WELL SITING SUMMARY REPORT FOR

PINEDALE ESTATES
DOMESTIC WATER IMPROVEMENT DISTRICT

NAVAJO COUNTY, ARIZONA

Prepared For:

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ABBREVIATIONS & ACRONYMS

ACC	Arizona Corporate Commission
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
ANSI	American National Standards Institute
APN	Assessor's Parcel Number
AZ	Arizona
bgs	Below grade surface
CGIAR	Consultative Group for International Agricultural Research
DWID	Domestic Water Improvement District
E	East
EPA	Environmental Protection Agency
ESRI	Environmental Systems Research Institute
EWL	Engineered With Layton
FEMA	Federal Emergency Management Agency
ft	Feet / Foot
gal	Gallons / Gallon
GIS	Geographic Information System
gpd	Gallons Per Day
gpm	Gallons Per Minute
hp	Horsepower
hrs	Hours
IOC	Inorganic Contaminants
in	Inch
IX	Ion Exchange
L	Liter
lf	Linear Foot
MCL	Maximum Contaminant Level
mg	Milligram
mg/L	Milligram Per Liter
MSDS	Material Safety Data Sheet
N	North
NASA	National Aeronautics and Space Administration
NCEAS	National Center for Ecological Analysis and Synthesis
NGA	National Geospatial Intelligence Agency
NLS	National Library Service
NOAA	National Oceanic and Atmospheric Administration
NSF	National Sanitation Foundation
O&M	Operation and Maintenance
pCi	Picocuries
POA	Property Owners Association
ppm	Parts per million
psi	pounds per square inch
PWS	Public Water System
RO	Reverse Osmosis
S	South
SDWIS	Safe Drinking Water Information System
sUAS	Small Unmanned Aircraft System
US	United States
USGS	United States Geological Survey
W	West
WHO	World Health Organization

1.0 INTRODUCTION

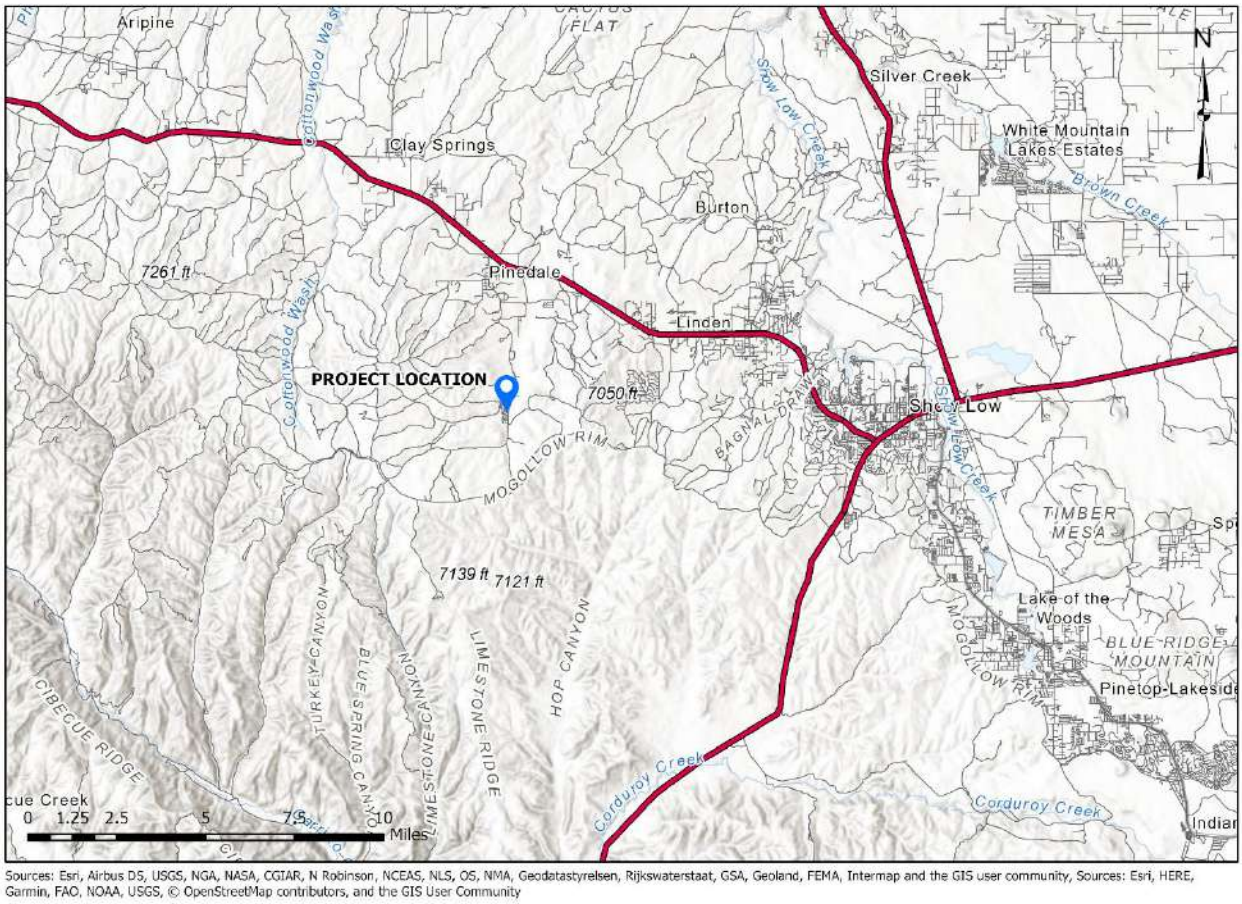
1.1 Project Location

The Pinedale Estates Domestic Water Improvement District (DWID) is located along Rim Drive, 5-miles south of Arizona Highway 260, approximately 15-miles west of the Town of Show Low, Navajo County, Arizona. It is in the portion of the northeast quarter of the northwest quarter of the northeast quarter of Section 20, Township 10 north, Range 20 east of the Gila and Salt River Base and Meridian.

The approximate location of the Pinedale Estates DWID well is as follows:

- Latitude: 34°15'18" N Longitude: 110°14'17" W

Refer to **Figure A** and **Appendix A** for the project vicinity map.



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Figure A: Vicinity Map of Pinedale Estates Domestic Water Improvements District

1.2 Project Background

The Pinedale Estates DWID is located approximately 15-miles west of Show Low, Arizona in Navajo County. The Pinedale Estates DWID is a Public Water System (PWS) regulated by the Arizona Department of Environmental Quality (ADEQ) and provides potable water to approximately 208 customers. The Water System Detail Information as listed on ADEQ Safe Drinking Water Information Systems (SDWIS) database is given below:

- Water System ID#: AZ04-09-040
- Water System Name: Pinedale Estates DWID
- Principal County Served: Navajo
- Water System Classification: C
- Primary Water Source: GW
- Administrative Contact: Eckert, Michael
- Email: smeckert@q.com

During the period between June 1993 and February 2020, the water produced by the existing well consistently exhibited high levels of selenium. Prior to the deepening of the Pinedale Estate Well in 1995, the average level of selenium was 0.12 mg/L. Following the deepening of the well, the average selenium levels rose to 0.30-mg/L.

The Maximum Contaminant Level (MCL) for selenium was established by the United States Environmental Protection Agency (EPA) for drinking water in January of 1991 (40 CFR Part 141, 1998) at 0.05-mg/L. The National Primary Drinking Water Regulations (NPDWR) are legally enforceable primary standards meant to protect public health by limiting the levels of contaminants in drinking water supplies.

Historically, the water system was owned and operated by Sitgreaves Water Company and regulated by the Arizona Corporate Commission (ACC) and ADEQ. In November of 2017, the Navajo County Board of Supervisors approved the formation of the Pinedale Estates DWID (KUV Consultants, LLC., 2019). The water system was originally constructed in 1970's and consists of a well, two (2) 5,000-gal storage tanks, disinfection system (chlorine), one (1) booster pump, and the distribution network.

1.3 Project Site Topography

Pinedale Estates is situated in a depression between Lons Point to the west and Juniper Ridge to the east at approximately 6,550-ft in elevation. The Lons Point rises to an elevation of over 7,166-ft and Juniper Ridge is approximately 7,050-ft at its highest point. Most of the parcels within Pinedale Estates are located between 6,500-ft and 6,630-ft in elevation.

It should be noted that the Pinedale Estates project study area is adjacent to the Mogollon Rim. The Mogollon Rim is a geologic formation that was formed during the uplift of the Colorado Plateau that is characterized with about 200 miles of vertical scarps that can be several hundred to as tall as 2,000-ft across Arizona and western New Mexico. Mogollon Rim Road is the rural forest road along the top of the "Rim". The Rim is identified in Figure B with the black arrow. The Rim, in relation to the project location is about 2-miles east, 2.2-miles south and about 1.3-miles southeast of the Project Location. It is anticipated that the geologic anomaly creating the Rim may be the contributing factor to the coal (therefore Selenium) found in the PE DWID well.

Refer to **Figure B** and **Appendix A** for site vicinity topographic map.

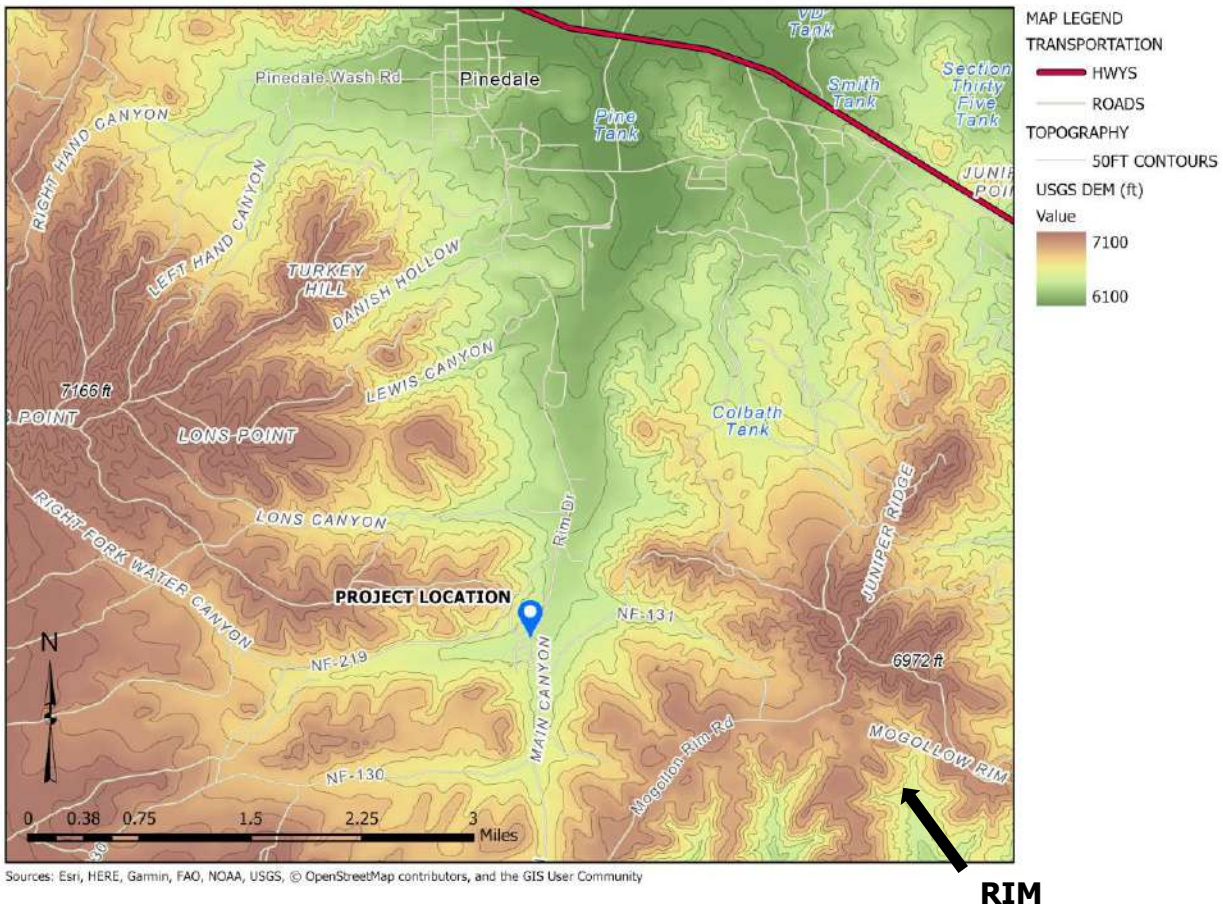


Figure B: Site Vicinity Topographic Map With 50-ft Contours

1.4 Hydrology and Hydrogeology of the Region

The Pinedale Estates community is bisected by Dodson Wash, (also known as Mortenson Wash), an intermittent stream along the Rim Drive as shown in **Figure C**. Engineered With Layton (EWL) interviewed local resident and DWID vice president, Mr. Charles Mead, during an onsite visit regarding flows in the stream due to flooding concerns. Mr. Mead described the flows in the stream as being highly seasonal with high water levels never rising above surrounding riverbanks, several feet below the elevation of the water facility.

FEMA floodplain map shows the project area is in Zone A, an area with 1% annual chance flood hazard. Refer to **Appendix B** for the FEMA flood map (FEMA FIRM Map #04017C4442F).

Given the depth of groundwater and the hydrogeology of the region, surface waters are not likely to be a contributing factor to the elevated levels of contaminants at Pinedale Estates.

Refer to **Figure C** and **Appendix A** for map depicting site vicinity surface waters.

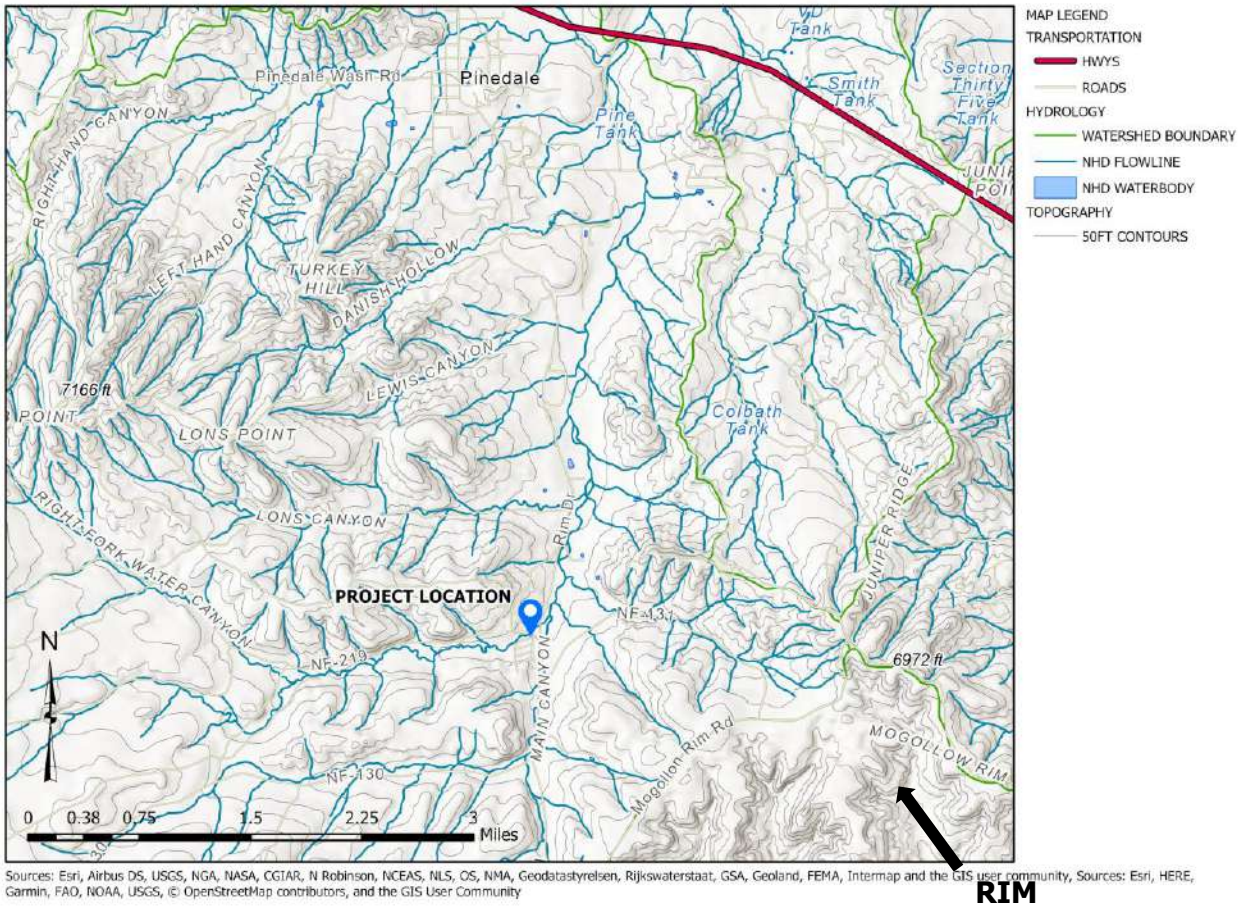


Figure C: Site Vicinity Surface Waters and Watershed Boundaries

Pinedale Estates is located within the Little Colorado River Plateau Basin which is part of the larger Colorado Plateau physiographic region (Fenneman et al., 1964). In general, the aquifers of the Colorado Plateau are contained in a thick sequence of sandstone, siltstone and shale. In addition, volcanic rocks, carbonate rocks, and evaporite deposits in the area yield water to wells. Due to structural deformation, faulting and lateral changes in lithology, a complex sequence of water yielding layers have formed overtime (Robson et al., 1987). Within the Colorado Plateau, the four principal aquifers are as follows: Uinta-Animas, Mesaverde, Dakota-Glen Canyon, and Coconino-De Chelly Aquifers (Dane et al., 1965). Although the water quality and availability within these aquifers can vary widely, much of the land is underlain by rocks that contain usable quantities and quality of water suitable for domestic use.

The Pinedale Estates well draws water from the Coconino-De Chelly aquifer, which is primarily composed of Coconino, De Chelly, and Glorieta Sandstones. The Coconino and De Chelly sandstones consist of well-sorted quartz sandstone with interbedded siltstone, mudstone, and carbonates (Johnson, 1962). In northeastern Arizona and west-central New Mexico, the dissolved solids concentrations of the Coconino-De Chelly aquifer are generally below 1,000-milligrams per liter. However, in the southern portions of the Coconino-De Chelly aquifer, where Pinedale Estates is located, the dissolved-solids concentrations have been observed as high as 25,000-milligrams per liter. Historical studies of the aquifer have suggested that the north-westerly movement of the groundwater in the region may have produced elongated distribution of the highly mineralized water (Lindner-Lunsford et al., 1989).

The groundwater basins of Northeastern Arizona are shown in **Figure D**.

Figure D: Groundwater Basin Map of Northern Arizona

1.5 Current Pinedale Estates Well

The current Pinedale Estates well (ADWR 55-806522) provides water services to 83 customers in the community of Pinedale Estates. Originally drilled in 1968 by Sitgreaves Water Company to a depth of 525-ft, the well was deepened to a depth of 675-ft in 1995.

The Arizona Department Water Resources (ADWR) Well Registry (as of June 2020), states the following for Pinedale Estates well:

- Well Depth: 675-ft
- Static Water Level: 449-ft bls
- Casing Diameter: 6-in
- Casing Depth: 645-ft
- Water level: 487-ft
- Casing Type: Steel- Perforated
- Pump Capacity: 75-gpm

During the 2018-2019 year, the well produced on average 9,092-gallons per day (gpd). The maximum production peaked at 16,864-gpd while the minimum production was 3,437-gpd.

1.6 Water Quality Issues at Pinedale Estates Well

The EPA established the MCL of selenium at 0.05-milligrams per Liter (mg/L). On average, the selenium levels at Pinedale Estates is five times greater than the MCL set by the EPA. During the period between June 1993 to February 2020, the water produced from the existing well consistently exhibited high levels of selenium with the average concentration of 0.25-mg/L. On March 19, 2019, the well recorded a selenium level of 1.70-mg/L. This data point has been excluded from the report due to possible sample irregularities. Refer to **Table A** for summary of water quality testing performed at Pinedale Estates well.

Interpolation of the available data on selenium shows an increasing trend by approximately 6-micrograms per year since deepening of the well. Comparatively, including the years prior to 1995 result in average selenium level increasing at a rate of 20-micrograms per year. Refer to **Figure E** and **Figure F** for historical trends in selenium from 2001 to 2020 and from 1993-2020, respectively.

Table A: Historical Selenium Levels at Pinedale Estates Well From 1993 to 2020

DATE SAMPLED	Se (mg/L)	DATE SAMPLED	Se (mg/L)	DATE SAMPLED	Se (mg/L)
6/2/1993	0.077	4/29/2002	0.320	5/3/2004	0.300
11/7/1993	0.077	5/8/2002	0.340	6/14/2004	0.180
1/11/1994	0.091	6/5/2002	0.320	7/12/2004	0.300
2/3/1994	0.119	7/10/2002	0.370	8/11/2004	0.290
3/8/1994	0.091	8/11/2002	0.320	8/30/2004	0.420
6/5/1994	0.200	9/3/2002	0.150	9/30/2004	0.310
7/12/1994	0.200	10/8/2002	0.330	10/5/2004	0.240
9/5/1994	0.150	2/18/2003	0.310	12/6/2004	0.260
10/3/1994	0.260	3/3/2003	0.400	9/6/2007	0.306
12/4/1994	0.120	4/8/2003	0.220	10/25/2007	0.215
3/2/1995	0.120	5/6/2003	0.260	2/19/2019	0.350
5/21/1995	0.120	6/4/2003	0.310	8/19/2019	0.420
6/20/1995	0.089	7/8/2003	0.410	8/9/2019	0.380
7/10/1995	0.078	12/30/2003	0.250	5/22/2019	0.337
8/2/1995	0.022	1/6/2004	0.210	8/14/2019	0.370
9/19/2001	0.330	2/2/2004	0.290	12/23/2019	0.330
10/22/2001	0.320	3/1/2004	0.280	2/25/2020	0.200
1/10/2002	0.270	4/8/2004	0.300	- -	- -

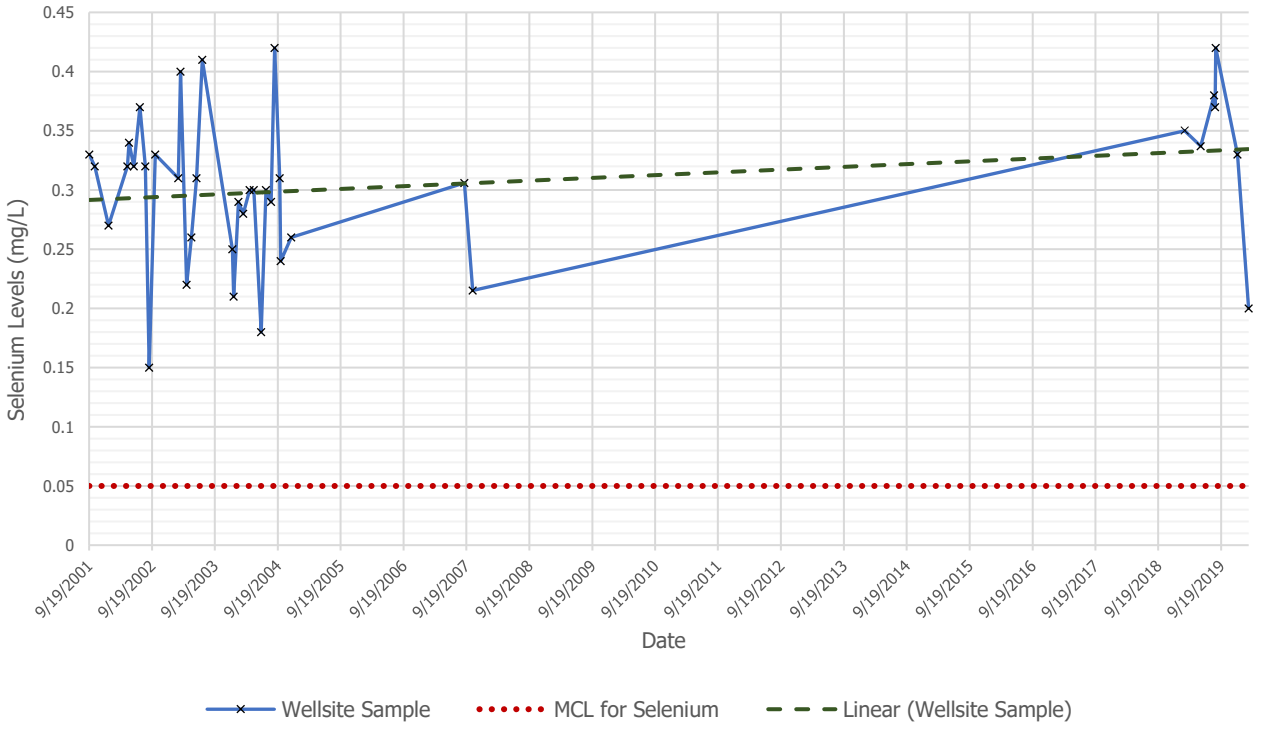


Figure E: Timeseries of Selenium Levels at Pinedale Estates Well from 2001 to 2020

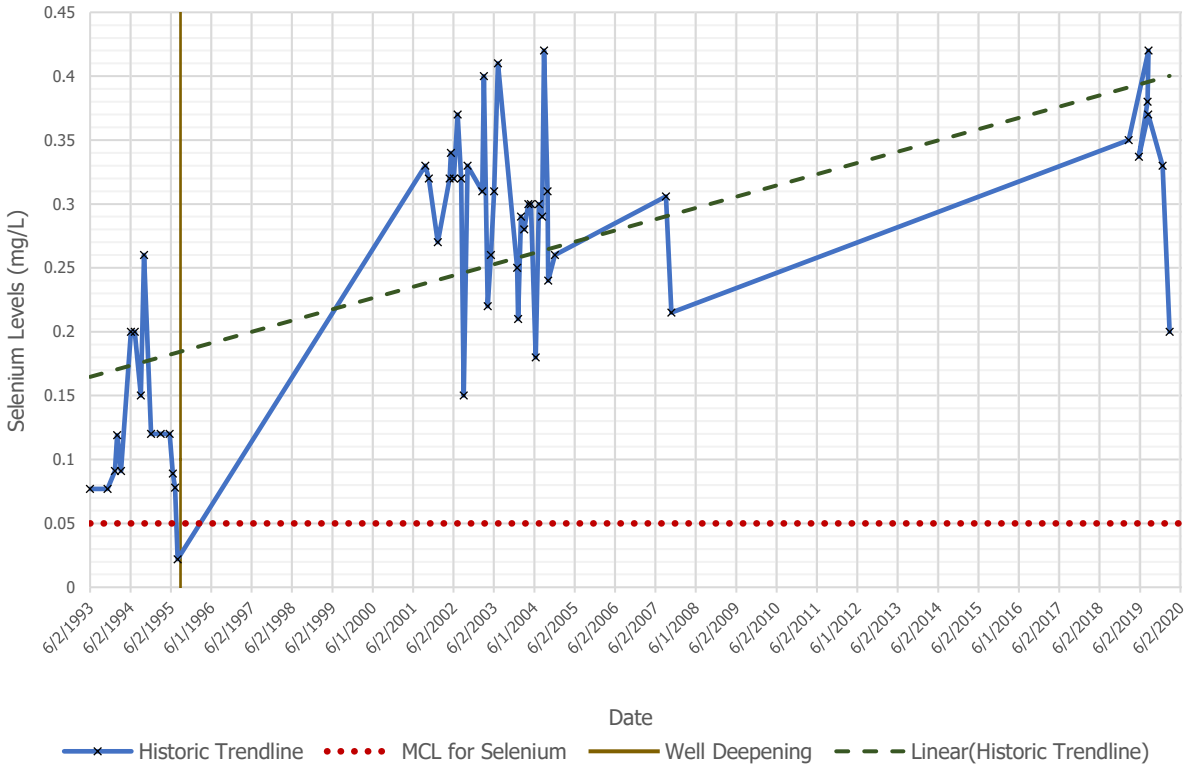


Figure F: Timeseries of Selenium Levels at Pinedale Estates Well from 1993 to 2020

1.7 Previous Studies of Pinedale DWID

There has been two previous studies on the Pinedale Estates well and its surrounding area. The first study took place in June 2019 by KUV Consultants, LLC., and the second study took place in August 2019 by NCS Engineers. The KUV report described the current well condition as well as the history of the well. The NCS Report explored several ways to mitigate selenium levels of the well. The subsequent sections summarize key findings of the two reports.

1.7.1 KUV Report

The KUV Report on Pinedale Estates recorded that the well serves a population of approximately 220 people through 83 service connections. The area is expected to grow in population as remaining parcels are developed. The report notes significant seasonal variation of water demands. During the summer months, the water demand is three-fold higher than in the winter months, with demands peaking around the month of June.

Within the past twenty years, moderate improvements have been made to the water campus. The well pump, chlorination system, sand separator, flow meter, and storage tanks have been upgraded in the previous two years. Following their assessment of the water system, KUV recommended installation of a new well or rehabilitating the current existing well, additional storage tanks, back-up booster pump, new electrical system, as well as new fencing for the well site in order to improve water quality and overall reliability.

1.7.2 NCS Report

The report issued by NCS explored possible solutions to mitigating high levels of selenium in the groundwater. The report expounded on the three different types of selenium that exist in water.

There are three forms of selenium, selenite (Se IV) is effectively removed by most treatment processes, whereas selenate (Se VI) is more difficult to remove. Selenium can also exist in the form of selenide (Se^{2-}) but is in gaseous form under ambient temperature and is thermodynamically unstable in aqueous solutions (Martens, 2003). In the aqueous phase, selenite and selenate are dominant and are the most mobile species of selenium (Breynaert et al., 2010). As different forms of selenium have varied chemical characteristics, understanding the type of selenium present is critical for designing the appropriate treatment scheme.

The hardness of the water was at 360-milligrams which falls in the category of "very hard". TDS was also recorded below the 500-mg/L limit. The selenium level recorded was 0.32-mg/L, which is noted to be "totally recoverable selenium". The speciation showed selenate (Se VI) concentration level of 0.0249-mg/L and a selenite (Se IV) concentration less than 0.000035 mg/L. Other constituents that might cause treatment interference, discussed in the NCS report include: arsenic, barium, and vanadium below detection levels. NCS study also recommended monitoring of gross alpha as it was noted to be close to the EPA MCL of 15-picocuries (pCi) per Liter.

Typically, alkalinity and total hardness should be around the same concentration as they are typically sourced from the same minerals. When alkalinity has a lower concentration than total hardness, it may be due to the elevated level of chlorine, nitrate, or sulfate (Shaw et al., 2009).

In May 2019, NCS conducted a field survey of the well, the nearby Dodson Wash, and surrounding areas as part of their study. NCS noted that the well was adjacent to a residential community on the western side with most of those lots being vacant. Beyond the residential community, the land surrounding Pinedale Estates is heavily forested with no notable human activity that can be directly attributed to the elevated levels of selenium. Thus, based on the site vicinity survey performed by NCS, no surrounding facility can be directly attributed to the high levels of selenium.

The NCS report also analyzed the drillers log recorded during the deepening of the well. Referring to a USGS survey investigation, NCS found a correlation between occurrence of coal strata and elevation concentrations of selenium in groundwater (Paschke et al., 2014). Furthermore, the driller's log suggests the source of elevated selenium may be the shale and as well above 600-ft bgl. Given such observations, NCS posited the following for possible well rehabilitation:

- Remove the pump equipment from the well
- Perforate the interval from about 500- to 600-ft with a Mills knife tool
- Backfill the well with clean sand fill, from the bottom up at 580-ft (The sand should be fine enough to flow through the well perforations into the annulus outside the well casing)
- Fill the interval from 580-ft up to 500-ft with cement and set up cement seal
- Drill the cement seal back out of the well down the 580-ft and then airlift or bail the clean sand fill out of the well

The treatment technologies discussed in the NCS report are: biological treatment, coagulation and filtration, ion exchange (IX), reverse osmosis (RO), and media adsorption. Based on the selenium speciation found at Pinedale Estates, NCS recommends IX with regenerative and disposable resin and RO. These two options are compared in subsequent sections with construction of a new well as possible mitigation options for Pinedale Estates.

1.8 Study of Private Wells in the Local Vicinity

Adjacent to Pinedale Estates on the east side of Dodson Wash, there are at least nine privately own wells. These wells were individually sampled and analyzed for different analytes or parameters including iron, manganese, gross alpha, Uranium, and arsenic. The sampling data is summarized in **Table B** along with primary and secondary MCL values (SMCL) established under the Safe Drinking Water Act (SDWA). The data highlighted in ***red*** indicates exceedances of the primary or secondary MCL(s). The highest detected levels of selenium at each of the wells are shown graphically in **Figure G**.

Table B: Contaminant Levels in Private Wells of Pinedale Estates

Well Site	Distance (ft)	Se (mg/L)	Fe (mg/L)	Mn (mg/L)	Gross Alpha (pCi/L)	Ur (µg/L)	As (mg/L)
MCL/SMCL		**0.05**	**0.30**	**0.05**	**15.00**	**30.00**	**0.01**
Bunyard	4400	<0.002	N/A	<0.020	7.00	N/A	<0.001
Woolf	4600	<0.002	N/A	<0.020	9.00	N/A	0.0011
Ridenhour	3700	0.0022	2.900	0.032	16.80	0.010	<0.001
Flores	3100	<0.002	N/A	0.092	12.00	N/A	<0.001
Flores	3100	<0.002	3.700	0.059	N/A	N/A	N/A
Claseman (House)	3300	0.015	N/A	<0.020	12.00	N/A	N/A
Claseman 2nd Well	2900	0.017	0.082	<0.020	13.70	N/A	<0.001
Kaiser	1800	0.0022	<0.05	<0.020	40.40	0.019	<0.001
Melton	1200	0.0690	9.400	<0.020	18.40	0.008	0.0230
Forsyth	1100	<0.002	0.062	N/A	0.01	N/A	<0.001
Forsyth	1100	0.0420	2.200	0.026	N/A	N/A	N/A
Pinedale Estates	N/A	0.3800	0.08	N/A	14.00	N/A	N/A
Pinedale Estates	N/A	0.4200	1.300	0.080	N/A	N/A	N/A

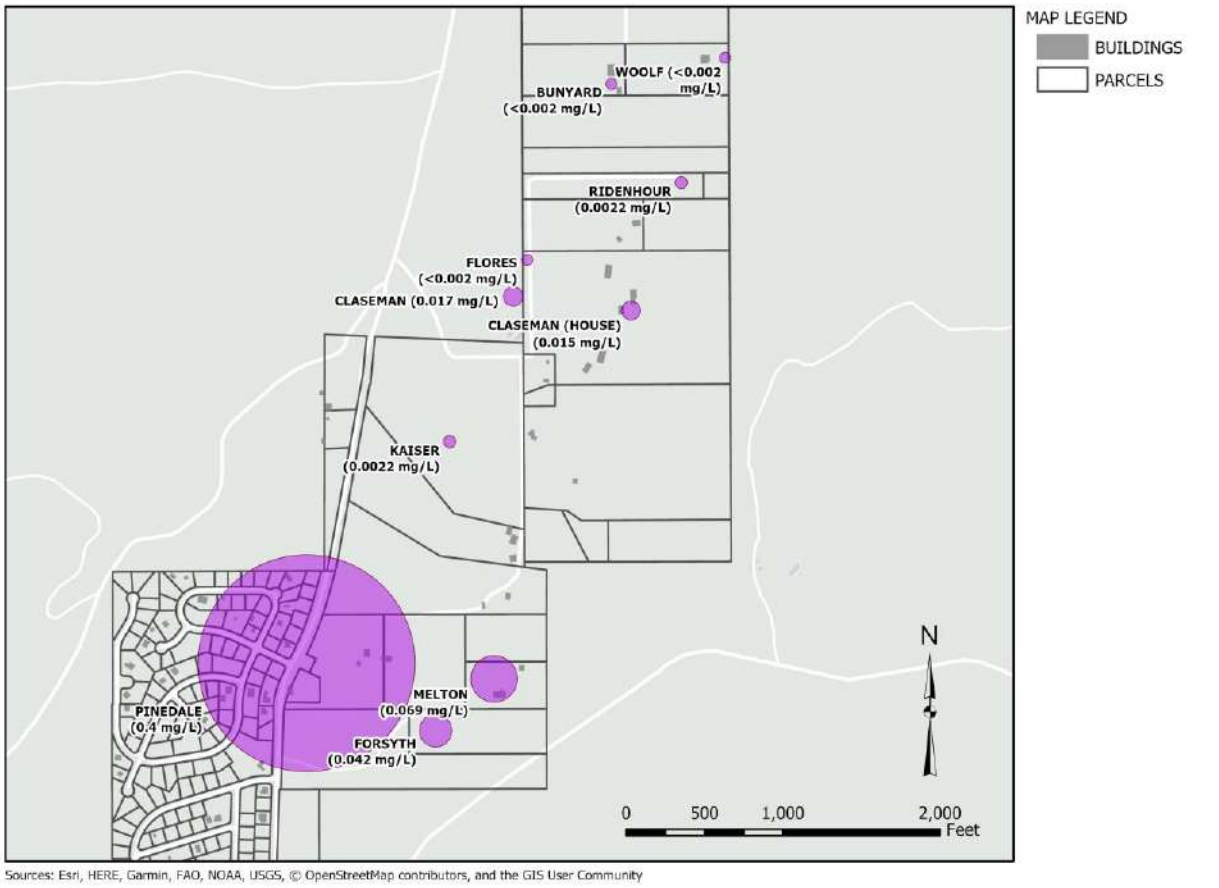


Figure G: Levels of Selenium Detected in 2019 at Various Wells of Pinedale Estates

In general, the available data on selenium shows a decreasing trend with respect to distance from the existing Pinedale Estates well. The three highest levels of selenium presented in **Table B** occur at Pinedale, Melton, and Forsyth wells. The two most distant wells, Bunyard and Woolf, had non-detectable levels of selenium.

Other inorganic contaminants (IOCs) such as iron and manganese tested for at Pinedale Estates show similar trends as described above for selenium. At the Pinedale Estates well, the iron and manganese levels tested as high as 1.30-mg/L and 0.08-mg/L, respectively. At Ridenhour, iron and manganese levels were found to be above the SMCL levels. At Bunyard, the iron levels were above the SMCL, but the manganese level was approximately half of the SMCL level. The EPA SMCL for iron is 0.3-mg/L and 0.05-mg/L for manganese.

The highest measured gross alpha of Pinedale Estates well was a recorded 14.6-pCi per liter (June, 1994). This level is near the MCL of 15-pCi per liter and should be closely monitored. Kaiser, Melton, and Ridenhour have contaminants above MCL and should also be closely monitored.

2.0 PROPOSED SOLUTIONS

This section describes the potential solutions for achieving regulatory compliance at Pinedale Estates DWID with respect to selenium. The treatment options discussed in the Section 2.1 were originally presented by NCS Engineers in a previous study on behalf of ADEQ. In Section 2.2, construction of a new well and its potential location are presented. The locations proposed in Section 2.2 have been derived from available water quality data, interviews with local residents, hydrogeologic records, and feasibility of construction.

2.1 Water Treatment Systems

The RO water treatment system is a water purification process that uses a semi-permeable membrane to filter large molecules such as selenium, salts, and bacteria from the water. The remaining water that does not permeate thru the membrane is known as the reject stream. Challenges presented with the RO system is the frequent maintenance of the system, high energy consumption, and high concentration of contaminants in the reject stream. Given that Pinedale Estates is situated in a remote area, transportation and disposal of RO reject stream may be costly. Alternatively, onsite evaporation ponds can be used to reduce the amount of waste water that must be transported offsite. Such a pond would need to be approximately 0.6-acres and built outside of flood plains. Given that the current well site is located within a flood zone, construction of a evaporation pond would require additional land to be acquired.

IX water treatment systems allow water to pass through multiple resins that in turn reduces contaminants such as selenium from water using base anion resins. A high salinity brine is needed due to frequent regeneration. Single-use IX resins can be used as an alternative, but the continued system and facility maintenance increase operations costs. Having a contaminant level that exceeds the maximum concentration established by the EPA's Resource Conservation and Recovery Act (RCRA) the disposal costs will increase with Single-use IX Resins.

2.2 Well Relocation

In **Figure F**, there are 4 possible location sites considered in this report for a new Pinedale Estates DWID well. Sites A, B, and C are all within 2000 feet of the current well site, while Site D is approximately 4000 feet away. Sites A, B, and C were location sites given by the DWID as a possibility. In analyzing the water quality data, well sites near Pinedale Estates had higher level of contaminants in the water than well sites further north. If the selenium levels at Pinedale Estates continue to increase, then it is most likely that the areas closest to the well will continue to see an increase as well. Due to the lack of documented wells to the south and east, insufficient data exists to suggest the water quality will improve. Site D has been chosen based on the spatial trend of selenium concentrations, where the groundwater is most likely to be of sufficient quality.

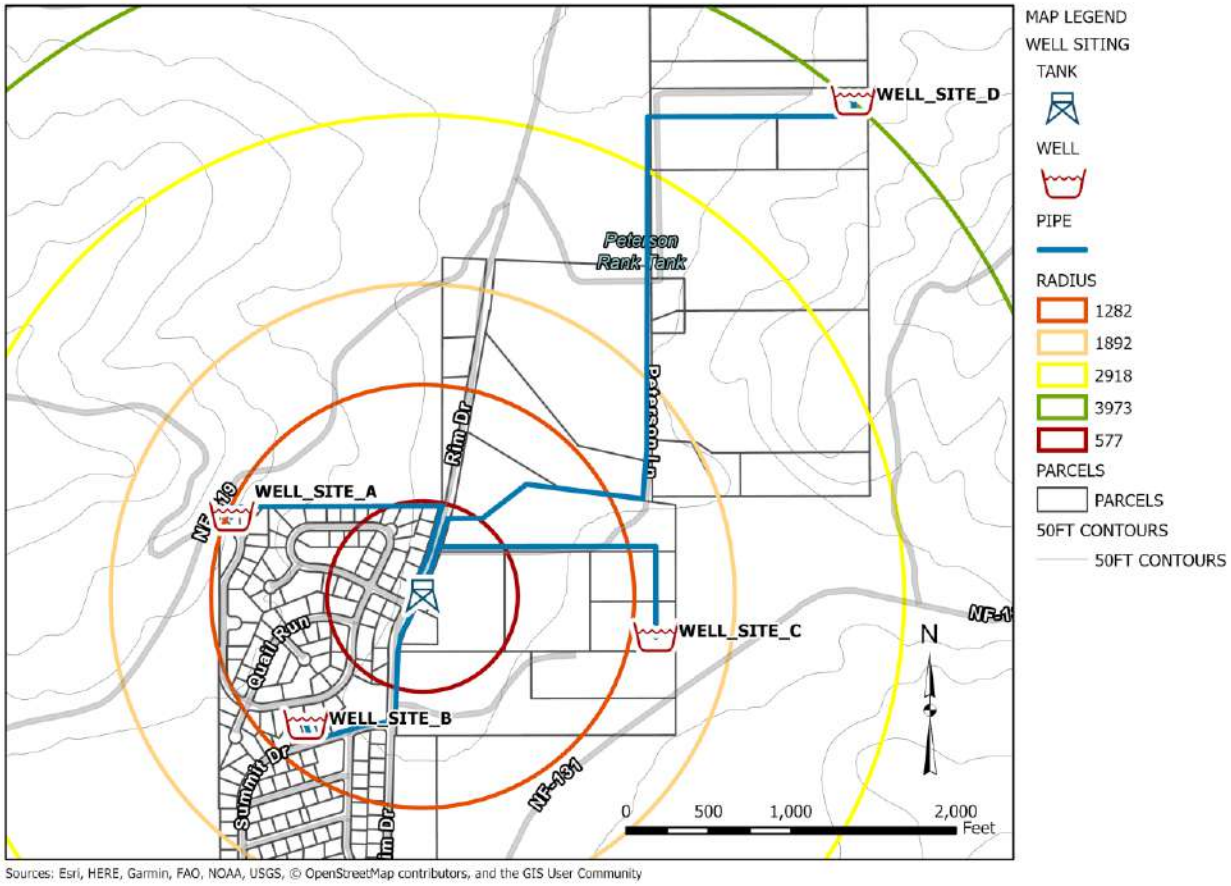


Figure H: Potential Well Site Locations

2.3 Local Stratigraphy

Analysis of drill logs of nearby wells, including Pinedale Estates, demonstrates similarity in the local stratigraphy. Note that the recorded water level between the wells range from 430- and 480-ft below ground surface in a Sandstone layer. Pinedale Estates well did not have a drill log during the original construction of the well in 1968. However, the consistency of local strata, as shown in **Figure H**, provides a strong predictor for conditions underground at the Pinedale Estates well. Furthermore, given that all wells shown in the figure have consistent groundwater levels, it can be safely assumed that the wells are withdrawing from the same aquifer, eliminating the possibility that the differences in selenium levels are caused by withdrawal from different aquifers.

Outside the Pinedale Estates well, none of the other local drill logs have wells lower than 585-ft below ground surface level. The deepest strata that they penetrate is the Sandstone, between 40- and 80-ft below the reported water level during their original construction. Meanwhile, the Pinedale Estates well deepening log notes presence of coal and shale in its deepest strata. The well is nearly 200-ft below the reported water level when the well was deepened in 1995.

Refer to **Figure I** on the following page for a diagram created from the drill logs of Pinedale Estates Well as well as the local privately owned wells.

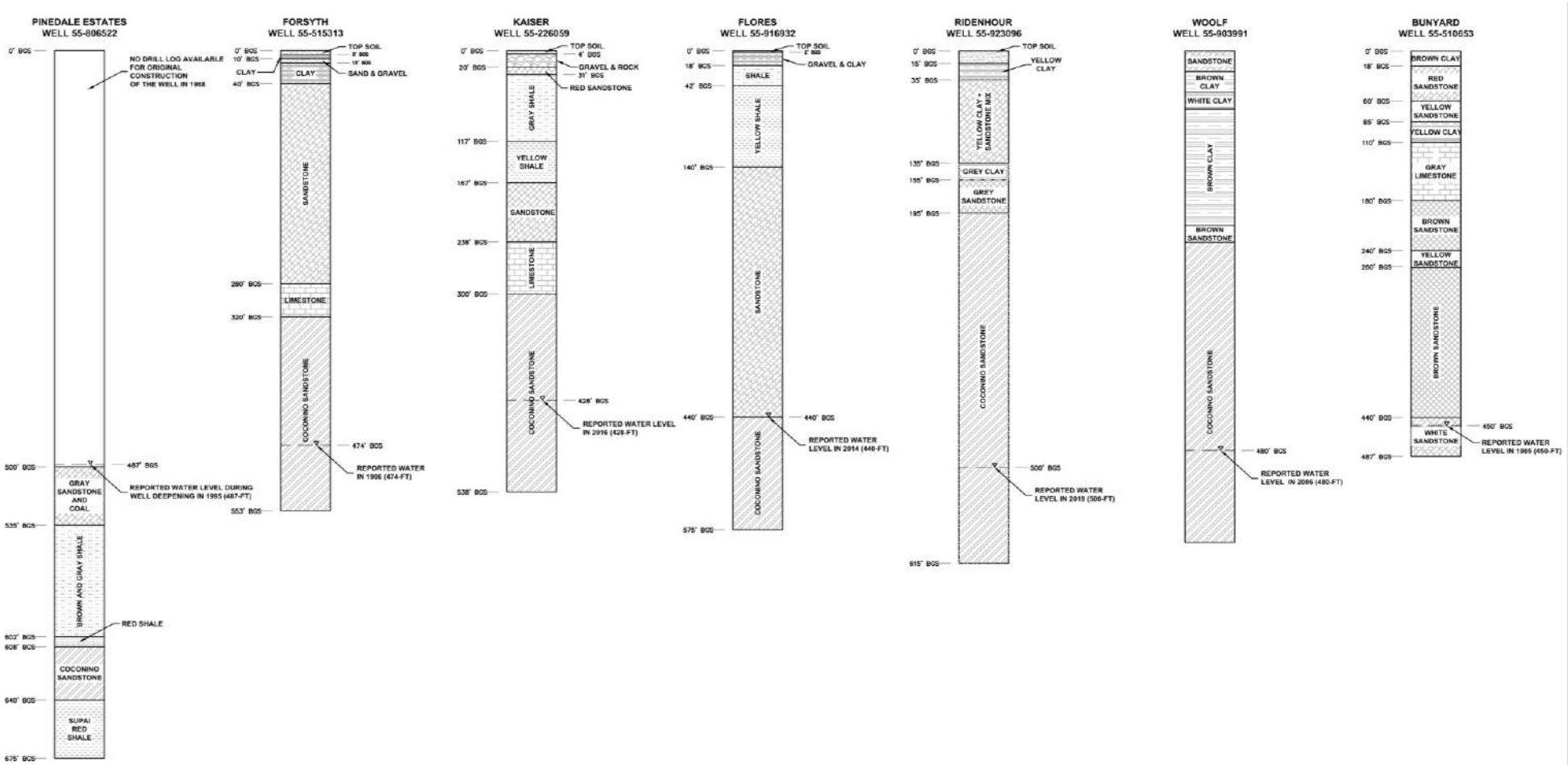


Figure I: Drill Logs of Local Wells in Pinedale Estates

3.0 WELL TRANSMISSION PIPELINE ALIGNMENT

All well transmission mains will require line connection back to the current wellsite. The two existing 5,000-gal storage tanks are assumed to remain at the current wellsite to minimize costs of improvements.

As stated in previous sections, the existing well pump operates at approximately 75-gpm. On average the system requires a 35-gpm well pump to have sufficient water throughout the summer months and to prevent pump exhaustion or underusage of pump. Given the expected increase in population and customers, the 75-gpm capacity pump may be suitable for Pinedale Estates. Using a total differential head (TDH) calculation of 685-ft, the following minimum horsepower required is calculated using the following equation:

$$Min.Horsepower\ Required = \frac{(flow)(TDH)}{(3.960)(Efficiency)}$$

Where,

- $Flow = Approximately\ 75\text{-}gpm$
- $TDH = 685\text{-}ft$
- $Efficiency = 0.70$

Therefore, the minimum horsepower required is approximately 18.55-hp.

$$\frac{(flow)(TDH)}{(3.960)(Efficiency)} = \frac{(75\ gpm)(685\ ft)}{(3.960)(0.70)} \cong 18.55\ hp$$

Based on the TDH calculations, the recommended well pump shall be rated for 20-hp (pump hp sizes are 15, 20, and 25) and efficiency of approximately 0.70 while maintaining a flow rate of roughly 75-gpm.

All of the proposed sites are located in a Zone X of the FEMA FIRM Map.

Constructing a well site at either Site A or Site B will require utilization of parcels originally intended for residential development. In general, Sites A and B are closer to the current wellsite than Sites C and D and thus will require less piping to be constructed. The advantages and disadvantages of each of the sites (proposed by the project team) are summarized in the following sub-sections.

3.1 Summary of Proposed Well Sites

Well Site A

At proposed well site A, all the adjacent parcels are privately owned and not by the Pinedale Estates Property Owners Association (PEPOA). The northern boundary of the subdivision is set apart for public utility easements. Refer to **Figure J** for recorded easements near Well Site A. It should be noted that satellite images show existing development that extends beyond the recorded easement. If the recorded easement cannot be utilized, special permission from the United States Forest Service may be required to construct the water line further to the north. This route of connection requires approximately 1,956-ft of pipe to be constructed.

Alternatively, the water line may be constructed southward towards Ridge Drive then east across the existing easement between Lot 7 and Lot 8 to Forest Drive, where the rest of the connection can be completed within the roadway.

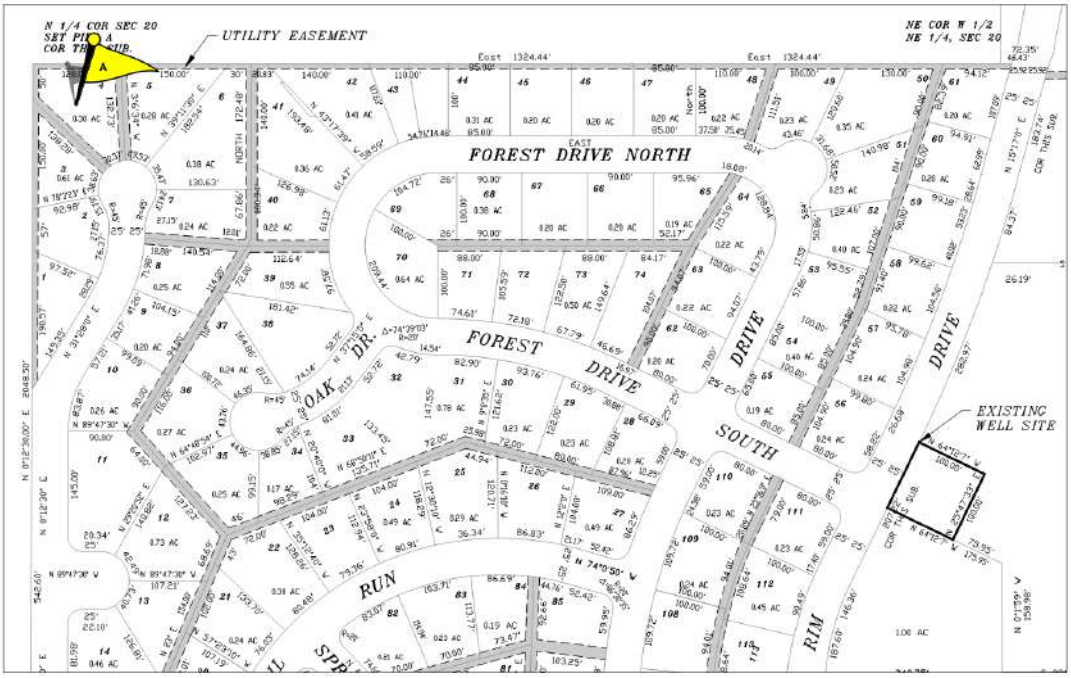


Figure J: Parcel Map showing recorded easements around Well Site A

Well Site B

The closest potential parcel that closely resembles the same size as the current location would be parcel 409-12-121. This current parcel is sized over 10,000 square feet and is owned by the PEPOA. As shown in **Figure K**, there are recorded easements along lots on Summit Drive that provide a direct connection to Rim Road. Connecting Site B to the existing facility will require approximately 1,421-ft of pipe to be constructed. Alternatively, the water line may be constructed along Summit Drive and Rim Road where no utility easements are required.

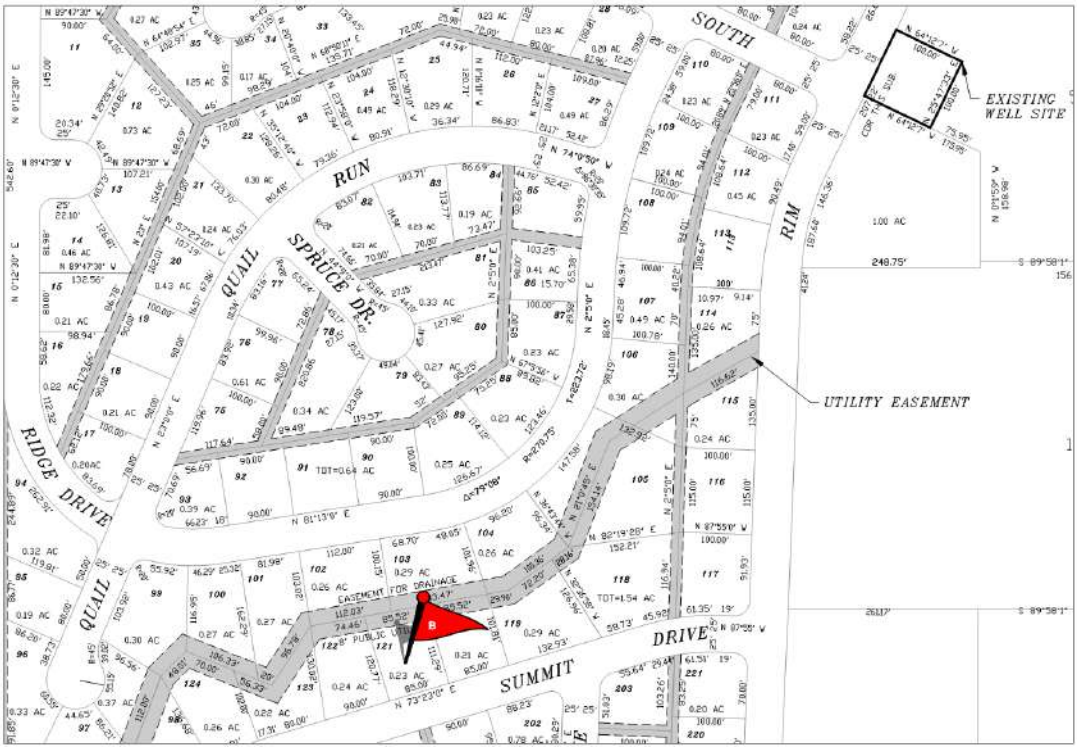


Figure K: Parcel Map showing recorded easements around Well Site B

Well Site C

Site C is a moderate distance away from the original well site with relatively simple pipe alignment. The site is currently on private land owned by the owners of the Melton well. Private land purchase or land lease from the owners would be required to construct a well at Site C. Furthermore, there are no known easements that connect Site C to Aurelio Way. New utility easements dedications may be required in order to connect Site C to the existing well site. The most feasible pathway of connection between Site C and the existing facility will require 2,189-ft of pipe to be constructed. Refer to **Figure L** for recorded easements near Well Site C.

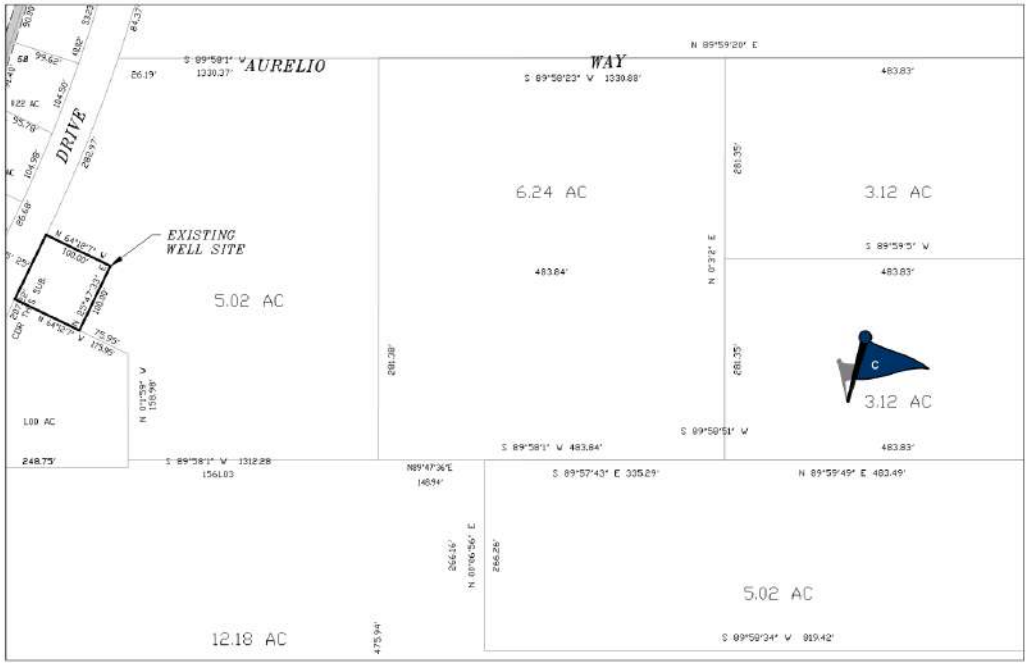


Figure L: Parcel Map showing recorded easements around Well Site C

Well Site D

This site offers the possibility of the best water quality results as compared to the other options. Wells in close proximity to this site, Ridenhour and Woolf, did not have report elevated levels of selenium. The most significant challenge with respect to Site D is the distance from the current well site. Due to the remote location of Site D, the construction costs associated with water line is higher.

There are several recorded utility easements as well as existing roadways between Site D and the existing well site as shown in **Figure M** below. However, the extent of the known easements are unclear and no New easements may also be needed between the current well site and Site D. The most feasible pathway of connection between Site D and the existing facility will require 5,243-ft of pipe to be constructed.

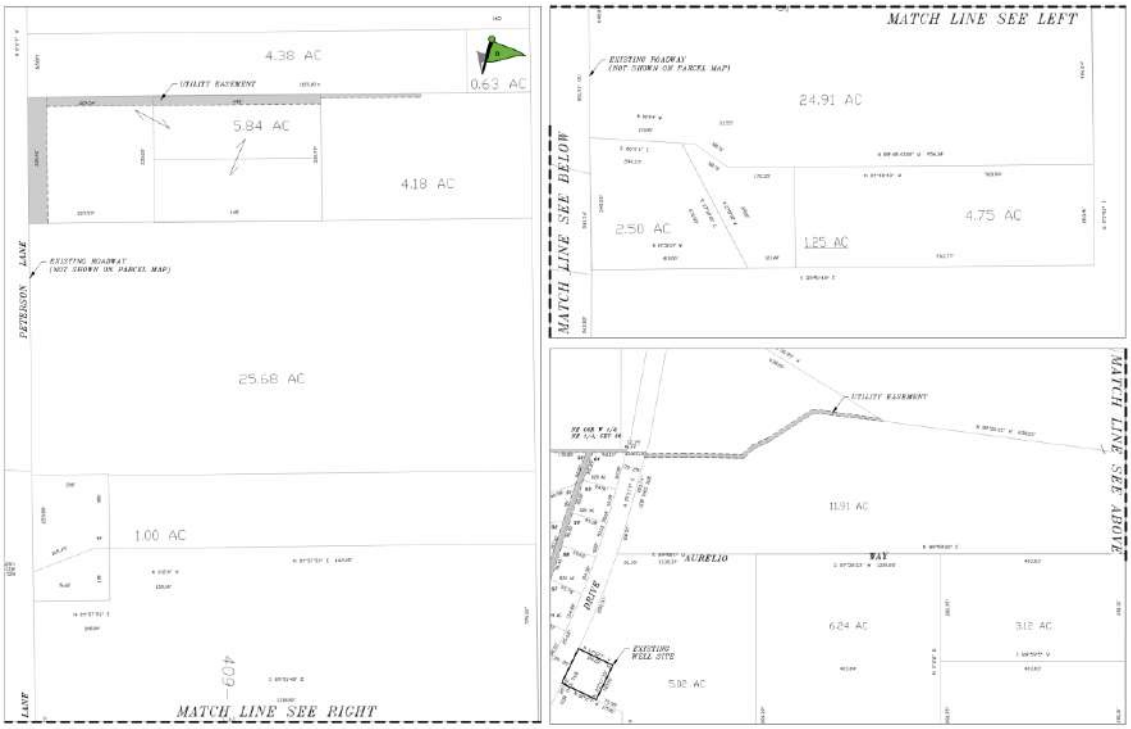


Figure M: Parcel Map showing recorded easements around Well Site D

4.0 ENGINEER'S OPINIONS OF PROBABLE COST (EOPC)

Using previous studies and cost estimation software, RSMeans®, the two avenues for remediation of water quality issues at Pinedale Estates are compared. The options presented in this section are: the Reverse Osmosis (RO) treatment facility, and the Ion Exchange (IX) treatment system, derived from the NCS Report and construction of a new well at sites four (4) sites proposed in Section 2.4.

4.1 Opinion of Probable Cost on Treatment Solutions

The Reverse Osmosis treatment facility cost estimation is shown in **Table C**. This cost used the prices of the components and installation as referenced by the NCS report. In addition to the construction costs, there is an implementation of professional support costs as well as a contingency to include any costs that have not been factored in for equitable comparison. The RO system would also require additional land for an evaporation pond and the treatment system. Estimates for land purchase or land lease are not included. Overall a Reverse Osmosis system has an anticipated total project cost of $874,495.65.

The IX Water Treatment System Opinion of Probable Cost is shown in **Table D**. Similar to the RO system, the IX Treatment System has incorporated costs of project professional support costs. As stated in the previous sections, the current lot size is not sufficient for this any of water treatment system. Cost to include an expanded lot is not reflected in the Opinion of Probable Cost. Expansion of facility would likely incur additional costs, including land expansion in a non-floodplain area. Expansion of facility costs are not included in this cost. The estimated costs for the IX treatment system excluding lot expansion is $647,840.66.

4.2 Opinion of Probable Cost on New Well Sites

The main difference from the each of the potential new well sites is primarily the distance and quality of the groundwater. As stated in the previous sections, from general testing of the local wells, Site D could possibly have the best ground water, although this would still be theoretical until the water is drilled and tested. The same is true at all the other well sites, the water quality is unknown until the well is drilled, developed, and when testing can occur. While relocation to a new well may improve the water quality, it is possible that some level of treatment may still be required. However, if Selenium is found in the new well location, lower levels of Selenium are anticipated thereby making treatment more cost effective than the current location. None of the costs associated with treatment have been included in the Probable Cost Estimation since treatment costs were outside the scope of this study. The following tables show the cost analysis for building a well site at each site: **Table E** on Site A, **Table F** on Site B, **Table G** on Site C, and **Table H** on Site D. Note that the only real difference between these figures are the amount of transmission pipe needed. This Opinion of Probable Cost reflects a 6-inch PVC pipe from the new well site to existing well site.

In **Table I**, price estimation per connection for the cost of either a new water treatment system or a relocation of the well is presented. This table reflects an increase in customer fees for the current connections over the span of 20 years for only the initial capital costs. This table does not reflect price for repairs and ongoing maintenance of the well or water treatment system. In general, installation a treatment system incurs additional costs that are three to four times higher than construction of a new well to the end user.

Table C: Engineer's Opinion of Probable Cost – RO System

Pinedale Estates DWID - RO System				
Construction Costs				
Components	**Equip / Material Cost ($)**	**Install / Labor Cost ($)**	**Quantity**	**Total Cost ($)**
Recirculation Pump			1	$ -
Iron Pretreatment Filter			1	$ -
Centrifugal RO HP Feed Pump			1	$ -
Cartridge Filter			1	$ -
Complete CIP System w/ Appurtenances			1	$ -
Programmable Logic Controller			1	$ -
Subtotal	$ 140,000.00	$ 90,000.00	1	$ 230,000.00
Electrical Instruments Installation	$ -	$ 60,000.00	1	$ 60,000.00
30' by 40' Building	$ -	$ 50,000.00	1	$ 50,000.00
Evaporation Pond w/ Liner (0.6-Acre)	$ -	$ 150,000.00	1	$ 150,000.00
Construction Subtotal				**$ 490,000.00**
Bonding & Mobilization		10%		$ 49,000.00
Taxes		8%		$ 39,200.00
Construction Contingency		20%		$ 98,000.00
Construction Total				**$ 676,200.00**
Project Professional Support Costs		**% of Construction**		
Engineering Planning & Design			15.0%	$ 101,430.00
Engineer Bidding Services			1.5%	$ 10,143.00
Bid Advertisement & Related Costs			0.5%	$ 3,381.00
Bid Package Prep & Printing Costs			1.0%	$ 6,762.00
Engineering Contract Prep Costs			1.25%	$ 8,452.50
Legal Costs			1.0%	$ 6,762.00
Administrative Costs			0.25%	$ 1,690.50
Engineering Construction Admin & Post Construction Permitting			5.0%	$ 33,810.00
Professional Support Subtotal				**$ 172,431.00**
Contingency		15%		$ 25,864.65
Professional Support Total				**$ 198,295.65**
ANTICIPATED TOTAL PROJECT COSTS				**$ 874,495.65**

NOTE: The prices of the components and installation are referenced from the NCS Engineers Report drafted in August of 2019. The cost estimate from NCS Engineers is based on condition of the project location at the time of the report. The Professional Support Costs have been modified to EWL's standard table for comparison purposes.

Table D: Engineer's Opinion of Probable Cost – IX Treatment System

Pinedale Estates DWID - IX Treatment System				
Construction Costs				
Components	**Equip / Material Cost ($)**	**Install / Labor Cost ($)**	**Quantity**	**Total Cost ($)**
24" x 72" FRP Vessels, Skid Mounted			1	$ -
ABS Distributors / Collectors			1	$ -
Anion Exchange Resin, 18-cubic feet			1	$ -
PVC Piping			1	$ -
Iron Pre-treatment Filter			1	$ -
Electric Ball Valves			1	$ -
Brine Pumps and Dilution Component / Panel			1	$ -
Flow Meter			1	$ -
PE Brine Maker / Tank w/ Controller & Sensor			1	$ -
Control Panel			1	$ -
Subtotal	$ 150,000.00	$ 100,000.00	1	$ 250,000.00
Electric Instruments Installation	$ -	$ 63,000.00	1	$ 63,000.00
30' x 40' Building	$ -	$ 50,000.00	1	$ 50,000.00
Construction Subtotal				**$ 363,000.00**
Bonding & Mobilization		10%		$ 36,300.00
Taxes		8%		$ 29,040.00
Construction Contingency		20%		$ 72,600.00
Construction Total				**$ 500,940.00**
Project Professional Support Costs		**% of Construction**		
Engineering Planning & Design			15.0%	$ 75,141.00
Engineer Bidding Services			1.5%	$ 7,514.10
Bid Advertisement & Related Costs			0.5%	$ 2,504.70
Bid Package Prep & Printing Costs			1.0%	$ 5,009.40
Engineering Contract Prep Costs			1.25%	$ 6,261.75
Legal Costs			1.0%	$ 5,009.40
Administrative Costs			0.25%	$ 1,252.35
Engineering Construction Admin & Post Construction Permitting			5.0%	$ 25,047.00
Professional Support Subtotal				**$ 127,739.70**
Contingency		15%		$ 19,160.96
Professional Support Total				**$ 146,900.66**
ANTICIPATED TOTAL PROJECT COSTS				**$ 647,840.66**

NOTE: The prices of the components and installation are referenced from the NCS Engineers Report drafted in August of 2019. The cost estimate from NCS Engineers is based on condition of the project location at the time of the report. The Professional Support Costs have been modified to EWL's standard table for comparison purposes.

Table E: Engineer's Opinion of Probable Cost – Well Option A

PINEDALE ESTATES DWID - WELL OPTION A				
Construction Costs				
Components	**Equip / Material Cost ($)**	**Install / Labor Cost ($)**	**Quantity**	**Total Cost ($)**
PVC Pipe, AWWA C900, 6" Diameter (Per LF)	$ 5.57	$ 3.50	1,956	$ 17,740.92
PVC 90-Deg Elbow w/ Gasket, 6" Diameter (Ea)	$ 82.36	$ 8.61	3	$ 272.91
PVC 45-Deg Elbow w/ Gasket, 6" Diameter (Ea)	$ 85.70	$ 8.61	3	$ 282.93
Check Valves, 6" Diameter (Ea)	$ 1,474.73	$ 157.31	1	$ 1,632.04
Gate Valves, CI w/ Boxes, 6" Diameter (Ea)	$ 1,307.78	$ 157.31	6	$ 8,790.54
Air Rel & Vacuum Valve (Ea)	$ 912.66	$ 39.45	2	$ 1,904.22
PVC Restraint Joint, 6" Diameter (Ea)	$ 64.55	$ 43.22	22	$ 2,370.94
Thrust block, 6" Diameter (Ea)	$ 41.74	$ 15.51	6	$ 343.50
Domestic Well Drilling, 8" Diameter (Per ft)	$ 14.95	$ 34.99	550	$ 27,467.00
Pump, 6" Submersible, 25HP, 500' Deep (Ea)	$ 11,549.00	$ 1,451.93	1	$ 13,000.93
Well Casing, PVC (Per ft)	$ 14.47	$ 15.73	550	$ 16,610.00
Well Screen Assembly, SS, 6" Diameter (Per LF)	$ 227.05	$ 12.51	10	$ 2,395.60
Well Sterilization, Chlorine (Ea)	$ 156.93	$ 463.05	1	$ 619.98
Flow Meter, Bronze, 320GPM, 3" Diameter (Ea)	$ 2,567.85	$ 240.25	1	$ 2,808.10
Utility Trench, 8" Wide, 36" Deep (Per LF)	$ -	$ 2.47	1,956	$ 4,831.32
Backfill & Compact, 8" Wide, 36" Deep (Per LF)	$ -	$ 3.86	1,956	$ 7,550.16
Rough Grading, Sub 1,000 S.F. (Ea)	$ -	$ 1,432.20	1	$ 1,432.20
Concrete In Place, 36" x 36", 4000 PSI (Per CY)	$ 203.53	$ 233.09	1.00	$ 436.62
Chain Link Fence, Industrial, 9 ga, 6' High (Per LF)	$ 62.35	$ 4.97	209	$ 14,069.88
Construction Subtotal				**$ 124,559.79**
Bonding & Mobilization		10%		$ 12,455.98
Taxes		8%		$ 9,964.78
Construction Contingency		20%		$ 24,911.96
Construction Total				**$ 171,892.51**
Project Professional Support Costs		**% of Construction**		
Engineering Planning & Design			15.0%	$ 25,783.88
Engineer Bidding Services			1.5%	$ 2,578.39
Bid Advertisement & Related Costs			0.5%	$ 859.46
Bid Package Prep & Printing Costs			1.0%	$ 1,718.93
Engineering Contract Prep Costs			1.25%	$ 2,148.66
Legal Costs			1.0%	$ 1,718.93
Administrative Costs			0.25%	$ 429.73
Engineering Construction Admin & Post Construction Permitting			5.0%	$ 8,594.63
Professional Support Subtotal				**$ 43,832.59**
Contingency		15%		$ 6,574.89
Professional Support Total				**$ 50,407.48**
ANTICIPATED TOTAL PROJECT COSTS				**$ 222,299.99**

NOTE:
1. Project costs are preliminary and based on: budget quotes obtained from vendors, list prices on retail catalogs, cost estimation tool (RSMeans). Cost estimate will be further developed upon initial engineering planning and design efforts are complete.
2. Professional services costs are based on a percentage of the construction amount (subtotal + contingency) not including Bonding, Mob or Taxes.

Table F: Engineer's Opinion of Probable Cost – Well Option B

PINEDALE ESTATES DWID - WELL OPTION B				
Construction Costs				
Components	**Equip / Material Cost ($)**	**Install / Labor Cost ($)**	**Quantity**	**Total Cost ($)**
PVC Pipe, AWWA C900, 6" Diameter (Per LF)	$ 5.57	$ 3.50	1,421	$ 12,888.47
PVC 90-Deg Elbow w/ Gasket, 6" Diameter (Ea)	$ 82.36	$ 8.61	2	$ 181.94
PVC 45-Deg Elbow w/ Gasket, 6" Diameter (Ea)	$ 85.70	$ 8.61	3	$ 282.93
Check Valves, 6" Diameter (Ea)	$ 1,474.73	$ 157.31	1	$ 1,632.04
Gate Valves, CI w/ Boxes, 6" Diameter (Ea)	$ 1,307.78	$ 157.31	6	$ 8,790.54
Air Rel & Vacuum Valve (Ea)	$ 912.66	$ 39.45	2	$ 1,904.22
PVC Restraint Joint, 6" Diameter (Ea)	$ 64.55	$ 43.22	22	$ 2,370.94
Thrust block, 6" Diameter (Ea)	$ 41.74	$ 15.51	5	$ 286.25
Domestic Well Drilling, 8" Diameter (Per ft)	$ 14.95	$ 34.99	550	$ 27,467.00
Pump, 6" Submersible, 20HP, 500' Deep (Ea)	$ 11,549.00	$ 1,451.93	1	$ 13,000.93
Well Casing, PVC (Per ft)	$ 14.47	$ 15.73	550	$ 16,610.00
Well Screen Assembly, SS, 6" Diameter (Per LF)	$ 227.05	$ 12.51	10	$ 2,395.60
Well Sterilization, Chlorine (Ea)	$ 156.93	$ 463.05	1	$ 619.98
Flow Meter, Bronze, 320GPM, 3" Diameter (Ea)	$ 2,567.85	$ 240.25	1	$ 2,808.10
Utility Trench, 8" Wide, 36" Deep (Per LF)	$ -	$ 2.47	1,421	$ 3,509.87
Backfill & Compact, 8" Wide, 36" Deep (Per LF)	$ -	$ 3.86	1,421	$ 5,485.06
Rough Grading, Sub 1,000 S.F. (Ea)	$ -	$ 1,432.20	1	$ 1,432.20
Concrete In Place, 36" x 36", 4000 PSI (Per CY)	$ 203.53	$ 233.09	1.00	$ 436.62
Chain Link Fence, Industrial, 9 ga, 6' High (Per LF)	$ 62.35	$ 4.97	209	$ 14,069.88
Construction Subtotal				**$ 116,172.57**
Bonding & Mobilization		10%		$ 11,617.26
Taxes		8%		$ 9,293.81
Construction Contingency		20%		$ 23,234.51
Construction Total				**$ 160,318.15**
Project Professional Support Costs		**% of Construction**		
Engineering Planning & Design			15.0%	$ 24,047.72
Engineer Bidding Services			1.5%	$ 2,404.77
Bid Advertisement & Related Costs			0.5%	$ 801.59
Bid Package Prep & Printing Costs			1.0%	$ 1,603.18
Engineering Contract Prep Costs			1.25%	$ 2,003.98
Legal Costs			1.0%	$ 1,603.18
Administrative Costs			0.25%	$ 400.80
Engineering Construction Admin & Post Construction Permitting			5.0%	$ 8,015.91
Professional Support Subtotal				**$ 40,881.13**
Contingency		15%		$ 6,132.17
Professional Support Total				**$ 47,013.30**
ANTICIPATED TOTAL PROJECT COSTS				**$ 207,331.44**

NOTE:
1. Project costs are preliminary and based on: budget quotes obtained from vendors, list prices on retail catalogs, cost estimation tool (RSMeans). Cost estimate will be further developed upon initial engineering planning and design efforts are complete.
2. Professional services costs are based on a percentage of the construction amount (subtotal + contingency) not including Bonding, Mob or Taxes.

Table G: Engineer's Opinion of Probable Cost – Well Option C

PINEDALE ESTATES DWID - WELL OPTION C				
Construction Costs				
Components	**Equip / Material Cost ($)**	**Install / Labor Cost ($)**	**Quantity**	**Total Cost ($)**
PVC Pipe, AWWA C900, 6" Diameter (Per LF)	$ 5.57	$ 3.50	2,189	$ 19,854.23
PVC 90-Deg Elbow w/ Gasket, 6" Diameter (Ea)	$ 82.36	$ 8.61	2	$ 181.94
PVC 45-Deg Elbow w/ Gasket, 6" Diameter (Ea)	$ 85.70	$ 8.61	2	$ 188.62
Check Valves, 6" Diameter (Ea)	$ 1,474.73	$ 157.31	1	$ 1,632.04
Gate Valves, CI w/ Boxes, 6" Diameter (Ea)	$ 1,307.78	$ 157.31	6	$ 8,790.54
Air Rel & Vacuum Valve (Ea)	$ 912.66	$ 39.45	2	$ 1,904.22
PVC Restraint Joint, 6" Diameter (Ea)	$ 64.55	$ 43.22	22	$ 2,370.94
Thrust block, 6" Diameter (Ea)	$ 41.74	$ 15.51	4	$ 229.00
Domestic Well Drilling, 8" Diameter (Per ft)	$ 14.95	$ 34.99	550	$ 27,467.00
Pump, 6" Submersible, 20HP, 500' Deep (Ea)	$ 11,549.00	$ 1,451.93	1	$ 13,000.93
Well Casing, PVC (Per ft)	$ 14.47	$ 15.73	550	$ 16,610.00
Well Screen Assembly, SS, 6" Diameter (Per LF)	$ 227.05	$ 12.51	10	$ 2,395.60
Well Sterilization, Chlorine (Ea)	$ 156.93	$ 463.05	1	$ 619.98
Flow Meter, Bronze, 320GPM, 3" Diameter (Ea)	$ 2,567.85	$ 240.25	1	$ 2,808.10
Utility Trench, 8" Wide, 36" Deep (Per LF)	$ -	$ 2.47	2,189	$ 5,406.83
Backfill & Compact, 8" Wide, 36" Deep (Per LF)	$ -	$ 3.86	2,189	$ 8,449.54
Rough Grading, Sub 1,000 S.F. (Ea)	$ -	$ 1,432.20	1	$ 1,432.20
Concrete In Place, 36" x 36", 4000 PSI (Per CY)	$ 203.53	$ 233.09	1.00	$ 436.62
Chain Link Fence, Industrial, 9 ga, 6' High (Per LF)	$ 62.35	$ 4.97	209	$ 14,069.88
Construction Subtotal				**$ 127,848.21**
Bonding & Mobilization		10%		$ 12,784.82
Taxes		8%		$ 10,227.86
Construction Contingency		20%		$ 25,569.64
Construction Total				**$ 176,430.53**
Project Professional Support Costs		**% of Construction**		
Engineering Planning & Design			15.0%	$ 26,464.58
Engineer Bidding Services			1.5%	$ 2,646.46
Bid Advertisement & Related Costs			0.5%	$ 882.15
Bid Package Prep & Printing Costs			1.0%	$ 1,764.31
Engineering Contract Prep Costs			1.25%	$ 2,205.38
Legal Costs			1.0%	$ 1,764.31
Administrative Costs			0.25%	$ 441.08
Engineering Construction Admin & Post Construction Permitting			5.0%	$ 8,821.53
Professional Support Subtotal				**$ 44,989.79**
Contingency		15%		$ 6,748.47
Professional Support Total				**$ 51,738.25**
ANTICIPATED TOTAL PROJECT COSTS				**$ 228,168.78**

NOTE:
1. Project costs are preliminary and based on: budget quotes obtained from vendors, list prices on retail catalogs, cost estimation tool (RSMeans). Cost estimate will be further developed upon initial engineering planning and design efforts are complete.
2. Professional services costs are based on a percentage of the construction amount (subtotal + contingency) not including Bonding, Mob or Taxes.

Table H: Engineer's Opinion of Probable Cost – Well Option D

PINEDALE ESTATES DWID - WELL OPTION D				
Construction Costs				
Components	**Equip / Material Cost ($)**	**Install / Labor Cost ($)**	**Quantity**	**Total Cost ($)**
PVC Pipe, AWWA C900, 6" Diameter (Per LF)	$ 5.57	$ 3.50	5,243	$ 47,554.01
PVC 90-Deg Elbow w/ Gasket, 6" Diameter (Ea)	$ 82.36	$ 8.61	4	$ 363.88
PVC 45-Deg Elbow w/ Gasket, 6" Diameter (Ea)	$ 85.70	$ 8.61	5	$ 471.55
Check Valves, 6" Diameter (Ea)	$ 1,474.73	$ 157.31	1	$ 1,632.04
Gate Valves, CI w/ Boxes, 6" Diameter (Ea)	$ 1,307.78	$ 157.31	10	$ 14,650.90
Air Rel & Vacuum Valve (Ea)	$ 912.66	$ 39.45	4	$ 3,808.44
PVC Restraint Joint, 6" Diameter (Ea)	$ 64.55	$ 43.22	40	$ 4,310.80
Thrust block, 6" Diameter (Ea)	$ 41.74	$ 15.51	9	$ 515.25
Domestic Well Drilling, 8" Diameter (Per ft)	$ 14.95	$ 34.99	550	$ 27,467.00
Pump, 6" Submersible, 20HP, 500' Deep (Ea)	$ 11,549.00	$ 1,451.93	1	$ 13,000.93
Well Casing, PVC (Per ft)	$ 14.47	$ 15.73	550	$ 16,610.00
Well Screen Assembly, SS, 6" Diameter (Per LF)	$ 227.05	$ 12.51	10	$ 2,395.60
Well Sterilization, Chlorine (Ea)	$ 156.93	$ 463.05	1	$ 619.98
Flow Meter, Bronze, 320GPM, 3" Diameter (Ea)	$ 2,567.85	$ 240.25	1	$ 2,808.10
Utility Trench, 8" Wide, 36" Deep (Per LF)	$ -	$ 2.47	5,243	$ 12,950.21
Backfill & Compact, 8" Wide, 36" Deep (Per LF)	$ -	$ 3.86	5,243	$ 20,237.98
Rough Grading, Sub 1,000 S.F. (Ea)	$ -	$ 1,432.20	1	$ 1,432.20
Concrete In Place, 36" x 36", 4000 PSI (Per CY)	$ 203.53	$ 233.09	1.00	$ 436.62
Chain Link Fence, Industrial, 9 ga, 6' High (Per LF)	$ 62.35	$ 4.97	209	$ 14,069.88
Construction Subtotal				**$ 185,335.37**
Bonding & Mobilization		10%		$ 18,533.54
Taxes		8%		$ 14,826.83
Construction Contingency		20%		$ 37,067.07
Construction Total				**$ 255,762.81**
Project Professional Support Costs		**% of Construction**		
Engineering Planning & Design			15.0%	$ 38,364.42
Engineer Bidding Services			1.5%	$ 3,836.44
Bid Advertisement & Related Costs			0.5%	$ 1,278.81
Bid Package Prep & Printing Costs			1.0%	$ 2,557.63
Engineering Contract Prep Costs			1.25%	$ 3,197.04
Legal Costs			1.0%	$ 2,557.63
Administrative Costs			0.25%	$ 639.41
Engineering Construction Admin & Post Construction Permitting			5.0%	$ 12,788.14
Professional Support Subtotal				**$ 65,219.52**
Contingency		15%		$ 9,782.93
Professional Support Total				**$ 75,002.44**
ANTICIPATED TOTAL PROJECT COSTS				**$ 330,765.25**

NOTE:
1. Project costs are preliminary and based on: budget quotes obtained from vendors, list prices on retail catalogs, cost estimation tool (RSMeans). Cost estimate will be further developed upon initial engineering planning and design efforts are complete.
2. Professional services costs are based on a percentage of the construction amount (subtotal + contingency) not including Bonding, Mob or Taxes.

Table I: Engineer's Opinion of Probable Cost – Expected Fee Increase Per Connection

Cost Per Connection - 20 Year				
Initial Cost Per Connection				
Options	**Total Costs**	**Number of Years**	**Number of Connections**	**Fee Increase per Month**
Reverse Osmosis Water Treatment	$ 874,495.65	20	83	$ 43.90
IX Water Treatment	$ 647,840.66	20	83	$ 32.52
Site A Well Relocation	$ 223,538.56	20	83	$ 11.22
Site B Well Relocation	$ 208,570.01	20	83	$ 10.47
Site C Well Relocation	$ 229,407.35	20	83	$ 11.52
Site D Well Relocation	$ 332,003.83	20	83	$ 16.67
NOTE: 1. These costs do not include any unforeseen charges nor do they include costs of continuing maintenance and facility oversight. Possible increase in number of connections are also not included.				

If water quality at the new wellsite still requires treatment, then the cost per connection would require adding a treatment a

5.0 RECOMMENDATIONS

Based on our findings described in this report, the elevated selenium levels in the groundwater appear to be localized to a few wells in close proximity to the existing Pinedale Estates well. It is anticipated that this is due to the well(s) proximity to the Mogollon Rim. Several of the wells tested near the existing Pinedale Estates well had elevated levels of selenium that decrease with distance in a northerly direction (increasing in distance from the Rim). As such, it is likely that a potable well located further north should produce water acceptable for drinking purposes. However, it should be noted that with limited data and scope of study, we cannot make recommendations with a high degree of certainty. Nevertheless, the following recommendations are given under the assumption that a new well location would improve water quality.

- Recommendation 1: Drill a new well at or near proposed Well Site D

A newly constructed well, placed towards the north of the current well (study area) is most likely to produce water with lower levels of selenium relative to wells further south. Though several of the wells in the study area surrounding Pinedale Estates had elevated levels of selenium, the two northern most wells had non-detectable levels significantly below the MCL.

- Recommendation 2: Site the exact location of the well based on available utility easements and community feedback

As the current well site is situated in the southern half of Pinedale Estates, a new transmission line will be required to pump water from the proposed well. Though there are several recorded utility easements, the precise alignment of the transmission line will likely require new dedications and final community approval. Further, given that the DWID does not currently own any parcels in the area identified as most likely to produce high quality water, additional property will have to be acquired.

- Recommendation 3: Consider funding a pilot study of potential well sites

Exploratory drilling of potential well sites will ensure that the site chosen will produce water of acceptable quality. The utility could drill a small diameter borehole for confirmation of water quality. This however is a typical method for sizing large diameter wells. As such the cost savings may be negligible if several pilot drillings are required to find a final wellsite.

- Recommendation 4: Combined approach to addressing selenium

Given that no certain claims can be made with regards to selenium, it is possible that a new well will require additional treatment in order to achieve regulatory compliance. By constructing a new well with lower levels of selenium, operational costs to treat selenium can be significantly reduced.

- Recommendation 5: Consider relocating the entire well site along with appurtenances

If a new well is constructed a significant distance from the existing well site, additional considerations in pump capacity need to be considered in order to ensure sufficient pressures within the transmission line. Given the historical age of the site and improvements required to meet current G&D building codes it may be more economical to simply abandon the current existing site and construct a new well facility.

6.0 CONCLUDING REMARKS

Given the current high level of selenium at the existing well, remediation efforts should be prioritized in order to ensure safe drinking water for Pinedale Estates DWID as well as the local community as it continues to grow in population. The Pinedale Estates DWID has a service area that could be expanded to ensure that all persons living in the Pinedale Estates area have access to clean, safe, drinking water. Encouragement of DIWD growth not only increases the service area but also increases the potential customer base allowing for additional resources for the small water utility.

Water treatment options discussed in this report can remediate the levels of selenium to be below the MCL level but present their own set of challenges. Due to nature of centralized treatment systems, construction and maintenance costs are significant, and may require additional certifications, qualifications, or licenses for the operators. Depending on the required water treatment system, weekly, monthly, and yearly maintenance would be necessary that further drives up operational costs. Expertise and care are needed for maintain assets appropriately and if not completed accelerates the degradation of the asset expiration (before typical end of useful life).

As highlighted in the preliminary cost estimation of various solutions, construction of a new well may require significantly less capital investment. Based on the level of study performed improvement to the water quality cannot be stated with high degree of certainty, however patterns in the geospatial data suggests wells sited north of the existing well could produce lower levels of selenium. Since the wells towards the south are closer to the Mogollon Rim, a significant geologic anomaly, it is expected with a high degree of confidence that any movement away from the geologic anomaly should improve water quality. Moving the well location further north also increases the likelihood that additional groundwater flows are available to dilute the Selenium in the groundwater traveling further from the source rock (leaching location). As mentioned in the previous section, some level of treatment may still be required in order to achieve regulatory compliance. However, the lower level of selenium that could be sourced in a new northern well reduces the sizing and impact on the treatment system if still required.

7.0 REFERENCES

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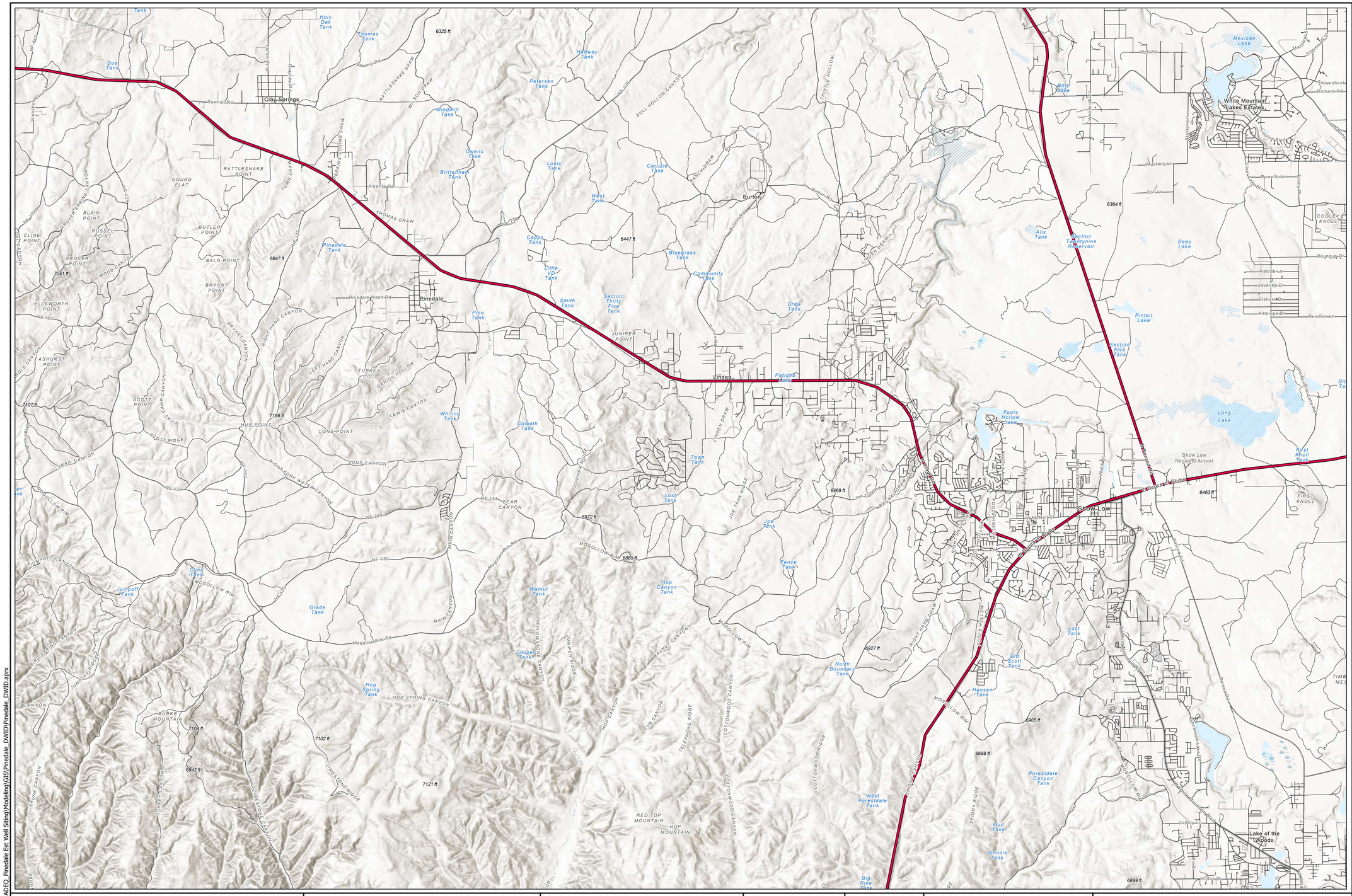
APPENDIX A

GIS MAPS AND FIGURES



TRANSPORTATION
- HWYS
- ROADS

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ENGINEERED WITH LAYTON 1490 SOUTH PRICE ROAD, SUITE 215 CHANDLER, ARIZONA 85286 480.616.0011	PINEDALE ESTATES DWID P.O. BOX 1553 LAKESIDE, ARIZONA 85929 928.367.6621	PINEDALE EST WELL SITING	2020-0202	JSW	AS SHOWN	SOURCES: ESRI, AIRBUS DS, USGS, NGA, NASA, CGIAR, N ROBINSON, NCEAS, NLS, OS, NMA, GEODATASTYRELSEN, RIJKSWATERSTAAT, GSA, GEOLAND, FEMA, INTERMAP AND THE GIS USER COMMUNITY, SOURCES: ESRI, HERE, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY	PROJECT VISCINITY MAP
		LOCATION PINEDALE, ARIZONA	DATE APRIL 2020	APPROVED BY NEL	REV 1: REVISED BY - -, DATE REVISED - - REV 2: REVISED BY - -, DATE REVISED - -		Spatial Reference Name: NAD 1983 UTM Zone 12N PCS: NAD 1983 UTM Zone 12N GCS: GCS North American 1983 Datum: North American 1983 Projection: Transverse Mercator

GIS-001
FIGURE 1 OF 9

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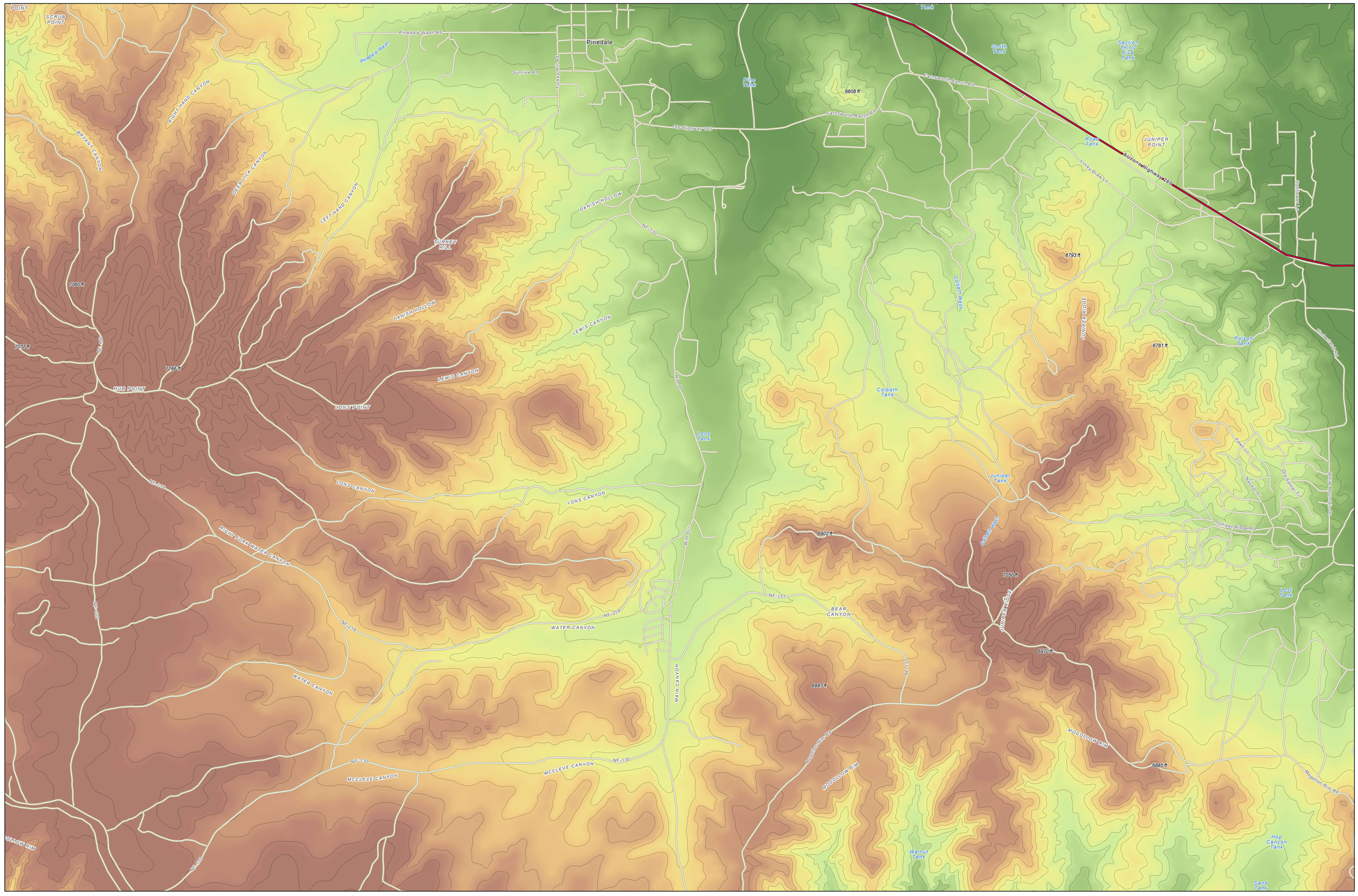

MAP LEGEND

TRANSPORTATION
- HWYS
- ROADS

TOPOGRAPHY
- 50FT CONTOURS

USGS DEM (ft)

Value
- 7100
- 6100

N

0 0.13 0.25 0.5 0.75 1 Miles

Path: L:\1.0 - Projects\2020-0202 - ADEQ_Pinedale Est Well Siting\Modeling\GIS\Pinedale_DWID\Pinedale_DWID.aprx

ENGINEER OF RECORD

ENGINEERED WITH LAYTON
1490 SOUTH PRICE ROAD, SUITE 215
CHANDLER, ARIZONA 85286
480.616.0011

CLIENT / OWNER

PINEDALE ESTATES DWID
P.O. BOX 1553
LAKESIDE, ARIZONA 85929
928.367.6621

PROJECT TITLE	PROJECT NUMBER	DRAFTED BY	SCALE
PINEDALE EST WELL SITING	2020-0202	JSW	AS SHOWN
LOCATION	DATE	APPROVED BY	
PINEDALE, ARIZONA	APRIL 2020	NEL	

REV	REVISED BY	DATE REVISED
1	- -	- -
2	- -	- -

REFERENCE

SOURCES: ESRI, AIRBUS DS, USGS, NGA, NASA, CGIAR, N ROBINSON, NCEAS, NLS, OS, NMA, GEODATASTYRELSEN, RIJKSWATERSTAAT, GSA, GEOLAND, FEMA, INTERMAP AND THE GIS USER COMMUNITY, SOURCES: ESRI, HERE, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

FIGURE NAME

SITE TOPOGRAPHY

Spatial Reference
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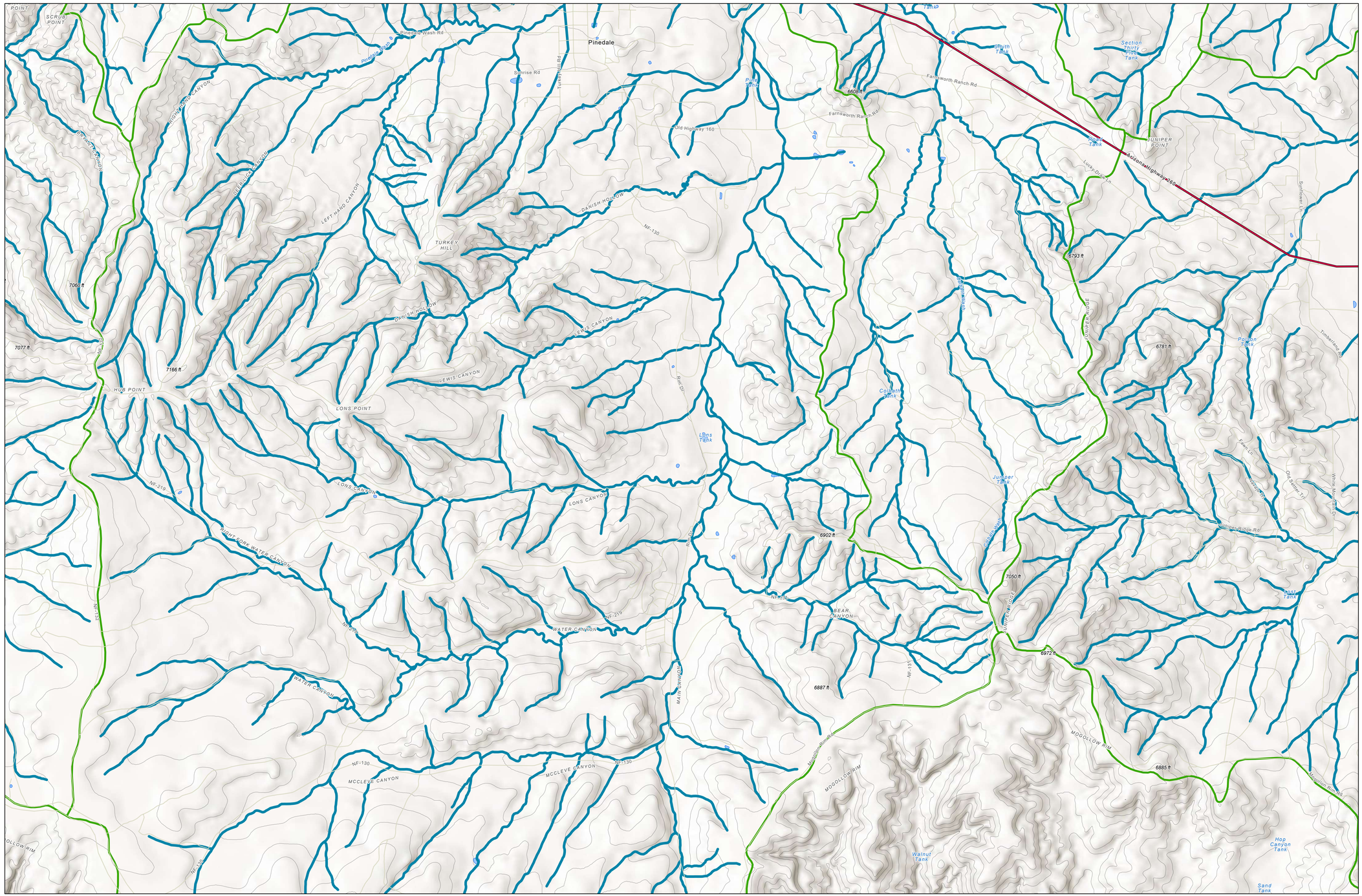
PCS: NAD 1983 UTM Zone 12N
GCS: GCS North American 1983
Datum: North American 1983
Projection: Transverse Mercator

GIS-002



MAP LEGEND

TRANSPORTATION
- HWYS
- ROADS

HYDROLOGY
- WATERSHED BOUNDARY
- NHD FLOWLINE
- NHD WATERBODY

TOPOGRAPHY
- 50FT CONTOURS

N

0 0.13 0.25 0.5 0.75 1 Miles

ENGINEER OF RECORD	CLIENT / OWNER	PROJECT TITLE	PROJECT NUMBER	DRAFTED BY	SCALE	REFERENCE	FIGURE NAME
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		LOCATION: PINEDALE, ARIZONA	DATE: APRIL 2020	APPROVED BY: NEL	REV 1: - - / - - ; REV 2: - - / - -		Spatial Reference Name: NAD 1983 UTM Zone 12N PCS: NAD 1983 UTM Zone 12N GCS: GCS North American 1983 Datum: North American 1983 Projection: Transverse Mercator

GIS-003

FIGURE 3 OF 9

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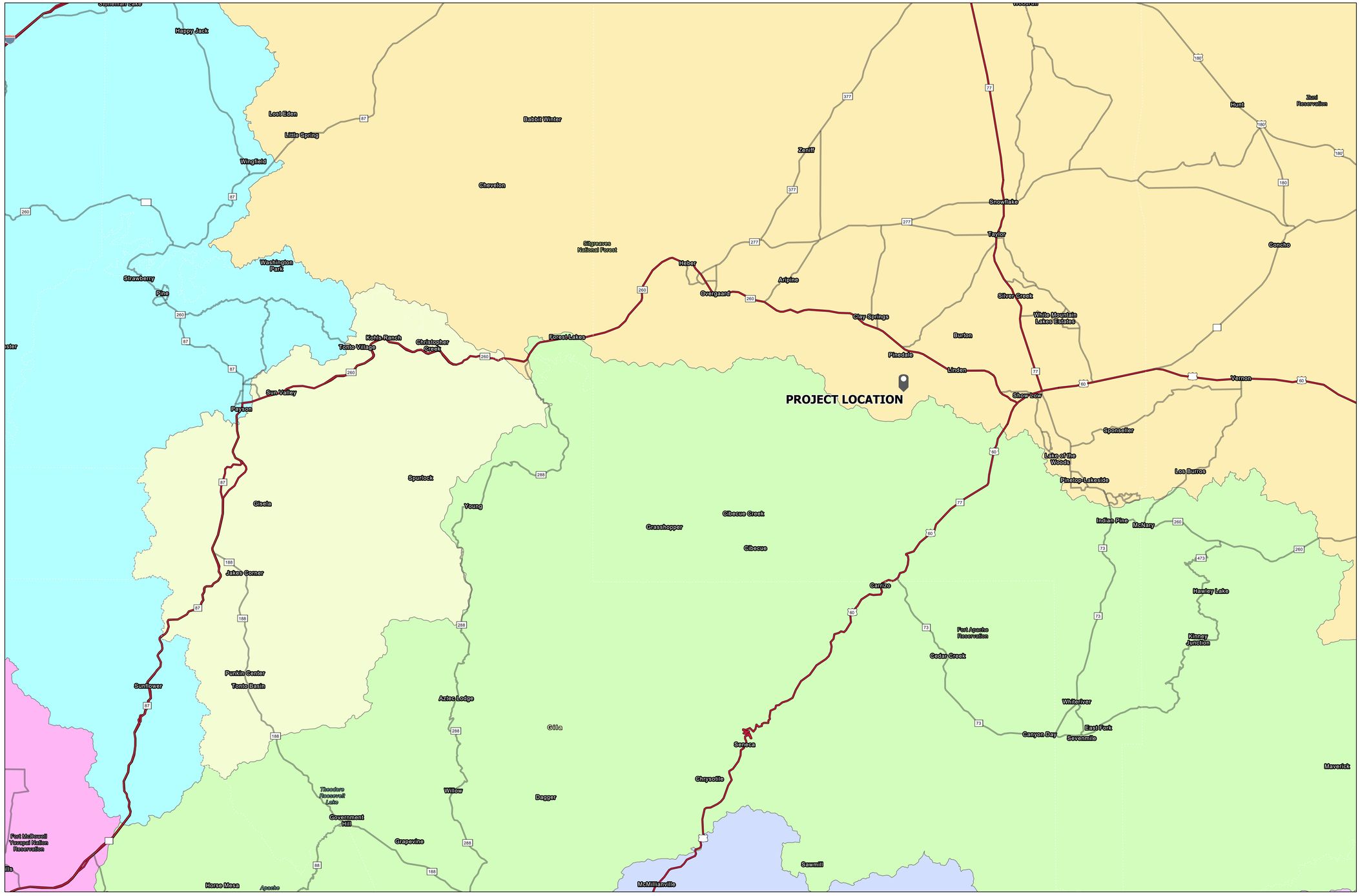

MAP LEGEND

TRANSPORTATION

- HWYS

HYDROLOGY

BASIN_NAME_GWSI

- LITTLE COLORADO RIVER PLATEAU BASIN
- MORENCI BASIN
- PHOENIX AMA
- SAFFORD BASIN
- SALT RIVER BASIN
- TONTO CREEK BASIN
- VERDE RIVER BASIN

N

0 1.75 3.5 7 10.5 14 Miles

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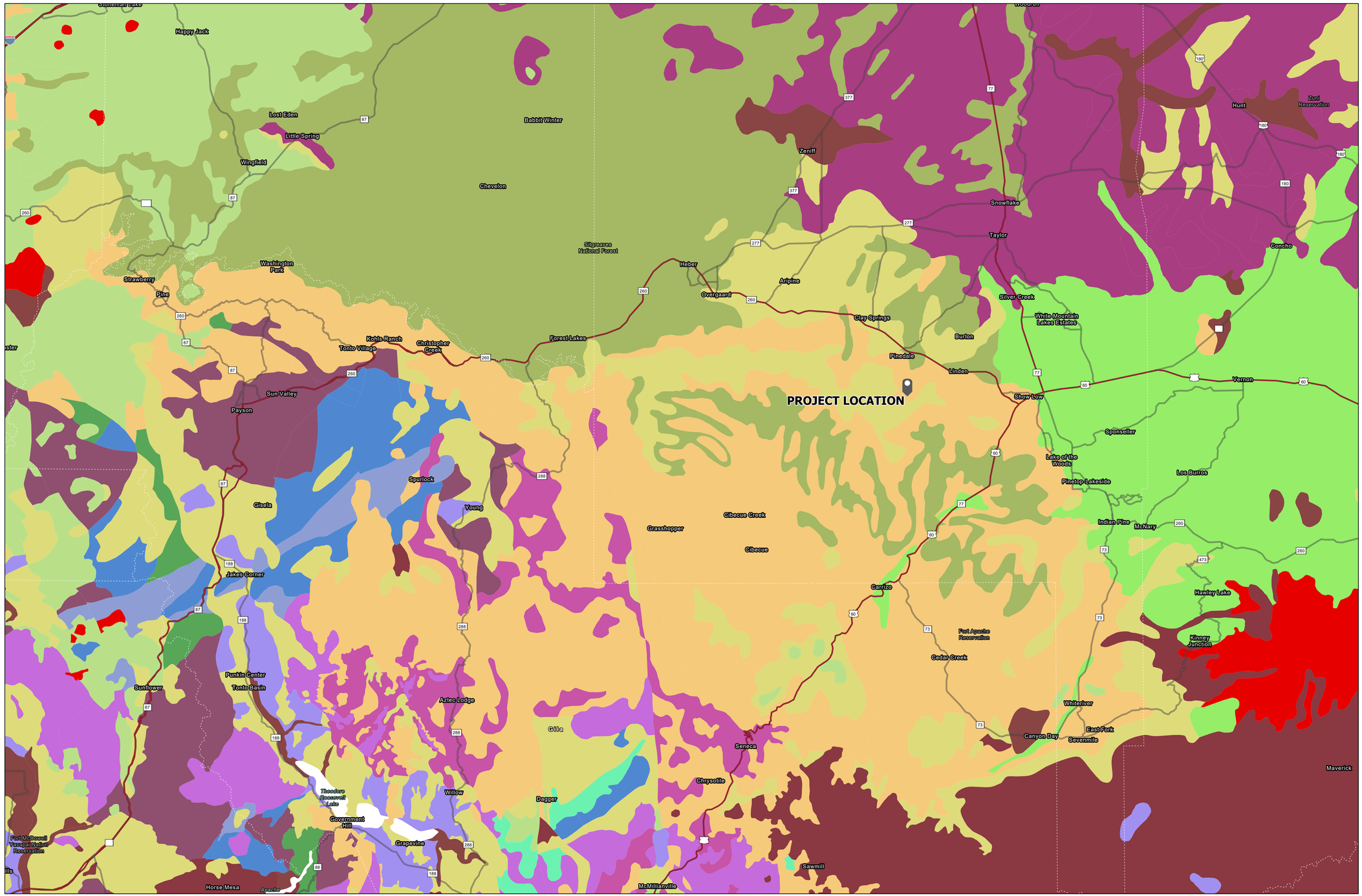
GIS-004

FIGURE 4 OF 9



MAP LEGEND

TRANSPORTATION

- HWYS

GEOLOGY

- alkaline basalt
- andesite
- basalt
- conglomerate
- dacite
- diabase
- gneiss
- granite
- granodiorite
- gravel
- greenstone
- limestone
- mudstone
- phyllite
- quartz-feldspar schist
- rhyolite
- sand
- sandstone
- schist
- water

N

0 1.75 3.5 7 10.5 14 Miles

Path: L:\1.0 - Projects\2020-0202 - ADEQ_Pinedale Est Well Siting\Modeling\GIS\Pinedale_DWID\Pinedale_DWID.aprx

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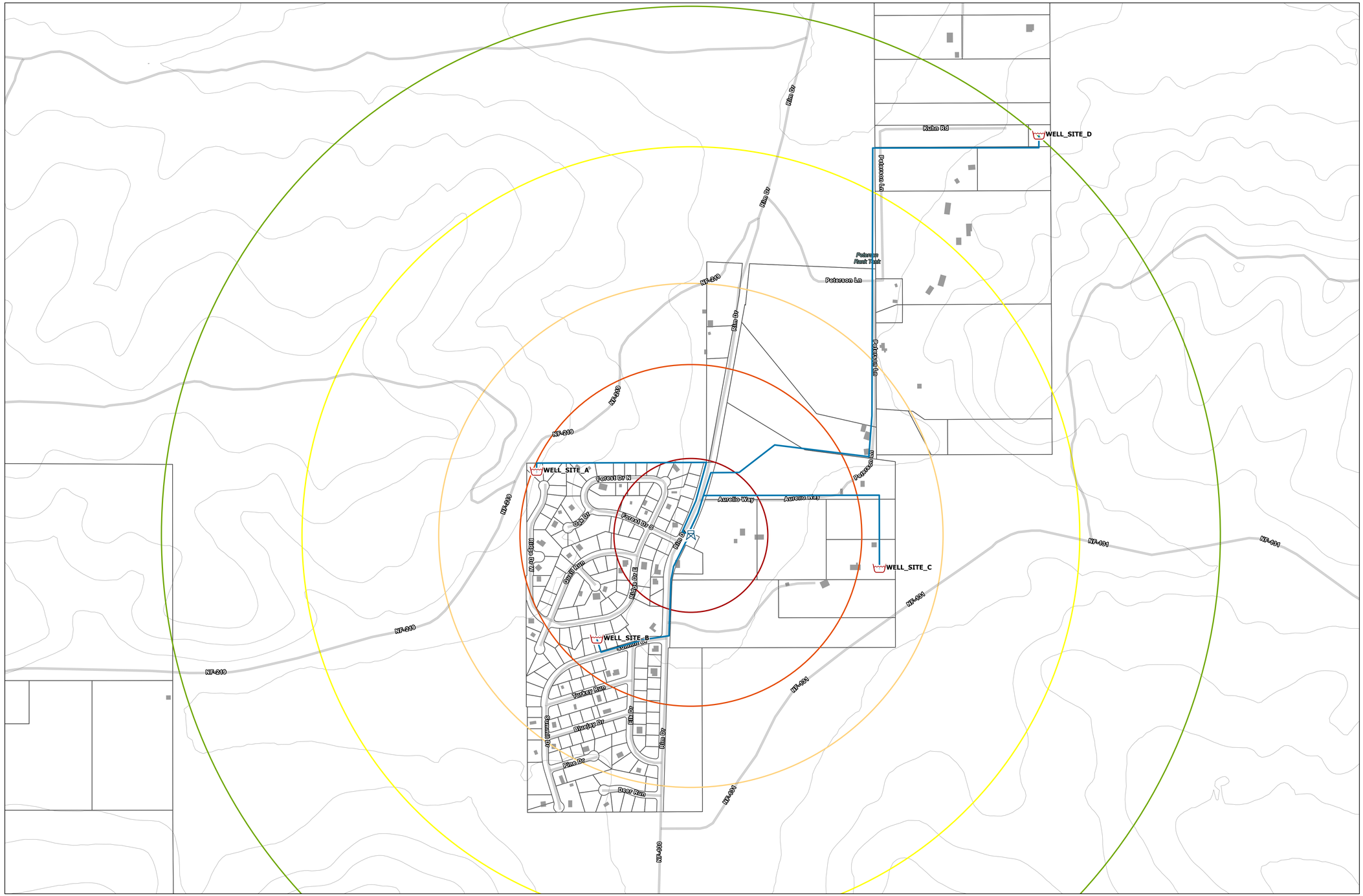
GIS-005

FIGURE 5 OF 9



MAP LEGEND

WELL SITING

TANK

WELL

PIPE

RADIUS

1282
1892
2918
3973
577

BUILDINGS

BUILDINGS

PARCELS

PARCELS

TOPOGRAPHY

50FT CONTOURS

N

0 145 290 580 870 1,160 Feet

Path: L:\1.0 - Projects\2020-0202 - ADEQ_Pinedale Est Well Siting\Modeling\GIS\Pinedale_DWID\Pinedale_DWID.aprx

ENGINEER OF RECORD	CLIENT / OWNER	PROJECT TITLE	PROJECT NUMBER	DRAFTED BY	SCALE	REFERENCE	FIGURE NAME
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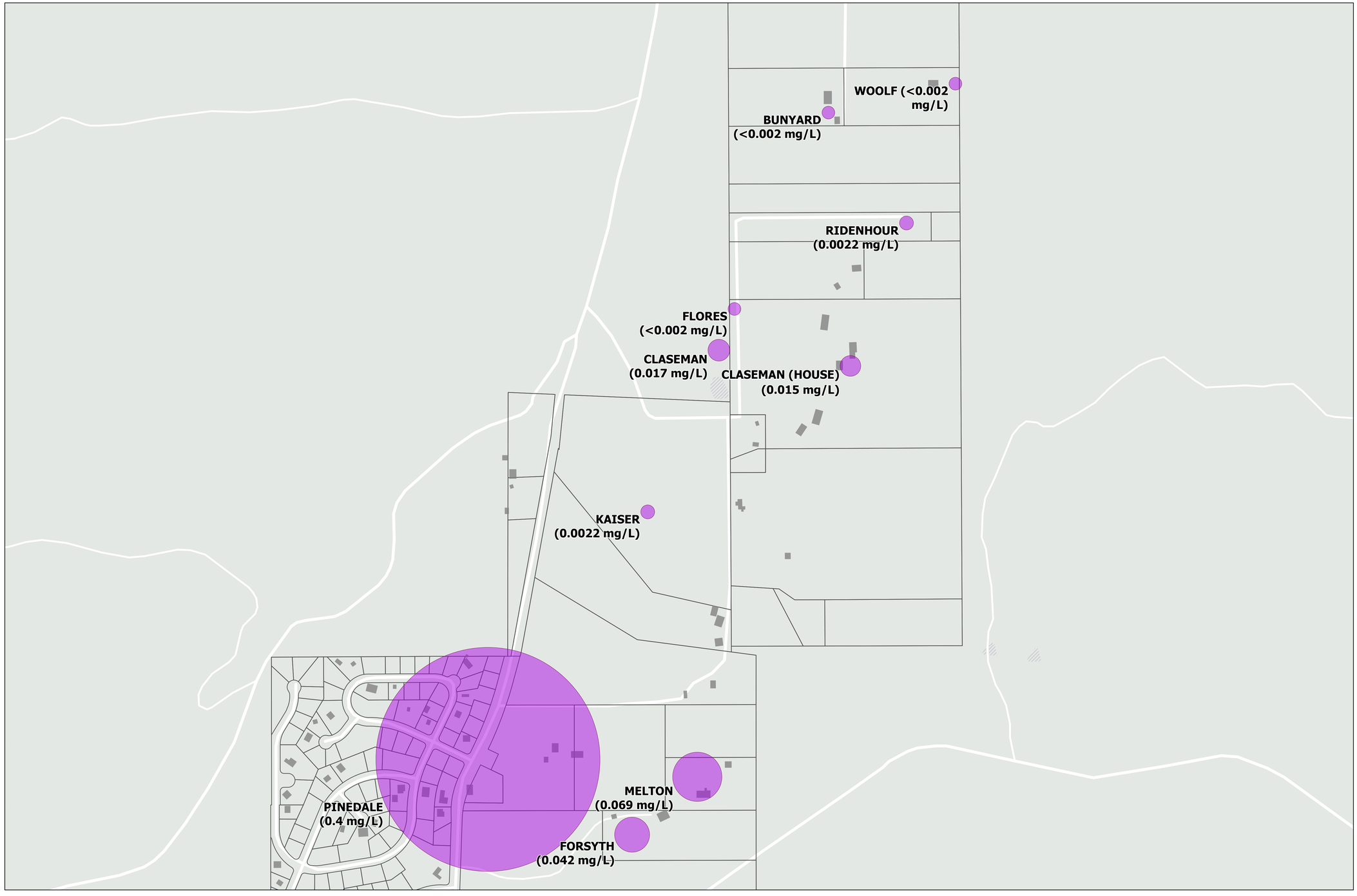
		LOCATION	DATE	APPROVED BY	REV / REVISED BY / DATE REVISED		
		PINEDALE, ARIZONA	APRIL 2020	NEL	1 - - - - ; 2 - - - -		Spatial Reference Name: NAD 1983 UTM Zone 12N PCS: NAD 1983 UTM Zone 12N GCS: GCS North American 1983 Datum: North American 1983 Projection: Transverse Mercator

GIS-006



MAP LEGEND

BUILDINGS

BUILDINGS

PARCELS

PARCELS

N

0 112.5 225 450 675 900 Feet

Path: L:\1.0 - Projects\2020-0202 - ADEQ_Pinedale Est Well Siting\Modeling\GIS\Pinedale_DWID\Pinedale_DWID.aprx

ENGINEER OF RECORD

ENGINEERED WITH LAYTON
1490 SOUTH PRICE ROAD, SUITE 215
CHANDLER, ARIZONA 85286
480.616.0011

CLIENT / OWNER

PINEDALE ESTATES DWID
P.O. BOX 1553
LAKESIDE, ARIZONA 85929
928.367.6621

PROJECT TITLE	PROJECT NUMBER	DRAFTED BY	SCALE
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LOCATION	DATE	APPROVED BY	
PINEDALE, ARIZONA	APRIL 2020	NEL	

REV	REVISED BY	DATE REVISED
1	- -	- -
2	- -	- -

REFERENCE

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FIGURE NAME

SELENIUM LEVELS

Spatial Reference
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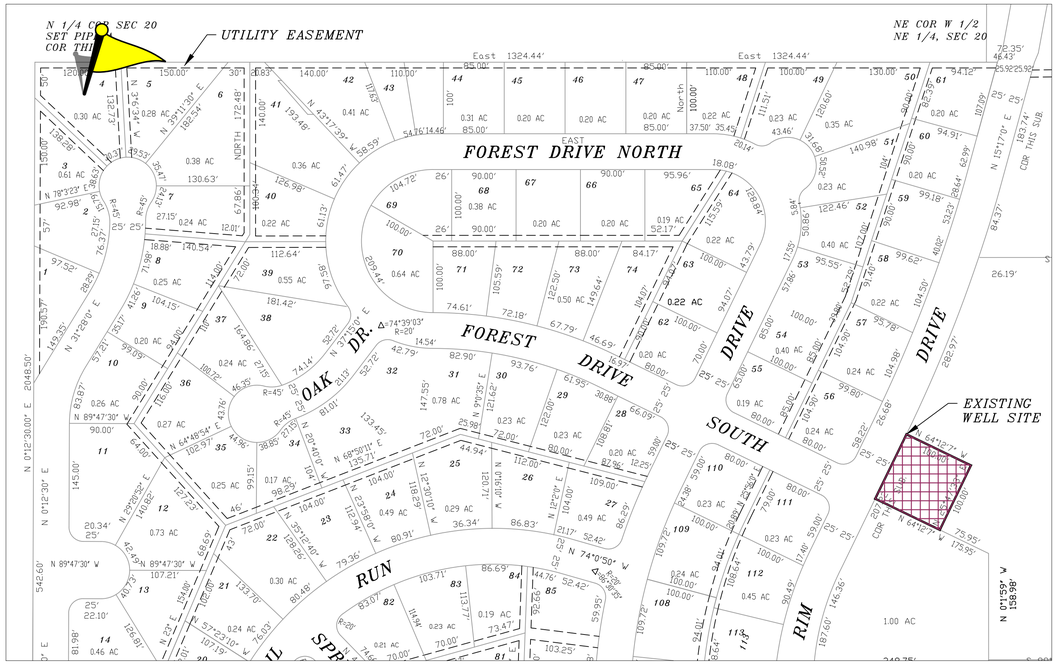
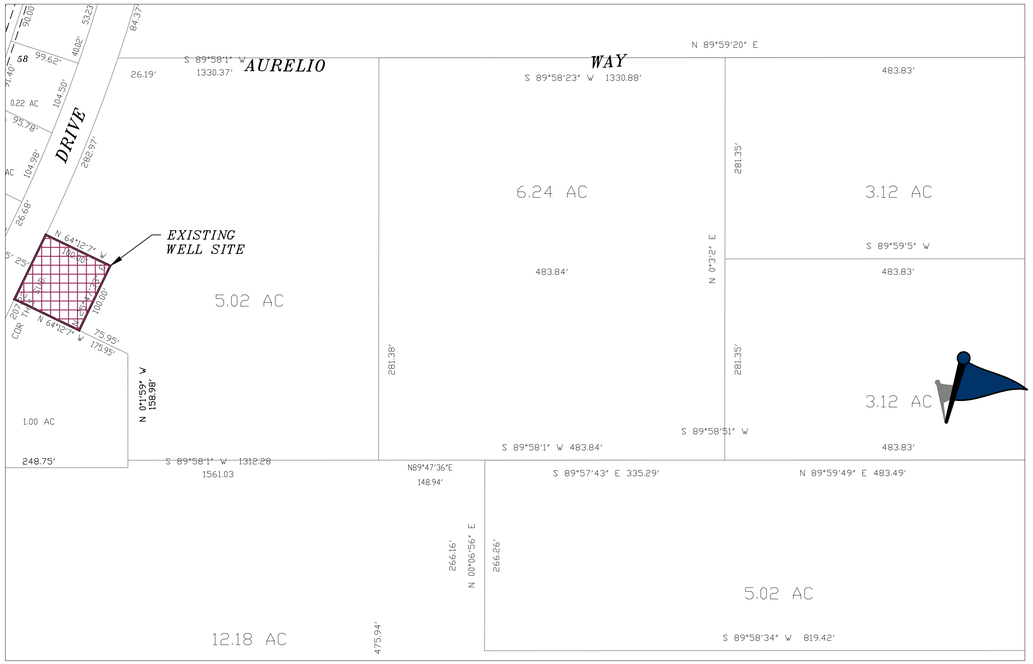
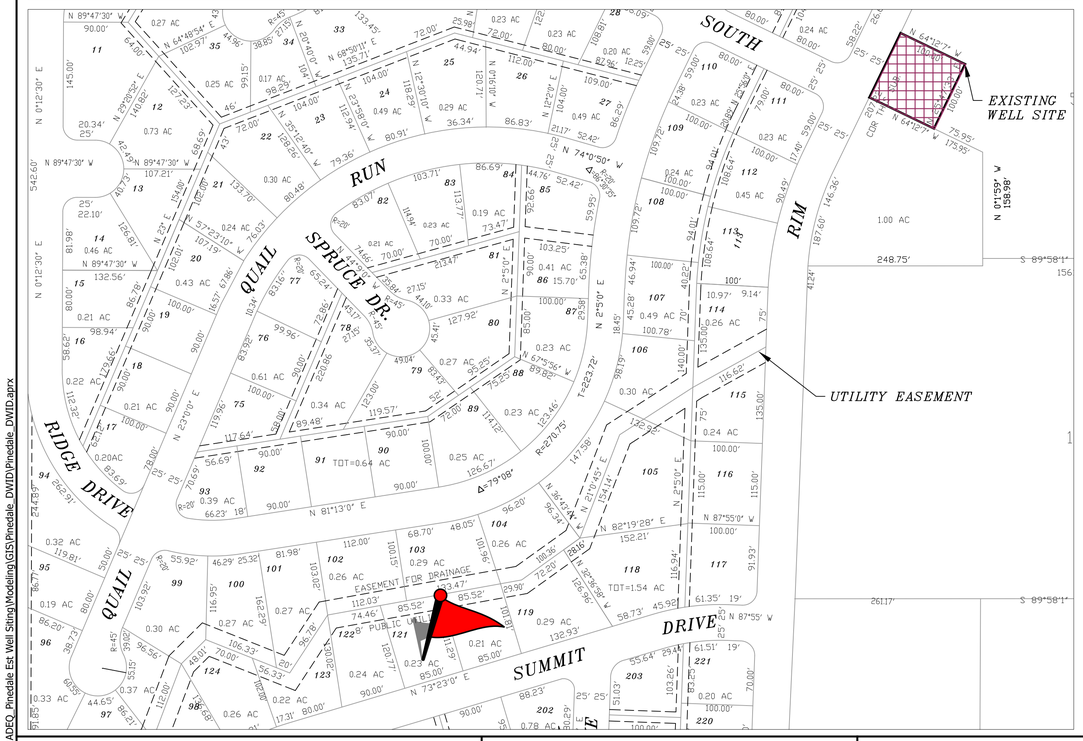
GCS: GCS North American 1983
Datum: North American 1983
Projection: Transverse Mercator

GIS-007

FIGURE 7 OF 9





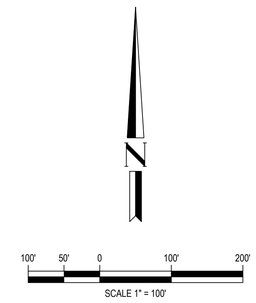


WELL SITE A

WELL SITE B

WELL SITE C

EXISTING WELL SITE



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		LOCATION	DATE	APPROVED BY	REV / REVISED BY / DATE REVISED		
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Spatial Reference
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GCS: GCS North American 1983
Datum: North American 1983
Projection: Transverse Mercator

FIGURE 8 OF 9

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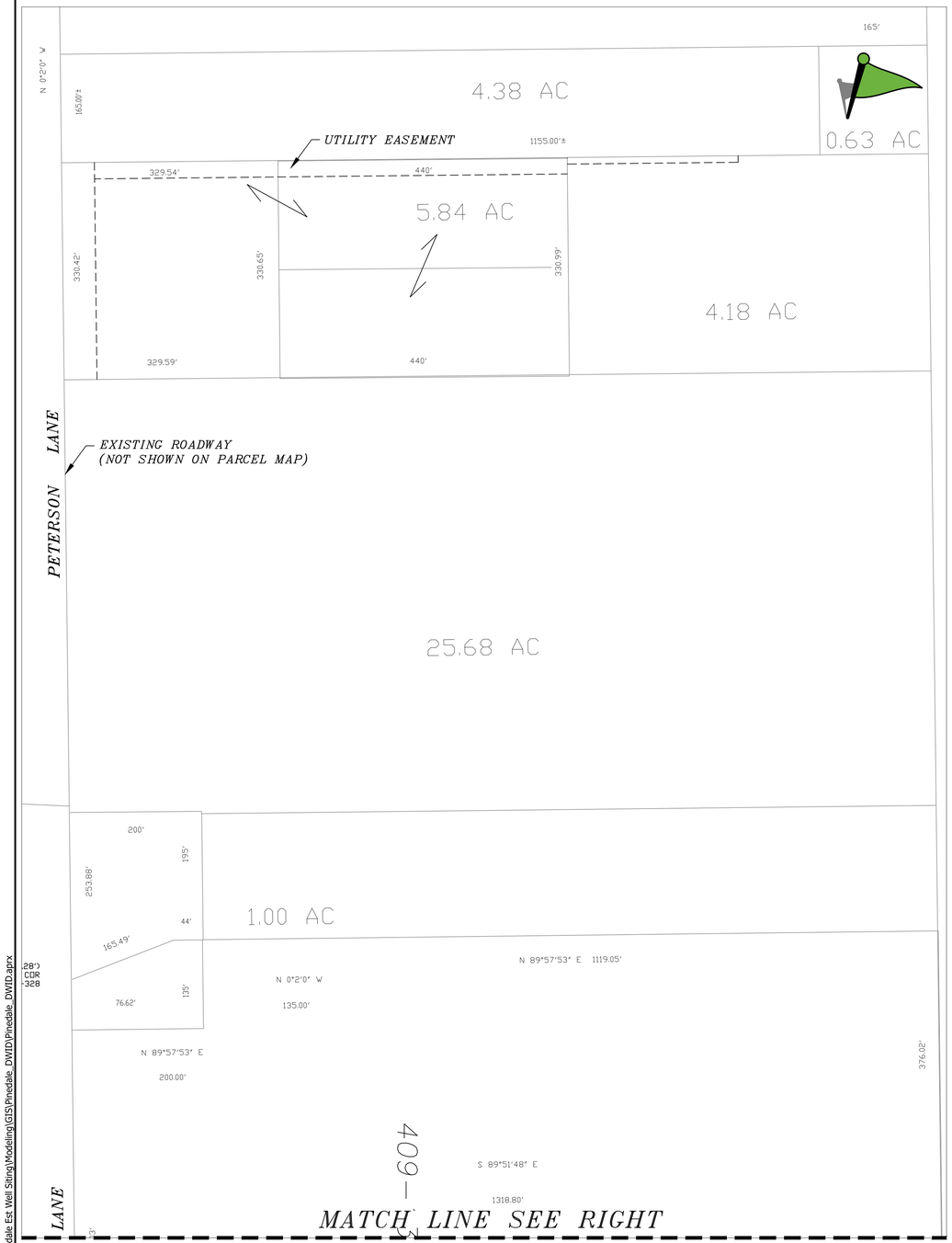

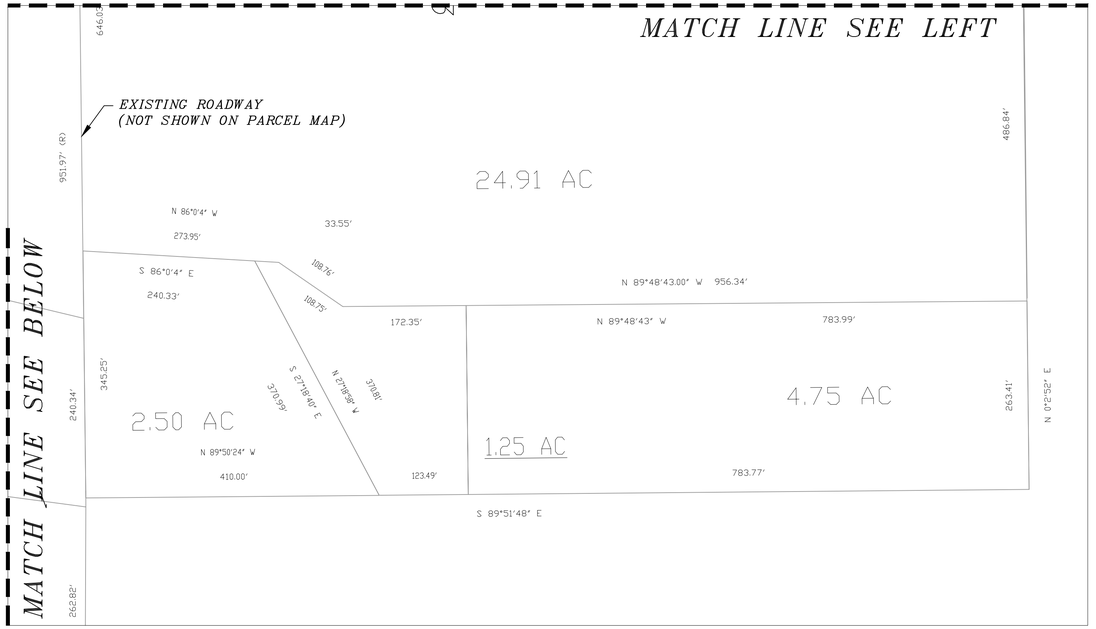

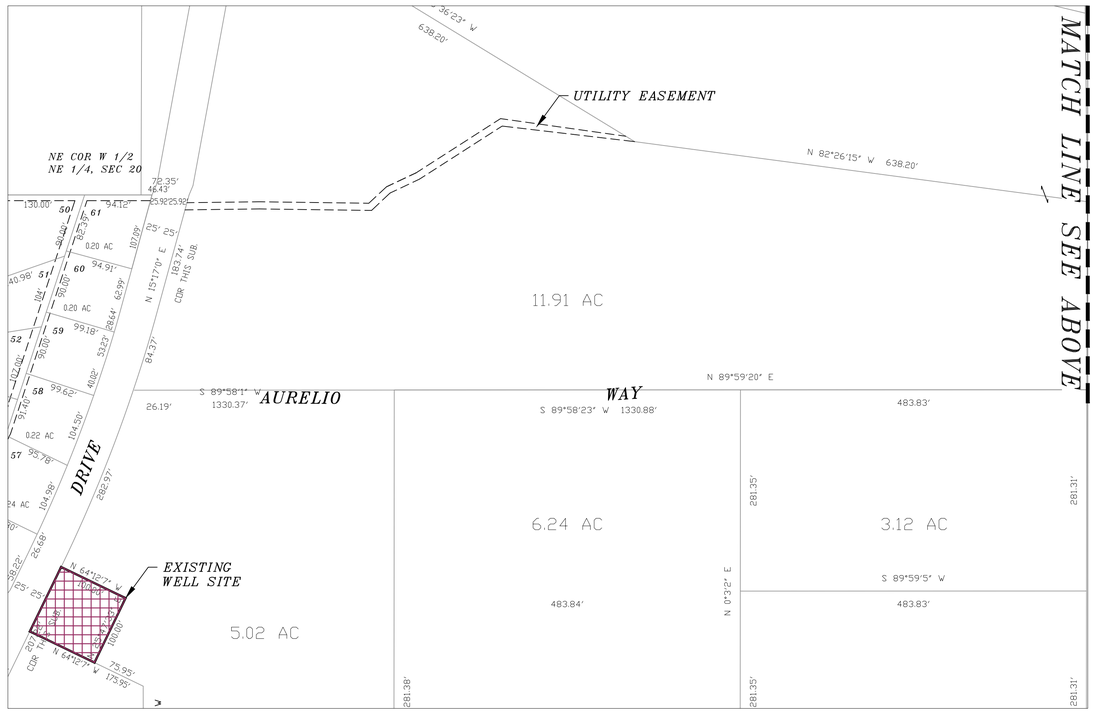

WELL SITE D

EXISTING WELL SITE

N

100' 50' 0 100' 200'

SCALE 1" = 100'

ENGINEER OF RECORD	CLIENT / OWNER	PROJECT TITLE	PROJECT NUMBER	DRAFTED BY	SCALE	REFERENCE	FIGURE NAME
ENGINEERED WITH LAYTON 1490 SOUTH PRICE ROAD, SUITE 215 CHANDLER, ARIZONA 85286 480.616.0011	PINEDALE ESTATES DWID P.O. BOX 1553 LAKESIDE, ARIZONA 85929 928.367.6621	PINEDALE EST WELL SITING	2020-0202	JSW	AS SHOWN	SOURCES: ESRI, HERE, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY	KNOWN EASEMENTS
		LOCATION	DATE	APPROVED BY	REV / REVISED BY / DATE REVISED		
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GIS-009

FIGURE 9 OF 9

Path: L:\1.0 - Projects\2020-0202 - ADEQ_Pinedale Est Well Siting\Modeling\GIS\Pinedale_DWID\Pinedale_DWID.aprx

APPENDIX B

FEMA FLOOD MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 12. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

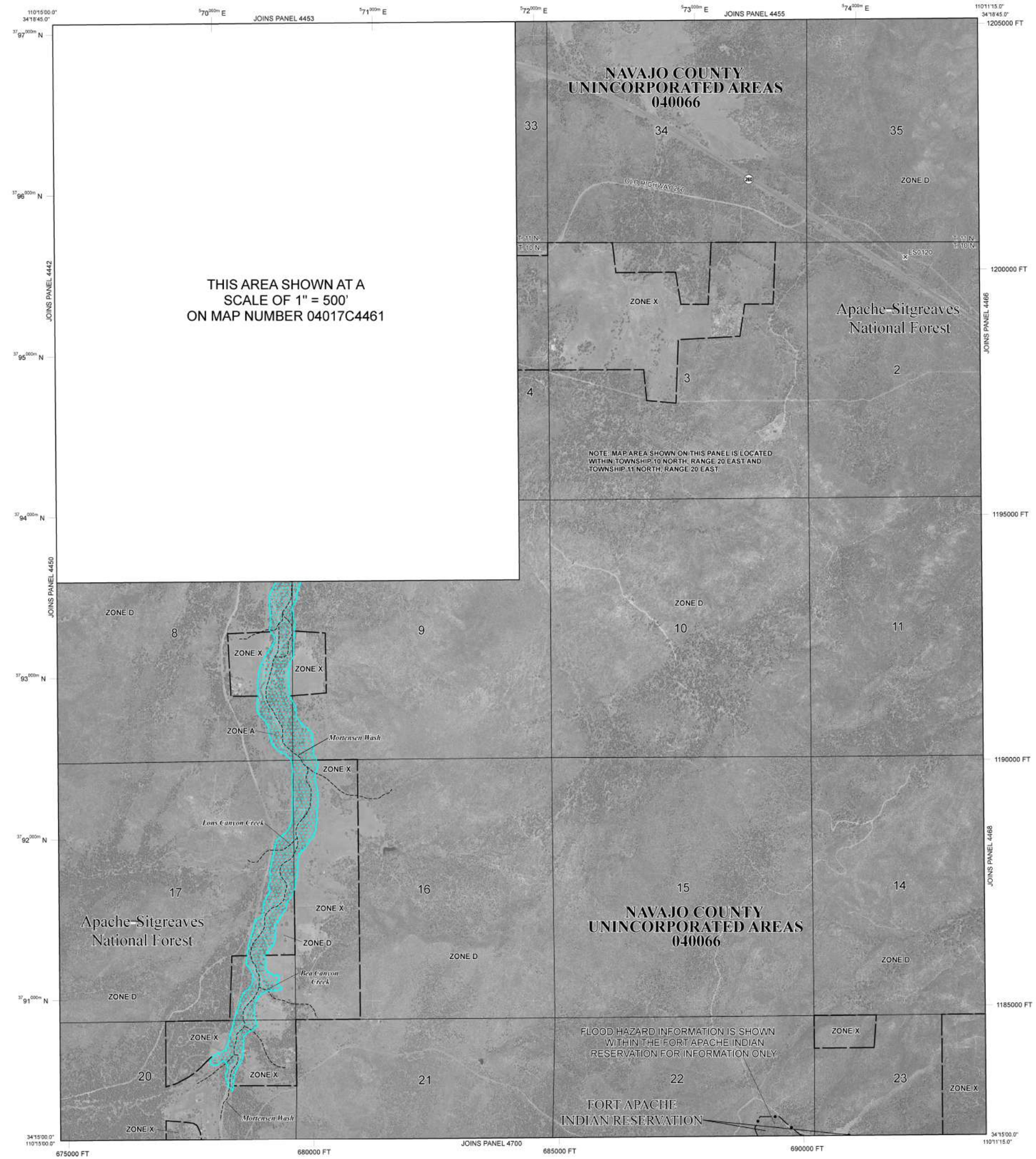
Base map information shown on this FIRM was provided in digital format by the US Department of Agriculture. This information was photogrammetrically compiled from DOQ Quadrangles at a scale of 1:40,000 and dated 2010 as a part of the National Agriculture Imagery Program (NAIP).

This map may reflect more detailed or up to date stream channel configurations than those shown on the previous FIRM. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations and improved topographic data. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the **FEMA Map Service Center** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the **FEMA Map Service Center** website or by calling the FEMA Map Information eXchange.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 12
- 6000000 FT — 5000-foot grid ticks: Arizona State Plane coordinate system, east zone (FIPSZONE 0201), Transverse Mercator
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
August 17, 2015 - to change Special Flood Hazard Areas.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 4465F

FIRM
FLOOD INSURANCE RATE MAP

NAVAJO COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 4465 OF 5250
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NAVAJO COUNTY	040066	4465	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04017C4465F

MAP REVISED
AUGUST 17, 2015

Federal Emergency Management Agency