# INTERIM RESPONSE ACTION
# CAPTURE SYSTEM CONVERSION AT WELLS 673A AND 1136A IN SOUTH FORK COW CREEK DRAINAGE – COLSTRIP STEAM ELECTRIC STATION, PPL MONTANA, LLC


***Executive Summary***

PPL Montana, LLC (PPL) monitors groundwater in the area surrounding the Units 3 & 4 Effluent Holding Pond (3&4 EHP) at the PPL Colstrip Steam Electric Station (Colstrip –SES) to detect inconsistencies in water quality and/or quantity that may be attributable to seepage from the ponds. As monitoring data become indicative of potential process water impacts, PPL installs groundwater capture systems or converts monitoring wells to recovery wells to mitigate the influence of the 3&4 EHP on local groundwater. Groundwater quality in the South Fork Cow Creek (SFCC) drainage south of the 3&4 EHP has been impacted by process water. Among the wells in SFCC with inconsistent groundwater quality are monitoring wells 673A and 1136A. This work plan outlines groundwater mitigation procedures to be taken at the two impacted wells. Specifically, monitoring well 1136A will be converted to a groundwater capture well and a new capture well will be installed very near existing well 673A. In addition to capture well conversion, this work plan details procedures for groundwater quality sampling, capture system startup evaluation, reporting, and analysis. Location maps and diagrams of new proposed capture system infrastructure are included in the work plan.

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## Introduction

This work plan was prepared as an Interim Response Action in accordance with the Administrative Order on Consent (AOC) Regarding Impacts Related to Wastewater Facilities Comprising the Closed-Loop System at Colstrip Steam Electric Station, Colstrip, Montana between PPL Montana as Operator of the Colstrip Steam Electric Station and Montana Department of Environmental Quality. While the AOC provides for work to be done as an Interim Response Action, the examples provided in the AOC are not exhaustive, and the prompt action described in the following work plan is to respond to the circumstances identified in the work plan and not because of an acute threat to human health or a recent spill.

PPL Montana, LLC (PPL) monitors groundwater in the area surrounding the Units 3 & 4 Effluent Holding Pond (3&4 EHP) at the PPL Colstrip Steam Electric Station (Colstrip –SES) to detect inconsistencies in water quality and/or quantity that may be attributable to seepage from the ponds. As monitoring data become indicative of potential process water impacts, PPL installs groundwater capture systems or converts monitoring wells to recovery wells to mitigate the influence of the 3&4 EHP on local groundwater.

Groundwater quality in the South Fork Cow Creek (SFCC) drainage has been impacted by process water, most notably by the emergence of the SFCC seep in 2004. Characterization of the seep and a details of monitoring and mitigation measures taken by PPL are well documented (Hydrometrics, Inc., 2005). Many wells have been installed in SFCC both in response to the seep and as part of the ongoing monitoring and mitigation effort. SFCC capture systems continue to operate and have made progressive improvements to local water quality; however, some monitoring and capture wells in SFCC still exhibit inconsistent water quality (e.g. monitoring wells 673A, 1023AM, and 1136A; and capture wells 1024AM and 1019AM).

Extensive groundwater investigation was conducted between the 3&4 EHP and SFCC during 2011 and 2012 in attempt to identify a flow path of impacted groundwater (Hydrometrics, Inc., January 2013; Hydrometrics, Inc., January 2012). Drilling observations showed the base of the Rosebud Clinker burn to extend relatively close to the monitoring and capture well network along SFCC. Although no saturated intervals in the clinker were observed, it is possible that

some water from the 2004 leak could have reached this area via subsurface flow. Such a pulse of water may have been responsible for inconsistent groundwater quality observed at monitoring wells 673A, 1023AM, and most recently 1136A. This appears to be the most likely scenario given the lack of any clear active groundwater flow paths identified through extensive study in the area. Note that the Clinker would no longer be saturated near the new well locations since the source has been controlled.

Recommendations regarding the outcome of impacted wells in the 1023AM Area of SFCC were made based on findings of the recent investigations (Hydrometrics, Inc., January 2013; Hydrometrics, Inc., January 2012):

- Monitoring well 1023AM was not recommended for conversion, not only because it is a low yield well but also because water quality at this well appears to have attenuated as a result of nearby capture system pumping. Results of quarterly samples collected at 1023AM should be evaluated to identify future changes in groundwater quality, if any. Note that the direction of groundwater flow at 1023AM proceeds toward existing capture wells (e.g. 687A, 688A, 1019AM, and 1024AM).
- Groundwater capture is recommended at existing monitoring wells 673A and 1136A. Aquifer test results and observations made during well completion and development of these wells indicate that these sites will be beneficial, albeit low yield, capture locations.

A general project map and locations of wells subject to this Work Plan are included in Figure 1. The scope of work outlined in this Work Plan includes procedures for capture well construction, startup, and evaluation. This Work Plan will be completed in five tasks:

- Task 1 – New Well Installation
    - A new well will be drilled and completed with 4.5-inch well casing very near existing well 673A. The new larger diameter well will facilitate groundwater capture better than existing well 673A, which is constructed of two-inch PVC well casing.
- Task 2 – Groundwater Quality Sampling
    - A groundwater sample will be collected at the new capture well, prior to its conversion.

- Task 3 – Capture Well Conversion
    - Both the new well and existing well 1136A will be converted to collection wells according to PPL's typical procedure.
- Task 4 – Capture System Startup Evaluation
    - Capture system pumping rates, field specific conductance, and water levels in the pumping wells and/or nearby observation wells will be monitored upon capture system startup.
- Task 5 – Analysis and Reporting
    - Results of the well installation, groundwater sampling, capture conversion, and startup evaluation will be presented in both an interim report and a final report.

Specific methodology planned for each task and a schedule of work are included herein.

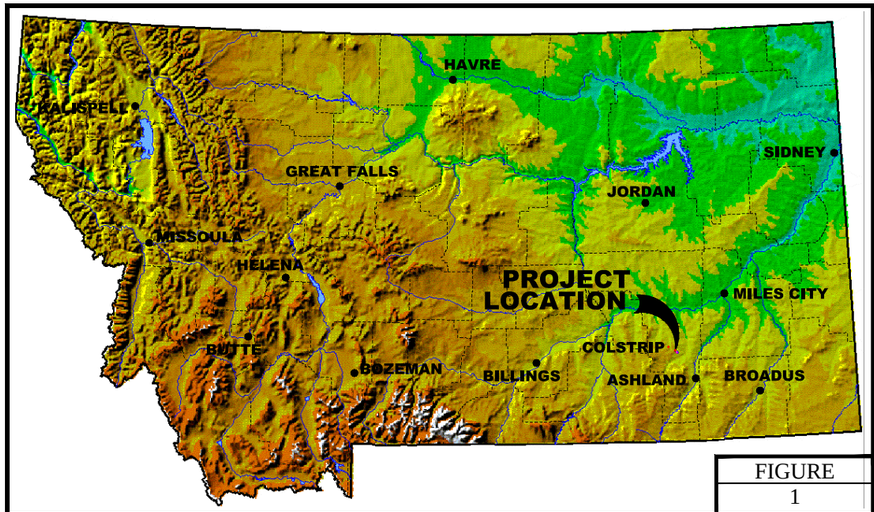



FIGURE 1

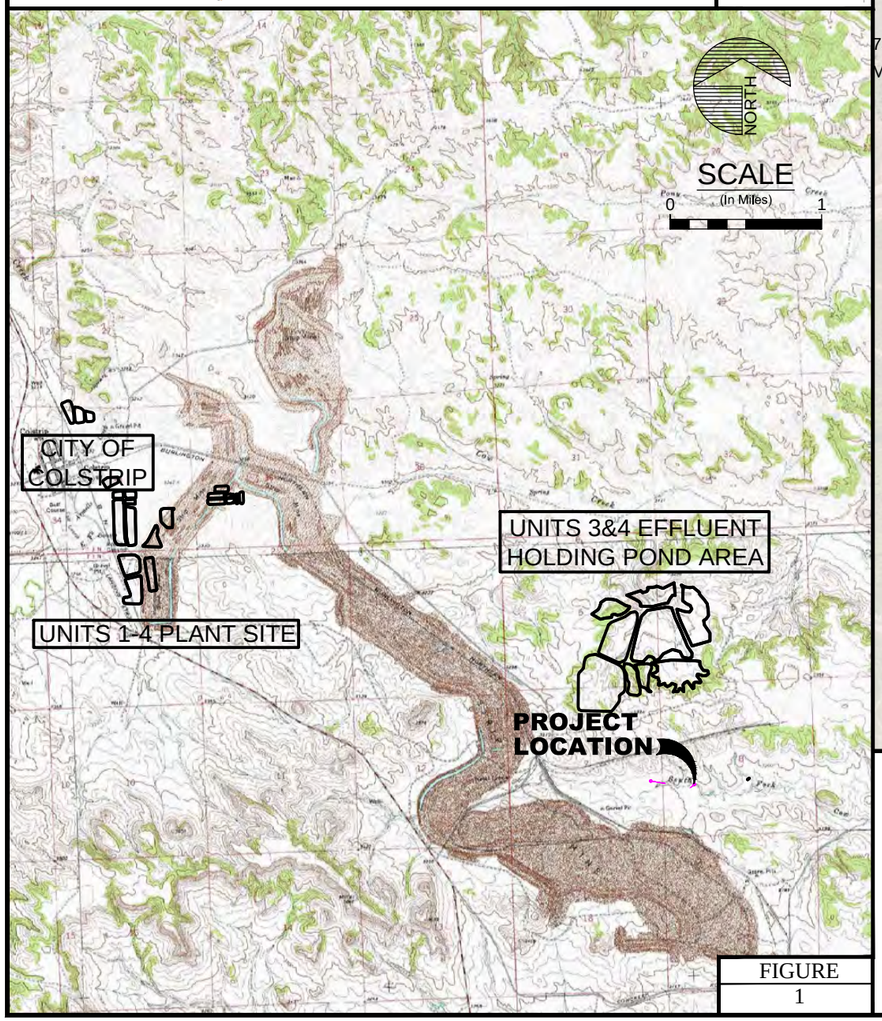
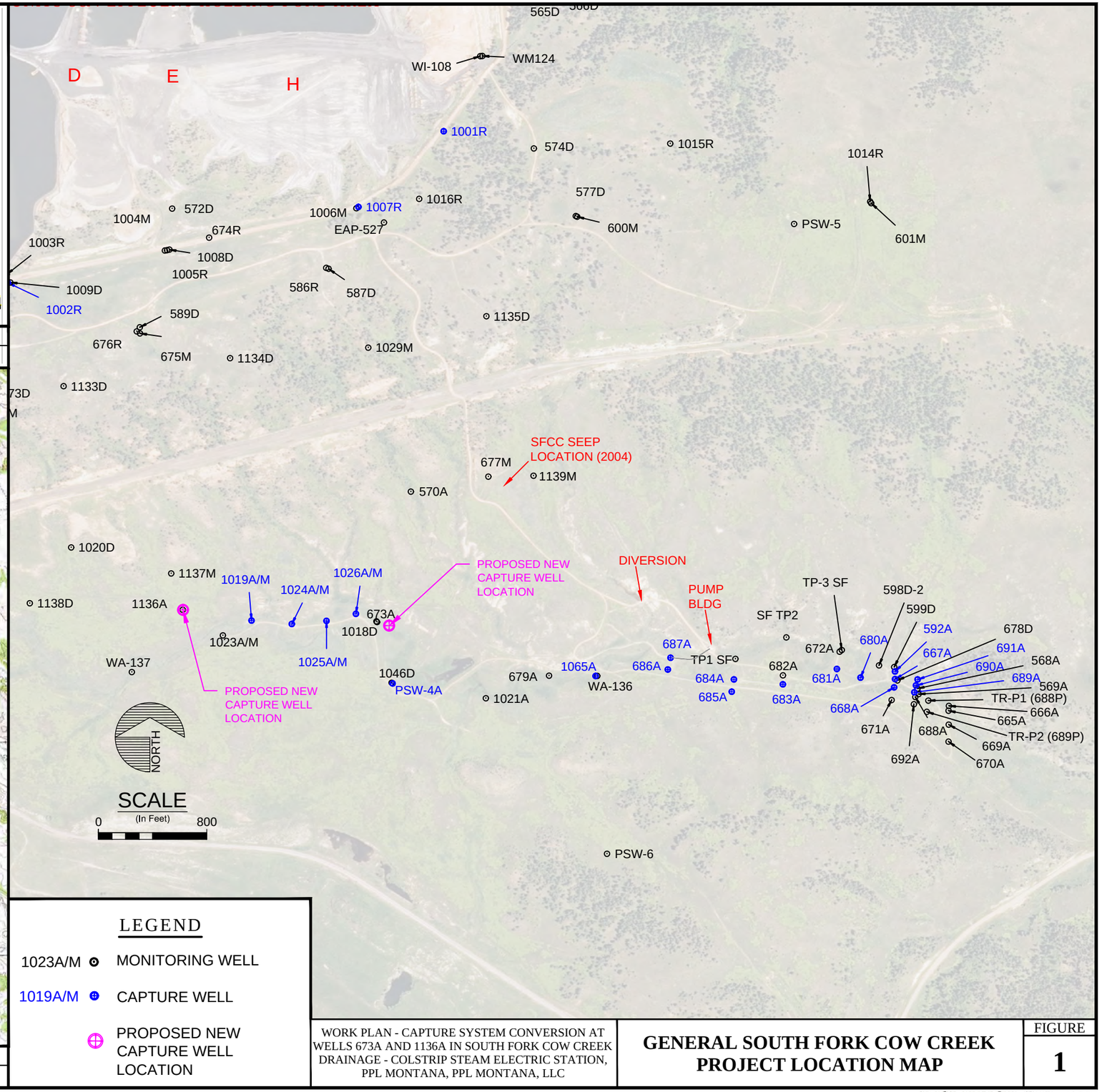



FIGURE 1




## LEGEND

- 1023A/M — MONITORING WELL
- 1019A/M — CAPTURE WELL
- PROPOSED NEW CAPTURE WELL LOCATION

WORK PLAN - CAPTURE SYSTEM CONVERSION AT WELLS 673A AND 1136A IN SOUTH FORK COW CREEK DRAINAGE - COLSTRIP STEAM ELECTRIC STATION, PPL MONTANA, PPL MONTANA, LLC

# GENERAL SOUTH FORK COW CREEK PROJECT LOCATION MAP

FIGURE 1

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Hydrometrics, Inc.
Consulting Scientists and Engineers

***Task 1 Monitoring Well Installation***

A single new well is proposed at the location identified in Figure 1. As noted previously, the purpose of the new well is to create a more efficient capture well alternative to existing two-inch well 673A.

The borehole for the new well will be drilled using air-rotary methods. If necessary, 8-inch diameter steel casing will be advanced through incompetent surface intervals (clinker, fill, sloughing alluvium/ colluvium, etc.) using drill and drive methods. In such an instance, 4.5-inch PVC casing will be installed through the steel casing. The target interval will be screened with 0.025-inch slot, four-and-one–half-inch diameter PVC screen. The target interval of the new well is shallow alluvium consistent with that found at well 673A; however, the new well will be advanced up to five feet beyond the bottom of the alluvium to create a more efficient pumping well. The total depth of the new well is expected to be less than 20 feet below ground surface. A filter pack, consisting of 10-20 silica sand, will be placed across the entire length of the screened interval. Bentonite chips will be used to create an annular seal from the top of the silica sand to ground surface. If necessary, steel casing will be pulled back to expose the slotted section of PVC. A minimum of five feet of eight-inch steel surface casing will be left in the completed borehole (approximately two feet of steel will extend above ground). A locking steel lid will be installed at the wellhead.

Cuttings from the boring will be logged for lithology, including texture, color, relative moisture, and origin (alluvium, colluvium, bedrock, etc.), by a geologist, hydrogeologist, or engineer. A log of borehole lithology and well completion will be prepared and submitted to PPL and the Montana Board of Water Well Contractors.

The well will be developed using air-lift methods or bailing. Air-lift development involves forcing compressed air into the completed well to purge water, cuttings, fines, and debris from the casing. Providing the well makes sufficient water, development will continue until fine-grained sediments have been adequately removed from the well to allow pumping with a submersible pump. Bailing involves repeatedly removing water from the well with a steel bailer

(with check valve) until the well has been effectively purged. Field parameters (specific conductance (SC), pH, temperature) will be measured and recorded during development.

***Task 2 Groundwater Quality Sampling***

A single groundwater quality sample will be collected and analyzed at the new well. The sample will be collected using methods consistent with Hydrometrics, Inc. Standard Operating Procedures (SOP) and methods commonly used by PPL for operational monitoring. The samples will be collected using either a submersible sampling pump or a disposable bailer. Field parameters (SC, pH, temperature) will be measured and recorded during sampling. Samples will be submitted to Energy Laboratories in Billings, Montana for analysis of the parameters listed in Table 1.

**TABLE 1. New Monitoring Well Analytical Parameters**

- **Physical properties**
  - pH
  - Specific Conductance
  - Total Dissolved Solids
- **Common Ions**
  - Alkalinity, Total as $CaCO_3$
  - Bicarbonate as $HCO_3$
  - Carbonate as $CO_3$
  - Chloride
  - Sulfate
  - Magnesium
  - Calcium
  - Potassium
  - Sodium
  - Bromide
- **Nutrients**
  - Nitrate plus nitrite
- **Dissolved Metals**
  - Boron
  - Selenium
  - Mercury

Analytical results will be evaluated to identify potential process water impacts and verify similarities in water quality between existing well 673A and the new capture location. Process water indicator parameters include SC, TDS, B, and $Cl^-$. Groundwater mixed with process water typically exhibits a strong Mg-$SO_4$ ionic composition; thus, $SO_4$ concentration and the ratio of Ca:Mg are also important process water indicators.

***Task 3 Capture Well Construction***

Conversion of the new well and existing well 1136A will be completed according to PPL's commonly used and accepted procedure, as follows:

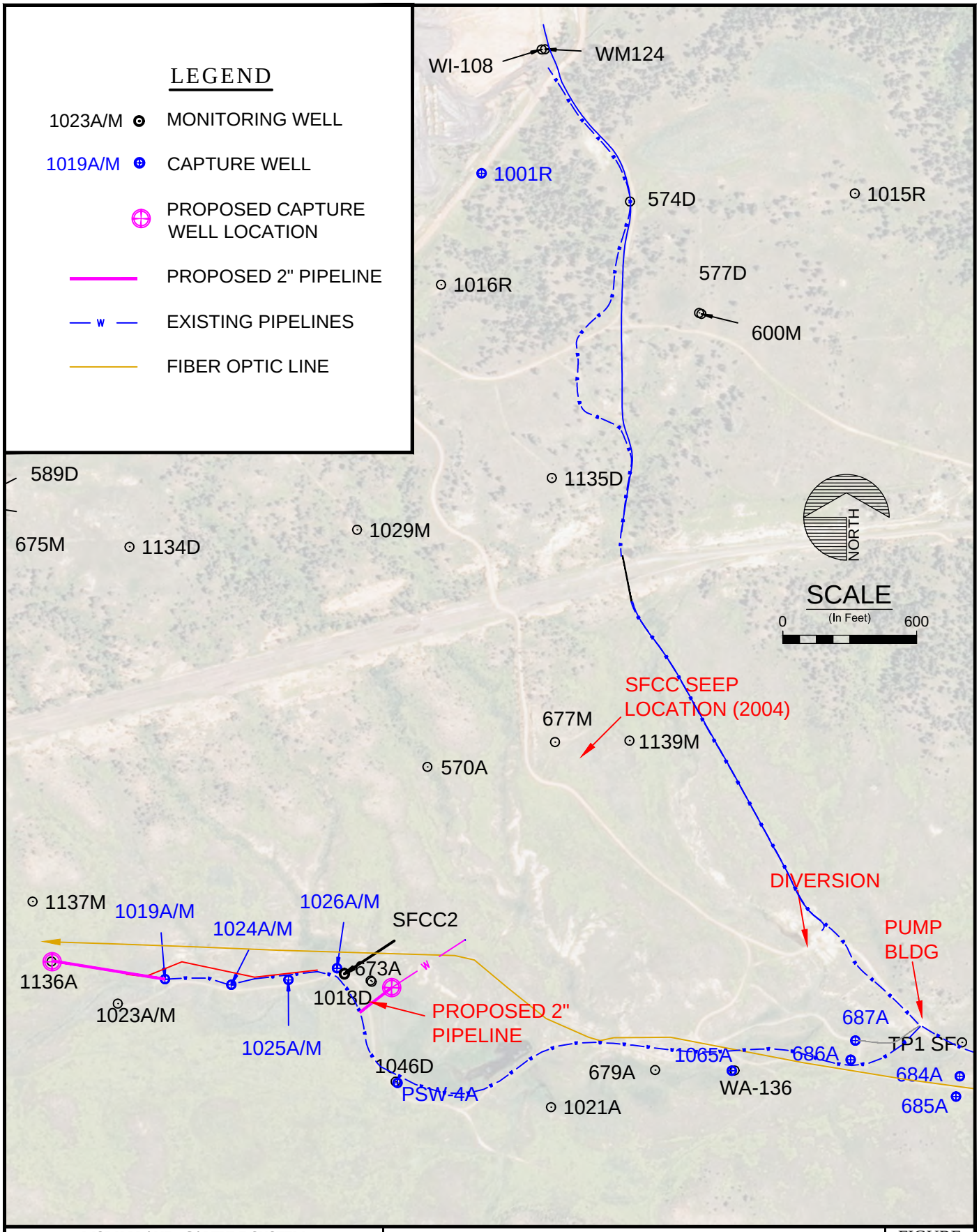
- The existing monument and concrete pad (present at 1136A only) will be removed and the area around the wells will be excavated to an approximate depth of five feet below ground surface with a backhoe or track excavator.
- The excavations will be of sufficient width to place a six-foot diameter Corrugated Metal Pipe (CMP) over the existing wellheads.
- Excavated materials will be backfilled around the CMPs and mounded at the surface to promote drainage from the capture wells.
- Washed gravel will be placed in the bottom of the CMPs at an approximate thickness of one-foot.
- Existing PVC well casing will be cut off so that it extends just above the washed gravel in the bottom of the CMP vaults.
- Hinged metal lids will be installed at the top of the CMPs.
- Aluminum ladders will be secured to the inside of the CMPs for access/egress into and out of the culverts.
- A ½ hp, 240V, single-phase submersible pump will be installed in each well at total depth.
- Submersible pumps will be hung in the wells by one-inch schedule 80 PVC threaded drop pipe with brass couplings.
- Drop pipe will extend from the well to a one-inch brass pipeline on the floor of each vault.

- Necessary pipe fittings (i.e. one-inch unions, tees, valves, and sample port) will be plumbed into the one-inch line in each vault; and the one-inch lines will be connected to existing HDPE pipelines.
- Redundant check valves will be installed both immediately above the pump and inside the vault to prevent backflow to the wells.
- Electrical controls, an hour meter, and automated pump protection (i.e. pumptec) will be installed in a secure electrical enclosure adjacent to each wellhead.

Captured groundwater from the wells will be routed to existing HDPE pipelines in the SFCC Area. Specifically, discharge from the new capture wells will be routed to the existing four-inch HDPE pipeline that services capture wells 1019AM, 1024AM, 1025AM, 1026AM, and others. Water collected in this pipeline is routed to the SFCC Lift Station, where it is pumped to the 3&4 EHP. The proposed pipeline layout for the new collection wells is presented in Figure 2. A typical capture well construction diagram is presented in Figure 3.

***Task 4 Capture System Startup/Evaluation***

New capture wells will be instrumented with pressure transducers and automated data-loggers to record the aquifer response to pumping at the new capture wells. Pumping rates and frequent checks of the hour meter will be used to calculate capture volumes during the evaluation period. Water levels in the pumping well and/or nearby monitoring wells will be recorded to measure the capture radii of the pumping wells. Water level responses to pumping will be entered into Aqtesolv software for analysis.




WORK PLANE - CAPTURE SYSTEM CONVERSION AT WELLS 673A AND 1136A IN SOUTH FORK COW CREEK DRAINAGE - COLSTRIP STEAM ELECTRIC STATION, PPL MONTANA, PPL MONTANA, LLC

# TYPICAL CAPTURE WELL AND PIPELINE LAYOUT

FIGURE 2

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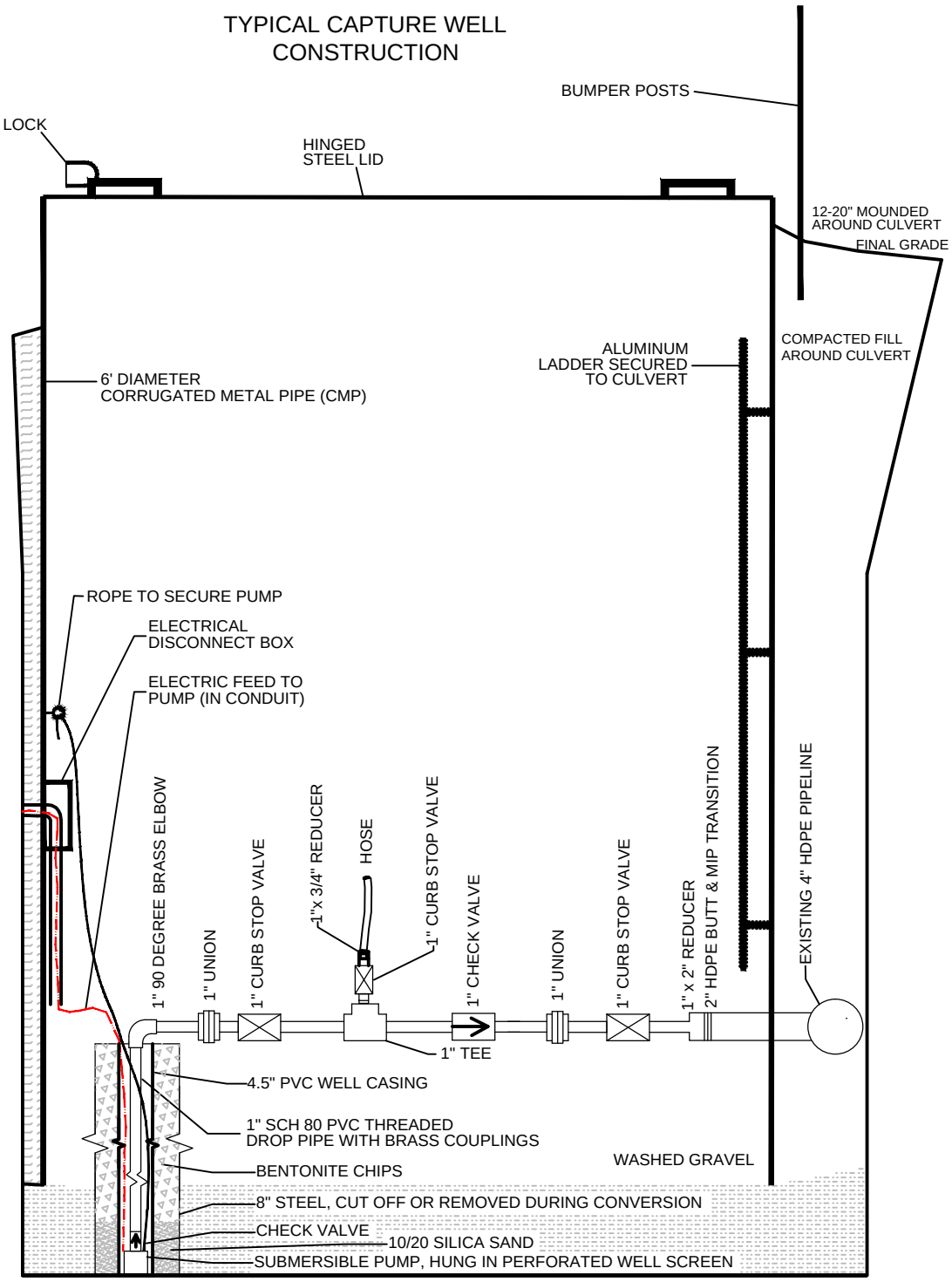



NOTE: 1" STILLING TUBE TO BE INSTALLED IN WELL TO MONITOR WATER LEVELS (NOT SHOWN)

| | | |
|---|---|---|
| WORK PLANE - CAPTURE SYSTEM CONVERSION AT WELLS 673A AND 1136A IN SOUTH FORK COW CREEK DRAINAGE - COLSTRIP STEAM ELECTRIC STATION, PPL MONTANA, PPL MONTANA, LLC | **TYPICAL CAPTURE WELL AND PIPELINE LAYOUT** | FIGURE **3** |

***Task 5 Reporting***

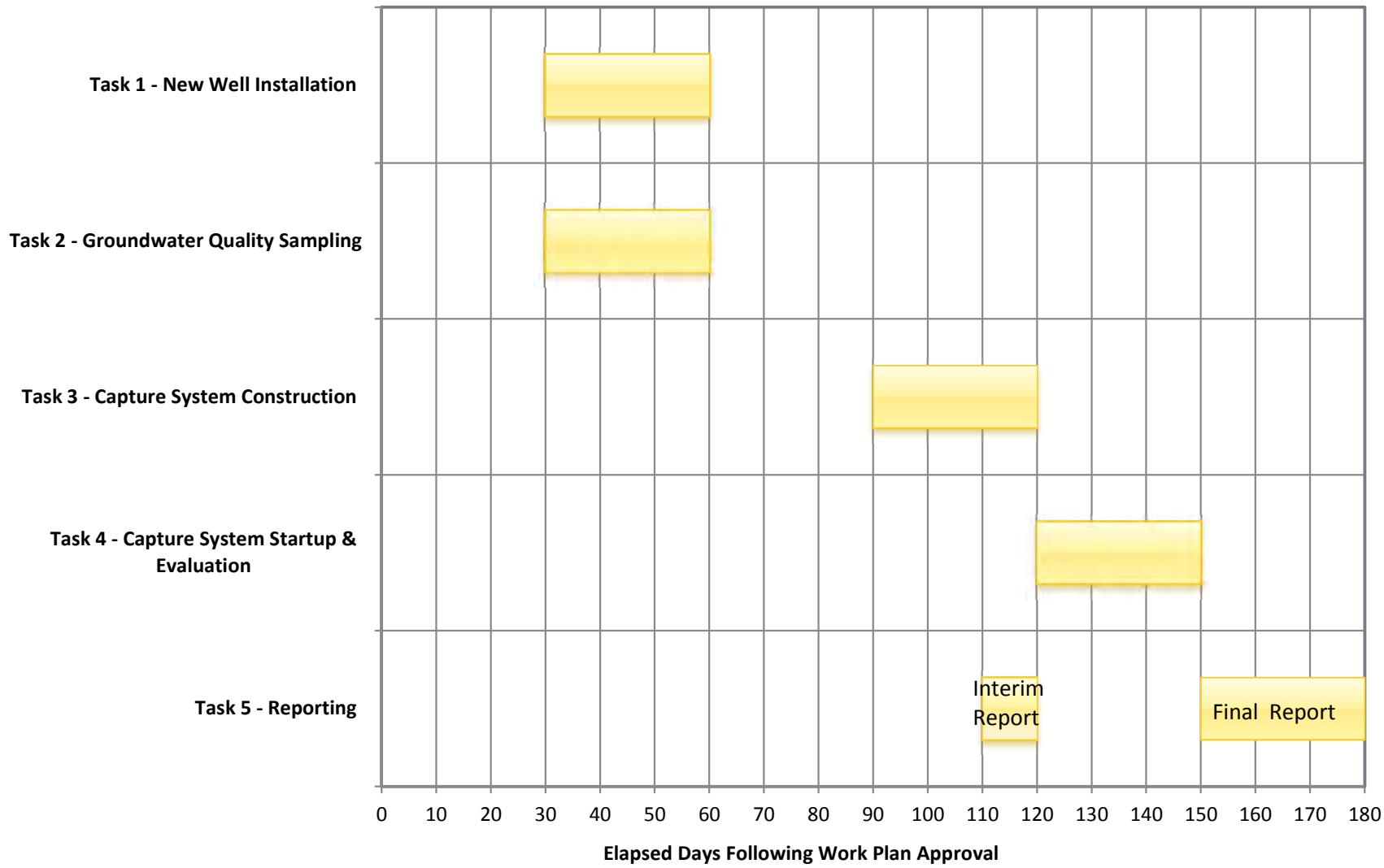
An interim report, including a narrative of new well installation and capture well conversion, will be written for submittal to the Montana Department of Environmental Quality (MT-DEQ). Per requirements of the Administrative Order On Consent Regarding Impacts Related to Wastewater Facilities Comprising the Closed-Loop System and Colstrip Steam Electric Station, Colstrip, Montana, the interim report will be submitted within 60 days of completing and converting new wells. However, the final capture system startup evaluation report will not be submitted until results of the evaluation detailed above are analyzed. The evaluation will begin immediately upon capture system startup and is expected to last for up to one month. The duration of the evaluation will be dependent on groundwater level responses to pumping at the new capture system.

The final technical report will contain a narrative of sampling, testing, and construction procedures and an interpretive summary of groundwater quality and capture system startup results. If necessary, the report will include recommendations for additional groundwater capture locations and/or groundwater monitoring activities.

***Schedule***

The proposed timeline to complete the scope of work outlined above is included in Figure 4. New well installation and groundwater quality sampling is expected to be completed within 60 days of approval of this plan by the Montana Department of Environmental Quality. Conversion of new wells and submittal of an interim report are to be completed within 60 days of installation. The final evaluation report will be submitted approximately 180 days after work plan approval.

# Figure 4. 673A and 1136A Capture Well Conversion Schedule



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Hydrometrics, Inc. (January 2012). *Technical Memorandum -- Results of Drilling and Testing at Geophysical Anomalies between the Units 3&4 Effluent Holding Pond and South Fork Cow Creek.* Billings, MT.

Hydrometrics, Inc. (January 2013). *Monitoring Well Installation and Groundwater Investigation in the 1023AM Area.*

# PPL MONTANA, LLC
# COLSTRIP STEAM ELECTRIC STATION

## INTERIM RESPONSE ACTION– CAPTURE SYSTEM CONVERSION AT WELLS 673A AND 1136A IN SOUTH FORK COW CREEK DRAINAGE – COLSTRIP STEAM ELECTRIC STATION, PPL MONTANA, LLC

*Pursuant to: ADMINISTRATIVE ORDER ON CONSENT REGARDING IMPACTS RELATED TO WASTEWATER FACILITIES COMPRISING THE CLOSED-LOOP SYSTEM AT COLSTRIP STEAM ELECTRIC STATION, COLSTRIP, MONTANA SECTION XI - SUBMISSIONS*

**CERTIFICATION:**

I, the undersigned, hereby certify that this document was prepared under my direction and to the best of my knowledge the information contained herein is correct and accurate.

Michael V Holzwarth | Environmental Compliance Professional | 5/21/13

Name | Title | Date