335	Date & Time	Date & Time

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

AEL6 : 070024

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Aspect Project Name: WRIA 30

COC No(s) _____ NA Delivered by Fed-Ex UPS Courier Hand Delivered Other _____

Assigned ARI Job No AEL6 Tracking No _____ NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES (NO)

Were custody papers included with the cooler? .. YES NO

Were custody papers properly filled out (ink, signed, etc.) YES NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 4.1

Time 1400

If cooler temperature is out of compliance fill out form 00070F Temp Gun ID# 90877950

Cooler Accepted by: _____ Date 4/16/15 Time 1335

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES (NO)

What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other _____

Was sufficient ice used (if appropriate)? NA YES NO

Were all bottles sealed in individual plastic bags? YES NO

Did all bottles arrive in good condition (unbroken)? YES NO

Were all bottle labels complete and legible? YES NO

Did the number of containers listed on COC match with the number of containers received? YES NO

Did all bottle labels and tags agree with custody papers? YES NO

Were all bottles used correct for the requested analyses? YES NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) NA YES NO

Were all VOC vials free of air bubbles? (NA) YES NO

Was sufficient amount of sample sent in each bottle? YES NO

Date VOC Trip Blank was made at ARI..... (NA) _____

Was Sample Split by ARI (NA) YES Date/Time _____ Equipment: _____ Split by _____

Samples Logged by TB Date 4-16-15 Time 1510

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By _____ Date. _____

Small Air Bubbles ~ 2mm	Peabubbles 2-4 mm	LARGE Air Bubbles > 4 mm
• • •	• • •	● ● ●

Small → "sm" (< 2 mm)

Peabubbles → "pb" (2 to < 4 mm)

Large → "lg" (4 to < 6 mm)

Headspace → "hs" (> 6 mm)

PRESERVATION VERIFICATION 04/16/15

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: **AEL6**

Inquiry Number: NONE
Analysis Requested: 04/16/15
Contact: Rugh, David
Client: Aspect Consulting
Logged by: TS
Sample Set Used: Yes-481
Validatable Package: No
Deliverables:

PC: Mark
VTSR: 04/16/15

Project #: 070024
Project: WRIA30
Sample Site:
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	TPHD <2	Fe2+ <2	DMET FLT	DOC FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
15-7498 **AEL6A**	27A2-041515						TOT Pass															
15-7499 **AEL6B**	27D6-041515						TOT															
15-7500 **AEL6C**	28B1-041515						TOT															
15-7501 **AEL6D**	22P1-041515						TOT															
15-7502 **AEL6E**	27C1-041515						TOT															
15-7503 **AEL6F**	27D4-041515						TOT Pass															
15-7509 **AEL6G**	27A2-041515						DIS F									N						
15-7510 **AEL6H**	27D6-041515						DIS									N						
15-7511 **AEL6I**	28B1-041515						DIS									N						
15-7512 **AEL6J**	22P1-041515						DIS									N						
15-7513 **AEL6K**	27C1-041515						DIS									N						
15-7514 **AEL6L**	27D4-041515						DIS F									N						

F = Fail

Checked By TS Date 4-16-15

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: AEL6
Client: Aspect Consulting
Project Event: 070024
Project Name: WRIA30

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	27A2-041515	AEL6A	15-7498	Water	04/15/15 08:55	04/16/15 13:35
2.	27D6-041515	AEL6B	15-7499	Water	04/15/15 10:40	04/16/15 13:35
3.	28B1-041515	AEL6C	15-7500	Water	04/15/15 12:20	04/16/15 13:35
4.	22P1-041515	AEL6D	15-7501	Water	04/15/15 13:45	04/16/15 13:35
5.	27C1-041515	AEL6E	15-7502	Water	04/15/15 15:10	04/16/15 13:35
6.	27D4-041515	AEL6F	15-7503	Water	04/15/15 16:20	04/16/15 13:35
7.	27A2-041515	AEL6G	15-7509	Water	04/15/15 08:55	04/16/15 13:35
8.	27D6-041515	AEL6H	15-7510	Water	04/15/15 10:40	04/16/15 13:35
9.	28B1-041515	AEL6I	15-7511	Water	04/15/15 12:20	04/16/15 13:35
10.	22P1-041515	AEL6J	15-7512	Water	04/15/15 13:45	04/16/15 13:35
11.	27C1-041515	AEL6K	15-7513	Water	04/15/15 15:10	04/16/15 13:35
12.	27D4-041515	AEL6L	15-7514	Water	04/15/15 16:20	04/16/15 13:35

Data Reporting Qualifiers

Effective 12/31/13

Inorganic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Duplicate RPD is not within established control limits
B	Reported value is less than the CRDL but ≥ the Reporting Limit
N	Matrix Spike recovery not within established control limits
NA	Not Applicable, analyte not spiked
H	The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
L	Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U	Indicates that the target analyte was not detected at the reported concentration
*	Flagged value is not within established control limits
B	Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
J	Estimated concentration when the value is less than ARI's established reporting limits
D	The spiked compound was not detected due to sample extract dilution
E	Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

Q Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).

S Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte

NA The flagged analyte was not analyzed for

NR Spiked compound recovery is not reported due to chromatographic interference

NS The flagged analyte was not spiked into the sample

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" **(Dioxin/Furan analysis only)**

C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

X Analyte signal includes interference from polychlorinated diphenyl ethers. **(Dioxin/Furan analysis only)**

Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions. **(Dioxin/Furan analysis only)**

Geotechnical Data

A	The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
F	Samples were frozen prior to particle size determination
SM	Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
SS	Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
W	Weight of sample in some pipette aliquots was below the level required for accurate weighting

SAMPLE RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Client ID: 27A2-041515
ARI ID: 15-7498 AEL6A

Analyte	Date Batch	Method	Units	RL	Sample
Alkalinity	04/20/15 042015#1	SM 2320	mg/L CaCO3	1.0	88.8
Carbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Bicarbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	88.8
Hydroxide	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Chloride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	2.6
Fluoride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	0.2
N-Nitrate	04/16/15 041615#1	EPA 300.0	mg-N/L	0.1	0.4
Sulfate	04/16/15 041615#1	EPA 300.0	mg/L	0.1	1.7

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Client ID: 27D6-041515
ARI ID: 15-7499 AEL6B

Analyte	Date Batch	Method	Units	RL	Sample
Alkalinity	04/20/15 042015#1	SM 2320	mg/L CaCO3	1.0	138
Carbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Bicarbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	138
Hydroxide	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Chloride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	2.5
Fluoride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	0.2
N-Nitrate	04/16/15 041615#1	EPA 300.0	mg-N/L	0.1	< 0.1 U
Sulfate	04/16/15 041615#1	EPA 300.0	mg/L	0.1	3.8

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Client ID: 28B1-041515
ARI ID: 15-7500 AEL6C

Analyte	Date Batch	Method	Units	RL	Sample
Alkalinity	04/20/15 042015#1	SM 2320	mg/L CaCO3	1.0	103
Carbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Bicarbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	103
Hydroxide	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Chloride	04/23/15 042315#1	EPA 300.0	mg/L	0.5	13.1
Fluoride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	0.4
N-Nitrate	04/16/15 041615#1	EPA 300.0	mg-N/L	0.1	1.0
Sulfate	04/23/15 042315#1	EPA 300.0	mg/L	0.2	7.0

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Client ID: 22P1-041515
ARI ID: 15-7501 AEL6D

Analyte	Date Batch	Method	Units	RL	Sample
Alkalinity	04/20/15 042015#1	SM 2320	mg/L CaCO3	1.0	129
Carbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Bicarbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	129
Hydroxide	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Chloride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	3.2
Fluoride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	0.2
N-Nitrate	04/16/15 041615#1	EPA 300.0	mg-N/L	0.1	< 0.1 U
Sulfate	04/23/15 042315#1	EPA 300.0	mg/L	0.5	21.0

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Client ID: 27C1-041515
ARI ID: 15-7502 AEL6E

Analyte	Date Batch	Method	Units	RL	Sample
Alkalinity	04/20/15 042015#1	SM 2320	mg/L CaCO3	1.0	113
Carbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Bicarbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	113
Hydroxide	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Chloride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	4.6
Fluoride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	0.2
N-Nitrate	04/16/15 041615#1	EPA 300.0	mg-N/L	0.1	0.9
Sulfate	04/16/15 041615#1	EPA 300.0	mg/L	0.1	1.6

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Client ID: 27D4-041515
ARI ID: 15-7503 AEL6F

Analyte	Date Batch	Method	Units	RL	Sample
Alkalinity	04/20/15 042015#1	SM 2320	mg/L CaCO3	1.0	124
Carbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Bicarbonate	04/20/15	SM 2320	mg/L CaCO3	1.0	124
Hydroxide	04/20/15	SM 2320	mg/L CaCO3	1.0	< 1.0 U
Chloride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	3.8
Fluoride	04/16/15 041615#1	EPA 300.0	mg/L	0.1	0.2
N-Nitrate	04/16/15 041615#1	EPA 300.0	mg-N/L	0.1	0.2
Sulfate	04/16/15 041615#1	EPA 300.0	mg/L	0.1	3.4

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	Blank	ID
Chloride	EPA 300.0	04/16/15	mg/L	< 0.1 U	
		04/23/15		< 0.1 U	
Fluoride	EPA 300.0	04/16/15	mg/L	< 0.1 U	
N-Nitrate	EPA 300.0	04/16/15	mg-N/L	< 0.1 U	
Sulfate	EPA 300.0	04/16/15	mg/L	< 0.1 U	
		04/23/15		< 0.1 U	

STANDARD REFERENCE RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: NA
Date Received: NA

Analyte/SRM ID	Method	Date	Units	SRM	True Value	Recovery
Alkalinity ERA #P224-506	SM 2320	04/20/15	mg/L CaCO3	60.9	61.7	98.7%
Chloride ERA #290313	EPA 300.0	04/16/15 04/23/15	mg/L	2.8 3.0	3.0 3.0	93.3% 100.0%
Fluoride ERA 330613	EPA 300.0	04/16/15	mg/L	2.8	3.0	93.3%
N-Nitrate ERA #320614	EPA 300.0	04/16/15	mg-N/L	2.8	3.0	93.3%
Sulfate ERA 131013	EPA 300.0	04/16/15 04/23/15	mg/L	2.7 3.0	3.0 3.0	90.0% 100.0%

REPLICATE RESULTS-CONVENTIONALS
AEL6-Aspect Consulting

ANALYTICAL RESOURCES INCORPORATED

Matrix: Water
Data Release Authorized:
Reported: 04/28/15

Project: WRIA30
Event: 070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Analyte	Method	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: AEL6A Client ID: 27A2-041515						
Alkalinity	SM 2320	04/20/15	mg/L CaCO3	88.8	89.4	0.7%
Carbonate	SM 2320	04/20/15	mg/L CaCO3	< 1.0	< 1.0	NA
Bicarbonate	SM 2320	04/20/15	mg/L CaCO3	88.8	89.4	0.7%
Hydroxide	SM 2320	04/20/15	mg/L CaCO3	< 1.0	< 1.0	NA

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 27A2-041515
SAMPLE

Lab Sample ID: AEL6A
LIMS ID: 15-7498
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
3010A	04/20/15	6010C	04/22/15	**7440-70-2**	**Calcium**	0.05	**16.1**	
3010A	04/20/15	6010C	04/22/15	**7439-95-4**	**Magnesium**	0.05	**7.88**	
3010A	04/20/15	6010C	04/22/15	**7440-09-7**	**Potassium**	0.5	**2.4**	
3010A	04/20/15	6010C	04/22/15	**7440-23-5**	**Sodium**	0.5	**8.8**	

U-Analyte undetected at given LOQ
LOQ-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 27A2-041515
DUPLICATE

Lab Sample ID: AEL6A
LIMS ID: 15-7498
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Calcium	6010C	16.1	16.3	1.2%	+/- 20%	
Magnesium	6010C	7.88	7.96	1.0%	+/- 20%	
Potassium	6010C	2.4	2.5	4.1%	+/- 0.5	L
Sodium	6010C	8.8	8.8	0.0%	+/- 20%	

Reported in mg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 27A2-041515
MATRIX SPIKE

Lab Sample ID: AEL6A
LIMS ID: 15-7498
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Calcium	6010C	16.1	26.4	10.0	103%	
Magnesium	6010C	7.88	18.9	10.0	110%	
Potassium	6010C	2.4	12.9	10.0	105%	
Sodium	6010C	8.8	19.6	10.0	108%	

Reported in mg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 27D6-041515
SAMPLE

Lab Sample ID: AEL6B
LIMS ID: 15-7499
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
3010A	04/20/15	6010C	04/22/15	**7440-70-2**	**Calcium**	0.05	**23.5**	
3010A	04/20/15	6010C	04/22/15	**7439-95-4**	**Magnesium**	0.05	**14.0**	
3010A	04/20/15	6010C	04/22/15	**7440-09-7**	**Potassium**	0.5	**2.6**	
3010A	04/20/15	6010C	04/22/15	**7440-23-5**	**Sodium**	0.5	**11.3**	

U-Analyte undetected at given LOQ
LOQ-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 28B1-041515
SAMPLE

Lab Sample ID: AEL6C
LIMS ID: 15-7500
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
3010A	04/20/15	6010C	04/22/15	**7440-70-2**	**Calcium**	0.05	**19.8**	
3010A	04/20/15	6010C	04/22/15	**7439-95-4**	**Magnesium**	0.05	**11.4**	
3010A	04/20/15	6010C	04/22/15	**7440-09-7**	**Potassium**	0.5	**2.6**	
3010A	04/20/15	6010C	04/22/15	**7440-23-5**	**Sodium**	0.5	**14.6**	

U-Analyte undetected at given LOQ
LOQ-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 22P1-041515
SAMPLE

Lab Sample ID: AEL6D
LIMS ID: 15-7501
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
3010A	04/20/15	6010C	04/22/15	**7440-70-2**	**Calcium**	0.05	**24.4**	
3010A	04/20/15	6010C	04/22/15	**7439-95-4**	**Magnesium**	0.05	**15.4**	
3010A	04/20/15	6010C	04/22/15	**7440-09-7**	**Potassium**	0.5	**3.4**	
3010A	04/20/15	6010C	04/22/15	**7440-23-5**	**Sodium**	0.5	**11.7**	

U-Analyte undetected at given LOQ
LOQ-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 27C1-041515
SAMPLE

Lab Sample ID: AEL6E
LIMS ID: 15-7502
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
3010A	04/20/15	6010C	04/22/15	**7440-70-2**	**Calcium**	0.05	**21.0**	
3010A	04/20/15	6010C	04/22/15	**7439-95-4**	**Magnesium**	0.05	**9.91**	
3010A	04/20/15	6010C	04/22/15	**7440-09-7**	**Potassium**	0.5	**2.3**	
3010A	04/20/15	6010C	04/22/15	**7440-23-5**	**Sodium**	0.5	**11.6**	

U-Analyte undetected at given LOQ
LOQ-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 27D4-041515
SAMPLE

Lab Sample ID: AEL6F
LIMS ID: 15-7503
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
3010A	04/20/15	6010C	04/22/15	**7440-70-2**	**Calcium**	0.05	**22.2**	
3010A	04/20/15	6010C	04/22/15	**7439-95-4**	**Magnesium**	0.05	**11.6**	
3010A	04/20/15	6010C	04/22/15	**7440-09-7**	**Potassium**	0.5	**3.2**	
3010A	04/20/15	6010C	04/22/15	**7440-23-5**	**Sodium**	0.5	**11.2**	

U-Analyte undetected at given LOQ
LOQ-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: 27A2-041515
SAMPLE

Lab Sample ID: AEL6G
LIMS ID: 15-7509
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
6010C	04/20/15	6010C	04/22/15	**7440-21-3**	**Silicon**	0.06	**27.0**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: 27A2-041515
DUPLICATE

Lab Sample ID: AEL6G
LIMS ID: 15-7509
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Silicon	6010C	27.0	26.9	0.4%	+/- 20%	

Reported in mg/L

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: 27A2-041515
MATRIX SPIKE

Lab Sample ID: AEL6G
LIMS ID: 15-7509
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Silicon	6010C	27.0	36.0	10.0	90.0%	

Reported in mg/L

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: 27D6-041515
SAMPLE

Lab Sample ID: AEL6H
LIMS ID: 15-7510
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
6010C	04/20/15	6010C	04/22/15	**7440-21-3**	**Silicon**	0.06	**19.7**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: 28B1-041515
SAMPLE

Lab Sample ID: AEL6I
LIMS ID: 15-7511
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
6010C	04/20/15	6010C	04/22/15	**7440-21-3**	**Silicon**	0.06	**26.1**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: 22P1-041515
SAMPLE

Lab Sample ID: AEL6J
LIMS ID: 15-7512
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
6010C	04/20/15	6010C	04/22/15	**7440-21-3**	**Silicon**	0.06	**22.1**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: 27C1-041515
SAMPLE

Lab Sample ID: AEL6K
LIMS ID: 15-7513
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
6010C	04/20/15	6010C	04/22/15	**7440-21-3**	**Silicon**	0.06	**28.5**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: 27D4-041515
SAMPLE

Lab Sample ID: AEL6L
LIMS ID: 15-7514
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: 04/15/15
Date Received: 04/16/15

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
6010C	04/20/15	6010C	04/22/15	**7440-21-3**	**Silicon**	0.06	**23.4**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: AEL6MB
LIMS ID: 15-7503
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
3010A	04/20/15	6010C	04/22/15	7440-70-2	Calcium	0.05	0.05	U
3010A	04/20/15	6010C	04/22/15	7439-95-4	Magnesium	0.05	0.05	U
3010A	04/20/15	6010C	04/22/15	7440-09-7	Potassium	0.5	0.5	U
3010A	04/20/15	6010C	04/22/15	7440-23-5	Sodium	0.5	0.5	U

U-Analyte undetected at given LOQ
LOQ-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS **Sample ID: LAB CONTROL**

Lab Sample ID: AEL6LCS
LIMS ID: 15-7503
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Calcium	6010C	10.0	10.0	100%	
Magnesium	6010C	10.4	10.0	104%	
Potassium	6010C	10.4	10.0	104%	
Sodium	6010C	10.7	10.0	107%	

Reported in mg/L

N-Control limit not met
Control Limits: 80-120%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS **Sample ID: METHOD BLANK**

Lab Sample ID: AEL6MB
LIMS ID: 15-7514
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/L	Q
6010C	04/20/15	6010C	04/22/15	7440-21-3	Silicon	0.06	0.06	U

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: AEL6LCS
LIMS ID: 15-7514
Matrix: Water
Data Release Authorized:
Reported: 04/23/15

QC Report No: AEL6-Aspect Consulting
Project: WRIA30
070024
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Silicon	6010C	9.22	10.0	92.2%	

Reported in mg/L

N-Control limit not met
Control Limits: 80-120%

Beta Analytic Inc.
4985 SW 74 Court
Miami, Florida 33155 USA
Tel: 305 667 5167
Fax: 305 663 0964
Beta@radiocarbon.com
www.radiocarbon.com

Consistent Accuracy . . .
. . . Delivered On-time

May 7, 2015

Mr. David Rugh
Aspect Consulting
401 2nd Ave South
Seattle, WA 98104
United States

RE: Radiocarbon Dating Results For Samples 27A2-041415 , 27D6-041415 , 28B1-041415 , 22P1-041415 , 27C1-041415 , 27D4-041415

Dear Mr. Rugh:

Enclosed are the radiocarbon dating results for six samples recently sent to us. The report sheet contains the Conventional Radiocarbon Age (BP), the method used, material type, and applied pretreatments, any sample specific comments and, where applicable, the two-sigma calendar calibration range. The Conventional Radiocarbon ages have been corrected for total isotopic fractionation effects (natural and laboratory induced).

All results (excluding some inappropriate material types) which fall within the range of available calibration data are calibrated to calendar years (cal BC/AD) and calibrated radiocarbon years (cal BP). Calibration was calculated using the one of the databases associated with the 2013 INTCAL program (cited in the references on the bottom of the calibration graph page provided for each sample.) Multiple probability ranges may appear in some cases, due to short-term variations in the atmospheric ^{14}C contents at certain time periods. Looking closely at the calibration graph provided and where the BP sigma limits intercept the calibration curve will help you understand this phenomenon.

Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result.

All work on these samples was performed in our laboratories in Miami under strict chain of custody and quality control under ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 accreditation protocols. Sample, modern and blanks were all analyzed in the same chemistry lines by qualified professional technicians using identical reagents and counting parameters within our own particle accelerators. A quality assurance report is posted to your directory for each result.

Thank you for prepaying the analyses. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

Digital signature on file

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. David Rugh

Report Date: 5/7/2015

Aspect Consulting

Material Received: 4/24/2015

Sample Data	pMC	Fmdn	d13C
Beta - 409509	60.1 +/- 0.2 pMC	0.6010 +/- 0.0022	-18.7 o/oo

SAMPLE : 27A2-041415
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (water DIC): acidify-gas strip
COMMENT: The equivalent "Apparent" radiocarbon age to the reported pMC/fMDN values is ~ 4090 BP (not adjusted for any hydro-geochemical effects on meteoric water $^{14}CO_2$). Given the complex nature of groundwater DIC^{14} chemistry, duplicate measurements within 1-2 pMC are reasonable for a single water sample. For very low DIC concentration waters (< 20 mg/L HCO3) DIC^{14} and waters with complex organic chemistry, results can vary significantly outside of this expectation.

Beta - 409510	39.0 +/- 0.1 pMC	0.3897 +/- 0.0014	-19.8 o/oo

SAMPLE : 27D6-041415
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (water DIC): acidify-gas strip
COMMENT: The equivalent "Apparent" radiocarbon age to the reported pMC/fMDN values is ~ 7570 BP (not adjusted for any hydro-geochemical effects on meteoric water $^{14}CO_2$). Given the complex nature of groundwater DIC^{14} chemistry, duplicate measurements within 1-2 pMC are reasonable for a single water sample. For very low DIC concentration waters (< 20 mg/L HCO3) DIC^{14} and waters with complex organic chemistry, results can vary significantly outside of this expectation.

Beta - 409511	47.9 +/- 0.2 pMC	0.4786 +/- 0.0018	-19.4 o/oo

SAMPLE : 28B1-041415
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (water DIC): acidify-gas strip
COMMENT: The equivalent "Apparent" radiocarbon age to the reported pMC/fMDN values is ~ 5920 BP (not adjusted for any hydro-geochemical effects on meteoric water $^{14}CO_2$). Given the complex nature of groundwater DIC^{14} chemistry, duplicate measurements within 1-2 pMC are reasonable for a single water sample. For very low DIC concentration waters (< 20 mg/L HCO3) DIC^{14} and waters with complex organic chemistry, results can vary significantly outside of this expectation.

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. David Rugh

Report Date: 5/7/2015

Sample Data	pMC	Fmdn	d13C
Beta - 409512	47.6 +/- 0.2 pMC	0.4756 +/- 0.0018	-18.5 o/oo

SAMPLE : 22P1-041415
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (water DIC): acidify-gas strip
COMMENT: The equivalent "Apparent" radiocarbon age to the reported pMC/fMDN values is ~ 5970 BP (not adjusted for any hydro-geochemical effects on meteoric water $^{14}CO_2$). Given the complex nature of groundwater DIC^{14} chemistry, duplicate measurements within 1-2 pMC are reasonable for a single water sample. For very low DIC concentration waters (< 20 mg/L HCO3) DIC^{14} and waters with complex organic chemistry, results can vary significantly outside of this expectation.

Beta - 409513	64.2 +/- 0.2 pMC	0.6420 +/- 0.0024	-19.0 o/oo

SAMPLE : 27C1-041415
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (water DIC): acidify-gas strip
COMMENT: The equivalent "Apparent" radiocarbon age to the reported pMC/fMDN values is ~ 3560 BP (not adjusted for any hydro-geochemical effects on meteoric water $^{14}CO_2$). Given the complex nature of groundwater DIC^{14} chemistry, duplicate measurements within 1-2 pMC are reasonable for a single water sample. For very low DIC concentration waters (< 20 mg/L HCO3) DIC^{14} and waters with complex organic chemistry, results can vary significantly outside of this expectation.

Beta - 409514	53.9 +/- 0.2 pMC	0.5386 +/- 0.0020	-17.5 o/oo

SAMPLE : 27D4-041415
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (water DIC): acidify-gas strip
COMMENT: The equivalent "Apparent" radiocarbon age to the reported pMC/fMDN values is ~ 4970 BP (not adjusted for any hydro-geochemical effects on meteoric water $^{14}CO_2$). Given the complex nature of groundwater DIC^{14} chemistry, duplicate measurements within 1-2 pMC are reasonable for a single water sample. For very low DIC concentration waters (< 20 mg/L HCO3) DIC^{14} and waters with complex organic chemistry, results can vary significantly outside of this expectation.

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

Radiocarbon Dating
Consistent Accuracy
Delivered On-Time

Beta Analytic Inc.
4985 SW 74 Court
Miami, Florida 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com
www.betalabservices.com

Mr. Darden Hood
President

Mr. Ronald Hatfield
Mr. Christopher Patrick
Deputy Directors

The Radiocarbon Laboratory Accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423

Quality Assurance Report

This report provides the results of reference materials used to validate radiocarbon analyses prior to reporting. Known value reference materials were analyzed quasi-simultaneously with the unknowns. Results are reported as expected values vs measured values. Reported values are calculated relative to NIST SRM-4990B and corrected for isotopic fractionation. Results are reported using the direct analytical measure percent modern carbon (pMC) with one relative standard deviation.

Report Date: May 11, 2015
Submitter : Mr. David Rugh

QA MEASUREMENTS

Reference 1	Expected Value:	96.7 +/- 0.5 pMC
	Measured Value:	96.3 +/- 0.4 pMC
	Agreement:	Accepted
Reference 2	Expected Value:	47.9 +/- 0.3
	Measured Value:	47.9 +/- 0.2 pMC
	Agreement:	Accepted
Reference 3	Expected Value:	27.2 +/- 0.2
	Measured Value:	27.3 +/- 0.1 pMC
	Agreement:	Accepted

COMMENT: All measurements passed acceptance tests.

Validation: Darden Hood Date: May 11, 2015

APPENDIX B

Well Logs for Study Area Wells Deeper than 400 Feet (Sections 21, 22, 27, 28 of T13N/R13E)

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. .....

Permit No. .....

(1) OWNER: Name Jim Finley Address 1709 N.E.Argyle Portland, Orego

(2) LOCATION OF WELL: County Klickitat — NE ¼ NE¼ Sec. 21 T. 3 N., R. 13 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) .....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 510 ft. Depth of completed well 510 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 70 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: 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.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 58 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level 1600 ft.
Static level 392 ft. below top of well Date 6 June
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) 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.
12 gal min air test with drill pipe at 510' for 1 hour.
" " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

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	0	4
Rock broken	4	45
Sand yellow	45	50
Rock maroon	50	62
Rock broken	62	69
Basalt gray hard	69	141
Claystone green	141	143
Basalt gray	143	261
Claystone maroon-green-black	261	272
Basalt gray	272	450
Basalt black visic. WB	450	475
Basalt gray with cracks WB	475	510

RECEIVED
JUN 11 1981
DEPARTMENT OF ECOLOGY
CENTRAL REC

Work started 30 May 19 81 Completed 6 June 19 81

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 Murray Well Drilling Inc.
(Person, firm, or corporation) (Type or print)

Address 3712 W 8th The Dalles, Oregon

[Signed] Richard J. Murray
(Well Driller)

License No. 325 Date 8 June 19 81

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. .....

Permit No. 1

(1) OWNER: Name John Mott Address 2101 S.324th Federal Way, Wa.

(2) LOCATION OF WELL: County Klickitat — NW ¼ NE ¼ Sec 21 T. 3 N., R 13E W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) .....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 490 ft. Depth of completed well 490 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 18 ft.
Threaded ☐ ..... " Diam. from ..... ft. to ..... ft.
Welded ☐ ..... " Diam. from ..... ft. to ..... ft.

Perforations: 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.

Screens: Yes ☐ No ☒
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ..... Depth of strata .....
Method of sealing strata off .....

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

(8) WATER LEVELS: Land-surface elevation above mean sea level .... 1500 ft.
Static level 247 ft. below top of well Date 9 June
Artesian pressure ..... lbs. per square inch Date .....
Artesian water is controlled by ..... (Cap, valve, etc.)

(9) 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.

" 15 gal min air test with drillpipe
" at 490' for one hour " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test .....
Bailer test ..... gal./min. with ..... ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

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	0	8
Basalt gray	8	37
Basalt brown	37	41
Basalt gray	41	46
Rock brown soft	46	55
Basalt gray	55	88
Conglomerate	88	112
Basalt gray hard	112	441
Basalt black visic.	441	460
Conglomerate WB	460	470
Basalt black WB	470	490

RECEIVED
JUN 15 1981

Work started 6 June, 19 81 Completed 9 June, 19 81

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 Murray Well Drilling Inc.
(Person, firm, or corporation) (Type or print)

Address 3712 W 8th The Dalles, Oregon

[Signed] Richard J Murray (Well Driller)

License No. 325 Date 11 June, 19 81

(USE ADDITIONAL SHEETS IF NECESSARY) DK 6.14.81

ECY 050-1-20

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ....

Permit No. ....

(1) OWNER: Name Doug Taylor Address Rt.4 Box 84 Lyle, Wa.

(2) LOCATION OF WELL: County Klickitat — NE ¼ SW ¼ Sec. 21 T. 3 N., R. 13E W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well [ ] Method: Dug [ ] Bored [ ]
Deepened [X] Cable [ ] Driven [ ]
Reconditioned [ ] Rotary [X] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 449 ft. Depth of completed well 449 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ..." Diam. from .... ft. to .... ft.
Threaded [ ] ..." Diam. from .... ft. to .... ft.
Welded [ ] ..." Diam. from .... ft. to .... ft.

Perforations: 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.

Screens: Yes [ ] No [ ]
Manufacturer's Name ....
Type .... Model No ....
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... ft.

Gravel packed: Yes [ ] No [ ] Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: 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 ....

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

(8) WATER LEVELS: Land-surface elevation above mean sea level .... 1500 ft.
Static level 98 ft. below top of well Date 30 May
Artesian pressure .... lbs. per square inch Date ....
Artesian water is controlled by .... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [ ] No [X] If yes, by whom? ....
Yield: .... gal./min. with .... ft. drawdown after .... hrs.
100 gal min air test with the drill steel at 449' for 1 hr. " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ....
Bailer test .... gal./min. with .... ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water .... Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG:

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
~~Basalt gray~~	205	248
~~Rock black~~	248	251
~~Basalt gray WB~~	251	350
~~Clay green~~	350	353
~~Basalt gray WB~~	353	435
~~Basalt black visic. WB~~	435	449

This could be developed into a very high yield well for irrigation as we did not go through the aquifier.

RECEIVED JUN 11 1981 DEPARTMENT OF ECOLOGY CENTRAL REGION

Work started 23 May, 1981 Completed 30 May, 1981

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 Murray Well Drilling Inc.
(Person, firm, or corporation) (Type or print)

Address 3712 W 8th The Dalles, Oregon

[Signed] Richard J Murray (Well Driller)

License No. 325 Date 8 June, 1981

(USE ADDITIONAL SHEETS IF NECESSARY)

DK 6-12-81

ECY 050-1-20

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 1
Permit No. ....

(1) **OWNER:** Name Marcus Willis Address 15813 N.E. F Plain Vancouver

(2) **LOCATION OF WELL:** County Klickitat — NE ¼ SW ¼ Sec. 21 T. 3 N., R. 13E W.M.
Bearing and distance from section or subdivision corner SE Lot 8 Klickitat Ranch

(3) **PROPOSED USE:** Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (if more than one) ....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 6 inches.
Drilled 550 ft. Depth of completed well 550 ft.

(6) **CONSTRUCTION DETAILS:**
Casing installed: 6 " Diam. from +1 ft. to 87 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: 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.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 25 ft.
Material used in seal Cement & bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) **PUMP:** Manufacturer's Name
Type: H.P.

(8) **WATER LEVELS:** Land-surface elevation above mean sea level.... ft.
Static level 370 ft. below top of well Date 4-11-83
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) **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.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
Blow test		5 gpm			

Date of test 4-11-83
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) **WELL LOG:**
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
Top soil	0'	3'
River gravel cemented, brown basalt, brown clay	3'	46'
White clay	46'	71'
river gravel cemented	71'	75'
brown basalt, med	75'	87'
brown basalt, med. hard	87'	110'
brown basalt broken	110'	113'
brown basalt med. hard	113'	128'
brown basalt & brown clay	128'	133'
gray basalt, hard	133'	168'
brown basalt, med. hard	168'	232'
white clay	232'	236'
brown basalt & White clay	236'	239'
brown basalt, porous	239'	246'
brown & gray basalt, med. hard	246'	250'
gray basalt, hard	250'	274'
brown basalt, porous, med.	274'	285'
brown basalt, med. hard	285'	293'
gray basalt, hard	293'	433'
brown basalt, med. hard	433'	445'
gray basalt, hard	445'	453'
brown basalt, porous, med.	453'	482'
gray basalt, hard	482'	550'

Work started 4-4- 19 83 Completed 4-11- 19 83

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 M-K Drilling Company
(Person, firm, or corporation) (Type or print)
Address P.O. Box 373 Dallesport, WA 98611

[Signed] Karl S Moore
(Well Driller)

License No. 0973 Date 4-11 19 83

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

6767

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No. 079095
Water Right Permit No. N/A

(1) OWNER: Name ROGERS, ERIC Address BOX 727 BINGEN, WA 98605-

(2) LOCATION OF WELL: County KLICKITAT - NW 1/4 SW 1/4 Sec 21 T 3 N., R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) WINDY RIDGE RD.

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one)
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 465 ft. Depth of completed well 465 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from -1 ft. to 104.5 ft.
WELDED " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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.

Screens: NO
Manufacturer's Name
Type Model No.
Dia. slot size from ft. to ft.
Dia. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 30 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 365 ft. below top of well Date 03/25/90
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 20 gal/min. w/ stem set at 455 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation.

MATERIAL	FROM	TO
TOP SOIL & RIVER GRAVEL	0	3
CEMENTED GRAVEL	3	16
BROWN CLAY & RIVER GRAVEL	16	28
CEMENTED GRAVEL	28	42
WHITE SILTSTONE	42	59
BROWN SANDSTONE	59	78
BROWN BASALT & CLAY	78	103
BLACK BASALT	103	112
GRAY BASALT , HARD	112	228
BROWN BASALT	228	234
BLACK BASALT & BLUE CLAYSTONE	234	242
GRAY BASALT , HARD	242	287
BROWN BASALT & CLAY	287	293
GRAY BASALT , HARD	297	435
BLACK & RED BASALT , WATER BEARING	435	465

Work started 12/11/90 Completed 03/25/91

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K WELL DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS P.O.BOX 373 Davenport, WA 98617

[SIGNED] Charles L Mork License No. 833 & 834 & 973

Contractor's
Registration No. MKDRIC134PE Date 03/29/91

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No. W 094076
Water Right Permit No.

(1) OWNER: Name WILKINS, MAYLAND (01233) Address PO BOX 820 LYLE, WA 98635-

(2) LOCATION OF WELL: County KLICKITAT - NW 1/4 SW 1/4 Sec 21 T 3 N., R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) WINDY RIVER RD, LYLE

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 01
DEEPENED Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 520 ft. Depth of completed well 520 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: " Dia. from ft. to ft.
" Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 30 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 425 ft. below top of well Date 07/11/97
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 15 gal/min. w/ stem set at 510 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG ID# ACL 787

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 in formation.

MATERIAL	FROM	TO
GRAY BASALT , HARD	465	473
BLACK BASALT & BLUE CLAYSTONE	473	482
BLACK BASALT ,MEDIUM HARD	482	488
GRAY BASALT , HARD	488	520

JUL 18 1997

Work started 07/02/97 Completed 07/11/97

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] _____ License No. 833 & 834 & 973

Contractor's
Registration No. MKDRIC134PE Date 07/15/97

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No. 079139
Water Right Permit No.

(1) OWNER: Name WOLMAN, ABEL 00331 Address 2104 W. ROGERS AVE. BALTIMORE, MD 21209-

LOCATION OF WELL: County KLICKITAT - SW 1/4 SE 1/4 Sec 21 T 3N N., R 13 WM

(2a) STREET ADDRESS OF WELL (or nearest address) WIND RIDGE

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 520 ft. Depth of completed well 520 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 - Dia. from -1 ft. to 108 ft.
WELDED 4.5 - Dia. from 220 ft. to 520 ft.
- Dia. from ft. to ft.

Perforations: YES
Type of perforator used SAW
SIZE of perforations 1/8 in. by 4 in.
50 perforations from 340 ft. to 510 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 25 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 305 ft. below top of well Date 07/24/91
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 12 gal/min. w/ stem set at 510 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation.

MATERIAL	FROM	TO
BROWN CLAY	0	4
BROWN BASALT	4	39
CEMENTED RIVERGRAVEL	39	65
CEMENTED SAND & GRAVEL	65	76
WHITE CLAY	76	98
HARD	98	103
BLACK BASALT & GREEN CLAYSTONE	103	107
BLACK BASALT , HARD	107	127
GRAY BASALT , HARD	127	240
BROWN & BLACK CLAY BLACK BASALT	240	244
BLACK BASALT & BLUE CLAYSTONE	244	256
GRAY BASALT , HARD	256	307
BLACK BASALT , POROUS	307	312
GRAY BASALT	312	332
BROWN BASALT , POROUS , WATER BEARING	332	357
GRAY BASALT , HARD	357	423
BLACK BASALT , POROUS , WATER BEARING	423	429
GRAY BASALT	429	445
GRAY BASALT , HARD	445	462
GRAY BASALT	462	495
GRAY BASALT , HARD	495	520
	520	

Work started 07/19/91 Completed 07/24/91

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME K-I WELL DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA.

[SIGNED] Charles E Moore License No. 833 & 834 & 973

Contractor's Registration No. KKDRIC134PK Date 06/07/94

36390

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No W 047720
Water Right Permit No

(1) OWNER Name SPAULDING, BILL (01053) Address 107 ELM ST LYLE, WA 98635-

(2) LOCATION OF WELL County KLICKITAT - SE 1/4 SE 1/4 Sec 21 T 3 N , R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) OFF LYLE/CNTVILL RD,LYLE

(3) PROPOSED USE DOMESTIC

(4) TYPE OF WORK Owner's Number of well (If more than one) 01
NEW WELL Method ROTARY

(5) DIMENSIONS Diameter of well 6 inches
Drilled 505 ft Depth of completed well 505 ft

(6) CONSTRUCTION DETAILS
Casing installed 6 " Dia from -1 ft to 90 ft
WELDED " Dia from ft to ft
" Dia from ft to ft

Perforations 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

Screens NO
Manufacturer's Name
Type Model No
Diam slot size from ft to ft
Diam slot size from ft to ft

Gravel packed NO Size of gravel
Gravel placed from ft to ft

Surface seal YES To what depth? 45 ft
Material used in seal CEMENT & BENTO
Did any strata contain unusable water? NO
Type of water? Depth of strata ft
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type H P

(8) WATER LEVELS Land-surface elevation above mean sea level ft
Static level 390 ft below top of well Date 06/01/95
Artesian Pressure lbs per square inch Date
Artesian water controlled by

(9) WELL TESTS Drawdown is amount water level is lowered below static level
Was a pump test made? NO If yes, by whom?
Yield gal /min with ft drawdown after hrs

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min ft drawdown after hrs
Air test 15 gal/min w/ stem set at 495 ft for 1 hrs
Artesian flow g p m Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation

MATERIAL	FROM	TO
TOP SOIL	0	1
BROWN CLAY	1	8
BROWN BASALT & CLAY	8	24
SAND & GRAVEL	24	41
WHITE CLAY	41	70
BROWN BASALT ,MEDIUM	70	84
GRAY BASALT , HARD	84	111
BLACK BASALT , POROUS	111	119
GRAY BASALT , POROUS	119	210
GRAY BASALT , FRACTURED	210	218
GRAY BASALT , HARD	218	293
BROWN BASALT ,MEDIUM	293	302
GRAY BASALT , HARD	302	465
BLACK & GRAY BASALT CREVISED,	465	481
, WATER BEARING	465	481
GRAY BASALT , HARD	481	505

RECEIVED
JUN 8
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Work started 05/31/95 Completed 06/01/95

WELL CONSTRUCTOR CERTIFICATION
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards Materials used and the information reported above are true to my best knowledge and belief

NAME M-K DRILLING CO
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Charles S Moore License No (833) & 834 & 973

Contractor's
Registration No MKDRIC134PE Date 06/05/95

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No. W100884
Water Right Permit No.

(1) OWNER: Name FREE GERALD E (01350) Address 1320 BERYL ST SAN DIEGO, CA 92109-

(2) LOCATION OF WELL: County KLICKITAT - W 1/4 SE 1/4 Sec 21 T 3 N., R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) ODA KNIGHT RD LYLE WA

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 01
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 400 ft. Depth of completed well 400 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 19 ft.
WELDED " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 18 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 310 ft. below top of well Date 09/18/98
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 12 gal/min. w/ stem set at 390 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG ID # AC 1506 K,Q

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 in formation.

MATERIAL	FROM	TO
TOP SOIL	0	2
BROWN CLAY & BROWN BASALT	2	6
BROWN BASALT , FRACTURED,	6	12
GRAY BASALT ,MEDIUM HARD	12	32
BROWN BASALT ,MEDIUM HARD	32	42
GRAY BASALT ,MEDIUM HARD	42	60
GRAY BASALT , HARD	60	126
BLACK & GRAY BASALT ,MEDIUM HARD	126	138
GRAY BASALT , HARD	138	190
BLACK BASALT ,MEDIUM HARD	190	202
BROWN BASALT ,MEDIUM HARD	202	212
GRAY BASALT ,MEDIUM HARD	212	240
GRAY BASALT , HARD	240	348
BLACK BASALT , HARD	348	376
BROWN BASALT ,MEDIUM HARD ,WATER BEARING	376	395
GRAY BASALT , HARD	395	400

RECEIVED
OCT 1998
DEPARTMENT OF ECOLOGY
REGIONAL REGION OFFICE

Work started 09/16/98 Completed 09/18/98

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Karl Moore License No. 833 & 834 & 973

Contractor's
Registration No. MKDRIC134PE Date 09/21/98

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W094067
Unique Well I.D. # AFE015
Water Right Permit No.

(1) OWNER: Name HUTCHISON DOUGLAS (01450) Address PO BOX 101 LYLE, WA 98635-0101

(2) LOCATION OF WELL: County KLICKITAT E½ - SW 1/4 SW 1/4 Sec 22 T 3 N., R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) OFF CENTERVILLE HWY, LYLE

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 01
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 550 ft. Depth of completed well 550 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 79 ft.
WELDED " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 25 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 395 ft. below top of well Date 09/01/99
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 30 gal/min. w/ stem set at 440 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation.

MATERIAL	FROM	TO
TOP SOIL & CLAY	0	2
BROWN CLAY	2	11
BROWN BASALT	11	53
BROWN BASALT & WHITE CLAY	53	58
BROWN & GRAY BASALT	58	76
GRAY BASALT ,HARD	76	148
BLACK BASALT ,MEDIUM	148	158
GRAY BASALT ,HARD	158	223
BROWN BASALT ,HARD	223	225
BROWN BASALT ,MEDIUM ,POROUS	225	235
RED BASALT ,POROUS	235	248
RED BASALT ,MEDIUM HARD	248	253
GRAY BASALT ,MEDIUM HARD	253	261
GRAY BASALT ,HARD	261	326
BLACK BASALT W/GREEN & BROWN	326	339
SEAMS	326	339
BLACK BASALT W/BLUE SEAMS PYRITE & WOOD	339	346
BLACK BASALT ,HARD	346	356
BLACK BASALT ,FRACTURED	356	364
BLACK BASALT ,POROUS W/ GREEN CLAYSTONE & PYRITE	364	378
BLACK & GRAY BASALT ,MEDIUM	364	378
GRAY BASALT ,HARD	378	405
BLACK BASALT ,FRACTURED ,WATER BEARING	405	533
BLACK BASALT ,HARD	533	545
	545	550

CENTRAL REGION OFFICE DEPT. OF ECOLOGY SEP 30 1999 Received

Work started 08/30/99 Completed 09/01/99

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Charles S Moore License No 833 & 834 & 973

Contractor's
Registration No. MKDRIC134PE Date 09/22/99

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No W120589
Unique Well I D # AFE008
Water Right Permit No

(1) OWNER Name LONG GALE (01483) Address 3314 EDGEWOOD DR VANCOUVER, WA 98661-

(2) LOCATION OF WELL County KLICKITAT W½ SW 1/4 SW 1/4 Sec 22 T 3 N , R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 7 5 MI UP LYLE-CENTERVILL, LYLE

(3) PROPOSED USE DOMESTIC

(4) TYPE OF WORK Owner's Number of well (If more than one) 01
NEW WELL Method ROTARY

(5) DIMENSIONS Diameter of well 6 inches
Drilled 595 ft Depth of completed well 595 ft

(6) CONSTRUCTION DETAILS
Casing installed 6 " Dia from +1 ft to 79 ft
WELDED " Dia from ft to ft
4 5 " Dia from 15 ft to 595 ft

Perforations YES
Type of perforator used SAW
SIZE of perforations 1/8 in by 6 in
60 perforations from 555 ft to 595 ft
perforations from ft to ft
perforations from ft to ft

Screens NO
Manufacturer's Name
Type Model No
Diam slot size from ft to ft
Diam slot size from ft to ft

Gravel packed NO Size of gravel
Gravel placed from ft to ft

Surface seal YES To what depth? 25 ft
Material used in seal CEMENT & BENTO
Did any strata contain unusable water? NO
Type of water? Depth of strata ft
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type H P

(8) WATER LEVELS Land surface elevation above mean sea level ft
Static level 400 ft below top of well Date 11/16/99
Artesian Pressure lbs per square inch Date
Artesian water controlled by

(9) WELL TESTS Drawdown is amount water level is lowered below static level
Was a pump test made? NO If yes, by whom?
Yield gal /min with ft drawdown after hrs

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min ft drawdown after hrs
Air test 20 gal/min w/ stem set at 585 ft for 1 hrs
Artesian flow g p m Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation

MATERIAL	FROM	TO
TOP SOIL	0	1
BROWN CLAY	1	10
BROWN BASALT ,MEDIUM	10	27
WHITE CLAY	27	38
BROWN SANDSTONE	38	59
BROWN BASALT ,MEDIUM	59	78
GRAY BASALT ,HARD	78	107
BROWN BASALT ,MEDIUM	107	118
GRAY & BLACK BASALT ,HARD	118	208
BLACK BASALT W/GREEN CLAYSTONE	208	214
GRAY BASALT ,HARD	214	286
BLACK BASALT W/BROWN SEAMS ,MEDIUM HARD	286	294
GRAY BASALT ,HARD	294	483
BLACK BASALT W/WHITE SEAMS ,WATER BEARING	483	508
GRAY BASALT ,HARD	508	573
BLACK BASALT ,VESCULAR ,WATER BEARING	573	592
GRAY BASALT ,HARD	592	595

DEPT OF ECOLOGY Received SEP 05 2000 CENTRAL REGION OFFICE

Corrected well log-
*See liner

Work started 11/11/99 Completed 11/16/99

WELL CONSTRUCTOR CERTIFICATION
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards Materials used and the information reported above are true to my best knowledge and belief

NAME M-K DRILLING CO
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Charles L Moore License No 833 & 834 & 973

Contractor's Registration No MKDRIC134PE Date 08/09/00

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice*

273540 *of Intent Number* _____

CURRENT

Notice of Intent No. W255885

Unique Ecology Well ID Tag No. APT511

Water Right Permit No. _____

Property Owner Name Kylea Garrett

Well Street Address Luftfeld Road

City Lyle County Klickitat

Location SE 1/4-1/4 SW 1/4 Sec 22 Twn3 R13 EWM or WWM ☑ check one

(Lat/Long (s, t, r Still **REQUIRED**) Lat Deg N45° Lat Min/Sec 43.456

Long Deg W121° Long Min/Sec 10.150

Tax Parcel No. 03132253000100

PROPOSED USE: ☑ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☑ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☑ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 577 ft.

Depth of completed well 577 ft.

CONSTRUCTION DETAILS

Casing Installed: ☑ Welded 6 " Diam. from 2.5 ft. to 117.5 ft.

☑ Liner installed 4 " Diam. from 16 ft. to 557 ft.

☐ Threaded _____ " Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ☑ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☑ Yes ☐ No ☐ K-Pac Location _____

Manufacturer's Name Certa Loc

Type PVC Sch 40 Model No. _____

Diam. 4 Slot size .032 from 557 ft. to 577 ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☑ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☑ Yes ☐ No To what depth? 117.5 ft.

Material used in seal Bentonite Chips

Did any strata contain unusable water? ☐ Yes ☑ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level 1715 ft.

Static level 345 ft. below top of well Date 9-25-07

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

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.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 85 gal./min. with stem set at 577 ft. for 1 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water 60° Was a chemical analysis made? ☑ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
brown clay	0	9
broken brown & grey rock, few agates	9	55
light tan claystone going to sandstone	55	70
soft brown rock, sandstone	70	95
broken weathered brown rock - sandstone	95	101
hard grey basalt	101	195
soft brown rock	195	200
hard grey basalt	200	245
soft fractured black & grey rock	245	254
medium soft reddish grey rock	254	290
hard grey basalt with thin fractured layers	290	380
305-310 badly broken layer		
soft black basalt	380	387
med grey basalt	387	565
fractured grey basalt	565	567
black vesicular basalt, greenish claystone,	567	577
fractured black basalt w/reddish material in		
fractures W.B.		
P.H.: 6.5		
Hardness : 40ppm		
Iron : .05ppm		
Nitrate : N.D.		

RECEIVED

OCT 03 2007

DEPARTMENT OF ECOLOGY
WELL DRILLING UNIT

Start Date 9-24-2007 Completed Date 9-25-2007

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☑ Driller ☐ Engineer ☐ Trainee Name (Print) Dwayne Person

Driller/Engineer/Trainee Signature _____

Driller or trainee License No. 2705

Drilling Company Person Pump & Well Drilling

Address 166 Rimrock Road

City, State, Zip Goldendale, WA 98620

IF TRAINEE,
Driller's Licensed No. _____
Driller's Signature _____

Contractor's Registration No. PERSOPW940PQ Date 9-26-2007

ECY 050-1-20 (Rev 3/05)

Ecology is an Equal Opportunity Employer.

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W122802
Unique Well I.D. # AFE005
Water Right Permit No.

(1) OWNER: Name PALMER RIC (01482) Address PO BOX 495 LYLE, WA 98635-0495

(2) LOCATION OF WELL: County KLICKITAT - NW 1/4 NE 1/4 Sec 27 T 3 N., R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 760 LYLE-CENTERVILLE HWY, LYLE

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 01
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 335 ft. Depth of completed well 335 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 19 ft.
WELDED " Dia. from ft. to ft.
4.5 " Dia. from 5 ft. to 325 ft.

Perforations: YES
Type of perforator used SAW
SIZE of perforations 1/8 in. by 6 in.
50 perforations from 285 ft. to 325 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 19 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 228 ft. below top of well Date 11/11/99
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data

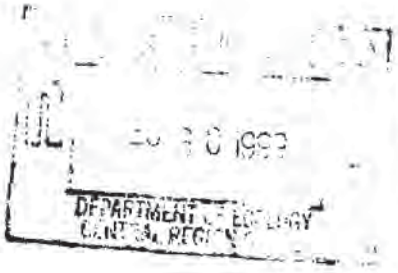
Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 10 gal/min. w/ stem set at 325 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation.

MATERIAL	FROM	TO
TOP SOIL	0	1
BROWN BASALT W/ CLAY	1	36
BROWN BASALT ,FRACTURED	36	124
BROWN & GRAY BASALT ,MEDIUM	124	163
BROWN BASALT ,FRACTURED	163	203
BROWN AGATE W/WHITE	203	218
CLAYSTONE	203	218
GRAY BASALT ,MEDIUM HARD	218	235
BROWN & GRAY BASALT	235	245
BROWN BASALT ,FRACTURED	245	255
GRAY BASALT ,HARD	255	270
BROWN & RED BASALT ,VESCULAR	270	279
WATER BEARING	270	279
BLACK BASALT ,HARD	279	305
BROWN & RED BASALT ,VESCULAR	305	320
GRAY BASALT ,HARD	320	335



Work started 11/09/99 Completed 11/11/99

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Charles E Morris License No 833 & 834 & 973

Contractor's Registration No. MKDRIC134PE Date 11/13/99

Please print, sign and return to the Department of Ecology

DEPT OF ECOLOGY Received NOV 1 0 2014 CENTRAL REGIONAL OFFICE

Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

Construction/Decommission

☑ Construction CRO

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* W122802

Current Notice of Intent No. WE18525

Unique Ecology Well ID Tag No. AFE005

Water Right Permit No.

Property Owner Name Josh Machado

Well Street Address 776 Centerville Hwy

City Lyle **County** Klickitat

Location NW 1/4-1/4 NE 1/4 Sec 27 Twn 3N R 13 EWM or WWM ☑ circle one

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. 03132751000100

PROPOSED USE: ☑ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other

TYPE OF WORK: Owner's number of well (if more than one)

☐ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☑ Rotary ☐ Jetted ☑ Deepened

DIMENSIONS: Diameter of well 6 inches, drilled 85 ft. Depth of completed well 420 ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded ___" Diam. from ___ ft. to ___ ft.

☑ Liner installed 4 PVC " Diam. from 12 ft. to 420 ft.

☐ Threaded ___" Diam. from ___ ft. to ___ ft.

Perforations: ☑ Yes ☐ No

Type of perforator used SAW CUTS

SIZE of perfs 1/8 in. by 7 in. and no. of perfs 33 from 400 ft. to 420 ft.

Screens: ☐ Yes ☑ No ☐ K-Pac Location

Manufacturer's Name

Type Model No.

Diam. Slot size from ft. to ft.

Diam. Slot size from ft. to ft.

Gravel/Filter packed: ☐ Yes ☐ No ☐ Size of gravel/sand

Materials placed from ft. to ft.

Surface Seal: ☐ Yes ☐ No To what depth? ft.

Material used in seal DID NOT DISTURB

Did any strata contain unusable water? ☐ Yes ☑ No

Type of water? Depth of strata

Method of sealing strata off

PUMP: Manufacturer's Name

Type: H.P.

WATER LEVELS: Land-surface elevation above mean sea level ft.

Static level 286 ft. below top of well Date 9/12/2014

Artesian pressure lbs. per square inch Date

Artesian water is controlled by (cap, valve, etc.)

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.

Yield: gal./min. with ft. drawdown after hrs.

Yield: gal./min. with ft. drawdown after hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test

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

Airtest 30 gal./min. with stem set at 415 ft. for 2 hrs.

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes ☑ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
BROWN BASALT	335	345
GRAY WEAK BASALT	345	380
GRAY VES. BASALT W/GREEN CLAYSTONE		
SOME BLACK CLAY W/B	380	400
GRAY BASALT WEAK TO MED	400	420

Start Date 9/1/14 Completed Date 9/5/2014

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Driller/Engineer/Trainee Name (Print) Brian Schrodere

Driller/Engineer/Trainee Signature

Driller or trainee License No. 2707

Drilling Company SCHRODERS WELL DRILLING LLC

Address 1743 HWY 97

City, State, Zip GOLDENDALE WA 98620

Contractor's Registration No. SCHROWD948R6 Date 11/7/2014

If TRAINEE,

Driller's Licensed No.

Driller's Signature

Ecology is an Equal Opportunity Employer. ECY 050-1-20 (Rev 2/03)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report

104249

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W148860
Unique Well I.D. # AGM070
Water Right Permit No.

(1) OWNER: Name ZAHL JAMES B (01657) Address 1347 HEANY RD WHITE SALMON, WA 98672-

(2) LOCATION OF WELL: County KLICKITAT - NW 1/4 NW 1/4 Sec 27 T 3 N., R 13E WM D
(2a) STREET ADDRESS OF WELL (or nearest address) LOT 1 LYLE-CENTERVILLE RD, LYLE WA

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 634 ft. Depth of completed well 634 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 39 ft.
WELDED " Dia. from ft. to ft.
4.5 " Dia. from 0 ft. to 350 ft.

Perforations: 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.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 38 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 155 ft. below top of well Date 10/08/01
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 150 gal/min. w/ stem set at 624 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation.

MATERIAL	FROM	TO
TOP SOIL	0	1
BROWN CLAY	1	31
BROWN BASALT ,MEDIUM	31	88
BROWN BASALT ,FRACTURED	88	110
BROWN BASALT W/GRAY CLAY	110	132
BROWN BASALT ,MEDIUM	132	173
AGATE	173	179
BROWN BASALT ,MEDIUM	179	185
GRAY BASALT ,MEDIUM HARD	185	203
GRAY BASALT ,HARD	203	230
GRAY BASALT BROWN SEAMS	230	238
GRAY BASALT ,HARD	238	255
GRAY BASALT W/WHT MINERALS	255	260
BLACK SANDSTONE	260	268
GRAY BASALT ,HARD	268	301
GRAY BASALT W/BROWN & BLACK SEAMS	301	309
GRAY BASALT ,HARD	309	443
GRAY BASALT W/BROWN SEAMS	443	447
GRAY BASALT ,HARD	447	625
GRAY BASALT ,FRACTURED ,WATER BEARING	625	634

DEPT OF ECOLOGY Received NOV 05 2001 CENTRAL REGION OFFICE

Work started 10/03/01 Completed 10/08/01

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Sandra L Moore License No (833) & 834 & 973

Contractor's Registration No. MKDRIC134PE Date 10/09/01

File Original with Department of Ecology 95158
Second Copy - Owner's Copy
Third Copy - Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Notice of Intent # 127967
UNIQUE WELL I D # AFQ 965
Water Right Permit No

(1) OWNER Name Linda, John COX Address 2040 green ST. white salmon WA.

(2) LOCATION OF WELL County KLICKITAT NW 1/4 NW 1/4 Sec 27 T 3 N R 13E WM

(2a) STREET ADDRESS OF WELL. (or nearest address) Adams view Rd.

TAX PARCEL NO

(3) PROPOSED USE ☒ Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) TYPE OF WORK Owner's number of well (if more than one)
☒ New Well Method ☐ Deepened ☐ Dug ☐ Bored ☐ Reconditioned ☐ Cable ☐ Driven ☐ Decommission ☐ Rotary ☐ Jetted

(5) DIMENSIONS Diameter of well 6 inches
Drilled 200 feet Depth of completed well 200 ft

(6) CONSTRUCTION DETAILS
Casing Installed
☒ Welded 6 " Diam from +1½ ft to 27 ft
☒ Liner installed 4 " Diam from -5 ft to 200 ft
☐ Threaded " Diam from ft to ft

Perforations ☒ Yes ☐ No
Type of perforator used SAW
SIZE of perforations 6 in by 1/8 in
36 perforations from 180 ft to 198 ft

Screens ☐ Yes ☒ No ☐ K Pac Location
Manufacturer's Name
Type Model No
Diam Slot Size from ft to ft
Diam Slot Size from ft to ft

Gravel/Filter packed ☐ Yes ☒ No ☐ Size of gravel/sand
Material placed from ft to ft

Surface seal ☒ Yes ☐ No To what depth? 24 ft
Material used in seal Bentonite
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP Manufacturer's Name myers
Type Submers, BLC HP 1

(8) WATER LEVELS Land surface elevation above mean sea level ft
Static level 178 ft below top of well Date April 01
Artesian pressure lbs per square inch Date
Artesian water is controlled by
(Cap, valve, etc)

(9) 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
Yield gal /min with ft drawdown after hrs
Yield gal /min with ft drawdown after hrs
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal /min with ft drawdown after hrs
Airtest 13 gal./min with ft drawdown after ½ hrs
Artesian flow g p m Date
Temperature of water 49 Was a chemical analysis made? ☐ Yes ☒ No

(10) WELL LOG or DECOMMISSIONING PROCEDURE DESCRIPTION
Formation Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information Indicate all water encountered

MATERIAL	FROM	TO
SOIL	0	1½
BROWN CLAY W. TH SMALL GRAVEL	1½	21
BROWN BASALT	21	127
HARD BROWN CLAY	127	138
cemented GRAVEL	138	178
GRAY BROWN SANDY CLAY, HARD	178	182
FISSURED BASALT W/ B	182	200

STATE OF ECOLOGY Received APR 23 2001 REGION OFFICE

Work Started 4/6 01 Completed 4/7 01

WELL CONSTRUCTION CERTIFICATION

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards Materials used and the information reported above are true to my best knowledge and belief

Type or Print Name LINDSAY HAZARD License No 2498
(Licensed Driller/Engineer)

Trainee Name License No
Drilling Company COLUMBIA WELL DRILLING
(Signed) Lindsay Hazard License No 2498
(Licensed Driller/Engineer)
Address PO BOX 1460, white SALMON WA. 98672
Contractor's Registration No COLUMWD353MD Date 4/17 01

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer For special accommodation needs, contact the Water Resources Program at (360) 407-6600 The TDD number is (360) 407-6006

ECY 050-1-20 (11/98)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

373656

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W268670
Unique Well I.D. # AFQ965
Water Right Permit No.

(1) OWNER: Name COX JOHN A (02352) Address PO BOX 107 LYLE, WA 98635-

(2) LOCATION OF WELL: County KLICKITAT - NW 1/4 NW 1/4 Sec 27 T 3 N., R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 28 ADAMS VIEW DR, LYLE 03-13-2700-0005-00

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
DEEPENED Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 465 ft. Depth of completed well 665 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 4.5 " Dia. from 20 ft. to 660 ft.
WELDED & LINER " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: YES
Type of perforator used SAW
SIZE of perforations 1/8 in. by 6 in.
40 perforations from 620 ft. to 660 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: NO To what depth? ft.
Material used in seal
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 480 ft. below top of well Date 02/17/10
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 25 gal/min. w/ stem set at 655 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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 in formation.

MATERIAL	FROM	TO
GRAY BASALT ,HARD	200	241
GRAY BASALT W/BROWN SEAMS	241	260
BLACK BASALT ,POROUS	260	285
GRAY BASALT ,MEDIUM HARD	285	315
RED & BLACK BASALT ,POROUS	315	332
GRAY BASALT ,MEDIUM HARD	332	351
GRAY BASALT ,HARD	351	462
BLACK & BLUE BASALT	462	482
,MILD FRACTURED	462	482
GRAY & BLACK BASALT ,MEDIUM HARD	482	500
GRAY BASALT ,HARD	500	638
BLACK BASALT ,POROUS W/	638	652
BLUE CLAYSTONE ,WATER BEARING	638	652
GRAY BASALT ,MEDIUM HARD	652	665

RECEIVED
FEB 25 2010
DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Work started 02/12/10 Completed 02/17/10

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS PO BOX 470 DALLESPORT, WA

[SIGNED] License No. 0833,2740,3019

Contractor's Registration No. MKDRIC*948Q7 Date 02/22/10

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

DEPARTMENT OF ECOLOGY State of Washington

Construction/Decommission *("x" in circle)*

☒ Construction CRO

☐ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number _____

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☐ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☒ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 190 ft. Depth of completed well 410 ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded _____" Diam. from _____ ft. to _____ ft. ☐ Liner installed _____" Diam. from _____ ft. to _____ ft. ☐ Threaded _____" Diam. From _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☐ 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 _____

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 205 ft. below top of well Date 7/11/2014

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

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.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 35 gal./min. with stem set at _____ ft. for 1 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No

CURRENT

Notice of Intent No. W 360217

Unique Ecology Well ID Tag No. BIF 979

Water Right Permit No. _____

Property Owner Name SHARON A ALECKSON

Well Street Address 783 CENTERVILLE HWY

City LYLE County KLICKITAT

Location NW1/4-1/4 NW1/4 Sec 27 Twn 3 R 13 (s, t, r Still REQUIRED) EWM ☒ Or WWM ☐

Lat/Long Lat Deg ____ Lat Min/Sec ____ Long Deg ____ Long Min/Sec ____

Tax Parcel No. (Required) 03132212030100

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
GRAY BASALT, MED HARD	220	261
GRAY BASALT, HARD	261	360
BROWN & GRAY BASALT, POUROS	360	372
GRAY BASALT, HARD	372	385
GRAY BASALT, POUROS W/B	385	402
BLACK BASALT, CREVICED W/B	402	410

RECEIVED JUL 28 2014 Department of Ecology Eastern Regional Office

RECEIVED JUL 25 2014 WA State Department of Ecology (SWRO)

DEPT OF ECOLOGY Received FEB 02 2015 CENTRAL REGION OFFICE

Start Date 7/10/2014 Completed Date 7/11/2014

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) GABRIEL J MOORE

Driller/Engineer/Trainee Signature

Driller or trainee License No. 3019

IF TRAINEE: Driller's License No:

Driller's Signature: Gabe Moore

Drilling Company M-K DRILLING CO

Address PO BOX 470

City, State, Zip DALLESPORT , WA, 98617

Contractor's Registration No. MKDRIC*94807 Date 7/12/2014

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No. W-49340
UNIQUE WELL I.D. # _____
Water Right Permit No. _____

(1) OWNER: Name Norm Bendtsen Address Cornelius, Ore.

(2) LOCATION OF WELL: County Klickitat SW 1/4 NW 1/4 Sec 27 T. 3 N., R. 13E WM

(2a) STREET ADDRESS OF WELL (or nearest address) Centerville Hy.

(3) PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one) _____
Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches. Drilled 594 feet. Depth of completed well 594 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from +1 ft. to 59 ft.
Welded ☒ 4½" Diam. from 54 ft. to 594 ft.
Liner installed ☐ _____" Diam. from _____ ft. to _____ ft.
Threaded ☐

Perforations: Yes ☒ No ☐
Type of perforator used Saw
SIZE of perforations .087 in. by 6 in.
100 perforations from 554 ft. to 594 ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☐ No ☒
Manufacturer's Name _____
Type _____ Model No. _____
Diam. ____ Slot size _____ from _____ ft. to _____ ft.
Diam. ____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 59 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

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

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 41 2 ft. below top of well Date 4-29-95
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) 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.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest 10 gal./min. with stem set at 590 ft. for 6 hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water 58 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
Top Soil	0	7
Fractured Shale	7	21
Sand + Gravel Cemented	21	53
Hard Grey Basalt	53	99
Vesecular Brown Basalt w/ Hard Grey Basalt Ribs	99	268
Hard Grey Basalt w/ Vesecular Black Basalt Seams	268	551
Vesecular Black, Brown + Blue Basalt w/ Quartz (w/13)	551	588
Hard Grey Basalt	588	594

RECEIVED
MAY 3
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Work Started 4-25-95 19. Completed 4-29- 1995

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Bills well Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address Goldendale, Wa.

(Signed) Donald W. Reed Jr. (WELL DRILLER) License No. 1052

Contractor's Registration No. BILLSWD088OC Date 4-29 1995

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * 1

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

18184

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W175990
Unique Well I.D. # ALC859
Water Right Permit No.

(1) OWNER: Name ESTRADA JOEL,DAMARIS(2004 Address PO BOX 644 LYLE, WA 98635-

(2) LOCATION OF WELL: County KLICKITAT - SE 1/4 SE 1/4 Sec 27 T 3 N., R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 15 MT BUDMORE RD, LYLE

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 370 ft. Depth of completed well 370 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 319 ft.
WELDED & LINER " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: YES
Type of perforator used HOLTE
SIZE of perforations 1/8 in. by 6 in.
30 perforations from 280 ft. to 310 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 20 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 270 ft. below top of well Date 09/07/05
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 15 gal/min. w/ stem set at 360 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG R

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 in formation.

MATERIAL	FROM	TO
TOP SOIL	0	1
BROWN BASALT ,FRACTURED	1	215
BROWN BASALT ,MEDIUM HARD	215	271
GRAY BASALT	271	280
BROWN BASALT W/ AGATE	280	313
,WATER BEARING	280	313
GRAY BASALT ,HARD	313	355
BLACK & BLUE	355	365
BASALT ,POROUS ,WATER BEARING	355	365
GRAY BASALT	365	370

DEPT OF ECOLOGY Received OCT 0 3 2005 CENTRAL REGION OFFICE

Work started 09/01/05 Completed 09/07/05

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Tyler Thornton License No. 0833,2740,2559

Contractor's Registration No. MKDRIC134PE Date 09/09/05

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

DEPARTMENT OF ECOLOGY State of Washington

Construction/Decommission *("x" in circle)*

☒ Construction CRO

☐ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number _____

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☐ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☒ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 300 ft. Depth of completed well 710 ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded _____" Diam. from _____ ft. to _____ ft. ☐ Liner installed _____" Diam. from _____ ft. to _____ ft. ☐ Threaded _____" Diam. From _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☐ 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 _____

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 550 ft. below top of well Date 6/26/2014

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

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.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 15 gal./min. with stem set at 675 ft. for 1 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No

CURRENT

Notice of Intent No. W 359214

Unique Ecology Well ID Tag No. ALC859

Water Right Permit No. _____

Property Owner Name PAUL JOEL ESTRADA

Well Street Address 15 MT BUDMORE RD

City LYLE County KLICKITAT

Location SE 1/4-1/4 NW 1/4 Sec 27 Twn 3N R 13 **(s, t, r Still REQUIRED)** EWM ☒ Or WWM ☐

Lat/Long Lat Deg ____ Lat Min/Sec ____ Long Deg ____ Long Min/Sec ____

Tax Parcel No. (Required) 03132753000100

Department of Ecology JUL 03 Water Resources Program

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
GRAY BASALT, HARD	370	391
GRAY & BLUE BASALT, MED HARD	391	415
GRAY BASALT, HARD	415	440
BLACK BASALT W/WHITE SEAMS	440	464
GRAY BASALT, HARD	464	578
BLACK BASALT, MED HARD	578	602
GRAY BASALT, HARD	602	641
BLACK BASALT, POROUS W/B	641	675
GRAY BASALT, HARD	675	710

DEPT OF ECOLOGY Received JUL 11 2014 CENTRAL REGION OFFICE

Start Date 6/24/2014 Completed Date 6/26/2014

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) GABRIEL J MOORE

Driller/Engineer/Trainee Signature

Driller or trainee License No. 3019

IF TRAINEE: Driller's License No:

Driller's Signature: Gabe Moore

Drilling Company M-K DRILLING CO

Address PO BOX 470

City, State, Zip DALLESPORT , WA, 98617

Contractor's Registration No. MKDRIC*94807 Date _____

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

17204S

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W183111
Unique Well I.D. # ALC251
Water Right Permit No.

(1) OWNER: Name JENKINS STEPHEN (01941) Address P O BOX 93 LYLE, WA 98635-

(2) LOCATION OF WELL: County KLICKITAT - SW 1/4 NE 1/4 Sec 27 T 3 N., R 13E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 18 MT BUDMORE RD, LYLE

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 330 ft. Depth of completed well 280 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 19 ft.
WELDED & LINER " Dia. from ft. to ft.
4.5 " Dia. from 1 ft. to 280 ft.

Perforations: YES
Type of perforator used SAW
SIZE of perforations 1/8 in. by 6 in.
80 perforations from 200 ft. to 280 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 20 ft.
Material used in seal CEMENT & BENTO.
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 240 ft. below top of well Date 03/31/05
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 20 gal/min. w/ stem set at 270 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG G

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 in formation.

MATERIAL	FROM	TO
TOP SOIL	0	2
BROWN BASALT ,FRACTURED	2	55
BROWN BASALT ,MEDIUM	55	82
BROWN BASALT ,WEATHERED	82	120
GRAY & BROWN BASALT ,FRACTURED	120	135
BROWN BASALT ,WEATHERED	135	200
GRAY CLAYSTONE	200	215
WHITE CLAY & RIVERGRAVEL	215	230
BROWN SANDSTONE	230	245
BROWN BASALT ,WEATHERED ,WATER BEARING	245	275
BROWN BASALT W/ WHITE CLAYSTONE	275	289
& BROWN SOAPSTONE	275	289
,WATER BEARING	275	289
BROWN BASALT ,WEATHERED	289	330

Work started 03/30/05 Completed 03/31/05

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
(Person, firm, or corporation) (Type or print)

ADDRESS BOX 470 DALLESPORT, WA

[SIGNED] Tyler Thornton License No. 0833,2740,2559

Contractor's Registration No. MKDRIC134PE Date 04/04/05

DEPT. OF ECOLOGY Received APR 29 2005 CENTRAL REGION OFFICE

Please print, sign and return to the Department of Ecology

DEPT OF ECOLOGY Received NOV 10 2014 CENTRAL REGION OFFICE

Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

Construction/Decommission

☑ Construction CRS

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* W183111

Current Notice of Intent No. WE19307

Unique Ecology Well ID Tag No. ALC251

Water Right Permit No.

Property Owner Name Steve Jenkins

Well Street Address MT Budmore Rd

City Lyle **County** Klickitat

Location SW 1/4-1/4 NE 1/4 Sec 27 Twn 3N R 13 EWM or WWM ☑ circle one

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. 03132700002800

PROPOSED USE: ☐ DeWater ☑ Domestic ☐ Irrigation ☐ Industrial ☐ Test Well ☐ Municipal ☐ Other

TYPE OF WORK: Owner's number of well (if more than one) _____

☐ New well ☐ Reconditioned ☑ Deepened

Method: ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 400 ft.

Depth of completed well 680 ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded ___" Diam. from ___ ft. to ___ ft.

☑ Liner installed 4 T&C" Diam. from 8 ft. to 680 ft.

☐ Threaded ___" Diam. from ___ ft. to ___ ft.

Perforations: ☑ Yes ☐ No

Type of perforator used TORCH

SIZE of perfs 1/4 in. by 7 in. and no. of perfs 15 from 659 ft. to 680 ft.

Screens: ☐ Yes ☑ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☑ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☐ Yes ☐ No To what depth? _____ ft.

Material used in seal DID NOT DISTURB

Did any strata contain unusable water? ☑ Yes ☐ No

Type of water? CASCADING Depth of strata 290

Method of sealing strata off SHALE TRAP & BENTONITE

PUMP: Manufacturer's Name FLINT & WALLING

Type: SUBMERSIBLE H.P. 3

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 533 ft. below top of well Date 10/12/14

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

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.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 15 gal./min. with stem set at 670 ft. for 2 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☑ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
BROWN CLAYSTONE SANDSTONE CAVED IN	280	330
GRAY BASALT MED	330	370
GRAY BASALT WEAK	370	390
GRAY BASALT MED	390	420
GRAY BASALT WEAK	420	475
GRAY BASALT HARD	475	500
GRAY BASALT MED	500	557
GRAY WEAK BASALT	557	600
GRAY BASALT MED	600	620
GRAY VES BASALT WEAK W/B	620	650
GRAY BASALT HARD	650	680

Start Date 9/10/2014 Completed Date 10/12/2014

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Driller/Engineer/Trainee Name (Print) Brian Schroder

Driller/Engineer/Trainee Signature Brian Schroder

Driller or trainee License No. 2707

If TRAINEE,

Driller's Licensed No. _____

Driller's Signature _____

Drilling Company SCHRODERS WELL DRILLING LLC

Address 1743 HWY 97

City, State, Zip GOLDENDALE WA 98620

Contractor's Registration No. SCHROWD948R6 Date 11/7/2014

Ecology is an Equal Opportunity Employer. ECY 050-1-20 (Rev 2/03)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

☒ Construction ☐ Decommission *ORIGINAL INSTALLATION*

430503

Notice of Intent Number _____

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) 2

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 590 ft. Depth of completed well 590ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +1 ft. to 229 ft.
☒ Liner installed 5" Diam. from +1 ft. to 489 ft.
☐ Threaded _____" Diam. From _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18.5ft.

Material used in seal BENTONITE

Did any strata contain unusable water? ☐ Yes ☑ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 515ft. below top of well Date 10-11-11

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

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.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 15 gal./min. with stem set at 580ft. for 1hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☐ No

CURRENT

Notice of Intent No. W253497

Unique Ecology Well ID Tag No. BBJ088

Water Right Permit No. _____

Property Owner Name JOESPH MINNICK

Well Street Address 81 S. PRARIE RD

City LYLE County KLICKITAT

Location NE1/4-1/4 SW1/4 Sec 27 Twn 3N R 13E **(s, t, r Still REQUIRED)** EWM ☒ Or WWM ☐

Lat/Long Lat Deg ____ Lat Min/Sec ____
Long Deg ____ Long Min/Sec ____

Tax Parcel No. (Required) 03-13-2700-0016-00

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
TOPSOIL	0	1
BROWN BASALT & CLAY	1	15
BROWN BASALT, WEATHERED	15	70
BROWN BASALT, MEDIUM	70	115
BROWN BASALT, MEDIUM	115	255
GRAY & BLACK BASALT, MEDIUM	255	280
GRAY BASALT, WHITE SEAMS	280	295
BLACK BASALT, MEDIUM	295	310
SAND & CLAY	310	333
GRAY BASALT, HARD	333	415
GRAY BASALT W/CLAYSTONE	415	435
GRAY BASALT, HARD	435	458
BLUE CLAYSTONE,BROKEN, CAVING	458	480
BLACK & GRAY BASALT, MED HARD	480	550
BLACK BASALT, POROUS, W/BROWN	550	590
SEAMS, WATERBEARING	550	590

DEPT OF ECOLOGY Received NOV 03 2011 CENTRAL REGION OFFICE

Start Date 9-14-11 Completed Date 10-11-11

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) TYLER F THORNTON

Driller/Engineer/Trainee Signature

Driller or trainee License No. 3020

IF TRAINEE: Driller's License No:

Driller's Signature: Tyler Thornton

Drilling Company M-K DRILLING COMPANY

Address PO BOX 470

City, State, Zip DALLESPORT , WA, 98617

Contractor's Registration No. MKDRIC*948Q7 Date 10-14-11

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. .....

Permit No. .....

(1) OWNER: Name Chris Patric Address Star Route 4 Lyle, Wa.

(2) LOCATION OF WELL: County Klickitat — NW¼ NW¼ Sec 28 T 3 N. R. 13E W.M

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) .....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 555 ft. Depth of completed well 555 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 40 ft.
Threaded ☐ ..... " Diam. from ..... ft. to ..... ft.
Welded ☒ ..... " Diam. from ..... ft. to ..... ft.

Perforations: 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.

Screens: Yes ☐ No ☒
Manufacturer's Name .....
Type ..... Model No .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☒ No ☐ To what depth? 36 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ..... Depth of strata .....
Method of sealing strata off .....

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

(8) WATER LEVELS: Land-surface elevation above mean sea level .... 1600 ft.
Static level 395 ft. below top of well Date 7/21
Artesian pressure ..... lbs. per square inch Date .....
Artesian water is controlled by ..... (Cap, valve, etc.)

(9) 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.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test .....
Bailer test 30 gal./min. with 140 ft. drawdown after 1 hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

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	0	5
Rock brown broken	5	32
Basalt gray	32	83
Rock brown damp	83	105
Basalt gray	105	135
Rock black damp	135	154
Basalt gray	154	285
Basalt black WB	285	340
Basalt gray hard	340	455
Basalt black & green clay-stone WB	455	480
Basalt gray	480	521
Basalt black WB	521	555

RECEIVED
DEPARTMENT OF ECOLOGY

Work started 18 July 19 81 Completed 21 July 19 81

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 Murray Well Drilling Inc.
(Person, firm, or corporation) (Type or print)

Address 3712 W 8th The Dalles, Oregon

[Signed] Richard J. Murray
(Well Driller)

License No. 325 Date 21 Aug 19 81

(USE ADDITIONAL SHEETS IF NECESSARY) OK EP 9-16-81

ECY 050-1-20