SAND COULEE WATER DISTRICT PUBLIC WATER SUPPLY WELL INSTALLATION FINAL REPORT

The Montana Department of Environmental Quality (DEQ) Abandoned Mine Lands (AML) Section contracted Hydrometrics, Inc. (Hydrometrics) to oversee installation and testing of a new public water supply well for the Sand Coulee Water District (DEQ Contract 407034). This submittal describes the work completed under this contract and includes copies of all relevant documentation. An electronic version of this report with supporting documentation is on a DVD at the back of this report.

The new Sand Coulee water supply well was drilled and installed by Boland Drilling with oversight by Hydrometrics. The well installation and testing was completed successfully on June 13, 2012, and water quality samples were submitted to Energy Laboratories in Helena, MT for analysis. A well completion report that describes in detail the well installation, hydrostratigraphy, aquifer testing and water quality testing results was prepared by Hydrometrics and submitted to the DEQ Public Water Supply Bureau on July 12, 2012. The well completion report is included as Part 1 of this submittal.

On July 12 and July 13, 2012, Hydrometrics also submitted to DEQ Public Water Supply plans and specifications for the installation of a submersible pump, control valves and a supply line to connect the new well to the Water District's existing distribution system. Boland Drilling installed the pump and piping, and the Sand Coulee Water District contracted an electrician to complete the electrical work to connect the pump and controls to the Water District's existing system. Hydrometrics contracted with Casne and Associates to conduct the engineering oversight on the well installation. Casne verified that the installation was consistent with approved plans, and submitted as-built drawings to DEQ Public Water Supply once coliform testing was completed. The installation of the pump and piping is described in Part 2 of this submittal and copies of approved plans and specifications, as-built drawings and DEQ correspondence are included in Part 2A.

PART 1 - WELL COMPLETION REPORT

WELL COMPLETION REPORT FOR SAND COULEE WATER DISTRICT PUBLIC WATER SUPPLY WELL NO. 5

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1.0 PROJECT DESCRIPTION

The Montana Department of Environmental Quality (DEQ) Abandoned Mines Section contracted Hydrometrics, Inc. (Hydrometrics) to oversee installation and testing of a new public water supply well for the Sand Coulee Water District (DEQ Contract 407034). The Water District has had chronic water shortages and needs to develop additional water supply sources; however, available options are limited in the Sand Coulee area due to impacts from historical coal mining activities. The Sand Coulee Water District currently relies on groundwater wells completed in lower Kootenai Formation sandstone and upper Morrison Formation coal as the sole water source for the communityôs public water supply system. These formations produce limited water due in part to dewatering of the Kootenai Formation by an extensive network of abandoned coal mines.

Options for further water supply development in Sand Coulee were evaluated in a recent study by Hydrometrics (2011), which identified completion of deep wells into the Madison aquifer as the Water Districtôs most promising alternative for further water supply development. The top of the Madison Formation is reported to lie at a depth of approximately 400 feet (Smith, 2008). Yields from Madison wells in this area are variable with the majority of the wells reporting only 15 to 35 gallons per minute (gpm); however, there are some higher yielding wells, including one well at the nearby Big Stone Colony that reportedly produces over 150 gpm (Hydrometrics, 2011). The Big Stone Colony well is a former oil and gas exploration well that was completed to a depth of 1400 feet below ground surface (bgs) and later converted to a water supply well.

The objective for this project was to drill and complete an 8-inch diameter public water supply well into the Madison aquifer with a targeted completion depth of 800 feet bgs. The required design yield for the well is 100 gpm with a maximum capacity of 150 gpm for purposes of testing. The proposed well design specified drilling an oversized 11-inch hole to 440 feet, setting 8-inch casing, and grouting the annular space to provide a robust seal through the shallow groundwater system before advancing the drill hole into the Madison aquifer to the proposed completion depth of 800 feet. Well design plans were submitted to the DEQ Public Water Supply Division for approval prior to drilling. An electronic copy of the design documents and DEQ approval letter are included on a DVD at the end of this report.

Hydrometrics developed the engineering designs for the well, supervised the well installation, and conducted the aquifer testing and water quality sampling for this project. Tom Henderson of the DEQ Mine Waste Cleanup Bureau reviewed design submittals and provided field oversight in conjunction with Hydrometrics staff. Boland Drilling located in Great Falls, Montana was awarded the contract to drill and complete the well and instrument it for aquifer testing based on an open bidding process. Chris Boland was the project manager for Boland Drilling, and his son Christopher was the driller and acted as their on-site supervisor.

2.0 WELL INSTALLATION

Drilling was initiated on April 17, 2012 and completed on June 1, 2012. A chronological description of drilling activities is provided in Table 2-1 and a detailed well log providing descriptions of stratigraphy and well construction is in Appendix A. A summary of the drilling conditions, geology and well construction is provided below.

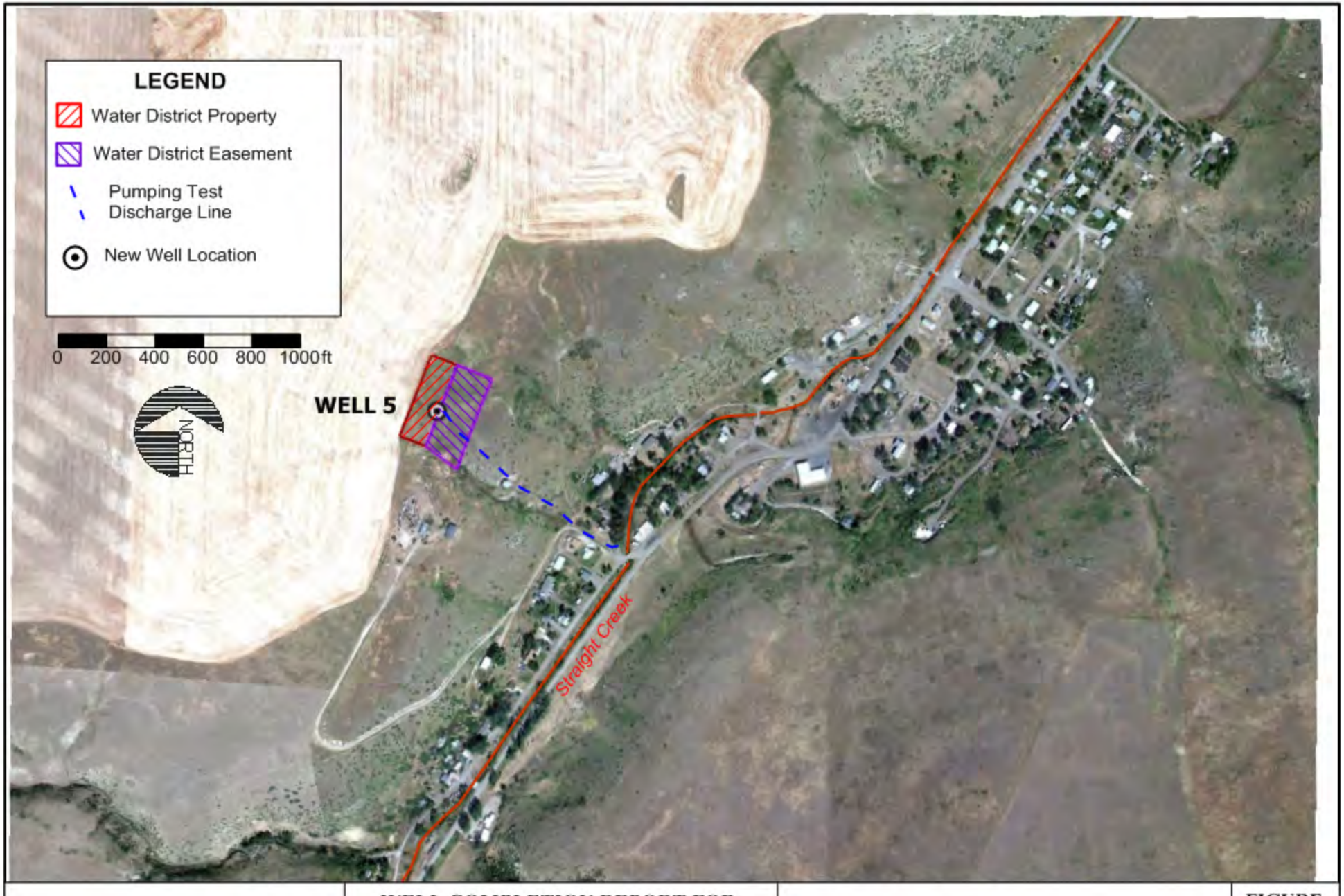
The new well is referred to as Well 5 based on the Water Districtôs sequential numbering system for their existing wells. The new well is located within the Water Districtôs existing well field immediately west of Sand Coulee (Figure 2-1). The well field has in place an existing protective zone through ownership and easements (shown in Figure 2-1) that encompasses the 100 foot control zone for the new well.

Drilling encountered unconsolidated clayey soils to a depth of 10 feet underlain by bedrock of the Kootenai Formation, which is composed of a mixed sequence of sandstone, siltstone and shale to a depth of 170 feet bgs. The Kootenai Formation is the primary source of water to the Water Districtôs existing well field. A vertical fracture was encountered in the Kootenai sandstone at a depth of 162 feet that produced approximately 25 gpm of flow to the drill hole. This fracture was documented in a downhole video, which is included on DVD at the back of this report. The static water level depth in the Kootenai Formation at the time of drilling was approximately 155 feet bgs. There was no additional groundwater inflow observed from the Kootenai Formation below this depth.

At 170 feet bgs there was an abrupt transition from the Kootenai sandstone to black shale of the Morrison Formation. Minor amounts of coal were encountered from 180 to 190 feet bgs. Shales and mudstones of the Morrison Formation continue to the upper contact of the Swift Formation at a depth of 363 feet. There were no significant producing zones in the Morrison formation.

TABLE 2-1. CHRONOLOGIC DESCRIPTION OF COMPLETION AND TESTING OF SAND COULEE WATER DISTRICT WELL 5

Date	Hydrometrics Present	Description
04/17/12	yes	Boland initiates drilling. Set 12" surface casing to 20 feet, drilled 8-inch borehole , hole producing approx 15 gpm at 175', lost circulation at 363', pulling flights to clean jets on hammer bit
04/18/12	no	Measured water levels in Well-2 and Well-4, Boland grouts test hole using aggregate/cement mix to plug voids; added total of 6 yds cement w/3/8" aggregate.
04/19/12	yes	Measured water levels in Well-2, Well-3 and Well-4, Drilled out cement, lost circulation from 370 - 373, drill stem stuck in testhole
05/01/12	no	Boland added 2 75-bag grout additions on 4/29 - 4/30 , grout at 366 feet bgs
05/02/12	yes	Downhole video recording of testhole, TD = 366 feet
05/04/12	yes	Grouting with 50 bags of cement, and Pol-E-Flake, Perlite & Magna Fiber additives
05/07/12	no	Grouting with 50 bags grout, CaCl, magna fiber, and bentonite crumbles
05/08/12	yes	Grout up to 275'. Resumed drilling. Circulation loss again at 386'; lost all circulation at 392'. Hole caved to 385'. DTW=~369'.
05/21/12	no	Casing driven to 424 ft, TD of drillhole = 425 ft, DTW = 358 ft.
05/22/12	yes	Placing annular seal around casing. Boland did 3 separate grout additions - each consisting of 40 bags cement + bentonite crumbles as additive.
05/23/12	no	Boland did two more grout additions, the first using 55 bags cement plus bentonite, poly flake, magna fiber and CaCl additives, and the second with 60 bags cement, CaCl, bentonite, poly flake and magna fiber additives.
05/24/12	no	Boland adds 3 gallons of polyswell mixed in 10 gallons of water to hole
05/25/12	no	Boland added grout in two additions, the first with 10 sacks of cement plus sand and CaCl, and the second with 50 sacks of cement plus sand and CaCl. Drilled 5 feet and tremied 4 to 6 sacks of cement from the final mix into the bottom of the hole.
05/29/12	no	Boland did 3 final grout additions, the first with 50 sacks of cement plus bentonite, sand, and CaCl additives, the second with 50 sacks cement plus bentonite, sand, and CaCl; and the third with 30 sacks of cement, plus bentonite powder, bentonite crumbles, sand and CaCl. 10 additional sacks of cement used to complete the surface seal after the surface casing was removed.
05/31/12	yes	Resumed drilling. Drilled from 675' to 745'. Blew air seal at 745' on top head. After repairing seal were unable to get circulation/returns
06/01/12	yes	Complete drilling well to 785 feet with limited circulation/returns; DTW approx 370 ft
06/07/12	no	Boland set pump for aquifer test and developed well for 2 hours
06/08/12	no	Boland set discharge line and developed well for additional 2 hours
06/08/12	yes	Hydrometrics conducted step test, collecting turbidity sample from discharge = 1.4 ntu
06/12/12	yes	Initiated 24-hr pumping test at average pumping rate of 145 gpm. Produces approximately 1.8 feet of drawdown in well.
06/13/12	yes	Completed pumping test and collected water quality samples. Well fully recovered within 2 min. Pulled transducer from well. Submitted samples to Energy Labs in Helena, MT for water quality analysis.
06/19/12	no	Boland removes drop pipe and pump from well.
06/21/12	yes	Record downhole video of well



Hydrometrics, Inc. Consulting Scientists and Engineers	WELL COMPLETION REPORT FOR SAND COULEE WATER DISTRICT PUBLIC WATER SUPPLY WELL NO. 5	LOCATION MAP	FIGURE 2-1

k:/project/10039/water supply well/Location Map.srf"

The Swift formation extends to a depth of 390 feet. The Swift Formation at this location consists of a mixed sequence of fine to medium grained sandstone, siltstone and dirty limestone. The Swift Formation is highly fractured and problematic to drill due to loss of circulation in the open fractures. When circulation was lost the water level in the drill hole drained down to a depth of 326 feet. The loss of circulation resulted in cuttings dropping on top of the bit and sticking the bit in the hole. The bit had to be drilled out and extensive grouting was required before circulation was restored and drilling could continue. A detailed description of the grout additions and materials used is provided in Table 2-2.

Orange iron-colored water was encountered at the base of the Swift Formation just above the contact with the Madison limestone at 390 feet. Eight-inch steel casing was added to the drill hole to a depth of 390 feet and the casing was driven across the contact with the Madison and into competent rock at a depth of 424 feet. The annular space between the casing and borehole was sealed with cement grout with bentonite from 424 feet to the ground surface before drilling further to prevent cross circulation of groundwater between the shallow formations and the Madison limestone. Because of the fractured condition of the Swift Formation grout was top loaded into the hole rather than pressure grouted though the casing as originally proposed. The initial grouting failed to fill the annular space due to grout losses to open fractures in the formation (Table 2-2). Repeated grouting was required to bring the annular seal up to the surface. Grouting was ultimately successful in sealing the casing to the surface. A total of 435 94-lb sacks of cement were used to grout the casing annulus (details in Table 2-2).

Once grouting was completed and the overlying groundwater sources were sealed off, no groundwater entered the drill hole from the top of the Madison. Groundwater was first encountered in the Madison from a fracture at a depth of 532 feet. Groundwater inflow to the drill hole from this fracture was approximately 30 gpm at the time of drilling. Small increases in flow were noted at approximately 605 feet, 675 feet and 710 feet. The hole was estimated to produce approximately 50 gpm at a depth of 725 feet, although consistent flow measurements were difficult to obtain due to surging flow rates. At 748 feet, the drill hole

TABLE 2-2. SUMMARY OF GROUT MATERIALS USED

Date	Description	cement aggregate mix (cu yds)	cement (94-lb bag)	sand (50-lb/bag)	CaCl (50-lb bag)	bentonite (50-lb bag)	magna fiber (50-lb bag)	perlite (ft3)
4/18/2012	United Materials cement truck	6	0	0	0	0	0	0
4/29/2012	grout formation voids	0	75	0	0	0	0	0
4/30/2012	grout formation voids	0	75	0	0	0	0	0
5/4/2012	grout formation voids	0	50	0	3	0	1	150 ft3
5/7/2012	grout formation voids	0	50	0	2	3	1	0
Subtotal		**6**	**250**	**0**	**5**	**3**	**2**	150 ft3
5/22/2012	grout well annulus	0	40	0	0	0.25	0	0
5/22/2012	grout well annulus	0	40	0	0	0.75	0	0
5/22/2012	grout well annulus	0	40	0	0	1	0	0
5/23/2012	grout well annulus	0	55	0	1	1	0	0
5/23/2012	grout well annulus	0	60	0	1	1	0	0
5/25/2012	grout well annulus	0	10	10	0.6	0	0	0
5/25/2012	grout well annulus	0	50	8	2	0	0	0
5/29/2012	grout well annulus	0	50	7	1	2	0	0
5/29/2012	grout well annulus	0	50	10	1	2	0	0
5/29/2012	grout well annulus	0	30	8	1	3	0	0
5/29/2012	complete surface seal	0	10	0	0	0	0	0
Subtotal			**435**	**43**	**7.6**	**11**	**0**	**0**

again lost most of the circulation and the driller was able to advance the hole to a depth of 785 feet before there was insufficient circulation to continue drilling further. Since this was within 15 feet of the proposed completion depth, drilling was stopped and the hole was completed at 785 feet.

The well could not be developed by air lifting as originally proposed due to lack of circulation. Instead Boland developed the well for four hours using a submersible pump at a flow rate of approximately 150 gpm. The well did not appear to be flow limited during development at that pumping rate, but an accurate assessment of the well yield could not be established. The estimated yield of the well was evaluated in more detail during aquifer testing (Section 3.0).

A downhole video of the well was recorded on June 21, 2012 to document the final well completion, borehole characteristics, and the geology in the lower uncased section of the borehole. The video shows a static water level in the well of 367 feet. The logged fracture at 532 feet is prominent in the video; however, open fractures in the lower section of the borehole are not clearly evident. Downhole videos of the completed well are included on the DVD at the end of this report.

3.0 AQUIFER TESTING

Boland Drilling installed the pump, generator and discharge line for the aquifer test. A 30 horsepower Grundfos submersible pump with a rated capacity of 160 gpm was set at a depth of 745 feet using 2-inch galvanized riser pipe, with a check valve above the pump and a second one at a depth of 640 feet. A 1-inch I.D. PVC stilling tube was also installed in the well for measuring water levels during testing. The stilling tube was set 5 feet above the pump. Hydrometrics installed a 300 psi In-situ transducer/datalogger in the stilling tube at a depth of 652 feet to record water level fluctuations during testing. A paddlewheel flow meter with a digital readout and a regulating valve was installed at the well head to measure and adjust discharge rates. Two-inch diameter PVC piping was laid from the well head to ñStraight Ditchò in Sand Coulee to route discharge water during the pumping test to the existing surface water drainage approximately 1000 feet to the east (Figure 2-1).

3.1 STEP-DRAWDOWN TEST

Hydrometrics conducted a step-drawdown test on the well on June 8, 2012. The purpose of the test was to establish water level drawdown characteristics for the well under a range of pumping rates. The resultant data were used to verify that the well was capable of sustaining the proposed test rate of 150 gpm (1.5 times the design rate of 100 gpm) over the full duration of the 24 hour pumping test, and achieving water level stabilization within that time frame. The step drawdown data also allow calculation of well loss and formation losses that affect drawdown. In theory, in an ideal aquifer with a 100% efficient well, drawdown increases linearly with the discharge rate. Under these assumptions doubling the pumping rate would double the drawdown; however, in practice there can be additional non-linear drawdown effects due to frictional losses or turbulent flow conditions in the well or formation. These effects need to be considered in assessing the potential yield of the well at higher pumping rates. Step tests allow quantification of both the linear and non-linear drawdown effects.

The step test was conducted at discharge steps of 46 gpm, 101 gpm and 132 gpm, maintaining a constant pumping rate at each step for approximately 30 minutes. Water level

drawdown stabilized nearly instantaneously at each step. The total drawdown at each step and resultant specific capacity (gallons per minute per foot of drawdown) are shown in Figure 3-1, along with calculated drawdown coefficients and the estimated maximum yield of the well.

Although the step-drawdown test produced very minimal drawdown (less than 2 feet out of 367 feet of available drawdown) indicating that the well is easily capable of sustaining the proposed pumping rate of 150 gpm, there were significant nonlinear drawdown effects evident in the test with increases in discharge rate (i.e., specific capacity decreased as the pumping rate increased). This is not uncommon in bedrock aquifers where there may be non-linear drawdown effects due to high flow velocities within fracture systems. When the potential yield of the well is calculated with these well loss coefficients the estimated yield of the well is still extremely high, on the order of 1000 gpm (Figure 3-1). It should be emphasized that this number is only an estimate and the actual yield could be substantially less, since the testing was performed at only a fraction of this rate and the drawdown characteristics of bedrock aquifers often vary from theoretical assumptions. However, the results confirm that the well is capable of yields greater than the current required design rate of 100 gpm. In order to establish an accurate estimate of the maximum yield of the well an extended pumping test would need to be performed at a much higher pumping rate than utilized in the current tests.

3.2 24-HOUR PUMPING TEST

Hydrometrics recorded background water level measurements and barometric data from June 8 until the 24-hour pumping test was initiated on June 12, 2012. The pumping was started at 1:20 pm on June 12. The pump was operated at its full capacity during the test, which produced an average yield of 145 gpm over the duration of the test. Water level measurements in the test well were recorded on a logarithmic schedule that logged water levels at an initial frequency of 2 readings per second, gradually decreasing in frequency to a maximum interval of 1 reading every 30 minutes. Periodic manual water level measurements were taken with an electronic water level indicator for confirmation. Figure 3-2 contains a

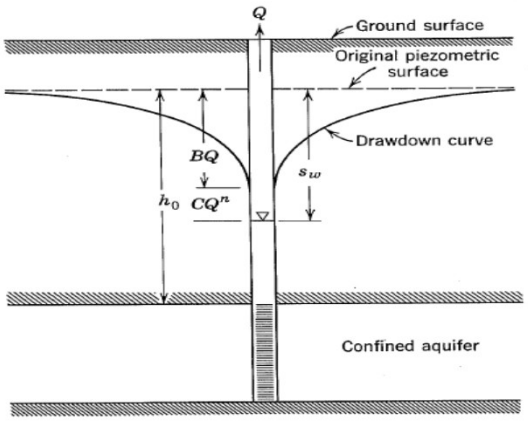
FIGURE 3-1. STEP TEST EVALUATION

Total drawdown in a pumping well is a function of the drawdown in the formation (formation loss) plus any additional loss in head that occurs in the well (well loss) due to any frictional resistance as water flows from the formation to the pump intake. Jacob (1947) developed the following equation describing the drawdown components to a well at a given pumping rate:

eqn 1 $s_w = Q*B + Q^2*C$

where:

s_w = Total Drawdown
Q = Pumping Rate (gpm)
B = Formation Loss Coefficient
C = Well Loss Coefficient



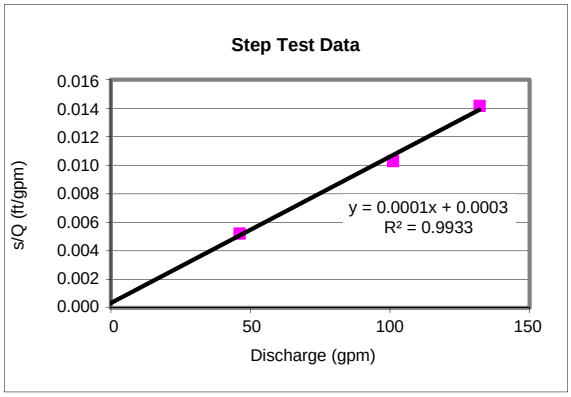
(Figure from Todd, 1980)

Well loss and potential yield can be calculated from step drawdown pumping test results by plotting s/Q versus discharge and fitting a straight line through the observed data. The slope of the best fit line is equal to C (the non-linear well loss coefficient) and the intercept of this line with Q = 0 is B (the linear drawdown coefficient) which together allow calculation of drawdown in a well at a given pumping rate.

Sand Coulee Water District Well 5 Step Test Results

Test Date: 3/7/2006

Discharge Rate	Drawdown	Specific Drawdown (ft/gpm)	Specific Yield (gpm/ft)
Test Results			
Q (gpm)	s(ft)	s/Q	Q/s
46	0.24	0.005	192
101	1.04	0.010	97
132	1.87	0.014	71



Drawdown Coefficients

formation	B =	3.42E-04
well	C =	1.03E-04

Calculated Drawdown at Proposed Yield

proposed discharge rate	Q =	150	gpm
aquifer drawdown	B*Q =	0.05	ft
well loss	$C*Q^2$ =	2.31	ft
Total Drawdown		**2.36**	

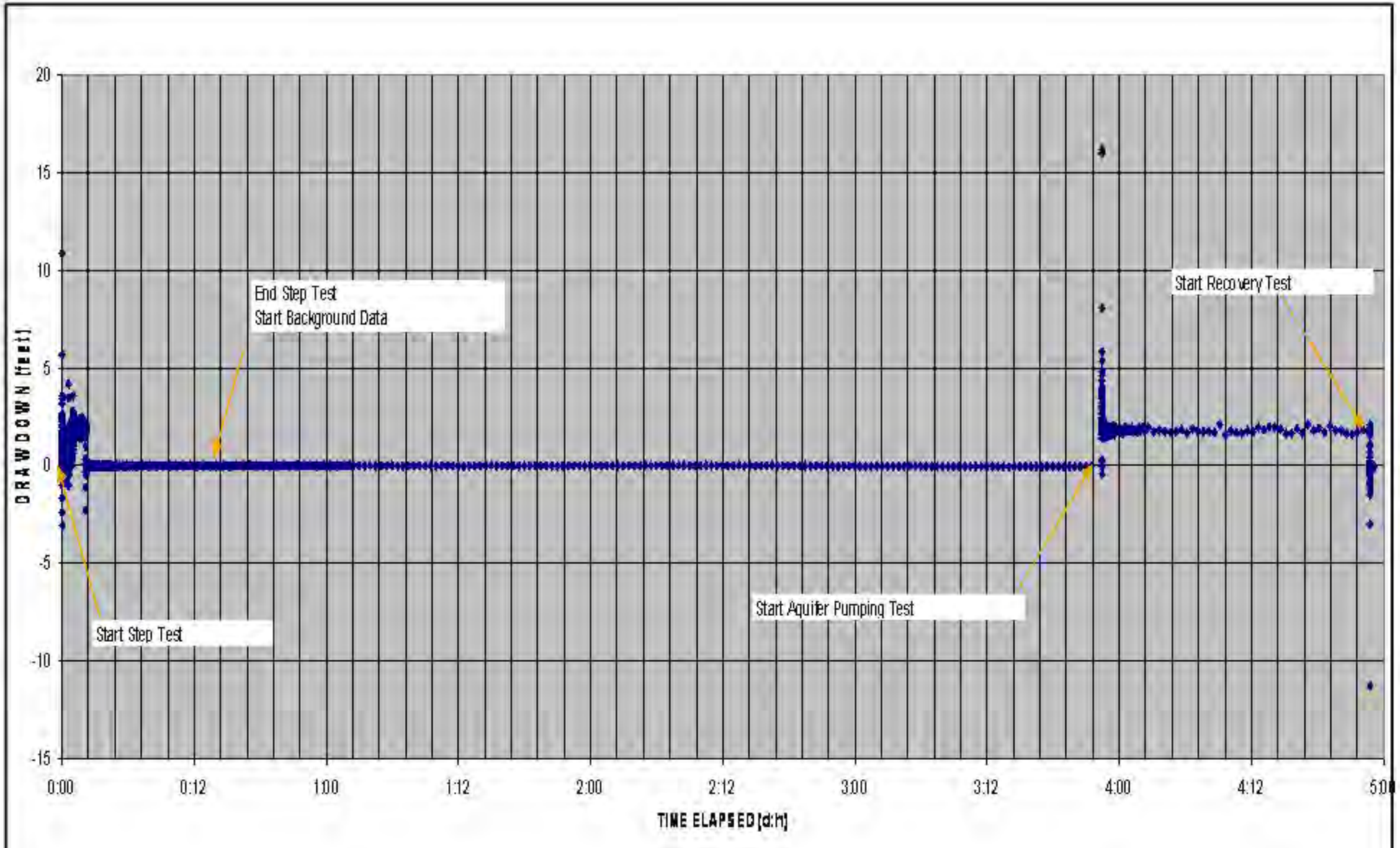
Potential Yield

The potential yield of a well is estimated below based on the Jacobs equation considering non-linear well losses at higher pumping rates. The potential yield is the discharge rate at two-thirds of the available drawdown.

Depth of primary producing zone	532	ft
Static water level depth	370	ft
Available drawdown	162	ft
2/3 available drawdown	108	ft
Potential Yield of Well	**1,024**	**gpm**

REFERENCES

Jacob C.E., 1947. Drawdown test to determine effective radius of artesian well, Trans. Amer. Soc. Civil Engrs. v. 112 pp.1047-1070
Todd, D.K, 1980. Groundwater Hydrology 2nd Edition. p.153.



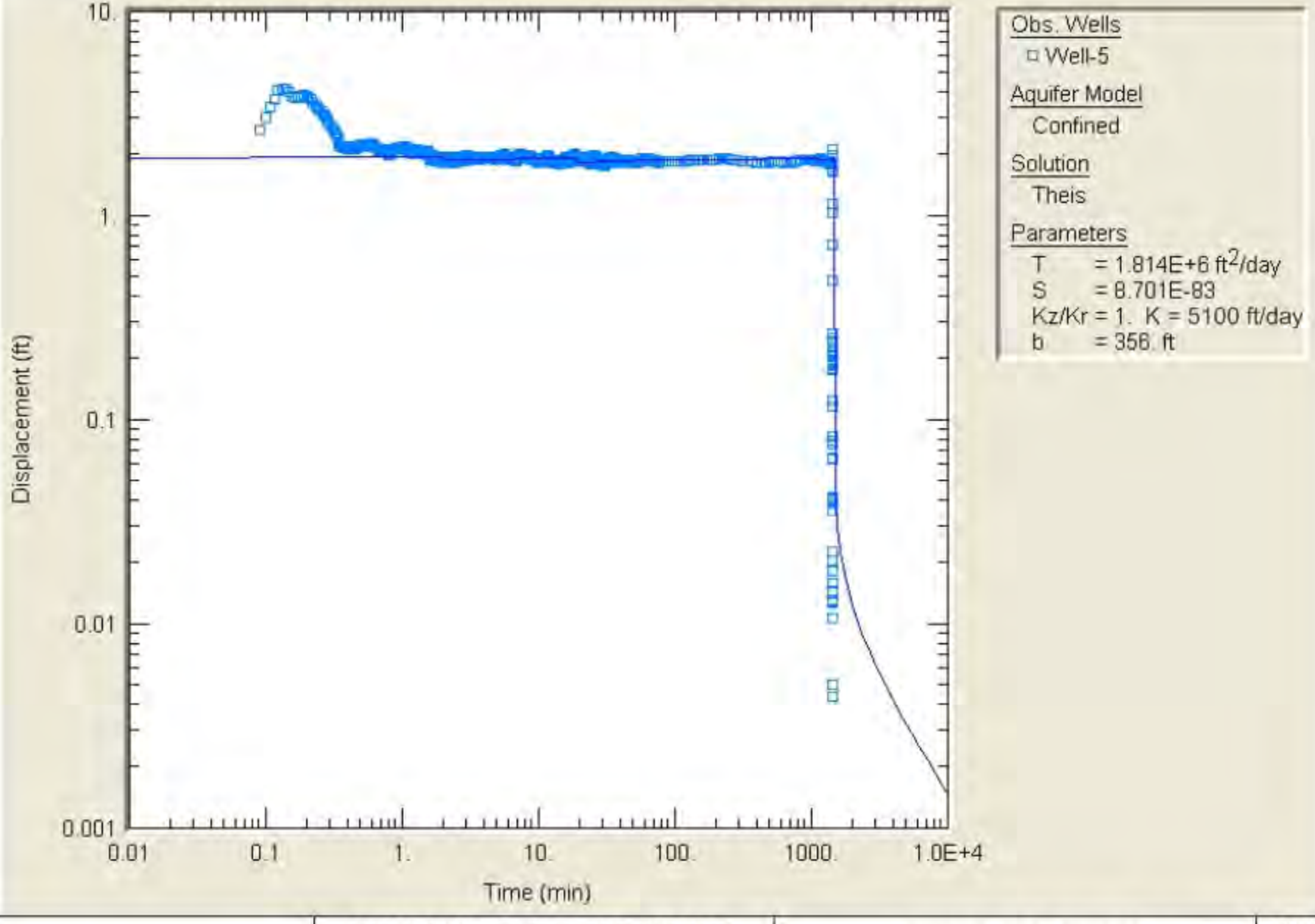
Hydrometrics, Inc. Consulting Scientists and Engineers	WELL COMPLETION REPORT FOR SAND COULEE WATER DISTRICT PUBLIC WATER SUPPLY WELL NO. 5	WELL 5 PUMPING TEST DRAWDOWN TREND	FIGURE 3-2

K:/project/10039/Water Supply Well/Aquifer Test Water Level Graph

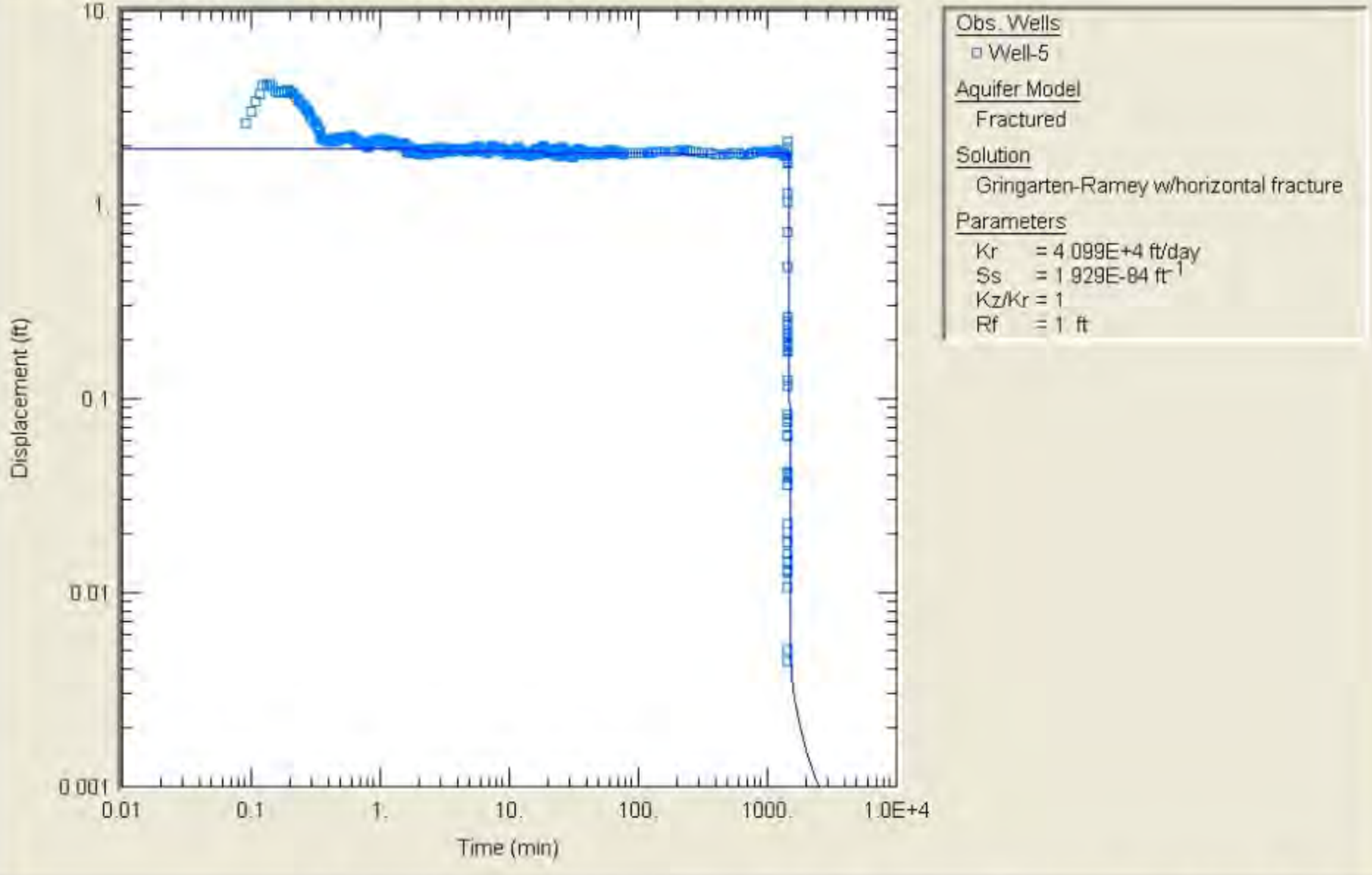
graph showing drawdown trends over time during the pumping and recovery tests. The drawdown and discharge data are included in electronic form on the attached DVD.

Pumping produced a brief drawdown surge in the well followed by an oscillatory response within the first 30 seconds of the test. Water levels in the well then stabilized at about 1.8 feet of total drawdown. No further drawdown was observed over the remainder of the test. A similar oscillatory response was produced when the pump was shut off at the end of the test at 1:40 pm on June 13, 2012. The oscillatory response is an ñunderdampedò response attributable to inertial effects following a rapid change in water levels in a highly permeable aquifer. Water levels were fully recovered within 30 seconds of the test completion.

Water level data collected from the pumping well were corrected for barometric changes and evaluated using AQTESOLV (v.4.01) to calculate the resultant hydraulic conductivity of the aquifer. The data were analyzed using both an equivalent porous media approach (Theis, 1935) and a bedrock solution (Gringarten and Ramey, 1974). Both methods yield hydraulic conductivity estimates on the order of 4,000 to 5,000 feet/day. Graphical curve matching results are shown in Figures 3-3 and 3-4. The 24-hour pump test results indicate that the fracture system intercepted by this well has a very high hydraulic conductivity, which is consistent with the high yield estimate for this well determined from the step drawdown test results.



Hydrometrics, Inc. Consulting Scientists and Engineers	WELL COMPLETION REPORT FOR SAND COULEE WATER DISTRICT PUBLIC WATER SUPPLY WELL NO. 5	THEIS SOLUTION CURVE MATCHING RESULTS	FIGURE 3-3



Hydrometrics, Inc. Consulting Scientists and Engineers	WELL COMPLETION REPORT FOR SAND COULEE WATER DISTRICT PUBLIC WATER SUPPLY WELL NO. 5	GRINGARTEN-RAMEY SOLUTION CURVE MATCHING RESULTS	FIGURE 3-4

4.0 WATER QUALITY TESTING

The Phase II and Phase V rules of the federal Safe Drinking Water Act require community water supplies to monitor for radionuclides, volatile organic compounds (VOCs), synthetic organic chemicals (SOCs), inorganic compounds (IOCs) and microbiological contaminants. Hydrometrics collected water quality samples at the completion of the 24-hour pumping test and submitted the samples under standard chain of custody protocol to Energy Laboratories in Helena, Montana for analysis of Phase II and Phase V VOCs, SOCs, IOCs and radionuclides. Microbiological testing will be conducted after the piping and pump are installed and the well has been sterilized.

Analytical results are summarized in Table 4-1 and the complete laboratory analytical report and chain of custody documentation is included in Appendix B.

The water quality results meet applicable regulatory limits for all constituents and show nondetectable concentrations of VOCs, SOCs and dissolved metals. The water has a high hardness (288 mg/L) which is typical of water derived from the Madison aquifer. High hardness does not adversely affect water quality but may cause scaling on plumbing fixtures and appliances, such as water heaters.

In addition to monitoring for Phase II and Phase V rule contaminants, DEQ requires public water supply wells to be evaluated to determine whether the groundwater source is under the direct influence of surface water (GWUDISW assessment). Sources that have a direct surface water influence have an increased risk of contamination from pathogenic organisms (Giardia lamblia, Cryptosporidium, viruses, and bacteria), therefore DEQ has developed a screening process to determine whether there is significant risk that a source is directly influenced by surface water and whether it will be subject to the Surface Water Treatment Rule requirements. DEQ has a preliminary assessment (PA) form that can be used to establish that a source is not directly connected to surface water if it is sufficiently deep, the well has an adequate seal and there is a large set-back from surrounding surface water bodies.

TABLE 4-1. SUMMARY OF LABORATORY ANALYTICAL RESULTS

Parameter	Results	Units	Reporting Limit	Regulatory Limit
pH	7.8	s.u.		6.50-8.50
Conductivity	651	umhos/cm	1	
Total Alkalinity	200	mg/L	4	
Calcium	72	mg/L	1	
Magnesium	26	mg/L	1	
Sulfate	120	mg/L	1	
Chloride	8	mg/L	1	
Fluoride	0.6	mg/L	0.1	4
Nitrate+Nitrite as N	0.37	mg/L	0.01	10
Hardness	288	mg/L	1	
METALS (Dissolved)				
Mercury	ND	mg/L	0.0001	
Antimony	ND	mg/L	0.002	0.006
Barium	ND	mg/L	0.1	2
Beryllium	ND	mg/L	0.001	0.004
Cadmium	ND	mg/L	0.001	0.005
Chromium	ND	mg/L	0.01	0.1
Iron	ND	mg/L	0.03	
Nickel	ND	mg/L	0.01	
Selenium	ND	mg/L	0.005	0.05
Thallium	ND	mg/L	0.001	0.002
Arsenic (Total)	0.002	mg/L	0.001	0.01
RADIONUCLIDES				
Gross Alpha	0.6	pCi/L		15
Gross Alpha Adjusted	0.6	pCi/L		15
Gross Beta	4.1	pCi/L		50
Radium 226	0.05	pCi/L		5
Radium 228	0.5	pCi/L		5
Radium 226 + 228	0.4	pCi/L		5
Uranium	0.002	mg/L	0.001	0.03
Uranium Activity	1.1	pCi/L	0.9	20
VOLATILE ORGANIC COMPOUNDS			All parameters ND	
SEMI-VOLATILE COMPOUNDS			All parameters ND	
HERBICIDES			All parameters ND	

Note: ND = Not Detected at applicable reporting limits.

Hydrometrics completed the PA Form, a copy of which is included in Appendix C. There resultant ranking classifies the source as groundwater that does not require further evaluation, based on the large depth to the Madison aquifer, the inclusion of an adequate annular seal and the set-back to surface water.

Aquifer and water quality testing indicates that the capacity of the new well exceeds the required design flow of 100 gpm, and that water quality meets applicable requirements for a community water supply well. A final round of microbiological testing will be required prior to putting the well to use, but given the depth of the aquifer and the well completion characteristics problems with microbiological contaminants at this site are not anticipated.

5.0 REFERENCES

Gringarten, A.C. and H.J. Ramey, 1974. Unsteady state pressure distributions created by a well with a single horizontal fracture, partial penetration or restricted entry, Soc. Petrol. Engrs. J., pp. 413-426.

Hydrometrics, Inc. 2011. Sand Coulee Water District Water Supply Assessment. Prepared for MTDEQ Remediation Division, January 2011. 116 p.

Smith, L.N. 2008. Altitude of the top of the Madison Group in part of Cascade County, Montana. Montana Bureau of Mines and Geology. Montana Ground-Water Assessment Atlas 7, Part B Map 3 Open File Version September 2008.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

APPENDIX A

WELL LOG

Hydrometrics, Inc.

Consulting Scientists and Engineers

Helena, Montana

Hole Name: Well-5

Date Hole Started: 4/17/12 Date Hole Finished: 6/1/12

Client: Sand Coulee Water District/DEQ

Project: 10039

County: Cascade State: Montana

Property Owner: Sand Coulee Water District

Legal Description: T19N, R4E,S14 NESE

Location Description: Sand Coulee Water District Well Field

Recorded By: Bill Thompson

Drilling Company: Boland Drilling

Driller: Chistopher Boland

Drilling Method: Air Rotary

Drilling Fluids Used: Water

Purpose of Hole: Public Water Supply Well

Target Aquifer: Madison Aquifer

Hole Diameter (in): 8 in

Total Depth Drilled (ft): 785

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	8-inch, steel casing	0-424
Surface Casing Used?	Y	12-inch temporary surface casing	0-20
Screen/Perforations?	Y	Open hole	424-785
Sand Pack?	Y	None	
Annular Seal?	Y	Bentonite/Cement Grout	0-424
Surface Seal?	Y	Bentonite/Cement Grout	0-20'
DEVELOPMENT/SAMPLING			
Well Developed?	Y	4 hrs pumping at 150 gpm	
Water Samples Taken?	Y	IOC, VOC, SOC	
Boring Samples Taken?	N		

Northing: 47.397813 Easting: -111.177153

Static Water Level Below MP: 373 Surface Casing Height (ft): +2

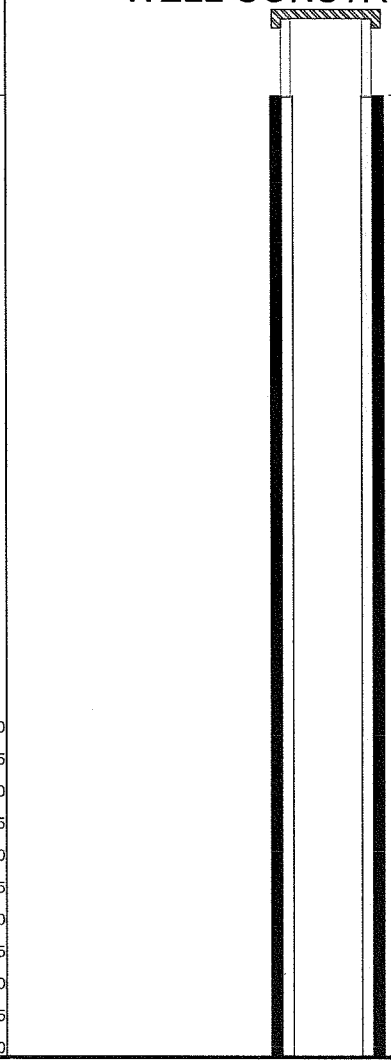
Date: 6/1/12 Riser Height (ft): NA

MP Description: Top of Steel Ground Surface Elevation (ft): 3685

MP Height Above or Below Ground (ft): MP Elevation (ft):

Remarks: 12-inch diameter temporary casing set to 20 feet, then 11-inch diameter borehole completed to 390 feet. 8-inch casing driven to 424 feet and then annular space completely sealed to ground surface with cement/bentonite grout. Drill hole advanced through the Madison limestone from 424 to 785 feet and completed open hole. 24-hr pumping test condcuted at 145 gpm produced 1.8 ft of drawdown and recovered in less than 1 minute.

WELL CONSTRUCTION



GEOLOGICAL DESCRIPTION

GRAPHICS

0.0 - 10.0' **Clayey Sand**
Red/brown

10.0 - 25.0' **Siltstone/Sandstone**
[Kootenai Fm]

Siltstone
Light grey, fine sandy, moderately indurated, dry.

25.0 - 30.0' **Silt**
Light grey tan loose silt.

30.0 - 35.0' **Shale**
Grey to reddish brown shale, hard, dry.

35.0 - 40.0' **Sandstone**
Light brown fine sandstone, weakly indurated, dry.

40.0 - 45.0' **Sandstone/Siltstone**
Tan very fine sand/silt, trace of grey shale, soft, dry.

45.0 - 65.0' **Siltstone**
Mix of grey to tan siltstone/shale, hard, dry.
Light brown, sandy siltstone, very soft, dry.
Tan to light grey, siltstone/shale, soft, dry.
Light grey, siltstone/shale, harder than above.

65.0 - 70.0' **Shale**
Light grey shale/siltstone, hard, dry.

70.0 - 100.0' **Siltstone**
Light grey siltstone with minor amounts of very fine sandstone, hard, indurated, dry.

Pinkish grey siltstone w/some very fine sandstone, hard, dry.

100.0 - 110.0' **Siltstone**
Grey tan mixed siltstone and very fine sandstone, hard, dry.

110.0 - 115.0' **Sand**
Light brown, fine sand, well sorted, slightly moist, loose.

115.0 - 120.0' **Siltite**
Light grey, siltite weakly lithified.

120.0 - 170.0' **Sandstone**
Transition to tan quartz silty sand, very fine grained, well cemented. Driller adding water at 120'
130' Tan sandstone/siltstone.

Tan sandstone slightly coarser grained than above. Some dark (chert?) grains giving salt and pepper appearance.

Continued Next Page

DOMESTIC_WELL2 K:\GINT\PROJECTS\10039.GPJ HYDHLN2.GDT 7/12/12

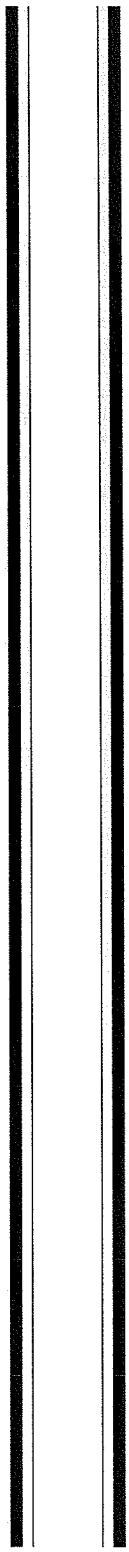
Hydrometrics, Inc.

Consulting Scientists and Engineers
Helena, Montana

Hole Name: Well-5

Date Hole Started: 4/17/12 Date Hole Finished: 6/1/12

WELL CONSTRUCTION



DEPTH

155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390

GRAPHICS

GEOLOGICAL DESCRIPTION

150' Grey sandstone with gray siltstone intermixed.

Grey fine to medium sandstone with silica cementation. No primary porosity.
Salt and pepper appearance.
162' - fracture producing water.

170.0 - 180.0' **Shale**
Black siliceous shale, hard, well indurated. At 175' making ~15 gpm.

180.0 - 190.0' **Coal/Shale**
Black coal/shale. Softer than above.

190.0 - 235.0' **Shale**
Black shale, harder, more indurated than above.

200' Dark grey shale, hard.

225' Light grey thinly bedded shale, hard.

235.0 - 240.0' **SILTSTONE**
235' Grey siltstone, softer than above.

240.0 - 310.0' **Shale**
Grey/green shale.

At 250' making ~25 gpm.

Grey shale.

Greenish grey shale.

Green/brown shale and siltsone.
At 300' still making 25 gpm.

Grey green shale, hard.

310.0 - 315.0' **Sandstone**
Tan silty sandstone, hard.

315.0 - 363.0' **Mudstone**
Transition to grey mudstone, moderatly hard.
320' Yellow brown mudstone.
325' Light grey mudstone, very soft.
330' Yellow orange brown mudstone, soft.

335' Light grey mudstone, soft.

360' Yellow/tan clayey mudstone, soft. Driller reports loss of circulation.

363.0 - 378.0' **Sandstone**
Light yellow/brown quartz sandstone, very fine. Producing ~17.5 gpm.
Driller infers formation is fractured up, loosing air circulation. [Swift Fm]

378.0 - 380.0' **Limestone**
Orange/brown indurated limestone - coarsely fractured.

380.0 - 385.0' **Sandstone**

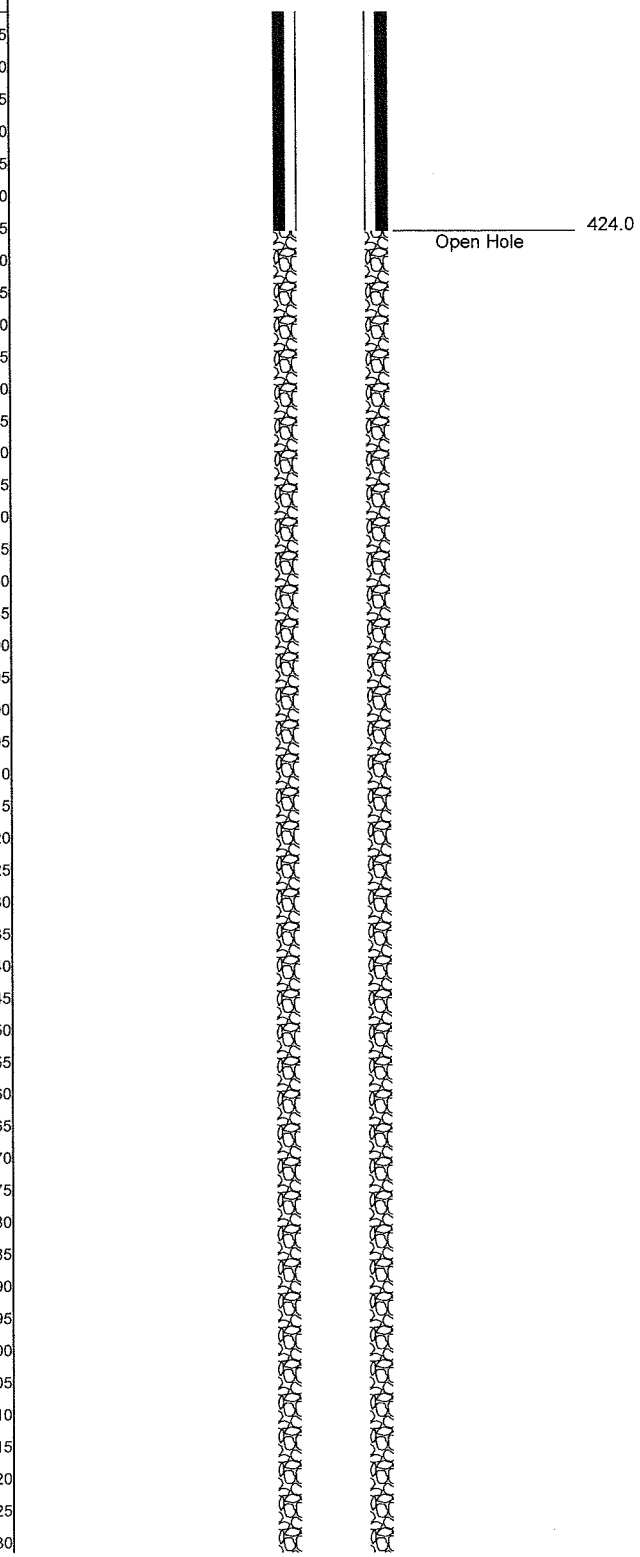
Continued Next Page

Hydrometrics, Inc.
Consulting Scientists and Engineers
Helena, Montana

Hole Name: Well-5

Date Hole Started: 4/17/12 Date Hole Finished: 6/1/12

WELL CONSTRUCTION



GRAPHICS

GEOLOGICAL DESCRIPTION

Sandstone/siltstone with orange deeply weathered/altered surfaces, heavy iron encrustation.

385.0 - 390.0' **Limestone/Sandstone**
Cuttings are a mix of dirty limestone and sandstone, iron oxide encrusted surfaces and staining.

390.0 - 470.0' **Limestone**
Buff limestone with some vuggy openings. [Madison Limestone]
Buff limestone.
Buff limestone with iron encrustation on surfaces.
Buff limestone with very heavy iron oxide encrustation.

Tan/light grey limestone. Hard/competant rock. Hole not producing water after casing grouted.

Tan limestone with very minor iron staining on some surfaces.

Tan limestone.

470.0 - 475.0' **Shaley Limestone**
Grey shaley limestone. At 475' no significant inflow.

475.0 - 785.0' **Limestone**
Tan limestone.

Darker tan/grey brown limestone.

Driller indicates fracture producing ~30 gpm.
Tan limestone with minor iron staining.

Tan/ grey brown limestone with some quartz veining. Still producing 30 gpm.
Tan limestone.

Still producing 30 gpm.

Tan limestone some iron staining on surfaces appeared to pick up a few gpm (~3).
Tan limestone.

Tan limestone. At 625' producing ~40 gpm.

Continued Next Page

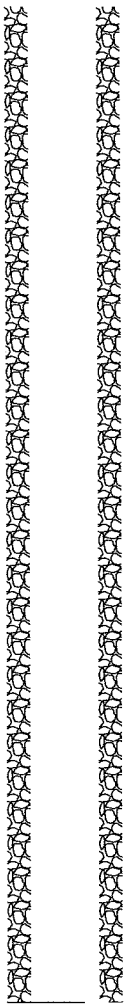
Hydrometrics, Inc.

Consulting Scientists and Engineers
Helena, Montana

Hole Name: Well-5

Date Hole Started: 4/17/12 Date Hole Finished: 6/1/12

WELL CONSTRUCTION



Bottom of Hole 785.0

GRAPHICS

GEOLOGICAL DESCRIPTION

Tan limestone, trace of iron staining on fracture surfaces. At 675' making ~45 gpm.

Tan limestone, trace of iron staining on fracture surfaces. At 725' flow up to ~50 gpm (surging). Drill water returns are orange.

Same tan limestone, drill water returns no longer orange.

Light brown/ grey limestone with traces of white calcite.

748' Driller infers fracture based on loss of circulation.

Grey brown softer gritty limestone.

Grey hard limestone.

Tan/grey limestone.

No returns due to insufficent air circulation. Drilling stopped at 785'.

DOMESTIC_WELL2 K:\GINT\PROJECTS\10039.GPJ HYDHLN2.GDT 7/12/12

APPENDIX B

ENERGY LABORATORY ANALYTICAL REPORT

ANALYTICAL SUMMARY REPORT

July 05, 2012

MT DEQ-Abandoned Mines
PO Box 200901
Helena, MT 59620-0901

Workorder No.: H12060253 Quote ID: H756 - Sand Coulee New Well

Project Name: Sand Coulee Water Supply

Energy Laboratories Inc Helena MT received the following 2 samples for MT DEQ-Abandoned Mines on 6/13/2012 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H12060253-001	SCW-1206-100	06/13/12 12:00	06/13/12	Drinking Water	Metals by ICP/ICPMS, Drinking Water Alkalinity Conductivity Mercury, Drinking Water Fluoride 515-Herbicides, Chlorinated SDWA Hardness as CaCO3 Anions by Ion Chromatography Total Uranium Nitrogen, Nitrate + Nitrite pH Drinking Water Metals Digestion by EPA 200.2 Digestion, Mercury by CVAA Seperatory Funnel Liquid Liquid Ext. Pesticides, Carbamates SDWA Gross Alpha Gross Alpha, Gross Beta Radium 226 + Radium 228 Radium 226, Total Radium 228, Total Solids, Total Dissolved - Calculated Semi-Volatile Organic Compounds Extraction 525-Semi-Volatile Organic Compounds, Montana List 524-Purgeable Organics, SDWA
H12060253-002	TB 6/6/12 KK HCL0256 2760	06/13/12 12:00	06/13/12	Trip Blank	524-Purgeable Organics, SDWA

This is a preliminary report that contains incomplete data or data that has not been fully validated. Caution should be exercised in the use of any data presented as final reported results may not reflect the values presented.

If you have any questions regarding these tests results, please call 406-442-0711 or 877-472-0711.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: Sand Coulee Water Supply
Lab ID: H12060253-001
Client Sample ID SCW-1206-100

Report Date: 07/05/12
Collection Date: 06/13/12 12:00
DateReceived: 06/13/12
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.8	s.u.	H	0.1		A4500-H B	06/28/12 13:20 / cmm
Conductivity @ 25 C	651	umhos/cm		1		A2510 B	06/28/12 13:20 / cmm
INORGANICS							
Alkalinity, Total as CaCO3	200	mg/L	H	4		A2320 B	06/29/12 15:09 / cmm
Chloride	8	mg/L		1		E300.0	06/28/12 17:30 / cmm
Sulfate	120	mg/L		1		E300.0	06/28/12 17:30 / cmm
Fluoride	0.6	mg/L		0.1	4	A4500-F C	06/18/12 15:16 / zeg
Hardness as CaCO3	288	mg/L		1		A2340 B	06/28/12 12:38 / abb
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.37	mg/L		0.01	10	E353.2	06/14/12 17:21 / reh
METALS, DISSOLVED (CONTRACT LAB MT00945)							
Mercury	ND	mg/L		0.00010		E245.1	06/26/12 16:07 / sbk
Antimony	ND	mg/L		0.003	0.006	E200.8	06/20/12 14:14 / dck
Barium	ND	mg/L		0.1	2	E200.8	06/20/12 14:14 / dck
Beryllium	ND	mg/L		0.001	0.004	E200.8	06/20/12 14:14 / dck
Cadmium	ND	mg/L		0.001	0.005	E200.8	06/20/12 14:14 / dck
Chromium	ND	mg/L		0.01	0.1	E200.8	06/20/12 14:14 / dck
Iron	ND	mg/L		0.03		E200.7	06/28/12 12:38 / sld
Nickel	ND	mg/L		0.01		E200.8	06/20/12 14:14 / dck
Selenium	ND	mg/L		0.005	0.05	E200.8	06/20/12 14:14 / dck
Thallium	ND	mg/L		0.001	0.002	E200.8	06/20/12 14:14 / dck
METALS, TOTAL (CONTRACT LAB MT00945)							
Arsenic	0.002	mg/L		0.001	0.01	E200.8	06/20/12 14:38 / eli-b2
Calcium	72	mg/L		1		E200.7	06/28/12 12:38 / sld
Magnesium	26	mg/L		1		E200.7	06/28/12 12:38 / sld
RADIONUCLIDES - TOTAL							
Gross Alpha	0.6	pCi/L	U		15	E900.0	06/26/12 05:36 / eli-ca1
Gross Alpha MDC	2.1	pCi/L				E900.0	06/26/12 05:36 / eli-ca1
Gross Alpha precision (±)	2.0	pCi/L				E900.0	06/26/12 05:36 / eli-ca1
Gross Alpha - Adjusted	0.6	pCi/L	U		15	E900.0	06/26/12 15:11 / eli-c
Gross Beta	4.1	pCi/L			50	E900.0	06/26/12 05:36 / eli-ca1
Gross Beta precision (±)	2.3	pCi/L				E900.0	06/26/12 05:36 / eli-ca1
Gross Beta MDC	2.2	pCi/L				E900.0	06/26/12 05:36 / eli-ca1
Radium 226	0.05	pCi/L	U		5	E903.0	07/03/12 14:50 / eli-c
Radium 226 precision (±)	0.09	pCi/L				E903.0	07/03/12 14:50 / eli-c
Radium 226 MDC	0.09	pCi/L				E903.0	07/03/12 14:50 / eli-c
Radium 228	0.5	pCi/L	U		5	RA-05	07/03/12 12:06 / eli-c

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
U - Not detected at minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: Sand Coulee Water Supply
Lab ID: H12060253-001
Client Sample ID SCW-1206-100

Report Date: 07/05/12
Collection Date: 06/13/12 12:00
DateReceived: 06/13/12
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radium 228 precision (±)	0.6	pCi/L				RA-05	07/03/12 12:06 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	07/03/12 12:06 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U		5	A7500-RA	07/05/12 09:26 / eli-c
Radium 226 + Radium 228 precision (±)	0.6	pCi/L				A7500-RA	07/05/12 09:26 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	07/05/12 09:26 / eli-c
Uranium	0.002	mg/L		0.001	0.03	E200.8	06/20/12 16:36 / eli-c
Uranium, Activity	1.1	pCi/L		0.9	20	E200.8	06/20/12 16:36 / eli-c
- See case narrative regarding combined Ra226+Ra228 calculation.							
VOLATILE ORGANIC COMPOUNDS							
Benzene	ND	ug/L		0.50	5	E524.2	06/18/12 15:21 / abb
Bromobenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Bromochloromethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Bromodichloromethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Bromoform	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Bromomethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
n-Butylbenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
sec-Butylbenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
tert-Butylbenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Carbon tetrachloride	ND	ug/L		0.50	5	E524.2	06/18/12 15:21 / abb
1,2-Dichloroethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Chlorobenzene	ND	ug/L		0.50	100	E524.2	06/18/12 15:21 / abb
Chlorodibromomethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Chloroethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Chloroform	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Chloromethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
2-Chlorotoluene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
4-Chlorotoluene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,2-Dibromo-3-chloropropane	ND	ug/L		0.50	0.2	E524.2	06/18/12 15:21 / abb
Dibromomethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,2-Dichlorobenzene	ND	ug/L		0.50	600	E524.2	06/18/12 15:21 / abb
1,3-Dichlorobenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,4-Dichlorobenzene	ND	ug/L		0.50	75	E524.2	06/18/12 15:21 / abb
Dichlorodifluoromethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,1-Dichloroethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,2-Dibromoethane	ND	ug/L		0.50	0.05	E524.2	06/18/12 15:21 / abb
1,1-Dichloroethene	ND	ug/L		0.50	7	E524.2	06/18/12 15:21 / abb
cis-1,2-Dichloroethene	ND	ug/L		0.50	70	E524.2	06/18/12 15:21 / abb
trans-1,2-Dichloroethene	ND	ug/L		0.50	100	E524.2	06/18/12 15:21 / abb
1,2-Dichloropropane	ND	ug/L		0.50	5	E524.2	06/18/12 15:21 / abb
1,3-Dichloropropane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
2,2-Dichloropropane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,1-Dichloropropene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
cis-1,3-Dichloropropene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: Sand Coulee Water Supply
Lab ID: H12060253-001
Client Sample ID SCW-1206-100

Report Date: 07/05/12
Collection Date: 06/13/12 12:00
DateReceived: 06/13/12
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
trans-1,3-Dichloropropene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Ethylbenzene	ND	ug/L		0.50	700	E524.2	06/18/12 15:21 / abb
Hexachlorobutadiene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Isopropylbenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
p-Isopropyltoluene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Methyl tert-butyl ether (MTBE)	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Methylene chloride	ND	ug/L		0.50	5	E524.2	06/18/12 15:21 / abb
Naphthalene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
n-Propylbenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Styrene	ND	ug/L		0.50	100	E524.2	06/18/12 15:21 / abb
1,1,1,2-Tetrachloroethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,1,2,2-Tetrachloroethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Tetrachloroethene	ND	ug/L		0.50	5	E524.2	06/18/12 15:21 / abb
Toluene	ND	ug/L		0.50	1000	E524.2	06/18/12 15:21 / abb
1,2,3-Trichlorobenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,2,4-Trichlorobenzene	ND	ug/L		0.50	70	E524.2	06/18/12 15:21 / abb
1,1,1-Trichloroethane	ND	ug/L		0.50	200	E524.2	06/18/12 15:21 / abb
1,1,2-Trichloroethane	ND	ug/L		0.50	5	E524.2	06/18/12 15:21 / abb
Trichloroethene	ND	ug/L		0.50	5	E524.2	06/18/12 15:21 / abb
Trichlorofluoromethane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,2,3-Trichloropropane	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,2,4-Trimethylbenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
1,3,5-Trimethylbenzene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Vinyl chloride	ND	ug/L		0.50	2	E524.2	06/18/12 15:21 / abb
m+p-Xylenes	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
o-Xylene	ND	ug/L		0.50		E524.2	06/18/12 15:21 / abb
Trihalomethanes, Total	ND	ug/L		0.50	80	E524.2	06/18/12 15:21 / abb
Xylenes, Total	ND	ug/L		0.50	10000	E524.2	06/18/12 15:21 / abb
Surr: p-Bromofluorobenzene	104	%REC		70-130		E524.2	06/18/12 15:21 / abb
Surr: 1,2-Dichloroethane-d4	108	%REC		70-130		E524.2	06/18/12 15:21 / abb
Surr: Toluene-d8	89.0	%REC		70-130		E524.2	06/18/12 15:21 / abb
SEMI-VOLATILE ORGANIC COMPOUNDS							
Alachlor	ND	ug/L		0.10	2	E525.2	06/28/12 21:14 / eli-b
Aldrin	ND	ug/L		0.10		E525.2	06/28/12 21:14 / eli-b
Atrazine	ND	ug/L		0.10	3	E525.2	06/28/12 21:14 / eli-b
Benzo(a)pyrene	ND	ug/L		0.10	0.2	E525.2	06/28/12 21:14 / eli-b
Butachlor	ND	ug/L		0.10		E525.2	06/28/12 21:14 / eli-b
Chlordane	ND	ug/L		1.0	2	E525.2	06/28/12 21:14 / eli-b
di(2-ethylhexyl)Adipate	ND	ug/L		0.50	400	E525.2	06/28/12 21:14 / eli-b
di(2-ethylhexyl)Phthalate	ND	ug/L		2.0	6	E525.2	06/28/12 21:14 / eli-b
Dieldrin	ND	ug/L		0.10		E525.2	06/28/12 21:14 / eli-b
Endrin	ND	ug/L		0.10	2	E525.2	06/28/12 21:14 / eli-b

Report Definitions: RL - Analyte reporting limit. MCL - Maximum contaminant level.
QCL - Quality control limit. ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: Sand Coulee Water Supply
Lab ID: H12060253-001
Client Sample ID SCW-1206-100

Report Date: 07/05/12
Collection Date: 06/13/12 12:00
DateReceived: 06/13/12
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SEMI-VOLATILE ORGANIC COMPOUNDS							
gamma-BHC (Lindane)	ND	ug/L		0.10	0.2	E525.2	06/28/12 21:14 / eli-b
Heptachlor	ND	ug/L		0.10	0.4	E525.2	06/28/12 21:14 / eli-b
Heptachlor epoxide	ND	ug/L		0.10	0.2	E525.2	06/28/12 21:14 / eli-b
Hexachlorobenzene	ND	ug/L		0.10	1	E525.2	06/28/12 21:14 / eli-b
Hexachlorocyclopentadiene	ND	ug/L		0.10	50	E525.2	06/28/12 21:14 / eli-b
Methoxychlor	ND	ug/L		0.10	40	E525.2	06/28/12 21:14 / eli-b
Metolachlor	ND	ug/L		0.10		E525.2	06/28/12 21:14 / eli-b
Metribuzin	ND	ug/L		0.10		E525.2	06/28/12 21:14 / eli-b
Propachlor	ND	ug/L		0.10		E525.2	06/28/12 21:14 / eli-b
Simazine	ND	ug/L		0.10	4	E525.2	06/28/12 21:14 / eli-b
Toxaphene	ND	ug/L		2.0	3	E525.2	06/28/12 21:14 / eli-b
Surr: 1,3-Dimethyl-2-nitrobenzene	102	%REC		70-130		E525.2	06/28/12 21:14 / eli-b
Surr: Perylene-d12	115	%REC		70-130		E525.2	06/28/12 21:14 / eli-b
Surr: Pyrene-d10	102	%REC		70-130		E525.2	06/28/12 21:14 / eli-b
Surr: Triphenylphosphate	136	%REC	S	70-130		E525.2	06/28/12 21:14 / eli-b
HERBICIDES, BY HPLC (CONTRACT LAB MT00005)							
2,4-D	ND	ug/L		1.0	70	E515.1	06/25/12 21:54 / eli-b
2,4-DB	ND	ug/L		2.5		E515.1	06/25/12 21:54 / eli-b
Dalapon	ND	ug/L		2.5	200	E515.1	06/25/12 21:54 / eli-b
Dicamba	ND	ug/L		0.25		E515.1	06/25/12 21:54 / eli-b
Dichlorprop	ND	ug/L		1.0		E515.1	06/25/12 21:54 / eli-b
Dinoseb	ND	ug/L		1.0	7	E515.1	06/25/12 21:54 / eli-b
Pentachlorophenol	ND	ug/L		0.040	1	E515.1	06/25/12 21:54 / eli-b
Picloram	ND	ug/L		0.50	500	E515.1	06/25/12 21:54 / eli-b
2,4,5-TP (Silvex)	ND	ug/L		0.20	50	E515.1	06/25/12 21:54 / eli-b
Surr: DCAA	91.0	%REC		70-130		E515.1	06/25/12 21:54 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
S - Spike recovery outside of advisory limits.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: Sand Coulee Water Supply
Lab ID: H12060253-002
Client Sample ID TB 6/6/12 KK HCL0256 2760

Report Date: 07/05/12
Collection Date: 06/13/12 12:00
DateReceived: 06/13/12
Matrix: Trip Blank

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Benzene	ND	ug/L		0.50	5	E524.2	06/18/12 14:50 / abb
Bromobenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Bromochloromethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Bromodichloromethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Bromoform	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Bromomethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
n-Butylbenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
sec-Butylbenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
tert-Butylbenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Carbon tetrachloride	ND	ug/L		0.50	5	E524.2	06/18/12 14:50 / abb
1,2-Dichloroethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Chlorobenzene	ND	ug/L		0.50	100	E524.2	06/18/12 14:50 / abb
Chlorodibromomethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Chloroethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Chloroform	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Chloromethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
2-Chlorotoluene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
4-Chlorotoluene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,2-Dibromo-3-chloropropane	ND	ug/L		0.50	0.2	E524.2	06/18/12 14:50 / abb
Dibromomethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,2-Dichlorobenzene	ND	ug/L		0.50	600	E524.2	06/18/12 14:50 / abb
1,3-Dichlorobenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,4-Dichlorobenzene	ND	ug/L		0.50	75	E524.2	06/18/12 14:50 / abb
Dichlorodifluoromethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,1-Dichloroethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,2-Dibromoethane	ND	ug/L		0.50	0.05	E524.2	06/18/12 14:50 / abb
1,1-Dichloroethene	ND	ug/L		0.50	7	E524.2	06/18/12 14:50 / abb
cis-1,2-Dichloroethene	ND	ug/L		0.50	70	E524.2	06/18/12 14:50 / abb
trans-1,2-Dichloroethene	ND	ug/L		0.50	100	E524.2	06/18/12 14:50 / abb
1,2-Dichloropropane	ND	ug/L		0.50	5	E524.2	06/18/12 14:50 / abb
1,3-Dichloropropane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
2,2-Dichloropropane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,1-Dichloropropene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
cis-1,3-Dichloropropene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
trans-1,3-Dichloropropene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Ethylbenzene	ND	ug/L		0.50	700	E524.2	06/18/12 14:50 / abb
Hexachlorobutadiene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Isopropylbenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
p-Isopropyltoluene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Methyl tert-butyl ether (MTBE)	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Methylene chloride	ND	ug/L		0.50	5	E524.2	06/18/12 14:50 / abb
Naphthalene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
n-Propylbenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb

Report Definitions: RL - Analyte reporting limit. MCL - Maximum contaminant level.
QCL - Quality control limit. ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: MT DEQ-Abandoned Mines
Project: Sand Coulee Water Supply
Lab ID: H12060253-002
Client Sample ID TB 6/6/12 KK HCL0256 2760

Report Date: 07/05/12
Collection Date: 06/13/12 12:00
DateReceived: 06/13/12
Matrix: Trip Blank

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Styrene	ND	ug/L		0.50	100	E524.2	06/18/12 14:50 / abb
1,1,1,2-Tetrachloroethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,1,2,2-Tetrachloroethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Tetrachloroethene	ND	ug/L		0.50	5	E524.2	06/18/12 14:50 / abb
Toluene	ND	ug/L		0.50	1000	E524.2	06/18/12 14:50 / abb
1,2,3-Trichlorobenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,2,4-Trichlorobenzene	ND	ug/L		0.50	70	E524.2	06/18/12 14:50 / abb
1,1,1-Trichloroethane	ND	ug/L		0.50	200	E524.2	06/18/12 14:50 / abb
1,1,2-Trichloroethane	ND	ug/L		0.50	5	E524.2	06/18/12 14:50 / abb
Trichloroethene	ND	ug/L		0.50	5	E524.2	06/18/12 14:50 / abb
Trichlorofluoromethane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,2,3-Trichloropropane	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,2,4-Trimethylbenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
1,3,5-Trimethylbenzene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Vinyl chloride	ND	ug/L		0.50	2	E524.2	06/18/12 14:50 / abb
m+p-Xylenes	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
o-Xylene	ND	ug/L		0.50		E524.2	06/18/12 14:50 / abb
Trihalomethanes, Total	ND	ug/L		0.50	80	E524.2	06/18/12 14:50 / abb
Xylenes, Total	ND	ug/L		0.50	10000	E524.2	06/18/12 14:50 / abb
Surr: p-Bromofluorobenzene	102	%REC		70-130		E524.2	06/18/12 14:50 / abb
Surr: 1,2-Dichloroethane-d4	102	%REC		70-130		E524.2	06/18/12 14:50 / abb
Surr: Toluene-d8	93.0	%REC		70-130		E524.2	06/18/12 14:50 / abb

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

APPENDIX C

PRELIMINARY ASSESSMENT FORM FOR GROUNDWATER UNDER THE DIRECT INFLUENCE OF SURFACE WATER

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Metcalf Building
1520 East Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901

PRELIMINARY ASSESSMENT WORKSHEET

Preliminary Assessment of Ground Water Sources that may be Under the Direct Influence of Surface Water

SYSTEM NAME Sand Coulee Water District PWS ID# Mt000325

SOURCE NAME Well 5 - Madison Aquifer COUNTY Cascade

DATE 7-10-12 NC NTNC (C) POPULATION 160

Index Points

A. TYPE OF STRUCTURE (Circle ONE that Applies)

Spring 40
Horizontal Well 40
Well..... (0)

B. HISTORICAL PATHOGENIC ORGANISM CONTAMINATION

History or suspected outbreak of Giardia, or other pathogenic organisms associated with surface water with current system configuration 40
No history or suspected outbreak of Giardia or other pathogenic organisms..... (0)

C. HISTORICAL MICROBIOLOGICAL CONTAMINATION

Record of acute (boil order or fecal positive sample) MCL violations of the Total Coliform Rule during the last 3 years (Circle ONE that Applies)

No violations ..... (0)
One violation 5
Two violations 10
Three violations 15

Record of non-acute (two coliform positive samples in one month) MCL violations of the Total Coliform Rule during the last 3 years (Circle ONE that Applies)

One violation or none ..... (0)
Two violations 5
Three violations 10
DEQ-verified complaints about turbidity..... 5

D. HYDROLOGICAL FEATURES

Horizontal distance between surface water and the source:
Greater than 250 feet ..... (0)
175 - 250 feet 10

100 - 174 feet 20
Less than 100 feet 40

E. WELL SEAL Well has cement-bentonite annular seal from 0-424 feet

Poorly constructed well (uncased, or annular space not sealed to depth of at least 18 feet below land surface),
or casing construction is unknown 15

F WELL INTAKE CONSTRUCTION Well intake completed from 424- 785 feet

In wells tapping unconfined or semi-confined aquifers, with a depth below land surface to top of perforated interval or screen greater than 100 feet ..... (0)
50 - 100 feet 5
25 - 49 feet 10
0 - 24 feet 15
Unknown 15

G. STATIC WATER LEVEL Static Water level depth is approx. 370 feet

In wells tapping unconfined or semi-confined aquifers, depth to static water level below land surface greater than 100 feet ..... (0)
50 - 100 feet 5
25 - 49 feet 10
0-24 feet 15
Unknown 15

H. WELL CAP CONSTRUCTION Well will be completed with vented, vermin proof cap.

Poor sanitary seal, or seal without acceptable material 15

TOTAL SCORE 0

I. PRELIMINARY ASSESSMENT DETERMINATION (Circle **ONE** that Applies)

1. (PASS:) Source is not under the direct influence of surface water.
2. FAIL: Well must undergo further GWUDISW analysis.
3. FAIL: Spring, must undergo further GWUDISW analysis.
4. FAIL: Well or horizontal well less than 100 feet from surface water, must undergo further GWUDISW analysis.
5. FAIL: Well will PASS if well construction deficiencies (section E or F) are repaired.
6. FAIL: Well may PASS if well construction details (section E, F, or G) become available.

ANALYST Bill Thompson

ANALYST AFFILIATION Hydrometrics, Inc.

COMMENTS: _____

PART 2 – DESIGN AND INSTALLATION OF PUMP AND PIPING, AND BACTERIAL TESTING OF WELL

DESIGN AND INSTALLATION OF PUMP AND PIPING,

AND BACTERIAL TESTING OF WELL

Hydrometrics prepared plans and specifications necessary to complete the pump installation and connect the new well up to the Water District's distribution system. The pump was sized to provide a maximum yield of 35 gpm, which would allow the Water District to put the well into immediate operation as an exempt well. This was necessary as the community of Sand Coulee was experiencing a severe water shortage due to continuing decline in yield from their existing well field. The Montana Water Use Act provides a limited exemption from the water right permitting requirements for groundwater wells if the wells have a maximum appropriation of 35 gallons a minute or less, not to exceed 10 acre-feet a year (§ 85-2-306 (3)(a), MCA). While the exempt well provisions specifically preclude connecting multiple wells from the same source in a common system, the Water District's new deep well is completed in the Madison aquifer, which is a separate source from the District's shallow Kootenai aquifer wells. The new well therefore can qualify as an exempt well for augmenting the Water District's existing supply during periods of high demand as long as the exempt well flow and volume limitations are met.

A Gould 33GS50 submersible pump with a 5 horsepower 3 phase 230 volt motor was specified on the engineering plans to provide a maximum discharge rate for the well of 35 gpm based on the calculated total dynamic head (TDH) at the wellhead of 400 feet. TDH calculations and pump curves for the 33GS50 model pump are included with this report (Part 2A). Specifications for the drop pipe, pitless adapter and supply line are shown in attached plans (Part 2A). Several minor modifications were made to the system during installation. The plans called for installation of a 1-inch frost free hydrant in the supply line 25 feet from the wellhead. The hydrant size was increased to 2-inch at the request of the Water District to facilitate purging of the well. A thrust block was added to the design to minimize the potential for pipe movement where the hydrant and the supply line connect due pressure surges when the larger diameter hydrant is put in use. Sand bedding was added to the supply line trench to protect the supply line from sharp rocks that were present in the trench walls.

The final modification was the addition of a backflow prevention valve in the existing supply line. It was unclear whether the existing system had adequate backflow protection. As-built drawings showing the final configuration of the system are included in Part 2A of this report.

Water supply wells and new piping must be disinfected and sampled for total coliform bacteria before final approval can be obtained from DEQ Public Water Supply. On July 21, 2012, Boland Drilling added 5 pounds of powdered chlorine (calcium hypochlorite) mixed with approximately 100 gallons of water to disinfect the new well. The well was purged for approximately two hours on July 22, 2012, to remove residual chlorine. Ryan Casne of Casne and Associates collected a water sample for total coliform testing on July 23rd. The well was purged for 15 minutes prior to sampling and the water sample was hand delivered that day to Energy Laboratory in Helena, MT for total coliform analysis. A duplicate sample was also collected and submitted for analysis. One of the two samples tested positive for coliform.

The well was disinfected a second time after a resample on July 25th also tested positive for coliform bacteria. The Water District added another 5 lbs. of powdered chlorine mixed with approximately 100 gallons of water to the new well on July 28, 2012, to disinfect the system. Water was run through the hydrant and the new supply line after the chlorine was added to ensure adequate disinfection. The well was purged by the Water District to remove the residual chlorine on July 29th and resampled by DEQ AML oversight personnel on August 30th. The sample was hand delivered by DEQ to the State's analytical lab in Helena, MT for analysis of total coliform. This round of testing showed no coliform bacteria present in either the test sample or the duplicate.

The test results were submitted to DEQ Public Water Supply on July 31, 2012, along with final as-built drawings. DEQ Public Water Supply gave verbal approval to Casne and Associates to allow the new well to be put into operation that same day.

Copies of the laboratory test results and DEQ correspondence are in Section 2A of this report.

PART 2A – FINAL INSTALLATION DOCUMENTATION

Letter to DEQ with initial design submittal including:

- **Pump and Piping Plans and Specs**
- **Total Dynamic Head Calculations**
- **Goulds 33GS50 Submersible Pump Specifications**

DEQ Approval Letter

Casne & Associates Final Submittal letter including:

- **Analytical Results for Bacterial Testing**
- **As-Built Drawings**
- **Photos**

Hydrometrics, Inc.
consulting scientists and engineers

3020 Bozeman Avenue
Helena, MT 59601
(406) 443-4150
Fax: (406) 443-4155
www.hydrometrics.com

July 12, 2012

Ms. Rachel Clark
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Subject: Sand Coulee Well 5 Completion Report and
Engineering Specifications for Pump and Piping

Dear Rachel,

The new well for the Sand Coulee Water District has been installed and tested in conformance with the approved plans and specifications. Enclosed is the well completion report for the new well, which includes the following information:

- A well log with descriptions of lithology, water levels and well completion that show compliance with well construction standards in DEQ-1;
- A map showing the protective zone provided through ownership and easement;
- Pumping test results showing compliance with DEQ-1 standards;
- Water quality testing showing compliance with DEQ-1 standards; and
- An assessment of Groundwater Sources Under the Direct Influence of Surface Water that indicates that the source is ranked as groundwater.

The water quality results from Energy Labs are noted as "preliminary" as the lab has not completed their final QC review, but they do not anticipate any modifications. A final version of the Laboratory report will be forwarded to you upon completion

Also enclosed are engineering plans for the pump and piping necessary to tie the well into the existing discharge lines at the well field. As we have discussed, the well design specifies a 35 gpm pump, which will be used until a larger appropriation is approved by DNRC.

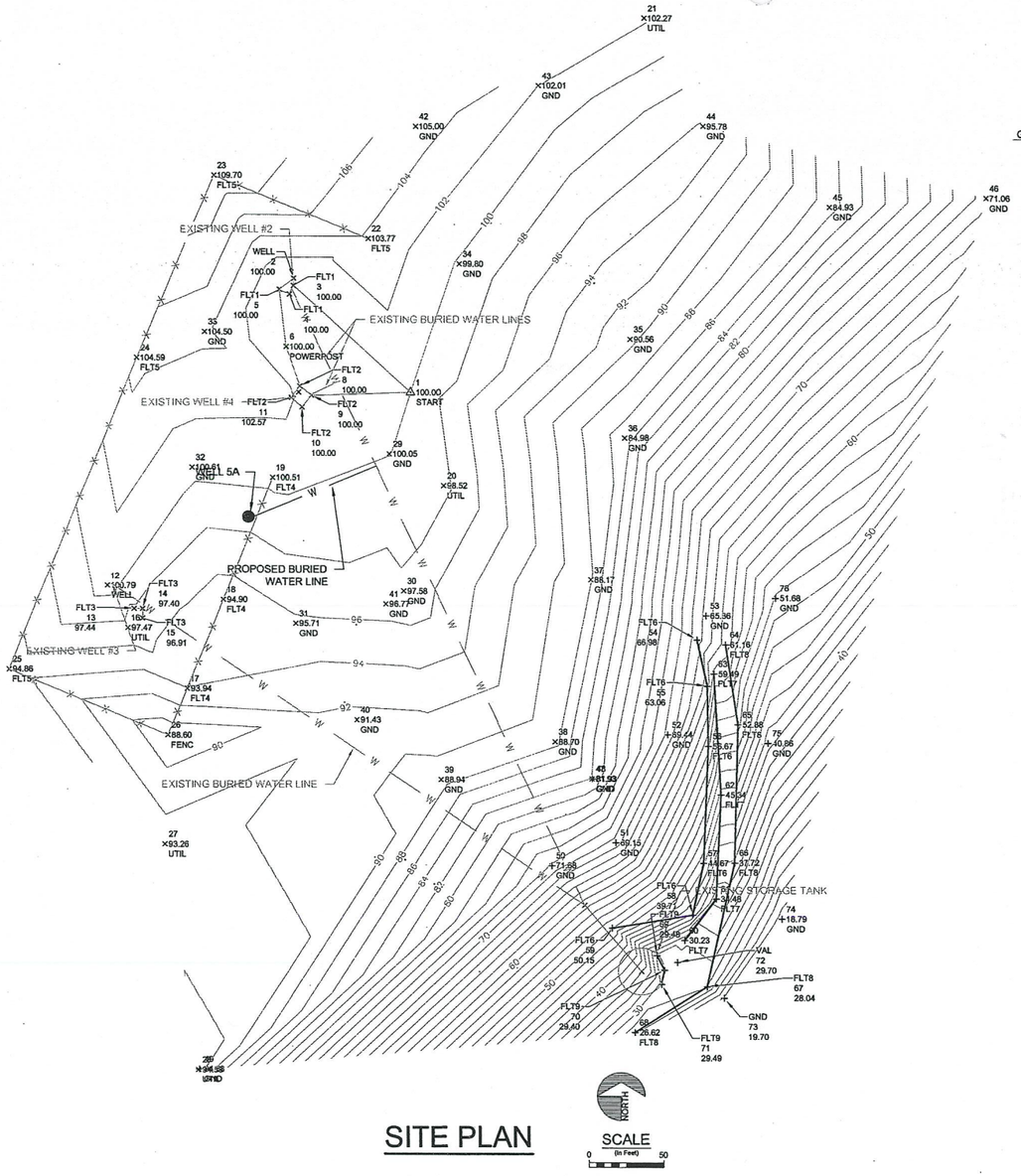
The Sand Coulee Water District has implemented severe water use restrictions due to water shortages from their existing system. Anything you can do to expedite approval of this new well would therefore be much appreciated by the community.

Thank you for your assistance. If you have any questions, please call me.

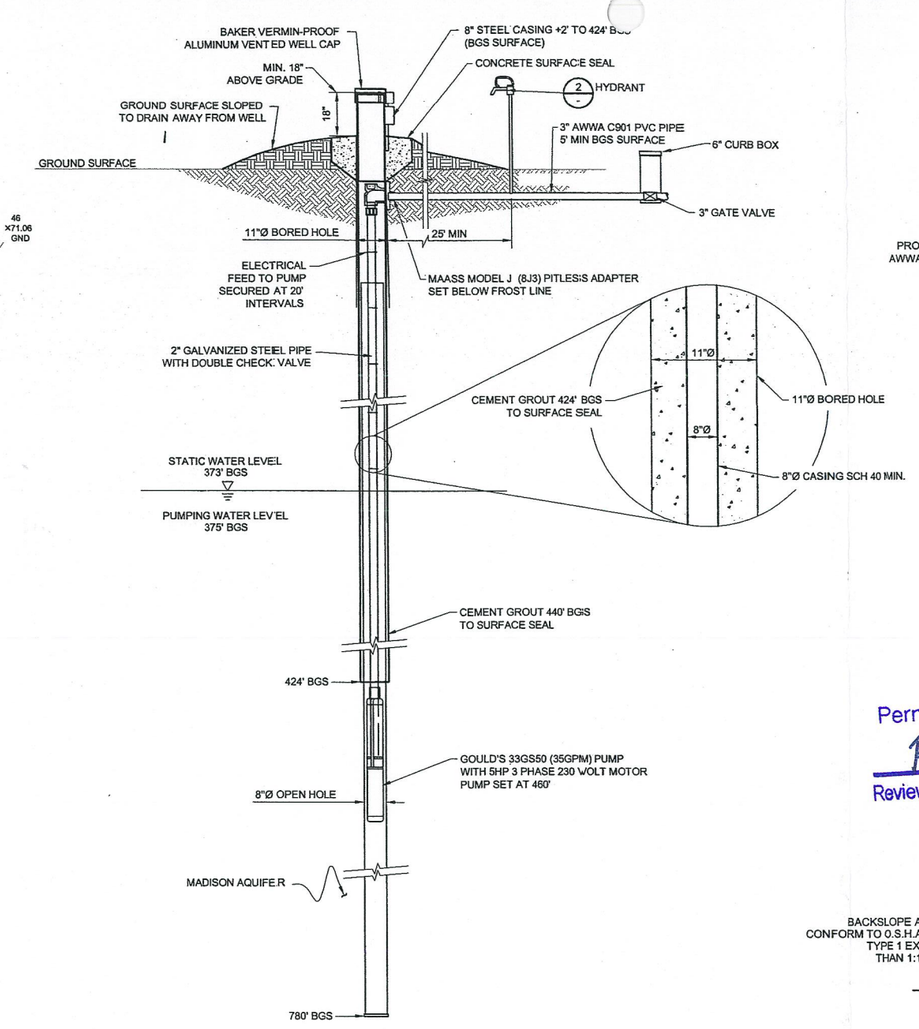
Sincerely,

Bill Thompson
Project Manager and Senior Hydrologist

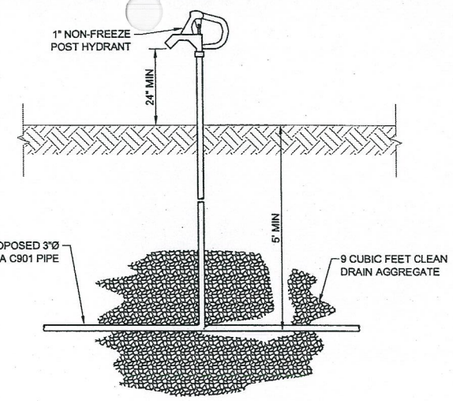
Enclosure



SITE PLAN

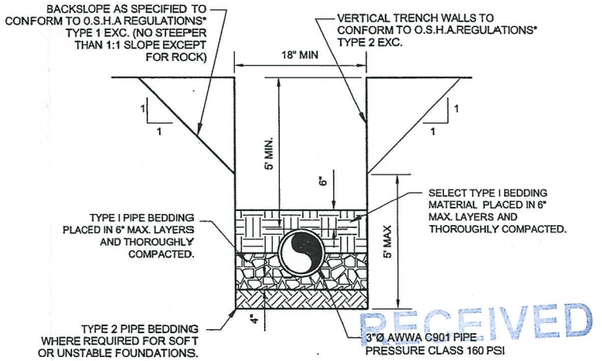


1 - DETAIL
WELL INSTALLATION
NTS



2 - DETAIL
FROST FREE HYDRANT
NTS

APPROVED
Montana Department of Environmental Quality
Permitting and Compliance Division
Reviewer
7-16-12
Date



3 - DETAIL
PIPE TRENCH
NTS

MONTANA
GARY R. FUSCHER
5310 PE
REGISTERED
PROFESSIONAL ENGINEER
7/13/12

RECEIVED
JUL 13 2012
MT DEQ PUBLIC WATER & SUBDIVISION BUREAU

REVISIONS NO	BY	DATE	DESCRIPTION

SCALE VERIFICATION BAR IS ONE INCH ON ORIGINAL DRAWING
0 — 1
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Project No.:		
DRAWN BY	SDP	5/11/12
CHECKED BY		
APPROVED BY		
SCALE: AS NOTED		

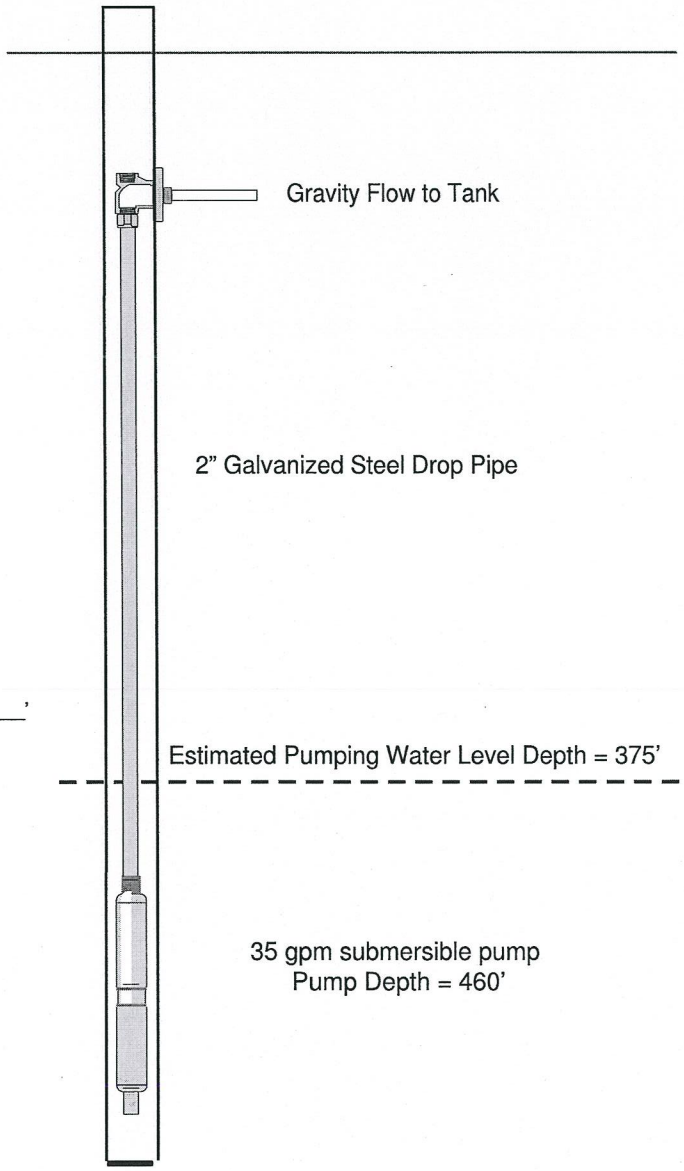
Hydrometrics, Inc.
Consulting Scientists and Engineers
Helena, Montana 59601
3020 Bozeman Avenue
(406) 443-4150

SAND COULEE PUBLIC WATER SUPPLY IMPROVEMENTS

SITE PLAN AND DETAILS

DRAWING FILE NUMBER	
1003901H003	
AUTOCAD 2004 DRAWING (DWG)	
SHEET NUMBER	REV
W1	△

UPDATE TIME: 1:57 PM
SPLETTENBERG\H2L\20120713\E:\LAND PROJECTS\1003901\DWG\1003901H003.DWG



TDH Calculator

Pump Flow Rate	Pipe Diameter(ID)	Pipe Length	Differential Elevation	Pipe Material	Total Dynamic Head(TDH)
US GPM	in.	ft.	ft.	New Steel	ft.
35	2	460	375		391.85

Compute Total Dynamic Head(TDH) | Reset

SAND COULEE WATER SUPPLY WELL

TOTAL DYNAMIC HEAD CALCULATION

K:\PROJECT\10039\Water Supply Well\TDH.cdr

B33-80GS

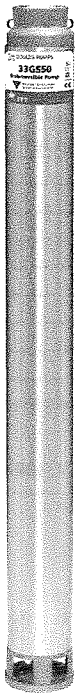
ITT

Residential Water Systems

Goulds Pumps

33GS, 40GS, 55GS, 60GS, 75GS & 80GS

33-80 GPM, 1 – 10 HP,
60 Hz, Submersible Pumps



GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

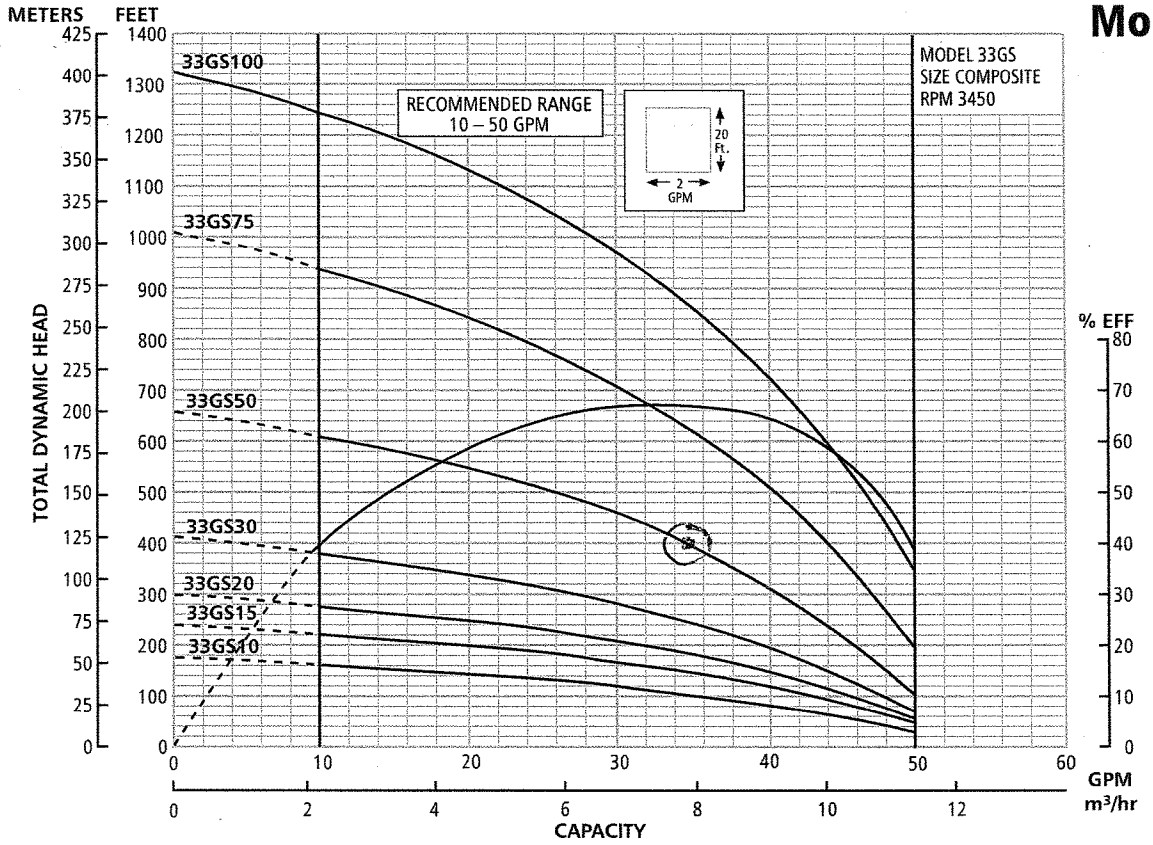
www.goulds.com

Engineered for life

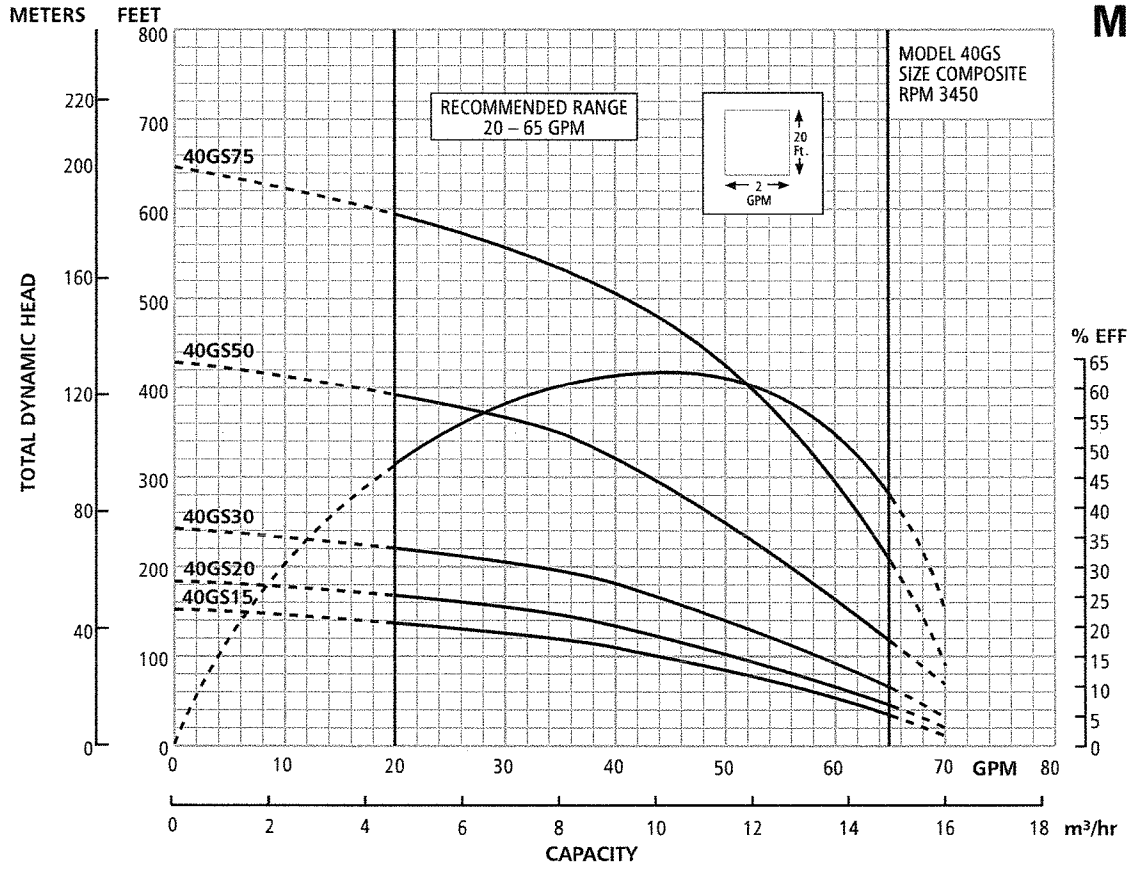
FEATURES

- **Powered for Continuous Operation:** All ratings are within the working limits of the motor as recommended by the motor manufacturer. Pump can be operated continuously without damage to the motor.
- **Field Serviceable:** Units have left hand threads and are field serviceable with common tools and readily available repair parts.
- **Sand Handling Design:** Our face clearance, floating impeller stack has proven itself for over 40 years as a superior sand handling, durable pump design.
- **FDA Compliant Non-Metallic Parts:** Impellers, diffusers and bearing spiders are constructed of glass filled engineered composites. They are corrosion resistant and non-toxic.
- **Discharge Head/Check Valve:** Cast 303 stainless steel for strength and durability. Two cast-in safety line loops for installer convenience. The built-in check valve is constructed of stainless steel and FDA compliant BUNA rubber for abrasion resistance and quiet operation.
- **Motor Adapter:** Cast 303 stainless steel for rigid, accurate alignment of pump and motor. Easy access to motor mounting nuts using standard open end wrench.
- **Stainless Steel Casing:** Polished stainless steel is strong and corrosion resistant.
- **Hex Shaft Design:** Six sided shafts for positive impeller drive.
- **Engineered Polymer Bearings:** The proprietary, engineered polymer bearing material is strong and resistant to abrasion and wear. The upper bearing is mounted in a durable engineered composite bearing spider for excellent abrasion resistance.

Model 33GS



Model 40GS



Model 33GS

SELECTION CHART

Horsepower Range 1 – 3, Recommended Range 10 – 50 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	520	560	600	
33GS10	1	0		48	45	41	36	30	22	11																				
		20	44	39	34	28	19																							
		30	39	33	27	17																								
		40	32	25	15																									
		50	24	14																										
		60	12																											
Shut-off PSI			67	58	50	41	32	24	15	6																				
33GS15	1½	0		50	48	46	43	40	37	32	26	19																		
		20	48	45	43	39	35	31	24	17																				
		30	45	42	39	35	30	23	15																					
		40	42	38	34	29	22	14																						
		50	38	33	28	21	12																							
		60	33	27	20	11																								
Shut-off PSI			95	86	78	69	60	52	43	34	26	17																		
33GS20	2	0			49	48	46	44	41	38	35	32	28	22																
		20	49	47	45	43	40	38	34	31	26	21	14																	
		30	47	45	42	40	37	34	30	25	20	13																		
		40	44	42	40	37	33	29	24	19	11																			
		50	42	39	36	33	29	24	18																					
		60	39	36	32	28	23	16																						
Shut-off PSI			121	112	103	95	86	77	69	60	51	43	34	26																
33GS30	3	0				49	48	46	45	43	41	40	38	35	33	31	28	24	20	15										
		20	50	49	47	46	44	43	41	39	37	35	32	30	27	23	19	13												
		30	49	47	46	44	42	41	39	37	34	32	29	26	22	18	12													
		40	47	45	44	42	40	38	36	34	32	29	25	22	17	11														
		50	45	44	42	40	38	36	34	31	28	25	21	16																
		60	43	42	40	38	36	33	31	28	24	20	15																	
Shut-off PSI			170	161	152	144	135	126	118	109	100	92	83	74	66	57	48	40	31	23										

Horsepower Range 5-10, Recommended Range 10 – 50 GPM, 60 Hz, 3450 RPM

Pump Model	HP	PSI	Depth to Water in Feet/Ratings in GPM (Gallons per Minute)																											
			50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	
33GS50	5	0		50	48	46	44	41	38	35	31	27	20	11															
		20	50	48	46	44	41	38	35	32	27	21	11																
		30	49	47	45	43	40	37	34	30	25	17																	
		40	48	46	44	41	39	36	32	27	21	12																	
		50	47	45	43	40	37	34	30	25	18																		
		60	46	44	42	39	36	32	28	22	13																		
Shut-off PSI			264	242	220	199	177	156	134	112	91	69	47	26															
33GS75	7½	0				50	48	47	46	44	42	40	38	36	33	31	27	23	19	14										
		20			50	49	47	46	44	42	41	38	36	34	31	28	24	19	14											
		30		50	49	48	46	45	43	42	40	37	35	32	29	26	22	17	12											
		40		50	49	47	46	44	43	41	39	36	34	31	28	24	20	15												
		50		49	48	47	45	43	42	40	38	35	33	30	26	22	17	12												
		60	50	49	47	46	44	43	41	39	37	34	31	28	24	20	15													
Shut-off PSI			415	393	371	350	328	306	285	263	241	220	198	176	155	133	111	90	68	47										
33GS100	10	0							49	48	46	45	43	42	41	40	39	38	36	34	31	28	25	22	18	13				
		20						50	48	46	45	43	42	41	40	39	38	36	34	31	29	25	22	18	14					
		30						49	47	45	44	43	42	41	40	38	37	35	33	30	27	24	20	16	12					
		40					50	48	46	45	44	43	42	40	39	38	36	34	32	29	26	22	18	14						
		50					49	47	45	44	43	42	41	40	39	37	35	33	30	27	24	20	16	12						
		60				50	48	46	45	44	43	42	41	39	38	36	34	32	29	26	22	19	14							
Shut-off PSI			551	529	508	486	464	443	421	399	378	356	334	313	291	269	248	226	205	183	161	140	118	96	75	53				

10059

Montana Department of
ENVIRONMENTAL QUALITY

Brian Schweitzer, Governor
Richard H. Opper, Director

P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.mt.gov

July 16, 2012

Bill Thompson
Hydrometrics, Inc.
3020 Bozeman Avenue
Helena, MT 59601

RE: Sand Coulee New Public Water Supply Well Discharge Piping EQ #12-1193

Dear Mr. Thompson:

I have reviewed the information you submitted on July 12 and 13, 2012 for the above-mentioned project in accordance with Department design standards DEQ-1. The request to install discharge piping and appurtenances for the new public water supply well for the Town of Sand Coulee is hereby approved. A copy of the plan bearing the approval stamp of the Department of Environmental Quality is enclosed. A second set will be retained as Department record.

Any deviations from the approved plans and specifications must be submitted to the Department prior to modification. Within 90 days following completion of the project a complete set of "as-built" record drawings must be signed, stamped, certified to be constructed in accordance with approved plans and specifications, and submitted to the Department by the project engineer. Construction of this project must be completed within three years of this date. If more than three years elapse before completing construction, plans and specifications must be resubmitted and approved before construction begins.

Thank you for your efforts to meet our requirements. If I can offer any further information or assistance, please feel free to contact me at (406) 444-6722.

Thank you,

Rachel Clark

Rachel Clark, PE
Public Water and Subdivisions Bureau

cc: Cascade County EH Office

CASNE
ASSOCIATES INCORPORATED

Water, Wastewater, Subdivision Design and Environmental Solutions

Casne & Associates, Inc.

P.O. Box 1123
Helena, MT 59624-1123
(406) 443-1656
FAX: (406) 443-1656

July 31, 2012

COPY

Rachel Clark, P.E.
Public Water & Subdivisions Section
Montana Department of Environmental Quality
PO Box 200901
Helena, MT 59620-0901

RE: As-Built and PE Certification
Sand Coulee PWS Well 5 Discharge Piping
E.Q. #12-1193 (MT0000325)

Dear Rachel:

Please find enclosed the required information for activation of the new Public Water System (PWS) source well 5 serving the Sand Coulee Water District (PWS ID# MT0000325). The well, well pumping system, discharge piping, and connection to the existing infrastructure is complete and capable of producing water with acceptable quality and quantity for the approved use.

In accordance with 3.2.2.1 of Circular DEQ-1, two (2) bacteriological water quality samples were taken on July 30th with satisfactory results; the results have been attached. The samples were collected from the 2" post hydrant located approximately 26' from the new source well.

All work was completed by a licensed Montana well driller; Bolland Construction & Drilling. Installation of the well discharge piping was completed in accordance with the plans and specifications approved by the Department of Environmental Quality. A construction observation photo log has been attached.

If you have any questions concerning the enclosed material or this project, please feel free to call. Thank you.

Sincerely,
CASNE & ASSOCIATES, INC

By: Ryan E. Casne, P.E.
Senior Engineer, Principal

C.C.: Bill Thompson, Hydrometrics
Tom Henderson, MDEQ - Abandoned Mines
File

State of Montana
Department of Public Health and Human Services
ENVIRONMENTAL LABORATORY
1400 Broadway, Room B 221 Helena, MT 59620
PO Box 4369 Helena, MT 59604
phone: 406-444-2642 fax: 406-444-2617

RESULTS OF MICROBIAL ANALYSIS

BillingID: G0021700

TOM HENDERSON
DEQ AML
PO BOX 200901
HELENA MT 59620

Lab#: W1207-2539
Sample ID: W-5 NEW WATER WELL

Account #: DEQ AML
PWSID #:

Collected: 7/30/2012
Time: 8:40
By: T HENDERSON
Received Date: 7/30/2012

Sample Type: SP
Matrix: Water
Chlorine Res:

Sample Point ID:
Facility ID:
Report Date: 7/31/2012

TEST	FLAG	RESULT	UNITS	ANALYSIS DATE	METHOD	ANALYST
Total Coliform by Presence/Absence		Absent		7/30/2012	9223-B	Elizabeth
Sample results are Satisfactory at this time						
E.coli by Presence/Absence		Absent		7/30/2012	9223-B	Elizabeth
Sample results are Satisfactory at this time						

Reviewed by: _____

Comments:

Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially-harmful bacteria may be present. Coliform bacteria are usually harmless, but their presence in water can be an indication that disease-causing bacteria may also be present. For more information or for technical support, please call your county sanitarian; the Montana Department of Environmental Quality, Drinking Water Program at 406-444-4400; or the EPA's the Safe Drinking Water Hotline at 800-426-4791.

Flags:
< = less-than
> = greater-than
H = above EPA limit for drinking Water
* = holding time exceeded

State of Montana
Department of Public Health and Human Services
ENVIRONMENTAL LABORATORY
1400 Broadway, Room B 221 Helena, MT 59620
PO Box 4369 Helena, MT 59604
phone: 406-444-2642 fax: 406-444-2617

RESULTS OF MICROBIAL ANALYSIS

BillingID: G0021700

TOM HENDERSON
DEQ AML
PO BOX 200901
HELENA MT 59620

Lab#: W1207-2540
Sample ID: W-5 NEW WATER WELL

Account #: DEQ AML
PWSID #:

Collected: 7/30/2012
Time: 8:40
By: T HENDERSON
Received Date: 7/30/2012

Sample Type: SP
Matrix: Water
Chlorine Res:

Sample Point ID:
Facility ID:
Report Date: 7/31/2012

TEST	FLAG	RESULT	UNITS	ANALYSIS DATE	METHOD	ANALYST
Total Coliform by Presence/Absence		Absent		7/30/2012	9223-B	Elizabeth
Sample results are Satisfactory at this time						
E.coli by Presence/Absence		Absent		7/30/2012	9223-B	Elizabeth
Sample results are Satisfactory at this time						

Reviewed by: _____

Comments:

Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially-harmful bacteria may be present. Coliform bacteria are usually harmless, but their presence in water can be an indication that disease-causing bacteria may also be present. For more information or for technical support, please call your county sanitarian; the Montana Department of Environmental Quality, Drinking Water Program at 406-444-4400; or the EPA's the Safe Drinking Water Hotline at 800-426-4791.

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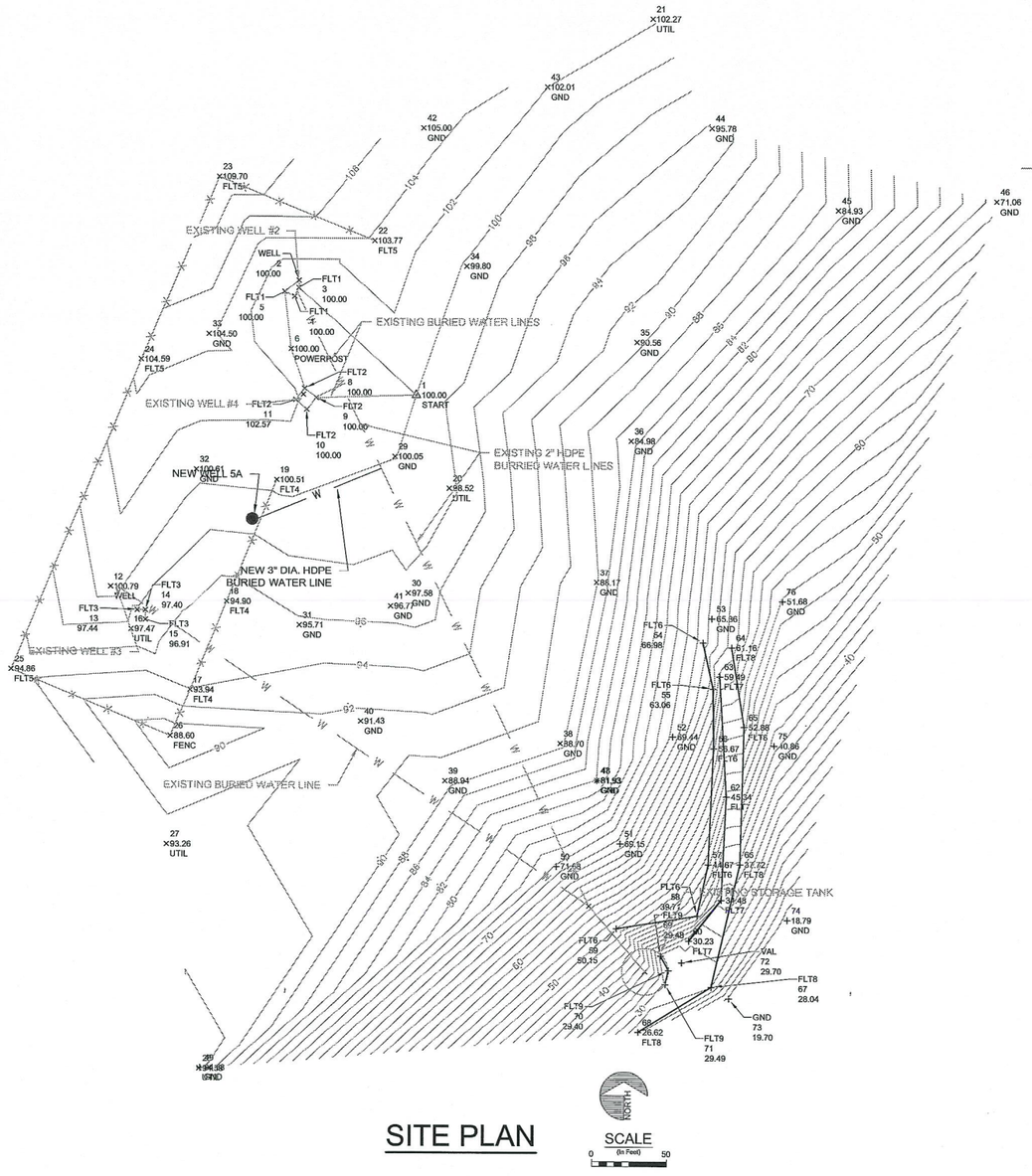
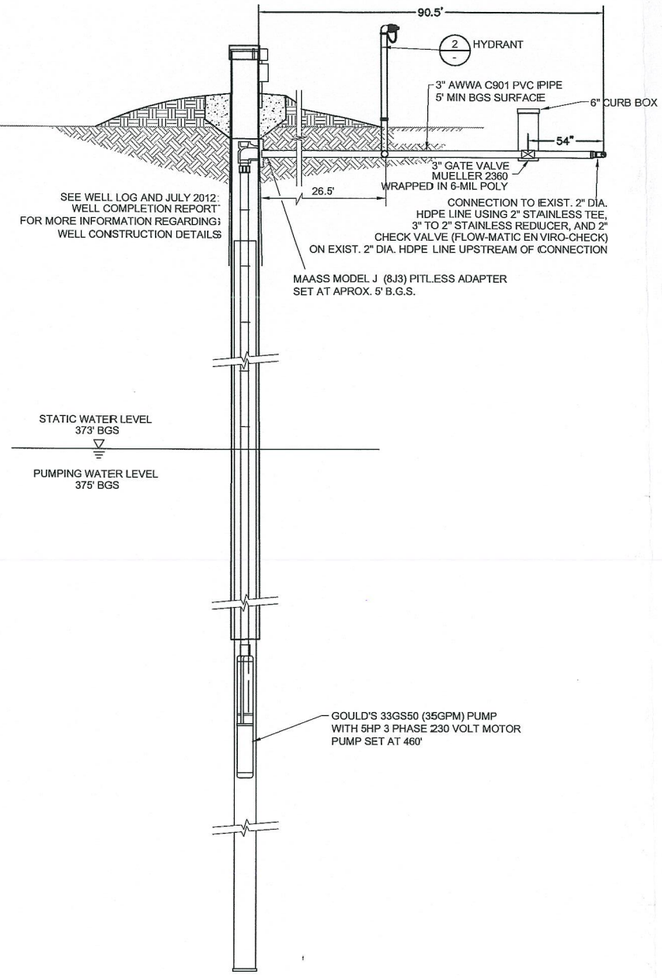
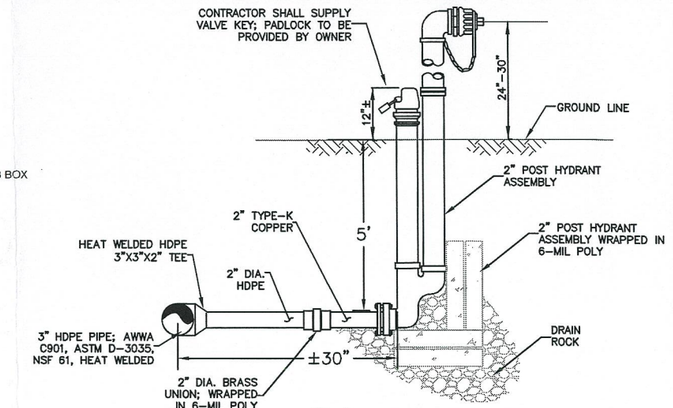


SITE PLAN



1/- DETAIL
WELL INSTALLATION
NTS

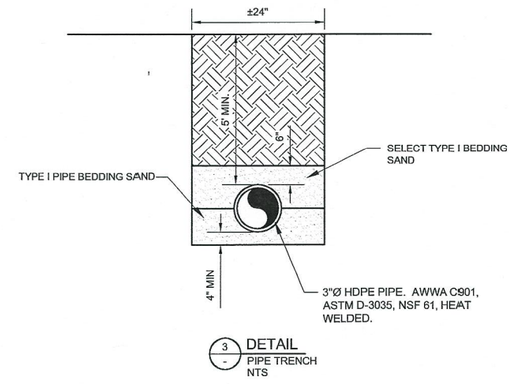


2/- 2" POST HYDRANT DETAIL
SECTION VIEW; NOT TO SCALE

AS–BUILT NOTE:

FLUSHING HYDRANT IS A MAINGUARD NO. 77 AS MANUFACTURED BY KUPFERLE FOUNDRY CO. HYDRANT IS NON–FREEZING, SELF DRAINING TYPE AND SERVICEABLE FROM ABOVE GRADE WITH NO DIGGING. HYDRANTS SHALL BE LOCKED TO PREVENT UNAUTHORIZED USE

MONTANA
RYAN EDWARD CASNE
15310PE
7/26/12
LICENSED PROFESSIONAL ENGINEER



3/- DETAIL
PIPE TRENCH
NTS

RECORD DRAWING
JULY 2012

REVISIONS NO	BY	DATE	DESCRIPTION
1	RC	7/26	AS–BUILT RECORD DRAWING

SCALE VERIFICATION BAR IS ONE INCH ON ORIGINAL DRAWING
0 1
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Project No.:		
DRAWN BY	SDP	7/24/12
CHECKED BY		
APPROVED BY		
SCALE: AS NOTED		

Hydrometrics, Inc.
Consulting Scientists and Engineers
Helena, Montana 59601
3020 Bozeman Avenue
(406) 443-4150

SAND COULEE PUBLIC WATER SUPPLY IMPROVEMENTS

SITE PLAN AND DETAILS "AS–BUILT"

DRAWING FILE NUMBER: AS-BUILT
AUTOCAD 2004 DRAWING (DWG)
SHEET NUMBER: W1
REV: 1

CASNE
ASSOCIATES INCORPORATED

Water, Wastewater, Subdivision Design and Environmental Solutions

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P.O. Box 1123
Helena, MT 59624-1123
(406) 443-1656
FAX: (406) 443-1656

Construction Observation Photo Log

Well No. 5 Discharge Piping and Connection to Existing Public Water Supply System

Sand Coulee Water District (PWS #MT0000325)

Prepared for:

Tom Henderson
Montana Department of Environmental Quality
Mine Waste Clean-up Bureau
PO Box 200901
Helena, MT 59620-0901

Prepared by:

Ryan Casne, PE
Casne & Associates, Inc.
PO Box 1123
Helena, MT 59624
(406) 443-1656
ryancasne@qwestoffice.net

All photos taken on July 23, 2012

Photo 1: New 3" diameter HDPE line; looking back towards well from yard hydrant tee. Note sand bedding entire width of trench.

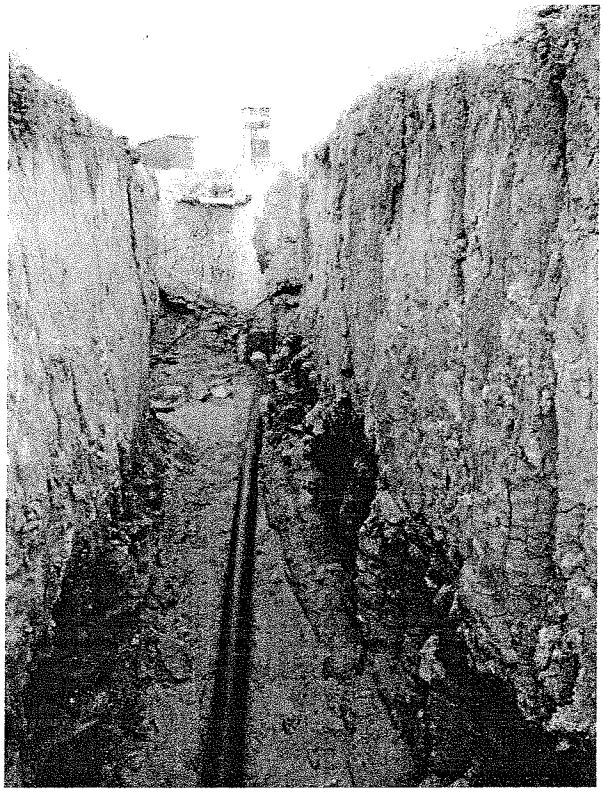

Photo 2: New 3" diameter HDPE line; looking towards connection to existing line.

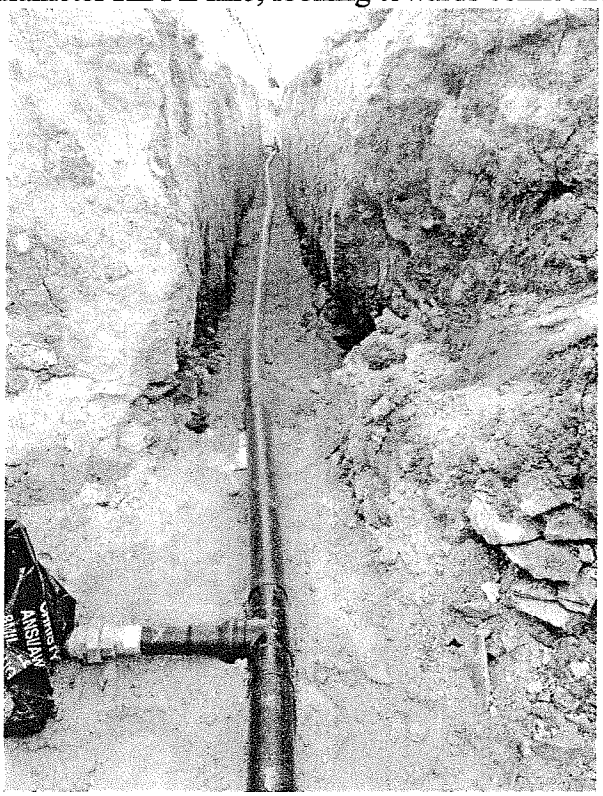

Photo 3: MAAS Model J (8-J-3) pitless adapter with stainless union.

Photo 4: Connection of new 3" HDPE line to existing 2" HDPE line; note 3" gate valve, stainless tee and reducer, and brass check valve. Gate and check valves were wrapped in 6 mil poly after photo.

Photo 5: Connection of 3" HDPE line to new 2" diameter post hydrant. Note heat welded 3" tee and 3" to 2" concentric reducer. Also note brass union and type K copper to hydrant. Brass union was wrapped in 6 mil poly after photo.