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Precision National Plating Services, Inc.

Response Action Plan
Docket No. CERC-03-2012-0031DC

Precision National Plating Services, Inc.
198 Ackerly Road
Clarks Summit, Pennsylvania 18411

July 30, 2012

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Clarks Summit, Pennsylvania 18411

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1. Introduction

ARCADIS U.S., Inc. (ARCADIS) is submitting this Response Action Plan on behalf of Precision National Plating Services, Inc. (Precision) as Respondent to Docket No. CERC-03-2012-0031DC for the former Precision facility located at 198 Ackerly Road in Clarks Summit, Lackawanna County, Pennsylvania (the Site). The Response Action described herein will be performed in accordance with the 2012 Administrative Settlement Agreement and Order on Consent for Removal Response Action (Settlement Agreement) entered by the United States Environmental Protection Agency (EPA) and Precision. The Settlement Agreement was executed pursuant to the Action Memorandum (2011 Action Memo) issued by the Director of the Hazardous Site Cleanup Division of EPA Region 3 which selected the response action for addressing chromium contamination at the Site.

Based on the Findings of Fact and Conclusions of Law presented in the Settlement Agreement, EPA determined that an actual and/or threatened release of hazardous substances from the Site may present an imminent and substantial endangerment to the public health or welfare or the environment. Therefore, EPA determined that the Work outlined in the Settlement Agreement is necessary to protect the public health and welfare and the environment. Because there is a threat to public health or welfare or the environment, EPA determined that a removal action is appropriate to abate, minimize, stabilize, mitigate or eliminate the release or threat of release of hazardous substances at or from the Site.

All work to be performed at the Site will be consistent with the National Oil and Hazardous Substances Pollution Contingency Plan, as amended (NCP), 40 C.F.R. Part 300 and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The general objectives of the work conducted pursuant to the Settlement Agreement are to conduct a removal action, as defined in Section 101(23) of CERCLA, 42 U.S.C. § 9601(23), to abate, mitigate and/or eliminate the release or threat of release of hazardous substances at the Site by preventing the migration of hazardous substances from the Site through the treatment of contaminated groundwater.

2. Background

2.1 Site Setting

The Precision Site is located at 198 Ackerly Road, Clarks Summit, in Lackawanna County, Pennsylvania, which is approximately 10 miles north of Scranton, Pennsylvania. The majority of the Site is located within Abington Township and a portion of the Site is located within Glenburn Township. The location of the Site is shown on Figure 1. The Site layout is illustrated on Figure 2. The total property measures 46 acres. Approximately five acres were used for site operations and the balance remained undeveloped and largely wooded. A 45,000 square foot operations building was the principal structure on site. This building was demolished in 2000. Portions of the concrete slab floor of the building remain.

The Site is located near a topographic high in the area with an average elevation of 1,190 feet above mean sea level (msl). Topography slopes down to the north and west of the site toward Ackerly Creek at a gradient of approximately 660 feet per mile. Ackerly Creek, a perennial stream that flows from southeast to northwest before joining a tributary and flowing northwest to Glenburn Pond, is located approximately 800 feet northwest of the former Site operations area. Residential properties are located north, east, and west of the Site. To the south is undeveloped land.

The geology beneath the Site consists of two primary lithologies, the unconsolidated glacial overburden and the consolidated bedrock. The overburden generally consists of silts and silty sands with some interbedded sands. One of these sand lenses occurs in the area of OMW-13 and extends to the area beneath the lagoon treatment shed northward to beneath the former lagoon where the sand lens pinches out.

The consolidated bedrock is a sandstone with interbedded siltstone and shale. At the top of the hill, a siltstone and shale unit is present at approximately 20 to 30 feet bgs in the vicinity of the former building slab. The unit projects out the slope of the hill. The bedrock has both primary and secondary (joints and fractures) porosity. Since there is a calcareous cement present throughout the formation much of the primary porosity has been sealed up. A significant amount of porosity was assigned to the fractures due to the presence of some intensely fractured zones especially in the vicinity of wells SB-2008-4 (SB-4) and SB-2008-7 (SB-7) to SB-2008-11 (SB-11) and SB-2008-12 (SB-12).

There are also sporadic vuggy zones present throughout the formation. These vuggy zones when present represent a preferential pathway for the accumulation and transport of impacted groundwater. The vuggy zones are discontinuous and are generally not connected. However, a vuggy zone is present in the area from SB-2007-H (SB-H) and SB-2007E (SB-E) to SB-2008-9 (SB-9) and SB-2008-8 (SB-8) at an elevation of approximately 1,175 feet above msl. There is a second vuggy zone that occurs from SB-2008-6 (SB-6) to SB-2008-5 (SB-5) and extends under the former lagoon and occurs at an elevation of approximately 1,140 feet above msl.

There are three primary hydrogeologic zones of concern beneath the Site. The uppermost zone is the overburden groundwater which occurs within the unconsolidated glacial deposits. This is generally the first groundwater encountered beneath the Site. The second zone is the shallow bedrock groundwater. The shallow bedrock groundwater occurs below the glacial sediments and bedrock surface, within the shallow bedrock. The shallow bedrock groundwater is perched above the siltstone/shale layer and contains the highest concentrations of hexavalent chromium. The third zone of concern represents the unconfined water table within the intermediate bedrock which occurs at a depth of 60 to 80 feet below the ground surface. The deep bedrock groundwater is not considered to be a zone of concern, although it is monitored along with the other zones.

2.2 Site History

The Site began operation as a chromium electroplating facility for locomotive crankshafts in 1956. This operation continued when Precision bought the facility in 1971. Precision operated an industrial component reconditioning facility on site from 1971 until 1999.

The original operations building was approximately 5,500 square feet. From 1975 to 1992, additions were constructed that increased the size of the building to 45,000 square feet.

Site operations ceased in April 1999. Shortly thereafter, the process equipment used for plating operations was decontaminated and either sold or properly disposed offsite. With U.S. EPA oversight and approval from Abington Township, the former plating building was demolished in the fall of 2000.

Based on historical investigations conducted to date, the hazardous substances at the Site are total chromium and hexavalent chromium; however, hexavalent chromium is the primary constituent of concern at the Site. Hexavalent chromium and total chromium in the soil and groundwater at the Site may be related to the following activities:

- Between 1958 and 1970, hexavalent chromium wastes were disposed of in an unlined waste lagoon located just northeast of the operations building. Around 1970, a breach developed in the lagoon wall and a portion of the lagoon contents were released during precipitation events into a drainage pathway leading from the break in the lagoon wall along Ackerly Road. Additional wastewater containing hazardous substances flowed along the drainage pathway leading to Ackerly Creek.

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- Until July 1970, plant rinse water containing chromium flowed into floor drains that discharged to the ground surface outside the operations building by way of a footer drain outlet. Until July 1970, some of the wastewater from the onsite treatment plant was discharged to the unlined waste lagoon through a tile field. From approximately 1970 until the cessation of operations, Precision utilized a closed-loop system for the treatment of wastewater in an effort to minimize contamination.
- Overflow spillage from the strip tank was transmitted to a 900 gallon, partially buried septic tank via floor drains.
- From 1978 to 1980, approximately 5,300 cubic yards of chromium-impacted soil from various locations on site were placed in an onsite encapsulation area. The encapsulation area was capped with clay and asphalt, which was maintained by periodically applying a sealer. The encapsulation area design also incorporated an interceptor trench that was designed to capture groundwater on top of the bedrock and divert it around the operations building and the encapsulation area.
- In February 1987, approximately 200 gallons of a cleaning solution containing chromium spilled from a faulty valve.

From 1970 through the present, Site investigation activities have been performed to delineate the extent of hexavalent chromium and total chromium contamination in the soil and groundwater. Various remedial activities have also been conducted to reduce the contamination of hexavalent chromium in the soil and groundwater at the Site. The following is a summary of the remedial history of the Site.

- From 1978 to 1980, approximately 5,300 cubic yards of chromium-impacted soil from various locations on site were placed in an onsite encapsulation area. The encapsulation area was capped with clay and asphalt, which was maintained by periodically applying a sealer. The encapsulation area design also incorporated an interceptor trench that was designed to capture groundwater on top of the bedrock and divert it around the operations building and the encapsulation area.
- In September of 1991, EPA and Precision entered into an Administrative Order by Consent, Docket No. III-90-057-DC, which required Precision to provide an alternate water supply to one residence located on Arch Avenue. Precision complied with this Order and replaced the well late in 1991. Precision installed another well on Arch Avenue in the fall of 1993 to be used as an alternate source of drinking water for three residents.

- On August 22, 1995, EPA and Precision entered into an Administrative Order by Consent for Removal Response Action (1995 AOC), Docket No. III-94-32-DC, which required Precision to perform an Engineering Evaluation/Cost Analysis (EE/CA) to characterize the nature and extent of contamination at the Site. The EE/CA, which was approved with reservations by EPA in 1997, was designed to gather sufficient information to identify and evaluate removal alternatives to ensure that any actions taken would protect public health, welfare, and the environment in accordance with 40 C.F.R. § 300.415(b)(4).
- In 1997, Precision voluntarily removed the encapsulation area. Soil data from the encapsulation area and areas adjacent to the removal showed that total chromium and hexavalent chromium concentrations were below the Pennsylvania State-wide Health Standards for residential soil.
- On April 22, 1998, the Director of the Hazardous Site Cleanup Division of EPA signed an Action Memorandum (1998 Action Memo), which determined that a threat to public health, welfare, and/or the environment exists due to the actual or threatened release of hazardous substances from the Site and set forth the requirements for the Removal Action at the Site. Supported by this Action Memo, on April 24, 1998, EPA issued Precision a Unilateral Administrative Order, Docket No. III-98-069-DC (1998 Order) which required Precision to conduct the Removal Action at the Site. In accordance with this AO and with input from the U.S. EPA, PADEP, and the local townships, Precision developed a Response Action Plan (RAP) that detailed the following Site activities:

    - Residential well monitoring;
    - Residential soil sampling;
    - Long-term ground water monitoring;
    - Ecological risk assessment; and
    - Collection and treatment of the four seeps, out of the eight identified, that exceeded the Pennsylvania Drinking Water Standard for hexavalent chromium.

  The investigation and remediation activities completed from 1998 through May 2012 have been conducted pursuant to the requirements of the 1998 Order.

- Precision extended a public water supply line along Ackerly Road and Arch Avenue to provide a municipal water supply for the residences downgradient of the Precision Site. This activity was confirmed by the 1998 Order.

- On January 29, 2001 Precision submitted a Seep Design Report which described how Precision would collect various seeps and treat the seeps to remove hexavalent chromium prior to discharge. EPA accepted the Seep Design Report on March 1, 2001 and the system was installed and in operation by November 2, 2001.
- Precision submitted surface water sampling results from the June 2002 sampling event in Ackerly Creek which showed hexavalent chromium concentrations were above EPA's ambient chronic water criteria of 11 ug/L hexavalent chromium for surface water bodies. EPA sent a notice to Precision on August 6, 2002 that these sampling results indicated that biota in the creek and Glenburn Pond were being exposed to elevated levels of hexavalent chromium. Biological assessment data from November 2001 also showed impacts to aquatic plants and animals in the form of elevated levels of total chromium accumulations in tissue. The August 2002 notice required Precision to submit to EPA a list of one or more proposals to cease the migration of chromium-contaminated groundwater to Ackerly Creek.
- On September 6, 2002, Precision submitted a summary of alternatives that could be used to reduce the impacts of hexavalent chromium to Ackerly Creek. Based on their evaluation, Precision proposed In-Situ Chemical Reduction (ISCR) as the preferred option to mitigate impacts of hexavalent chromium to the creek.
- On December 16, 2002, after meeting with PADEP and Precision, EPA selected Precision's proposal of ISCR using calcium polysulfide as a response alternative and directed Precision to prepare a response action work plan.
- In February 2003, Precision was alerted to the presence of green-tinted water in the former lagoon area on the Precision site. After an initial period of assessment, it was discovered that the water was impacted with hexavalent and trivalent chromium and was slowly being released into a nearby drainage ditch, which led into the neighboring Ackerly Creek. The hexavalent chromium concentrations exceeded the safe drinking water standard of 100 ug/L. The source of the water appeared to be a series of seeps that were located within the former lagoon area. Precision initiated a series of emergency responses to mitigate the release. A berm was constructed along the low end of the northern lagoon where water was draining to the Ackerly Road drainage ditch. A sump was installed in the lagoon and an on-Site Lagoon Treatment System was constructed to collect the water in the lagoon, and remove the hexavalent chromium before discharging the water to the surface.

- In response to an EPA verbal directive on February 3, 2003 and written directive on February 5, 2003, Precision performed emergency response actions and conducted an assessment of the hexavalent chromium release in the former lagoon area. The results of this assessment showed that there was chromium-impacted soil above bedrock that was impacting perched or shallow groundwater in the vadose zone. In addition, these impacts were directly observable in the former lagoon area downgradient of the area where operations occurred on the site. Precision reviewed the results of this assessment with EPA and PADEP and discussed strategies for identifying source areas upgradient of the lagoon. As a follow-up to these discussions, Precision incorporated the assessment information and sampling strategies into the Ackerly Creek Impact Mitigation Remedial Action Work Plan, which was submitted to the U.S. EPA on July 9, 2003 (2003 Work Plan).
- In accordance with the EPA approved 2003 Work Plan, Precision conducted a phased source area investigation at the Site from August 2003 through April 2004 to first identify and then delineate the source areas accurately. In December 2003, Precision submitted the results of the first phase of the investigation in the report "Source Area Investigation – Preliminary Results & Additional Requirements." This report identified the following four areas with consistently high concentrations of chromium that were potentially acting as source areas for groundwater:
    - Area adjacent to and south of the former plating building;
    - Area under the southern part of the former plating building;
    - Area between the former encapsulation vault and the former lagoon; and
    - Area between the former lagoon and Ackerly Road adjacent to the drainage trench.

  Precision reviewed the preliminary results with EPA and PADEP and agreed to a second phase of sampling to delineate the potential source areas. The second phase of the source area investigation consisted of additional soil borings/sampling and groundwater sampling activities in the above areas. These investigation activities were completed in February, March, and April 2004.

- Based on all of the soil and groundwater data collected as part of the lagoon and source area investigations, Precision submitted a Phase II Report on August 13, 2004 that defined the horizontal and vertical extent of soil source areas with hexavalent chromium in excess of 190 milligrams per kilogram (mg/kg) (Pennsylvania Act 2 Cleanup Standard for soil to groundwater threat) and concluded that the source areas were relatively small and had been delineated sufficiently to start evaluating remediation alternatives.
- In response to a September 9, 2004 EPA letter, Precision agreed to calculate a Site-specific sub-surface soil screening level for hexavalent chromium that would result in attainment of the surface water quality standard of 11 ug/l hexavalent chromium in Ackerly Creek, which EPA had selected as the overall cleanup standard for the Site. Using EPA guidance and Site-specific data, Precision calculated that remediation of soil in certain source areas to a level of 60 mg/kg hexavalent chromium would achieve this purpose. On March 31, 2005 EPA approved this proposed level and subsequently required Precision to provide a schedule for future soil remediation activities to mitigate the discharges of hexavalent chromium to Ackerly Creek.
- After evaluation of several alternatives, in-situ chemical reduction (ISCR) of the hexavalent chromium with calcium polysulfide (CaSx) was selected as the most effective cleanup method. A Source Area In Situ Chemical Reduction Design Report (2005 Work Plan) was prepared and submitted to U.S. EPA in November 2005.
- In June of 2006, a pilot test assessing the injection of calcium polysulfide into the soil was conducted on the Precision property. The results of the pilot test confirmed that the high-pressure injection method would successfully deliver the calcium polysulfide into the soil and that the frequency of the injections would depend on the soil types at the various locations of the Site. The testing also confirmed that calcium polysulfide could be injected into the soils of the former lagoon.
- From July 25 to December 15, 2006, Precision conducted soil injection activities to reduce the concentrations of hexavalent chromium in soil to below a calculated 60 mg/kg criterion for achieving 11 ug/l in Ackerly Creek. Approximately 265,000 gallons of calcium polysulfide solution at concentrations ranging from 3% to 6% were injected into approximately 3,677 injection points to reduce hexavalent chromium to trivalent chromium.
- On September 8, 2006, EPA issued a Response Approval Summary, which compiled, confirmed, updated and documented certain EPA-approved and selected response actions and measures to be performed pursuant to Section VIII of the 1998 Order.

- In 2007, Precision conducted soil excavation activities to remove hexavalent chromium impacted concrete and soil from the former Rectifier Room located in the basement of the former operations building.
- Between August 2008 and January 2009, approximately 150,000 gallons of a 1% to 2% solution of calcium polysulfide were injected into the shallow bedrock and weathered bedrock source areas through 25 injection points and an infiltration gallery installed within the former Rectifier Room to treat shallow bedrock contaminated groundwater.
- Between October and December 2010, Precision injected a total of 34,914 gallons of 1% calcium polysulfide solution and 14,852 gallons of 2% calcium polysulfide solution into the overburden, shallow bedrock, and weathered bedrock source areas to treat shallow bedrock contaminated groundwater.
- On March 25, 2010, EPA issued an EE/CA Approval Memorandum, approving the drafting of the EE/CA document.
- Concurrent with the injections in the shallow bedrock, EPA drafted a second EE/CA (2011 EE/CA) to present the final response alternatives for the Site. A public meeting was conducted on December 7, 2010 to present the response alternatives for the Site to the community and to solicit public comments as required by Section 300.820(a) of the NCP. The EPA provided the public an opportunity to submit written comments. The preferred alternative presented was continuation of the contaminant source area treatment using an in situ chemical injection system, continuation of the collection and treatment of seeps, as well as long-term monitoring and institutional controls (ICs) that will prevent exposure of residents to contaminated groundwater and surface water. EPA finalized the 2011 EE/CA on September 1, 2011.
- Between October and December 2011, Precision injected approximately 63,300 gallons of diluted calcium polysulfide solution (1% to 5%) into the overburden, shallow bedrock, and weathered bedrock source areas to treat contaminated groundwater. On September 9, 2011, the Director of the Hazardous Site Cleanup Division approved an Action Memorandum (2011 Action Memo) selecting the response action for addressing chromium contamination at the Site.

3. Seep Collection and Treatment

During the historical Site investigations, eight groundwater seeps had been observed in the vicinity of the Site. The seeps were generally only present during times of significant precipitation events. When groundwater infiltrating through the unconsolidated glacial sediments reaches the top of the bedrock surface, the top of the bedrock surface is less permeable in many areas. The infiltrating groundwater collects on top of the bedrock surface and begins to flow downhill along the top of the bedrock. The seeps generally occur where there are abrupt changes in the bedrock surface. For groundwater flowing through the bedrock, when the bedrock surface drops off, the groundwater is then discharged into the overburden and has the potential to seep out.

Historically, the eight seeps located downgradient of the site along Ackerly Creek were sampled for hexavalent chromium. Of the eight seeps, the three seeps in the vicinity of Braces Pond contained hexavalent chromium at low concentrations. One seep adjacent to Ackerly Creek on the east side of Ackerly Road had no detectable concentration of hexavalent chromium. The EPA agreed to exclude these seeps from collection and treatment requirements. The remaining seeps (Bathtub Seep, Cinderblock Seep, Trolley Track Seep, and Arch Avenue dug well) contained higher concentrations of hexavalent chromium.

The May 26, 1999 unfiltered samples of the Bathtub and Cinderblock seeps contained 4,100 ug/L and 1,000 ug/L of hexavalent chromium, respectively. Hexavalent chromium concentrations for the Trolley Track Seep were reported to be in the range of 2,800 to 7,680 ug/L. A filtered sample of water retrieved from the former Arch Avenue dug well on January 22, 1998 had a hexavalent chromium concentration of 922 pg/L. Historically, the hexavalent chromium concentrations observed in these seeps have been consistent with ground water concentrations seen in the vicinity of these seeps.

Two water treatment systems are located at the Precision site to address the seeps identified. The first and largest treatment system is the Lagoon Treatment System which collects water from the former lagoon area and seeps that discharge in this area. The second treatment system is the Seep Shed Treatment System that collects water from the Trolley Track Seep, Bathtub Seep and Cinderblock Seep located upgradient of Ackerly Creek.

A third treatment system was previously installed and operated by Precision; however, it was removed in 2008. Precision had previously installed and operated a seep collection and treatment system for the Arch Avenue dug well location. The Arch Avenue dug well was properly filled and closed in 2008 and the water treatment system dismantled. A report summarizing the well closure activities was submitted to the EPA in February 2009.

3.1 Lagoon Treatment System

3.1.1 Operation

The Lagoon Treatment System consists of three 300-gallon resin tanks, a sand filter, bag filters, a 300-gallon inlet holding tank, a process pump, inlet and outlet rotameter flow meters, a flow totalizer and control valves and piping. The resin tanks are installed in series. The SIR-700 resin in the initial two tanks is designed for the removal of hexavalent chromium. The SIR-300 resin in the final tank is designed for the removal of total metals. The final resin tank will remove trivalent chromium but also treats other transitional metals, some of which have a higher selectivity than trivalent chromium. This higher selectivity results in decreased treatment efficiency for trivalent chromium.

The system is housed in an on-Site building located above the former lagoon near the former building slab. The system receives water from a sump pump located in a sump within the lagoon area. The lagoon sump collects water from a seep that surfaces near monitoring well OMW-3, surface water runoff that collects during precipitation events, groundwater from a french drain located within the former lagoon, and groundwater from a french drain system located along Ackerly Road. After the water is treated in the Lagoon Treatment System, it is discharged to the ground surface in a pre-existing rip-rap lined infiltration swale located on the western side of the site.

The lagoon seep, which is contaminated with hexavalent chromium, discharges a relatively steady volume of water from a location near monitoring well OMW-3. This seep previously flowed over the ground surface approximately 75 feet and entered the lagoon collection sump. Currently, the seep is hard piped to the lagoon collection sump. Additional groundwater that surfaces in the former lagoon area flows to the collection sump as well. The lagoon consists of a shallow, bermed area of approximately 5,000 square feet. The lagoon is constructed with a berm on the two downgradient sides. The berm is approximately 3 feet high at its highest point adjacent to the sump. The volume of water contained in the lagoon varies widely during the year depending on seasonal precipitation amounts. The Lagoon Treatment System will continue to be operated in accordance with Section 8.3 of the Settlement Agreement

3.1.2 Monitoring

The Lagoon Treatment System will be monitored on a monthly basis. Samples will be collected from the influent and effluent and analyzed for hexavalent chromium and total chromium to evaluate the effectiveness of the treatment system. In addition, a sample will be collected between the two SIR-700 resin tanks and analyzed for total and hexavalent chromium to evaluate the removal efficiency of the lead unit and determine when the resin needs to be changed. The monitoring frequency and parameters will be adjusted during times of on-Site in situ chemical reduction activities, as described in Section 5.3.6.3 below.

3.2 Seep Shed Treatment System

3.2.1 Operation

The Seep Shed Treatment System consists of a collection sump and pump, bag filters, four 7-ft^3 resin tanks in series, outlet rotameter flow meter, a flow totalizer, control valves and piping. The treatment system receives water from collection systems installed at the Trolley Track Seep, Bathtub Seep, and Cinderblock Seep. At each seep, a subsurface stone collection system is installed to collect the water. The collected water is then transferred via underground piping to the collection sump of the Seep Shed Treatment System. The water is then pumped through a bag filter unit, two resin vessels containing SIR-700 resin for the removal of hexavalent chromium and two resin vessels containing SIR-300 resin for the removal of total metals. The use of the SIR-300 resin was initiated during 2007 and the use of SIR-700 resin was initiated during 2009. Previously all the resin vessels contained SBG1 resin for the removal of hexavalent chromium. Following treatment, the water is discharged to a subsurface infiltration gallery located adjacent to the shed and upgradient of Ackerly Creek. The Seep Shed Treatment System will continue to operate in accordance with Section 8.3 of the Settlement Agreement.

3.2.2 Monitoring

The Seep Shed Treatment System will be monitored on a monthly basis. Samples will be collected from the influent and effluent and analyzed for hexavalent chromium and total chromium to evaluate the effectiveness of the treatment system. In addition, samples will be collected between the two SIR-700 and SIR-300 resin vessels and analyzed for hexavalent chromium and total chromium respectively, to evaluate the removal efficiency of the units and determine when the resin needs to be changed. The monitoring frequency and parameters will be adjusted during times of on-Site in situ chemical reduction activities, as described in Section 5.3.6.3 below.

4. Supplemental Overburden and Bedrock Groundwater Investigation Activities

The majority of the source material located in the overburden and shallow bedrock in the vicinity of the former Precision facility has been treated based on the current hexavalent chromium concentrations observed in the monitoring locations. The recent groundwater sampling data indicate that the source areas in the overburden and shallow bedrock beneath the former building slab have been effectively treated by the 2011 injection activities. Prior to the 2011 injection activities, residual hot spots of elevated concentrations of hexavalent chromium were detected at injection point IP-14 and boring SB-E in the shallow bedrock. However, recent groundwater sampling results for these two locations show that hexavalent chromium concentrations were either undetected or calcium sulfide was present. Hexavalent chromium is still detected at lower concentrations in the area north of the former building slab in the overburden groundwater and in the shallow bedrock.

To assess the residual concentrations, evaluate potential contaminant pathways, and identify potential remedial actions, Precision is proposing additional investigation of the overburden, shallow bedrock and intermediate bedrock groundwater in the areas downgradient of the former building slab towards Ackerly Creek. Based on the existing data and the current Site conceptual model, Precision is proposing the installation of six shallow bedrock monitoring wells, four intermediate bedrock monitoring wells and six overburden monitoring wells.

The proposed monitoring wells are expected to be placed in clusters roughly along lines perpendicular to the groundwater flow away from and downgradient from the former building area. These rows of additional bedrock and overburden monitoring well clusters will be installed to evaluate potential contaminant pathways to Ackerly Creek.

One well cluster of shallow and intermediate wells will be placed downgradient of OMW-4. One well cluster consisting of overburden, shallow bedrock and intermediate bedrock wells will be placed along the paper road. A further downgradient line of four well clusters will be placed along the Trolley Tracks. A final well cluster consisting of an overburden well and a shallow bedrock well will be installed just south of Ackerly Creek to assess lithology and potential connections between the hexavalent chromium concentrations identified on the Site and Ackerly Creek.

In addition, Precision is currently evaluating borehole geophysics information for the bedrock wells along the Trolley Tracks and will be proposing modifications to these wells in a separate work plan. The locations of the proposed wells are illustrated on Figure 9.

The depths of the wells, polyvinyl chloride (PVC) casing and open boreholes will be dependent on the observations made during the drilling activities including the depths at which major fractures are identified. Some of the boring locations also may be adjusted based on Site conditions, access constraints, and field observations identified during the performance of the investigation activities.

4.1 Proposed Overburden Wells

One of the six proposed overburden monitoring wells will be installed downgradient of the former lagoon area along the paper road to evaluate the relationship between the overburden groundwater and the former lagoon. This proposed overburden well, OMW-30, will be installed adjacent to the shallow bedrock monitoring well, MW-18S and the intermediate bedrock monitoring well, MW-18I.

Four proposed overburden monitoring wells will be installed along the Trolley Tracks to evaluate the relationship between the overburden groundwater and the shallow bedrock in this area as well as the potential pathways to Ackerly Creek. Overburden well OMW-26 will be installed adjacent to the existing shallow bedrock and intermediate bedrock monitoring wells, AGM-4S and AGM-4I, respectively. Overburden well OMW-28 will be installed adjacent to the existing shallow bedrock and intermediate bedrock monitoring wells, AGM-3S and AGM-3I, respectively. Overburden well OMW-23 will be installed along the Trolley Tracks midway between proposed overburden wells OMW-26 and OMW-28. Overburden well OMW-29 will be installed along the Trolley Tracks further west from proposed overburden well OMW-28 in an area that provides suitable access during drilling and sampling activities.

The sixth proposed overburden monitoring well, OMW-25, will be installed along Ackerly Creek to evaluate the relationship between the overburden groundwater and surface water sampling locations in the creek. This overburden well will be installed in an area adjacent to surface water sample location SW-14BC2 that provides suitable access during drilling and sampling activities.

ARCADIS will contract with a Pennsylvania licensed well driller to install the six proposed overburden wells. The wells will be installed by advancing a 6-inch diameter borehole to the top of competent bedrock using a drill rig equipped with a hollow-stem auger (HSA). Upon encountering bedrock refusal, the well will be constructed as a single-cased well with 2-inch diameter schedule 40 PVC casing with 0.020-slot PVC screen installed across the water table as encountered in each area. The PVC riser will extend above the screened interval to 2 to 3 feet above the ground surface. The six overburden wells will be finished such that they may be used as injection points during calcium polysulfide injection activities. After completion, groundwater samples will be collected from the new overburden wells and analyzed for total and hexavalent chromium.

Based on previous drilling data from these portions of the Site, it is anticipated that bedrock will be encountered at depths of approximately 10 to 20 feet bgs. Therefore, the screened intervals are anticipated to range from 5 to 20 feet bgs. A sand pack will be installed around the well screen and the remaining annulus above the screen will be grouted with a cement/bentonite mixture to the surface. The well will be completed with a standard stick-up, lockable, protective monitoring well casing composed of steel. The locations of the proposed wells are depicted on Figure 9. A diagram depicting the proposed well construction is provided as Figure 10.

4.2 Proposed Shallow Bedrock Wells

Six shallow bedrock monitoring wells will be installed to evaluate potential contaminant pathways between the residual bedrock source areas at the Site and the areas downgradient towards Ackerly Creek. These wells will also assist in evaluating the influence of the shallow bedrock on the overburden groundwater in the proposed overburden wells. The locations of the proposed shallow bedrock wells (MW-15S, MW-16S, MW-17S, MW-18S, MW-19S and MW-21S) are depicted on Figure 9.

One of the six shallow bedrock monitoring wells, MW-21S, will be installed upgradient of the former lagoon area to evaluate the influence of the shallow bedrock groundwater on the overburden groundwater beneath the former lagoon.

Shallow bedrock monitoring well MW-19S will be installed to the northwest of the former building slab area to evaluate concentrations further downgradient from the original source area.

One proposed shallow bedrock monitoring well will be installed along the paper road to evaluate the relationship between the groundwater concentrations in this area and the former lagoon. This proposed shallow well, MW-18S, will be installed adjacent to the proposed overburden monitoring well, OMW-30, and the proposed intermediate bedrock monitoring well, MW-18I.

Two shallow bedrock monitoring wells will be installed along the Trolley Tracks to evaluate the relationship between the overburden groundwater and the shallow bedrock in this area and the potential pathways to Ackerly Creek. Shallow bedrock well MW-16S will be installed adjacent to the proposed overburden well, OMW-27. Shallow bedrock well MW-17S will be installed adjacent to the proposed overburden well, OMW-29.

One shallow bedrock monitoring well, MW-15S, will be installed adjacent to the overburden well OMW-25 adjacent to Ackerly Creek. This well will be used to evaluate the influence of the shallow bedrock on the overburden adjacent to the creek.

The borings for the six proposed wells will be extended into the shallow bedrock approximately 1 to 3 feet using air rotary drilling techniques and a 4-inch schedule 40 PVC casing will be grouted into the bedrock to provide a seal from the overburden groundwater. The boring will then be extended as a 4-inch diameter open hole approximately 15 to 20 feet into the competent bedrock. It is anticipated that the wells will be installed to total depths of approximately 25 to 40 feet bgs. After completion, groundwater samples will be collected and analyzed for total and hexavalent chromium. The wells will be finished such that they can be used as injection points during calcium polysulfide injection activities. After completion, groundwater samples will be collected from the new shallow bedrock wells and analyzed for total and hexavalent chromium.

Each shallow bedrock well will be completed to seal off the overburden groundwater such that if the well is selected for future injection activities, the seal will prevent the injection solution from short- circuiting and rising to the surface. To convert the wells into injection points, the wells will be fitted with PVC well head caps to allow for injection under pressure using the existing on-Site injection system. Diagrams depicting typical shallow bedrock well and injection point construction are provided as Figures 11 and 13, respectively.

4.3 Proposed Intermediate Bedrock Wells

Four intermediate bedrock monitoring wells will be installed to evaluate potential contaminant pathways between the residual bedrock source areas at the Site and the areas downgradient towards Ackerly Creek. These wells will also assist in evaluating the influence of the intermediate bedrock on the overburden and shallow bedrock groundwater in the other proposed wells. The locations of the proposed intermediate bedrock wells (MW-11I, MW-18I, MW-19I and MW-20I) are depicted on Figure 9.

Two of the proposed intermediate bedrock monitoring wells will be installed downgradient of the former lagoon area along the paper road to evaluate the relationship between the groundwater concentrations in this area and the former lagoon. One proposed intermediate bedrock well, MW-11I, will be installed adjacent to the existing overburden monitoring well OMW-17 and shallow bedrock monitoring well MW-11S. Intermediate bedrock well MW-18I will be installed adjacent to the proposed shallow bedrock monitoring well, MW-18S and the proposed overburden monitoring well, OMW-30.

Intermediate bedrock monitoring well MW-19I will be installed to the northwest of the former building slab area to evaluate concentrations further downgradient from the original source area, adjacent to MW-19S.

One proposed intermediate bedrock monitoring well, MW-20I, will be installed in the former lagoon area to evaluate the intermediate bedrock groundwater beneath the sand lens and its impact on the overburden groundwater beneath the former lagoon.

Based on access to the desired installation locations, the proposed intermediate bedrock monitoring wells will be installed in one of two manners. For the first option, the borings for the proposed wells will be extended into the intermediate bedrock approximately 85 feet using air rotary drilling techniques and a 4-inch schedule 40 PVC casing will be grouted into the bedrock to provide a seal from the overburden groundwater. The boring will then be extended as a 4-inch diameter open hole approximately 15 to 20 feet into the competent bedrock. Alternatively, the intermediate bedrock wells will be installed by drilling a 6-inch diameter borehole into the bedrock to a depth of approximately 100 feet. A 2-inch diameter PVC casing with 0.020-slot PVC well screen will be set into the borehole. The well screen will extend from approximately 85 to 100 feet bgs. The PVC riser will extend from the top of the well screen to approximately 2 to 3 feet above ground surface. A sand pack will be installed around the well screen and the remaining annulus above the screen will be grouted with a cement/bentonite mixture to the surface. The wells will be completed with a standard stick-up, lockable, protective monitoring well casing composed of steel.

It is anticipated that the wells will be installed to total depths of approximately 100 feet bgs. After completion, groundwater samples will be collected and analyzed for total and hexavalent chromium.

Each intermediate bedrock well will be completed to seal off the overburden groundwater such that if the well is selected for future injection activities, the seal will prevent the injection solution from short-circuiting and rising to the surface. To convert the wells into injection points, the wells will be fitted with PVC well head caps to allow for injection under pressure using the existing on-Site injection system. Diagrams depicting typical intermediate bedrock well and injection point construction are provided as Figures 12 and 13, respectively.

4.4 Other Activities

Monitoring wells AGM-2S, AGM- 2I, AGM-3S, AGM-3I, AGM-4S and AGM-4I previously were evaluated using borehole geophysics. The results of the geophysical investigation are being evaluated. Based on the results, select zones in each well will be packer tested to evaluate groundwater quality (hexavalent and total chromium concentrations) and flow. The results of the packer testing will then be evaluated to determine if modifications to the open-hole interval being monitored in each well would yield more representative groundwater quality data for future monitoring. The concentrations in each zone sampled will be evaluated relative to the flows within the zones to determine if the monitoring zone should be modified. Any proposed modifications to the sampling depth or well construction of these open-hole bedrock wells will be submitted to the EPA in a separate work plan.

4.5 Groundwater Sampling

Following the well installation activities, groundwater samples will be collected from all of the newly installed wells to determine the concentrations of total and hexavalent chromium in the wells. The groundwater samples will be collected using low flow purging procedures and submitted to an EPA/PADEP certified laboratory for analysis for the presence of total and hexavalent chromium. Following the initial sampling event, the data will be evaluated to determine the extent of hexavalent and total chromium concentrations in each zone, the need for additional calcium polysulfide injection activities, and the locations of injection activities to treat the remaining hexavalent chromium concentrations at the Site. In addition, select wells from each groundwater monitoring zone may be selected for future sampling along with the existing monitoring wells that are monitored as part of the semi-annual sampling program. The results from the monitoring wells that are selected for future periodic monitoring will be used to evaluate the effectiveness of treatment activities and to determine if the requirements of the Settlement Agreement are being achieved.

The wells will be surveyed by a Pennsylvania-licensed land surveyor to determine their location and elevation.

4.6 Reporting

Following the monitoring well installation activities, a report will be prepared to summarize the activities including the description of the monitoring wells, the field monitoring data, the soil boring logs and an evaluation of the groundwater quality.

5. In Situ Chemical Reduction of Hexavalent Chromium in Overburden and Bedrock

The proposed supplemental bedrock chemical injection activities are designed to treat the remaining hexavalent chromium in the overburden and shallow bedrock beneath the former building slab area and downgradient areas of the Site as a follow-up to the previous chemical injection activities completed from 2008 through 2011. In general, the remedial strategy of treating the hexavalent chromium by ISCR with calcium polysulfide (CaSx) will be implemented as outlined herein. The Work Plan follows the general procedures previously submitted and approved by EPA for the previous injection activities conducted in 2008, 2009, 2010 and 2011, and includes the flexibility for on-site changes in design parameters including, but not limited to, location of injection points, calcium polysulfide concentrations, calcium polysulfide volumes, injection techniques, follow-up injection chemicals and other site-specific variables depending upon actual Site conditions. If modifications to the injection plan outlined below are necessary during implementation, Precision or ARCADIS will notify the EPA onsite representative of the modifications.

The remediation strategy follows from the same interpretation of site characteristics as updated based on recent investigation results, remedial alternative selection, and feasibility study that were performed in preparation for the first phase of bedrock injection activities completed in 2008/2009 and the source area overburden soil injection activities completed in 2006. The strategy incorporates the results of the supplemental investigation activities completed from 2007 through 2011.

From August 2008 to January 2009, the initial phase of shallow bedrock injection activities was completed at the Site. Calcium polysulfide was injected into the shallow bedrock through 25 injection points/wells. During the injection activities, approximately 150,000 gallons of a 1% to 2% solution of percent calcium polysulfide were injected into the shallow bedrock. The quarterly monitoring activities following the injection activities indicated an overall decrease in both hexavalent chromium and total chromium concentrations in the monitoring wells, influents to the treatment systems, and Ackerly Creek. The results indicated that the hexavalent chromium concentrations had been effectively treated by the CaSx injections. However, the surface water quality standard of 11 ug/l of hexavalent chromium had not been achieved in Ackerly Creek. In addition, a rebound in hexavalent chromium concentrations was observed in SB-2008-8/IP-14. Although the concentrations in IP-14 were significantly lower than the pre-injection concentrations, the increase indicated the presence of residual source material in the weathered rock and shallow bedrock in the vicinity of the well. The source area also appeared to be connected to the overburden groundwater in the area of OMW-13.

A second phase of the shallow bedrock injection activities was completed at the Site from October 2010 to December 2010. Calcium polysulfide was injected into the overburden and shallow bedrock through 37 injection points/wells. During the second phase of injection activities, approximately 50,000 gallons of dilute (1% to 2%) calcium polysulfide solution were injected into the overburden and shallow bedrock.

A third phase of the shallow bedrock injection activities was completed at the Site from October 2011 to November 2011. Calcium polysulfide was injected into the overburden and shallow bedrock through 48 injection points/wells. During this phase of injection activities, approximately 63,300 gallons of diluted calcium polysulfide solution was injected into the overburden and shallow bedrock.

Following the injection activities, monitoring of the groundwater during semi-annual events and supplemental sampling activities has indicated that the source areas beneath the building slab have been effectively treated. Total chromium and hexavalent chromium concentrations are still present in wells downgradient of the building slab in the former lagoon area and along the Trolley Tracks. Although hexavalent chromium concentrations are still present at levels above 100 ug/l in the overburden and shallow bedrock, the concentrations and areas impacted have been reduced considerably since the initial injection activities in 2008/2009, indicating that the CaSx injection activities have been successful in reducing the hexavalent chromium concentrations. To address the remaining concentrations identified during the recent investigation activities, additional injection activities are proposed. The proposed activities are presented in this work plan.

5.1 Investigation Results

The groundwater, surface water, and seep monitoring activities following the 2011 injection activities indicated a further trend of the overall decrease in both hexavalent chromium and total chromium concentrations in the monitoring wells, influents to the treatment systems and Ackerly Creek. The results indicated once again that the 2011 CaSx injection activities had effectively treated the hexavalent chromium concentrations in the overburden and shallow bedrock. However, the surface water quality standard of 11 ug/l of hexavalent chromium has not been achieved in Ackerly Creek. The data indicate that residual concentrations of hexavalent chromium are present in the overburden, weathered rock and shallow bedrock in the downgradient areas north of the former building slab.

The existing injection points and other monitoring locations not typically included in the quarterly and semi-annual monitoring program were sampled in January 2012 and April 2012 for hexavalent chromium to evaluate conditions following the 2011 injection activities. These results were evaluated with the semi-annual monitoring data from October 2011 and April 2012 to determine additional delineation locations downgradient of the former building slab and areas for future injection activities.

The surface water and groundwater sampling locations and results for the January 2012 sampling event are summarized in Figures 3 through 5. The sample results for the April 2012 semi-annual monitoring event are summarized on Figures 6 through 8. The results indicate that the source areas beneath the former building slab have been effectively treated. Residual concentrations are still present downgradient of the building slab towards the former lagoon and trolley track. To address the remaining concentrations identified in the recent investigation activities and as directed by the 2012 Settlement Agreement, additional injection activities are proposed. The proposed activities are presented in this work plan.

5.2 Remedial Approach

As presented in the May 2008 Proposed Shallow Bedrock In Situ Chemical Reduction Work Plan, Precision evaluated several cleanup alternatives to mitigate the discharges to Ackerly Creek as part of the Remedial Action Plan (RAP) for the 2006 ISCR. Precision's evaluation showed that ISCR with CaSx would be the most effective way to clean up source area soils and overburden groundwater at the Site. With EPA's approval, Precision employed ISCR with CaSx to convert the hexavalent chromium in the soils and groundwater to the less toxic, more stable and less leachable trivalent form of chromium.

In the 2008 Work Plan, in situ chemical reduction was identified as the most practical and effective remediation method for the treatment of the remaining sources in the shallow bedrock and weathered rock. The selection of this remedial approach was based on a review and update of the remedial alternatives evaluated by Precision in the Focused Feasibility Study completed in 2005 and approved by EPA. Five remediation methodologies previously were considered: excavation and off-site disposal, a funnel and gate system, a permeable reactive barrier, capping and installation of a slurry wall, and in situ chemical reduction. Most of the remediation methodologies considered would be difficult to implement at the Precision Site and are more suited to treatment of near-surface soil rather than bedrock. The results of the previous injection activities confirmed the effectiveness of the ISCR method as the source area was reduced significantly and the concentrations in the Lagoon Seep, Seep Shed Treatment System influent and Ackerly Creek have decreased considerably. Using in situ chemical reduction, both contaminated bedrock and groundwater could be treated.

Precision used the same remedial approach for the shallow bedrock injection activities in 2008/2009, 2010 and again in 2011, and the results have confirmed the effectiveness of this method for reducing the hexavalent chromium concentrations in the shallow bedrock and associated groundwater beneath the Site. The proposed injection activities for 2012 will again use CaSx for the reduction of hexavalent chromium based on the evaluation of potential reducing agents and the results of the previous injection activities that confirmed the effectiveness of CaSx as the reducing agent. Any source material remaining after the treatment can be addressed with additional rounds of injection.

The reduction of hexavalent chromium to trivalent chromium with CaSx proceeds as shown in the following simplified equation.

$$2\,CrO_4^{-2} + 3\,CaS_5 + 10\,H^+ \text{ ® } 2\,Cr(OH)_3 + 15\,S + 3\,Ca^{+2} + 2\,H_2O$$

The treatment process is not intended to reduce the total chromium concentrations at the Site.

The following provides a summary of the proposed site remediation approach:

- Use ISCR with CaSx to treat the residual concentrations in the overburden and shallow bedrock groundwater that are impacting the surface water quality in Ackerly Creek.
- Monitor Ackerly Creek, the seeps, and groundwater to determine the effectiveness of the treatment in achieving EPA’s Water Quality CCC of 11 ug/l of hexavalent chromium in Ackerly Creek.
- If the monitoring results indicate hexavalent chromium concentrations above the EPA Water Quality CCC of 11 ug/l in Ackerly Creek, it may be necessary to perform additional monitoring and/or additional treatment with CaSx or another reducing agent depending on how the concentrations have decreased over time.

If after injection and monitoring it is found that hexavalent chromium concentrations remain in Ackerly Creek at levels above 11 ug/l, additional rounds of injections may be necessary. Depending on the hexavalent chromium concentrations, successive injections may be performed with CaSx at higher concentrations or another suitable reducing agent or an organic substrate.

5.3 Calcium Polysulfide Injection

As presented in the May 2008 Proposed Shallow Bedrock In Situ Chemical Reduction Work Plan, Precision evaluated several cleanup alternatives to mitigate the discharges to Ackerly Creek as part of the Remedial Action Plan (RAP) for the 2006 ISCR. Precision's evaluation showed that ISCR with CaSx would be the most effective way to clean up source area soils and overburden groundwater at the Site. With EPA's approval, Precision employed ISCR with CaSx in 2008/2009, 2010 and 2011 to convert the hexavalent chromium in the groundwater to the less toxic, more stable and less leachable trivalent form of chromium. Additional injection activities are proposed for 2012.

5.3.1 Material Storage and Concentration

The CaSx solution will be delivered to the Site in approximately 300-gallon totes by flatbed trucks. A maximum of six totes will be delivered at a time. The trucks will be placarded appropriately. The CaSx will be received at a concentration of 29 percent. The material will be stored in the totes on site. Secondary containment will be provided for the totes. If smaller quantities of CaSx solution are determined to be needed towards the end of the proposed injection activities, then deliveries of 55-gallon drums of CaSx may occur. Drums of CaSx will be stored within the on-site containment area.

All valves on the totes will be locked shut when not in use to prevent any accidental discharge of CaSx. Only authorized personnel will have keys to the valves. The Site fence will remain locked during non-working hours to prevent vandalism that could result in a discharge of CaSx. Spill cleanup supplies such as absorbent pads, drums, and pumps will be on site to clean up any spills that occur. Emergency response contacts are included in the Health and Safety Plan (HASP) and prominently displayed inside the on-site treatment shed that is used as the Site office. These emergency response contacts include the following:

1) ARCADIS and Precision contacts (Lawrence Brunt and Kevin Quinn)
2) PADEP contact (Joseph Iannuzzo)
3) EPA contact (Ann DiDonato)
4) Hospital
5) Police/Fire Department

The HASP is discussed further in Section 6 of this work plan.

In preparation for injection into the shallow bedrock, the concentrated CaSx solution (29 percent) will be blended with water from the on-site production well to create a 1 percent to 5 percent CaSx solution as was prepared for the previous injection activities at the Site. Prior to its use, the water from the production well will be sampled and analyzed for hexavalent chromium and total chromium. The blending will occur by pre-mixing the solution in two 2,500 gallon polyethylene mixing storage tanks. The CaSx solution will be injected into the overburden and shallow bedrock via pumping or delivered by gravity through a manifold system into injection wells installed in the contaminated areas. Secondary containment will be provided for the mixing storage tanks.

5.3.2 Injection Method/System Design

The supplemental injection activities will utilize the existing wells that were installed in the overburden and shallow bedrock across the source area. In addition, the new wells proposed in this Response Action Plan will be used to monitor the injection activities and may possibly be used as supplemental injection wells. The selection of the injection points and the CaSx concentrations will be determined by Precision based on the hexavalent chromium groundwater concentrations and field observations during the activities to maximize the effectiveness of the injection activities. During previous investigation activities, bedrock was encountered at approximately 20 feet below the surface of the slab and approximately 10 feet below ground surface to the north of the slab and on the southern side of the lagoon area. The injection wells were constructed such that they generally extended between 10 and 15 feet into bedrock at each location. The depths are designed to intersect the impacted groundwater within the shallow bedrock. Previously, it was determined that this zone contained the highest concentrations of hexavalent chromium. The wells are designed to be as shallow as possible so that treatment can be targeted within this zone. In addition, the existing and newly installed overburden wells will be utilized for monitoring and injection activities for the impacted overburden groundwater.

The 2012 injection activities will target the areas identified for treatment in the 2012 Settlement Agreement as specified in Section 8.3(d) and as illustrated in Figure 6 in Attachment A of the Settlement Agreement and that was originally provided in the 2011 Engineering Evaluation/Cost Analysis (EE/CA) in Figure 6. Similar to the previous injection activities, the 2012 injection activities will be implemented by initially injecting beneath the former building slab to ensure complete treatment of the source area and then working progressively outwards towards the downgradient areas with detected hexavalent chromium concentrations. Depending on the evaluation of the recent injection point sampling activities, the initial injection wells will include as necessary, but not be limited to, SB-E SB-7, SB-12, SB-2008-15 (SB-15), SB-2008-17 (SB-17), SB-2008-18 (SB-18), SB-2008-20 (SB-20), SB-2010-22 (SB-22), SB-2010-24 (SB-24), SB-2010-25 (SB-25), SB-2010-26 (SB-26), SB-2010-27 (SB-27), IP-4, IP-8, IP-11, IP-12, IP-14, IP-15, IP-16, and IP-17. Following these wells, the injections will be performed in areas north of the former building slab that contained the highest concentrations of hexavalent chromium detected in the groundwater. During the injection activities, the surrounding points will be monitored to determine influence, and the quantity and concentration of CaSx will be adjusted accordingly. The concentrations of CaSx solution may be increased up to 5 percent in the center high concentration zones to maximize the chemical reduction activity. The injection wells are illustrated on Figure 9.

The overburden locations will be treated following the injection in the shallow bedrock. Based on geophysical data collected during the 2011 investigation activities, it is believed that the shallow bedrock groundwater is discharging into the overburden groundwater in the areas of OMW-13 and OMW-19 and is the source of the hexavalent chromium concentrations downgradient of OMW-13 and OMW-19. This area will be monitored during the shallow bedrock injection activities to determine if there is a connection between the units. Once the shallow bedrock injections activities have been substantially implemented, the injection activities in the overburden will be initiated. The initial injection points will include as necessary, but not be limited to, OMW-11, OMW-13, OMW-19, OMW-20, OMW-21, OMW-22 and SB-10. Following the injection at these locations, CaSx may be injected in additional overburden wells located between the former plant area and the Trolley Tracks. During the injection activities, the surrounding points will be monitored to determine influence, and the quantity and concentration of CaSx will be adjusted accordingly. The overburden injection points are illustrated on Figure 9.

The wells that will be used for injection will be fitted with well head caps to allow for injection under pressure and monitoring of flow, pressure and concentrations, as necessary. A diagram of the typical injection well construction is included as Figure 13.

The injection system is designed to inject the appropriate amount of CaSx solution under pressure into the shallow bedrock and overburden groundwater. The system will use make-up water from the on-site production well and mix it with the 29 percent CaSx feedstock to achieve the desired injection concentration. Prior to its use, the water from the production well will be sampled and analyzed for hexavalent chromium and total chromium. The CaSx solution will then be injected through a manifold system in up to ten wells at a time using gravity or plastic air-diaphragm pumps and centrifugal pumps with pressures up to a maximum of 60 pounds per square inch (psi). The injection flow rate in each well is anticipated to be approximately one to two gallons per minute.

As with the prior bedrock injection activities, the CaSx solution will be blended and mixed in two 2,500 gallon polyethylene mixing storage tanks. The CaSx solution will be injected into the overburden and shallow bedrock via pumping or delivered by gravity through a manifold system into injection wells installed in the contaminated areas. Secondary containment will be provided for the mixing storage tanks. The metering diaphragm pumps and injection manifold apparatus will be housed in a trailer located on site to protect the equipment from the elements. The centrifugal pumps and their distribution manifold will be located in the containment area adjacent to the above ground mixing tanks. The gravity feed manifold will be located adjacent to the wells being injected. Based on the previous injection activities, it has been determined that injection through a manifold system under pressure for injection points near the on-Site injection trailer and by gravity feeding for the downgradient wells will be appropriate methods for delivery of the calcium polysulfide solution.

As the CaSx solution is introduced into the injection points, the surrounding wells will be used as monitoring points. Groundwater levels, pH, and distance/time of CaSx progression from the injection points will be monitored in these locations. The monitoring points will also include the Seep Shed Treatment System (including associated seeps) and select, existing bedrock and overburden monitoring wells at the Site and along the Trolley Tracks. The proposed monitoring locations, parameters, and frequency are summarized in Table 2.

5.3.3 Injection Concentration, Frequency, Depth, and Volume

The calcium polysulfide will be received on Site in totes at a concentration of 29 percent. The CaSx feedstock will be diluted to concentrations ranging from one to five percent solution using make-up water obtained from the on-site production well. The diluted CaSx solution will then be injected into the injection points to treat the overburden and shallow bedrock beneath the Site. This concentration range is based on the existing hexavalent chromium levels in the shallow bedrock and groundwater.

Based on the 2011 injection volumes and most recent groundwater sampling analytical results, similar volumes of CaSx from 2010 and 2011 will be injected in 2012. Approximately 2,500 gallons of 29% solution will be injected into the shallow bedrock and 350 gallons of 29% solution will be injected in the overburden. The actual injection concentrations will be determined in the field based on the onsite monitoring activities and will range from 1% to 5% CaSx. The injection system is designed to inject the CaSx solution in up to ten wells at the same time with pressures up to 60 psi. The injection flow rate in each well is anticipated to be approximately one to two gallons per minute.

Confirmation sampling with analysis for hexavalent chromium will be performed in select monitoring wells and Ackerly Creek at the completion of the injection activities. The results of the surface water analyses will be compared to the 11 ug/l surface water standard for hexavalent chromium to determine if additional injection activities are required.

5.3.4 Permit Requirements

Since remedial activities will be conducted under CERCLA, Precision will not be required to obtain permits, but will comply with the substantive requirements for various permits as they have with previous remedial activities. The following is a list of permit requirements that have been considered:

- Erosion and Sedimentation control requirements for site disturbance;
- Underground Injection Control (UIC) requirements for injection into groundwater (EPA); and
- Local building permits and work ordinances.

5.3.4.1 Erosion and Sediment Control

Precision will not be disturbing any significant soil areas as part of these remedial activities. The development and implementation of erosion and sediment control measures are not necessary at this time.

5.3.4.2 Underground Injection Control

As discussed and presented in the previous injection workplans, Precision will be injecting CaSx into and above groundwater. Property owners (or their consultants) are required to contact EPA Region 3 and obtain approval from EPA before injecting or placing remediation materials or treated water into or above the groundwater under the UIC Program. The EPA UIC Program requires the submission of site/facility information typically provided in a remediation plan (name, location, address, site contact person, etc.). Information required by the UIC program includes the number and location (latitude and longitude) of the remediation wells, the extent of contamination and contaminants being treated, the remediation materials proposed for use and method of introduction into the groundwater, and the identification and location of all drinking water wells within a ¼-mile radius of the contaminated area being treated. The name of the PADEP contact (site Project Manager) and the PADEP Region Office should also be included. The approval by EPA for a remediation project typically constitutes a Rule Authorization Letter for a Class V well.

For this project, EPA approval of the work plan will be considered approval for injecting the CaSx. For the Precision remediation, the locations of the remediation well points are shown on Figure 9. The substantive information required by the UIC program with applicable background information is included as Appendix A.

Due to the proximity and continuing use of two potable wells located approximately 0.25 mile to the north of the Site, the frequency of sampling of these residential wells will be increased to twice a month once injection of calcium polysulfide begins. The samples will be analyzed for hexavalent chromium, total chromium, sulfate, sulfides, and pH. Preliminary lab results will be shared with the EPA as they are available. This increased sampling frequency will continue for one month following the injections. After that time, the sampling interval will return to semiannual.

5.3.4.3 Local Permits and Work Ordinances

In order to limit the impact of noise and traffic on the surrounding area, work will be limited to the hours of 7:30 am to 7:30 pm, Monday through Friday. Saturday work, if necessary, will be limited to 8:00 am to 4:30 pm. No work will be permitted on Sundays.

5.3.4.4 Health and Safety

Precision will continue to follow the site specific Health and Safety Plan (HASP) that was prepared in 2006 and updated in March 29, 2007 and September 16, 2011 in order to meet the requirements of the Occupational Health and Safety Act (OSHA) CFR 1910.120. The HASP, in addition to the standard requirements, will address the safe handling and injection of CaSx and other site-specific contingencies. The HASP also includes procedures for the air and odor monitoring plan described below to ensure that there are no impacts to off-site personnel and further described in the Standard Operating Procedure for Hydrogen Sulfide Perimeter Air Monitoring Activities prepared by ARCADIS and dated July 31, 2008. Dust monitoring and mitigation will be performed if any off-site migration of dust is detected, but dust generation is not expected as a result of the remedial activities.

5.3.5 Air Monitoring

When calcium polysulfide comes into contact with acids or acidic materials or is diluted with water, hydrogen sulfide (H_2S) gas is produced. Hydrogen sulfide gas is colorless, and at elevated concentrations can be toxic and flammable. It has a characteristic rotten egg odor. The odor alone cannot be used as an indicator of exposure to hydrogen sulfide, since hydrogen sulfide can be detected at very low levels [odor threshold of 0.5 parts per billion (ppb)] that are not harmful to health and the sense of smell can become rapidly fatigued (i.e., reduced) with continued exposure. The recommended exposure limit developed by the National Institute for Occupational Safety and Health (NIOSH) for H_2S is 10,000 ppb (time-weighted average concentrations for up to a 10-hour work day). The maximum permissible exposure limit established by the OSHA for H_2S is 20,000 ppb (time-weighted concentration not to be exceeded during any 8-hour work shift).

The CaSx injection activities will be performed in two general types of areas: areas below asphalt or concrete pavement (i.e., building slab) and areas with exposed surface soil (i.e., north of slab). Based on the depths of the treatment zones within the overburden and shallow bedrock groundwater, the anticipated low injection flow rates (approximately one to two gallons per minute in each well), and the observations of the prior bedrock injection activities, Precision anticipates minimal surfacing of calcium polysulfide. With little opportunity for exposure to air, rainwater, and sunlight, hydrogen sulfide generation should be minimal.

For the protection of the workers on Site and the nearest residents and to comply with the 2012 Settlement Agreement, Section 8.3(g), H_2S concentrations will be monitored surrounding the exclusion zone and at the Site perimeter. The H_2S concentrations will be compared to the ambient air action level for the general population of 30 ppb established by ATSDR for the previous injection activities. This concentration is two orders of magnitude below known health effects and is based on long term exposure.

H_2S ambient air action level	30 ppb

If an H_2S reading of 30 ppb or greater is identified on-Site, additional monitoring will be conducted at the Site perimeter (along the fence line) and along Arch Avenue to ensure that the hydrogen sulfide is not affecting the residences downgradient of the Site. If the H_2S concentrations at the Site perimeter or along Arch Avenue exceed 30 ppb, injection activities will be stopped temporarily until the source of the release can be located and mitigated. The mitigation measures may include reducing the emission rate of hydrogen sulfide at the point source and implementing air plume suppression techniques at the Site boundary.

5.3.5.1 Exclusion Zone Monitoring

As described in the HASP and Addendum for Calcium Polysulfide Injection Activities previously prepared by ARCADIS, continuous exclusion zone real-time ambient air monitoring will be conducted as necessary by ARCADIS during all work activities within the exclusion zone. The Exclusion Zone real-time ambient air monitoring details and action levels are summarized in Table 1 of the HASP. For hydrogen sulfide, the monitoring will be performed and evaluated relative to the NIOSH and OSHA acceptable exposure limits of 10,000 ppb and 20,000 ppb, respectively.

A handheld Jerome 631-X Hydrogen Sulfide Analyzer with a detection limit of 3 ppb will be used to obtain hourly H_2S measurements at locations surrounding the current injection area. Readings will continue for one hour after the injection work ends each day. In the event of any calcium polysulfide spill or surfacing, additional monitoring will occur surrounding the exposed calcium polysulfide. The approximate locations for the exclusion zone monitoring are shown on Figure 14.

5.3.5.2 Perimeter Air Monitoring

As requested by EPA with respect to the prior remediation, perimeter air monitoring will be conducted to confirm that fugitive emissions, if any, of H_2S leaving the Site are below action levels for residential neighborhoods (30 ppb). The perimeter monitoring will be performed on the property boundary of the Precision National Plating Services Site prior to the residential areas and along Arch Avenue. The monitoring will be performed manually with hand held instruments during the work day, as well as continuously electronically with monitoring stations installed on the Site boundary and along Arch Avenue. The manual monitoring will be limited to the typical work day (approximately 8:00 am to 6:00 pm) while calcium polysulfide is being injected and continue for one hour after the injection work ends each day. Manual monitoring along Arch Avenue will be performed every two hours during the work day. The electronic monitoring stations will collect perimeter air monitoring data 24 hours a day.

The electronic monitoring stations will consist of Jerome 651 stationary units, which include a Jerome 631-X Hydrogen Sulfide Analyzer with a detection limit of 3 ppb. The Jerome Analyzers will be programmed to record real time data on 10-minute intervals 24 hours per day. The data will be transmitted from the analyzers to a computer via radio modem, so it can be evaluated and saved electronically for future use. The electronic monitoring stations will be programmed to provide an alert via email and/or SMS text message (i.e., cellular phone text message) to the appropriate Site persons if there is a detection of H_2S above the 30 ppb action level. The perimeter monitoring units will also record meteorological data to document current conditions each day during the injection activities. As a supplement to the data being recorded electronically, the analyzers will be checked periodically and manual measurements will be recorded.

The electronic monitoring stations will be installed at two locations to collect perimeter air monitoring data. Air monitoring data will be collected at a fixed monitoring location on the northern property boundary between the Site and the residences located along Arch Avenue. In addition, a fixed monitoring station will be located at the end of Arch Avenue near the Trolley Tracks. These locations will provide air monitoring data to evaluate any potential impacts to the residences in the area throughout the remediation activities. The approximate locations of the perimeter air monitoring stations are shown on Figure 14

A handheld Jerome 631-X Hydrogen Sulfide Analyzer with a detection limit of 3 ppb will be available on site for manual readings in the event of a calcium polysulfide spill or surfacing of material. Surfacing is not anticipated since the treatment zone is below grade within the groundwater and the injection flow rate will be very low.

5.3.6 Performance Monitoring

5.3.6.1 Groundwater Monitoring

Precision will continue monitoring the groundwater, surface water, and seeps on a semi-annual basis in accordance with the existing monitoring plan and to comply with the 2012 Settlement Agreement, Section 8.3(e). To supplement these activities, a round of groundwater and surface water samples will also be collected approximately one month following the completion of each round of injection activities. During these post-injection sampling events, the injection points and other locations not monitored during the semi-annual events will also be sampled.

The results of the sampling events will be evaluated to determine the need for additional monitoring and/or additional rounds of injections with calcium polysulfide or another suitable reducing agent. The evaluation of the data will be performed following the injection event and based on the results Precision may elect to perform additional injection activities prior to the completion of the monitoring.

During the injection activities, the potential influence of the CaSx on the groundwater at the Site will be monitored at several permanent wells surrounding the injection area. Continuous monitoring probes will be installed in locations downgradient of the injection wells and in the collection sump in the Seep Shed. By monitoring the pH, dissolved oxygen, oxidation-reduction potential (ORP) and specific conductance of the groundwater, the movement of the calcium polysulfide through the bedrock aquifer and the creation of the desired reducing environment will be tracked. These field parameters will also be measured at additional groundwater and surface water locations on a periodic or as-needed basis throughout the injections. Also, sulfide and sulfate analysis will be added to the monthly sampling schedule for both the Lagoon and the Seep Shed Treatment Systems.

Due to the proximity and continuing use of two potable wells located approximately 0.25 mile to the north of the Site, these residential wells will be sampled twice a month once injection of calcium polysulfide begins. The samples will be analyzed for hexavalent chromium, total chromium, sulfate, sulfides, and pH. This increased sampling frequency will continue for one month following the injections. After that time, the sampling interval will return to semiannual.

The proposed monitoring locations, parameters, and frequency are summarized in Table 2.

5.3.6.2 Surface Water Monitoring

Precision will continue monitoring the surface water on a semi-annual basis in accordance with the existing monitoring plan. To supplement these activities, a round of surface water samples will also be collected approximately one month following the injection activities.

During the injection activities, the creek will be monitored for influence from the CaSx injections. Samples from several locations between and including SW-14 and SW-15 will be screened in the field for pH and ORP with a multi-parameter meter. A sample of surface water from each of the locations also will be screened for sulfides with a Hach test kit on a bi-weekly basis. Upgradient location SW-16 will also be field screened for pH, ORP, and sulfides every 2 weeks to provide background data. An additional sample from each of the screened locations will be sent to the laboratory monthly for hexavalent chromium, sulfate, and sulfide analysis. Brace’s Pond will also be monitored in the same fashion on a monthly basis during the injection activities. The proposed monitoring locations, parameters, and frequency are summarized in Table 2.

5.3.6.3 Monitoring of Treatment Systems

Precision will continue to operate the two water treatment systems on Site during the shallow bedrock remediation activities. CaSx, and the reducing environment it creates, can negatively impact the resin in the treatment systems. To ensure that the treatment resin maintains its efficiency, the pH of the lagoon influent will be screened periodically during the injection activities. The collection sump of the Seep Shed will have a probe installed for continuous monitoring of temperature, pH, dissolved oxygen, and specific conductance for the duration of the injection activities. Also, the water collecting in the lagoon area and in the Seep Shed sump will be visually inspected for the presence of CaSx daily. If at any time the concentration of CaSx or the pH becomes too high for the effective operation of the treatment systems, the systems will be shut down and any collected water will be contained for analysis and proper treatment.

To demonstrate the continued effective operation of the treatment systems, the monthly sampling of the Lagoon Treatment System and Seep Shed Treatment System will continue and will include analysis of the influents for sulfate and sulfide during the injection activities. Following this monitoring, the sampling will return to the regular sampling parameters at monthly intervals.

5.3.7 Reporting

Following the shallow bedrock ISCR activities, a report will be prepared to summarize the activities including the volume of material injected, the field monitoring data and an initial evaluation of the effects of the treatment. Groundwater monitoring will be initiated at the completion of the ISCR activities as described above. Semi-annual groundwater reports that summarize the monitoring results will be prepared and submitted to EPA following the completion of the ISCR injection activities and groundwater monitoring. The reports will summarize the data and monitor the effectiveness of the treatment activities.

6. Semi-annual Groundwater Monitoring

6.1 Monitoring Well Sampling Locations and Methodology

Monitoring wells on and surrounding the Precision Site will be sampled semi-annually to evaluate hexavalent chromium and total chromium concentrations. The list of locations to be monitored will include wells in the overburden unconsolidated aquifer as well as the shallow, intermediate, and deep bedrock layers. The wells have been selected to monitor the distribution of hexavalent and total chromium concentrations across the Site and downgradient to the Creek. The wells will be monitored to determine if the requirements of the Settlement Agreement are being achieved. The locations, construction details, and depths of each well to be sampled are presented in Table 1. Sampling will be performed in accordance with the Quality Assurance/Quality Control Monitoring and Sampling Plan (Section 11), which is based on the Ground Water Sampling Procedure, Low Stress (Low Flow) Purging and Sampling prepared by U.S. EPA Region II dated March 26, 1998.

The static water level in each well will be measured prior to sampling and recorded on individual well purge forms so that groundwater elevations may be calculated and groundwater contour maps produced for each sampling event. The monitoring wells will be purged using a stainless steel submersible pump with flow controller. Wells will be purged using the slow purge technique according to the EPA guidance, minimizing drawdown in the well. During the purging process, water quality indicators including pH, temperature, dissolved oxygen concentration, oxidation/reduction potential, specific conductance, and turbidity will be measured with a properly calibrated multi-parameter water quality meter outfitted with a flow-through cell and recorded on field forms. If there is insufficient water volume in the well to accomplish purging and stabilization of water quality parameters, a grab sample will be collected with a dedicated disposable bailer and the conditions of sampling will be noted on the field form.

Samples will be collected in laboratory-supplied clean sampling jars with the proper preservatives as necessary. All samples will be shipped in coolers to an EPA/PADEP certified laboratory under proper chain-of-custody procedures.

6.2 Sampling Parameters

As required by the Settlement Agreement, the groundwater samples collected will be analyzed by an EPA/PADEP certified laboratory for hexavalent chromium via U.S. EPA Method SW846 7196A and for total chromium by U.S. EPA Method 200.7.

6.3 Reporting

The analytical results of the semi-annual groundwater monitoring conducted pursuant to the Settlement Agreement will be presented in the quarterly progress reports as required by paragraph 8.7 of the Settlement Agreement.

7. Surface Water Monitoring

7.1 Surface Water Sampling Locations and Methodology

The EPA has selected Ackerly Creek as an endpoint for monitoring the contamination status and progress of the Removal Action at the Precision Site. Pursuant to the Settlement Agreement, Precision will monitor select locations in Ackerly Creek on a quarterly basis. The locations to be sampled are listed in Table 1.

Samples will be collected in laboratory-supplied clean sampling jars with the proper preservatives as necessary. All samples will be shipped in coolers to an EPA/PADEP certified laboratory under proper chain-of-custody procedures.

7.2 Sampling Parameters

As required by the Settlement Agreement, the surface water samples collected will be analyzed by an EPA/PADEP certified laboratory for hexavalent chromium via U.S. EPA Method SW 846 7196A and for total chromium by U.S. EPA Method 200.7. Additional monitoring of Ackerly Creek will be conducted during the in situ chemical reduction activities; parameters may include sulfate, sulfide, and water quality indicators such as pH.

7.3 Reporting

The analytical results of the quarterly surface water monitoring conducted pursuant to the Settlement Agreement will be presented in the quarterly progress reports as required by paragraph 8.7 of the Settlement Agreement.

8. Potable Well Sampling

8.1 Potable Well Sampling Locations and Methodology

Residential potable wells in the vicinity of the Precision Site will be sampled semi-annually as put forth in paragraph 8.3 of the Settlement Agreement. The locations, construction details, and depths of each well to be sampled are presented in Table 1. In addition, during the in situ chemical reduction activities, the residential wells will be monitored with increased frequency and for additional parameters.

Samples will be collected in laboratory-supplied clean sampling jars with the proper preservatives as necessary. All samples will be shipped in coolers to an EPA/PADEP certified laboratory under proper chain-of-custody procedures.

8.2 Sampling Parameters

As required by the Settlement Agreement, the potable well samples collected will be analyzed by an EPA/PADEP certified laboratory for hexavalent chromium via U.S. EPA Method SW846 7196A and for total chromium by U.S. EPA Method 200.7. During the in situ chemical reduction activities, the residential wells will be monitored with increased frequency and additional parameters, including sulfate and sulfide, will be added to the monitoring.

8.3 Reporting

The analytical results of the potable well monitoring conducted pursuant to the Settlement Agreement will be presented in the quarterly progress reports as required by paragraph 8.7 of the Settlement Agreement.

9. Institutional Controls/Limitations on Use of Groundwater

As stated in paragraph 8.3h of the Settlement Agreement, groundwater within the contaminated plume shall not be used for drinking water until the MCL for total chromium (100 ug/L) is achieved. The limitation of use of groundwater will be accomplished through institutional controls including, but not limited to, easements, deed notices, zoning restrictions, or other appropriate means. The work proposed to evaluate and implement the potentially available institutional controls to prohibit groundwater use is described in the following sections.

9.1 Assessment of Water Supply for Properties with Potentially Impacted Groundwater

As a first step in identifying potentially available institutional controls to prohibit groundwater use within the affected area until the MCL for total chromium is met, all parcels located within the affected area and the owners of those parcels will be identified. Thereafter, the current water supply status of each parcel will be identified. In particular, the assessment will determine (1) whether each parcel currently has a water supply and (2) whether that supply is public water or a well. Precision will submit a report to EPA within 90 days of EPA's approval of the RAP which will describe the results of the assessment, including figures showing parcels within the area where total chromium in groundwater is known to exceed the MCL, together with their ownership and water supply status.

9.2 Screening of Potentially Available Institutional Controls

Following EPA's approval of the report prepared in Section 9.1, Precision will evaluate potentially available institutional controls, relying on EPA guidance for institutional controls at Superfund and RCRA corrective action clean-ups. The screening will identify institutional controls that are legally available and suited to the properties and current water supply status determined in Section 9.1. Because of the separate audiences involved, institutional controls which would be implemented by private parties; e.g. by agreement between a landowner and Precision, will be screened separately from public institutional controls that would be implemented by a government agency, such as a township or EPA. Precision will submit a report to EPA within 90 days of EPA's approval of the water supply status report prepared in Section 9.1, which will rank potentially available private and public institutional controls based on their (1) legal availability, (2) implementability for the properties requiring them and (3) effectiveness.

9.3 Review Available Private Alternatives With Property Owners

Following EPA's approval of the report prepared in Section 9.2, Precision will review any private alternatives, determined to be available and effective in the screening described in Section 9.2 with the affected landowners. As appropriate, Precision will prepare documents reflecting the institutional controls identified in Section 9.2 as being potentially available for review by EPA and the landowners. Precision will inform EPA of landowner responses and, based on those responses, provide EPA with an assessment of the overall effectiveness of the identified private alternatives with respect to prohibiting ground water use within the affected area.

9.4 Review Public Alternatives With EPA and PADEP

Following EPA's approval of the report prepared in Section 9.2, Precision will meet with EPA and PADEP to discuss any available and highly ranked public alternatives identified in the report. A comparison will be made of the respective implementability and effectiveness of the available private and public alternatives. In particular, a determination will be made regarding the availability and effectiveness of institutional controls requiring implementation by local government.

9.5 Review of Available Public Alternatives with Glenburn Township

Following EPA's approval of the report prepared in Section 9.2, Precision, EPA and PADEP will meet with Glenburn Township to discuss any available and highly ranked public alternatives requiring implementation by local government identified in the report.

9.6 Final Report

Precision will prepare a final report describing the selected institutional control(s) following the assessments made in the prior steps and any issues that arise with respect to its/their implementation.

10. Reporting

All reports and related documents prepared pursuant to the Settlement Agreement will be submitted by e-mail and/or overnight mail to the EPA Project Coordinator as specified in paragraph 8.8 of the Settlement Agreement. As stated in paragraph 8.9 of the Settlement Agreement, all reports and plans submitted to EPA to satisfy the requirements of the Settlement Agreement are subject to EPA approval and, once approved, will be incorporated into the Settlement Agreement.

10.1 Quarterly Progress Reports

In accordance with paragraph 8.7 of the Settlement Agreement, beginning seven calendar days following the receipt of approval of this RAP by EPA and every 90 calendar days thereafter, Precision will prepare and submit a progress report to the EPA. The progress reports will provide a report of the activities of the prior 90 days, or longer interval as determined in writing by the EPA Project Coordinator designated in Section IX of the Settlement Agreement. The submission of progress reports will continue until EPA advises Precision that the Work outlined in the Settlement Agreement is complete. At a minimum, the progress reports will include:

- A description of the response action completed and the actions that have been taken toward achieving compliance with the Settlement Agreement;
- A description of all data anticipated and all activities scheduled for the next 90 calendar days, or, if applicable, the period designated in writing by the EPA Project Coordinator;
- A description of any problems encountered or anticipated;
- Any actions taken to mitigate such problems;
- A schedule for completion of such actions;
- Copies of all analytical data received during the reporting period;
- All modifications to the response action, RAP, and schedule made in accordance with Section XIV of the Settlement Agreement during the reporting period.

10.2 Investigation and In-situ Chemical Reduction Reports

In addition to the progress reports specified in paragraph 8.7 of the Settlement Agreement, Precision will prepare and submit reports to the EPA documenting the additional investigation and in situ chemical reduction activities described in Sections 4 and 5 of this RAP. As stated in Section 9.6 above, a report will also be prepared and submitted to the EPA to document the assessment activities and implementation of institutional controls to prohibit the use of groundwater within the contaminated plume for drinking water until the MCL for total chromium has been achieved.

All reports and related documents will be submitted by e-mail and/or overnight mail to the EPA Project Coordinator as specified in paragraph 8.8 of the Settlement Agreement. As stated in paragraph 8.9 of the Settlement Agreement, all reports and plans submitted to EPA to satisfy the requirements of the Settlement Agreement are subject to EPA approval and, once approved, will be incorporated into the Settlement Agreement.

10.3 Final Report

Precision will prepare and submit a Final Report to the EPA within 20 calendar days of the date Precision concludes it has completed the implementation of this RAP and addressed the items in paragraph 8.3 of the Settlement Agreement. In accordance with the terms of Section XXII of the Settlement Agreement, the Final Report will detail the work undertaken to implement the RAP and address the items in paragraph 8.3 and will be certified by Precision or a responsible official of Precision. The Final Report will be subject to EPA approval as stated in paragraph 8.9 of the Settlement Agreement.

11. Quality Assurance/Quality Control Monitoring and Sampling Plan

A Quality Assurance/Quality Control Monitoring and Sampling Plan has been prepared for the activities proposed in this RAP and is included in Appendix B.

12. Site-Specific Health and Safety Plan

All proposed field activities will be conducted in accordance with the ARCADIS Site-specific Health and Safety Plan (HASP) maintained at ARCADIS' Branchburg, New Jersey office. This HASP will be updated to cover additional work when required.

13. Schedule for Completion of Removal Response Action

The activities proposed in this RAP will be implemented following EPA approval. It is anticipated that EPA will review and approve the RAP by July 2012, Based on that date, a tentative schedule for the implementation of the Work proposed in this RAP is provided below.

· Submittal of RAP	June 2012
· EPA Approval of RAP	July 2012
· Submittal of First Quarterly Progress Report (see Section 10.1)	August 2012
· Supplemental Investigation Activities (see Section 4)	Summer 2012
· Identification of Water Supplies (see Section 9.1)	Summer 2012
· Evaluation of Institutional Control Alternatives (Section 9.2)	Fall 2012
· First round of ISCR Injections (see Section 5)	Fall 2012
· Post-injection Monitoring (see Section 5.3.6)	January 2013
· Meetings with EPA, PADEP, and Township officials regarding Institutional Controls (see Sections 9.4 and 9.5)	late 2012
· Final Institutional Control Report	Spring 2013
· Semi-annual Groundwater Monitoring Events	Oct. 2012, Apr./Oct. 2013
· Quarterly Surface Water Monitoring	Jul./Oct. 2012, Jan./Apr./Jul/Oct. 2013
· ISCR Remedial Action Report	Spring 2013

The schedule is dependent on regulatory approvals, access, weather and other factors, and will be modified and updated accordingly during the implementation of the RAP.

ARCADIS

Tables

Table 1
Ground Water, Surface Water, and Seep Monitoring Locations
Precision National Plating Services, Inc. - Clarks Summit, PA

Sample ID	Location	Installation Date	Monitoring Zone	Post-Treatment Analysis	Number of Sample bottles required	Well Diameter (inches)	Well Construction	Total Depth (ft bgs)	Depth of Casing (ft bgs)	Significant Water Producing Zones (ft bgs)	Monitoring Interval (ft bgs)		Sampling Point (ft btoc)	Top of Bedrock (ft bgs)
											Top	Bottom		
AGM-2S	Trolly Track near Michaelangelo's	12/22/1998	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	130	17	115	17	130	117	7
AGM-2I	Trolly Track near Michaelangelo's	12/29/1998	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	190	150	171,183,186,190	150	190	173	7
AGM-3S	Trolly Track near trail to Seep Shed	12/30/1998	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	110	18	110	18	110	107	9
AGM-3I	Trolly Track near trail to Seep Shed	1/5/1999	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	200	130	177-180	130	200	179	9
AGM-4S	Trolly Tracks near Arch Avenue	1/6/1999	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	90	18	70	18	90	72	8
AGM-4I	Trolly Tracks near Arch Avenue	1/8/1999	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	147	110	127	110	147	130	8
MW-8S	End of Arch Avenue near Trolly Track	7/28/2008	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	40	30	ND	30	40	35	10
AGM-5S	Ballfield near turn in Ackerly Creek	12/21/1998	Overburden	Hex Chrome, Total Chromium	2	4	Open Borehole	19	9	ND	9	19	17	19
AGM-5I	Ballfield near turn in Ackerly Creek	12/18/1998	Bedrock	Hex Chrome, Total Chromium	2	4	Artesian	100	27	94	27	100	94	19
MW-3S ^	Precision (upgradient of former encapsulation vault)	1/30/2009	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	85	65	74-76, 82	65	85	76	ND
MW-3D ^	Precision (upgradient of former encapsulation vault)	1/30/2009	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	126	110	117	110	126	119	ND
MW-4S	Precision (at front of former building)	10/31/2002	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	195	185	190	185	195	188	ND
MW-4D	Precision (at front of former building)	10/31/2002	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	335	325	330	325	335	328	ND
MW-AS ^	Precision (downgradient of former encapsulation vault)	1/30/2009	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	90	70	83	70	90	83	1
MW-AD ^	Precision (downgradient of former encapsulation vault)	1/30/2009	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	152	127	130, 150	127	152	142	1
MW-BS ^	Precision (adjacent to former lagoon)	1/30/2009	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	90	70	ND	70	90	82	28.5
MW-BD ^	Precision (adjacent to former lagoon)	1/30/2009	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	128	110	110-116, 126	110	128	121	28.5
MW-C	Precision (upgradient of former building)	6/24/1991	Bedrock	Hex Chrome, Total Chromium	2	6	Open Borehole	191	25	ND	25	191	138	1
MW-9S	Ackerly Creek, south bank	5/5/2010	Bedrock	Hex Chrome, Total Chromium	2	2	Open Borehole	30	20		20	30	25	15
MW-10S	Paper Road, north of Site (west, closer to power line easement)	5/12/2010	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	43	28		28	43	35	23
MW-10I	Paper Road, north of Site (west, closer to power line easement)	5/7/2010	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	100	85		85	100	93	23
MW-11S	Paper Road, north of Site (east, closer to Ackerly Road)	9/26/2011	Bedrock	Hex Chrome, Total Chromium	2	2	Open Borehole	43						25
MW-11I	Paper Road, north of Site (east, closer to Ackerly Road)	TBD	Bedrock	Hex Chrome, Total Chromium	2	TBD	TBD	TBD	TBD				TBD	TBD
MW-12S	Precision (northwest, between former Plant Area and Trolly Track)	9/26/2011	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	30	20		20	30	25	18
MW-12I	Precision (northwest, between former Plant Area and Trolly Track)	9/27/2011	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	100	85		85	100	93	72
MW-14S	Ackerly Creek, south bank near ruin and bridge	9/28/2011	Bedrock	Hex Chrome, Total Chromium	2	4	Open Borehole	24	14		14	24	19	12
MW-15S	Ackerly Creek, south bank near SW-14BC2 (Proposed)	TBD	Bedrock	Hex Chrome, Total Chromium	2	TBD	TBD	TBD	TBD				TBD	TBD
MW-21S	Precision (Lagoon area, along southern fence) (Proposed)	TBD	Bedrock	Hex Chrome, Total Chromium	2	TBD	TBD	TBD	TBD					TBD
Res-1	Arch Avenue residential well	1991**	Bedrock	Hex Chrome, Total Chromium	2	6	Residential Spigot	178	150	ND	150	178	ND	ND
Res-2	Ackerly Road residential well	1979**	Bedrock	Hex Chrome, Total Chromium	2	ND	Residential Spigot	147	85	ND	85	147	ND	ND
OMW-2		9/25/2003	Overburden	Hex Chrome, Total Chromium	2	2	PVC	13	8	11	8	13	12	13
OMW-3	Precision (in the former lagoon)	9/30/2005	Overburden	Hex Chrome, Total Chromium	2	2	PVC	6.5	1.5	6	1.5	6.5	6	6.5
OMW-4	Precision (downgradient of OMW-2)	9/22/2003	Overburden	Hex Chrome, Total Chromium	2	2	PVC	13	8	11.32	8	13	12	13
OMW-6	Precision (adjacent to former lagoon)	9/29/2003	Overburden	Hex Chrome, Total Chromium	2	2	PVC	14	9	12	9	14	13	14
OMW-11	Precision (on building slab near NE corner and MW-4)	9/24/2003	Overburden	Hex Chrome, Total Chromium	2	2	PVC	21	16	18.2	16	21	19	21
OMW-13	Precision (outside main entrance along fence line)	9/26/2003	Overburden	Hex Chrome, Total Chromium	2	2	PVC	19	14	16.6	14	19	17	20
OMW-14	End of Arch Avenue near Trolly Track	7/28/2008	Overburden	Hex Chrome, Total Chromium	2	2	PVC/Screen	10	4	ND	4	10	7	10
OMW-15	Ackerly Creek, south bank	5/5/2010	Overburden	Hex Chrome, Total Chromium	2	2	PVC	10	3	7	3	10	8	15
OMW-16	Paper Road, north of Site (west, closer to power line easement)	5/6/2010	Overburden	Hex Chrome, Total Chromium	2	2	PVC	24	14	17.8	14	24	19	24
OMW-17	Paper Road, north of Site (east, closer to Ackerly Road)	5/12/2010	Overburden	Hex Chrome, Total Chromium	2	2	PVC	27.5	12.5	17.8	12.5	27.5	20	27.5
OMW-18	Precision (main entrance along Ackerly Road)	5/3/2010	Overburden	Hex Chrome, Total Chromium	2	2	PVC	15	5	10	5	15	11	15
OMW-23	Precision (northwest, between former Plant Area and Trolly Track)	9/25/2011	Overburden	Hex Chrome, Total Chromium	2	2	PVC/Screen	18	8		8	18	13	18
OMW-24	Ackerly Creek, south bank near ruin and bridge	9/27/2011	Overburden	Hex Chrome, Total Chromium	2	2	PVC/Screen	10	0		0	10	5	10
OMW-25	Ackerly Creek, south bank near SW-14BC2 (Proposed)	TBD	Overburden	Hex Chrome, Total Chromium	2	TBD	PVC/Screen	TBD	TBD		TBD	TBD	TBD	TBD
OMW-26	Trolly Track, near AGM-4S and AGM-4I (Proposed)	TBD	Overburden	Hex Chrome, Total Chromium	2	TBD	PVC/Screen	TBD	TBD		TBD	TBD	TBD	TBD
OMW-28	Trolly Track, near AGM-3S and AGM-3I (Proposed)	TBD	Overburden	Hex Chrome, Total Chromium	2	TBD	PVC/Screen	TBD	TBD		TBD	TBD	TBD	TBD
MW-B01S ^	Precision (in former building area - EPA Well)	1/29/2009	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	90	80	88	80	90	86	28
MW-B01D ^	Precision (in former building area - EPA Well)	1/30/2009	Bedrock	Hex Chrome, Total Chromium	2	2	PVC/Screen	121	111	114	111	121	117	28
SB-2008-1	Precision (East of former building)	6/4/2008	Bedrock	Hex Chrome, Total Chromium	2	2	Open Borehole	32 (50)	22 (19.5)	ND	22 (19.5)	32 (50)	29 (45)	19.5
SB-2008-2	Precision (South of former Rectifier Room)	6/4/2008	Bedrock	Hex Chrome, Total Chromium	2	2	Open Borehole	47	13	ND	13	47	42	13
SB-2008-6	Precison (Lagoon Area)	3/12/2008	Bedrock	Hex Chrome, Total Chromium	2	2	Open Borehole	30/34	24		24	34	29	30
SB-2008-10	Precision (Lagoon Area, along southern fence)	3/17/2008	Overburden	Hex Chrome, Total Chromium	2	2	PVC/Screen	15.5	10	ND	10	15	14	15.5
Lagoon System Influent	Lagoon Treatment System Inlet		Seeps	Hex Chrome, TAL Metals	2									
Lagoon Post Lead	Lagoon Treatment System - Effluent of Lead Tank		Seeps	Hex Chrome, Total Chromium	2									
Lagoon System Effluent	Lagoon Treatment System Outlet		Seeps	Hex Chrome, TAL Metals	2									
Seep Shed Influent	Seep Shed System Inlet		Seeps	Hex Chrome, Total Chrome	2									
Seep Shed Mid	Seep Shed System - Between Resin Tanks		Seeps	Hex Chrome, Total Chromium	2									
Seep Shed Effluent	Seep Shed System Outlet		Seeps	Hex Chrome, Total Chrome	2									
SW-10	Ackerly Creek (downgradient of confluence with unnamed tributary)		Surface Water	Hex Chrome, Total Chromium	2									
SW-14	Ackerly Creek (upgradient of confluence with unnamed tributary)		Surface Water	Hex Chrome, Total Chromium	2									
SW-14BC2	Ackerly Creek		Surface Water	Hex Chrome, Total Chromium	2									
SW-14DE	Ackerly Creek		Surface Water	Hex Chrome, Total Chromium	2									
SW-14G	Ackerly Creek (50' downstream of SW-15)		Surface Water	Hex Chrome, Total Chromium	2									
SW-15	Ackerly Creek (upgradient of bridge near Seep Shed)		Surface Water	Hex Chrome, Total Chromium	2									
SW-16	Ackerly Creek (upgradient of Ackerly Road bridge)		Surface Water	Hex Chrome, Total Chromium	2									
BRP-1	Brace's Pond (Michaelangelo's Restaurant 894 Old State Road)		Surface Water	Hex Chrome, Total Chromium	2									
SWALE-U	Ackerly Road drainage ditch, south of lagoon gate		Surface Water	Hex Chrome, Total Chromium	2									
SWALE-M	Ackerly Road drainage ditch, corner of fence by French Drain Sump		Surface Water	Hex Chrome, Total Chromium	2									
SWALE-D	Ackerly Road drainage ditch, utility pole north of lagoon		Surface Water	Hex Chrome, Total Chromium	2									

Notes:

ft bgs	Feet below ground surface
ft btoc	Feet below top of casing
ft msl	Feet above mean sea level
ND	No Data available
**	Exact date not known
(#)	Former depth; well has been modified after initial installation
^	Modified well installed within former well location in order to monitor discrete zones.
TBD	To be determined when proposed well is installed

Note: Proposed monitoring locations have been updated based on recent samplng results and well installation activities.

Table 2
ISCR Field Monitoring Locations
Precision National Plating Services, Inc. - Clarks Summit, PA

Sample ID	Location	Installation Date	Monitoring Zone	Field Monitoring During Treatment/ Frequency	Laboratory Analysis During Treatment	Frequency of Sampling
Bedrock Wells						
AGM-2S	Trolly Track near Michaelangelo's	12/22/1998	Bedrock	pH, ORP, Cond. / Weekly		
AGM-3S	Trolly Track near trail to Seep Shed	12/30/1998	Bedrock	pH, ORP, Cond./ Weekly		
AGM-4S	Trolly Tracks near Arch Avenue	1/6/1999	Bedrock	pH, ORP, Cond. / Weekly		
MW-8S	End of Arch Avenue near Trolly Track	7/28/2008	Bedrock	pH, ORP, Cond./Weekly		
MW-9S	Adjacent to Ackerly Creek	5/5/2010	Bedrock	pH, ORP, Cond. / Weekly		
MW-10S	Along Paper Road	5/12/2010	Bedrock	pH, ORP, Cond. / Weekly		
MW-12S	Hill at northwest corner of Site, towards Seep Shed	9/26/2011	Bedrock	pH, ORP, Cond. / Continuous		
MW-13S	Precision (North of Lagoon Treatment Shed)	9/26/2011	Bedrock	pH, ORP, Cond. / Continuous		
MW-14S	Adjacent to Ackerly Creek, near ruin	9/26/2011	Bedrock	pH, ORP, Cond. / Continuous		
Overburden Wells						
OMW-3	Precision (Lagoon Area)	9/30/2003	Overburden	pH, ORP, Cond. / Continuous		
OMW-13	Precision (Northeast of building slab)	9/26/2003	Overburden	pH, ORP, Cond./ As needed		
Residential Wells						
Res-1	Arch Avenue Residential well	1991	Bedrock		Hex Chrome, Total Chrome, Sulfide, Sulfate	Biweekly
Res-2	Ackerly Road Residential Well	1979	Bedrock		Hex Chrome, Total Chrome, Sulfide, Sulfate	Biweekly
Treatment Systems						
Lagoon System Influent	Lagoon Treatment System Inlet		Seeps	pH, ORP, Cond. / Weekly	Hex Chrome, TAL Metals, Sulfide, Sulfate	Monthly
Lagoon Post Lead	Lagoon Treatment System - Effluent of Lead Tank		Seeps		Hex Chrome, Total Chrome	Monthly
Lagoon System Effluent	Lagoon Treatment System Outlet		Seeps		Hex Chrome, TAL Metals	Monthly
Seep Shed Influent	Seep Shed System Inlet		Seeps	pH, ORP, Cond. / Continuous	Hex Chrome, Total Chrome, Sulfide, Sulfate	Monthly
Seep Shed Mid	Seep Shed System - Between Resin Tanks		Seeps		Hex Chrome, Total Chrome	Monthly
Seep Shed Effluent	Seep Shed System Outlet		Seeps		Hex Chrome, Total Chrome	Monthly
Surface Water						
SW-14	Ackerly Creek (upgradient of confluence with unnamed tributary)		Surface Water	pH, ORP, Cond., Sulfide / Biweekly	Hex Chrome, Sulfate, Sulfide	Biweekly
SW-15	Ackerly Creek (upgradient of bridge near Seep Shed)		Surface Water	pH, ORP, Cond., Sulfide / Biweekly	Hex Chrome, Sulfate, Sulfide	Biweekly
SW-16	Ackerly Creek (upgradient of Ackerly Road bridge)		Surface Water	pH, ORP, Cond., Sulfide / Biweekly	Hex Chrome, Sulfate, Sulfide	Biweekly
BRP-1	Brace's Pond (Michaelangelo's Restaurant 894 Old State Road)		Surface Water	pH, ORP, Cond., Sulfide / Monthly	Hex Chrome, Sulfate, Sulfide	Monthly
2008 Installed Borings						
SB-2007E	Precision (In former building area - north side of slab)	2/27/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-1	Precision (East of former building)	2/27/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-2	Precision (South of former Rectifier Room)	2/27/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-3	Precision (South of former Rectifier Room)	2/29/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-4	Precision (Outside West gate)	3/14/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-5	Precision (Outside West gate of Lagoon)	3/13/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-6	Precision (Lagoon Area)	3/12/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-7	Precision (Northwest of building slab	3/6/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-8	Precision (North of building slab)	3/5/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-9	Precision (Northeast of building slab)	3/7/2008	Bedrock	pH, ORP, Cond. / As needed		
SB-2008-10	Precision (Lagoon Area, along southern fence)	3/17/2008	Overburden	pH, ORP, Cond. / As needed		

Figures

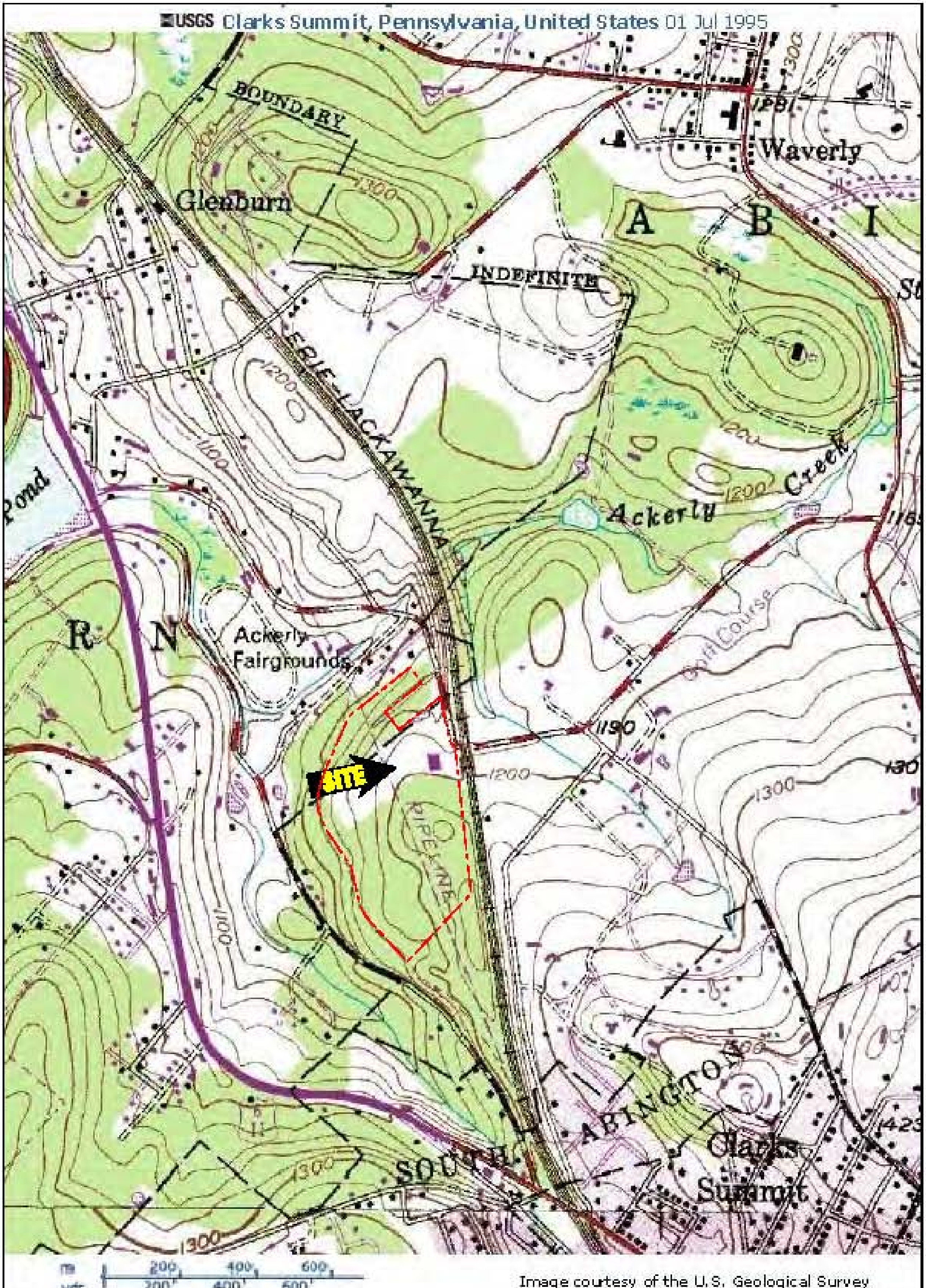

Image courtesy of the U.S. Geological Survey

ARCADIS

ARCADIS U.S., INC.

PRECISION NATIONAL PLATING SERVICES, INC. • 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

SITE LOCATION MAP

ARCADIS Project No.
[illegible]

Date
[illegible]

ARCADIS
36 COLUMBIA ROAD
BRANCHBURG, NEW JERSEY
TEL. [illegible]

1

CITY: MANCHESTER DIV/GROUP: ENVCAD DB: T.HALLIWELL PM: L.BRUNT TM: L.BRUNT
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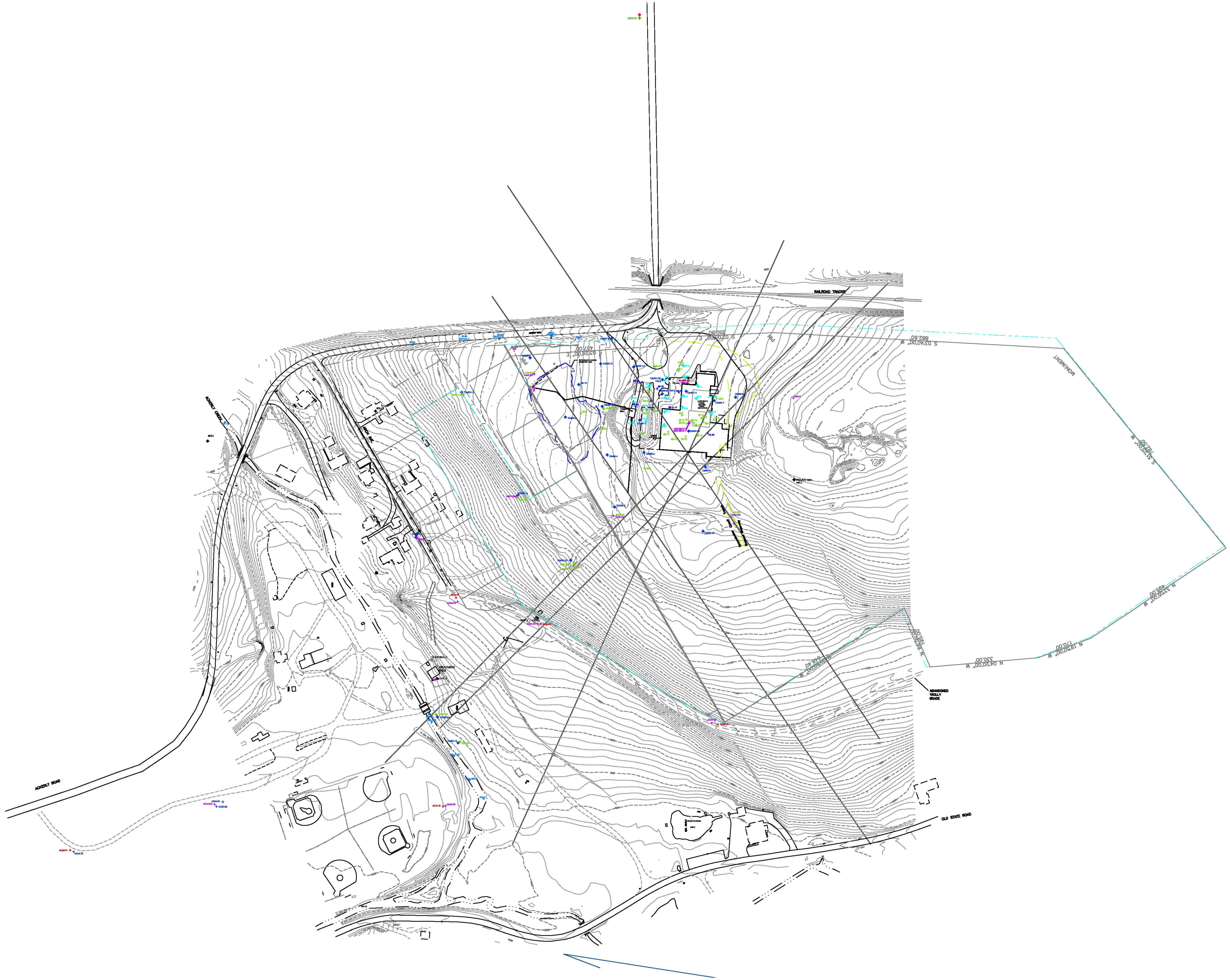

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- PATH/TRAIL
- FENCE
- GROUNDWATER INTERCEPTOR TRENCH
- FRACTURE TRACE (FROM R.E. WRIGHT, 1978)
- OVERBURDEN MONITORING WELL
- SHALLOW BEDROCK INJECTION LOCATIONS
- SHALLOW BEDROCK MONITORING WELL
- INTERMEDIATE BEDROCK MONITORING WELL
- DEEP BEDROCK MONITORING WELL
- PRODUCTION/POTABLE WELL
- MAY 2010 ROCK BORINGS/TEMPORARY MONITORING WELLS
- SURFACE WATER SAMPLE LOCATIONS

TW = TEMPORARY WELL LOCATION

NOTES:
1. ALL LOCATIONS SURVEYED BY DPK CONSULTING, LLC.THE LOCATIONS OF THE SWALE SAMPLES HAVE BEEN MODIFIED TO REFLECT THE OVERLAY OF ACKERLY ROAD.

2. OMW-15 WAS INSTALLED IN WEATHERED ROCK DUE TO LIMITED OVERBURDEN MATERIAL.

160' 0 160' 320'
Graphic Scale

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

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Professional Engineer's Name		
Professional Engineer's No.		
State	Date Signed	Project Mgr. LGB
Designed by LGB	Drawn by TPH	Checked by SWI

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PRECISION NATIONAL PLATING SERVICES, INC. • 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

SITE PLAN

ARCADIS Project No. BB014215.0005.00011

Date 05/25/2012

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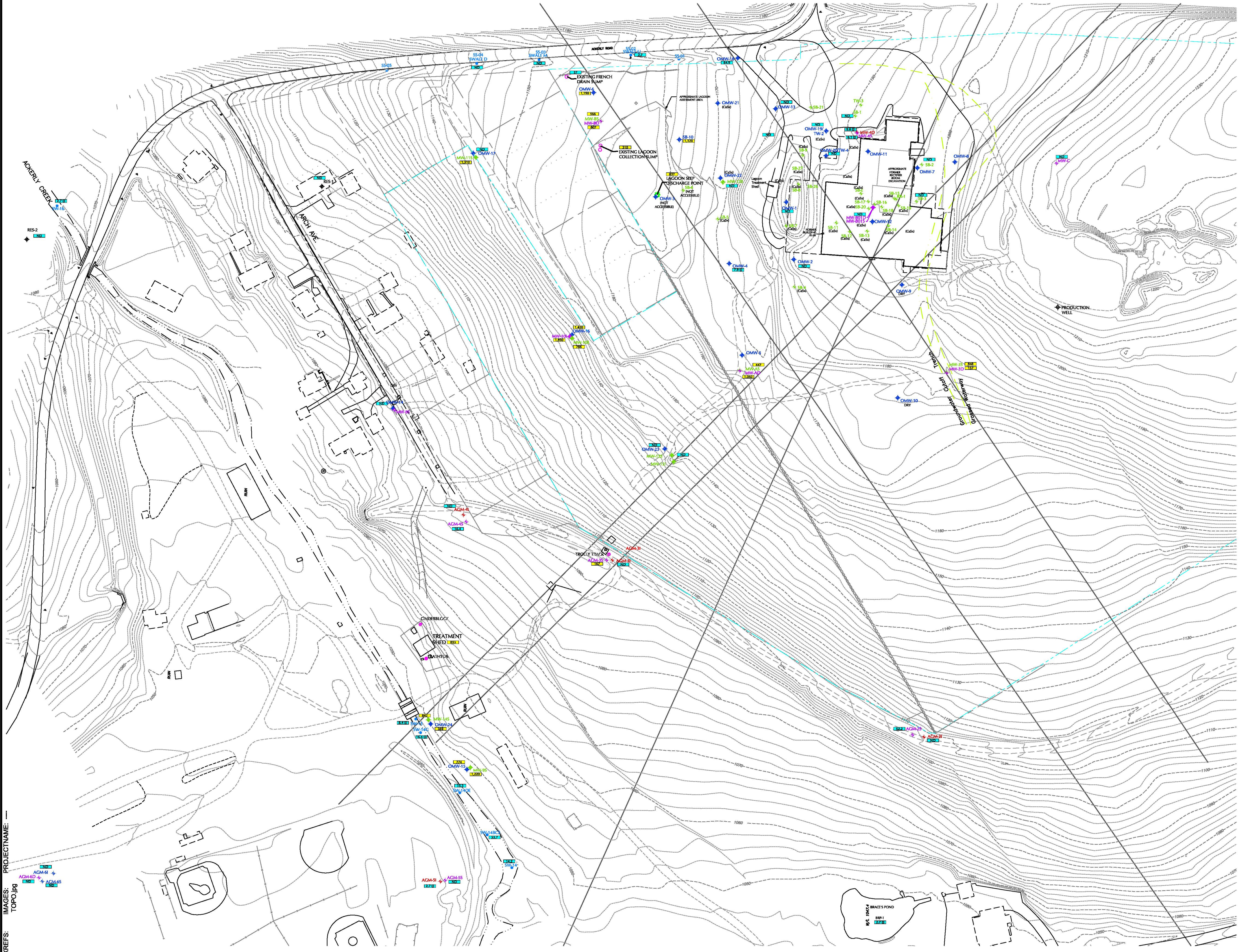
2



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- DEEP BEDROCK MONITORING WELL
- PRODUCTION/POTABLE WELL
- MAY 2010 ROCK BORINGS/TEMPORARY MONITORING WELLS
- SURFACE WATER SAMPLE LOCATIONS

ND	C+6r CONCENTRATIONS LESS THAN OR EQUAL TO 100 ug/l. ND= NOT DETECTED
X	Cr+6 CONCENTRATIONS GREATER THAN 100 ug/l LESS THAN 5,000 ug/l.
X	Cr+6 CONCENTRATIONS GREATER THAN 5,000 ug/l LESS THAN 30,000 ug/l.
X	Cr+6 CONCENTRATIONS GREATER THAN 30,000 ug/l LESS THAN 100,000 ug/l.

MW-3S = SHALLOW MONITORING ZONE
MW-3D = DEEPER MONITORING ZONE
TW = TEMPORARY WELL LOCATION
ND = NOT DETECTED
J = ESTIMATED VALUE
CaSx = CALCIUM POLYSULFIDE PRESENT IN WELL; NOT SAMPLED

NOTES:
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80' 0 80' 160'
Graphic Scale

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Professional Engineer's Name		
Professional Engineer's No.		
State	Date Signed	Project Mgr. LGB
Designed by LGB	Drawn by TPH	Checked by SWI

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PRECISION NATIONAL PLATING SERVICES, INC., 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN SURFACE WATER AND GROUNDWATER - JANUARY 2012

ARCADIS Project No. BB014215.0003.00007
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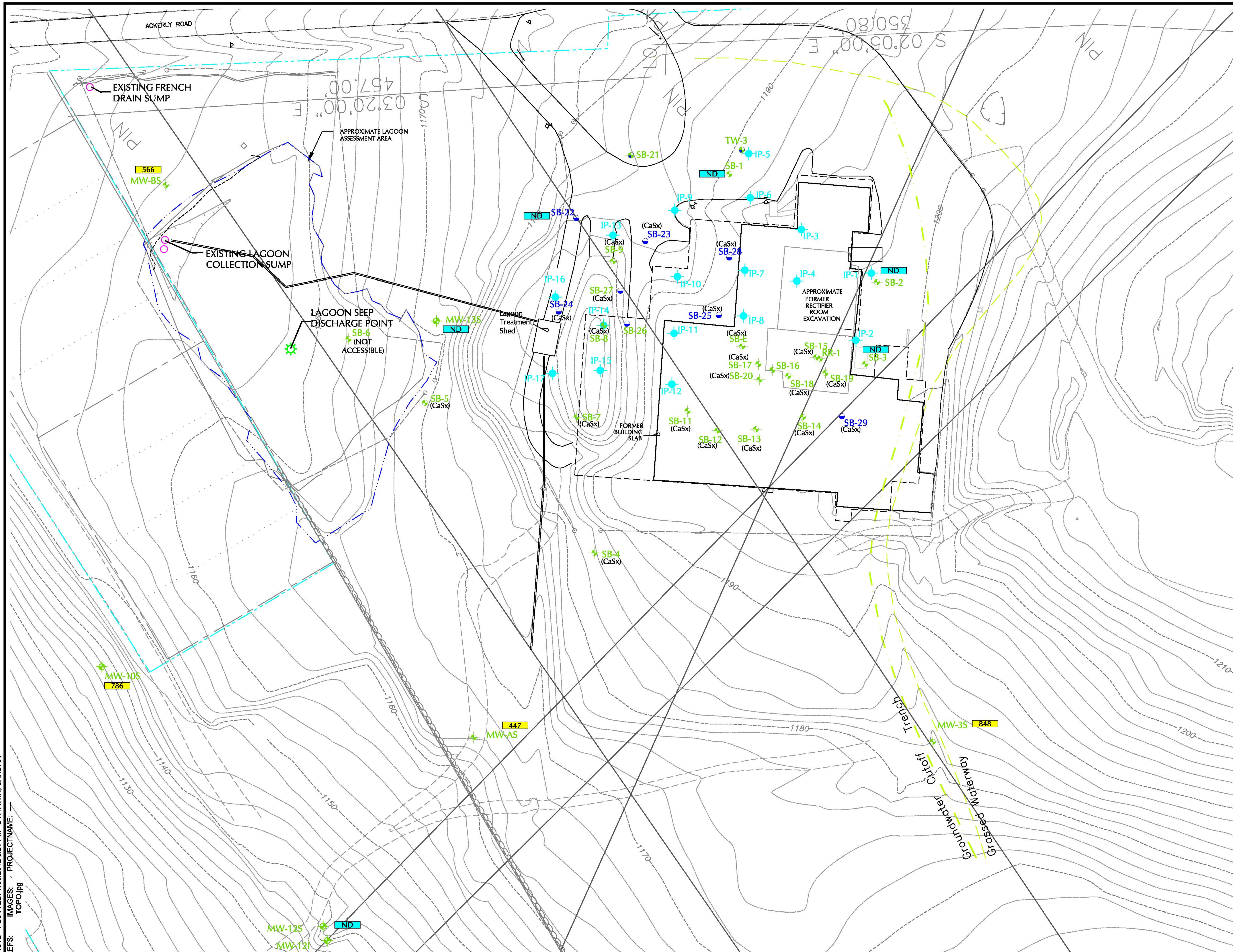

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- PATH/TRAIL
- FENCE
- GROUNDWATER INTERCEPTOR TRENCH
- FRACTURE TRACE (FROM R.E. WRIGHT, 1978)
- SHALLOW BEDROCK MONITORING WELL
- SHALLOW BEDROCK INJECTION WELLS
- MAY 2010 ROCK BORINGS/TEMPORARY MONITORING WELLS

ND	Cr+6 CONCENTRATIONS LESS THAN OR EQUAL TO 100 ug/l. ND= NOT DETECTED
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X	Cr+6 CONCENTRATIONS GREATER THAN 5,000 ug/l LESS THAN 30,000 ug/l.
X	Cr+6 CONCENTRATIONS GREATER THAN 30,000 ug/l LESS THAN 100,000 ug/l.

TW = TEMPORARY WELL LOCATION
ND = NOT DETECTED
J = ESTIMATED VALUE
CaSx = CALCIUM POLYSULFIDE PRESENT IN WELL; NOT SAMPLED

NOTES:
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2. OMW-15 WAS INSTALLED IN WEATHERED ROCK DUE TO LIMITED OVERBURDEN MATERIAL.

40' 0 40' 80'
Graphic Scale

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Professional Engineer's No.

State	Date Signed	Project Mgr.
		LGB
Designed by	Drawn by	Checked by
LGB	TPH	SWI

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RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN SHALLOW BEDROCK GROUNDWATER - JANUARY 2012

ARCADIS Project No.
BB014215.0005.00011
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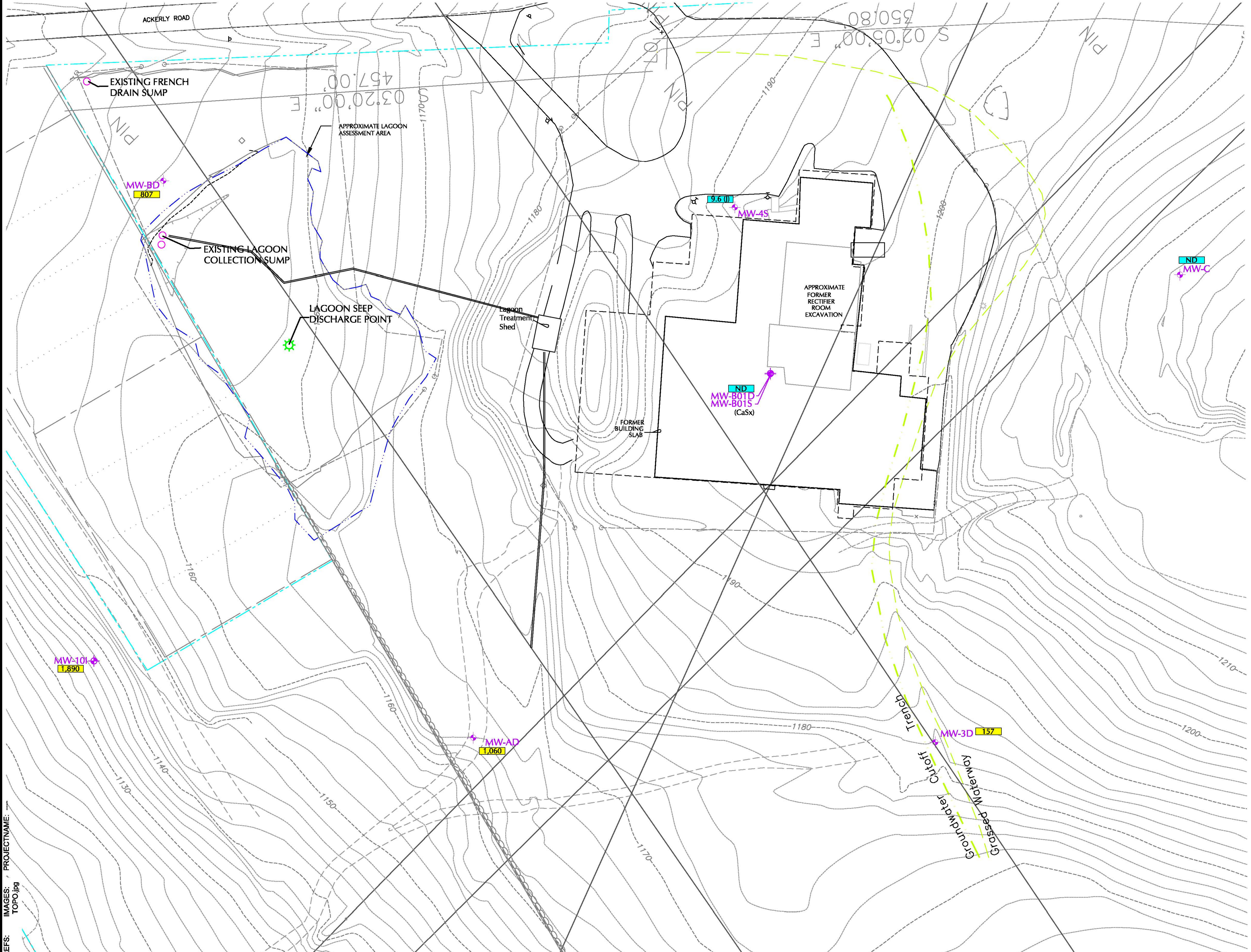

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- PATH/TRAIL
- FENCE
- GROUNDWATER INTERCEPTOR TRENCH
- FRACTURE TRACE (FROM R.E. WRIGHT, 1978)
- INTERMEDIATE BEDROCK MONITORING WELL

ND	Cr+6 CONCENTRATIONS LESS THAN OR EQUAL TO 100 ug/l. ND= NOT DETECTED
X	Cr+6 CONCENTRATIONS GREATER THAN 100 ug/l LESS THAN 5,000 ug/l.
X	Cr+6 CONCENTRATIONS GREATER THAN 5,000 ug/l LESS THAN 30,000 ug/l.
X	Cr+6 CONCENTRATIONS GREATER THAN 30,000 ug/l LESS THAN 100,000 ug/l.

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Graphic Scale

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Professional Engineer's No.		
State	Date Signed	Project Mgr. LGB
Designed by LGB	Drawn by TPH	Checked by SWI

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RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN INTERMEDIATE BEDROCK GROUNDWATER - JANUARY 2012

ARCADIS Project No.
BB014215.0005.00011

Date
05/25/2012

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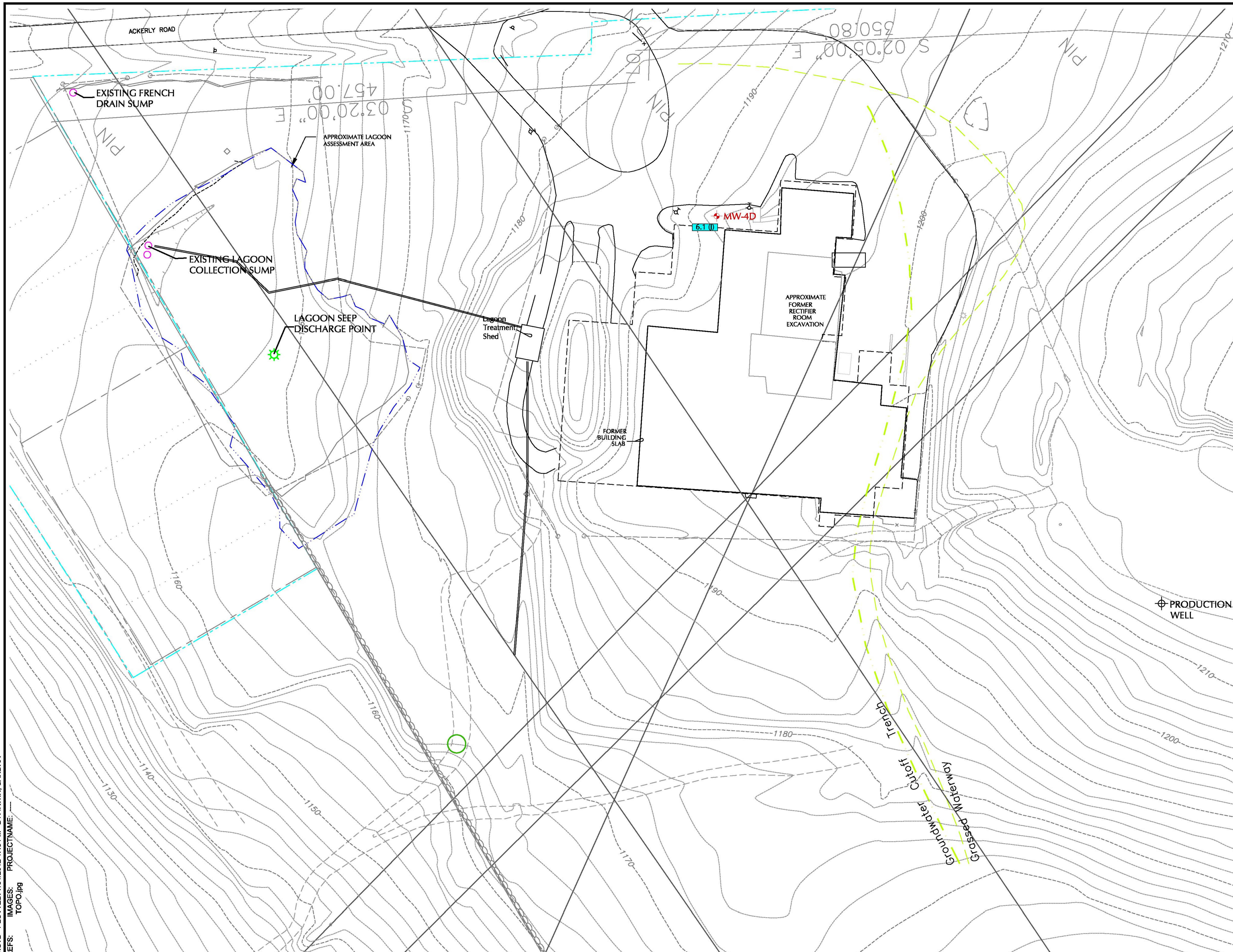

LEGEND:

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- PATH/TRAIL
- FENCE
- GROUNDWATER INTERCEPTOR TRENCH
- FRACTURE TRACE (FROM R.E. WRIGHT, 1978)
- DEEP BEDROCK MONITORING WELL
- PRODUCTION/POTABLE WELL

- ND — Cr+6 CONCENTRATIONS LESS THAN OR EQUAL TO 100 ug/l. ND= NOT DETECTED
- X (yellow) — Cr+6 CONCENTRATIONS GREATER THAN 100 ug/l LESS THAN 5,000 ug/l.
- X (green) — Cr+6 CONCENTRATIONS GREATER THAN 5,000 ug/l LESS THAN 30,000 ug/l.
- X (orange) — Cr+6 CONCENTRATIONS GREATER THAN 30,000 ug/l LESS THAN 100,000 ug/l.

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CITY: MANCHESTER DIV/GROUP: ENVCAD DB: T.HALLIWELL PM: L.BRUNT TM: L.BRUNT
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Professional Engineer's No.		
State	Date Signed	Project Mgr. LGB
Designed by LGB	Drawn by TPH	Checked by SWI

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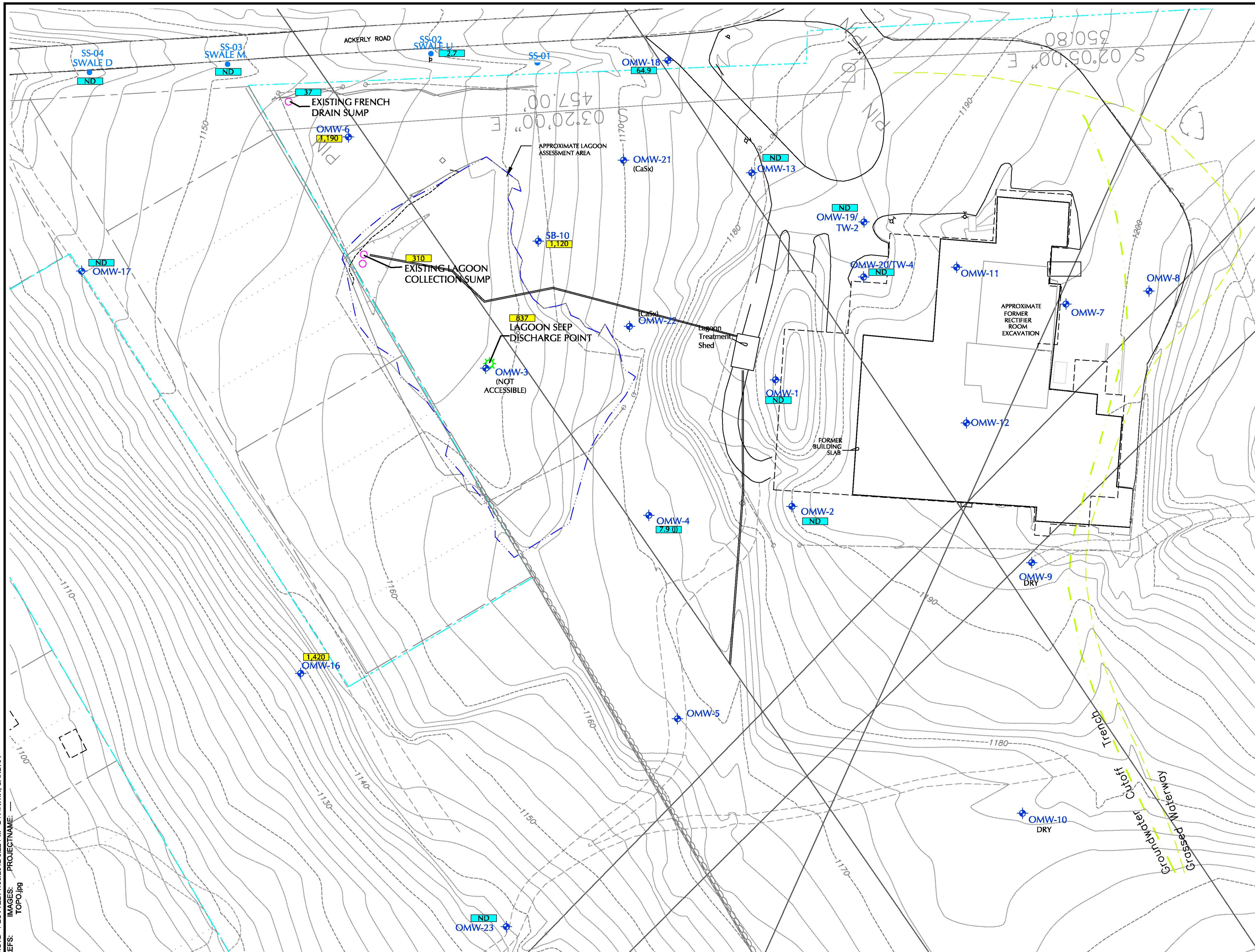
RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN DEEP BEDROCK GROUNDWATER - JANUARY 2012

ARCADIS Project No. B014215.0005.00011
Date 05/25/2012
ARCADIS
35 COLUMBIA ROAD
BRANCHBURG, NEW JERSEY
TEL. 908.526.1000

4C



LEGEND:

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2. OMW-15 WAS INSTALLED IN WEATHERED ROCK DUE TO LIMITED OVERBURDEN MATERIAL.

40' 0 40' 80'
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Professional Engineer's No.		
State	Date Signed	Project Mgr. LGB
Designed by LGB	Drawn by TPH	Checked by SWI

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PRECISION NATIONAL PLATING SERVICES, INC. • 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN OVERBURDEN GROUNDWATER - JANUARY 2012

ARCADIS Project No. BB014215.0005.00011
Date 05/25/2012
ARCADIS
35 COLUMBIA ROAD
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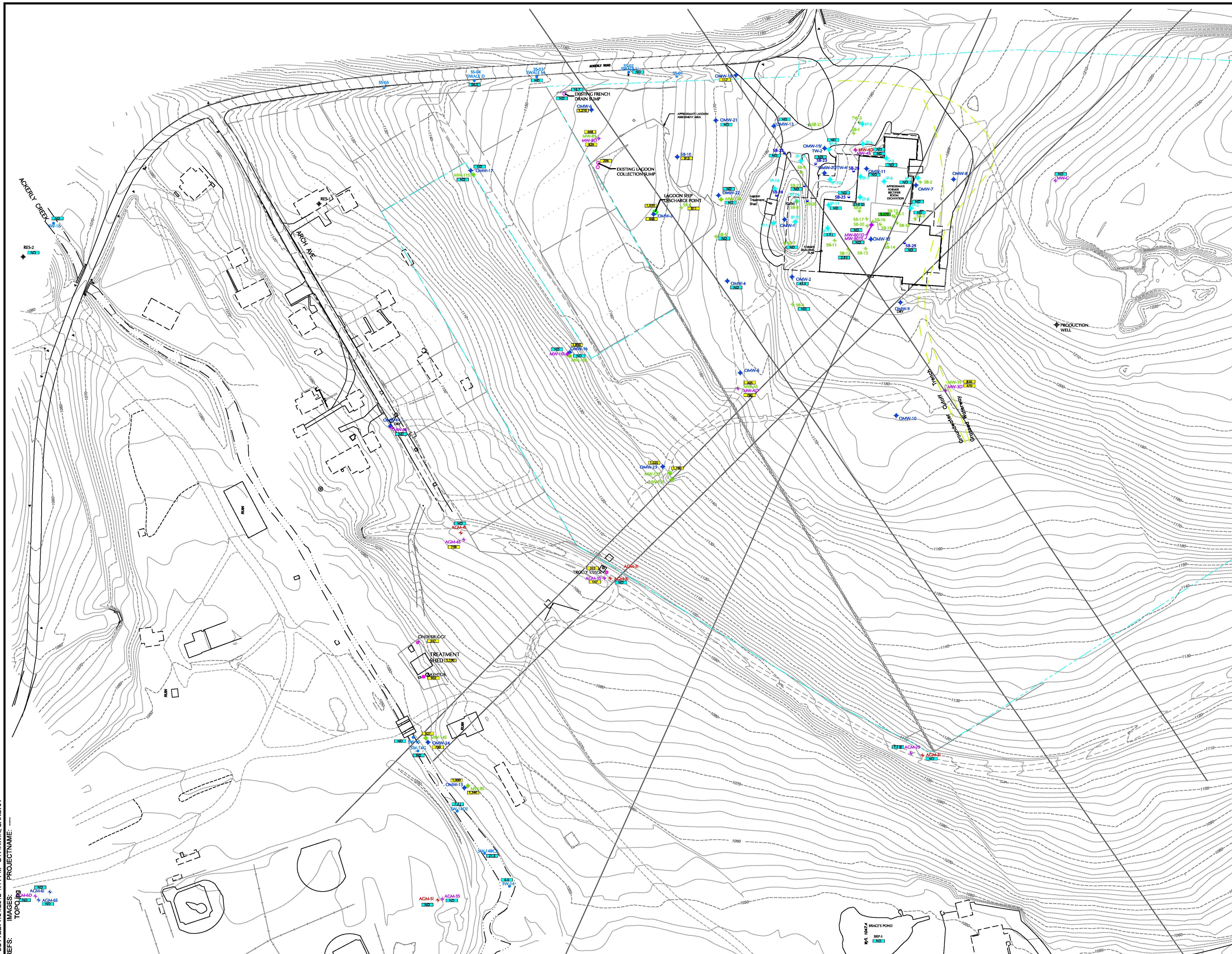

LEGEND:

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- FENCE
- GROUNDWATER INTERCEPTOR TRENCH
- FRACTURE TRACE (FROM R.E. WRIGHT, 1978)
- OVERBURDEN MONITORING WELL
- SHALLOW BEDROCK INJECTION WELLS
- SHALLOW BEDROCK MONITORING WELL
- INTERMEDIATE BEDROCK MONITORING WELL
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80' 0 80' 160'
Graphic Scale

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Professional Engineer's Name		
Professional Engineer's No.		
State	Date Signed	Project Mgr. LGB
Designed by LGB	Drawn by TPH	Checked by SWI

ARCADIS

ARCADIS U.S., INC.

PRECISION NATIONAL PLATING SERVICES, INC., 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN SURFACE WATER AND GROUNDWATER - APRIL/MAY 2012

ARCADIS Project No.
BB014215.0005.00011

Date
05/25/2012

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35 COLUMBIA ROAD
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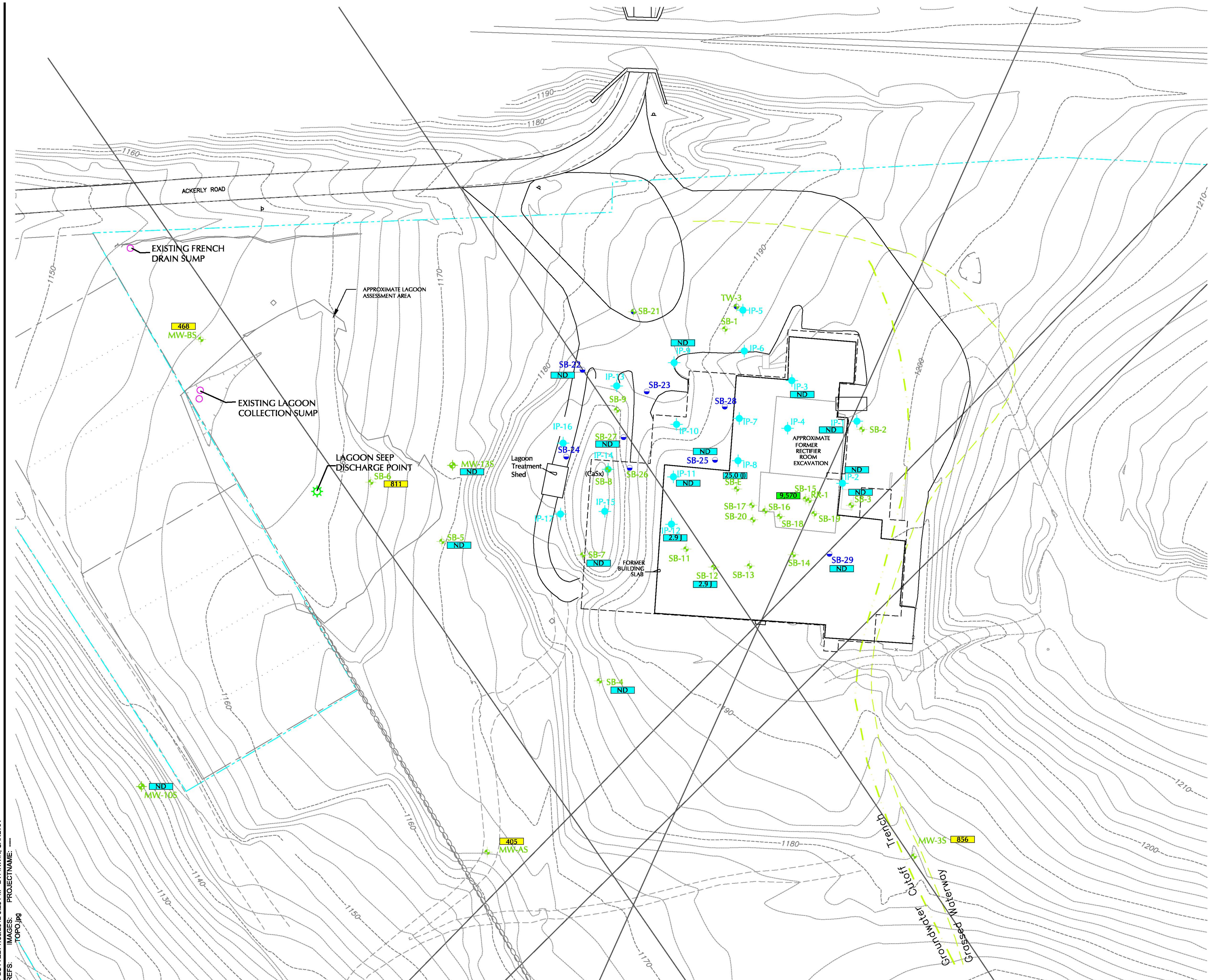
6



LEGEND:

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- X — Cr+6 CONCENTRATIONS GREATER THAN 30,000 ug/l LESS THAN 100,000 ug/l.

ND = NOT DETECTED
J = ESTIMATED VALUE

NOTES:
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2. OMW-15 WAS INSTALLED IN WEATHERED ROCK DUE TO LIMITED OVERBURDEN MATERIAL.

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Professional Engineer's Name
Professional Engineer's No.

State	Date Signed	Project Mgr. LGB
Designed by LGB	Drawn by TPH	Checked by SWI

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PRECISION NATIONAL PLATING SERVICES, INC., 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN SHALLOW BEDROCK GROUNDWATER - APRIL/MAY 2012

ARCADIS Project No. BB014215.0005.00011
Date 05/25/2012
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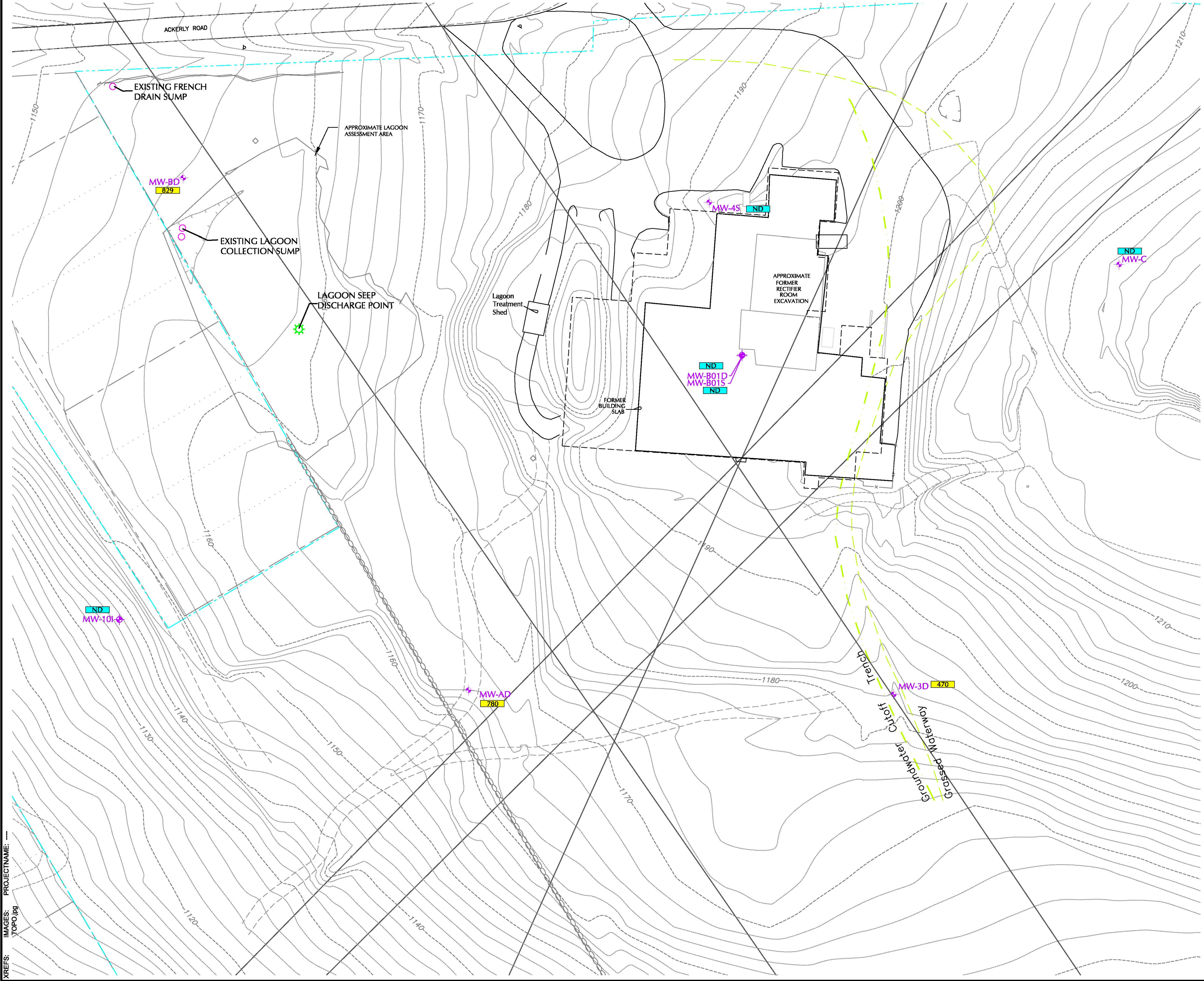

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- FENCE
- GROUNDWATER INTERCEPTOR TRENCH
- FRACTURE TRACE (FROM R.E. WRIGHT, 1978)
- INTERMEDIATE BEDROCK MONITORING WELL

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SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN INTERMEDIATE BEDROCK GROUNDWATER - APRIL/MAY 2012

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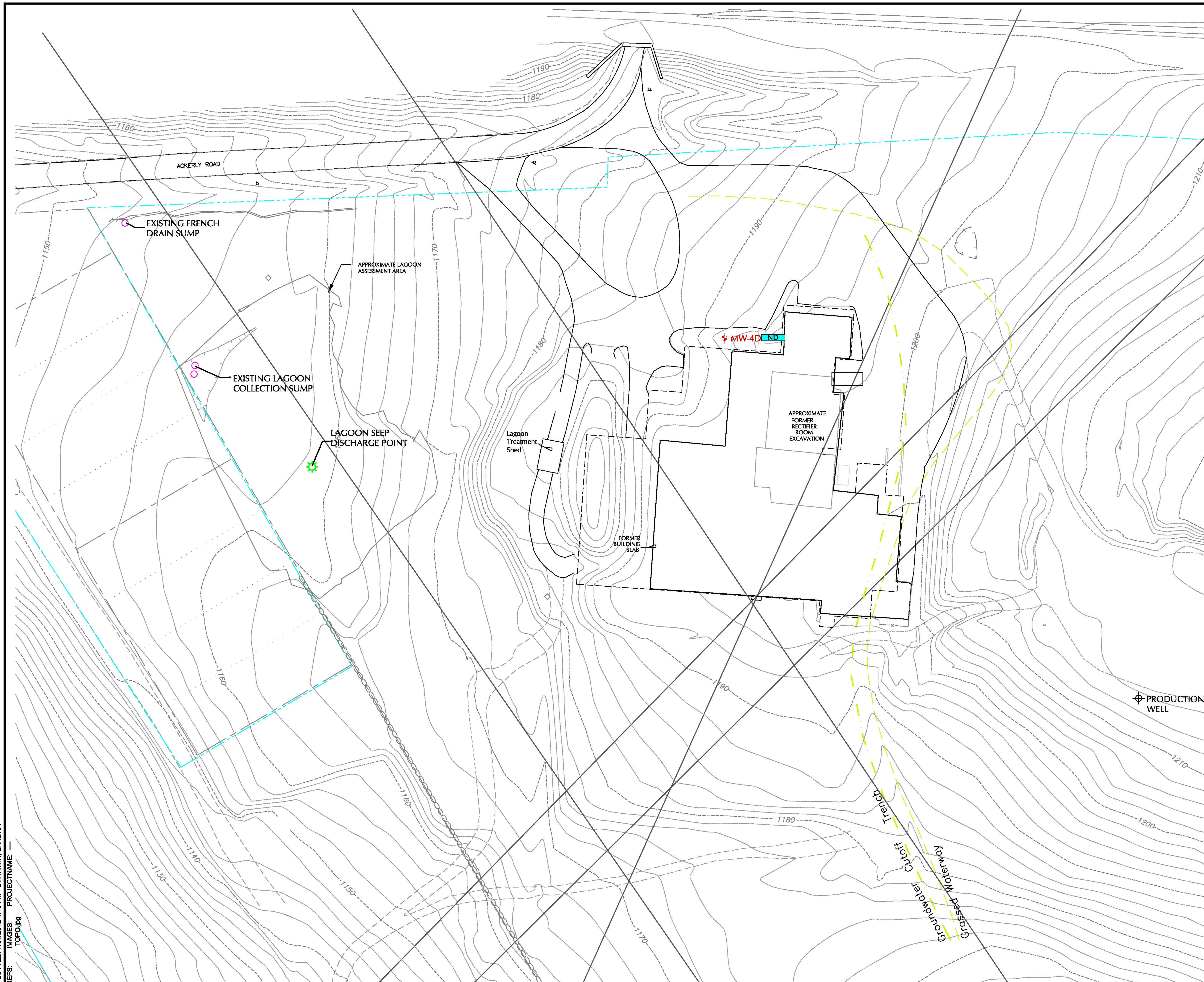

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- FRACTURE TRACE (FROM R.E. WRIGHT, 1978)
- DEEP BEDROCK MONITORING WELL
- PRODUCTION/POTABLE WELL

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PRECISION NATIONAL PLATING SERVICES, INC., 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN DEEP BEDROCK GROUNDWATER - APRIL/MAY 2012

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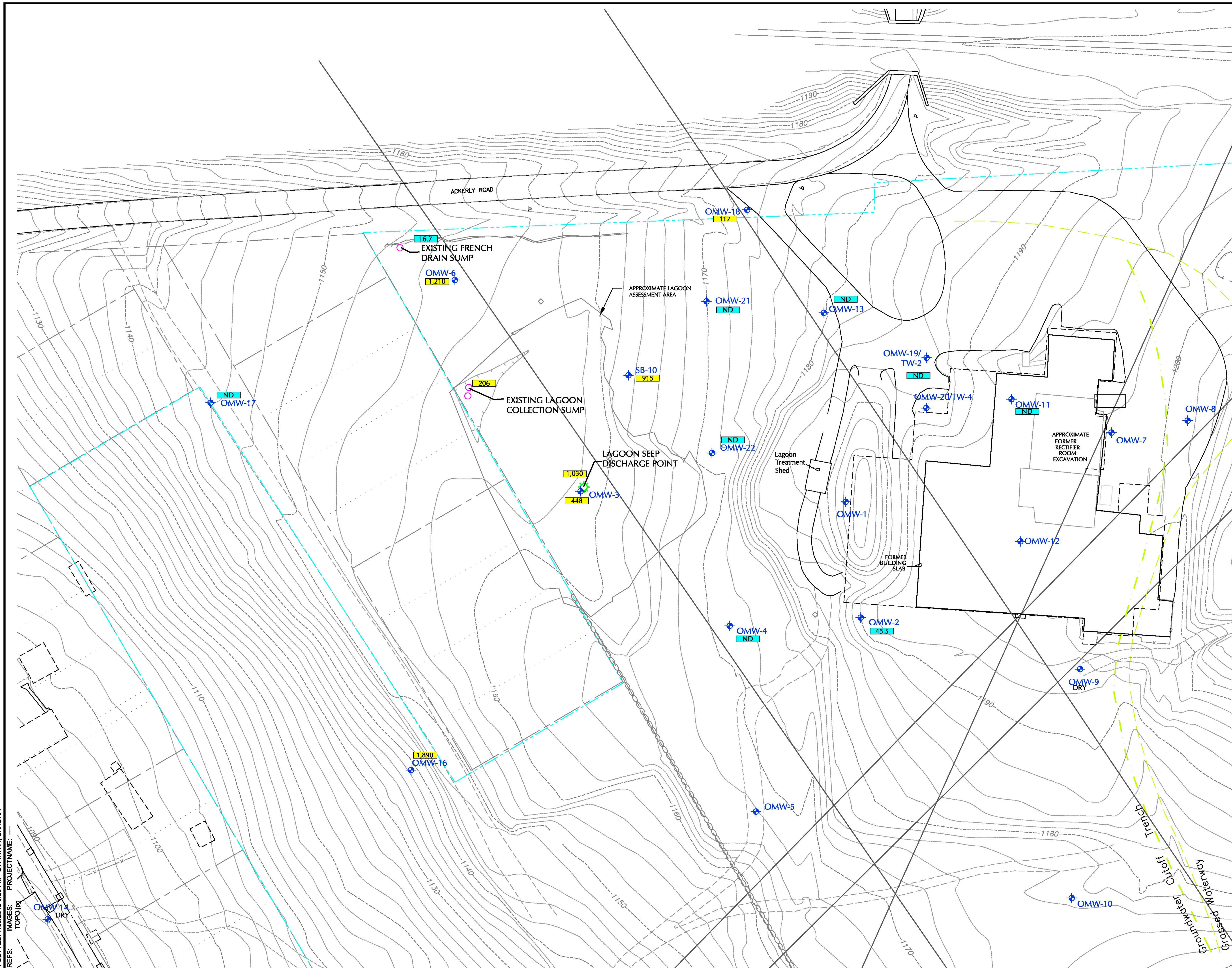

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PRECISION NATIONAL PLATING SERVICES, INC., 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA

RESPONSE ACTION PLAN

SUMMARY OF HEXAVALENT CHROMIUM CONCENTRATIONS IN OVERBURDEN GROUNDWATER APRIL/MAY 2012

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PRECISION NATIONAL PLATING SERVICES, INC. • 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

PROPOSED MONITORING WELL LOCATIONS

ARCADIS Project No.
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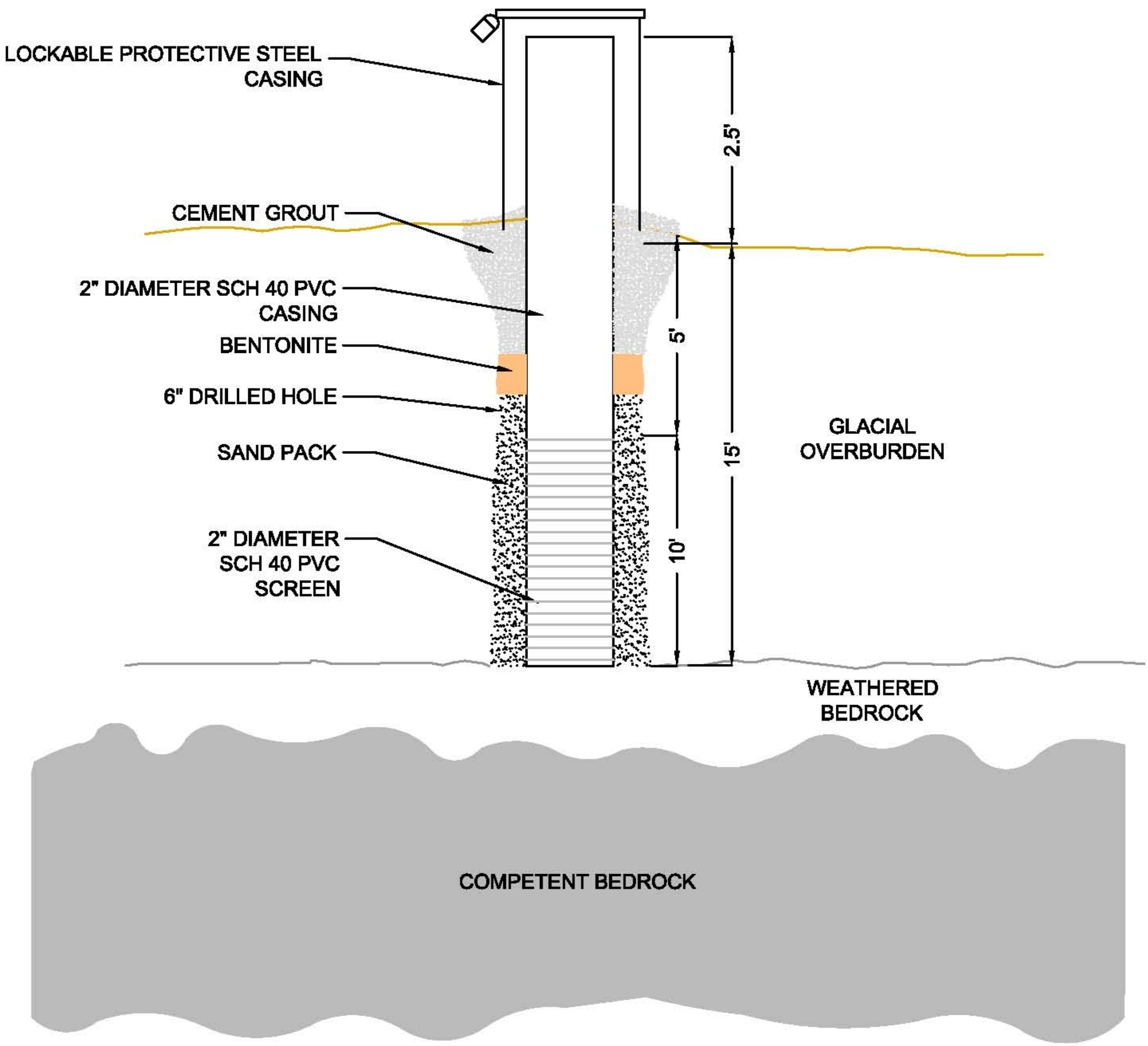

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TYPICAL OVERBURDEN WELL CONSTRUCTION

ARCADIS Project No.
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Date
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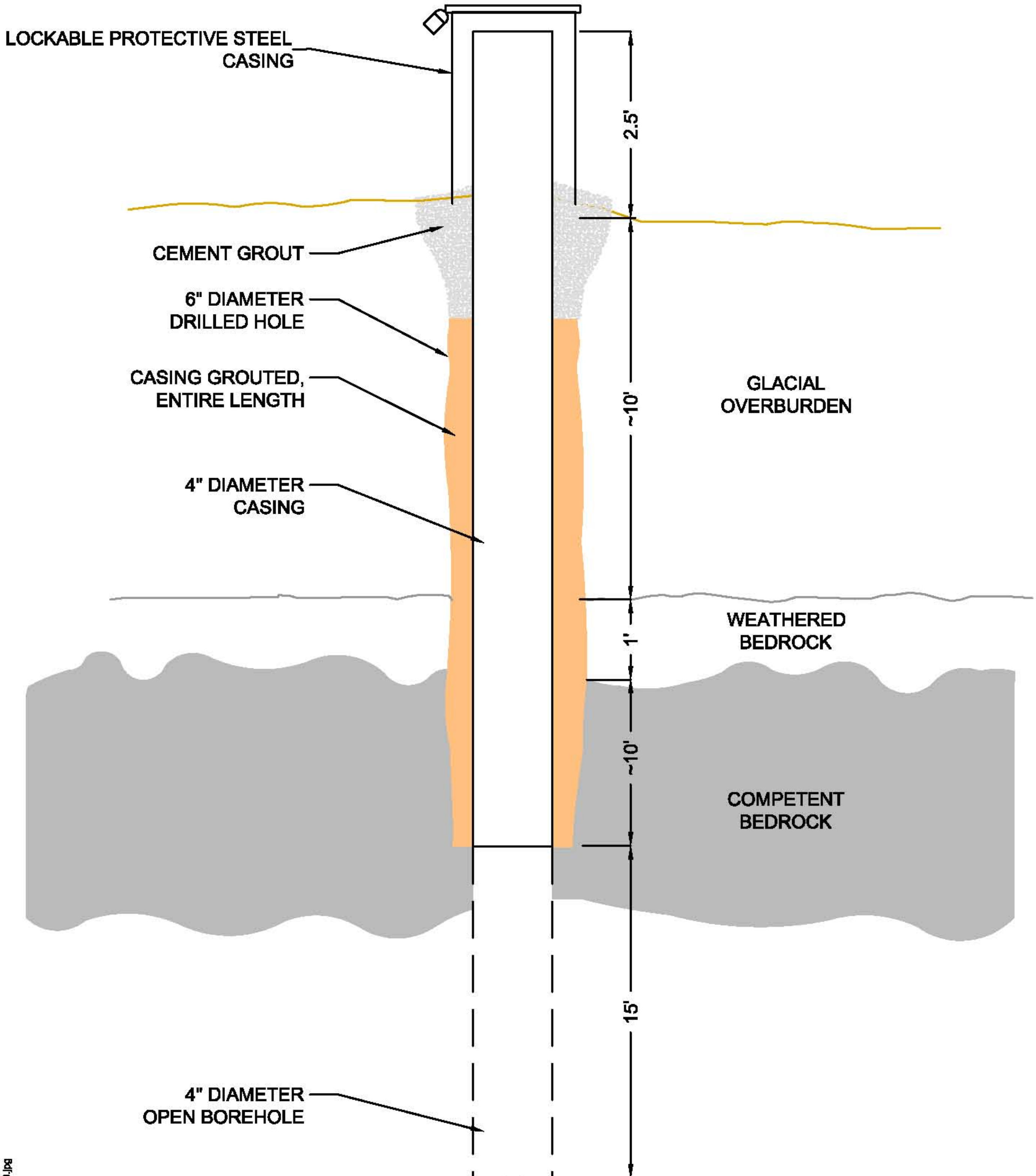

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RESPONSE ACTION PLAN

TYPICAL SHALLOW BEDROCK WELL CONSTRUCTION

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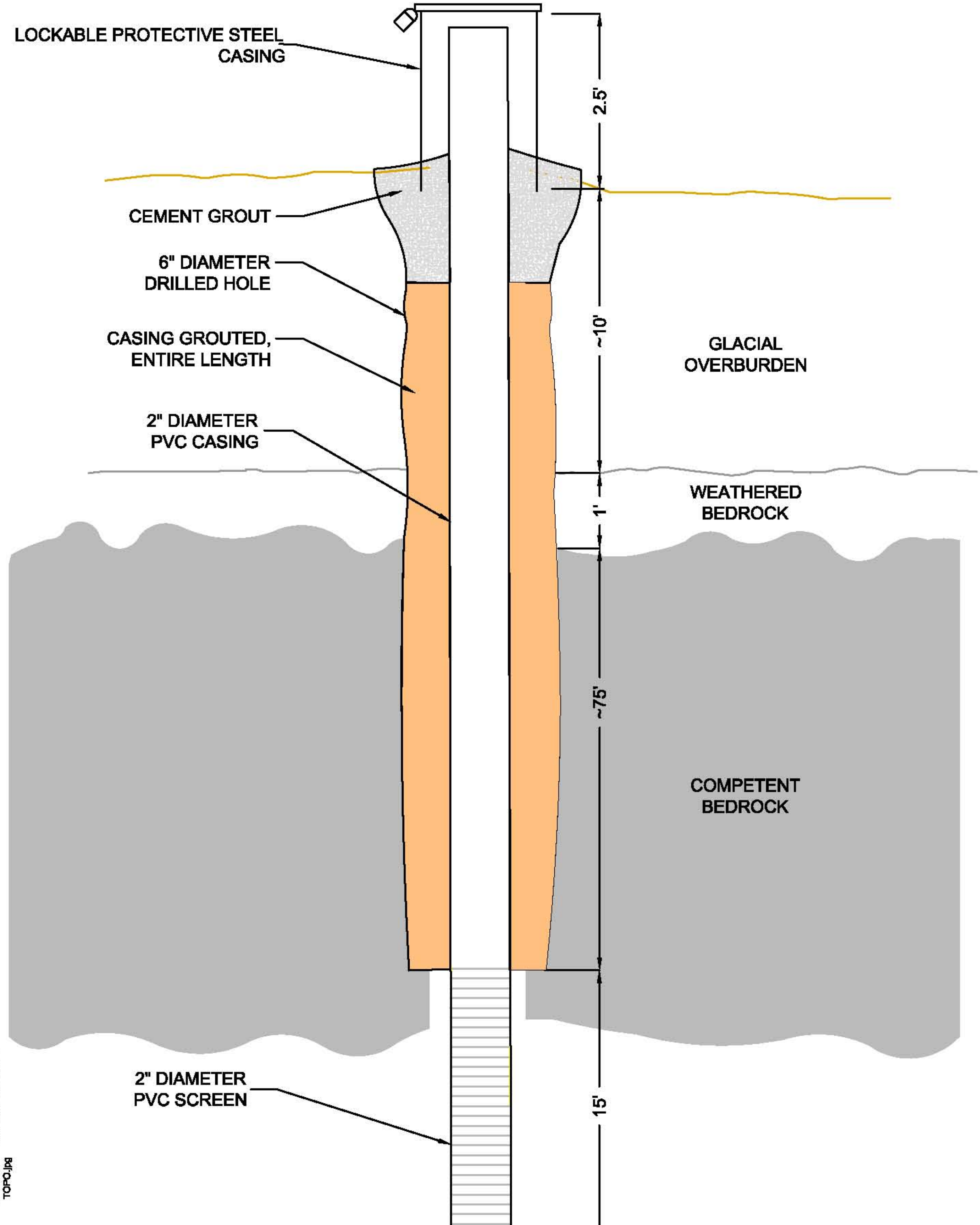

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RESPONSE ACTION PLAN

TYPICAL INTERMEDIATE BEDROCK WELL CONSTRUCTION

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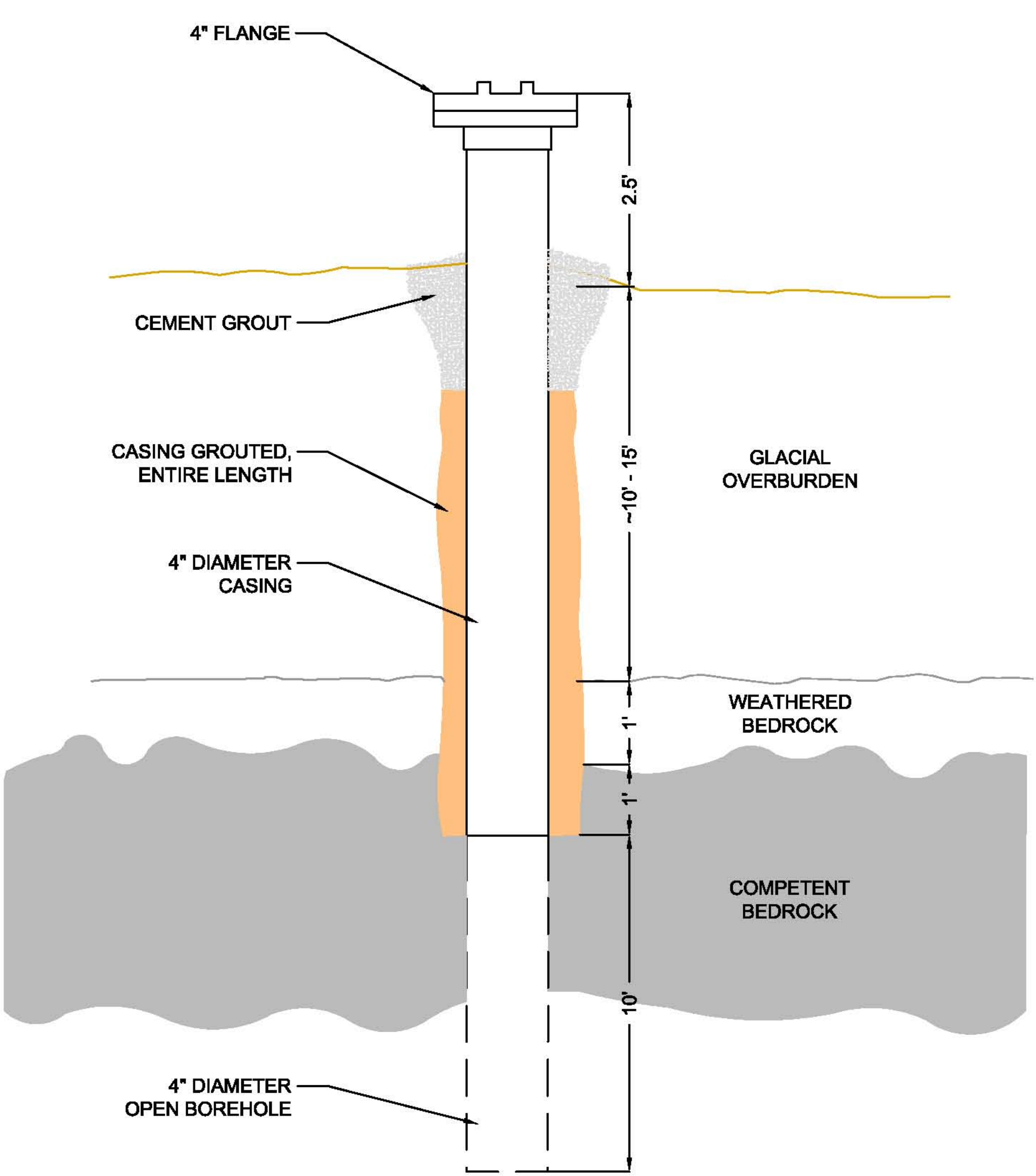

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RESPONSE ACTION PLAN

TYPICAL INJECTION WELL CONSTRUCTION

ARCADIS Project No.
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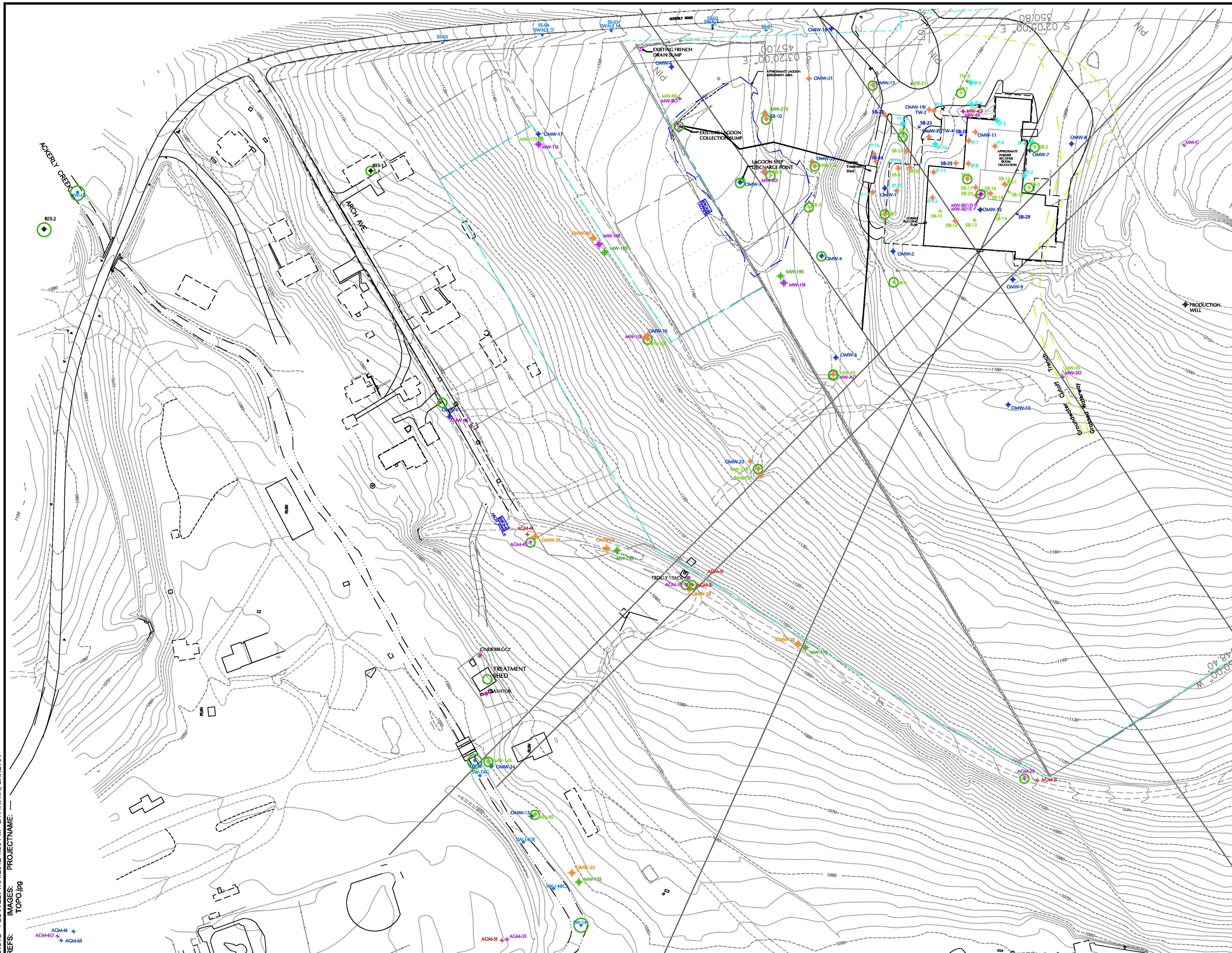

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- PROPOSED INTERMEDIATE BEDROCK MONITORING WELL
- JEROME PROPOSED PERIMETER AIR MONITORING LOCATION
- PROPOSED GROUNDWATER/SURFACE WATER FIELD MONITORING LOCATION

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Professional Engineer's Name		
Professional Engineer's No.		
State	Date Signed	Project Mgr. LGB
Designed by LGB	Drawn by TPH	Checked by SWI

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ARCADIS U.S., INC.

PRECISION NATIONAL PLATING SERVICES, INC. • 198 ACKERLY ROAD, CLARKS SUMMIT, PENNSYLVANIA
RESPONSE ACTION PLAN

PROPOSED MONITORING LOCATIONS DURING INJECTION ACTIVITIES

ARCADIS Project No. BB014215.0005.00011

Date 05/25/2012

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Appendix A

Underground Injection Control Information

Underground Injection Control Information

Site Name	Precision National Plating Services, Inc. Site
Site Address	198 Ackerly Road Clarks Summit, Pennsylvania 18411
Site Owner/Site Contact	Precision National Plating Services, Inc. P.O. Box 8588 Tarrytown, NY 10591-8588 Local Contact: Kevin Quinn, Esq. Hourigan Kluger and Quinn, P.C. 600 Third Ave. Kingston, PA 570-287-3000
Regulatory Authority	1998 Unilateral Administrative Order under the CERCLA Removal Authority and subsequent requirements from the United States Environmental Protection Agency (USEPA) to mitigate hexavalent chromium discharges to Ackerly Creek.
Regulatory Contact	Ann L. DiDonato On-Scene Coordinator Eastern Response Branch USEPA Region III 1650 Arch St. (3HS31) Philadelphia, PA 19103-2029 215-814-3311
PADEP Contact/Regional Office	Joe Iannuzzo Environmental Engineer PADEP-Northeastern Pennsylvania Office Two Public Square Wilkes Barre, PA 18711-0790 570-826-2589
Number and Location of Well Points (including Latitude and Longitude)	Approximately 35 monitoring/injection wells have been installed at the site for the proposed injection activities. The locations of existing wells and proposed injection points are shown on Figures 2 and 3.

Underground Injection Control Information

Site Name	Precision National Plating Services, Inc. Site
	The site is located in Abington Township, Lackawanna County at the following coordinates: Latitude 41° 30' 49.31" N Longitude 75° 42' 56.54" W
Site Contaminants/Extent of Contamination	The groundwater in the overburden and shallow bedrock beneath the Site is impacted by hexavalent chromium. The extent of the hexavalent chromium source areas are shown on Figures 2 and 3.
Remediation Materials	The impacted groundwater in the overburden and shallow bedrock will be treated in situ with 29% calcium polysulfide (CaSx) diluted to a 1%-5% solution.
Method of Introduction	The calcium polysulfide will be pumped into the well points using an injection system. The 29% CaSx feedstock will be stored in totes. The CaSx feedstock will be mixed with water in two 2,500 gallon polyethylene day tanks to create the desired injection concentrations. The injection system is designed to pump the mixture into the impacted areas under pressure. The system will inject the CaSx solution in up to 10 wells at the same time at pressures up to 60 psi.
Drinking Water Wells within ¼ mile of the Contaminated Area	Under the direction of the USEPA, Precision sampled all residential wells within a mile of the site in 1999 and has been conducting an ongoing ground water monitoring program that consists of routine sampling of 22 bedrock monitoring and residential wells. Neither of these sampling programs has identified any chromium impacts in either the drinking water wells or the deeper bedrock monitoring wells. The CaSx injection will occur in the overburden and shallow bedrock ground water. Based on the fact that there has been no chromium impacts in the deep bedrock/drinking water aquifer, it is extremely unlikely that there will be any CaSx impacts in this deep bedrock aquifer or to nearby wells. In addition, previous injection activities had no adverse affects on the bedrock/drinking water aquifer.

Underground Injection Control Information	
Site Name	**Precision National Plating Services, Inc. Site**
(continued)	That being said, the following is a list of the known drinking water wells within 1/4 mile of the site: [redacted] Clarks Summit, PA 18411 [redacted] [redacted] Clarks Summit, PA 18411 [redacted] [redacted] Clarks Summit, PA 18411 [redacted] New Residence [redacted] Clarks Summit, PA 18411

Appendix B

Quality Assurance/Quality Control Monitoring and Sampling Plan

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Infrastructure · Water · Environment · Buildings

Imagine the result

Precision National Plating Services, Inc.

Quality Assurance Project Plan and Field Sampling Plan

Precision National Plating Services, Inc.
198 Ackerly Road
Clarks Summit, Pennsylvania 18411

July 30, 2012

Quality Assurance Project Plan and Field Sampling Plan

Precision National Plating Services, Inc.
198 Ackerly Road
Clarks Summit, Pennsylvania 18411

Prepared for:

Precision National Plating Services, Inc.
120 White Plains Road
Tarrytown, New York 10591

Prepared by:

ARCADIS U.S., Inc.
35 Columbia Road
Branchburg, New Jersey 08876
Tel 908 526 1000
Fax 908 526 7886

Our Ref.:

BB014215.0005.00011

Date:

July 30, 2012

Table of Contents

1. Introduction

ARCADIS U.S., Inc. (ARCADIS) has prepared this Quality Assurance Project Plan and Field Sampling Plan (QAPP/FSP) on behalf of Precision National Plating Services, Inc. (Precision) for the implementation of the 2012 Response Action Plan (RAP). The RAP was prepared and submitted to the United States Environmental Protection Agency (EPA) by Precision as Respondent to Docket No. CERC-03-2012-0031DC for the former Precision facility located at 198 Ackerly Road in Clarks Summit, Lackawanna County, Pennsylvania (the Site). The Response Action will be performed in accordance with the 2012 Administrative Settlement Agreement and Order on Consent for Removal Response Action (Settlement Agreement) entered by EPA and Precision. The Settlement Agreement was executed to address chromium contamination at the Site.

Based on the Findings of Fact and Conclusions of Law presented in the Settlement Agreement, EPA determined that an actual and/or threatened release of hazardous substances from the Site may present an imminent and substantial endangerment to the public health or welfare or the environment. Therefore, the Work outlined in the Settlement Agreement is necessary to protect the public health and welfare and the environment. Because there is a threat to public health or welfare or the environment, EPA determined that a removal action is appropriate to abate, minimize, stabilize, mitigate or eliminate the release or threat of release of hazardous substances at or from the Site. The general objectives of the work conducted pursuant to the Settlement Agreement are to conduct a removal action, as defined in Section 101(23) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9601(23), to abate, mitigate and/or eliminate the release or threat of release of hazardous substances at the Site by preventing the migration of hazardous substances from the Site through the treatment of contaminated groundwater. The activities described in the RAP to meet these objectives include the installation of overburden, shallow bedrock, and intermediate bedrock monitoring wells, sampling of monitoring wells, residential wells, and surface water locations, in situ chemical reduction by injection of calcium polysulfide, operation and monitoring of two on-Site seep collection and treatment systems, and the evaluation and implementation of institutional controls to limit the use of groundwater within the contaminated plume.

All work to be performed at the Site will be consistent with the National Oil and Hazardous Substances Pollution Contingency Plan, as amended (NCP), 40 C.F.R. Part 300 and the CERCLA.

2. General Field Procedures

2.1 Field Documentation

Field activities will be documented in a Site log book and on appropriate field data forms. The collection and handling of all samples will be carefully recorded on appropriate chain of custody forms to document the integrity of each sample from the time the sampling personnel enter the Site through sample collection and shipment to the laboratory. Field forms that will be used for record-keeping at the Precision Site include, but are not limited to:

- Daily Tailgate Meeting Forms/Sign-in Logs
- Well Purge Forms
- Soil Boring/Well Construction Logs
- Field Sampling/Measurement Logs
- Chain of Custody Forms
- Air Monitoring Forms

2.1.1 Daily Tailgate Meeting Forms/Sign-in Logs

Daily tailgate meeting forms and sign-in logs will be used to document the personnel on-Site each day to conduct and/or oversee the Work outlined in the RAP. The daily tailgate meeting forms will also document the discussions of Site conditions, the work to be performed, health and safety protocols, any incidents that may occur, and any changes to the Site procedures or Health and Safety Plan (HSP). The forms will be maintained in a secure place on-Site along with the HSP.

2.1.2 Well Purge Forms

Well purge forms will be used to document all well sampling activities. In addition to general project information, the well purge forms will include the date and time of sampling, static water level in the well, well purge method and volume, field observations of the water and well conditions, water quality parameters recorded during well purging and sampling, results of any field analyses performed on the water sample, sampling method and materials used, and sampling personnel.

2.1.3 Soil Boring/Well Construction Logs

During the installation of soil borings or new wells, the field personnel will prepare a soil boring/well construction log for each boring/well location. In addition to general project information, the soil boring/well construction log will document the date of installation, method of drilling and well installation, total depth of drilling and depth at which bedrock is encountered, the date, time, and depth at which any samples are collected, first encountered and stabilized water levels in the boring/well, field observations, physical appearance of the soil and rock, results of any field analyses performed on the soil or water from the boring, sampling method and materials used, and boring/well installation and sampling personnel.

2.1.4 Field Sampling/Measurement Logs

For all other field sampling or monitoring where a purge form or soil boring/well construction log is not applicable, including daily monitoring during in situ chemical reduction activities and routine monitoring of the on-Site treatment systems, a field sampling or measurement log will be completed. The field sampling or measurement log will document the date and time of sampling or measurement, sampling method and materials used, the static water level in the boring/well if applicable, field observations, physical appearance of the samples, results of any field analyses performed on the soil or water samples, and sampling personnel.

2.1.5 Chain of Custody Forms

All samples collected at the Precision Site for laboratory analysis will be documented using proper chain of custody procedures. Sample labels will be completed by field sampling personnel and will be affixed to sample containers at the time of sampling. The sample labels and chain of custody forms will document the Site name, sample identification, the date and time of sampling, any sample preservatives, the required analyses to be performed on the soil or water sample, and sampling personnel. The chain of custody form will be completed in the field before the sampling team leaves the Site.

The sampling personnel will be responsible for maintaining custody of the samples until they are delivered to the carrier or the laboratory. The chain of custody form will then be signed by the field personnel and custody formally relinquished to the carrier or the laboratory. Samples will be kept in a secure location with access restricted to authorized personnel.

2.2 Health and Safety

All Site activities will be conducted according to the Site-specific Health and Safety Plan (HSP) that was prepared in 2006 and updated in March 29, 2007 and September 16, 2011 in order to meet the requirements of the Occupational Health and Safety Act (OSHA) CFR 1910.120. The HSP will be kept on-Site in the Lagoon Treatment System shed. The HSP will be updated as necessary to reflect changes in Site conditions, new activities to be performed, or new procedures to improve health and safety performance. All personnel working at the Site will be required to read and understand the requirements of the HSP. The appropriate personal protective equipment required for all Site activities is presented in the HSP. At a minimum, for all sampling and decontamination activities, Site personnel will wear steel-toed boots, gloves and safety glasses.

2.3 Sample Collection and Preservation

2.3.1 Sampling Equipment

All sampling equipment will be made of sturdy materials that will be thoroughly cleaned and decontaminated prior to use at the Site and after use at each sampling location. All reusable equipment that comes in contact with sample media will be decontaminated by scrubbing with a laboratory-grade detergent and water, thoroughly rinsing with tap water, and thoroughly rinsing with distilled/deionized water. Submersible pumps will be submerged and run for a short period of time in the laboratory-grade detergent and then in clean tap water to ensure internal decontamination. If field instruments come in contact with the sample media, they will be decontaminated by wiping off excess soil, water, or sediment with a clean paper towel and then rinsing with distilled/deionized water. For sampling equipment that cannot be easily or thoroughly decontaminated, such as polyethylene tubing and bailers, disposable, dedicated equipment will be selected for single use at each sampling location.

2.3.2 Sample Containers and Preservation

Prior to implementation of the field sampling program, the laboratory will be contacted to verify sample handling and preservation requirements. Samples will be collected in laboratory-supplied, clean sample containers of appropriate material and volume for the desired analyses. Soil samples will be collected in unpreserved, glass jars with Teflon-lined lids. Water samples for hexavalent chromium or sulfate analysis will be collected in unpreserved plastic bottles of at least 250 milliliter (mL) volume. Water samples for total chromium or other metals analysis will be collected in 500-mL plastic bottles with sufficient nitric acid (HNO3) preservative to reduce the pH of the sample to less than 2 standard pH units. Water samples for sulfide analysis will be collected in 500-mL plastic bottles preserved with sodium hydroxide and zinc acetate.

All samples will be preserved at approximately 4° Celsius in a sealed cooler during transport to the laboratory for analysis. Ice or other frozen media that cannot impact the samples will be used to keep the samples cold during shipping. The specific type of sample preservation will be recorded on the chain of custody form, the sample labels, and field sampling documentation.

2.4 Field Analyses and Measurements

Measurements for temperature, pH, specific conductance, oxidation/reduction potential, and dissolved oxygen for groundwater samples will be made in the field at the time of purging and sampling. Measurements of pH and temperature will also be collected at the time of the monthly performance monitoring of the treatment systems. During the in situ injection activities, continuous measurements of pH, temperature, specific conductance, and oxidation/reduction potential will be collected from strategic monitoring locations at the Site to monitor the progress of the injections. The instruments used to collect the field analytical data will depend on the type of sampling or monitoring being completed. During well sampling, field analytical parameters will be measured using a multi-parameter water quality meter with a flow-through cell, such as a Horiba U-53 or similar model meter. The meter will be calibrated each morning prior to sampling according to the manufacturer's specifications. All field parameters will be recorded on a well purge form or other appropriate field data log. The continuous field parameter monitoring during the injection activities will be performed using a YSI 600xl or similar model probe. The probe will be calibrated according to manufacturer's specifications prior to deployment. Data from the continuous monitoring probes will be downloaded daily to an on-Site computer.

A hand-held pH, temperature, and conductivity meter will be used to collect field analytical parameters during the monthly treatment system sampling, surface water sampling, and monitoring of the on-Site seeps and water collection sumps. Approximately 250 mL of sample will be placed in a clean, unpreserved container, and then the probe will be inserted into the sample and gently swirled to allow the reading to stabilize before recording the measurement. Additional monitoring during injection activities or well installation may also include the use of disposable pH measurement strips.

Field analyses for hexavalent chromium in soil or water and sulfide in water may be performed as necessary on-Site using the appropriate Hach test kits with colorimetric methods. Field personnel will follow the manufacturer's instructions for performing field tests with these kits.

2.5 Disposal Procedures

All refuse generated at the Site will be disposed properly off-Site. All disposable sampling supplies will be collected and disposed properly off-Site. Drill cuttings and soil generated by soil boring/well installation activities will be used to backfill the boring locations or spread in the vicinity of the boring location. Purge water evacuated during the installation of new wells or sampling of monitoring wells will be collected and treated in the on-Site treatment systems before being discharged. Any wastewater or sludge generated by the in situ chemical reduction with calcium polysulfide will be containerized and disposed off-Site in accordance with Federal, State, and local regulations. The spent resins from the on-Site treatment systems will be shipped off-Site for regeneration or proper disposal in accordance with Federal, State, and local regulations.

3. Well Installation

To assess the residual chromium concentrations, evaluate potential contaminant pathways, and identify potential remedial actions, Precision is proposing additional investigation of the overburden, shallow bedrock and intermediate bedrock groundwater in the areas downgradient of the former building slab towards Ackerly Creek. Based on the existing data and the current Site conceptual model, Precision is proposing the installation of six shallow bedrock monitoring wells, four intermediate bedrock monitoring wells and six overburden monitoring wells. In addition, Precision is currently evaluating borehole geophysics information for the bedrock wells along the Trolley Tracks and will be proposing modifications to these wells in a separate work plan. The locations of the proposed wells are illustrated on Figure 9 of the RAP.

The depths of the wells, polyvinyl chloride (PVC) casing and open boreholes will be dependent on the observations made during the drilling activities including the depths at which major fractures are identified. Some of the boring locations also may be adjusted based on Site conditions, access constraints, and field observations identified during the performance of the investigation activities. The wells will be installed by a Pennsylvania-licensed well driller. Upon completion, the wells will be surveyed by a Pennsylvania-licensed land surveyor to determine their location and elevation.

All downhole equipment (e.g., submersible pumps) that will be used to develop or purge groundwater monitoring wells will be thoroughly cleaned before each use to prevent the possibility of cross-contamination between wells. The pump will be cleaned on the outside with a solution of laboratory grade glassware detergent and potable water, followed by a potable water rinse and distilled/deionized water rinse. The inside of the pump will be cleaned by pouring a detergent solution and potable water through the intake valve and draining the solution through the discharge valve, followed by a thorough rinsing with potable and distilled water.

3.1 Overburden Monitoring Wells

ARCADIS will contract with a Pennsylvania-licensed well driller to install the six proposed overburden wells. The wells will be installed by advancing a 6-inch diameter borehole to the top of competent bedrock using a drill rig equipped with a hollow-stem auger (HSA). Upon encountering bedrock refusal, the well will be constructed as a single-cased well with 2-inch diameter schedule 40 PVC casing with 0.020-slot PVC screen installed across the water table as encountered in each area. The PVC riser will extend above the screened interval to 2 to 3 feet above the ground surface. The six overburden wells will be finished such that they may be used as injection points during calcium polysulfide injection activities.

Based on previous drilling data from these portions of the Site, it is anticipated that bedrock will be encountered at depths of approximately 10 to 20 feet bgs. Therefore, the screened intervals are anticipated to range from 5 to 20 feet bgs. A sand pack will be installed around the well screen and the remaining annulus above the screen will be grouted with a cement/bentonite mixture to the surface. The well will be completed with a standard stick-up, lockable, protective monitoring well casing composed of steel. Following installation and development, the new wells will be sampled for hexavalent chromium and total chromium. The locations of the proposed wells are depicted on Figure 9 of the RAP. A diagram depicting the proposed well construction is provided as Figure 10 of the RAP.

3.2 Shallow Bedrock Monitoring Wells

The borings for the six proposed wells will be extended into the shallow bedrock approximately 1 to 3 feet using air rotary drilling techniques and a 4-inch schedule 40 PVC casing will be grouted into the bedrock to provide a seal from the overburden groundwater. The boring will then be extended as a 4-inch diameter open hole approximately 15 to 20 feet into the competent bedrock. It is anticipated that the wells will be installed to total depths of approximately 25 to 40 feet bgs. After completion, groundwater samples will be collected and analyzed for total and hexavalent chromium. The wells will be finished such that they can be used as injection points during calcium polysulfide injection activities.

Each shallow bedrock well will be completed to seal off the overburden groundwater such that if the well is selected for future injection activities, the seal will prevent the injection solution from short- circuiting and rising to the surface. To convert the wells into injection points, the wells will be fitted with PVC well head caps to allow for injection under pressure using the existing on-Site injection system. Diagrams depicting typical shallow bedrock well and injection point construction are provided as Figures 11 and 13 of the RAP, respectively.

3.3 Intermediate Bedrock Monitoring Wells

Based on access to the desired installation locations, the proposed intermediate bedrock monitoring wells will be installed in one of two manners. For the first option, the borings for the proposed wells will be extended into the intermediate bedrock approximately 85 feet using air rotary drilling techniques and a 4-inch schedule 40 PVC casing will be grouted into the bedrock to provide a seal from the overburden groundwater. The boring will then be extended as a 4-inch diameter open hole approximately 15 to 20 feet into the competent bedrock. Alternatively, the intermediate bedrock wells will be installed by drilling a 6-inch diameter borehole into the bedrock to a depth of approximately 100 feet. A 2-inch diameter PVC casing with 0.020-slot PVC well screen will be set into the borehole. The well screen will extend from approximately 85 to 100 feet bgs. The PVC riser will extend from the top of the well screen to approximately 2 to 3 feet above ground surface. A sand pack will be installed around the well screen and the remaining annulus above the screen will be grouted with a cement/bentonite mixture to the surface. The wells will be completed with a standard stick-up, lockable, protective monitoring well casing composed of steel.

It is anticipated that the wells will be installed to total depths of approximately 100 feet bgs. After completion, groundwater samples will be collected and analyzed for total and hexavalent chromium.

Each intermediate bedrock well will be completed to seal off the overburden groundwater such that if the well is selected for future injection activities, the seal will prevent the injection solution from short-circuiting and rising to the surface. To convert the wells into injection points, the wells will be fitted with PVC well head caps to allow for injection under pressure using the existing on-Site injection system. Diagrams depicting typical intermediate bedrock well and injection point construction are provided as Figures 12 and 13 of the RAP, respectively.

4. Water Sampling Procedures

4.1 Monitoring Well Sampling Methodology

Monitoring wells on and surrounding the Precision Site will be sampled semi-annually to evaluate hexavalent chromium and total chromium concentrations. The list of locations to be monitored will include wells in the overburden unconsolidated aquifer as well as the shallow, intermediate, and deep bedrock layers. The wells have been selected to monitor the distribution of hexavalent and total chromium concentrations across the Site and downgradient to the Creek. The wells will be monitored to determine if the requirements of the Settlement Agreement are being achieved. The locations, construction details, and depths of each well to be sampled are presented in Table 1 of the RAP. Sampling will be performed in accordance with the procedures outlined in this QAPP/FSP, which is based on the Ground Water Sampling Procedure, Low Stress (Low Flow) Purging and Sampling prepared by U.S. EPA Region II dated March 26, 1998.

4.1.1 Sampling Procedure

The static water level in each well will be measured prior to sampling and recorded on individual well purge forms so that groundwater elevations may be calculated and groundwater contour maps produced for each sampling event. The monitoring wells will be purged using a stainless steel submersible pump with flow controller. Wells will be purged using the slow purge technique according to the EPA guidance, minimizing drawdown in the well. During the purging process, water quality indicators including pH, temperature, dissolved oxygen concentration, oxidation/reduction potential, specific conductance, and turbidity will be measured with a properly calibrated multi-parameter water quality meter outfitted with a flow-through cell and recorded on field forms. If there is insufficient water volume in the well to accomplish purging and stabilization of water quality parameters, a grab sample will be collected with a dedicated disposable bailer and the conditions of sampling will be noted on the field form.

Samples will be collected directly from the pump discharge tubing in laboratory-supplied clean sampling containers with the proper preservatives as necessary. All samples will be shipped in coolers to a certified laboratory under proper chain-of-custody procedures.

4.1.2 Sampling Parameters

As required by the Settlement Agreement, the groundwater samples collected will be analyzed by an EPA/PADEP certified laboratory for hexavalent chromium via U.S. EPA Method SW846 7196A and for total chromium by U.S. EPA Method 200.7.

4.2 Potable Well Sampling Methodology

Residential potable wells in the vicinity of the Precision Site will be sampled semi-annually as put forth in paragraph 8.3 of the Settlement Agreement. The locations, construction details, and depths of each well to be sampled are presented in Table 1 of the RAP. In addition, during the in situ chemical reduction activities, the residential wells will be monitored with increased frequency and for additional parameters.

4.2.1 Sampling Procedure

Potable well samples are to be collected from a water tap prior to any treatment devices. Prior to sampling, the aerator will be removed, the cold water tap will be turned on and the water will be allowed to flush for approximately five minutes. Samples will be collected in laboratory-supplied clean sampling jars with the proper preservatives as necessary. All samples will be shipped in coolers to a certified laboratory under proper chain-of-custody procedures.

4.2.2 Sampling Parameters

As required by the Settlement Agreement, the potable well samples collected will be analyzed by an EPA/PADEP certified laboratory for hexavalent chromium via U.S. EPA Method SW 846 7196A and for total chromium by U.S. EPA Method 200.7. During the in situ chemical reduction activities, the residential wells will be monitored with increased frequency and additional parameters, including sulfate and sulfide, will be added to the monitoring.

4.3 Surface Water Sampling Methodology

The EPA has selected Ackerly Creek as an endpoint for monitoring the contamination status and progress of the Removal Action at the Precision Site. Pursuant to the Settlement Agreement, Precision will monitor select locations in Ackerly Creek on a quarterly basis. Three locations in the drainage swale along Ackerly road will also be sampled semiannually. The locations to be sampled are listed in Table 1 of the RAP.

4.3.1 Sampling Procedure

Surface water samples will be collected as grab samples in laboratory-supplied clean sampling jars with the proper preservatives as necessary. The samples collected from each of the Ackerly Road drainage swale locations will be collected in clean, unpreserved containers. Every effort will be made to prevent leaf debris and other solids from entering the sample containers. The samples will then be allowed to rest so additional organic debris and sediments may settle. The water samples will then be decanted into new unpreserved and nitric acid-preserved sample containers as necessary. If the drainage swale water is especially turbid and sediments and debris cannot be kept out of the samples, additional sample volume may be collected in clean, unpreserved containers from the drainage swale locations and filtration by the laboratory prior to analysis will be requested. All samples will be shipped in coolers to a certified laboratory under proper chain-of-custody procedures.

4.3.2 Sampling Parameters

As required by the Settlement Agreement, the surface water samples collected will be analyzed by an EPA/PADEP certified laboratory for hexavalent chromium via U.S. EPA Method SW846 7196A and for total chromium by U.S. EPA Method 200.7. Additional monitoring of Ackerly Creek will be conducted during the in situ chemical reduction activities; parameters may include sulfate, sulfide, and water quality indicators such as pH.

4.4 Treatment System Sampling Methodology

The Lagoon Treatment System and Seep Shed Treatment System will be monitored on a monthly basis. Samples will be collected from the influent and effluent and analyzed for hexavalent chromium and total chromium to evaluate the effectiveness of each treatment system. In addition, samples will be collected between the SIR-700 and SIR-300 resin vessels and analyzed for hexavalent chromium and total chromium respectively, to evaluate the removal efficiency of the units and determine when the resin needs to be changed.

The systems will continue to operate in accordance with Section 8.3 of the Settlement Agreement. .

4.4.1 Sampling Procedure

Samples of the influent, effluent, and midpoint of the treatment systems will be collected while the treatment system is in operation. Grab samples will be collected in laboratory-supplied clean sampling jars with the proper preservatives as necessary. All samples will be shipped in coolers to a certified laboratory under proper chain-of-custody procedures. Field parameters including pH and temperature will be measured and recorded for the influent of the Lagoon Treatment System and Seep Shed Treatment System at the time of sampling. The flow rate and volume totalizer reading for each system will also be recorded on the field form at the time of sampling.

4.4.2 Sampling Parameters

As required by the Settlement Agreement, the samples collected from the treatment systems will be analyzed by an EPA/PADEP certified laboratory for hexavalent chromium via U.S. EPA Method SW846 7196A and for total chromium by U.S. EPA Method 200.7. During the in situ chemical reduction activities, the treatment systems will be monitored with increased frequency and additional parameters, including sulfate and sulfide, may be added to the monitoring.

5. Air Monitoring

When calcium polysulfide comes into contact with acids or acidic materials or is diluted with water, hydrogen sulfide (H_2S) gas is produced. Hydrogen sulfide gas is colorless, and at elevated concentrations can be toxic and flammable. It has a characteristic rotten egg odor. The odor alone cannot be used as an indicator of exposure to hydrogen sulfide, since hydrogen sulfide can be detected at very low levels [odor threshold of 0.5 parts per billion (ppb)] that are not harmful to health and the sense of smell can become rapidly fatigued (i.e., reduced) with continued exposure. The recommended exposure limit developed by the National Institute for Occupational Safety and Health (NIOSH) for H_2S is 10,000 ppb (time-weighted average concentrations for up to a 10-hour work day). The maximum permissible exposure limit established by the OSHA for H_2S is 20,000 ppb (time-weighted concentration not to be exceeded during any 8-hour work shift).

The CaSx injection activities will be performed in two general types of areas: areas below asphalt or concrete pavement (i.e., building slab) and areas with exposed surface soil (i.e., north of slab). Based on the depths of the treatment zones within the overburden and shallow bedrock groundwater, the anticipated low injection flow rates (approximately one to two gallons per minute in each well), and the observations of the prior bedrock injection activities, Precision anticipates minimal surfacing of calcium polysulfide. With little opportunity for exposure to air, rainwater, and sunlight, hydrogen sulfide generation should be minimal.

For the protection of the workers on Site and the nearest residents and to comply with the 2012 Settlement Agreement, Section 8.3(g), H_2S concentrations will be monitored surrounding the exclusion zone and at the Site perimeter. The H_2S concentrations will be compared to the ambient air action level for the general population of 30 ppb established by ATSDR for the previous injection activities. This concentration is two orders of magnitude below known health effects and is based on long term exposure.

H_2S ambient air action level	30 ppb

If a H_2S reading of 30 ppb or greater is identified at the Site, additional monitoring will be conducted at the Site perimeter (along the fence line) and along Arch Avenue to ensure that the hydrogen sulfide is not affecting the residences downgradient of the Site. If the H_2S concentrations leaving the Site boundary or along Arch Avenue exceed 30 ppb, injection activities will be stopped temporarily until the source of the release can be located and mitigated. The mitigation measures may include reducing the emission rate of hydrogen sulfide at the point source and implementing air plume suppression techniques at the Site boundary.

5.1 Exclusion Zone Monitoring

As described in the HSP and Addendum for Calcium Polysulfide Injection Activities previously prepared by ARCADIS, continuous exclusion zone real-time ambient air monitoring will be conducted as necessary by ARCADIS during all work activities within the exclusion zone. The Exclusion Zone real-time ambient air monitoring details and action levels are summarized in Table 1 of the HSP. For hydrogen sulfide, the monitoring will be performed and evaluated relative to the NIOSH and OSHA acceptable exposure limits of 10,000 ppb and 20,000 ppb, respectively.

A handheld Jerome 631-X Hydrogen Sulfide Analyzer with a detection limit of 3 ppb will be used to obtain hourly H_2S measurements at locations surrounding the current injection area. Readings will continue for one hour after the injection work ends each day. In the event of any calcium polysulfide spill or surfacing, additional monitoring will occur surrounding the exposed calcium polysulfide. The sensor of the Jerome 631-X will be thermally regenerated at the beginning and end of each work day according to the manufacturer's specifications. The analyzer will be properly zeroed in a clean air (no H_2S) environment prior to collecting measurements. The approximate locations for the exclusion zone monitoring are shown on Figure 14 of the RAP.

5.2 Perimeter Air Monitoring

As requested by EPA with respect to the prior remediation, perimeter air monitoring will be conducted to confirm that fugitive emissions, if any, of H_2S leaving the Site are below action levels for residential neighborhoods (30 ppb). The perimeter monitoring will be performed on the property boundary of the Precision Site prior to the residential areas and along Arch Avenue. The monitoring will be performed manually with hand-held instruments during the work day, as well as continuously electronically with monitoring stations installed on the Site boundary and along Arch Avenue. The manual monitoring will be limited to the typical work day (approximately 8:00 am to 6:00 pm) while calcium polysulfide is being injected and continue for one hour after the injection work ends each day. Manual monitoring along Arch Avenue will be performed every two hours during the work day. The sensor of the Jerome 631-X will be thermally regenerated at the beginning and end of each work day according to the manufacturer's specifications. The analyzer will be properly zeroed in a clean air (no H2S) environment prior to collecting measurements. The electronic monitoring stations will collect perimeter air monitoring data 24 hours a day.

The electronic monitoring stations will consist of Jerome 651 stationary units, which include a Jerome 631-X Hydrogen Sulfide Analyzer with a detection limit of 3 ppb. The Jerome Analyzers will be programmed to record real time data on 10-minute intervals 24 hours per day. The data will be transmitted from the analyzers to a computer via radio modem, so it can be evaluated and saved electronically for future use. The electronic monitoring stations will be programmed to provide an alert via email and/or SMS text message (i.e., cellular phone text message) to the appropriate Site personnel if there is a detection of H_2S above the 30 ppb action level. The Jerome 651 will be programmed to thermally regenerate the sensor in the early morning of each work day according to the manufacturer's specifications. The analyzer will be automatically zeroed immediately following sensor regeneration and prior to collecting measurements. The perimeter monitoring units will also record meteorological data to document current conditions each day during the injection activities. As a supplement to the data being recorded electronically, the analyzers will be checked periodically and manual measurements will be recorded.

The electronic monitoring stations will be installed at two locations to collect perimeter air monitoring data. Air monitoring data will be collected at a fixed monitoring location on the northern property boundary between the Site and the residences located along Arch Avenue. In addition, a fixed monitoring station will be located at the end of Arch

Avenue near the Trolley Tracks. These locations will provide air monitoring data to evaluate any potential impacts to the residences in the area throughout the remediation activities. The approximate locations of the perimeter air monitoring stations are shown on Figure 14 of the RAP.

A handheld Jerome 631-X Hydrogen Sulfide Analyzer with a detection limit of 3 ppb will be available on site for manual readings in the event of a calcium polysulfide spill or surfacing of material. Surfacing is not anticipated since the treatment zone is below grade within the groundwater and the injection flow rate will be very low.

6. Quality Assurance Project Plan

All sampling completed as part of the RAP activities will be performed using proper field techniques and sample handling such that the precision, accuracy, representativeness, comparability, and completeness of the collected data are known, documented, and adequate to satisfy the data quality objectives (DQOs) of the Site work. In addition, Precision will consult with EPA prior to all sampling and data collection activities outlined in the RAP. The collection and analysis of samples and data collected for the Site will be conducted in accordance with the following documents:

- “EPA NEIC Policies and Procedures Manual” (EPA Document 330/9-78-001-R), EPA, revised November 1984;
- “Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans” (QAMS-005/80), EPA, December 1980; and
- “QA/QC Guidance for Removal Activities” (EPA/540/G-90/004), EPA, April 1990.
- “U.S. EPA National Functional Guidelines for Inorganic Superfund Data Review” (U.S. EPA-540-R-10-011), January 2010.

6.1 Scope of Work

The scope of work consists of monitoring well installation, in situ calcium polysulfide injections, monitoring well sampling, residential well sampling, surface water sampling, treatment system operation, maintenance, and sampling, and evaluation and implementation of institutional controls to limit groundwater use. Detailed procedures for conducting the scope of work are provided in the RAP. The scope of work will be performed in accordance with the 2012 Settlement Agreement.

6.2 Data Quality Objectives

Data obtained during the implementation of the RAP will be used to determine and monitor the extent of the hexavalent chromium and total chromium in groundwater in the vicinity of the Site. The goals of the RAP are to address the issues outlined in the 2012 Settlement Agreement.

In order to best utilize the data generated during the implementation of the RAP, data quality objectives (DQOs) must be developed that relate the extent and quality of data to be gathered to the ultimate objective of the work. DQOs are qualitative and quantitative goals for precision, accuracy, reproducibility, comparability, and completeness specified for each data set. DQOs are based on the concept that different data uses require different levels of data quality. DQOs are defined with respect to the types, numbers, and locations of samples that will be collected, and the quality assurance levels associated with their analysis. The DQOs and quality assurance levels required for the work conducted according to the RAP will be guided by the above-listed EPA documents.

All analyses will be performed by a laboratory which has a documented Quality Assurance Program in compliance with EPA guidance document QAMS-005/80. Laboratory analyses of samples collected at the Precision Site will be performed following standard EPA methods. The laboratory will make every effort to achieve quantitation limits as low as practicable and will report estimated concentration values at less than the reporting limit by flagging the value with a “J”. All data packages provided by the certified laboratory will consist of Level IV deliverables.

6.3 Quality Assurance/Quality Control

The overall Quality Assurance (QA) objective is to develop and implement procedures for field measurements, sampling, and analytical testing that will provide data of known quality that is consistent with the intended use of the information. This section defines the objectives by 1) describing the use of the data; 2) specifying the applicable QC effort (field checks and analytical support levels); and 3) defining the QC objectives (data quality acceptance criteria).

6.3.1 Data Usage and Requirements

The field measurements and laboratory analyses will be used in support of the removal action at the Site and in determining the need for further remedial actions. The data to be collected range from qualitative information based on field observations to quantitative laboratory analyses.

6.3.2 Level of Quality Control Effort

The sampling personnel will use several types of QA/QC samples to ensure and document the integrity of the sampling procedures, laboratory sample handling procedures, and the validity of the measurement data. Field replicate samples will be collected to evaluate the reproducibility of the sampling technique. Replicate samples will be collected as needed and will be given a coded identity on the sample label and chain of custody form, so as to be a “blind” replicate to the laboratory. The actual sampling location will be recorded on the well purge form or other field sampling form.

If needed, field blanks will be collected using analyte-free water and identical clean sample bottles provided by the laboratory. Field blanks will be prepared to determine if cross-contamination has occurred during sampling. Field blanks will be handled and preserved in the same manner as field samples. The field blank will be analyzed for the same parameters as the associated samples.

All field samples and QC samples will be transported daily to the laboratory by ARCADIS personnel or shipped via courier or overnight delivery (FedEx). All blanks and samples will be maintained at 4°C while stored on-Site and while in transit.

The laboratory will follow standard QC procedures to provide data of known and defensible quality. The data quality elements that will be checked and documented include precision, accuracy, reproducibility, comparability, and completeness as described below.

6.3.2.1 Precision

Measurements of data precision are necessary to demonstrate the reproducibility of the analytical data. Precision of the sample data will be determined from the analyses of laboratory duplicates and field duplicates. Laboratory duplicates will be analyzed at a frequency of one per 20 samples per matrix. Laboratory precision requirements are set by the analytical methods used.

6.3.2.2 Accuracy

Accuracy is the relationship of the reported data to the “true” value. The accuracy of the methods used for the analyses of the samples will be evaluated through the use of calibration standards, matrix spike (MS) analyses, and laboratory control samples (LCS). MS samples will be analyzed at a frequency of one per 20 samples per matrix. Laboratory accuracy requirements are determined by the analytical methods used.

6.3.2.3 Representativeness

The sampling procedures employed during the implementation of the RAP are designed to provide data that are representative of actual conditions at the sampling location. Considerations for evaluating the representativeness of the data include, but are not limited to: the sampling location; the methods used to obtain the sample; and the appropriateness of the analytical method to the type of sample obtained. All field sampling activities will be performed following the procedures described in the RAP and this QAPP/FSP.

6.3.2.4 Comparability

Comparability expresses the confidence with which one data set can be compared with another data set. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the analytical data, as documented in this QAPP/FSP, are expected to provide comparable data. The new analytical data, however, may not be directly comparable to some existing historical data based on differences in procedures and QA objectives.

6.3.2.5 Completeness

Completeness is a measure of the amount of data obtained from a specific measurement that is judged to be valid as compared to the total amount of data collected. The validity of the collected data will be evaluated using the guidelines in the EPA guidance documents listed above. The laboratory should provide data that meet QC acceptance criteria for 90 percent or more of the requested determinations. If the percent completion limits are not met, the laboratory may be required to re-analyze samples or resampling may be required.

6.3.3 Quality Control Objective

The purpose of the Quality Control (QC) check samples is to determine if the data are of acceptable quality. Several different types of QC check samples will be analyzed and the results will be compared to data quality acceptance criteria and/or QC control limits that are specified for each analytical method. The laboratory will routinely run QC samples in accordance with the protocols and frequencies specified in the analytical methods used. The QC check samples include:

- Method blank samples,
- Preparation blanks,
- Initial and continuing calibration blanks,
- Initial and continuing calibration verification samples;
- Matrix Spikes/Analytical Spikes;
- Duplicate samples; and
- Laboratory control samples.

The specific types and frequencies of QC checks which will be performed in support of each test method, the calibration procedures for each instrument, and the QC control limits and/or data quality acceptance will be determined by the laboratory and verified during the review of the laboratory analytical report. Criteria for each of the types of QC check samples are set by the analytical method used.

6.3.4 Sampling Procedure

Samples will be collected according to the procedures provided in the RAP and this QAPP/FSP. All samples will be shipped or delivered to the laboratory within 24 hours of the time of sample collection. Preservation, container type, and holding time requirements for the parameters to be analyzed are determined by the specific analytical method to be used.

6.3.5 Sample Custody

A chain of custody record will be maintained for each sample collected and will provide an accurate written record that can be used to trace the possession of samples from collection through analysis and reporting. Sample bottles to be used for the work in support of the RAP will be clean, laboratory-supplied sampling containers appropriate for the matrix and analytes chosen.

The procedures that will be followed to provide chain of custody in the field from sample collection through shipment to the laboratory are specified in this QAPP/FSP. The procedures that will be used to continue the chain of custody for each sample from its arrival at the laboratory through analysis and reporting will be performed according to the laboratory QAPP. The laboratory sample custody procedures must conform to EPA guidelines. The laboratory will retain the project samples until the holding times are exceeded, or until permission to discard is received.

6.3.6 Calibration Procedures

The calibration procedures for field instrumentation are discussed in this QAPP/FSP. The calibration procedures for laboratory instrumentation will be performed in accordance with those specified by the analytical method to be used and the laboratory QAPP.

6.3.7 Analytical Procedures

The methods to be followed for the analysis of hexavalent chromium are found in U.S. EPA SW846 7196A and for total chromium and Target Analyte List Metals in U.S. EPA 200.7. The analysis for sulfate will follow U.S. EPA method D516-90, 02. The analysis of sulfide will follow Standard Method SM4500 S2E. The types and frequencies of QC checks will be those specified in the analytical methods and described in Section 6.3.2 above.

6.3.8 Data Reduction, Validation, and Reporting

All data collected during the implementation of the RAP, including field and laboratory results, will be reduced, reviewed, summarized, and reported. The reduction of the field data will consist of summarizing the raw field data, which may be presented in the form of tables, logs, illustrations, and graphs as appropriate. The analytical data from the laboratory will be reduced to appropriate forms and summarized as appropriate in the form of tables, illustrations, and graphs. All data will be maintained at the ARCADIS office until acceptance of final reports.

The sample data collected will be screened for completeness and technical compliance. All data packages provided by the laboratory will consist of Level IV deliverables. A Level IV data review of each laboratory report will be performed, which will include:

- Checking to see if the chain of custody form was filled out properly and if the samples were logged properly;
- Checking to verify the correct parameters were analyzed using the methods identified in the RAP and this QAPP/FSP;
- Checking to verify that the holding times were met for each parameter analyzed;
- Reviewing the blank results;
- Checking calibration records;
- Checking matrix spike/analytical spike analyses;
- Checking duplicate sample analyses;
- Checking laboratory control sample and standard analyses.

If the data appear suspect, specific data of concern will be investigated. On the basis of this review, the data validator will make judgments and comments on the quality and limitations of the data. The data validator will prepare documentation of his/her review and conclusions to summarize any overall deficiencies that require attention. General laboratory performance will also be assessed by the data validator. During the validation, the data validator may qualify sample results as estimated. In most cases, estimated results will meet project DQOs. However, if in the judgment of the data validator, the result does not meet the project DQOs, it will be clearly stated in the validation memorandum.

The data validator will inform the Project Coordinator of data quality and limitations, and assist in interacting with the laboratory to correct any data omissions and/or deficiencies. The laboratory may be required to rerun or resubmit data depending on the extent of the deficiencies and importance in meeting the DQOs within the overall context of the work.

The reviewed laboratory data will be reduced and tabulated for inclusion in the quarterly progress reports specified in paragraph 8.7 of the Settlement Agreement, additional reports that Precision will prepare and submit to the EPA documenting the additional investigation and in situ chemical reduction activities described in Sections 4 and 5 of the RAP, and the Final Report that Precision will submit to the EPA when it concludes it has completed the implementation of this RAP and addressed the items in paragraph 8.3 of the Settlement Agreement. The tabulated format will be designed to facilitate comparison and evaluation of the data. Field measurements, including well construction details, water level measurements, and other field analyses, will be similarly tabulated for inclusion in the reports submitted to the EPA to facilitate the comparison and evaluation of the data.

6.3.9 Internal Quality Control

The QA/QC samples collected, including field replicates and field blanks, will be used to ensure and document the integrity of the sampling procedures and the validity of the measurement data. The QA/QC sample results will be compared to acceptance criteria, and documentation will be performed showing that these criteria have been met. Any samples that are not in conformance with the QC criteria will be identified and reanalyzed by the laboratory, if appropriate.

Two types of quality assurance mechanisms are used to ensure the laboratory production of analytical data of known and documented quality: analytical method QC and program QA. The internal QC procedures for the analytical services on samples to be provided are specified in the analytical methods and the laboratory QAPP. These specifications include the types of control samples required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each control, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria. The laboratory will be responsible for documenting that both initial and ongoing instrument and analytical QC criteria are met in each package. This information will be included in the case narrative of the data packages generated by the laboratory and will be evaluated during the review performed by ARCADIS.

6.3.10 Preventive Maintenance

ARCADIS has an established program for the maintenance of field equipment to ensure the availability of equipment in good working order when it is needed. An inventory of equipment including model number, serial number, calibration records, and maintenance records is kept for each field instrument. Equipment manuals are also kept with all field instruments. Field personnel are responsible for calibration, operation, and cleaning of all field instruments according to manufacturer's specifications when the equipment is used in the field.

The laboratory also follows a well-defined program to prevent the failure of laboratory equipment and instrumentation. This preventive maintenance program is described in the laboratory QAPP.

6.3.11 Data Assessment Procedures

Both field- and laboratory-generated data will be assessed for precision, accuracy, representativeness, comparability, and completeness. Both qualitative and quantitative procedures will be used for these assessments. The criterion for field measurements will be that the measurements were taken properly using calibrated instruments. Assessment of the sampling data with respect to field performance will be based on the criteria that the samples were properly collected and handled. Field QC check samples will also be considered in assessing the representativeness and comparability of the samples collected. The Project Coordinator will have overall responsibility for data assessment and integration of that assessment into data use and interpretation.

The QC acceptance criteria prescribed for each test method are presented in the laboratory QAPP. Rigorous QA/QC procedures will be followed for the collection of samples. The sampling protocols will be strictly adhered to in order to maintain consistency in sampling.

6.3.12 Corrective Actions

The QA/QC program contained in this QAPP/FSP will enable problems to be identified, controlled, and corrected. Potential problems may involve non-conformance with the standard operating procedures (SOPs) and/or analytical procedures established for the work, or other unforeseen difficulties. Any persons identifying an unacceptable condition will notify the Project Coordinator. The Project Coordinator will be responsible for developing and initiating appropriate corrective action and verifying that the corrective action has been effective. For laboratory analysis, both the identified deviations and corrective actions will be documented.

Corrective actions may include repeating measurements, resampling and/or reanalysis of samples, and amending or adjusting project procedures. If warranted by the severity of the problem, the EPA Project Coordinator will be notified. Additional work, which is dependent upon an unacceptable activity, will not be performed until the problem has been corrected.

6.3.13 Quality Assurance Reports

During each data review, the data validator will make judgments and comments on the quality and limitations of the data. The data validator will prepare documentation of his/her review and conclusions to summarize any overall deficiencies that require attention. General laboratory performance will also be assessed by the data validator. During the validation, the data validator may qualify sample results as estimated. In most cases, estimated results will meet project DQOs. However, if in the judgment of the data validator, the result does not meet the project DQOs, it will be clearly stated in the validation memorandum. This documentation of the review of analytical data and any other documentation of QA/QC evaluation will be included in the quarterly progress reports specified in paragraph 8.7 of the Settlement Agreement, additional reports that Precision will prepare and submit to the EPA documenting the additional investigation and in situ chemical reduction activities described in Sections 4 and 5 of the RAP, and the Final Report that Precision will submit to the EPA when it concludes it has completed the implementation of this RAP and addressed the items in paragraph 8.3 of the Settlement Agreement.