GM Sustainable Workplaces
VEC East, 5th Floor
30400 Van Dyke
Warren, MI 48093

Sustainable Workplaces

December 24, 2019

Mr. Peter Ramanauskas
Project Manager for IND 0060306099
Waste, Pesticide and Toxins Division
U.S. EPA Region 5
77 West Jackson Blvd. (DW-8J)
Chicago, IL 60604-3590

Re: RCRA Corrective Action Administrative Order on Consent (AOC)
Pilot Perimeter Groundwater Collection Trench Construction Certification Report
GM GPS - Bedford Facility, IND 006036099, Docket No. RCRA 05-2014-0011
Bedford, Indiana

Dear Mr. Ramanauskas:

Please find enclosed the “final” Pilot Perimeter Groundwater Collection Trench Construction Certification Report (CCR) documenting the completion of the Pilot Trench at the General Motors (GM) Bedford Global Propulsion Systems (GPS) (formerly Castings, Engines, and Transmissions (CET) and formerly Powertrain) Facility (Facility) at 105 GM Drive in Bedford, Indiana, and select surrounding properties (Site). The “draft” CCR was initially submitted to EPA on June 22, 2018, but has been revised to incorporate the GM responses dated March 22, 2019 to EPA comments dated Sept. 7, 2018. The GM responses were approved by EPA in an email dated Dec. 5, 2019.

The Pilot Trench installation was completed as an Interim Measure for the East Plant Area under the Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) project. This report is being submitted in accordance with the Administrative Order on Consent, effective Aug. 4, 2014 (United States Environmental Protection Agency (U.S. EPA) Docket No. RCRA 05-2014-011).

Please feel free to call me at 313-506-9465 if you have questions concerning this information or otherwise regarding the Bedford GM LLC project.

Sincerely,

Edward Peterson

Ed Peterson
Senior Project Manager, Remediation Services
GM Sustainable Workplaces

RH/aj/186

GM Bedford Distribution List

Peter Ramanauskas	U.S. EPA, Region 5
Daniel Haag	U.S. EPA, OSC
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Ed Peterson	GM Remediation Services
John Maher	GM Remediation Services
Ryan McDuffee	GM Bedford Environmental Compliance
Katie Kamm	GHD Project Manager
Bill Steinmann	GHD Project Geologist
Rick Hoekstra	GHD Design Engineer

Construction Certification Report

Pilot Perimeter Groundwater Trench Collection System

General Motors LLC

Table of Contents

Table of Contents

Figure Index

Table Index

Appendix Index

Acronyms List

AOC	Administrative Order on Consent
ASTM	American Society for Testing and Materials
Ben's Quarry	Ben's Quarry, LLC, 303 E Ingram Road, Springville, Indiana 47462
CA	Corrective Action
CLP	Community Liaison Panel
CQA	Construction Quality Assurance
DB-4	Detention Basin 4
ERI	Electrical Resistivity Imaging
Facility	GM GPS Bedford Facility
ft	Feet or Foot
GHD	GHD Services Inc.
GM	General Motors, LLC
GPR	Ground Penetrating Radar
GPS	Global Propulsion Systems
GWTP	Groundwater Treatment Plant

Acronyms List (cont'd)

HASP	Health and Safety Plan
HDPE	High-Density Polyethylene
HL Chapman	H.L. Chapman Pipeline Construction Inc.
IDEM	Indiana Department of Environmental Management
IM	Interim Measure
LLDPE	Linear Low Density Polyethylene
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
NAAQS	National Ambient Air Quality Standards
NAPL	Non-Aqueous Phase Liquid
NPDES	National Pollutant Discharge Elimination System
OMM	Operation, Maintenance, and Monitoring
PCBs	Polychlorinated biphenyls
Pilot Trench	Pilot Perimeter Groundwater Trench Collection System
PSI	Professional Service Industries, Inc.
QA	Quality Assurance
RA	Removal Action
RCRA	Resource Conservation and Recovery Act
Report	Construction Certification Report for the Pilot Perimeter Groundwater Trench Collection System
RFI	RCRA Facility Investigation
SES	Sevenson Environmental Services, Inc.
SSC	Site Source Control
TestAmerica	TestAmerica Laboratories, Inc.
TSCA	Toxic Substances Control Act
TSP	Total Suspended Particulate
TWA	Time-Weighted Average
U.S. EPA	United States Environmental Protection Agency
WW	Wet Well

1. Introduction

1.1 General

This Construction Certification Report (Report) has been prepared by GHD Services Inc. (GHD) to document the construction of the Pilot Perimeter Groundwater Trench Collection System (Pilot Trench), at the General Motors LLC (GM) Global Propulsion Systems (GPS) Bedford Facility (Facility) located in Bedford, Indiana, as part of the Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) activities being conducted under the Administrative Order on Consent (AOC) (effective August 4, 2014) between United States Environmental Protection Agency (U.S. EPA) and GM for the Facility (Docket No. RCRA-005-2014-0011). The Pilot Trench is the first phase of the Perimeter Groundwater Trench Collection System Interim Measure (IM), which is intended to work in conjunction with the East Plant Area Removal Action (RA) Site Source Control (SSC) systems and Cover System IMs to provide horizontal and vertical control of contaminated groundwater transport.

This Report includes revisions based on responses to U.S. EPA comments received by GM on September 7, 2018, as well as email comments received on July 13, 2018.

The Pilot Trench was constructed to competent bedrock as an initial phase of the Perimeter Trench to evaluate the effectiveness of the planned IM prior to design and construction of remaining trench, as required. The Pilot Trench was specifically designed to span the bedrock valley in the northeast corner of the East Plant Area Cover System. This Report documents construction of the Pilot Trench, including details of the restoration of the cover system, where a portion of the Pilot Trench fell within the limits of the East Plant Area Final Cover System. The Facility location and Facility plan are presented on Figures 1.1 and 1.2, respectively.

1.2 Report Organization

The Report is organized in the following sections:

i. Section 2 presents the Site location, description, the design basis and components of the Pilot Trench

ii. Section 3 provides a description of the Pilot Trench installation.

iii. Section 4 presents the air monitoring program implemented during construction.

iv. Section 5 summarizes the approved health and safety procedures implemented during the Pilot Trench construction.

v. Section 6 presents a description of the security measures taken to secure the Site during construction of the Pilot Trench.

vi. Section 7 presents the record keeping procedures implemented during construction.

vii. Section 8 presents the lessons learned and changes made to the original design, for future construction of other trench phases.

viii. Section 9 summarizes the monitoring and maintenance that will be conducted for the completed Pilot Trench.

ix. Section 10 presents various means of community participation and awareness that occurred during the Pilot Trench construction.

x. Section 11 presents references cited in this Report.

xi. Section 12 provides certification of the Pilot Trench construction completion.

2. Site Information

2.1 Site Location and Description

The Facility is located at 105 GM Drive in the City of Bedford, Shawswick Township, Lawrence County, Indiana. The Facility lies on approximately 256 acres of land on either side of GM Drive, with a piece on the east side of Bailey Scales Road. The East Plant Area represents a portion of the Facility and is located to the east of GM Drive and west of Bailey Scales Road (see Figure 1.2).

The Facility is bordered by residential and undeveloped areas to the north and east; to the south by the White River Port Authority (former Canadian and Pacific Railway railroad tracks have been removed), Bedford Recycling (formerly IMCO, a Kaiser Aluminum recycling facility) and a residential property; and to the west by the abandoned railway, a church, residential properties, commercial properties, and a cemetery.

The Facility is currently zoned and used for industrial purposes. The reasonably foreseeable future land use is industrial.

The Pilot Trench was constructed in the East Plant Area at the northeast corner of the East Plant Cover System. The alignment of the constructed Pilot Trench is presented on Figure 2.1.

2.2 Pilot Trench Location and Description

The Pilot Trench final design was presented to the U.S EPA in report entitled the "Pilot Perimeter Groundwater Trench Collection System Study", dated December 7, 2015, with Revision 1 to this design report issued on February 19, 2016. The design elements of the Pilot Trench include the following:

- Trench excavation to competent bedrock using specially-equipped trenching machine
- Cement-bentonite grout layer placed on trench bottom to provide low permeability seal
- Vinyl sheet piling on downgradient wall to prevent water from passing through trench
- 6-inch HDPE drain collection pipe to convey groundwater to wet well collection sump
- Gravel trench backfill providing preferential pathway in combination with collection pipe
- Geotextile over gravel backfill for filtration control as separation from overlying material
- Drainage media sand to provide hydraulic connection from overburden to bedrock trench

- Replacement of removed overburden soils, where suitable, or imported clean common fill
- Restoration of GM Bedford East Plant Area low permeability cover system, where removed.

The Pilot Trench is a section of the Perimeter Groundwater Trench Collection System IM approximately 750 feet (ft) in operational length, installed at the northeast corner of the East Plant Area Cover System along the downgradient extent of the property. The Pilot Trench alignment is approximately perpendicular to the karst valley feature defined by a drainage channel colloquially known as Tributary 3. The Pilot Trench consists of a continuous gravel-filled trench that crosses through detention basin 4 (DB-4) and along the east side of DB-5 to the south. The depth below grade of the Pilot Trench varies along its length with the deeper reaches being approximately 38 ft below ground surface (ft bgs) at the south end and approximately 28 ft bgs at the north end, while the shallowest depth below grade occurs near the mid-point beneath DB-4 at a depth of approximately 8 ft bgs.

A 6-inch diameter perforated high density polyethylene (HDPE) pipe was placed at the bottom of the excavated trench prior to gravel backfilling to facilitate groundwater conveyance via this preferential, gravity drainage (equivalent to a French drain) to Wet Well (WW) #4 located at Station 3+77. Four 30-inch diameter HDPE sumps were placed within the precast concrete WW#4 chamber to collect groundwater which is pumped to an on-Facility groundwater treatment plant (GWTP) via a buried underground forcemain. The GWTP was designed to remove low level polychlorinated biphenyl (PCB) concentrations in groundwater using a self-cleaning centrifugal filter system (Orival filtration) followed by granular activated carbon (GAC) treatment. Treated water is discharged under the National Pollutant Discharge Elimination System (NPDES) Permit No. IN0064424 back to Tributary 3.

2.2.1 Pilot Trench Design Basis

The planned Perimeter Groundwater Trench Collection System depth and alignment were determined based on bedrock topography, the elevation of competent bedrock, and groundwater flow direction. During the design process, the specific alignment for the Pilot Trench was based on the following considerations:

- The nature and extent of impacted groundwater and preferential flow pathways based upon the RCRA Facility Investigation (RFI) results and GM property boundaries (e.g. horizontal/vertical flow in fractured zones and horizontal flow at competent bedrock)
- The limits of the East Plant Area Cover System
- The number and location of RA SSC systems which have been installed upgradient of the trench within the bedrock valley directed to the existing Wet Well 3.
- The location and depth of competent rock (no significant open fractures) along this specific portion of the Perimeter Groundwater Trench Collection System
- Constraints of the bedrock trench construction methodology and bedrock trenching equipment (e.g., number of bends within the trench alignment, ability of the equipment to make turns, and depth restrictions of the equipment)

The Pilot Trench was designed to work in conjunction with the East Plant Area IM (RA SSC systems and East Plant Area Cover System IM) to provide horizontal and vertical control of groundwater transport. Source removal activities have already minimized contact between higher concentration soils with groundwater. High concentration (over 50 mg/kg PCB) waste removal was completed in 2009 with these soils placed in the East Plant Area double lined TSCA landfill vault (Vault). The Vault Cover System construction was completed in 2013. The East Plant Area Cover System reduces groundwater recharge, thereby reducing the volume of groundwater collected by the Perimeter Groundwater Trench Collection System (minimization of vertical groundwater flow into the area from precipitation).

The Pilot Trench consists of the installation of a portion of the Perimeter Groundwater Trench Collection System IM and will be used to evaluate the current and future performance and location of the groundwater collection system, as required. The Pilot Trench transects karstic bedrock features found in the shallow groundwater such as grikes, open fractures, solution cavities, and vugs. Groundwater conveyed within these features is intersected and collects in the Pilot Trench, providing efficient means to drain upgradient groundwater for collection and treatment prior to off-Site migration.

The bottom elevation of the Pilot Trench was designed to be completed within competent rock, with a physical barrier (vinyl sheet piling) placed along the downgradient side of the Pilot Trench and a grout layer along the Pilot Trench floor to prevent leakage. The bottom elevations were determined through bedrock coring and geophysical testing prior to cutting the trench, and confirmed by video survey during the trenching activities. The physical barriers reduce the potential for downward migration of groundwater with a low-permeability seal (grout) along the bottom along the length of the Pilot Trench, as well as minimizing upgradient water from traversing across the Pilot Trench (plastic sheet piling).

A description of the components used in the construction of the Pilot Trench is presented in the following sections of this Report.

3. Execution of the Work

Request for bids were sent out to prospective contractors, with the design package (drawings and technical specifications) to Envirocon Inc., HIS Constructors, Northstar Environmental Remediation, Remedial Construction Services (RECON), and Sevenson Environmental Services, Inc. (SES). The design package was based on the Pilot Trench final design report presented to the U.S EPA entitled the "Pilot Perimeter Groundwater Trench Collection System Study", dated December 7, 2015, with Revision 1 to the report issued to U.S EPA on February 19, 2016. SES was the selected contractor and mobilized to the Site in August 2015 to commence construction of the Pilot Trench. The GWTP was constructed concurrently with the completion of the Pilot Trench. The GWTP was constructed by GHD, with trench forcemain tie-ins completed by SES under the Pilot Trench contract.

3.1 Site Preparation

Site preparation activities were completed prior to initiating Pilot Trench construction activities. Where possible, resources already in place to support the East Plant IMs were used for the Pilot Trench construction activities, including site trailers, first aid facilities, break facilities, tool and material storage areas. The following is a list of Site preparation activities for the Pilot Trench construction not already completed in conjunction with other Site RCRA CA activities:

- Mobilized remaining construction support facilities, equipment, and personnel necessary to perform the work.
- Located and marked aboveground and underground utilities prior to commencing field activities. Utilities periodically required relocation during the course of the construction as needed, or required by law.
- Established erosion/sediment transport controls. A soil erosion and sediment control permit was required for the Pilot Trench installation and is provided in Appendix A.
- Constructed temporary berms and piping to divert surface water around the Pilot Trench area.
- Established Site security, Site communications, temporary access roads, and equipment laydown/parking area.
- Established on-Site staging areas for stockpiling overburden material removed during the construction of the working platform.
- Implemented fugitive particulate controls and institutional controls.
- Established air quality monitoring locations.
- Install a temporary water treatment system to treat water from the Pilot Trench excavation only (surface water was rerouted around the excavation area).

3.1.1 Working Platform

A working platform was constructed along the Pilot Trench alignment by removal of the overburden soils with an excavator to provide a working surface for operation of the trencher and to provide an area for the trench spoils to be discharged and managed. The working platform was constructed as close to the top of bedrock as possible, with minimal granular material used to level the path for the rock trencher. SES removed scrub vegetation (specifically stump and brush removal) along the Pilot Trench alignment in advance of overburden removal and bedrock excavation, as larger vegetation (e.g. trees) had previously been removed as part of the corehole drilling program conducted along the proposed trench alignment.

The top of bedrock was found to be irregular epi-karst, particularly along the south end of the Pilot Trench. Top of bedrock elevations were found to be higher than expected in some locations, as compared to the investigative corehole drilling data (coreholes were drilled at 150- to 200-ft intervals along the proposed Pilot Trench alignment). As a result, rock breaking was performed using an excavator with hoe ram attachment in order to remove the undulations in the bedrock surface. A layer of stone was placed over the exposed bedrock to create and level the working platform for loading and removal of bedrock. A protective construction fence was erected around the perimeter of the working platform during excavation to prevent unauthorized access into the Site and the open trench. Once the trench was cut, cuttings were placed back in the trench to prevent accidental falls into the trench by humans or animals.

A portion of the constructed Pilot Trench crossed the previously constructed East Plant Area Cover System (Cover System). The Cover System incorporates a low permeability compacted clay layer overlain with a Linear Low Density Polyethylene (LLDPE) liner, a lateral drainage layer (drainage geocomposite), a protective soil cover layer (common fill), and a vegetative topsoil layer. Cover soils removed from above the LLDPE liner/drainage geocomposite layer were treated as clean fill. The contractor then removed the drainage geocomposite material and LLDPE liner layers of the Cover System where it fell within the limits of the working platform. The leading edges of the liners were protected so that the Cover System could be re-established during restoration activities. Soils excavated from beneath the Cover System liner/drainage geocomposite, including the clay barrier layer, were segregated and managed as impacted soils (less than 50 mg/kg PCBs) and removed from the Facility for disposal at Twin Bridges Recycling and Disposal Facility.

The bedrock surface topography along the trench alignment is presented on Figure 3.1.

3.1.2 Electrical Resistivity Imaging

Following construction of the working platform and prior to bedrock trenching, an electrical resistivity imaging (ERI) survey was completed to provide additional information on bedrock competency. The survey included delineation of potential groundwater migration pathways such as fractures and voids. The survey was completed using a Syscal R1 Plus receiver and a 72 electrode spread, with an internal switching board and a 200 Watt power source. Electrode spacing ranged from three to five feet. The results were assessed using a Wenner-Schumberger array. The results were found to be inconclusive due to variable trench conditions. Although the ERI survey was intended to be used to determine fractures and voids in the trench by reading the bedrock layer, the ERI survey also read other layers of soil and aggregate, which created obscure results. As such, it was determined that the ERI survey results would not be reliable and the pre-excavation identification of the fractures and voids within the trench would rely on the ground penetrating radar (GPR) survey results.

3.1.3 Ground Penetrating Radar

After the overlying overburden soils were removed and prior to bedrock trenching, GPR surveys along the Pilot Trench were completed following the ERI survey. GPR surveys were performed over two site visits (based on the sequencing of the overburden removal and platform construction) and in four segments along the length of the Pilot Trench.

Two GPR surveys were performed during the first Site visit. One survey was performed over a 175-ft section (Station 6+75 to 8+50) at the south end of the Pilot Trench and a second survey performed over 168-ft section (Station 0+70 to 2+38) at the north end of the Pilot Trench. Further GPR work could not be completed during the initial visit due to a large rock outcropping located just north of Station 6+75 that prevented grounding of the electrodes, as well as the presence of still intact cover system (PCB-impacted overburden) within DB-4 (approximately Station 2+50 to 3+25) which had not been removed at the time the initial GPR surveys were being conducted.

During the second Site visit, two additional GPR surveys were completed. The first survey covered a 228-ft section (Station 2+70 to 4+98) of the Pilot Trench, within the DB-4 valley. This section was located, toward the south of the inflection point (i.e., bend in Pilot Trench alignment). The second survey was completed over a 190-ft section (Station 4+87 to 6+75) of the Pilot Trench after the large rock outcropping had been removed. It is noted that GPR survey for Station 2+70 to 4+97 was completed through the overlying aggregate material that had been placed for the working platform, as opposed being conducted directly over the exposed bedrock surface.

Details of the GPR survey results, how the surveys were performed, how the data were acquired, downloaded and processed, where adjustment were made to correlate with any known information (i.e., coreholes), and the conclusions made by the GHD technician are presented in Appendix B. The GPR results were used to confirm the appropriate Pilot Trench depth was achieved by defining any change in rock conditions from fractured to more massive rock types.

In conclusion, acquired data provided on the generated GPR survey plots presented in Appendix B demonstrates that an adequate depth of investigation to confirm competent bedrock was achieved along all conducted transects. A strong GPR reflector identifying competent bedrock was observed to be present at the base of interpreted fracture/void responses along these transects. Comparison and ground-truthing of the acquired GPR survey results to historical corehole information was used to make final adjustments to the generated plots, involving slightly modified GPR velocities in order to account for the non-homogeneous properties of the shallow bedrock. Finally, the location of the strong GPR reflector as provided on the trench profile figures presented with the memorandum in Appendix B indicates that an appropriate depth of excavation to competent bedrock at the base of the trench was achieved.

3.2 Trench Excavation

A specially-equipped bedrock trenching machine, Trencor 1660, was used by H.L. Chapman Pipeline Construction, Inc. (HL Chapman), a rock trenching company subcontracted by SES to perform the bedrock excavation for the Pilot Trench. Bedrock trench excavation commenced on November 2, 2015 at the north end of the Pilot Trench alignment (Station 0+00) and continued to the south. Bedrock trenching was completed on December 12, 2015. Trenching progressed at a rate of approximately 30 linear feet per day.

The working platform and rock trenching equipment were leveled to be plumb within one percent of vertical to achieve vertical walls within the Pilot Trench excavation and followed the designed Pilot Trench alignment within two feet of the designated centerline. The rock trencher cutting arm worked to the prescribed design elevations using its own built-in internal positioning system, with the depths manually measured at regular intervals along the excavation to verify completed depths. The trench width cut was approximately two feet.

A clay dam and a temporary storm pipe were constructed adjacent to the Pilot Trench excavation to direct stormwater away from the excavation, preventing water from DB-3 and other upstream areas from entering the Pilot Trench.

The Pilot Trench was remotely inspected, to the extent it could be done safely, prior to installation of the remaining components, discussed in the following sections (See Section 3.3).

Groundwater and stormwater collected in the trench during the construction of the Pilot Trench was treated as PCB-impacted remediation water. This remediation water was collected and treated via a temporary water treatment plant constructed by SES. No oil was encountered during Pilot Trench construction. Water treatment consisted of tank settlement for sediments, influent bag filters, sand filtration, carbon filtration, and effluent bag filters. The treated water was batched and tested prior to discharge at the permitted Outfall 003 located directly east of the Pilot Trench. A summary of the temporary water treatment plant discharge analytical data is presented on Table 3.1.

3.2.1 Soil Handling and Stockpiling

Soils removed during the construction of the working platform outside the Cover System footprint and overburden soils above the Cover System liner were handled as clean soil (based on historical soil sampling results). The material was stockpiled for reuse as clean backfill.

Soil from beneath the Cover System liner were transported off-Site for disposal as <50 mg/kg PCBs-non-TSCA impacted soil. The PCB-impacted soil was transported to Twin Bridges Recycling and Disposal Facility by Young Trucking, Baugh Trucking, Bloomington Trucking Inc. and Strouse Trucking. A summary of the PCB-impacted soil disposal weights can be found in Table 3.2. An analytical summary of the soil samples (collected as required by Twin Bridges prior to material acceptance at the landfill) are provided in Table 3.3.

Rock cuttings from the trenching activities were placed back into the open trench for temporary storage. Storing the rock cuttings in the trench prevented the trench from potential collapse until the final construction components. This also alleviated safety concerns regarding maintaining an open trench. A sample of the rock spoils were collected by GHD to determine if PCBs were present in the rock. The rock cutting sample results were non-detect for total PCBs. A summary of the analytical results for the Pilot Trench rock cuttings are presented in Table 3.4. Off-Site disposal of the trench cuttings was not required due to the sample results.

Although the rock cutting samples were non-detect, the rock cuttings were deemed not suitable for re-use within the Pilot Trench as the drainage layer. It was determined that the rock cuttings could be stored on-Site for potential re-use at the Site in the future (in conformance with Indiana Department of Environmental Management's [IDEM] non-rule policy). A portion of the rock cuttings were stockpiled on the former lower modutank pad, located on Parcel 216 across Bailey Scales Road. The balance of the rock cuttings were used to raise the elevation of the bedrock trencher laydown area.

3.3 Bedrock Quality Verification

After a section of bedrock trenching was completed, but before the rock cuttings were placed back into the trench, GHD oversight personnel performed "trial" video inspections of the excavated trench wall to determine an effective method for documenting the nature of bedrock competency and for observation of the ability of any observed fractures to transmit groundwater into the trench. Several different methods for lowering the camera into the open trench and viewing the bedrock trench walls were field tested in order to determine the most practical, effective, and safe method to conduct the eventual confirmatory video recordings.

GHD completed a review of the 17 trial high definition quality video recordings performed during initial bedrock trenching. This preliminary review indicated that the video inspections provided high quality pictures with sufficient coverage of the bedrock walls to document that the trench had been completed within competent bedrock. The trial video inspections were used to support the decision to demobilize the bedrock trenching machine from the Site immediately upon completion of the rock trenching work, based on the conclusion that competent rock had been encountered. A summary of the general rock fracture conditions observed from these "trial" videos is provided in Appendix B. Copies of the "trial" videos have been sent separately.

Following determination of the most effective method for video inspection of the open trench, GHD oversight personnel regularly conducted final video inspections of the trench during the bedrock trench construction process. As a result, the video inspection process became a two-step process, including the initial “trial” inspection of the bedrock trench shortly after each trench section was cut, but before the trench was temporarily backfilled with the rock cuttings, and the confirmatory “final” inspections after the rock cuttings were removed, but before the sheet piling and pipe was installed and the trench backfilled with drainage media.

Once the temporarily stored rock cuttings were removed from the trench, confirmatory inspection videos documenting both the upgradient and downgradient sides of the trench wall were recorded. The videos were taken at approximately 5-ft intervals along the length of the Pilot Trench to provide documentation of the vertical and horizontal bedrock conditions. Copies of the confirmatory videos are provided in Appendix C (copies of these videos were supplied to U.S. EPA separately). A total of 165 videos were recorded and reviewed over the length of the Pilot Trench excavation. The final videos documented 59 vertical and 26 horizontal fractures.

The physical location (related to chainage along the trench centerline) of the majority of the vertical fractures were surveyed from a safe position along the top of the open trench. The videos identified additional fractures at deeper depths that could not be visually observed from the top of the trench, and therefore the location of those deeper features are approximated.

It should also be noted that seepage from the fractures was visually observed by field personnel to have diminished at the time of the final confirmatory video work performed in December 2015, as compared to general observations made during initial excavation of the Pilot Trench and the “trial” video recordings completed in late October/early November 2015. The general observation that trench seepage appeared to decrease is an intuitive outcome of drier weather and does not appear to be a reflection of trench performance, but evidence of seasonal variation. However, both the Pilot Trench and the GWTP have been designed with capacity sufficient for the varying productivity (i.e., groundwater removal) of the Pilot Trench.

Vertical fractures located at Stations 1+00 (VF9), 1+55 (VF15), 2+00 (VF19), 2+20 (VF22), 8+05 (VF55), and 8+10 (VF56) were identified as water bearing fractures. The majority of the vertical fractures terminated before the bottom of the trench, with the bedrock at the base of the trench generally observed to be in sound condition. Two of the water bearing vertical fractures (those at Stations 1+00 and 8+05) carried to the base of the trench but, narrowed significantly to very thin fractures as they approached the base of the trench. The vertical fracture locations are presented on Drawings C-06 and C-07 in Appendix D.

In general, the quality of the high definition video recordings demonstrated an exceptional ability to observe and record fractures within the trench walls and to see water emanating from the fractures (if present). The video recording technique that was tested and selected allowed GHD to perform a thorough survey along the entire Pilot Trench length. This video survey provided an indication of the fracture density, size of fractures, and ability to transmit groundwater, demonstrating that the rock fractures decreased with depth. Qualitative observations of rock fractures, groundwater flow, and comparison of general rock competency to expectations based on the pre-design investigation data were the feasible remote methods available for visual inspection of the trench sidewalls due to safety concerns with respect to standing too close to the edge of an open rock trench.

Table 3.5 presents the stations and approximate depths and/or lengths of the fractures observed from the confirmatory videos. Observations of the fracture cavities made during the review of the final confirmatory videos are provided on Table 3.5 and include both a determination if the cavity formed by the fracture was filled with native material (e.g., clay) or was potentially void of material and an indication that the fracture showed evidence of water flow.

Two station-based cross-sections along the length of the east and west walls of the Pilot Trench (Figures 3.2 and 3.3) have been prepared illustrating the visually observed horizontal and vertical fractures discussed above to allow for spatial reference of the information presented in this Report. Please note that a number of the deeper fractures were approximately positioned as they could not be visually identified from observing from the top of the trench because the field survey personnel could not get close to the edge of the open rock trench to safely perform this task. Therefore these deeper fracture locations could not be accurately surveyed. It should also be noted that many of the horizontal features within the Harrodsburg Formation are thin bedding features and not necessarily fractures or voids that can transmit water as part of the flow regime.

Although the video inspection data was instrumental in the preparation of the cross-sections, the decision process related to the final selected depth of the Pilot Trench involved the use of multiple lines of evidence collected prior to, during, and after trench construction. In addition to a qualitative assessment of the fractures presented in the cross-section figures, other physical evidence such as that derived from the series of pre-design coreholes installed along the proposed trench alignment was used to identify where competent bedrock generally exists along the east side of the East Plant Area. Subsequent to the design, other evidence such as geophysical (see Sections 3.1.2 and 3.1.3) and direct visual observations were employed to validate that the base of the bedrock trench was constructed within competent bedrock. Several examples of these lines of evidence are discussed in the next paragraph.

Visual observation of the post-construction cross-sections (Figures 3.2 and 3.3) clearly show a decreased frequency and density of the significant vertical fractures with depth within the Salem Formation. These vertical fractures are prevalent in the Salem Formation karstic features. The majority of the vertical fractures terminate above the bottom of the Pilot Trench. It should be noted that the two station-based cross-section figures are not an exact reproduction of all the fractures listed in Table 3.5, but a generalization of the video review and presentation of those fractures of significance.

The ability for fractures observed in the coreholes to convey water was also assessed as a line of evidence. Fractures identified in retrieved rock cores during pre-design drilling were measured and pressure testing of fractures was conducted.

Section 2.7 of the draft RFI Report presents a discussion of the site hydrogeologic characterization, including a mathematical evaluation of the hydraulic aperture width of karst bedrock fractures as it relates to transport of groundwater and DNAPL. Appendix J of the draft RFI Report presents the calculations performed by Dr. B.H. Keuper and subsequent testing, while Figures 2.41 and 2.42 of the draft RFI Report present graphs of the data with respect to hydraulic aperture width. When discussing the pressure testing results, the RFI Report also indicated that statistically the hydraulic conductivity of the bedrock decreased with depth.

Based on limited (thin) fractures near the base of the Pilot Trench and the observation that these fractures did not appear to produce substantial water, the base of the Pilot Trench was determined to have been completed within competent, more massive, bedrock. For confirmation, the final trench depth was also consistent with the bedrock corehole information used for design of the Pilot Trench.

To further confirm that the Pilot Trench was constructed to the appropriate depth, implementation of a Pilot Trench Performance Monitoring Plan (PMP) will evaluate the vertical and horizontal hydraulic performance of the Pilot Trench. The PMP activities will include dye trace studies to further support the observations that the Pilot Trench was sufficiently constructed into competent bedrock.

3.3.1 Horizontal Fractures

During the Pilot Trench bedrock wall inspection process, two horizontal fractures were observed to be discharging a small volume of water into the trench. The significance of this water flow is further evaluated in the context of verifying the Pilot Trench has been installed into the competent bedrock.

The horizontal fractures were not physically surveyed (in relation to the trench chainage), as they could not be observed from the top of the trench, however they were positioned upon review of the confirmatory videos. Two fractures on the west side of the trench at Stations 1+55 (HF5) and 8+65 (HF26) were found to have minimal flow, however at both locations the observed water flow from the horizontal fractures appeared to be hydraulically connected with surface water sources along the overburden/bedrock interface. The suggestion of contribution from the overburden regime is based on visual observations of the water quality (i.e., clarity/turbidity) and quantity. Therefore, this flow does not appear to represent a source of groundwater flow through the fracture system. The basis for concluding that water emanating from these two fractures is derived from near-surface infiltration is based on one or more of the following observations: visual observations of the fracture connections to the overburden geology, groundwater table elevation relative to the water producing fracture, presence of turbid water quality indicative of direct contact with unconsolidated soils and the quantity of water emanating from the fractures.

For the fracture located at Station 1+55 (HF5), Table 3.5 specifically indicates that there was a large V-notch in the bedrock surface at the top of the trench connected to a vertical fracture at the same station. Although the horizontal fracture was observed to be approximately three-quarters of the way down the trench wall (approx. 15 ft), there was a clear visual connection of the vertical fracture originating from the top of the bedrock to the horizontal fracture at depth. As well, the observation of turbid water and varying flow rate related to precipitation are other lines of evidence that the water source was related to near surface infiltration.

As for the observed fracture located at Station 8+65 (HF26), Table 3.5 specifically notes that this horizontal fracture was one-quarter of the way down the trench wall (approx. 30 ft), but there was a vertical fracture in close proximity (Station 8+60). It should be noted that the horizontal fracture was estimated to extend from Station 8+60 to 8+65, with the vertical fracture at Station 8+60 extending vertically from the top of the trench to the mid-depth (i.e., past the horizontal fracture). As such, it was postulated that the flow observed in the horizontal fracture originated from the vertical fracture that extended down from the top of bedrock (i.e., below the water table). Although it is possible that groundwater flow observed in horizontal and vertical fractures could be considered potential “flow through” within the bedrock formation, the observations in the field during at the two fractures in question appeared to indicate vertical flow from the overburden/bedrock interface was more likely.

In addition, a water bearing horizontal fracture was observed to run between Stations 6+50 and 8+65 (HF23). This fracture was measured 14 ft below the bedrock surface. Iron staining from water seepage can be observed along the side of the trench in the video coverage. The seepage from the horizontal fracture diminished over the dry winter months relative to the time of trench construction.

3.4 Trench Completion

Once bedrock trenching was completed by HL Chapman, SES constructed the drainage features of the Pilot Trench. The work was completed in three stages. The first stage included the installation of drainage components in trench portions north of WW#4. The second stage included the installation of drainage components in trench portions south of WW#4. The third stage included installation of WW#4 and the associated water transmission lines.

Prior to installing the drainage components, the temporarily stored rock cuttings were removed. The excavated trench cuttings from the northern half of the Pilot Trench were stockpiled on Parcel 216 at the former lower modutank pad and trench cuttings from the southern half of the Pilot Trench were placed on the trencher laydown area.

The Pilot Trench as-built bottom of trench elevations are presented on Drawing C-02 in Appendix D.

3.4.1 Physical Barrier

A physical barrier was constructed on the downside wall of the trench once the cuttings were removed. ShoreGuard Synthetic Sheet Piling (vinyl sheet piling) made by Crane Materials International was installed on the eastern (downgradient) wall of the Pilot Trench to serve as a water resistant membrane to minimize the potential for groundwater entering the trench from the west from migrating beyond the downgradient trench wall. The technical data sheet for the vinyl sheet piling is provided in Appendix E.

Prior to installation, the vinyl sheet piles and geotextile materials were visually inspected to ensure they were free from damage. The visual inspections of materials were performed on an ongoing basis as the materials were used and the work progressed, however no specific written forms were generated during construction to document these visual inspections. There were no instances of damaged vinyl sheets that precluded them from being used and no geotextile rolls were deemed to have been damaged and returned to the supplier.

The vinyl sheet piling was cut to appropriate lengths, progressively lowered into the bottom of the open trench and the tongue and groove joints individually sealed with 1-component hydro swell Swellseal Sealant. The bottom of the vinyl sheet piles were marked six inches from the bottom to assist with grout placement by indicating the minimum depth of grout required to be placed at the base of the Pilot Trench. Inflated tire tubes were used during the vinyl sheet piling installation to keep the sheet piling in place until the trench bottom could be grouted and the gravel fill could be placed. The excess vinyl sheet piling was cut off to grade with the top of bedrock surface along the Pilot Trench alignment.

With regards to sealing of the tongue and groove joints, the groove of each sheet pile was filled with the sealing compound in a horizontal position, prior to lifting the sheet and sliding along the tongue of the vertical sheet pile within the trench. A continuous bead of the sealing compound was placed within the groove, which was visually observed for uniformity by the field Quality Assurance (QA) personnel from both SES and GHD. The sealing compound was purchased separately from the plastic sheet piling as the sheet pile manufacturer did not supply this material, hence there were no manufacturer's installation procedures related to sealing of the tongue and groove joints in the plastic sheet piling. The sealing of the sheet piles was added as a design component to provide for an impermeable barrier on the back side of the bedrock trench. The sealing compound used was a hydrophilic waterstop that was designed for sealing smooth to very irregular construction joints and pipe penetrations. The sealing compound cures and swells in the presence of moisture or water. A field photo is included in the photographic log to clearly illustrate the sealing process.

A summary of the vinyl sheet piling installation log is presented in Table 3.6.

3.4.2 Grout Placement

Temporary clay dams were placed upstream and downstream of the sections of the trench where grout was placed. This was done to minimize the amount of water collecting in those sections while the grout was curing. Once the grout was sufficiently cured (curing completion time was determined by tapping the grout surface with rods and by previous field experience with grout curing time), the temporary clay dams were removed. This sequence continued until grout had been placed along the length of the barrier wall. The grout was placed at the bottom of the trench to seal the trench floor from potential groundwater migration and to cement the barrier wall in place. The combination of grout placement on the trench bottom and the vinyl sheet piling barrier wall on the downgradient wall was designed to inhibit groundwater from bypassing the trench, either by flowing vertically out the bottom or horizontally through (across) the trench.

Pure Gold Gel (bentonite) from CETCO Drilling Products was mixed with cement to form the grout mixture. The bentonite powder was added to the cement trucks as they arrived at the Site and was allowed to thoroughly mix, prior to emptying the grout mixture into the cement truck hopper. The technical data sheet and material safety data sheet for Pure Gold Gel is provided in Appendix F.

The grout mixture was tested in accordance with the American Society for Testing and Materials (ASTM) Method C109 (Standard Test Method for Compressive Strength of Hydraulic Cement Mortars) at a frequency of one sample per batch. Testing confirmed the minimum unconfined compressive strength results met the acceptance criteria of 100 psi.

The cement-bentonite grout mixture was poured into the Pilot Trench using a concrete hopper. A minimum of six inches of grout was placed at the base of the trench to provide a low-permeability seal to key in the physical barrier and thus prevent water from circumventing the barrier system by going under the installed physical barrier. To confirm that at least six inches of grout was placed, the trench bottom/floor was surveyed after the rock cuttings were removed and prior to placement of the grout. A second survey was completed following placement of the grout to confirm the grout thickness. The second survey also documented the slope of the trench bottom, which was used to determine whether additional grout was required to ensure the trench floor was sloped to effectively transport water to the Wet Well. The top of grout as-built topographic survey confirming the grout layer thickness is presented on Drawing C-02 in Appendix D.

Detail 1 on Drawing C-09 of the Bedrock Pilot Trench Record (As-Built) Drawings presented in Appendix D illustrates that the base of the excavated bedrock trench was covered with a 6-inch minimum thickness of cement-bentonite grout prior to placement of the perforated HDPE drain pipe and granular backfill. The grout layer was installed to cover over remaining fractures still present at the base of the trench, and to prevent any groundwater that had entered the Pilot Trench via the horizontal and vertical fractures present in the sidewalls from escaping collection by exiting through the bottom of the Pilot Trench. Note that groundwater within water bearing fractures that are located partially above, and partially below, the grouted trench bottom will still discharge into the trench as groundwater within the fracture will flow in direction of lower hydraulic pressure (i.e., the trench cavity creates the lowest hydraulic pressure point within the geologic system).

The cement-bentonite grout layer was placed after installation of the plastic sheet piling on the back side of the excavated rock trench, such that the base of the plastic sheet piling was embedded into the grout layer to ensure complete containment of collected groundwater. As such, this combination of grout seal and sheet piling provides both vertical and horizontal control of contaminated groundwater.

3.4.3 Perforated Drain Pipe

A 6-inch perforated HDPE drain pipe was placed at the bottom of the excavated trench to facilitate groundwater conveyance via gravity drainage to the Wet Well location. The drain pipe was placed at the bottom of the trench once the grout had sufficiently set. The drain pipe was installed in accordance with the manufacturer's recommendations, and without kinks or bends. The grade of the pipe was maintained continuously without mounds or sags in the pipe, as confirmed by survey.

3.4.4 Wet Well Chamber (WW#4)

A Wet Well chamber was installed to house four vertical 2-ft diameter HDPE sump pipes. The chamber is located between Stations 3+50 and 4+00, at the low point within the Pilot Trench. Groundwater from the 6-inch diameter HDPE drain pipe installed at the bottom of the trench free-flows to the 4 sumps. The sumps, along with the wet well chamber, pumps and controls are referred to as WW#4. Water collected in WW#4 is transferred via buried forcemain to the on-Site GWTP for treatment prior to discharge at Outfall 004 under the NPDES permit (NPDES Permit No. IN0064424).

Two of the four 30-inch diameter sump pipes are equipped with electric submersible pumps (EPG Series 60, Model 60-6 vertical sump drainer pumps capable of 340 USGPM at total dynamic head of 166-ft.) with individual 3-inch diameter discharge lines connected to a 6-inch diameter header pipe within the WW#4 chamber. The header pipe leads to a buried HDPE forcemain. The third sump was installed to provide additional pumping capacity (i.e., install third pump if required).

The remaining fourth sump pipe was installed to facilitate the use of a diesel pump, to be installed as a backup pumping source in the event of a power outage and to provide supplemental pumping capabilities, if necessary.

As-built drawings for the WW#4 sumps and chamber construction are presented on Drawing C-10 and C-11 in Appendix D, however it should be noted that the internal piping was not surveyed as to the exact positioning within the WW#4 chamber but it closely replicates the original design (i.e., as-built drawings for WW#4 are copies of design drawings).

3.4.5 Pilot Trench Backfill

The drain pipe was covered using imported 1/4 inch diameter granular material. The gravel backfill extended to the top of bedrock. Prior to construction, the imported granular material was tested to ensure the material was acceptable for use as trench backfill. The results of the analytical test are present in Table 3.7. The granular material was transported from Ben's Quarry, LLC (Ben's Quarry), an approved off-Facility source, located in Springville, Indiana and end dumped directly into the trench. Multiple lifts of backfill were placed, allowing for natural spreading and compaction of the granular material.

3.4.5.1 Piezometers

Fifteen vertical 2-inch diameter piezometers were installed at approximate 50-ft intervals along the Pilot Trench. Seven piezometers were installed north of WW#4 and 8 were installed south of WW#4). Eleven piezometers were installed within the trench, along the inside groove of the vinyl sheet piling and rested on the grout base. Four piezometers were installed along the outside of the vinyl sheet piling (east of the sheet piling, downgradient of the trench). The piezometers were secured with a U-clamp drilled into the vinyl sheet piling. The piezometers will assist in evaluating the Pilot Trench performance. Piezometers locations are presented on Figure 3.4 and on Drawing C-03 in Appendix D.

3.4.6 Geotextile

Geotextile was placed over the top of the granular backfill to keep separation between the granular backfill and the overburden soil. The geotextile layer also acts as filtration control to minimize the fines from the overburden soil from entering the gravel backfill. The geotextile fabric was installed such that overlaps of the fabric panels were at least four feet.

Table 3.8 presents a summary of the manufacturer's testing results for the selected geotextile fabric, which were provided by the contractor as a submittal and reviewed and approved by the engineer prior to placement in the trench.

Prior to installation, SES and Quality Assurance (QA) personnel visually inspected the geotextile material to ensure the material was free from damage and contamination. The product tags were removed from each roll to cross-check against the contractor's submittal of the technical data for the material, confirming QA testing procedures were met prior to installation of the geotextile.

3.4.7 Drainage Media Sand

In areas where the trench extends beneath the Cover System, a sand component was added to the geotextile layer. The sand was placed above the geotextile placed over the backfilled trench and then the geotextile was wrapped over top of the sand (burrito-wrap). The purpose of the sand blanket is to create a vertical extension of the Pilot Trench to provide a downward pathway into the trench for water that had been in contact with <50 mg/kg soil within the Cover System from traversing past the Pilot Trench.

A schematic representation of the geotextile wrapped sand backfill over the bedrock trench is presented on detail Drawing C-09 in Appendix D.

3.4.8 Stockpiled Fill Placement

Stockpiled fill material was placed on either side of the geotextile-wrapped sand by end-dumping to complete backfilling of the excavated working platform. Fill material was placed and spread in approximate eight-inch (maximum) uncompacted lifts using a bulldozer, compacted to approximate six-inch thick lifts, and graded to promote surface water drainage away from the Pilot Trench.

A topographical survey of the completed backfill layer was performed. The as-built survey for the top of backfill layer is presented on Drawing C-02 in Appendix D.

3.4.9 East Plant Cover System

For the portion of the Pilot Trench located within the limits of the Cover System, the area was restored consistent with the previously installed Cover System design. The design included the following components (listed from bottom to top) placed over the compacted native and/or common fill backfill layer:

- Soil barrier layer – compacted clay (12 inches)
- 60-mil LLDPE Liner
- Drainage geocomposite
- Common fill (12 inches)
- Topsoil (6 inches) and vegetative cover.

The East Plant Area Cover System Design Report (CRA, April 18, 2008) provides a detailed description of the Cover System design elements. As-built construction details for the East Plant Area Cover System are provided in the Construction Certification Report for the East Plant Area Cover System – Revision 1 (CRA, January 25, 2016).

3.4.9.1 Soil Barrier Layer – Compacted Clay

The soil (compacted clay) barrier layer consists of a one-foot thick layer of compacted clay taken from the former lower modutank area on Parcel 216.

The clay was trucked from Parcel 216 and end-dumped directly onto the pre-graded surface layer. The soil (clay) barrier layer was placed in two six-inch compacted lifts to achieve the desired twelve-inch thick common fill layer.

Following the placement of each compacted clay layer, CQA testing was performed. The maximum dry density and optimum moisture content results (Proctor) from the Parcel 216 samples were collected and used to calibrate the field nuclear densometer in order to confirm that the required 95 percent in place compaction had been achieved. Table 3.9 presents a summary of the clay compaction test data that was collected by Professional Service Industries, Inc. (PSI).

Grade control for the clay placement activities was initially performed using grade stakes and later using Global Positioning System (GPS) equipped dozers. The depth/thickness of the soil (clay) barrier layer was confirmed by survey, conducted on a 50-ft grid after completion of the clay placement activities. The top of clay surface was compared to the previous survey of the grading layer surface (at a similar 50-ft grid, where possible) to ensure the specified clay thickness of

12 inches (compacted). The surveyed top of clay contours are presented on Drawing C-02 in Appendix D.

3.4.9.2 Linear Low Density Polyethylene Liner

The 60-mil thick textured LLDPE liner (geomembrane) was placed above the completed compacted clay layer. The specifications for the 60-mil textured LLDPE liner were presented in the East Plant Area Cover System Design Report (CRA, April 18, 2008). The liner used for the trench was excess material stored on-Site from the East Plant Area Cover System. The manufacturer's liner product data has been previously reviewed and accepted.

The material was visually inspected by the field QA personnel prior to installation of the liner. Table 3.10 presents a summary of the LLDPE liner installation log maintained by the field QA personnel.

Test seams (i.e. trial welds) were conducted at a minimum frequency of twice per day for each piece of seaming equipment (hot wedge fusion and/or extrusion welders). If a test seam failed, the seaming equipment was rejected for field seaming until the deficiencies were corrected (i.e., reducing or increasing the machine speed) and a successful seam test was produced. Table 3.11 presents a summary of the test seam results for the LLDPE liner layer of the Cover System.

Non-destructive seam testing was performed by air pressure testing over the full length of the installed seams, including tie-in seams to the LLDPE liner layer of the existing Cover System,. Seams where non-destructive testing results did not meet the QA testing acceptance criteria were repaired using extrusion welding in lieu of the fusion welding. Less than 7-percent of the non-destructive seam tests completed on the LLDPE liner were rejected. Table 3.12 summarizes the non-destructive seam tests completed during the LLDPE liner installation for the Cover System.

Destructive seam tests were completed at a minimum frequency of one test per 500 linear feet of continuous seam or 300 linear feet of combined seams. Destructive seam test included five field test coupons tested for both shear and peel using a calibrated field tensiometer. A set of five test coupons for each passing destructive seam test performed in the field was provided to the field QA personnel to submit for similar peel and sheer laboratory testing. Table 3.13 summarizes the destructive seam test results completed during the LLDPE liner installation for the Pilot Trench. Destructive seam tests completed in the field and laboratory achieved acceptable results (i.e., destructive seam testing had a zero percent failure rate).

Some of the liner seams were damaged and repaired during construction (e.g. a result of the destructive seam testing). A summary of the LLDPE seam repairs is presented in Table 3.14. Seam repairs were tested in a non-destructive manner using vacuum box testing, with periodic destructive seam testing as appropriate.

Drawing C-08 in Appendix D presents the panel layout drawing, destructive seam test, and seam repair locations.

3.4.9.3 Drainage Geocomposite Layer

The drainage geocomposite used for the construction of the Cover over the Pilot Trench was excess material from the East Plant Area Cover System. Since the material was previously used and approved, a submittal containing the QA testing results was not required.

The drainage geocomposite was initially placed over the completed LLDPE liner layer by unrolling the panels in their general intended location. The panels were then adjusted for proper alignment to provide the required overlap for joining, including overlapping with the tie-in to the existing Cover System. Appropriate care was exercised to not damage the drainage geocomposite material or the underlying textured LLDPE liner material during placement and joining activities.

3.4.9.4 Common Fill Layer

Common fill was obtained from Ben's Quarry and delivered to the Pilot Trench by Young's Trucking. A sample of common fill was collected from the source to ensure the material was acceptable for use in the Cover System. The analytical testing results for the common fill are presented in Table 3.7.

A minimum of one foot of imported common fill material was placed by end-dumping directly onto the completed drainage geocomposite material. The common fill was spread in approximately eight-inch (maximum) thick uncompacted lifts using a bulldozer, resulting in approximate six-inch thick compacted lifts upon completion.

Grade control for the common fill placement activities was performed by SES using a combination of grade stakes and GPS located on their equipment (i.e., GPS-equipped dozer). A survey of the top of the common fill surface was compared to the previously surveyed pre-graded clay barrier layer surface to ensure the specified common fill thickness was placed over the Cover System footprint within the Pilot Trench alignment. Additional common fill was placed where required, to create a uniform surface prior to installation of the topsoil and vegetative cover layers. The surveyed top of Cover System common fill contours are presented on Drawing C-02 in Appendix D.

These stockpile fill material (discussed previously in Section 3.4.8) and the common fill material were field compacted with the construction equipment, however no formal compaction testing was performed (or required per the specifications). The underlying clay is either (1) the impermeable layer for the East Plant Area final cover system or (2) a clay cover placed over the trench in areas outside the final cover system to reduce surface water recharge directly into the trench. As such, the compaction testing of these clay layers is critical to achieving the specifications for cover permeability, not the stockpiled or common fill placement. Also, with the liner (geomembrane) and drainage geocomposite being placed over the clay layer comprising the final cover system, it would not be appropriate to compact the overlying common fill layer due to the potential for damaging the drainage geocomposite and/or liner. It should be noted that this same process was followed during implementation of the East Plant Area final cover system, with compaction of the common fill being completed using standard construction equipment.

3.4.10 Topsoil Layer

Following placement of the common fill material, a 6-inch lift of topsoil was placed over the working platform where the surface was backfilled with common fill material. The topsoil from the existing

East Plant Area Cover System was removed, stockpiled and reused for the Cover over the Pilot Trench Construction area.

As recorded-final contours representing the final surface of the topsoil layer is presented on Drawing C-01 in Appendix D.

3.4.11 Vegetative Cover Layer

Following placement of the topsoil material, grass seed was planted via drill seeding to establish a vegetative cover over the replaced Cover System and Pilot Trench alignment. Erosion control matting was placed over the seeded area to prevent erosion of the topsoil and loss of seed during the first growing season. Curlex II, a biodegradable blanket constructed of Aspen excelsior fabric was used for the slopes and swales.

3.5 Design Deviations

Deviations from the final design presented Pilot Trench design report entitled the “Pilot Perimeter Groundwater Trench Collection System Study”, issued to U.S EPA dated December 7, 2015, with Revision 1 dated February 19, 2016, were as follows:

- The excavated bedrock trench was backfilled with rock cuttings for health and safety purposes (i.e., prevent accidental entry into deep trench by personnel or wildlife), with the cuttings subsequently removed via backhoe immediately prior to perforated pipe and stone drainage media backfill installation. This was a safety precaution determined to be appropriate in the field.
- During implementation of the Pilot Trench, the contractor determined that a more appropriate method of providing for possible future extension of the Pilot Trench was to lengthen the distance between the primary and secondary cleanouts. This eliminated the need for a steel plate at each end of the trench to hold back the stone drainage media should either end of the trench be extended during future trench construction.
- As part of restoration, a clay cap was placed over the entire length of the Pilot Trench, not just the section within the East Plant Area Cover System, to reduce the potential for infiltration of surface water and thus reducing the unnecessary infiltration of precipitation into the trench collection system and requiring treatment at the new Groundwater Treatment Plant (GWTP). This was also a decision made during backfilling and was efficient because of the availability of clean clay stockpiled on site for previous work.

4. Monitoring Procedures

4.1 Air Quality Monitoring

Air monitoring was conducted during Pilot Trench construction activities where there was a potential of airborne contaminants. Monitoring was performed in accordance with the Ambient Air Quality Monitoring Plan (AAQMP) (GHD, February 19, 2016) to quantify any airborne concentrations of contaminants. Monitoring occurred at locations nearest potential receptors during rock trenching activities and during the excavation of low-level non-TSCA PCB-impacted soil (<50 mg/kg) and subsequent loading for off-Site disposal.

Air monitoring was conducted by GHD from October 14, 2015 through March 16, 2016 (in addition portable dust monitors were used by SES in the immediate work areas (i.e., worker's breathing zone) under the Contractor's Site-specific HASP). Real time air monitoring for TSPs was conducted at the perimeter of the working zone for the Pilot Trench construction activities that included trenching and excavation activities for the Cover System. Air monitoring readings collected on October 14 and 15, 2015 prior to commencing excavation activities were used as background air results. Daily air monitoring activities began on October 16, 2015, coinciding with the start of excavation work.

Real-time air monitoring for dust was performed using TSI DustTrak aerosol monitors during operations that involved the disturbance/handling of potentially impacted material (remedial activities). The instruments were calibrated and operated in accordance with the manufacturer's specifications. Real time air monitoring was performed at the perimeter of the Pilot Trench work zone, including one upwind (background) location and three downwind locations. Figure 4.1 presents the locations of the air monitoring stations that were used during the Pilot Trench construction.

DustTraks were placed at the beginning of each work day and were programmed to continuously monitor dust concentrations through 15-minute time weighted average (TWA) readings. The action level was set at 0.15 milligrams per cubic meter (mg/m^3) (action level) over the 15 minute TWA. The DustTraks were housed in environmental enclosures. Enclosures were attached to a surveying tripod and powered by a deep cycle marine battery. DustTraks were connected to a Netronix modem that streamed the data (in real-time) to a secure website called Environet. The Environet website allowed authorized users to set custom alert levels to send an email that notified an alarm, or some other threshold, had been triggered within the Pilot Trench construction work zone.

The daily air monitoring results are summarized in Table 4.1. The real-time dust concentrations collected between 0700 – 1700 hours were used as the work shift dust concentrations indicating potential exposure.

The action level for the daily TWA for TSPs/dust was not exceeded during the course of the trenching work. The daily TWA for TSPs/dust presented in Table 4.1 are considerably lower than the action level of 0.15 mg/m^3. Appendix G provides a description of how the daily TWA was calculated.

The maximum daily TWA (0.108 mg/m^3) for TSPs/dust occurred at the west station on November 2, 2016. On this day, the bedrock trenching process began at the north end of the Pilot Trench, nearest to the location of the west air monitoring station. The initial trench cut resulted in dust generation sufficient to trigger the maximum daily TWA. Once the trenching process continued down-gradient and the cutting action was below grade, the creation of airborne dust during the trenching activities was diminished

The second maximum daily TWA (0.094 mg/m^3) for TSPs/dust occurred at the south station on December 12, 2015 and corresponded to the completion of rock cutting when the trench arm and final cut was again at the surface of the bedrock where the particulates more easily became airborne.

November 2, and December 12, 2015 were considered the "worst case" days for the creation of dust and similar conditions were not anticipated to complete the remainder of the installation of the Pilot

Trench. Neither of the ‘worst case’ readings exceeded the action level of 0.15 mg/m^3 over the 15 minute TWA.

On March 10, 2016, GM formally requested approval from U.S. EPA for the cessation of the real-time ambient air monitoring activities described in the AAQMP based on the air monitoring results collected and the remaining stages of construction/restoration with unimpacted materials. The request to terminate the ambient air monitoring program did not include termination of the use of portable dust monitors in the immediate work area (worker’s breathing zones) used by SES. U.S. EPA approved cessation of the ambient air monitoring activities on March 14, 2016.

5. Health and Safety Plan

Work conducted by GHD was performed in accordance with the Site-specific HASP entitled “GM Bedford Site Specific Project Health and Safety Plan” dated May 2016. The general contractor (SES) and their subcontractors followed their contractor Site-specific HASPs.

6. Security

Temporary high visibility orange construction fencing was erected to enclose the active work areas. The general contractor was responsible for maintaining security during the construction period. The contractor inspected, maintained, and repaired the fencing, as necessary, to ensure protection of the public and security of the trenching work area. To increase security and safety of the site, the open areas of the bedrock trench were minimized by replacing the rock cuttings in the trench until pipe installation. The trench rock cuttings were used to backfill the trench as the work progressed which resulted in less open trench area, which increased overall safety.

7. Record Keeping

The record keeping activities included the following:

- Photographs and video of the Pilot Trench construction.
- Preparation of corehole logs.
- Records of inspections and cleanups performed during excavation and transportation of <50 mg/kg PCB impacted soils, as required.
- Waste manifests.

In addition, field records including inspection logs, field notes, surveys, GPR reports, videos, and sample results, were collected and are stored at the Site trailer or in GHD’s archival records storage.

Appendix H presents a photographic log containing representative photographs of different phases of construction of the Pilot Trench. Appendix I presents copies of the field records pertinent to documentation that QA procedures were followed and the construction met the requirements of the design.

8. Lessons Learned During Pilot Trench

The Pilot Trench was constructed in accordance with the plans and specifications. The construction activities for the Pilot Trench installation were generally completed as expected, with few deviations during field implementation. The following bullets provide a summary of the successes and lessons learned during the Pilot Trench construction:

- The working platform constructed along the Pilot Trench alignment for operation of the trencher required removal of the overlying soil. During this soils removal, the top of bedrock was found to be irregular epi-karst, such that the top of bedrock elevations were often found to be higher than expected in various locations, as compared to the investigative corehole drilling data. Although this irregular bedrock surface was anticipated based on prior work on the project, the corehole data showed the expected top of bedrock along the trench alignment (north to south). With the overall width of the working platform being almost 40 ft, the working platform design should have accounted for the general cross slope from west to east perpendicular the bedrock trench. Although the corehole drilling for subsequent sections of the perimeter bedrock collection trench was also performed at 150- to 200-ft intervals along the proposed alignment, the design of the future trench will recognize the cross slope when designing the working platform. This lesson learned does not change the fact that rock removal will be required, but recognition of this fact will allow for inclusion of an estimated quantity of rock breaking in the Contract Form of Bid so this cost can be accounted for by the construction contractor up front (and not require a change order).
- Rock trencher excavated through bedrock very efficiently and at a progress rate consistent with the advertised rate (approx. 30 feet per day), resulting in clean vertical side walls that facilitated access for visual observation of fractures and water discharge via video camera inspection. GM has previously shared with U.S. EPA select “trial” videos of both the actual trenching, as well as the trench interior walls, which show very clearly that the rock trenching methodology worked very efficiently for the Pilot Trench construction. Upon removal of the backfilled rock cuttings, final “confirmatory” videos were performed at 5-ft interval along the entire Pilot Trench length. GM has separately provided these additional videos of the trenching and interior trench walls to U.S. EPA due to the excessive file size for 165 video recordings.
- The excavated bedrock trench was backfilled with rock cuttings for health and safety purposes (i.e., prevent any accidental entry into deep trench by personnel or wildlife), with the cuttings subsequently removed via backhoe immediately prior to perforated pipe and stone drainage media backfill installation. This was a safety precaution determined to be appropriate in the field.
- The post-trenching video inspections validated the design depth of the Pilot Trench, which was intended to terminate within competent bedrock. This method, which was developed in the field, involved the use of a GoPro™ camera affixed to a long pole, with rope and pulley system used to raise and lower video camera into the open trench. The video camera was very effective in performing the remote inspection across the entire length and width of the trench. Personnel operating the video camera enhanced their ability to gain photographic coverage by standing on a movable temporary bridge placed across the trench. This method allowed close up and detailed photographic documentation of the conditions along the entire trench length.

- Observations of the open trench walls provided a detailed evaluation of the bedrock fracture conditions, including any evidence of residual non-aqueous phase liquids (NAPL) in the observable voids or smeared on the trench walls. However, no such evidence of either condition was observed on the videos. Note that no evidence of residual NAPL has been observed in the water collected from trench to date.
- Observations of open trench side walls showed fractures typically narrowed in width and reduced in length with increasing depth, as observed on the face of the excavated trench walls, confirming previous observations regarding depth of competent bedrock made using ground penetrating radar (GPR), electrical resistivity imaging (ERI), and the rock core descriptions and downhole geophysical logging of exploratory coreholes that were installed in advance of trench construction.
- No fractures yielding a substantial volume of water were observed in the basal portion of the trench.

- Sheet pile installation performed efficiently and safely, with vinyl sheet piles being easy to cut in the field to individual lengths as measured upon reaching the required depth in the trench. GM intended to limit hydrogeologic communication with the downgradient side of the trench and evaluate several options (grout for one) before determining the cost effectiveness and ease of installation of the plastic sheet wall interlocking materials.
- During implementation of the Pilot Trench, the contractor determined that a more appropriate method of providing for any possible future extension of the Pilot Trench was to lengthen the distance between the primary and secondary cleanouts. This eliminated the need for a steel plate at each end of the trench to hold back the stone drainage media should either end of the trench be extended during future trench construction.
- As part of restoration, a clay cap was placed over the entire length of the Pilot Trench, not just the section within the East Plant Area Cover System, to reduce the potential for infiltration of surface water and thus reducing the unnecessary infiltration of precipitation into the trench collection system and requiring treatment at the new Groundwater Treatment Plant (GWTP). This was also a decision made during backfilling and was efficient because of the availability of clean clay stockpiled on site for previous work.
- The ERI survey investigation results were found to be inconclusive. Despite the inconclusive results from the ERI survey, other assessment methods used during trench excavation (visual, video recordings, etc.) were sufficient for determination of rock fractures and voids and confirmation of the depth of competent rock. In particular, the GPR survey data yielded much better resolution in the identification of significant fractures and voids in the bedrock in the area of the Pilot Trench. To supplement the GPR survey for the next phase of trenching, other geophysical methods will be researched and evaluated during design and planning that might provide better resolution or better identify the competent rock surface.
- In general, based on the limited (thin) fractures near the base of the Pilot Trench and the observation that these fractures did not appear to produce substantial water, the Pilot Trench was determined to have been completed within the competent, more massive, bedrock. For confirmation, the final trench depth was also in compliance with bedrock corehole information used for design of the Pilot Trench.

9. Operation, Maintenance, and Monitoring

The Pilot Trench Interim Groundwater Monitoring Program and Operation Schedule (Interim Monitoring Program) will be included as Appendix J upon approval by U.S EPA. This Interim Monitoring Program presents the parameters for monitoring the effectiveness of the Pilot Trench.

9.1 Vegetated Cover System

Routine inspections of the restored Cover System over the Pilot Trench area have been and will be conducted to ensure that the IM continues to meet the remedial action objectives. Inspections will be conducted concurrently with the East Plant Area Cover System inspections outlined in the Construction Certification Report for the East Plant Area Cover System Revision 1 (CRA, January 25, 2016).

The restored Cover System is inspected for the following items:

- Evidence of erosion, exposure of liner, settlement causing ponding of water, and areas of insufficient grass coverage.
- Evidence of burrowing animals, rooting trees, or other evidences of conditions impacting the integrity of the soil cover
- Evidence of damage caused by environmental conditions and/or monitoring and maintenance vehicular traffic

Areas where repairs are needed are recorded and reported to a representative of GM, whereupon arrangements are made to effectuate the repair. Maintenance of the Cover System and other grassed areas consists of the following elements, as required:

- Woody growth is removed, as needed, following routine OMM inspections.
- Areas where erosion is observed will be repaired by replacing vegetative cover soil to meet the surrounding grades and re-establishing the grass cover.
- Areas where the grass cover has declined to less than 75 percent as determined by visual inspection will be fertilized and re-seeded.

10. Community Relations

Prior to initiation of the construction activities, the project engineer went door-to-door along Bailey Scales Road to inform neighbors to the Site of the Pilot Trench project, specifically the use of the large rock trenching machine and the potential increased truck traffic, as well as to remind them of project contacts if they have concerns about the activities (i.e., noise).

On-going community relation activities and community participation in the review of the East Plant Area IM prior to initiation of the Pilot Trench included:

- Project Fact Sheets specific to the East Plant Area IM activities (March 2006 to December 2015)
- Project website (www.bedfordpowertraincorrectiveaction.com)

- GM organized community meetings for neighbors and the general public
- Community Liaison Panel involvement, as required

Project update meetings with the public are held bi-annually with meetings documenting the Pilot Trench construction for the public and the Community Liaison Panel (CLP) were held on:

- June 10, 2015, prior to construction kick-off
- December 12, 2015, following trencher activities
- June 29, 2016, following substantial completion of construction.

During these meetings the public was informed about the final design, expected impacts to traffic, noise, and reminded how to get in touch with the project team with any concerns.

11. References

Conestoga-Rovers & Associates, Inc., Consolidated GM Bedford Health and Safety Plan, Ref. No. 13968 (95), November 2004, Modified March 27, 2007 and June 24, 2008.

Conestoga-Rovers & Associates, Inc., RCRA Corrective Action Program, IM Alternatives Review Report, East Plant Area, Ref. No. 13968 (151), April 13, 2005.

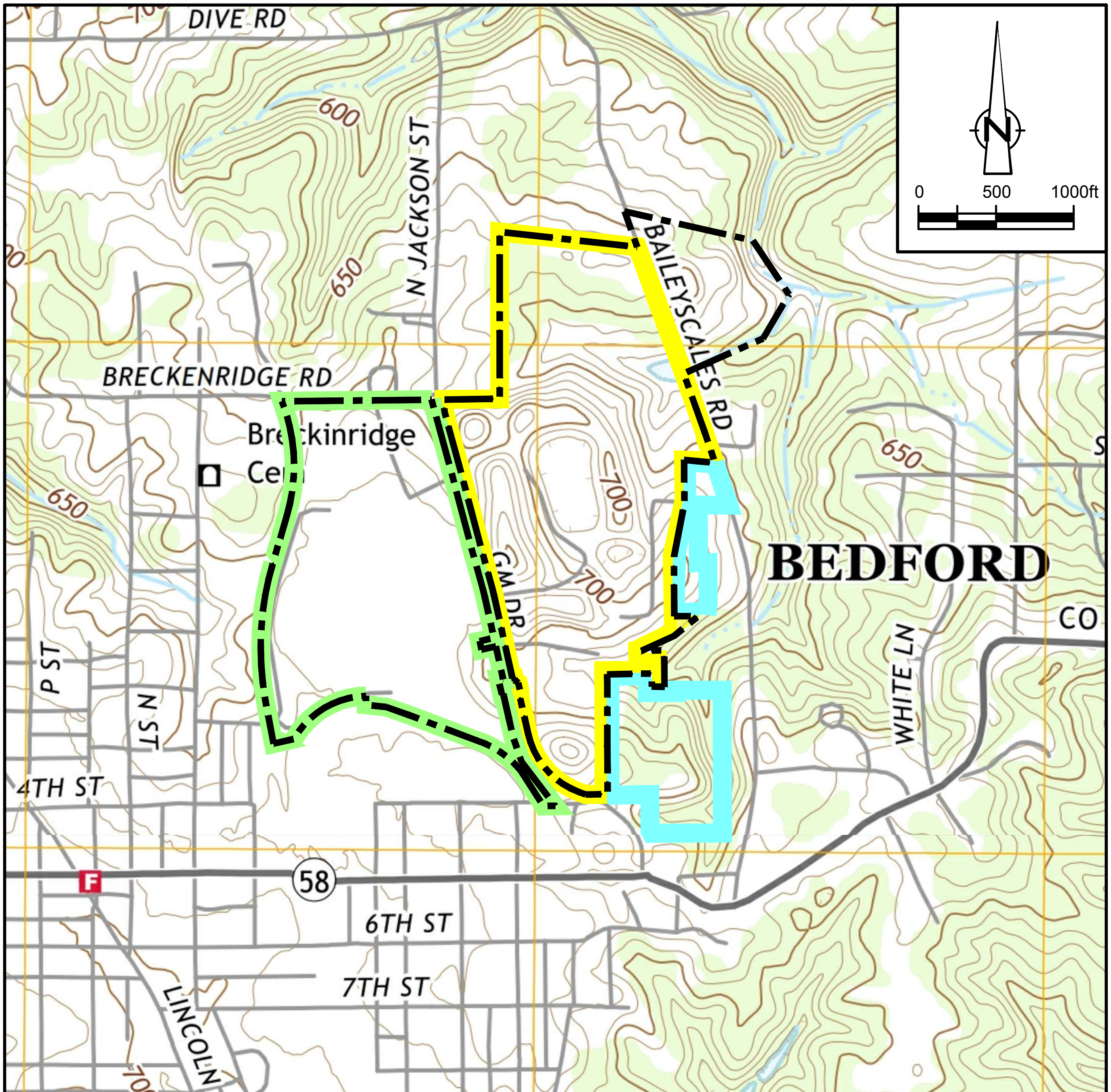
Conestoga-Rovers & Associates, Inc., East Plant Area Cover System Design Report, Revision 1, Ref. No. 13968 (163), April 18, 2008.

Conestoga-Rovers & Associates, Inc., Construction Certification Report East Plant Area Cover System – Revision 1, Ref. No. 13968 (350), January 25, 2016.

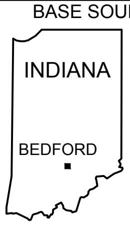
Conestoga-Rovers & Associates, Inc., Pilot Perimeter Groundwater Trench Collection System Study – Revision 1, Ref. No. 13968 (365), February 19, 2016

GHD Services, Inc., Ambient Air Quality Monitoring Plan (AAQMP) Pilot Perimeter Groundwater Trench Collection System, Ref. No. 13968 (388), February 19, 2016.

IDEM/Office of Land Quality, Brownfields Bulletin, Issue 23, 1st Quarter 2004.



BASE SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES;
BARTLETTSVILLE, INDIANA 2016
BEDFORD EAST, INDIANA 2016
BEDFORD WEST, INDIANA 2016
OOLITIC, INDIANA 2016
GM PROPERTY BOUNDARY SURVEY BY
BLEDSOE RIGGERT GUERRETTAZ
RECEIVED OCTOBER 2007



LEGEND
- APPROXIMATE FACILITY BOUNDARY
- EAST PLANT AREA BOUNDARY
- WEST PLANT AREA BOUNDARY
- GM LLC OWNED RESIDENTIAL PROPERTIES

figure 1.1

FACILITY LOCATION
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER
GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

13968-00(394)GN-WA002 JUN 22, 2018

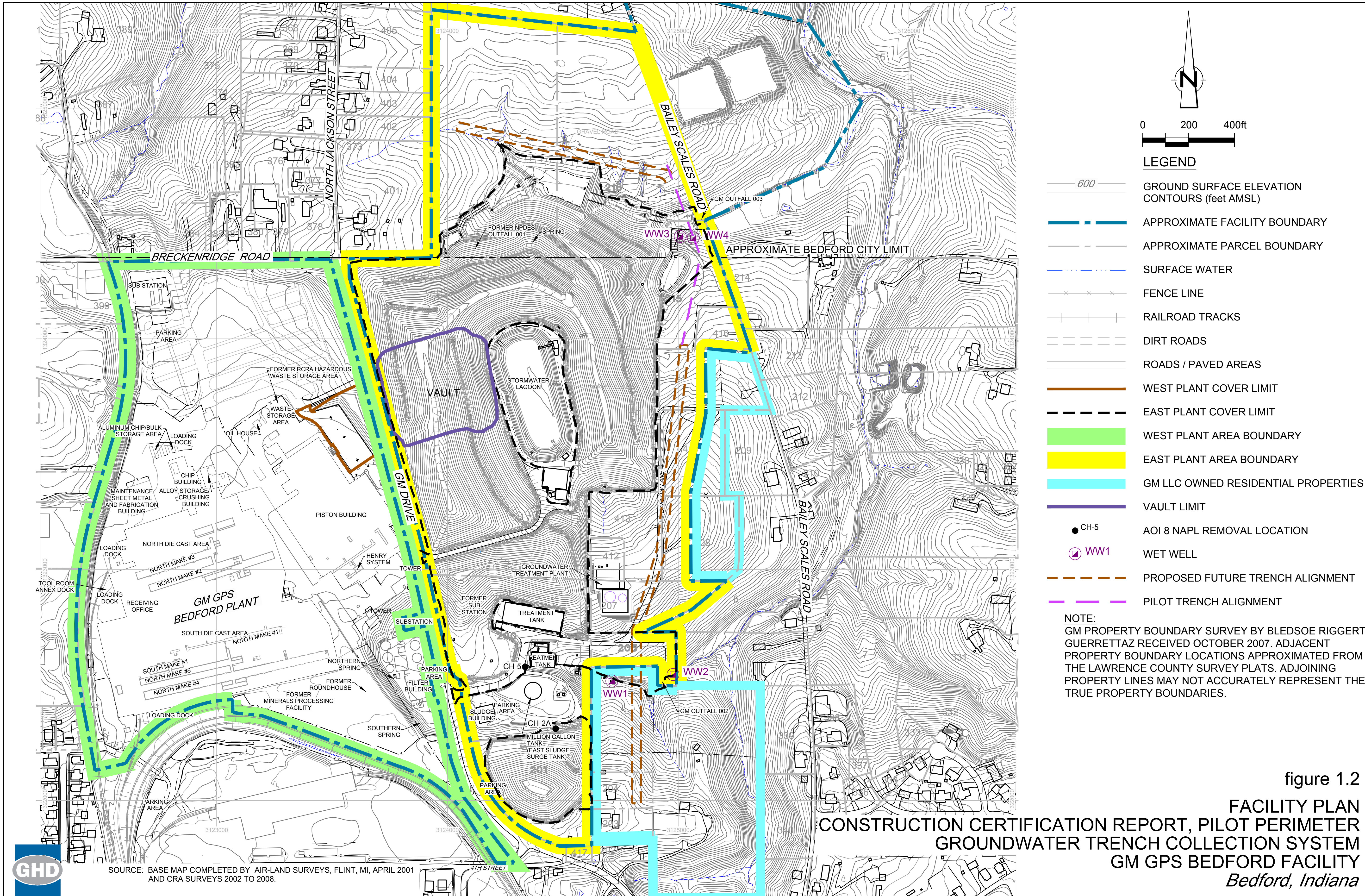
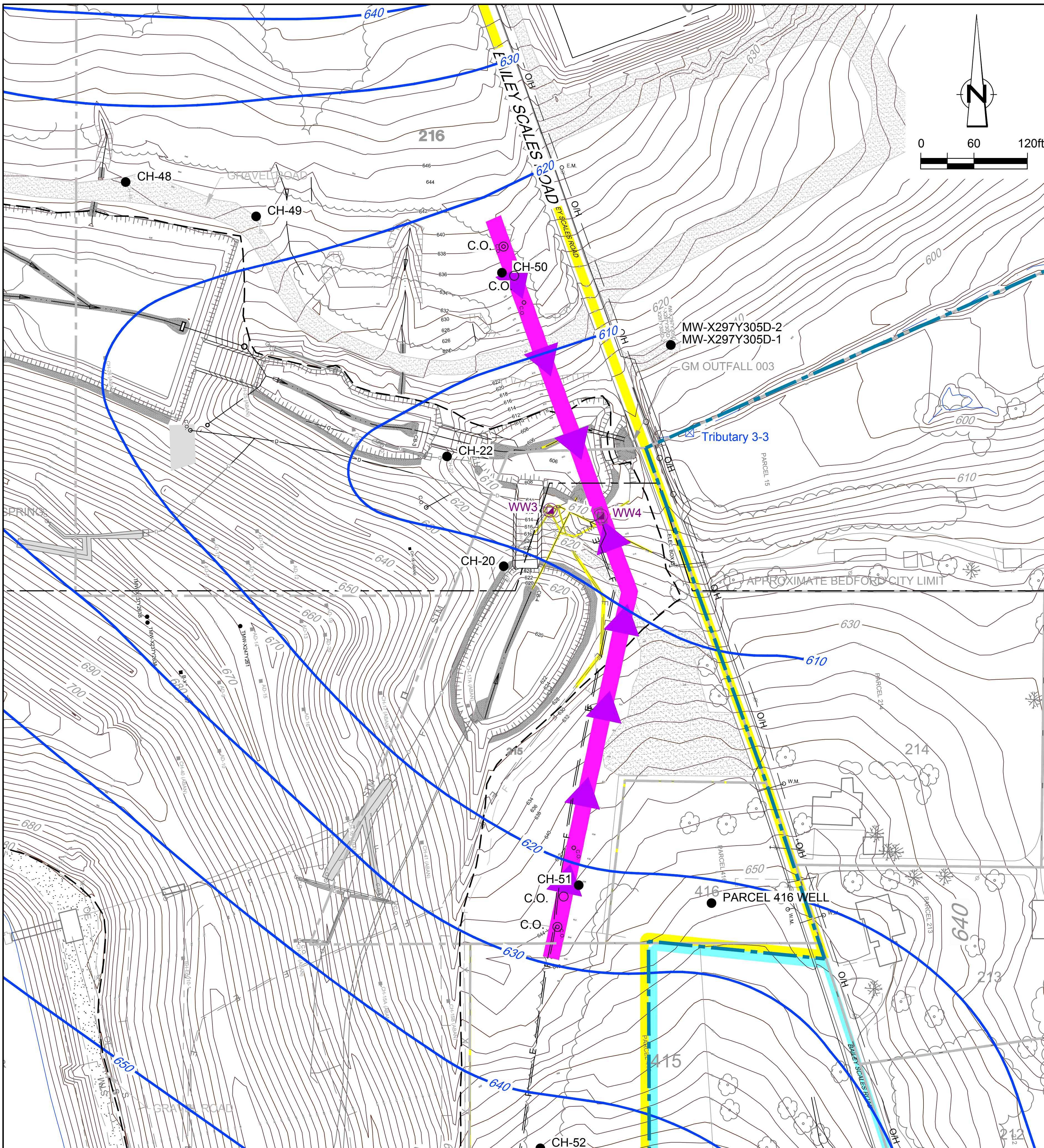


figure 1.2

FACILITY PLAN
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

13968-00(394)GN-WA003 JUN 22, 2018



SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

LEGEND

- 600 — GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- FENCE LINE
- SURFACE WATER
- APPROXIMATE GM PROPERTY BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY
- D — EXISTING GRAVITY UNDERDRAIN (HDPE PERFORATED PIPE)
- D — EXISTING GRAVITY DRAIN (HDPE SOLID WALL PIPE)
- EAST PLANT COVER SYSTEM LIMIT
- EAST PLANT AREA BOUNDARY
- GM LLC OWNED RESIDENTIAL PROPERTIES
- 640 — GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR (ft AMSL), SEPTEMBER 2 TO 3, 2015
- PILOT TRENCH ALIGNMENT
- WW — WET WELL
- C.O. — TEMPORARY CLEANOUT
- EXISTING COREHOLE AND MONITORING WELL LOCATIONS NEAR PROPOSED BEDROCK TRENCH
- SURFACE WATER MONITORING LOCATION

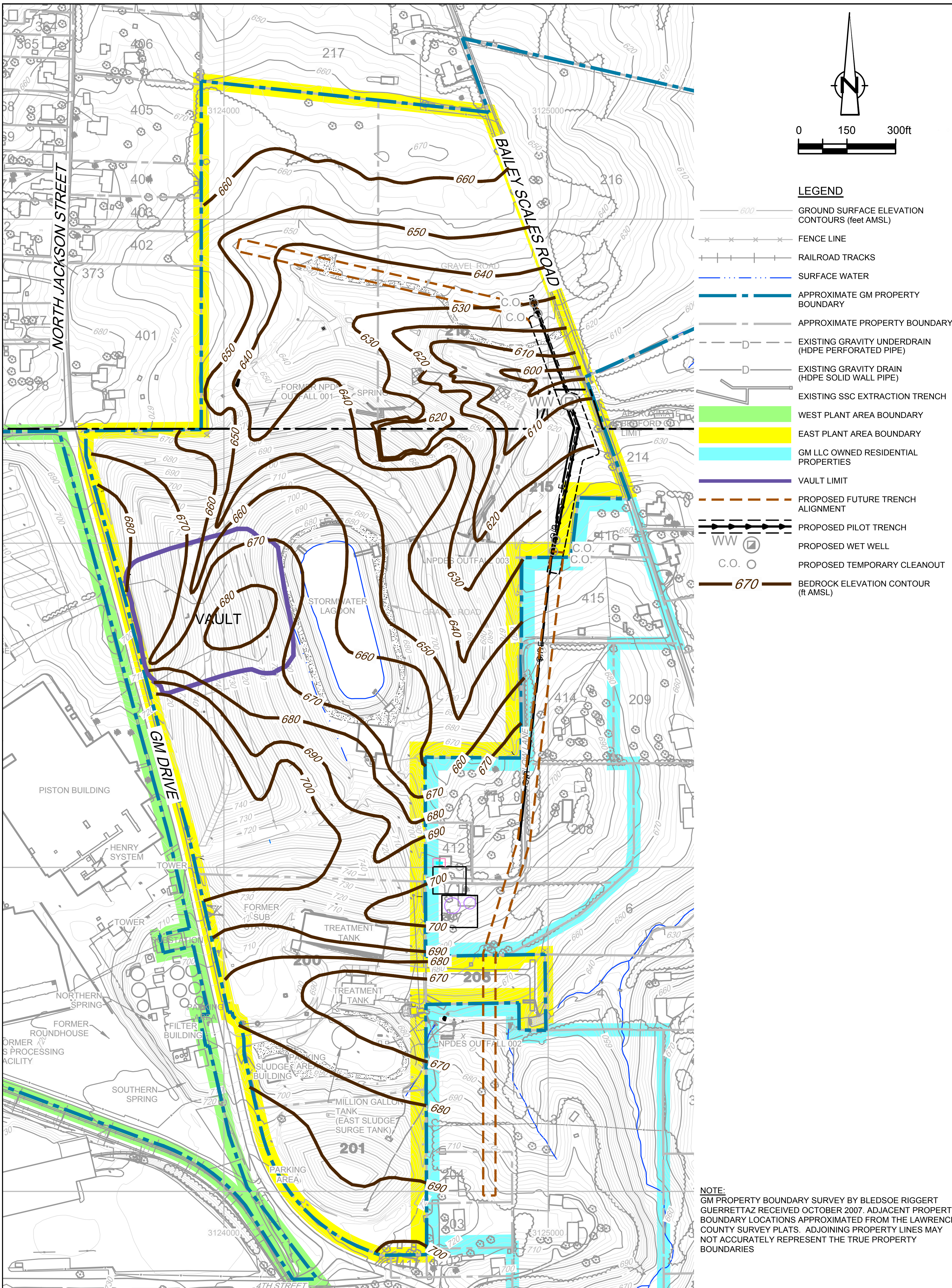
NOTE:
GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

figure 2.1

PILOT TRENCH LOCATION AND ALIGNMENT
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

13968-00(394)GN-WA023 JUN 22, 2018



SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

figure 3.1

BEDROCK TOPOGRAPHY
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER
GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

13968-00(394)GN-WA004 JUN 19, 2017

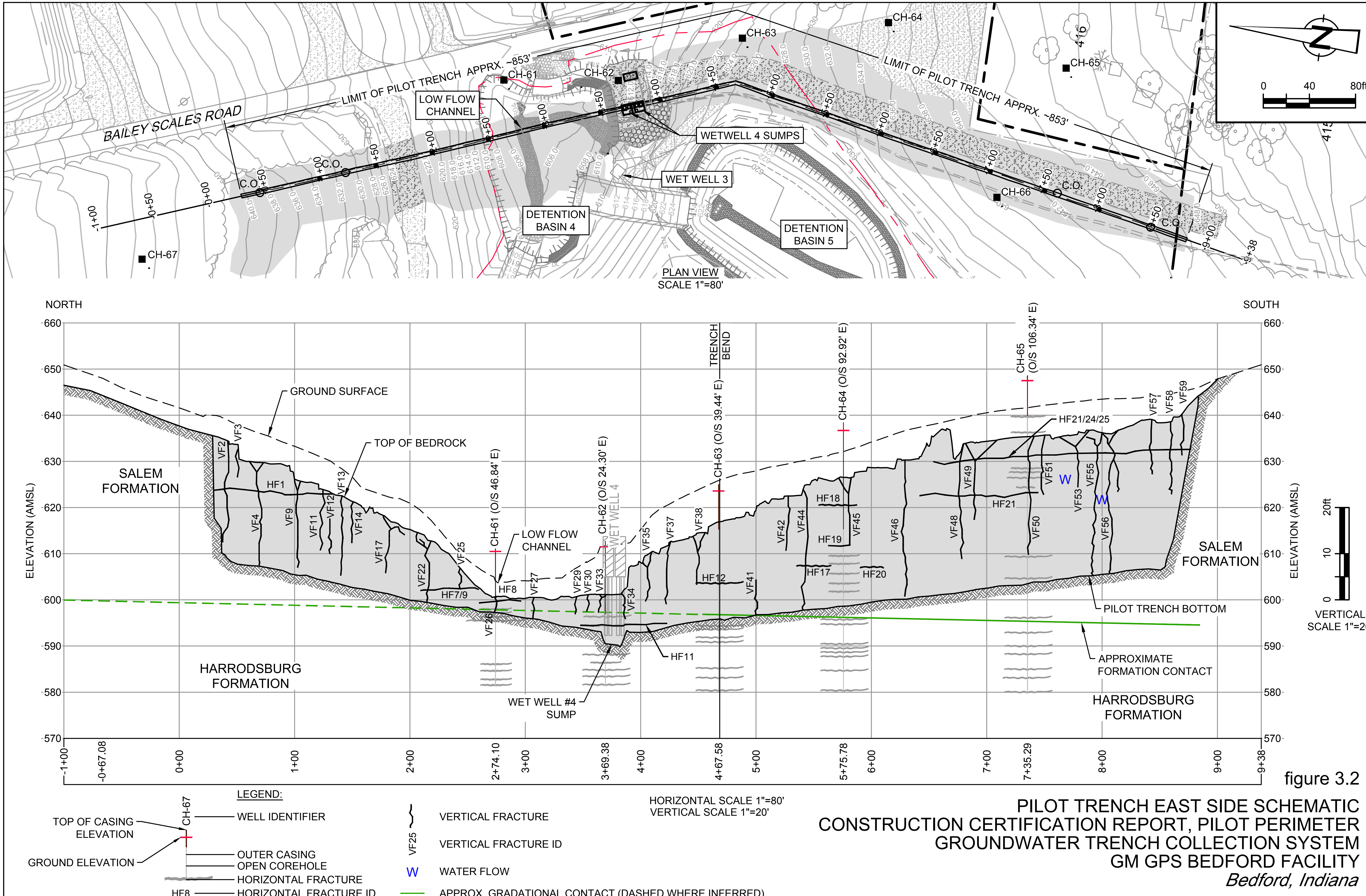


figure 3.2

PILOT TRENCH EAST SIDE SCHEMATIC
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER
GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

P:\drawings\13000s\13968\13968-REPORTS\13968-00(394)\13968-00(394)GN\13968-00(394)GN-WA007.dwg Plot Date: AUG 15, 2019

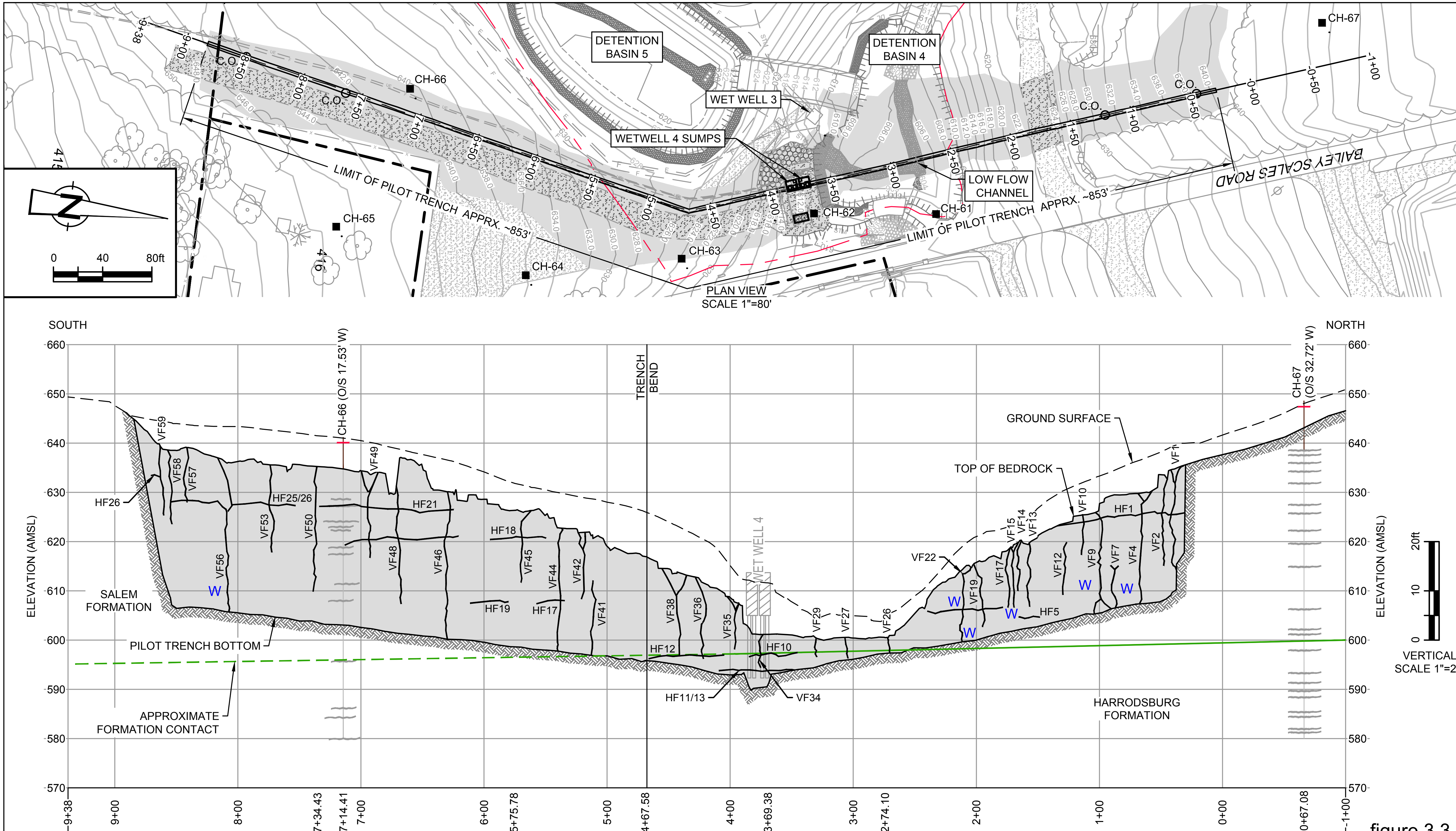


figure 3.3

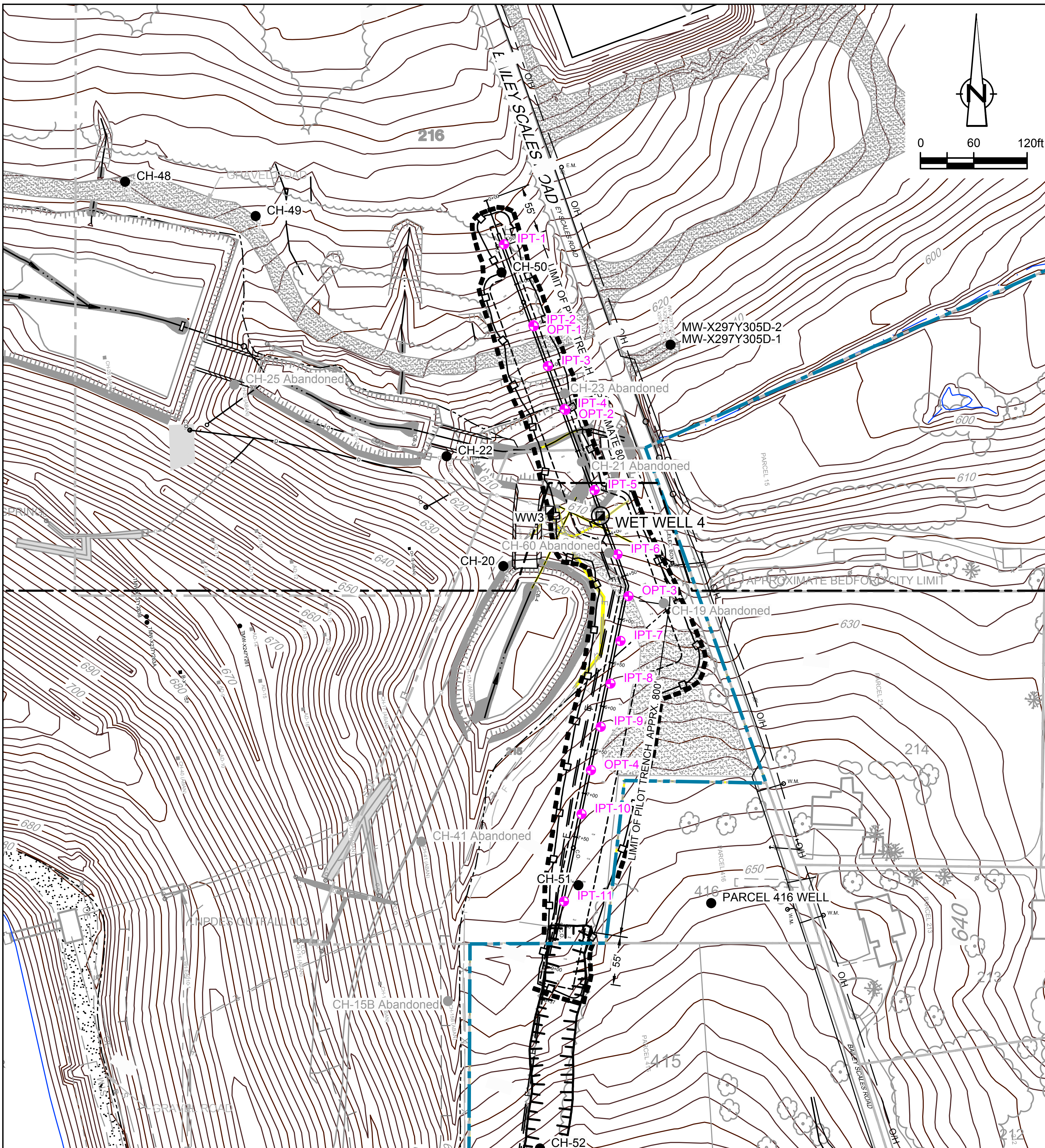
LEGEND:

- CH-67 — WELL IDENTIFIER
- TOP OF CASING ELEVATION
- GROUND ELEVATION
- OUTER CASING
- OPEN COREHOLE
- HORIZONTAL FRACTURE
- HF8 — HORIZONTAL FRACTURE ID
- VERTICAL FRACTURE
- VF25 — VERTICAL FRACTURE ID
- W — WATER FLOW
- APPROX. GRADATIONAL CONTACT (DASHED WHERE INFERRED)

HORIZONTAL SCALE 1"=80'
VERTICAL SCALE 1"=20'

PILOT TRENCH WEST SIDE SCHEMATIC
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER
GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

P:\drawings\13000s\13968\13968-REPORTS\13968-00(394)\13968-00(394)GN\13968-00(394)GN-WA008.dwg Plot Date: AUG 15, 2019



SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

LEGEND

600 GROUND SURFACE ELEVATION CONTOURS (feet AMSL)

FENCE LINE

SURFACE WATER

APPROXIMATE GM PROPERTY BOUNDARY

APPROXIMATE PROPERTY BOUNDARY

PILOT TRENCH

SILT FENCE

PIEZOMETER LOCATION

EXISTING COREHOLE AND MONITORING WELL LOCATIONS NEAR PROPOSED EXISTING WET WELL LOCATION

BEDROCK TRENCH

WET WELL 4 WET WELL

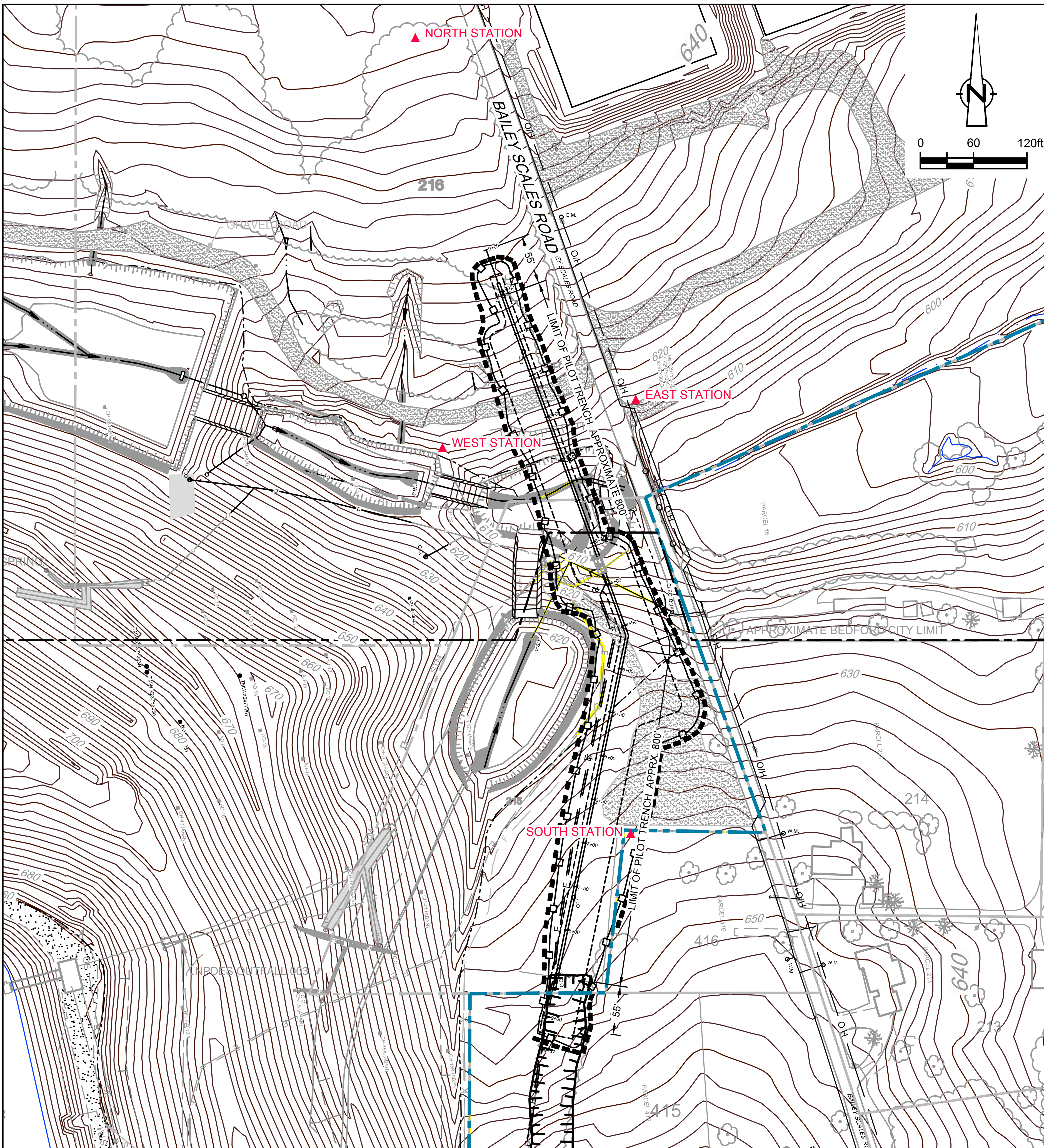
NOTE:
GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

figure 3.4

PIEZOMETER LOCATIONS WITHIN THE PILOT TRENCH
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

13968-00(394)GN-WA005 JUN 22, 2018



SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

LEGEND

600	GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
	FENCE LINE
	SURFACE WATER
	APPROXIMATE GM PROPERTY BOUNDARY
	APPROXIMATE PROPERTY BOUNDARY
	PILOT TRENCH
	SILT FENCE
	AIR MONITORING STATION

NOTE:
GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

figure 4.1

AIR MONITORING STATION LOCATIONS
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER
GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

13968-00(394)GN-WA006 JUN 22, 2018

Table 3.1

Temporary Water Treatment Plant Discharge Analytical Data
Construction Certification Report
GM CET Bedford Facility
Bedford, Indiana

Area		***P216***	***P216***	***P216***	***P216***	***P216***	***P216***
Sample Location:		***Effluent Post Bag Filter***	***Effluent Post Bag Filter***	***Effluent Post Bag Filter***	***Effluent Post Bag Filter***	***Effluent Post Bag Filter***	***Effluent Post Bag Filter***
Sample Identification:		***WW-216-102915-PB-40293***	***WW-216-110515-PB-40300***	***WW-216-110615-PB-40305***	***WW-216-110915-PB-40311***	***WW-216-111115-PB-40320***	***WW-216-112415-PB-40327***
Sample Date:		***10/29/2015***	***11/5/2015***	***11/6/2015***	***11/9/2015***	***11/11/2015***	***11/24/2015***
Sample Type:							
	Units						
Polychlorinated biphenyls (PCBs)							
Aroclor-1016 (PCB-1016)	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.20 U	0.20 U
Aroclor-1221 (PCB-1221)	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.20 U	0.20 U
Aroclor-1232 (PCB-1232)	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.20 U	0.20 U
Aroclor-1242 (PCB-1242)	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.20 U	0.20 U
Aroclor-1248 (PCB-1248)	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.20 U	0.20 U
Aroclor-1254 (PCB-1254)	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.20 U	0.20 U
Aroclor-1260 (PCB-1260)	ug/L	0.19 U	0.19 U	0.19 U	0.19 U	0.20 U	0.20 U
Total PCBs	ug/L	ND	ND	ND	ND	ND	ND

Notes:

U - Not detected at the associated reporting limit.

Table 3.1

Temporary Water Treatment Plant Discharge Analytical Data
Construction Certification Report
GM CET Bedford Facility
Bedford, Indiana

Area		***P216***	***P216***	***P216***	***P216***	***P216***
Sample Location:		***Effluent Post Bag Filter***	***Effluent Post Bag Filter***	***Effluent Post Bag Filter***	***Effluent Post Bag Filter***	***Effluent Post Bag Filter***
Sample Identification:		***WW-216-120115-PB-40335***	***WW-216-120815-PB-40342***	***WW-216-010516-PB-40353***	***WW-216-021616-PB-40353***	***WW-216-030716-PB-40368***
Sample Date:		***12/1/2015***	***12/8/2015***	***1/5/2016***	***2/16/2016***	***03/07/2016***
Sample Type:						
	Units					
Polychlorinated biphenyls (PCBs)						
Aroclor-1016 (PCB-1016)	ug/L	0.19 U	0.19 U	0.19 U	0.096 U	0.19 U
Aroclor-1221 (PCB-1221)	ug/L	0.19 U	0.19 U	0.19 U	0.096 U	0.19 U
Aroclor-1232 (PCB-1232)	ug/L	0.19 U	0.19 U	0.19 U	0.096 U	0.19 U
Aroclor-1242 (PCB-1242)	ug/L	0.19 U	0.19 U	0.19 U	0.096 U	0.19 U
Aroclor-1248 (PCB-1248)	ug/L	0.19 U	0.19 U	0.19 U	0.096 U	0.19 U
Aroclor-1254 (PCB-1254)	ug/L	0.19 U	0.19 U	0.19 U	0.096 U	0.19 U
Aroclor-1260 (PCB-1260)	ug/L	0.19 U	0.19 U	0.19 U	0.096 U	0.19 U
Total PCBs	ug/L	ND	ND	ND	ND	ND

Notes:

U - Not detected at the associated reporting lim

Table 3.2

Pilot Trench Construction off-Facility Hauling Summary
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date Shipped	Profile Number	Manifest No.	Waste Description	Waste Source	Truck No.	Transporter	Landfill Weight (tons)	Contractor
9/11/2015	608669IN	110915-001	Special Waste Solid Other	Pilot Trench	51	Young's Trucking	18.48	SES
9/11/2015	608669IN	110915-002	Special Waste Solid Other	Pilot Trench	55	Young's Trucking	17.57	SES
9/11/2015	608669IN	110915-003	Special Waste Solid Other	Pilot Trench	53	Young's Trucking	19.23	SES
9/11/2015	608669IN	110915-004	Special Waste Solid Other	Pilot Trench	54	Young's Trucking	20.15	SES
9/11/2015	608669IN	110915-005	Special Waste Solid Other	Pilot Trench	B16	Baugh	16.10	SES
9/11/2015	608669IN	110915-006	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	14.70	SES
9/11/2015	608669IN	110915-007	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	16.38	SES
9/11/2015	608669IN	110915-008	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	14.26	SES
9/11/2015	608669IN	110915-009	Special Waste Solid Other	Pilot Trench	53	Young's Trucking	20.04	SES
9/11/2015	608669IN	110915-010	Special Waste Solid Other	Pilot Trench	51	Young's Trucking	19.77	SES
9/11/2015	608669IN	110915-011	Special Waste Solid Other	Pilot Trench	55	Young's Trucking	18.38	SES
9/11/2015	608669IN	110915-012	Special Waste Solid Other	Pilot Trench	B16	Baugh	16.42	SES
10/11/2015	608669IN	110915-013	Special Waste Solid Other	Pilot Trench	54	Young's Trucking	19.34	SES
10/11/2015	608669IN	110915-014	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	14.55	SES
10/11/2015	608669IN	110915-015	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	16.15	SES
10/11/2015	608669IN	110915-016	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	17.88	SES
10/11/2015	608669IN	111015-001	Special Waste Solid Other	Pilot Trench	B16	Baugh	16.66	SES
10/11/2015	608669IN	111015-002	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	16.63	SES
10/11/2015	608669IN	111015-003	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	17.50	SES
10/11/2015	608669IN	111015-004	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	17.36	SES
10/11/2015	608669IN	111015-005	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	16.24	SES
10/11/2015	608669IN	111015-006	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	18.16	SES
10/11/2015	608669IN	111015-007	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	17.08	SES
10/11/2015	608669IN	111015-008	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	17.75	SES
10/11/2015	608669IN	111015-009	Special Waste Solid Other	Pilot Trench	B16	Baugh	18.29	SES
10/11/2015	608669IN	111015-010	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	16.71	SES
10/11/2015	608669IN	111015-011	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	15.27	SES
10/11/2015	608669IN	111015-012	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	14.24	SES
10/11/2015	608669IN	111015-013	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	14.60	SES
10/11/2015	608669IN	111015-014	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	16.42	SES
10/11/2015	608669IN	111015-015	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	15.67	SES
10/11/2015	608669IN	111015-016	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	17.60	SES
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11/11/2015	608669IN	111115-002	Special Waste Solid Other	Pilot Trench	3	Young's Trucking	15.82	SES
11/11/2015	608669IN	111115-003	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	19.18	SES
11/11/2015	608669IN	111115-004	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	18.49	SES
11/11/2015	608669IN	111115-005	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	18.90	SES
11/11/2015	608669IN	111115-006	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	17.39	SES
11/11/2015	608669IN	111115-007	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	15.93	SES
11/11/2015	608669IN	111115-008	Special Waste Solid Other	Pilot Trench	B16	Baugh	17.80	SES

Table 3.2

Pilot Trench Construction off-Facility Hauling Summary
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date Shipped	Profile Number	Manifest No.	Waste Description	Waste Source	Truck No.	Transporter	Landfill Weight (tons)	Contractor
11/11/2015	608669IN	111115-009	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.59	SES
11/11/2015	608669IN	111115-010	Special Waste Solid Other	Pilot Trench	3	Young's Trucking	17.46	SES
11/11/2015	608669IN	111115-011	Special Waste Solid Other	Pilot Trench	B16	Baugh	16.80	SES
11/11/2015	608669IN	111115-012	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	17.07	SES
11/11/2015	608669IN	111115-013	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	16.45	SES
11/11/2015	608669IN	111115-014	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	18.51	SES
11/11/2015	608669IN	111115-015	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	17.87	SES
11/12/2015	608669IN	111215-001	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.95	SES
11/12/2015	608669IN	111215-002	Special Waste Solid Other	Pilot Trench	3	Young's Trucking	17.93	SES
11/12/2015	608669IN	111215-003	Special Waste Solid Other	Pilot Trench	B16	Baugh	19.83	SES
11/12/2015	608669IN	111215-004	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	17.91	SES
11/12/2015	608669IN	111215-005	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.25	SES
11/12/2015	608669IN	111215-006	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	17.79	SES
11/12/2015	608669IN	111215-007	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	18.58	SES
11/12/2015	608669IN	111215-008	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	17.76	SES
11/12/2015	608669IN	111215-009	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	22.41	SES
11/12/2015	608669IN	111215-010	Special Waste Solid Other	Pilot Trench	B16	Baugh	17.41	SES
11/12/2015	608669IN	111215-011	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.56	SES
11/12/2015	608669IN	111215-012	Special Waste Solid Other	Pilot Trench	3	Young's Trucking	17.61	SES
11/12/2015	608669IN	111215-013	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	17.03	SES
11/12/2015	608669IN	111215-014	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	16.35	SES
11/12/2015	608669IN	111215-015	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	15.14	SES
11/12/2015	608669IN	111215-016	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	17.78	SES
11/12/2015	608669IN	111215-017	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	20.94	SES
11/12/2015	608669IN	111215-018	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	17.51	SES
11/13/2015	608669IN	111315-001	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	17.01	SES
11/13/2015	608669IN	111315-002	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	19.95	SES
11/13/2015	608669IN	111315-003	Special Waste Solid Other	Pilot Trench	50	Young's Trucking	17.32	SES
11/13/2015	608669IN	111315-004	Special Waste Solid Other	Pilot Trench	6	Young's Trucking	15.45	SES
11/13/2015	608669IN	111315-005	Special Waste Solid Other	Pilot Trench	11	Young's Trucking	18.24	SES
11/13/2015	608669IN	111315-006	Special Waste Solid Other	Pilot Trench	17	Young's Trucking	18.93	SES
11/13/2015	608669IN	111315-007	Special Waste Solid Other	Pilot Trench	B16	Baugh	18.90	SES
11/13/2015	608669IN	111315-008	Special Waste Solid Other	Pilot Trench	33	Young's Trucking	15.79	SES
11/13/2015	608669IN	111315-009	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	17.03	SES
11/13/2015	608669IN	111315-010	Special Waste Solid Other	Pilot Trench	B16	Baugh	18.46	SES
11/13/2015	608669IN	111315-011	Special Waste Solid Other	Pilot Trench	50	Young's Trucking	16.33	SES
11/13/2015	608669IN	111315-012	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	18.35	SES
11/13/2015	608669IN	111315-013	Special Waste Solid Other	Pilot Trench	6	Young's Trucking	16.12	SES
11/13/2015	608669IN	111315-014	Special Waste Solid Other	Pilot Trench	11	Young's Trucking	17.03	SES
11/13/2015	608669IN	111315-015	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	17.66	SES

Table 3.2

Pilot Trench Construction off-Facility Hauling Summary
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date Shipped	Profile Number	Manifest No.	Waste Description	Waste Source	Truck No.	Transporter	Landfill Weight (tons)	Contractor
11/13/2015	608669IN	111315-016	Special Waste Solid Other	Pilot Trench	33	Young's Trucking	17.27	SES
11/13/2015	608669IN	111315-017	Special Waste Solid Other	Pilot Trench	41	Young's Trucking	15.18	SES
11/16/2015	608669IN	111615-001	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	15.84	SES
11/16/2015	608669IN	111615-002	Special Waste Solid Other	Pilot Trench	6	Young's Trucking	17.08	SES
11/16/2015	608669IN	111615-003	Special Waste Solid Other	Pilot Trench	11	Young's Trucking	17.68	SES
11/16/2015	608669IN	111615-004	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	14.25	SES
11/16/2015	608669IN	111615-005	Special Waste Solid Other	Pilot Trench	40	Young's Trucking	16.56	SES
11/16/2015	608669IN	111615-006	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	16.74	SES
11/16/2015	608669IN	111615-007	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	18.91	SES
11/16/2015	608669IN	111615-008	Special Waste Solid Other	Pilot Trench	B16	Baugh	18.53	SES
11/16/2015	608669IN	111615-009	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.86	SES
11/16/2015	608669IN	111615-010	Special Waste Solid Other	Pilot Trench	6	Young's Trucking	16.85	SES
11/16/2015	608669IN	111615-011	Special Waste Solid Other	Pilot Trench	11	Young's Trucking	16.15	SES
11/16/2015	608669IN	111615-012	Special Waste Solid Other	Pilot Trench	28	Young's Trucking	14.81	SES
11/16/2015	608669IN	111615-013	Special Waste Solid Other	Pilot Trench	40	Young's Trucking	15.96	SES
11/16/2015	608669IN	111615-014	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	16.49	SES
11/16/2015	608669IN	111615-015	Special Waste Solid Other	Pilot Trench	B16	Baugh	16.34	SES
11/16/2015	608669IN	111615-016	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	17.70	SES
11/19/2015	608669IN	111915-001	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	18.38	SES
11/19/2015	608669IN	111915-002	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	18.55	SES
11/19/2015	608669IN	111915-003	Special Waste Solid Other	Pilot Trench	44	Young's Trucking	16.64	SES
11/19/2015	608669IN	111915-004	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	17.26	SES
11/19/2015	608669IN	111915-005	Special Waste Solid Other	Pilot Trench	43	Young's Trucking	17.79	SES
11/19/2015	608669IN	111915-006	Special Waste Solid Other	Pilot Trench	24	Young's Trucking	17.35	SES
11/19/2015	608669IN	111915-007	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	18.59	SES
11/19/2015	608669IN	111915-008	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	16.89	SES
11/19/2015	608669IN	111915-009	Special Waste Solid Other	Pilot Trench	33	Young's Trucking	15.91	SES
11/19/2015	608669IN	111915-010	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.66	SES
11/19/2015	608669IN	111915-011	Special Waste Solid Other	Pilot Trench	44	Young's Trucking	17.06	SES
11/19/2015	608669IN	111915-012	Special Waste Solid Other	Pilot Trench	16	Young's Trucking	18.02	SES
11/19/2015	608669IN	111915-013	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.80	SES
11/19/2015	608669IN	111915-014	Special Waste Solid Other	Pilot Trench	43	Young's Trucking	15.24	SES
11/19/2015	608669IN	111915-015	Special Waste Solid Other	Pilot Trench	24	Young's Trucking	16.10	SES
11/19/2015	608669IN	111915-016	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	16.41	SES
11/19/2015	608669IN	111915-017	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	15.96	SES
11/20/2015	608669IN	112015-001	Special Waste Solid Other	Pilot Trench	33	Young's Trucking	16.65	SES
11/20/2015	608669IN	112015-002	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	14.94	SES
11/20/2015	608669IN	112015-003	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.07	SES
11/20/2015	608669IN	112015-004	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	16.42	SES
11/20/2015	608669IN	112015-005	Special Waste Solid Other	Pilot Trench	B16	Baugh	17.59	SES

Table 3.2

Pilot Trench Construction off-Facility Hauling Summary
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date Shipped	Profile Number	Manifest No.	Waste Description	Waste Source	Truck No.	Transporter	Landfill Weight (tons)	Contractor
11/20/2015	608669IN	112015-006	Special Waste Solid Other	Pilot Trench	40	Young's Trucking	16.44	SES
11/20/2015	608669IN	112015-007	Special Waste Solid Other	Pilot Trench	24	Strouse	14.87	SES
11/20/2015	608669IN	112015-008	Special Waste Solid Other	Pilot Trench	20	Strouse	16.21	SES
11/20/2015	608669IN	112015-009	Special Waste Solid Other	Pilot Trench	9	Strouse	15.74	SES
11/20/2015	608669IN	112015-010	Special Waste Solid Other	Pilot Trench	41	Young's Trucking	15.71	SES
11/20/2015	608669IN	112015-011	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	17.64	SES
11/20/2015	608669IN	112015-012	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.11	SES
11/20/2015	608669IN	112015-013	Special Waste Solid Other	Pilot Trench	34	Young's Trucking	15.91	SES
11/20/2015	608669IN	112015-014	Special Waste Solid Other	Pilot Trench	B16	Baugh	17.16	SES
11/20/2015	608669IN	112015-015	Special Waste Solid Other	Pilot Trench	40	Young's Trucking	15.42	SES
11/20/2015	608669IN	112015-016	Special Waste Solid Other	Pilot Trench	24	Young's Trucking	17.58	SES
11/20/2015	608669IN	112015-017	Special Waste Solid Other	Pilot Trench	9	Strouse	16.03	SES
11/20/2015	608669IN	112015-018	Special Waste Solid Other	Pilot Trench	41	Young's Trucking	14.58	SES
11/20/2015	608669IN	112015-019	Special Waste Solid Other	Pilot Trench	1	Strouse	15.40	SES
11/20/2015	608669IN	112015-020	Special Waste Solid Other	Pilot Trench	20	Strouse	15.81	SES
11/23/2015	608669IN	112315-001	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.06	SES
11/23/2015	608669IN	112315-002	Special Waste Solid Other	Pilot Trench	44	Young's Trucking	17.37	SES
11/23/2015	608669IN	112315-003	Special Waste Solid Other	Pilot Trench	36	Young's Trucking	17.69	SES
11/23/2015	608669IN	112315-004	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.08	SES
11/23/2015	608669IN	112315-005	Special Waste Solid Other	Pilot Trench	9	Strouse	16.87	SES
11/23/2015	608669IN	112315-006	Special Waste Solid Other	Pilot Trench	1	Strouse	18.73	SES
11/23/2015	608669IN	112315-007	Special Waste Solid Other	Pilot Trench	20	Strouse	15.90	SES
11/23/2015	608669IN	112315-008	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	17.89	SES
11/23/2015	608669IN	112315-009	Special Waste Solid Other	Pilot Trench	B16	Baugh	20.26	SES
11/23/2015	608669IN	112315-010	Special Waste Solid Other	Pilot Trench	43	Young's Trucking	18.06	SES
11/23/2015	608669IN	112315-011	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	17.97	SES
11/23/2015	608669IN	112315-012	Special Waste Solid Other	Pilot Trench	9	Strouse	18.44	SES
11/23/2015	608669IN	112315-013	Special Waste Solid Other	Pilot Trench	44	Young's Trucking	17.79	SES
11/23/2015	608669IN	112315-014	Special Waste Solid Other	Pilot Trench	1	Strouse	17.86	SES
11/23/2015	608669IN	112315-015	Special Waste Solid Other	Pilot Trench	B16	Baugh	19.30	SES
11/23/2015	608669IN	112315-016	Special Waste Solid Other	Pilot Trench	20	Strouse	17.67	SES
11/23/2015	608669IN	112315-017	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	18.53	SES
11/23/2015	608669IN	112315-018	Special Waste Solid Other	Pilot Trench	36	Young's Trucking	17.83	SES
11/23/2015	608669IN	112315-019	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	17.46	SES
11/23/2015	608669IN	112315-020	Special Waste Solid Other	Pilot Trench	43	Young's Trucking	17.01	SES
11/24/2015	608669IN	112415-001	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	17.45	SES
11/24/2015	608669IN	112415-002	Special Waste Solid Other	Pilot Trench	9	Strouse	16.95	SES
11/24/2015	608669IN	112415-003	Special Waste Solid Other	Pilot Trench	1	Strouse	16.65	SES
11/24/2015	608669IN	112415-004	Special Waste Solid Other	Pilot Trench	20	Strouse	15.28	SES
11/24/2015	608669IN	112415-005	Special Waste Solid Other	Pilot Trench	36	Young's Trucking	17.33	SES

Table 3.2

Pilot Trench Construction off-Facility Hauling Summary
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date Shipped	Profile Number	Manifest No.	Waste Description	Waste Source	Truck No.	Transporter	Landfill Weight (tons)	Contractor
11/24/2015	608669IN	112415-006	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	15.64	SES
11/24/2015	608669IN	112415-007	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	17.02	SES
11/24/2015	608669IN	112415-008	Special Waste Solid Other	Pilot Trench	2	Bloomington	16.14	SES
11/24/2015	608669IN	112415-009	Special Waste Solid Other	Pilot Trench	3	Bloomington	11.24	SES
11/24/2015	608669IN	112415-010	Special Waste Solid Other	Pilot Trench	1	Bloomington	14.04	SES
11/24/2015	608669IN	112415-011	Special Waste Solid Other	Pilot Trench	B16	Baugh	19.48	SES
11/24/2015	608669IN	112415-012	Special Waste Solid Other	Pilot Trench	9	Strouse	17.08	SES
11/24/2015	608669IN	112415-013	Special Waste Solid Other	Pilot Trench	1	Strouse	17.21	SES
11/24/2015	608669IN	112415-014	Special Waste Solid Other	Pilot Trench	20	Strouse	17.23	SES
11/24/2015	608669IN	112415-015	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	18.71	SES
11/24/2015	608669IN	112415-016	Special Waste Solid Other	Pilot Trench	36	Young's Trucking	16.14	SES
11/24/2015	608669IN	112415-017	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.42	SES
11/24/2015	608669IN	112415-018	Special Waste Solid Other	Pilot Trench	B16	Baugh	18.76	SES
11/24/2015	608669IN	112415-019	Special Waste Solid Other	Pilot Trench	1	Bloomington	16.84	SES
11/24/2015	608669IN	112415-020	Special Waste Solid Other	Pilot Trench	2	Bloomington	18.51	SES
11/24/2015	608669IN	112415-021	Special Waste Solid Other	Pilot Trench	3	Bloomington	13.17	SES
11/30/2015	608669IN	113015-001	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.64	SES
11/30/2015	608669IN	113015-002	Special Waste Solid Other	Pilot Trench	B16	Baugh	20.07	SES
11/30/2015	608669IN	113015-003	Special Waste Solid Other	Pilot Trench	20	Strouse	18.66	SES
11/30/2015	608669IN	113015-004	Special Waste Solid Other	Pilot Trench	9	Strouse	18.09	SES
11/30/2015	608669IN	113015-005	Special Waste Solid Other	Pilot Trench	36	Young's Trucking	17.98	SES
11/30/2015	608669IN	113015-006	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.92	SES
11/30/2015	608669IN	113015-007	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	19.20	SES
11/30/2015	608669IN	113015-008	Special Waste Solid Other	Pilot Trench	23	Young's Trucking	18.89	SES
11/30/2015	608669IN	113015-009	Special Waste Solid Other	Pilot Trench	1	Strouse	20.78	SES
11/30/2015	608669IN	113015-010	Special Waste Solid Other	Pilot Trench	13	Strouse	18.91	SES
11/30/2015	608669IN	113015-011	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.98	SES
11/30/2015	608669IN	113015-012	Special Waste Solid Other	Pilot Trench	20	Strouse	15.91	SES
11/30/2015	608669IN	113015-013	Special Waste Solid Other	Pilot Trench	9	Strouse	16.68	SES
11/30/2015	608669IN	113015-014	Special Waste Solid Other	Pilot Trench	B16	Baugh	20.01	SES
11/30/2015	608669IN	113015-015	Special Waste Solid Other	Pilot Trench	36	Young's Trucking	17.19	SES
11/30/2015	608669IN	113015-016	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.80	SES
11/30/2015	608669IN	113015-017	Special Waste Solid Other	Pilot Trench	1	Strouse	18.86	SES
11/30/2015	608669IN	113015-018	Special Waste Solid Other	Pilot Trench	13	Strouse	18.24	SES
11/30/2015	608669IN	113015-019	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	16.38	SES
11/30/2015	608669IN	113015-020	Special Waste Solid Other	Pilot Trench	23	Young's Trucking	18.85	SES
12/1/2015	608669IN	120115-001	Special Waste Solid Other	Pilot Trench	B16	Baugh	18.18	SES
12/1/2015	608669IN	120115-002	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.52	SES
12/1/2015	608669IN	120115-003	Special Waste Solid Other	Pilot Trench	2	Bloomington	17.36	SES
12/1/2015	608669IN	120115-004	Special Waste Solid Other	Pilot Trench	3	Bloomington	13.70	SES

Table 3.2

Pilot Trench Construction off-Facility Hauling Summary
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date Shipped	Profile Number	Manifest No.	Waste Description	Waste Source	Truck No.	Transporter	Landfill Weight (tons)	Contractor
12/1/2015	608669IN	120115-005	Special Waste Solid Other	Pilot Trench	20	Strouse	17.16	SES
12/1/2015	608669IN	120115-006	Special Waste Solid Other	Pilot Trench	9	Strouse	14.99	SES
12/1/2015	608669IN	120115-007	Special Waste Solid Other	Pilot Trench	1	Strouse	18.67	SES
12/1/2015	608669IN	120115-008	Special Waste Solid Other	Pilot Trench	13	Strouse	15.89	SES
12/1/2015	608669IN	120115-009	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	17.30	SES
12/1/2015	608669IN	120115-010	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.92	SES
12/1/2015	608669IN	120115-011	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.35	SES
12/1/2015	608669IN	120115-012	Special Waste Solid Other	Pilot Trench	B16	Baugh	18.41	SES
12/1/2015	608669IN	120115-013	Special Waste Solid Other	Pilot Trench	9	Strouse	18.37	SES
12/1/2015	608669IN	120115-014	Special Waste Solid Other	Pilot Trench	20	Strouse	18.28	SES
12/1/2015	608669IN	120115-015	Special Waste Solid Other	Pilot Trench	1	Strouse	17.71	SES
12/1/2015	608669IN	120115-016	Special Waste Solid Other	Pilot Trench	13	Strouse	17.86	SES
12/1/2015	608669IN	120115-017	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	17.74	SES
12/1/2015	608669IN	120115-018	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	16.27	SES
12/1/2015	608669IN	120115-019	Special Waste Solid Other	Pilot Trench	2	Bloomington	18.33	SES
12/1/2015	608669IN	120115-020	Special Waste Solid Other	Pilot Trench	3	Bloomington	12.70	SES
12/2/2015	608669IN	120215-001	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	15.41	SES
12/2/2015	608669IN	120215-002	Special Waste Solid Other	Pilot Trench	B16	Baugh	15.79	SES
12/2/2015	608669IN	120215-003	Special Waste Solid Other	Pilot Trench	20	Strouse	16.43	SES
12/2/2015	608669IN	120215-004	Special Waste Solid Other	Pilot Trench	3	Bloomington	9.67	SES
12/2/2015	608669IN	120215-005	Special Waste Solid Other	Pilot Trench	9	Strouse	17.63	SES
12/2/2015	608669IN	120215-006	Special Waste Solid Other	Pilot Trench	1	Strouse	15.44	SES
12/2/2015	608669IN	120215-007	Special Waste Solid Other	Pilot Trench	2	Bloomington	16.50	SES
12/2/2015	608669IN	120215-008	Special Waste Solid Other	Pilot Trench	40	Young's Trucking	16.91	SES
12/2/2015	608669IN	120215-009	Special Waste Solid Other	Pilot Trench	13	Strouse	14.52	SES
12/2/2015	608669IN	120215-010	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	15.75	SES
12/2/2015	608669IN	120215-011	Special Waste Solid Other	Pilot Trench	B16	Baugh	18.88	SES
12/2/2015	608669IN	120215-012	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	14.02	SES
12/2/2015	608669IN	120215-013	Special Waste Solid Other	Pilot Trench	48	Young's Trucking	15.19	SES
12/2/2015	608669IN	120215-014	Special Waste Solid Other	Pilot Trench	20	Strouse	16.20	SES
12/2/2015	608669IN	120215-015	Special Waste Solid Other	Pilot Trench	9	Strouse	16.10	SES
12/2/2015	608669IN	120215-016	Special Waste Solid Other	Pilot Trench	13	Strouse	15.58	SES
12/2/2015	608669IN	120215-017	Special Waste Solid Other	Pilot Trench	1	Strouse	17.39	SES
12/2/2015	608669IN	120215-018	Special Waste Solid Other	Pilot Trench	40	Young's Trucking	15.13	SES
12/2/2015	608669IN	120215-019	Special Waste Solid Other	Pilot Trench	3	Bloomington	12.94	SES
12/2/2015	608669IN	120215-020	Special Waste Solid Other	Pilot Trench	2	Bloomington	20.18	SES
12/3/2015	608669IN	120315-001	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.78	SES
12/3/2015	608669IN	120315-002	Special Waste Solid Other	Pilot Trench	B16	Baugh	19.36	SES
12/3/2015	608669IN	120315-003	Special Waste Solid Other	Pilot Trench	9	Strouse	18.78	SES
12/3/2015	608669IN	120315-004	Special Waste Solid Other	Pilot Trench	1	Strouse	19.00	SES

Table 3.2

Pilot Trench Construction off-Facility Hauling Summary
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date Shipped	Profile Number	Manifest No.	Waste Description	Waste Source	Truck No.	Transporter	Landfill Weight (tons)	Contractor
12/3/2015	608669IN	120315-005	Special Waste Solid Other	Pilot Trench	20	Strouse	19.74	SES
12/3/2015	608669IN	120315-006	Special Waste Solid Other	Pilot Trench	13	Strouse	18.51	SES
12/3/2015	608669IN	120315-007	Special Waste Solid Other	Pilot Trench	40	Young's Trucking	17.40	SES
12/3/2015	608669IN	120315-008	Special Waste Solid Other	Pilot Trench	43	Young's Trucking	17.99	SES
12/3/2015	608669IN	120315-009	Special Waste Solid Other	Pilot Trench	44	Young's Trucking	17.41	SES
12/3/2015	608669IN	120315-010	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	18.77	SES
12/3/2015	608669IN	120315-011	Special Waste Solid Other	Pilot Trench	B16	Baugh	16.74	SES
12/3/2015	608669IN	120315-012	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.21	SES
12/3/2015	608669IN	120315-013	Special Waste Solid Other	Pilot Trench	40	Young's Trucking	16.86	SES
12/3/2015	608669IN	120315-014	Special Waste Solid Other	Pilot Trench	9	Strouse	18.60	SES
12/3/2015	608669IN	120315-015	Special Waste Solid Other	Pilot Trench	1	Strouse	17.09	SES
12/3/2015	608669IN	120315-016	Special Waste Solid Other	Pilot Trench	13	Strouse	17.90	SES
12/3/2015	608669IN	120315-017	Special Waste Solid Other	Pilot Trench	43	Young's Trucking	17.61	SES
12/3/2015	608669IN	120315-018	Special Waste Solid Other	Pilot Trench	20	Strouse	17.64	SES
12/3/2015	608669IN	120315-019	Special Waste Solid Other	Pilot Trench	47	Young's Trucking	17.10	SES
12/3/2015	608669IN	120315-020	Special Waste Solid Other	Pilot Trench	44	Young's Trucking	16.97	SES
12/8/2015	608669IN	120815-001	Special Waste Solid Other	Pilot Trench	B16	Baugh	16.96	SES
12/8/2015	608669IN	120815-002	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	16.60	SES
12/8/2015	608669IN	120815-003	Special Waste Solid Other	Pilot Trench	50	Young's Trucking	18.63	SES
12/8/2015	608669IN	120815-004	Special Waste Solid Other	Pilot Trench	46	Young's Trucking	17.69	SES
12/8/2015	608669IN	120815-005	Special Waste Solid Other	Pilot Trench	49	Young's Trucking	18.20	SES
12/8/2015	608669IN	120815-006	Special Waste Solid Other	Pilot Trench	B16	Baugh	17.31	SES
12/8/2015	608669IN	120815-007	Special Waste Solid Other	Pilot Trench	42	Young's Trucking	2.95	SES

Table 3.3

Summary of Waste Stockpile Analytical Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Area		**P215**	**P215**	**P215**	**P215**	**P215**	**P215**	**P215**	**P215**
Sample Location:		**215-40268**	**215-40269**	**215-40270**	**215-40271**	**215-40272**	**215-40273**	**215-40274**	**215-40275**
Sample Identification:		**S-100815-PB-40268**	**S-100815-PB-40269**	**S-100815-PB-40270**	**S-100815-PB-40271**	**S-100815-PB-40272**	**S-100815-PB-40273**	**S-100815-PB-40274**	**S-100815-PB-40275**
Sample Date:		**10/8/2015**	**10/8/2015**	**10/8/2015**	**10/8/2015**	**10/8/2015**	**10/8/2015**	**10/8/2015**	**10/8/2015**
Sample Depth:		**(0-0.33) ft**	**(0.5-1.5) ft**	**(0-0.33) ft**	**(0-0.33) ft**	**(1.5-2.25) ft**	**(0-0.5) ft**	**(2-2.5) ft**	**(0-0.33) ft**
Sample Type:					**Duplicate**				
Notes		**Characterization of material beneath liner for trenching operation**	**Characterization of material beneath liner for trenching operation**	**Characterization of material beneath liner for trenching operation**	**Characterization of material beneath liner for trenching operation**	**Characterization of material beneath liner for trenching operation**	**Characterization of material beneath liner for trenching operation**	**Characterization of material beneath liner for trenching operation**	**Characterization of material beneath liner for trenching operation**
	Units								
Polychlorinated biphenyl (PCBs)									
Aroclor-1016 (PCB-1016)	mg/kg	0.23 U	0.22 U	0.23 U	0.24 U	0.25 U	0.23 U	0.24 U	1.2 U
Aroclor-1221 (PCB-1221)	mg/kg	0.23 U	0.22 U	0.23 U	0.24 U	0.25 U	0.23 U	0.24 U	1.2 U
Aroclor-1232 (PCB-1232)	mg/kg	0.23 U	0.22 U	0.23 U	0.24 U	0.25 U	0.23 U	0.24 U	1.2 U
Aroclor-1242 (PCB-1242)	mg/kg	0.23 U	0.22 U	0.23 U	0.24 U	0.25 U	0.23 U	0.24 U	1.2 U
Aroclor-1248 (PCB-1248)	mg/kg	0.23 U	0.22	0.23 U	0.24 U	0.25 U	0.23 U	0.24 U	4.5
Aroclor-1254 (PCB-1254)	mg/kg	0.23 U	0.22 U	0.23 U	0.24 U	0.25 U	0.23 U	0.24 U	1.2 U
Aroclor-1260 (PCB-1260)	mg/kg	0.23 U	0.22 U	0.23 U	0.24 U	0.25 U	0.23 U	0.24 U	1.2 U
Total PCBs	mg/kg	ND	0.22	ND	ND	ND	ND	ND	4.5

Notes:

U - Not detected at the associated reporting limit.
TCLP - Toxicity Characteristic Leaching Procedure

Table 3.3

Summary of Waste Stockpile Analytical Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Area		**P215**	**P215**	**P215**	**P215**	**P215**	**P216**	**P216**
Sample Location:		**215-40276**	**215-40277**	**215-40333**	**215-40340**	**215-40341**	**216-40316**	**216-40317**
Sample Identification:		**S-100815-PB-40276**	**S-100815-PB-40277**	**SO-215-112415-PB-40333**	**SO-215-120415-PB-40340**	**SO-215-120415-PB-40341**	**SO-216-111015-PB-40316**	**SO-216-111015-PB-40317**
Sample Date:		**10/8/2015**	**10/8/2015**	**11/24/2015**	**12/4/2015**	**12/4/2015**	**11/10/2015**	**11/10/2015**
Sample Depth:		**(1-2) ft**	**-**	**-**	**-**	**-**	**(0-0.5) ft**	**(0-0.5) ft**
Sample Type:						**Duplicate**		**Duplicate**
Notes		**Characterization of material beneath liner for trenching operation**	**Characterization of material beneath liner for trenching operation**	**General Motors LLC - 15 point composite of trenching stockpile between 5+50 and 7+00**	**General Motors LLC - 15 point composite of trenching stockpile between 7+00 and 8+25**	**General Motors LLC - 15 point composite of trenching stockpile between 7+00 and 8+25**	**General Motors LLC - 15 point composite of trenching stockpile between 2+00 and 4+00**	**General Motors LLC - 15 point composite of trenching stockpile between 2+00 and 4+00**
	Units							
Polychlorinated biphenyl (PCBs)								
Aroclor-1016 (PCB-1016)	mg/kg	1.3 U	0.24 U	0.21 U	0.035 U	0.035 U	0.037 U	0.037 U
Aroclor-1221 (PCB-1221)	mg/kg	1.3 U	0.24 U	0.21 U	0.035 U	0.035 U	0.037 U	0.037 U
Aroclor-1232 (PCB-1232)	mg/kg	1.3 U	0.24 U	0.21 U	0.035 U	0.035 U	0.037 U	0.037 U
Aroclor-1242 (PCB-1242)	mg/kg	1.3 U	0.24 U	0.21 U	0.035 U	0.035 U	0.037 U	0.037 U
Aroclor-1248 (PCB-1248)	mg/kg	14	1.1	0.21 U	0.035 U	0.035 U	0.037 U	0.037 U
Aroclor-1254 (PCB-1254)	mg/kg	1.3 U	0.24 U	0.21 U	0.035 U	0.035 U	0.037 U	0.037 U
Aroclor-1260 (PCB-1260)	mg/kg	1.3 U	0.24 U	0.21 U	0.035 U	0.035 U	0.037 U	0.037 U
Total PCBs	mg/kg	14	1.1	ND	ND	ND	ND	ND

Notes:

U - Not detected at the associated reporting limit.
TCLP - Toxicity Characteristic Leaching Procedure

Table 3.3

Summary of Waste Stockpile Analytical Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Area		**P216**	**P216**	**P216**	**P216**	**P216**
Sample Location:		**216-40326**	**216-40349**	**216-40350**	**216-40351**	**216-40352**
Sample Identification:		**SO-216-111615-PB-40326**	**SO-216-121015-PB-40349**	**SO-216-121015-PB-40350**	**SO-216-121015-PB-40351**	**SO-216-121015-PB-40352**
Sample Date:		**11/16/2015**	**12/10/2015**	**12/10/2015**	**12/10/2015**	**12/10/2015**
Sample Depth:		**-**	**-**	**-**	**-**	**-**
Sample Type:						
Notes		**MS/MSD, General Motors LLC - 15 point composite of trenching stockpile between 4+00 and 5+50**	**General Motors LLC - 5 point composite from beneath NW quadrant of <50 ppm PCB Stockpile**	**MS/MSD, General Motors LLC - 5 point composite from beneath NW quadrant of <50 ppm PCB Stockpile**	**General Motors LLC - 5 point composite from beneath NW quadrant of <50 ppm PCB Stockpile**	**General Motors LLC - 5 point composite from beneath NW quadrant of <50 ppm PCB Stockpile**
	Units					
Polychlorinated biphenyl (PCBs)						
Aroclor-1016 (PCB-1016)	mg/kg	0.21 U	0.037 U	0.038 U	0.038 U	0.039 U
Aroclor-1221 (PCB-1221)	mg/kg	0.21 U	0.037 U	0.038 U	0.038 U	0.039 U
Aroclor-1232 (PCB-1232)	mg/kg	0.21 U	0.037 U	0.038 U	0.038 U	0.039 U
Aroclor-1242 (PCB-1242)	mg/kg	0.21 U	0.037 U	0.038 U	0.038 U	0.039 U
Aroclor-1248 (PCB-1248)	mg/kg	0.21 U	0.053	0.054	0.038 U	0.039 U
Aroclor-1254 (PCB-1254)	mg/kg	0.21 U	0.037 U	0.038 U	0.038 U	0.039 U
Aroclor-1260 (PCB-1260)	mg/kg	0.21 U	0.037 U	0.038 U	0.038 U	0.039 U
Total PCBs	mg/kg	ND	0.053	0.054	ND	ND

Notes:

U - Not detected at the associated reporting limit.
TCLP - Toxicity Characteristic Leaching Procedure

Table 3.4

Summary of Trench Cutting Sample Test Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Area		***P216***
Sample Location:		***216-40299***
Sample ID:		***S-216-110315-PB-40299***
Sample Date:		***11/3/2015***
Parameters	***Units***	
PCBs		
Aroclor-1016 (PCB-1016)	ug/kg	35 U
Aroclor-1221 (PCB-1221)	ug/kg	35 U
Aroclor-1232 (PCB-1232)	ug/kg	35 U
Aroclor-1242 (PCB-1242)	ug/kg	35 U
Aroclor-1248 (PCB-1248)	ug/kg	35 U
Aroclor-1254 (PCB-1254)	ug/kg	35 U
Aroclor-1260 (PCB-1260)	ug/kg	35 U
Total PCBs	ug/kg	ND

Footnotes:

ND Not detected at the associated reporting limit.
U Not detected at the associated reporting limit.

Table 3.5

Summary of Vertical and Horizontal Fractures from
Final Confirmatory Videos
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Name	Location	Depth/Length	Fill	Water	Fracture Notes
VF1	**0+35**	**T - B**	**Clay**	**Dry**	**Only visible on West side.**
VF2	**0+45**	**T - B**	**Clay**	**Dry**	**East and West. West ends about 3/4, east goes to bottom.**
VF3	**0+50**	**T - 1/4**	**Clay**	**Dry**	**East and West. Small fracture only found near top.**
VF4	**0+55**	**T - B**	**Clay**	**Flow (west**	**East and West. Only flowing on west side near bottom of trench. Starts as a large V at top and then gets narrower. Large fracture on both**
VF5	0+65	T - B	Clay	Dry	East and West. Both sides diagonal towards 0+60 and end at that station. East side breaks into 2 VF near bottom, one VF ends at this station, the other at 0+60.
VF6	0+70	T - B	Clay	Dry	Only visible on west side. Diagonals to South and ends at 0+75.
HF1	1/4	0+70 - 0+80	Clay	Dry	HF at 1/4 way down goes on for 3 stations Visible east and west.
HF2	M	0+80 - 0+90	Clay	Dry	Visible on East and West
VF7	**0+80**	**M - B**	**Clay**	**Dry**	**Only visible on west side. Large hole in middle of trench, VF forms after hole and carries on to the bottom of the trench.**
VF8	0+85	T - 1/4	Clay	Dry	Only visible on east side.
HF3	B	0+85 - 0+90	Clay	Dry	East and West
HF4	T	0+90 - 1+00	Clay	Dry	Both East and West sides.
VF9	**1+00**	**T - B**	**Clay**	**Flow (west**	**West side water flowing out of VF 3/4 way down. On East side 2 small VF lead to large hole in middle of trench. Carries out to bottom as 2 VF.**
VF10	**1+10**	**T - 1/4**	**Clay**	**Dry**	**Only visible on west side.**
VF11	**1+20**	**T - 3/4**	**Clay**	**Dry**	**Only visible on East side. Ends around station 1+15.**
VF12	**1+25**	**1/4 - 3/4**	**Clay**	**Dry**	**Both East and West sides.**
VF13	**1+30**	**T - 3/4**	**Clay**	**Dry**	**Both East and West sides.**
VF14	**1+45**	**T - M**	**Clay**	**Dry**	**Both East and West sides.**
HF5	**B**	**1+50 - 1+60**	**Clay**	**Flow (west**	**Only visible on West side. Water flowing at station 1+55 at VF.**
VF15	**1+55**	**T - 3/4**	**Clay**	**Flow**	**Only visible on West side. Large V shape at top of trench. Water flowing 3/4 way down trench.**
VF16	1+60	T - 3/4	Clay	Dry	Only visible on East side. Splits into 2 VF's after middle.
HF6	M	1+60 - 1+70	Clay	Dry	Only visible on East side.
VF17	1+70	T - 3/4	Clay	Dry	East and West.
VF18	1+80	T -3/4	Clay	Dry	East and West. On west, starts as 2 VFs and forms into one at middle. On east, starts as 3 VFs and forms 1 VF at about middle of trench.
VF19	**2+00**	**T - 3/4**	**Clay**	**Flow (west only) &**	**Only visible on West side. Water flowing near bottom of trench. Large section missing at top.**
VF20	2+05	T - M	Clay	Dry	Only visible on East side. Starts at this station but ends at 2+00 in the middle of the trench (on a diagonal).
VF21	2+10	T - 3/4	Clay	Dry	Only visible on East side. Starts at this station but ends at 2+00 at the bottom of the trench (on a diagonal). Large chunks missing throughout the VF.
VF22	**2+20**	**T - B**	**Clay**	**Flow (west only) &**	**East and West. On West water flowing and staining near bottom of trench. East side ends at 3/4. West ends just before bottom of trench.**
VF23	2+25	T - 1/4	Clay	Dry	East and West. On East, 2 small VF's.
VF24	2+40	T - M	Clay	Dry	East and West.
VF25	2+60	T - M	Clay	Dry	Only visible on East Side.
HF7	**M**	**2+60 - 2+70**	**Clay**	**Dry**	**Only visible on East side. Starts at 2+60 appearing as a VF but, turns and becomes HF at this station.**
HF8	**B**	**2+65 - 2+70**	**Clay**	**Dry**	**Only visible on West side.**
HF9	**M**	**2+70 - 3+85**	**Clay**	**Dry & Staining**	**East and West. Staining on the west side can be found at stations 2+75, 2+80, 2+90, 3+15, 3+25, 3+40 and 3+60**
VF26	**2+85**	**T - B**	**Clay**	**Dry**	**East and West.**
VF27	**3+10**	**T - B**	**Clay**	**Dry**	**East and West.**
VF28	3+44	T - 3/4	Clay	Dry	East and West.
VF29	**3+45**	**T - M**	**Clay**	**Dry**	**East and West. On East side, the VF at this station joins the VF at 3+44 to create 1 VF from the middle to 3/4 way down the trench. On the West side, the VF does not join the VF at 3+44, just ends in middle.**
VF30	**3+50**	**T - M**	**Clay**	**Dry**	**Only visible on East side. Ends at HF9**
HF10	**T**	**3+55 - 3+60**	**Clay**	**Dry**	**Only visible on West side.**
VF31	3+60	T - M	Clay	Dry & Staining	East and West. Both end at the HF in middle (HF9)
VF32	3+75	T - M	Clay	Dry	East and West. Both end at the HF in middle (HF9)
VF33	**3+80**	**T - 3/4**	**Clay**	**Staining**	**East and West. Both have staining, west appears to be wet but no water flowing.**
VF34	**3+90**	**T - 3/4**	**Clay**	**Dry**	**East and West. West side has a large V shape at top of trench and then narrows out. East side has large hole just above the bottom of the trench, VF ends there.**
HF11	**B**	**3+85 - 4+00**	**Nothing**	**Staining**	**East and West. West ends at 3+95, East ends at 4+00.**
HF12	**3/4**	**3+95 - 4+45**	**Clay**	**Dry**	**East and West. West ends at 4+25, East ends at 4+45**
HF13	**B**	**4+00 - 4+30**	**Clay**	**Dry**	**West side only.**
VF35	**4+00**	**T - M**	**Clay**	**Dry**	**East and West. Large V shape at top and gets narrower as it decreases.**
HF14	T	4+10 - 4+15	Clay	Dry	Only visible on West Side.

Table 3.5

Summary of Vertical and Horizontal Fractures from
Final Confirmatory Videos
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Name	Location	Depth/Length	Fill	Water	Fracture Notes
VF36	**4+15**	**T - 3/4**	**Clay**	**Dry & Staining**	**East and West. Staining on West side near bottom of VF, the rest is dry.**
VF37	**4+25**	**T - M**	**Clay**	**Dry**	**Only visible on East Side, very thin.**
VF38	**4+40**	**T - M**	**Clay**	**Dry & Staining**	**East and West. Staining at bottom of VF on West side. Large V shape at top of trench and then narrows after.**
HF15	B	4+45 - 4+55	Nothing	Dry	Only visible on West side. Fracture is very fine.
VF39	4+57	T - 3/4	Clay	Dry & Staining	East and West. Staining at bottom of VF on West side. West side, one VF goes top to middle and then breaks into 2 thin VF and continues to 3/4 way down trench. East side, one large VF goes top to middle and a second thin VF starts beside it and goes middle to close but not through the bottom of
HF16	M	4+70 - 4+75	Clay	Dry	West side only.
VF40	4+95	T - 3/4	Clay	Dry	East and West. Large V shape at top and gets narrower as it decreases.
VF41	**5+00**	**M - B**	**Nothing**	**Dry & Staining**	**East and West. Very fine fracture starting from middle and ends just before the bottom of the trench. West has staining at bottom.**
VF42	**5+20**	**1/4 - 3/4**	**Clay**	**Dry**	**East and West.**
VF43	5+25	T - M	Clay	Dry	East and West.
VF44	**5+40**	**T - B**	**Clay**	**Dry**	**East and West. Large V shape at top and gets narrower as it decreases. Ends just before the bottom of the trench.**
HF17	**M**	**5+40 - 5+50**	**Clay**	**Dry**	**East and West. Both start at VF's at 5+40. On east side HF is in 2 small fractures very close to one another.**
HF18	**T**	**5+50 - 6+00**	**Clay**	**Dry**	**East and West. East ends at 5+75, west ends a 6+00.**
HF19	**M**	**5+70 - 5+80**	**Clay**	**Dry**	**East side only.**
VF45	**5+80 & 5+85**	**T - M**	**Clay**	**Dry**	**East and West. East appears closer to 5+80 and west is closer to 5+85, but still appear to be the same fracture. Large V shape at top and gets narrower as it decreases.**
HF20	3/4	5+90 - 6+05	Clay	Dry	East and West.
VF46	**6+20**	**T - B**	**Clay**	**Dry**	**East and West.**
HF21	**T**	**6+20 - 6+90**	**Clay**	**Dry**	**East and West.**
VF47	6+40	T - B	Clay	Dry	East and West. Goes to bottom of trench.
HF22	1/4 & M	6+40 - 7+05	Clay	Dry	East and West. Starts at 1/4 down trench, at station 6+50 moves to middle of trench.
HF23	1/4 & M	6+50 - 8+65	Clay	Dry & Staining	East and West. Starts at 1/4 down trench, at station 7+70 moves to middle of trench. Staining apparent from 8+10 to 8+65 on West side.
VF48	**6+75**	**T - 3/4**	**Clay**	**Dry**	**East and West.**
VF49	**6+90**	**T - M**	**Clay**	**Dry**	**East and West. Large V shape at top and gets narrower as it decreases.**
HF24	**T & 1/4**	**7+05 - 7+80**	**Clay**	**Dry**	**East and West. At 7+70 appears to move to 1/4 of the trench rather than the top.**
VF50	**7+35**	**T - 3/4**	**Clay**	**Dry & Staining**	**East and West. Staining near bottom of the trench on the west side. Large V shape at top and gets narrower.**
VF51	**7+55**	**T - M**	**Clay**	**Dry**	**Only visible on East Side.**
VF52	7+60	T - 3/4	Clay	Dry	East and West.
VF53	**7+75**	**T - M**	**Clay**	**Wet**	**East and West. Both sides appear wet after the fracture ends.**
HF25	**T**	**7+90 - 8+65**	**Clay**	**Dry**	**East and West.**
VF54	8+00	T - M	Clay	Dry	East and West. East is in 2 VF, the one to the south only goes 1/4 of the way down the trench.
VF55	**8+05**	**T - B**	**Clay & Nothing**	**Flow (east side)**	**Only visible on East side. Large gaps missing at top of trench. Water flowing near bottom of trench just trickling.**
VF56	**8+10**	**T - B**	**Clay**	**Dry, Staining & Flow (west**	**East and West. Large water stains and flow coming from bottom of fracture on West side. On East side, large V shape chunk missing at top of trench. East ends about half way down trench. Goes to bottom.**
VF57	**8+30**	**T - 1/4**	**Clay**	**Dry & Staining**	**East and West. Water stains coming from bottom of fracture on west side. East side has a very thin VF that is dry.**
VF58	**8+50**	**T - M**	**Clay**	**Dry**	**East and West.**
VF59	**8+60**	**T - M**	**Clay**	**Dry**	**East and West.**
HF26	**1/4**	**8+60 - 8+65**	**Clay**	**Staining & Flow**	**West side only. Water flowing out of HF at station 8+65.**

Notes:

VF	- Vertical Fracture
HF	- Horizontal Fracture
T	- Top
M	- Approximately mid-height of trench at that station
B	- Bottom
1+15	- Station designation, for example, 115 feet along length of trench from the north-most section
BOLD	- Indicates fractures depicted on Figures 3.2 and 3.3. Table and figures represent two independent reviews of the final videos and may not represent actual scale.
	- Fractures depicted on Figures 3.2 and 3.3 are intended to be a general representation of the more significant fractures viewed from the videos.

Table 3.6

Summary of Vinyl Sheet Piling Installation Log
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date	Length (L.F.)	Start Station	End Station	Number of Panels
1/26/2016	10	3+10	3+20	5
1/27/2016	30	2+80	3+10	15
1/28/2016	42	2+38	2+80	21
1/28/2016	26	3+20	3+46	13
2/2/2016	68	1+70	2+38	34
2/3/2016	126	0+44	1+70	63
2/4/2016	2	0+40	0+44	1
2/22/2016	76	3+46	4+22	38
2/23/2016	40	4+22	4+62	20
2/26/2016	20	4+62	4+82	10
2/29/2016	100	4+82	5+82	50
3/1/2016	34	5+82	6+20	17
3/2/2016	70	6+20	6+90	35
3/3/2016	38	6+90	7+28	19
3/4/2016	40	7+28	7+68	20
3/7/2016	40	7+68	8+08	20
3/8/2016	49	8+08	8+57	24.5

Table 3.7

Summary of Fill Material Analytical Test Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Parameter	Method	Units	IDEM Screening Soil Exposure Direct Contact Excavation 2015	IDEM Screening Soil Exposure Direct Contact Commercial/Industrial 2015	IDEM Screening Soil Exposure Direct Contact Residential 2015	Common Fill	Stone
Aluminum	EPA 6010	mg/kg	100000	100000	100000	13600	2810
Arsenic	EPA 6010	mg/kg	920	30	9.4	4.6	7.8
Barium	EPA 6010	mg/kg	100000	100000	21000	99.9	61.2
Beryllium	EPA 6010	mg/kg	3800	2300	220	0.63	NA
Cadmium	EPA 6010	mg/kg	1900	980	98	0.33 J	0.45 J
Calcium	EPA 6010	mg/kg	-	-	-	2930	246000
Chromium	EPA 6010	mg/kg	-	-	-	16.8	7.8
Chromium, Hexavalent	EPA 7196A	mg/kg	2700	63	4.2	NA	NA
Cobalt	EPA 6010	mg/kg	590	350	32	5.9	4.9
Copper	EPA 6010	mg/kg	79000	47000	4300	8.6	4
Cyanide	EPA 9012	mg/kg	510	130	29	NA	0.16 J
Endrin aldehyde	EPA 8081	mg/kg	-	-	-	NA	NA
Iron	EPA 6010	mg/kg	100000	100000	77000	12800	10700
Lead	EPA 6010	mg/kg	1000	800	400	11.1	3.6
Magnesium	EPA 6010	mg/kg	-	-	-	1580	22200
Manganese	EPA 6010	mg/kg	46000	26000	2500	391	349
Mercury	EPA 7471	mg/kg	3.1	3.1	3.1	0.036 J	NA
Nickel	EPA 6010	mg/kg	38000	22000	2100	13.7	18.3
Percent Moisture	ASTM D2974-87	%		-	-	15.9	6.4
Potassium	EPA 6010	mg/kg	-	-	-	802	1190
Sodium	EPA 6010	mg/kg	-	-	-	35.3 J	235
Vanadium	EPA 6010	mg/kg	9900	5800	550	24.3	15.4
Zinc	EPA 6010	mg/kg	100000	100000	32000	51.5	51.7

Notes

"-" No limits have been set by IDEM
NA No result recorded
J Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

Table 3.8

Summary of Geotextile Material Test Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Roll Number	Weight	Thickness	Grab Tensile Machine Direction	Grab Tensile Cross Direction	Grab Elongation Machine Direction	Grab Elongation Cross Direction	Trap Tear Machine Direction	Trap Tear Cross Direction	CBR Puncture	UV Resistance (% strength retained/500 hrs)	AOS	Water Flow Rate	Permeability	Permittivity
	(oz/sq yd)	(mils)	(lbs)		(%)		(lbs)		(lbs)		(U.S. sieve)	(gpm/sq ft)	(cm/sec)	(sec-1)
J10135072	11.56	166.4	338	369	63	78	148	179	1099	70	100	95	0.514	1.29
J10135073	11.56	166.4	338	369	63	78	148	179	1099	70	100	95	0.514	1.29
J10135089	11.56	166.4	338	369	63	78	148	179	1099	70	100	95	0.514	1.29
J10135090	11.56	166.4	338	369	63	78	148	179	1099	70	100	95	0.514	1.29
J10135091	11.56	166.4	338	369	63	78	148	179	1099	70	100	95	0.514	1.29
J10135092	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135093	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135094	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135095	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135096	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135097	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135098	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135099	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135100	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135101	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135102	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2
J10135103	11	161.6	325	327	62	79	136	163	1006	70	100	88	0.464	1.2

Table 3.9

Summary of In-Place Soil Barrier (Clay) Compaction Testing Results
Construction Certificate Report
GM GPS Bedford Facility
Bedford, Indiana

Test Date	Location	Test ID	Daily Test Number	Test Depth Depth	Elevation of Test (ft)	Proctor Soil ID/Lab # [1]	Optimum Moisture Content (%) [1,2]	Moisture Content (%)	Moisture Content Above/Below Optimum Moisture (%) [3]	Moisture Content Test Pass/Fail	Maximum Dry Density (Pound-Force per ft^3) [1]	Dry Density (Pound-Force per ft^3)	Wet Density (Pound-Force per ft^3)	Compaction (%) [4]	Compaction Test Pass/Fail	PSI Pass/Fail Code [5]	Overall Test Pass/Fail	Comments
05/20/2016	Pilot Trench		6	6	-	00141392-29-S1	16.8	21.9	5.1	PASS	105.7	103.9	126.6	98.3	PASS	A	PASS	
05/24/2016	Pilot Trench		1	6	623.3	00141392-29-S1	16.8	17.9	1.1	PASS	105.7	108.3	127.7	102.5	PASS	A	PASS	
05/24/2016	Pilot Trench		2	6	604.7	00141392-29-S1	16.8	17.2	0.4	PASS	105.7	105.9	124.1	100.2	PASS	A	PASS	

Notes:

(1) Soil proctor information.
(2) Test results included a fail value for the compaction test and/or moisture content, which required a subsequent retest either the same day or the next if a failure occurred.
(3) Accepted moisture content to be within 0-5% of optimum moisture content of proctor.
(4) Accepted compaction to be at least 95% of maximum dry density of proctor.
(5) PSI Pass/Fail Codes are as follows:

1 = Fill material	A = Test results comply with specifications
2 = Backfill	B = Compaction does not comply with specifications
3 = Base course	C = Retest of previous test
4 = Sub-base	D = Moisture in excess of specifications
5 = Soil cement	E = Moisture below specifications
6 = Other	

(6) Moisture content results were below optimum moisture percentage, however the compaction at these locations all exceeded the 95% criteria.
"-" Information unavailable

Table 3.10

Summary of LLDPE Liner Installation Log
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Panel ID Number	Date Deployed	Area	Panel Dimensions Length (feet) (1)	Panel Dimensions Width (feet)	Panel Dimensions Area ($feet^2$)	Installation Approved (QA ID) (2)	Comment
EP808	05/24/2016	Trench	163	22.5	3,667.50	CRH	
EP809	05/24/2016	Trench	190	22.5	4,275.00	CRH	
EP810	05/24/2016	Trench	57	22.5	1,282.50	CRH	
EP811	05/24/2016	Trench	23	22.5	517.50	CRH	
EP812	05/24/2016	Trench	23	22.5	517.50	CRH	
EP813	05/24/2016	Trench	64	22.5	1,440.00	CRH	
EP814	05/24/2016	Trench	92	22.5	2,070.00	CRH	
EP815	05/24/2016	Trench	90	22.5	2,025.00	CRH	
EP816	05/24/2016	Trench	18	22.5	405.00	CRH	

Notes:

(1) Installed length represents field measurement of actual deployed length. For trapezoidal shapes, the measured length was the longer side.
(2) Installation approval refers to visual inspection of installation procedures.
(3) The panel shape was not always recorded on the Panel Installation Log form; however, the panel shape is presented on the respective Drawing.

Table 3.11

Summary of LLDPE Test Seam Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date	Time	Ambient Temperature (°F)	Seamer ID	Machine ID	Fusion/Extrusion Weld Type	Fusion/Extrusion Temperature (°F)	Fusion/Extrusion Speed	Peel Test [1,2] (ppi) Coupon 1 A/B	Peel Test Coupon 2 A/B	Peel Test Coupon 3 A/B	Peel Test Coupon 4 A/B	Peel Test Coupon 5 A/B	Shear Test [1] (ppi) Coupon 1/2/3	Shear Test Coupon 4/5	QA ID	Pass/Fail	Comments
24-May-16	11:50	-	KS	22	Fusion	550	500	97/98	98/91	92/96	97/101	100/99	98/98/99	99/99	CRH	Pass	
24-May-16	14:55	-	MM	53	Extrusion	550	500	96	96	87	106	104	96/109/100	97/90	CRH	Pass	
24-May-16	16:35	-	KS	22	Fusion	800	500	86/90	91/92	85/92	86/89	94/86	102/106/99	91/91	CRH	Pass	
24-May-16	16:40	-	KS	22	Fusion	800	500	92/89	93/91	91/86	89/94	90/89	86/91/106	97/99	CRH	Pass	
25-May-16	8:00	-	KS	56	Extrusion	500	500	103	103	99	102	103	108/112/111	112/116	CRH	Pass	
25-May-16	8:00	-	MM	53	Extrusion	550	500	114	118	107	114	118	117/115/113	120/120	CRH	Pass	
25-May-16	13:00	-	MM	53	Extrusion	550	500	100	101	110	101	107	108/113/112	107/93	CRH	Pass	
25-May-16	13:00	-	KS	56	Extrusion	500	500	97	92	100	95	110	104/99/108	96/108	CRH	Pass	

Notes:

" - " Data not available
T/T Weld was made between the textured side of both panels.
S/S Weld was made between the smooth side of both panels.
S/T or T/S Weld was made between the textured side of one panel and the smooth side of the second panel.
(1) Acceptance of test seams requires shear test results of 90 ppi (1,500 psi) and peel test results of 75 ppi (1,250 psi) for fusion welds and 66 (1,100 psi) for extrusion welds.
(2) Extrusion welds result in a single, continuous seam for peel tests to be performed on (therefore, only one sided peel test required).

Table 3.12

Summary of LLDPE Non Destructive Seam Test Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

			Seam Station		Pressure Testing							
					Pressure (psi)		Time		Pass/Fail (1)(2)			
Seam Number	Test Date	Location	Start	End	Start	End	Start	End	Test	Test Crew ID	QA ID	Comments (3)
808/809	24-May-16	Pilot Trench	0+94	1+63	32	32	2:40	2:45	Pass	SS	CRH	
809/810	24-May-16	Pilot Trench	0+57	T/S	32	31	2:45	2:50	Pass	SS	CRH	
810/811	24-May-16	Pilot Trench	0+23	T/S	32	29	2:50	2:55	Fail	SS	CRH	
810/811	24-May-16	Pilot Trench	0+23	T/S	32	30	3:00	3:05	Pass	SS	CRH	
808/809	24-May-16	Pilot Trench	0+94	0+27	32	31	3:10	3:15	Pass	SS	CRH	
808/809	24-May-16	Pilot Trench	0+27	0+10	32	31	4:00	4:05	Pass	SS	CRH	
808/809	24-May-16	Pilot Trench	0+08	0+00	32	31	4:05	4:10	Pass	SS	CRH	
815/814	24-May-16	Pilot Trench	0+00	0+91	32	32	4:20	4:25	Pass	SS	CRH	
815/808	24-May-16	Pilot Trench	Text	20'	32	31	4:25	4:30	Pass	SS	CRH	
809/812	24-May-16	Pilot Trench	0+00	0+23	32	30	4:55	5:00	Pass	SS	CRH	
813/814	24-May-16	Pilot Trench	Text	18'	32	31	5:05	5:10	Pass	SS	CRH	
809/813	24-May-16	Pilot Trench	0+00	0+28	32	32	5:10	5:15	Pass	SS	CRH	
809/813	24-May-16	Pilot Trench	0+39	0+46	32	31	5:20	5:25	Pass	SS	CRH	
809/813	24-May-16	Pilot Trench	0+50	0+64	32	31	5:29	5:34	Pass	SS	CRH	
812/813	24-May-16	Pilot Trench	Text	8'	32	31	5:35	5:40	Pass	SS	CRH	

Notes:

" - "	Data not available
T/T	Weld was made between the textured side of both panels.
S/S	Weld was made between the smooth side of both panels.
S/T or T/S	Weld was made between the textured side of one panel and the smooth side of the second panel.
(1)	The following are acceptance/rejection criteria for non-destructive seam testing:
(2)	- Per GRI GM6, the maximum pressure drop for 60 mil smooth and textured LLDPE over a 2 minute pressure test is 3.0 psi.
	- Per GRI GM6, the minimum air pressure for the air pressure test is 25 psi and the maximum air pressure is 35 psi for 60 mil smooth and textured LLDPE liner.
	- Per ASTM 5641, a vacuum is applied to a soaped section of seam, if bubbles appear, it indicates unbonded areas that will therfore require repair (i.e. seam failed test). No bubbles indicate an acceptable seam.
	The vacuum box test does not require time or air pressure measurements to be collected.
(3)	Refer to Table 3.21 for seam repair details and Table 3.20 for destructive test details.

Table 3.13

Summary of LLDPE Destructive Seam Test Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Test Sample ID	*Location*	*Seam Number*	*Field Test Date*	*Weld Type* [(1)]	*Peel 1A* [(1)]	*Peel 1B* [(1)]	*Peel 2A* [(1)]	*Peel 2B* [(1)]	*Peel 3A* [(1)]	*Peel 3B* [(1)]	*Peel 4A* [(1)]	*Peel 4B* [(1)]	*Peel 5A* [(1)]	*Peel 5B* [(1)]	*Shear 1A* [(1)]	*Shear 1B* [(1)]	*Shear 2A* [(1)]	*Shear 2B* [(1)]	*Test Pass/Fail* [(3)]	*Laboratory Test Date*
DS 380	Pilot Trench	809-810	5/25/2016	Fusion	104	110	117	117	120	109	111	116	115	113	116	131	115	122	Pass	6/15/2016
DS 381	Pilot Trench	808-Tie-in	5/25/2016	Extrusion	106	-	107	-	97	-	104	-	85	-	122	122	166	166	Pass	6/15/2016
DS 382	Pilot Trench	808-809	5/25/2016	Fusion	114	110	113	99	110	113	99	111	114	110	122	122	123	116	Pass	6/15/2016
DS 383	Pilot Trench	813-Tie-in	5/25/2016	Extrusion	114	-	85	-	97	-	94	-	106	-	117	125	151	123	Pass	6/15/2016
DS 384	Pilot Trench	809-815	5/24/2016	Fusion	111	105	104	105	103	101	107	101	102	107	95	105	104	106	Pass	6/15/2016
DS 385	Pilot Trench	814-815	5/24/2016	Fusion	94	100	105	98	103	104	106	96	96	103	105	102	101	102	Pass	6/15/2016

Notes:

" - " Data not available or not recorded.

(1) Destructive seam quality assurance field test results obtained using field tensiometer (ASTM D4437).

(2) Destructive seam quality assurance test results obtained from TRI/Environmental, Inc. laboratory testing final reports (ASTM D6392).

(3) Acceptance of destructive seam shear test requires a minimum of 90 ppi (1,500 psi) and acceptance of destructive seam peel test requires a minimum of 75 ppi (1,250 psi) for fusion welds and 66 ppi (1,100 psi) for extrusion welds.

Table 3.13

Summary of LLDPE Destructive Seam Test Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Test Sample ID	Location	Seam Number	Field Test Date	Weld Type [2]	Peel 1A [2]	Peel 1B [2]	Peel 2A [2]	Peel 4A [2]	Peel 5A [2]	Peel 1B [2]	Peel 2B [2]	Peel 3B [2]	Peel 4B [2]	Peel 5B [2]	Shear 1 [2]	Shear 2 [2]	Shear 3 [2]	Shear 4 [2]	Shear 5 [2]	Mean Peel A (ppi) [2]	Mean Peel B (ppi) [2]	Mean Shear (ppi) [2]	Test Pass/Fail [3]
DS 380	Pilot Trench	809-810	5/25/2016	Heat Fusion	113	113	108	111	108	122	124	119	118	116	124	120	121	123	122	111	120	122	Pass
DS 381	Pilot Trench	808-Tie-in	5/25/2016	Single Extrusion	112	118	112	119	116	-	-	-	-	-	120	130	123	122	120	115	-	123	Pass
DS 382	Pilot Trench	808-809	5/25/2016	Heat Fusion	115	111	118	118	116	117	117	119	125	120	130	124	117	126	126	116	120	125	Pass
DS 383	Pilot Trench	813-Tie-in	5/25/2016	Single Extrusion	114	114	123	111	121	-	-	-	-	-	119	118	117	120	121	117	-	119	Pass
DS 384	Pilot Trench	809-815	5/24/2016	Heat Fusion	119	119	118	122	114	119	118	118	128	130	123	129	126	132	124	118	123	127	Pass
DS 385	Pilot Trench	814-815	5/24/2016	Heat Fusion	113	112	114	114	110	119	111	117	114	116	119	119	120	116	117	113	115	118	Pass

Notes:

" - " Data not available or not recorded.

(1) Destructive seam quality assurance field test results obtained using field tensiometer (ASTM D4437).

(2) Destructive seam quality assurance test results obtained from TRI/Environmental, Inc. laboratory testing final reports (ASTM D6392).

(3) Acceptance of destructive seam shear test requires a minimum of 90 ppi (1,500 psi) and acceptance of destructive seam peel test requires a minimum of 75 ppi (1,250 psi) for fusion welds and 66 ppi (1,100 psi) for extrusion welds.

Table 3.14

Summary of LLDPE Seam Repairs
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Repair Number	Location	Repair Date	Seam ID	Panel	Location (Station) (1)	Repair Type (2)	Repair-Size Length (in)	Width (in)	Pass/Fail	Comment (3)
R 2006	Pilot Trench	24-May-16	EP399	-	Fireman PIV east of WTP	P	2	27	Fail	
R 2006	Pilot Trench	24-May-16	EP399	-	Fireman PIV east of WTP	P	2	27	Pass	
R 2007	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	3	6	Pass	
R 2008	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	1	3	Pass	
R 2009	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	2	3	Pass	
R 2010	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	1	1	Pass	
R 2011	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	2	2	Pass	
R 2012	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	2	5	Pass	
R 2013	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	1	5	Pass	
R 2014	Pilot Trench	26-May-16	808/Tie-in	-	E edge 808/Tie-in	P	1	2	Pass	
R 2015	Pilot Trench	26-May-16	808/Tie-in	-	NE edge 808/Tie-in	P	3	3	Pass	
R 2016	Pilot Trench	26-May-16	808/Tie-in	-	NE edge 808/Tie-in	P	3	3	Pass	
R 2017	Pilot Trench	26-May-16	808/Tie-in	-	NE edge 808/Tie-in	P	2	3	Pass	
R 2018	Pilot Trench	26-May-16	808/Tie-in	-	NE edge 808/Tie-in	P	3	4	Pass	
R 2019	Pilot Trench	26-May-16	808/Tie-in	-	NW edge of 808/809	P	2	6	Pass	
R 2020	Pilot Trench	26-May-16	808/Tie-in	-	NW edge of 808/810	P	2	3	Pass	
R 2021	Pilot Trench	26-May-16	808/Tie-in	-	NE edge 808/Tie-in	P	1	2	Pass	
R 2022	Pilot Trench	26-May-16	-	809	S end panel 809	P	3	7	Pass	
R 2023	Pilot Trench	26-May-16	809/815	-	S end 809/N end 815	P	2	5	Pass	
R 2024	Pilot Trench	26-May-16	Tie-in/815	-	E centre of 815/W on Tie-in	P	2	3	Pass	
R 2025	Pilot Trench	26-May-16	Tie-in/815	-	E centre of 815 on Tie-in	P	1	1	Pass	
R 2026	Pilot Trench	26-May-16	815/814	-	E central 814/W of 815	P	2	5	Pass	DS 385
R 2027	Pilot Trench	26-May-16	814/Tie-in	-	W central 814/Tie-in	P	3	6	Pass	
R 2028	Pilot Trench	26-May-16	814/Tie-in	-	W central 814/Tie-in	P	1	2	Pass	
R 2029	Pilot Trench	26-May-16	814/Tie-in	-	SW 814	P	1	1	Pass	
R 2030	Pilot Trench	26-May-16	814/813	-	814/813/819	P	1	2	Pass	
R 2031	Pilot Trench	26-May-16	-	813	N of DB-5 outfall	P	1	1	Pass	
R 2032	Pilot Trench	26-May-16	-	813	Around DB-5 outfall	P	10	9	Pass	
R 2033	Pilot Trench	26-May-16	816/Tie-in	-	W on 814/Tie-in	P	3	3	Pass	
R 2034	Pilot Trench	26-May-16	-	813	S of DB-5 outfall	P	1	1	Pass	
R 2035	Pilot Trench	26-May-16	-	813	SW of DB-5 outfall	P	1	1	Pass	
R 2036	Pilot Trench	26-May-16	-	813	NE WW-4	P	2	2	Pass	
R 2037	Pilot Trench	26-May-16	-	813	N side WW-4	P	9	2	Pass	
R 2038	Pilot Trench	26-May-16	813/819	-	NW of WW-4	P	3.5	4	Pass	
R 2039	Pilot Trench	26-May-16	-	813	N of electrical panel	P	3	1	Pass	
R 2040	Pilot Trench	26-May-16	-	813	N of electrical panel	P	3	2	Pass	
R 2041	Pilot Trench	26-May-16	-	813	NW WW-4	P	2	2	Pass	
R 2042	Pilot Trench	26-May-16	-	813	NW ground inspection well	P	2	4	Pass	
R 2043	Pilot Trench	26-May-16	-	813	N elctrical panel post beside 42	P	3.5	2	Pass	
R 2044	Pilot Trench	26-May-16	-	813	Beside (E) of R 2045	P	1.5	1.5	Pass	
R 2045	Pilot Trench	26-May-16	-	813	nduit line to electrical panel (cen	P	2.5	3	Pass	
R 2046	Pilot Trench	26-May-16	-	813	S electrical conduit	P	4	8	Pass	
R 2047	Pilot Trench	26-May-16	-	813	C post electical panel	P	5	3	Pass	
R 2048	Pilot Trench	26-May-16	-	813	W of electrical panel	P	1.5	1.5	Pass	

Table 3.14

Summary of LLDPE Seam Repairs
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Repair Number	*Location*	*Repair Date*	*Seam ID*	*Panel*	*Location (Station)* [(1)]	*Repair Type* [(2)]	*Repair-Size Length (in)*	*Repair-Size Width (in)*	*Pass/Fail*	*Comment* [(3)]
R 2049	Pilot Trench	26-May-16	-	813	N of R 2051	P	2	1.5	Pass	
R 2050	Pilot Trench	26-May-16	-	813	S electrical panel post	P	4	5	Pass	
R 2051	Pilot Trench	26-May-16	-	813	N of R 2054	P	2	2	Pass	
R 2052	Pilot Trench	26-May-16	-	813	Grounding inspection well	P	2.5	2.5	Pass	
R 2053	Pilot Trench	26-May-16	-	813	SW WW-4	P	2	3	Pass	
R 2054	Pilot Trench	26-May-16	813/812	-	S end 812	P	2	2	Pass	
R 2055	Pilot Trench	26-May-16	813/Tie-in	-	N of R 2057	P	1.5	1.5	Pass	
R 2056	Pilot Trench	26-May-16	813/812	-	NE corner of panel 812	P	1	1.5	Pass	
R 2057	Pilot Trench	26-May-16	-	Tie-in	Tie-in, W of R 2058	P	2	2	Pass	
R 2058	Pilot Trench	26-May-16	-	812	Centre	P	2.5	2.5	Pass	
R 2059	Pilot Trench	26-May-16	-	Tie-in	Panel south of R 2057	P	1	1	Pass	
R 2060	Pilot Trench	26-May-16	808/Tie-in	-	NW edge of 808/819	P	1	4	Pass	DS 382
R 2061	Pilot Trench	26-May-16	-	809	Monitoring wel	P	4	7	Pass	
R 2062	Pilot Trench	26-May-16	808/Tie-in	-	W centre of 809/808	P	1	2	Pass	
R 2063	Pilot Trench	26-May-16	808/Tie-in	-	W centre of 809/808	P	4	5	Pass	
R 2064	Pilot Trench	26-May-16	808/Tie-in	-	E centre 809/810	P	2	4	Pass	DS 380
R 2065	Pilot Trench	26-May-16	808/Tie-in	-	W of 810 on Tie-in	P	1	1	Pass	
R 2066	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	1	1	Pass	
R 2067	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808/Tie-in	P	1	5	Pass	DS 381
R 2068	Pilot Trench	26-May-16	808/Tie-in	-	SE end of 808	P	1	1	Pass	
R 2069	Pilot Trench	26-May-16	808/Tie-in	-	NE edge 808/Tie-in	P	1	1	Pass	
R 2070	Pilot Trench	26-May-16	813/Tie-in	-	NW on 813/Tie-in	P	1	6	Pass	DS 383
R 2071	Pilot Trench	26-May-16	808/Tie-in	-	N central 810	P	2	4	Pass	
R 2072	Pilot Trench	26-May-16	-	812	NE corner of panel	P	1.5	2	Pass	

Notes:

" - "	Data not available or not recorded.
"D"	Damaged
"DS #"	Destruct Sample
"P"	Patch Repair
"Ex"	Extrusion Weld
(1)	Destructive seam quality assurance field test results obtained using field tensiometer (ASTM D4437).
(2)	Destructive seam quality assurance test results obtained from TRI/Environmental, Inc. laboratory testing final reports (ASTM D6392).
(3)	Acceptance of destructive seam shear test requires minumum 90 ppi (1,500 psi) and acceptance of destructive seam peel test requires minimum 75 ppi (1,250 psi) for fusion weld and 66 ppi (1,100 psi) for extrusion welds.

Table 4.1

Summary of Air Monitoring Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date	#West Station		*North Station		*East Station		*South Station	
	Work Shift Average	24 hour TWA	Work Shift Average	24 hour TWA	Work Shift Average	24 hour TWA	Work Shift Average	24 hour TWA
10/16/2015	0.007	0.026	NA	NA	NA	NA	0.04	0.037
10/19/2015	0.007	0.025	NA	NA	NA	NA	0.015	0.026
10/20/2015	0.018	0.03	NA	NA	NA	NA	0.025	0.031
10/21/2015	0.023	0.032	NA	NA	NA	NA	0.076	0.052
10/22/2015	0.029	0.035	NA	NA	NA	NA	0.073	0.051
10/23/2015	0.035	0.037	0.029	0.027	NA	NA	0.047	0.04
10/26/2015	0.012	0.028	0.007	0.018	NA	NA	0.008	0.023
10/27/2015	0.016	0.029	0.012	0.02	NA	NA	0.016	0.027
10/28/2015	0.012	0.028	**0.007**	0.018	NA	NA	0.009	0.024
10/29/2015	0.009	0.026	**0.004**	0.017	NA	NA	0.009	0.024
10/30/2015	**0.016**	0.029	0.012	0.021	NA	NA	0.014	0.026
10/31/2015	**0.019**	0.031	0.014	0.021	NA	NA	0.018	0.028
11/2/2015	0.108	0.068	0.029	0.027	NA	NA	0.014	0.026
11/3/2015	0.058	0.047	0.019	0.024	NA	NA	0.017	0.027
11/4/2015	0.079	0.056	0.026	0.026	NA	NA	**0.026**	0.031
11/5/2015	0.031	0.036	**0.024**	0.026	NA	NA	0.035	0.035
11/6/2015	0.011	0.027	**0.008**	0.019	NA	NA	0.011	0.025
11/9/2015	**0.026**	0.033	0.026	0.026	NA	NA	0.024	0.03
11/10/2015	0.036	0.037	**0.027**	0.027	NA	NA	0.04	0.037
11/11/2015	0.041	0.04	**0.067**	0.043	NA	NA	0.051	0.041
11/12/2015	0.019	0.03	**0.013**	0.021	NA	NA	0.022	0.029
11/13/2015	0.008	0.026	**0.006**	0.018	NA	NA	0.015	0.026
11/16/2015	0.033	0.036	**0.022**	0.025	NA	NA	0.025	0.03
11/17/2015	**0.026**	0.034	0.018	0.023	NA	NA	0.025	0.03
11/18/2015	0.021	0.031	**0.007**	0.018	NA	NA	0.008	0.023
11/19/2015	0.008	0.026	0.005	0.018	NA	NA	0.01	0.024
11/20/2015	**0.021**	0.032	0.016	0.022	NA	NA	0.022	0.029
11/23/2015	0.015	0.029	**0.011**	0.02	NA	NA	0.015	0.026
11/24/2015	0.031	0.036	**0.025**	0.026	NA	NA	0.031	0.033
11/25/2015	0.026	0.034	**0.016**	0.022	NA	NA	0.018	0.028
11/30/2015	**0.031**	0.036	0.032	0.029	NA	NA	0.039	0.036
12/1/2015	0.011	0.027	**0.007**	0.019	NA	NA	0.012	0.025
12/2/2015	0.029	0.035	**0.024**	0.025	NA	NA	0.033	0.034
12/3/2015	0.034	0.037	**0.03**	0.028	NA	NA	0.043	0.038
12/4/2015	0.043	0.041	0.035	0.03	NA	NA	0.047	0.04
12/7/2015	0.057	0.046	0.045	0.034	NA	NA	0.064	0.047
12/8/2015	0.043	0.04	**0.036**	0.03	NA	NA	0.043	0.038
12/9/2015	0.03	0.035	0.028	0.027	NA	NA	0.039	0.036
12/10/2015	0.056	0.046	**0.04**	0.032	NA	NA	0.059	0.045
12/11/2015	**0.078**	0.055	0.063	0.042	NA	NA	0.094	0.059
12/14/2015	0.006	0.025	**0.006**	0.018	NA	NA	0.001	0.021
12/15/2015	**0.01**	0.027	0.006	0.018	NA	NA	0.008	0.023

Table 4.1

Summary of Air Monitoring Results
Construction Certification Report
GM GPS Bedford Facility
Bedford, Indiana

Date	#West Station		*North Station		*East Station		*South Station	
	Work Shift Average	24 hour TWA	Work Shift Average	24 hour TWA	Work Shift Average	24 hour TWA	Work Shift Average	24 hour TWA
12/16/2015	**0.027**	0.034	0.021	0.024	NA	NA	0.033	0.034
12/17/2015	0.014	0.028	**0.012**	0.021	NA	NA	0.016	0.027
12/18/2015	0.014	0.029	**0.013**	0.021	NA	NA	0.018	0.028
12/21/2015	0.025	0.033	**0.016**	0.022	NA	NA	0.018	0.028
12/22/2015	0.03	0.035	**0.023**	0.025	NA	NA	0.032	0.034
12/23/2015	0.013	0.028	**0.006**	0.018	NA	NA	0.008	0.023
1/4/2016	0.007	0.025	0.024	0.026	NA	NA	0.008	0.023
1/5/2016	0.014	0.028	0.015	0.022	NA	NA	**0.016**	0.027
1/6/2016	**0.024**	0.033	0.019	0.023	0.014	0.02	0.023	0.03
1/7/2016	**0.029**	0.035	0.023	0.025	0.023	0.024	0.032	0.033
1/8/2016	**0.047**	0.042	0.029	0.027	0.034	0.029	0.045	0.039
1/11/2016	**0.022**	0.032	0.019	0.023	0.022	0.024	0.013	0.025
1/12/2016	0.02	0.031	0.019	0.023	**0.019**	0.023	0.025	0.031
1/13/2016	0.031	0.036	**0.027**	0.027	0.03	0.027	0.036	0.035
1/14/2016	0.03	0.035	**0.022**	0.025	0.021	0.023	0.025	0.031
1/15/2016	**0.019**	0.031	0.013	0.021	0.012	0.02	0.018	0.028
1/18/2016	0.006	0.025	0.009	0.019	**0.006**	0.017	0.01	0.024
1/19/2016	0.013	0.028	0.015	0.022	**0.013**	0.02	0.017	0.027
1/20/2016	0.03	0.035	0.024	0.025	**0.025**	0.025	0.032	0.033
1/21/2016	0.049	0.043	0.037	0.031	0.04	0.031	**0.052**	0.042
1/22/2016	0.05	0.043	0.037	0.031	**0.046**	0.034	0.056	0.043
1/25/2016	0.023	0.032	0.018	0.023	NA	NA	0.024	0.03
Minimum	0.001	0.023	0.004	0.017	0.003	0.016	0.001	0.021
Maximum	0.108	0.068	0.067	0.043	0.07	0.044	0.094	0.059
Average	0.028	0.034	0.021	0.024	0.024	0.025	0.029	0.032

Notes:

Modem connection problem to the network denoted by "NA"
Bold denotes station generally considered to be upwind on day of readings

Appendices

Appendix A
Soil Erosion and Sediment Control Permit

RULE 5 - NOTICE OF INTENT (NOI)

State Form 47487 (R6 / 2-15)
Indiana Department of Environmental Management
Office of Water Quality
Approved by State Board of Accounts, 2005

Type of Submittal *(Check Appropriate Box)*: ☒ Initial ☐ Amendment ☐ Renewal
Permit Number: *(Note: The initial submittal does not require a permit number; the Department will assign a number. A permit number is required when filing an amendment, applying for renewal, or correspondence related to this permit).*

Note: Submission of this Notice of Intent letter constitutes notice that the project site owner is applying for coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit Rule for Storm Water Discharges Associated with Construction Activity. Permitted project site owners are required to comply with all terms and conditions of the General Permit Rule 327 IAC 15-5 (Rule 5).

NAME AND LOCATION OF PROJECT

Name of Project: **Perimeter Groundwater Trench Collection System & Groundwater Treatment Plant**

County: **Lawrence**

Brief Description of Project Location:
The work area is located on General Motors, LLC property, between GM Drive and Bailey Scales Road.

Project Location: *Describe location in Latitude and Longitude (Degrees, Minutes, and Seconds or Decimal representation)* and *by legal description (Section, Township, and Range, Civil Township)*

Latitude: **N35 52' 57"**

Longitude: **W86 28'42"**

Quarter: Section: **12** Township: **5 North** Range: **12** Civil Township: **Shawswick**

Does ☒ all or ☐ part of this project lie within the jurisdictional boundaries of a Municipal Separate Storm Sewer System (MS4) as defined in 327 IAC 15-13?
☒ Yes ☐ No If yes, name the MS4(s):
City of Bedford

SITE OWNER OF PROJECT AND CONTACT INFORMATION OF PROJECT

Name of Company *(If Applicable)*: **General Motors LLC**

Name of Project Site Owner: *(An Individual)*

Title/Position:

Address: **30200 Mound Road**

City: **Warren** State: **MI** ZIP Code: **48093**

Phone: **313-510-428** FAX: **586-947-8068** E-Mail Address: *(If Available)* **cheryl.r.hiatt@gm.com**

Ownership Status *(check one)*:
Governmental Agency: ☐ Federal ☐ State ☐ Local Non-Governmental: ☒ Public ☐ Private ☐ Other: *(Explain)*

Contact Person: **Cheryl Hiatt**

Name of Company: *(If Applicable)* **General Motors LLC**

Affiliation to Project Site Owner: **Project Manager**

Address: *(if different from above)* **(same)**

City: State: ZIP Code:

Phone: FAX: E-Mail Address: *(If Available)*

PROJECT INFORMATION

Project Description:
☐ Residential-Single Family ☐ Residential-Multi-Family ☐ Commercial ☐ Industrial ☒ Other: *(Explain)* **Environmental remediation**

Name of Receiving Water:
Bailey's Branch Creek
(Note: If applicable, name of municipal operator of storm sewer and the ultimate receiving water. If a retention pond is present on the property, the name of the nearest possible receiving water receiving discharge must be provided).

Project Acreage
Total Acreage: **25** Proposed Land Disturbance: *(in acres)* **15.2**
Total Impervious Surface Area: *(in square feet, estimated for completed project)* **1.2**

Project Duration
Estimated Start Date: **August 17, 2015** Estimated End Date for all Land Disturbing Activity: **February 2016**

(Continued on Reverse Side)

CONSTRUCTION PLAN CERTIFICATION

By signing this Notice of Intent letter, I certify the following:

A. The storm water quality measures included in the Construction Plan comply with the requirements of 327 IAC 15-5-6.5, 327 IAC 15-5-7, and 327 IAC 15-5-7.5;
B. the storm water pollution prevention plan complies with all applicable federal, state, and local storm water requirements;
C. the measures required under 327 IAC 15-5-7 and 327 IAC 15-5-7.5 will be implemented in accordance with the storm water pollution prevention plan;
D. if the projected land disturbance is One (1) acre or more, the applicable Soil and Water Conservation District or other entity designated by the Department, has been sent a copy of the Construction Plan for review;
E. storm water quality measures beyond those specified in the storm water pollution prevention plan will be implemented during the life of the permit if necessary to comply with 327 IAC 15-5-7; and
F. implementation of storm water quality measures will be inspected by trained individuals.

In addition to this form, I have enclosed the following required information:

☒ Verification by the reviewing agency of acceptance of the Construction Plan.

☒ Proof of publication in a newspaper of general circulation in the affected area that notified the public that a construction activity is to commence, including all required elements contained in 327 IAC 15-5-5 (9). The Proof of Publication **Must** include company name and address, project name, address/location of the project, and the receiving stream to which storm water will be discharged. Following is a sample Proof of Publication:

"XERT Development Inc. (10 Willow Lane, Indianapolis, Indiana 46206) is submitting a Notice of Intent to the Indiana Department of Environmental Management of our intent to comply with the requirements of 327 IAC 15-5 to discharge storm water from construction activities associated with Water Garden Estates located at 24 Washout Lane, Indianapolis, Indiana 46206. Runoff from the project site will discharge to the White River. Questions or comments regarding this project should be directed to Walter Water of XERT Development Inc."

☒ $100 check or money order payable to the Indiana Department of Environmental Management. A permit fee is required for all NOI submittals (initial and renewal). A fee is not required for amendments.

SITE OWNER OF PROJECT RESPONSIBILITY STATEMENT

By signing this Notice of Intent letter, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information or violating the provisions of 327 IAC 15-5, including the possibility of fine and imprisonment for knowing violations.

Printed Name of Project Owner: GENERAL MOTORS LLC (CHERYL HIATT PROJECT MANAGER)

Signature of Project Owner: Cheryl Hiatt on behalf of General Motors LLC Date *(month, day, year)*: 8/10/2015

This Notice of Intent must be signed by an individual meeting the signatory requirements in 327 IAC 15-4-3(g).
All NOI submittals must include an original signature (FAX and photo copies are not acceptable).

Note: Within 48 hours of the initiation of construction activity, the project site owner must notify the appropriate plan review agency and IDEM, Office of Water Quality of the actual project start date if it varies from the date provided above.

Note: A permit issued under 327 IAC 15-5 is granted by the commissioner for a period of five (5) years from the date coverage commences. Once the five (5) year permit term duration is reached, a general permit issued under this rule will be considered expired, and as necessary for construction activity continuation, a new Notice of Intent letter (Renewal) is required to be submitted ninety (90) days prior to the termination of coverage. The submittal must include the NOI Letter, Proof of Publication, Fee, and verification that the plan for the project was approved (original verification of plan approval is acceptable provided the scope of the project has not changed from the original submittal).

Mail this form to: Indiana Department of Environmental Management
Storm Water Program, IGCN, Room 1255
100 North Senate Avenue
Indianapolis., IN 46204-2251

327 IAC 15-5-6 (a) also requires a copy of the completed Notice of Intent letter be submitted to the local Soil and Water Conservation District or other entity designated by the Department, where the land disturbing activity is to occur.

Questions regarding the development or implementation of the Construction Plan/Storm Water Pollution Prevention Plan should be directed to the local county Soil and Water Conservation District (SWCD). If you are unable to reach the SWCD or have other questions please direct those inquiries to the IDEM Storm Water Permit Coordinator at 317/233-1864 or 800/451-6027 ext.3-1864.
For information and forms visit http://www.in.gov/idem/4896.htm .

Appendix B
Field Data Interim Review - GPR and “Trial” Bedrock Quality Verification Videos (videos provided separately)

DRAFT FOR REVIEW – PRIVILEGED AND CONFIDENTIAL

Memorandum

To:	Cheryl Hiatt (GM), Ed Peterson (GM)	Ref. No.:	013968
From:	Rick Hoekstra/Bill Steinmann/crh/798	Date:	December 17, 2015
CC:	Glenn Turchan (GHD), Jim McGuigan (GHD) Katie Kamm (GHD), Joe Rothfischer (GHD) Paul Gallaway (GHD)		

Re: **Bedrock Trench Field Data Interim Review**
Geophysical Surveys, Inspections, Photographs, and Videos
GM CET Bedford Facility
Bedford, Indiana

This Memorandum is intended to document field observations made prior to and during initial rock trenching activities for the pilot bedrock pilot trench being constructed in the northeast corner of the East Plant Area at the GM Bedford facility. This is an interim memorandum to document that the bedrock pilot trench has been completed to the correct depth and that no identified major vertical fractures were observed to the installed depth, supporting the previous decision to demobilize the rock trenching machine from the Site. Additional information will be presented in the Construction Certification Report.

The initial field activity required by the contractor to facilitate the rock trenching machine for installation of the bedrock pilot trench for groundwater collection involved removal of the overburden materials to the bedrock surface. During this initial construction activity, the top of bedrock was found to be very irregular and often at different elevations than expected, as the design was based on coreholes drilled at 150 to 200-foot intervals along the proposed alignment. As such, field adjustments were required to the proposed working platform elevation upon which the rock trenching equipment would be situated (i.e., rock breaking was performed to remove the undulations and create a more uniform working surface).

The attached Figure 1 (from Drawing C-05 of the pilot trench construction drawings) presents the surveyed top of bedrock after the overburden soils were removed and the adjusted top of working platform after rock breaking to facilitate implementation of the rock trencher. At the north end of the pilot trench, top of bedrock was found to be 2 to 3 feet below original design elevation as the excavation proceeded up the slope north of detention basin 4, with the adjusted top of working platform following the exposed top of rock (i.e., little rock breaking required). However, for the south half of the pilot trench, top of bedrock was found to be as much as 8 feet higher than expected (approximate chainage 6+50), but then flattening out to become 3 to 5 feet lower than the original design elevation at the far south end of the trench (approximate chainage 8+50). To facilitate a more appropriate working platform for the rock trencher, substantial rock breaking was performed to provide a more even surface.

The above discussion of the adjusted working platform depths/elevations is important to understanding the field observations made during the geophysical surveys and video recordings, as the depths to fractures and interpolated top of competent bedrock (strongest reflector) is based on actual (not design) conditions.

Geophysical Survey Results

Ground penetrating radar (GPR) surveys were completed over the pilot trench alignment after the overlying overburden soils were removed but prior to rock excavation itself. The GPR surveys were completed along four segments as the contractor provided appropriate access for the GHD technician. Besides overburden removal, the contractor was required to perform rock breaking at some locations along the trench alignment to remove undulations in the bedrock surface in order to provide a more consistent working platform for the rock trenching subcontractor.

During the initial site visit by the GHD technician, two GPR surveys were performed over a 175-foot section (6+75 to 8+50) at the south end of the pilot trench and a 168-foot section (0+70 to 2+38) at the north end of the trench. No further GPR work could be completed at that time due to a large rock outcropping just north of 6+75 that prevented grounding of the electrodes any further to the south, while the overburden removal had not been completed within detention basin 4 (approximately 2+50 to 3+25). During a subsequent site, two additional GPR surveys were completed over a 228-foot section (2+70 to 4+97.5) in the valley where detention basin 4 had been located toward the south beyond the inflection point (bend in trench alignment) and a 190-foot section (4+87 to 6+75) from the inflection point to the north end of the previous GPR survey completed at the south end of the trench. It should be noted that for the 2+70 to 4+97.5 section, the GPR survey was completed through the overlying aggregate material placed as the working platform for the rock trenching machine, as opposed to directly over the exposed bedrock surface like the other three surveys.

A separate memorandum prepared by the GHD technician is attached to this interim memorandum providing details of how the GPR surveys were performed, how the data was acquired, how it was downloaded and processed, where adjustment were made to correlate with known information (i.e., coreholes), and the conclusions made by the GHD technician. Figure 2 presents the results of the four GPR surveys overlain on the design Drawing C-05 to illustrate the correlation between the strong reflector noted in the GPR survey at the various locations along the pilot trench alignment and the previously delineated top of competent bedrock used for design of the pilot trench. In summary, the location of the strong GPR reflector as provided on the trench profile figures (see attached separate memorandum) indicates that based on the GPR results, an appropriate depth to the base of the trench was achieved.

Trench Photographic/Video Observations

As the trench was being cut through the bedrock, GHD conducted several “trial” videos of the trench walls in order to refine the field process for final confirmatory video recordings to be completed immediately prior to collection system construction. Current construction involved cutting through the bedrock to the prescribed depth, with sampling of the rock cuttings to determine if contamination was present and then placement of the rock cuttings back into the pilot trench until sample results were obtained as well as to ensure safety on the project site (i.e., no open trench for any extended length of time). As the bedrock trenching progressed, oversight personnel performed video recordings on a “trial” basis utilizing several different methodologies for lowering the camera and viewing the trench walls in order to determine the most practical and effective method for conducting the final confirmatory video recordings at a later date (after the rock cuttings were removed from the backfilled trench).

The intent of the future final video recordings would be to fully document all encountered rock stratigraphy and associated visual observations of fractures, rock staining, infiltrating water, and any other evidence of groundwater having travelled through the bedrock in this area at frequent (10 to 20-foot) intervals along the trench alignment. However, GHD has completed a review of the “trial” video recordings performed during rock trenching in order to provide sufficient documentation in support of the decision to demobilize the rock trenching machine from the site. The following bullet points summarize the general conditions observed at the 17 video recording locations illustrated on the attached Figure 3 (as marked up from Drawing C-05 of the pilot trench construction drawings):

Video 1 (0+30)
- several large clay-filled fractures on both sides of trench near ground surface
- two vertical fractures extending to bottom of excavated trench
- rock cut located within sloped portion leading to start of trench at 0+40 (i.e., trench not yet cut to full design depth at this location)

Video 2 (0+50)
- excavation approximately 22 feet in depth below top of bedrock
- horizontal fracture located 2 to 3 feet from bottom of trench
- vertical fracture observed approx. 10 feet up slope (not observed at surface)

Video 3 (0+75)
- excavation approximately 20 feet in depth below top of bedrock
- waterbearing open fracture noted by on-site personnel at approx. 0+60
- vertical fracture observed up slope approx. 10-15 feet, which extends to 16 feet
- significant void observed on east side approx. 4-8 feet down (much less on west side)
- vertical fracture extends down from void, but does not extend to bottom
- no major horizontal fractures observed over entire depth

Video 4 (1+25)
- excavation approximately 20 feet in depth below top of bedrock
- clay-filled vertical fracture connects to horizontal fracture approx. 5 feet from bottom
- similar fracturing noted on east side, fracture splits in three (still ends before bottom)
- diagonal fracture observed looking to the south but no evidence near bottom
- no major horizontal fractures observed over entire depth

Video 5 (2+50)
- excavation only 8 feet deep, as noted on Drawing C-05 (not stated on video)
- horizontal fracture observed approx. 3 feet from bottom
- wet trench walls, but no evidence of visible flow
- some stylolites observed on west wall near bottom

Video 6 (3+90)
- recorded in the approximate location of the future wet well
- excavation approximately 15 feet, as noted on Drawing C-05
- vertical fracture observed when looking to the north
- horizontal fracture located approx. 4-5 feet from bottom
- some water in trench, with visible flow noted on west wall
- second horizontal fracture located approx. 2 feet from bottom, rising to north
- significant vug observed on east wall when looking to the north

Video 7 (4+50)	- excavation up to 20 feet deep, as noted on Drawing C-05 - vertical fracture noted 20 feet to south, does not extend to bottom (but wet to bottom) - horizontal fracture located approx. 1-2 feet from bottom - no fracturing noted when looking south from this location
Video 8 (4+80)	- location of video recording after inflection point (bend in trench) - excavation approx. 20-25 feet deep (based on adjusted working platform) - no noticeable fractures looking to the north - contractor noted much harder rock as excavation moved south of inflection point
Video 9 (4+90)	- excavation approx. 20-25 feet deep (based on adjusted working platform) - waterbearing fracture noted on west wall by on-site personnel at approx. 5+20 - vertical fracture observed to south, connecting to horizontal fracture 5 feet from bottom - vertical fracture does not appear extend to bottom (definitely not on east side)
Video 10 (5+50)	- excavation approx. 25 feet deep (based on adjusted higher working platform) - horizontal fracture observed approx. 5 feet from top of bedrock - possible smaller horizontal fracture approx. 10 feet from top - no vertical fractures observed on either side - horizontal fracture visible near bottom on east wall (but did not see on west wall)
Video 11 (6+25)	- horizontal fracture observed approx. 5 feet from top of bedrock - wet on west wall, but could have originated from ground surface - two more horizontal fractures noted approx. 10-12 feet down - clay-filled void at surface appears to lead to vertical fracture near (but not to) bottom
Video 12 (6+50)	- excavation approx. 25 feet deep (based on adjusted higher working platform) - clay-filled vertical fracture crosses horizontal fracture neat top of trench - extends close to bottom of trench, but appears to pinch out before bottom - orange staining from vertical fracture extends down below fracture to bottom (visible orange staining appears to be iron staining from the ground surface) - same fracture is slightly offset on east side, but not nearly as obvious (less staining) - vertical fracture on east side reduces considerably about halfway down
Video 13 (6+70)	- excavation approx. 25-30 feet deep (no adjustment to working platform) - clay-filled vertical fracture to north, with orange staining, likely from iron leaching - vertical fracture ends at horizontal fracture approximately halfway down - horizontal fracture near bottom of trench when looking south
Video 14 (6+90)	- vertical fracture located approx. 10 feet to south - horizontal fracture approx. 5 feet down (ends at vertical fracture) - staining observed below horizontal fracture, but no vertical fracture visible - horizontal fracture observed about halfway down both trench walls - horizontal fracture noted approx. 3 feet from bottom, wet but no visible water
Video 15 (7+50)	- excavation approx. 30 feet deep (working platform adjusted lower at far south end) - vertical fracture at approx. 7+50 on east side, offset approx. 5 feet south on west side) - two horizontal fractures observed 10-15 feet below top of bedrock (wet)

- vertical fracture ends at lower horizontal fracture, but wet below this depth
- no fractures visible in bottom half of trench in either direction

Video 16 (8+00)
- horizontal fracture located approx. 5 feet below top of bedrock
- another horizontal fracture noted approx. 15 feet down, with what appears to be iron staining below this depth
- clay-filled vertical fracture (with flowing water) extends to bottom (almost pinched out)
- bottom of trench has some backfilled cuttings to create berm to block water (i.e., could not visually confirm if vertical fracture actually went to bottom of trench)
- same vertical fracture on east side (offset 5 feet north), much smaller with no staining (fairly large near surface, but much thinner after horizontal fracture halfway down)
- looking south, smaller vertical fracture, pinching out at horizontal fracture 15 feet down

Video 17 (8+25)
- excavation approx. 30 feet deep (working platform adjusted lower at far south end)
- looking north, small clay-filled vertical fracture (upper 5 feet only), offsets to east
- two horizontal fractures approx. 10 feet below top of bedrock (approx. 1-foot apart)
- another horizontal fracture noted about halfway down (approx. 15 feet deep)
- no fractures visible in bottom half of trench in either direction

In summary, there were many horizontal fractures present along the length of the bedrock pilot trench, but only a few vertical fractures were observed at depth. Only one or two potentially extended to the bottom of the trench, but these appeared to pinch out or there were some rock cuttings present that prevented viewing to the actual bottom of the trench at that location. Based on the observations made above for the 17 videos completed to December 9, 2015 (completion of rock trenching), excavation appears to have been completed to the appropriate depth for installation of the groundwater collection system, recognizing that the bedrock pilot trench cannot collect 100 percent of groundwater but not wanting to extend the trench into any lower waterbearing aquifers in subsequent geologic units where groundwater has been deemed clean based on historical groundwater sampling.

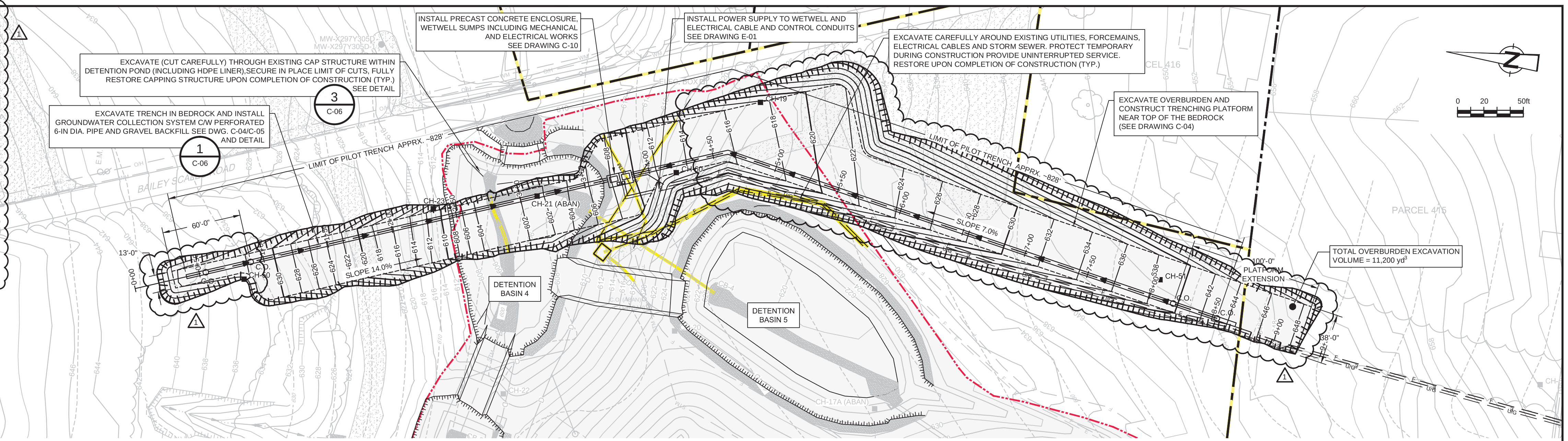
<u>Additional Considerations</u>

In addition to the review of the geophysical surveys and video recordings presented in this interim memo, GHD presents the following additional considerations that further confirm that the rock excavation has been performed to the correct depth for the pilot trench installation and re-confirm the design considerations:

- pilot trench was designed as a prescriptive remedy to exert more control of the potentially impacted groundwater that could migrate off-Site
- elevation of the bottom of the trench will drain the water flowing horizontally to the wet well pumping system for treatment at the new GWTP
- pilot trench bottom elevation was selected to go as deep as any identified major fractures but without encountering the next geologic unit and potential clean aquifer
- pilot trench designed on the balance of probabilities to intercept most of the impacted groundwater

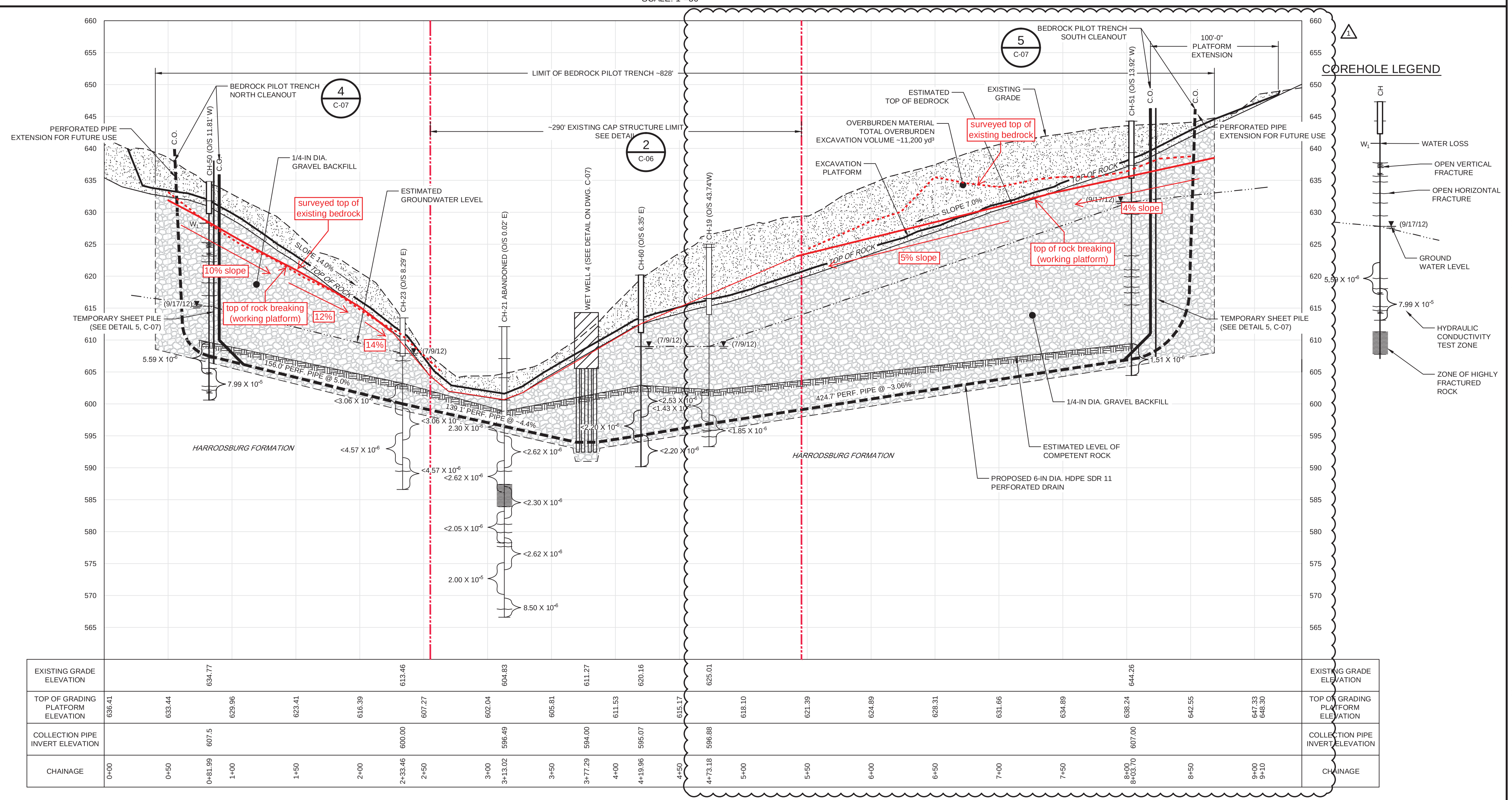
- prescriptive design is based on the collected information from bedrock corehole review, downhole geophysical results, packer-pressure test results, analytical results of groundwater and surface water samples, and evaluation of the groundwater flow systems at the Site
- pilot trench was intended supplement (or replace) the Site Source Control System (which has been operating well over the past 10+ years)
- historical dye tracer testing found that no impacted water from the Site was migrating downstream in the creeks past the Site Source Control System
- pilot trench is the “Cadillac” version of the Site Source Control System (as discussed during the U.S. EPA annual meeting)
- nature of the bedrock is such that the upper bedrock has been demonstrated to be more weathered, while the lower bedrock has lower hydraulic conductivity with less fractures
- infiltration percolates vertically from surface within the karstic rock and migrates horizontally to the creeks (CSM agreed with Dr. Kueper)
- observed fractures were not created by the trenching activities but are naturally occurring
- completion of the final trench construction is designed so that the trenching will not create any new cross-connections to lower aquifers

PROPOSED BEDROCK PILOT TRENCH ALIGNMENT LAYOUT		
STATION	NORTHING	EASTING
0+00	1324792.15	3124937.10
0+50	1324745.19	3124954.27
1+00	1324698.23	3124971.45
1+50	1324651.28	3124988.63
2+00	1324604.32	3125005.80
2+50	1324557.37	3125022.98
3+00	1324510.41	3125040.16
3+50	1324463.45	3125057.34
4+00	1324416.49	3125074.51
4+50	1324369.53	3125091.67
5+00	1324321.03	3125087.91
5+50	1324272.05	3125077.83
6+00	1324223.08	3125067.74
6+50	1324174.11	3125057.65
7+00	1324125.14	3125047.57
7+50	1324076.17	3125037.48
8+00	1324027.19	3125027.39
8+50	1323978.22	3125017.30
9+00	1323929.25	3125007.21
9+37	1323893.01	3124999.74



PLAN

SCALE: 1"=50'



PROFILE

HORZ: 1"=50'

VERT: 1"=10'

Revision №	Revision	Date	Initial
1	ADJUSTED TRENCH ALIGNMENT	SEPT 3, 2015	C.R.H.

LEGEND

- EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- EXISTING VEGETATION
- EXISTING FENCE LINE
- EXISTING DIRT ROADS
- EXISTING ROADS / PAVED AREAS
- EXISTING ELECTRICAL POWER LINE
- EXISTING FORCEMAIN TO TREATMENT FACILITY
- EXISTING OVERHEAD ELECTRICAL POWER LINE
- EXISTING WATERMAIN
- EXISTING OVERHEAD WIRES
- EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING UNDERGROUND TELEPHONE LINE
- APPROXIMATE SURFACE WATER LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE GM PROPERTY BOUNDARY
- EXISTING STORM SEWER
- EXISTING GUARD RAIL
- EXISTING GRAVITY DRAIN (HDPE SOLID WALL PIPE)
- EXISTING TOP OF BEDROCK CONTOUR
- LOW FLOW CHANNEL
- EXISTING SSC EXTRACTION TRENCH
- EXISTING MONITORING WELL TO/IN ROCK
- EXISTING BOREHOLE
- EXISTING CLEANOUT
- EXISTING MANHOLE
- EXISTING CATCHBASIN
- EXISTING POWER POLE
- EXISTING LIMIT OF CAPPING
- EXISTING RIPRAP EROSION PROTECTION
- EXISTING GRAVEL ROAD AREA
- UTILITIES TO BE TEMPORARILY RELOCATED
- PROPOSED PLATFORM CONTOUR
- PROPOSED EXCAVATION TRENCH PLATFORM TOP OF BANK
- PROPOSED EXCAVATION TRENCH PLATFORM BOTTOM OF BANK
- PROPOSED LIMIT OF EARTHWORK
- PROPOSED POWER SUPPLY
- PROPOSED CONTROL CONDUIT
- PROPOSED 6" Ø HDPE FORCEMAIN
- PROPOSED BEDROCK PILOT TRENCH
- PROPOSED TEMPORARY CLEANOUT

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
ISSUED FOR CONSTRUCTION	JUL 20, 2015	C.R.H.
ISSUED FOR BID	MAY 11, 2015	C.R.H.
ISSUED FOR DRAFT BID DOCUMENT REVIEW	APR. 24, 2015	C.R.H.
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RE-ISSUED FOR CLIENT REVIEW	NOV. 12, 2014	C.R.H.
RE-ISSUED FOR CLIENT REVIEW	SEPT. 26, 2014	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - BEDROCK PILOT TRENCH

GROUNDWATER COLLECTION SYSTEM
PLAN AND PROFILE

CONESTOGA-ROVERS & ASSOCIATES

Source Reference: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: J.M.	Reviewed By: C.R.H.	Date: JULY 2015	
Scale: AS SHOWN	Project №: 13968-00	Report №: 365	Drawing №: C-05

13968-00(365)CI-WA006 SEP 3/2015

Figure 1

Actual Surveyed Bedrock Information Prior to Trenching

PROPOSED BEDROCK PILOT TRENCH ALIGNMENT LAYOUT

STATION	NORTHING	EASTING
0+00	1324792.15	3124937.10
0+50	1324745.19	3124954.27
1+00	1324698.23	3124971.45
1+50	1324651.28	3124988.63
2+00	1324604.32	3125005.80
2+50	1324557.37	3125022.98
3+00	1324510.41	3125040.16
3+50	1324463.45	3125057.34
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4+50	1324369.53	3125091.67
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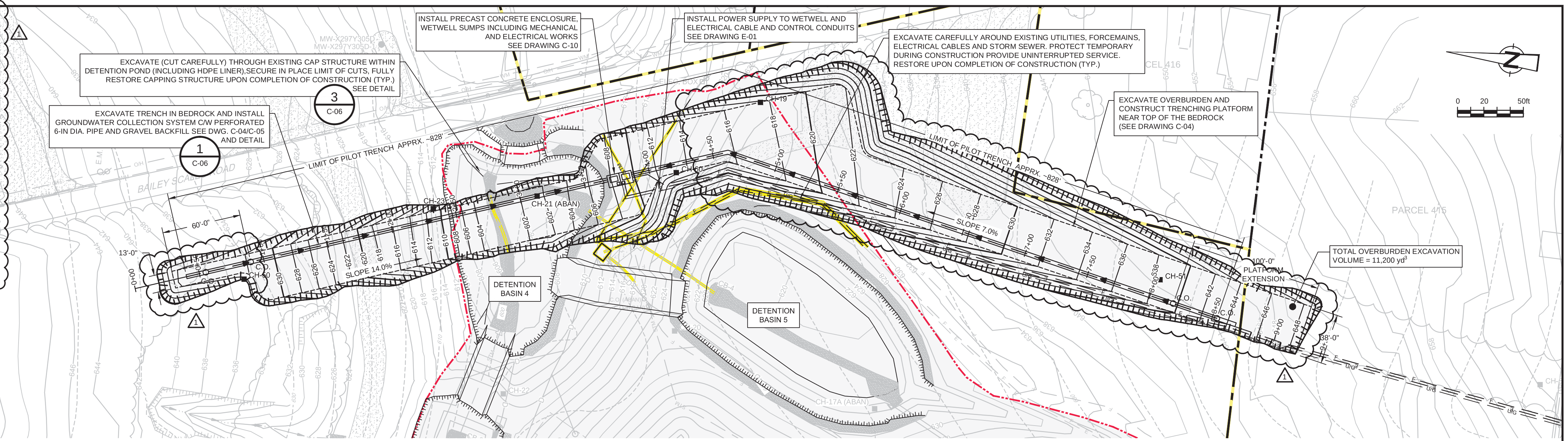
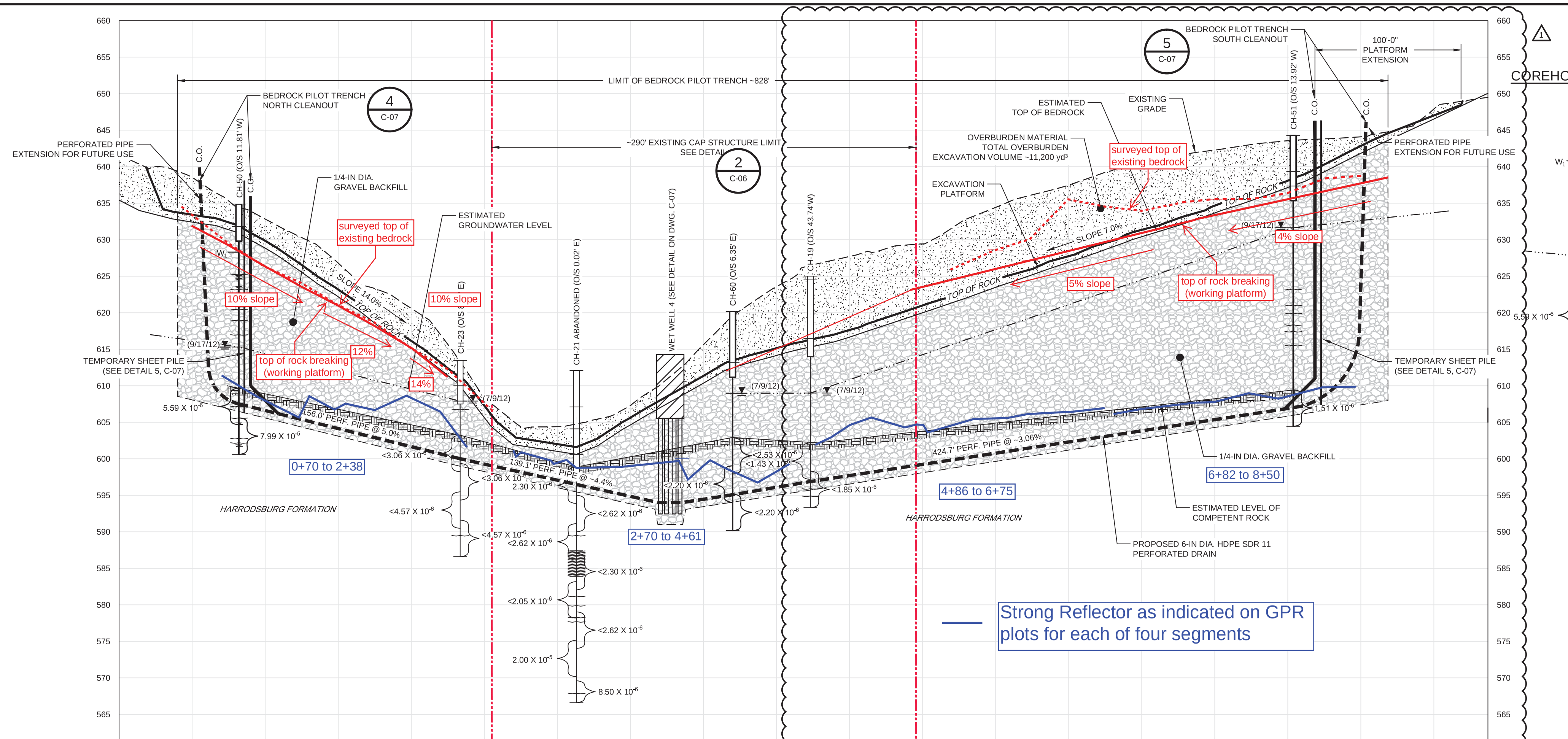
5+50	1324272.05	3125077.83
6+00	1324223.08	3125067.74
6+50	1324174.11	3125057.65
7+00	1324125.14	3125047.57
7+50	1324076.17	3125037.48
8+00	1324027.19	3125027.39
8+50	1323978.22	3125017.30
9+00	1323929.25	3125007.21
9+37	1323893.01	3124999.74



PLAN
SCALE: 1"=50'



EXISTING GRADE ELEVATION	TOP OF GRADING PLATFORM ELEVATION	COLLECTION PIPE INVERT ELEVATION	CHAINAGE
	636.41		0+00
	633.44		0+50
634.77		607.5	0+81.99
	629.96		1+00
	623.41		1+50
	616.39		2+00
613.46		600.00	2+33.46
	607.27		2+50
	602.04		3+00
604.83		596.49	3+13.02
	605.81		3+50
611.27		594.00	3+77.29
	611.53		4+00
620.16		595.07	4+19.96
	615.17		4+50
625.01		596.88	4+73.18
	618.10		5+00
	621.39		5+50
	624.89		6+00
	628.31		6+50
	631.66		7+00
	634.89		7+50
644.26	638.24	607.00	8+00 / 8+03.70
	642.55		8+50
	647.33 / 648.30		9+00 / 9+10

DISTANCE (feet)

PROFILE
HORZ: 1"=50'
VERT: 1"=10'

COREHOLE LEGEND

- WATER LOSS
- OPEN VERTICAL FRACTURE
- OPEN HORIZONTAL FRACTURE
- GROUND WATER LEVEL
- HYDRAULIC CONDUCTIVITY TEST ZONE
- ZONE OF HIGHLY FRACTURED ROCK

Nº	Revision	Date	Initial
1	ADJUSTED TRENCH ALIGNMENT	SEPT 3, 2015	C.R.H.

LEGEND

- EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- EXISTING VEGETATION
- EXISTING FENCE LINE
- EXISTING DIRT ROADS
- EXISTING ROADS / PAVED AREAS
- EXISTING ELECTRICAL POWER LINE
- EXISTING FORCEMAIN TO TREATMENT FACILITY
- EXISTING OVERHEAD ELECTRICAL POWER LINE
- EXISTING WATERMAIN
- EXISTING OVERHEAD WIRES
- EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING UNDERGROUND TELEPHONE LINE
- APPROXIMATE SURFACE WATER LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE GM PROPERTY BOUNDARY
- EXISTING STORM SEWER
- EXISTING GUARD RAIL
- EXISTING GRAVITY DRAIN (HDPE SOLID WALL PIPE)
- EXISTING TOP OF BEDROCK CONTOUR
- LOW FLOW CHANNEL
- C.O. EXISTING SSC EXTRACTION TRENCH
- MW-X233Y120A EXISTING MONITORING WELL TO/IN ROCK
- CH-20 EXISTING BOREHOLE
- C.O. EXISTING CLEANOUT
- MH-2 EXISTING MANHOLE
- CB-3 EXISTING CATCHBASIN
- EXISTING POWER POLE
- EXISTING LIMIT OF CAPPING
- EXISTING RIPRAP EROSION PROTECTION
- EXISTING GRAVEL ROAD AREA
- UTILITIES TO BE TEMPORARILY RELOCATED
- PROPOSED PLATFORM CONTOUR
- PROPOSED EXCAVATION TRENCH PLATFORM TOP OF BANK
- PROPOSED EXCAVATION TRENCH PLATFORM BOTTOM OF BANK
- PROPOSED LIMIT OF EARTHWORK
- E PROPOSED POWER SUPPLY
- U/G PROPOSED CONTROL CONDUIT
- F PROPOSED 6" Ø HDPE FORCEMAIN
- PROPOSED BEDROCK PILOT TRENCH
- C.O. PROPOSED TEMPORARY CLEANOUT

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

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ISSUED FOR CONSTRUCTION	JUL 20, 2015	C.R.H.
ISSUED FOR BID	MAY 11, 2015	C.R.H.
ISSUED FOR DRAFT BID DOCUMENT REVIEW	APR. 24, 2015	C.R.H.
ISSUED FOR EPA REVIEW	DEC. 01, 2014	C.R.H.
RE-ISSUED FOR CLIENT REVIEW	NOV. 25, 2014	C.R.H.
RE-ISSUED FOR CLIENT REVIEW	NOV. 12, 2014	C.R.H.
RE-ISSUED FOR CLIENT REVIEW	SEPT. 26, 2014	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - BEDROCK PILOT TRENCH

GROUNDWATER COLLECTION SYSTEM
PLAN AND PROFILE

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager:	Reviewed By:	Date:	
J.M.	C.R.H.	JULY 2015	
Scale:	Project Nº:	Report Nº:	Drawing Nº:
AS SHOWN	13968-00	365	C-05

13968-00(365)CI-WA006 SEP 3/2015

Figure 2

Strong Reflector of GPR Survey Overlain on Competent Bedrock

PROPOSED BEDROCK PILOT TRENCH ALIGNMENT LAYOUT		
STATION	NORTHING	EASTING
0+00	1324792.15	3124937.10
0+50	1324745.19	3124954.27
1+00	1324698.23	3124971.45
1+50	1324651.28	3124988.63
2+00	1324604.32	3125005.80
2+50	1324557.37	3125022.98
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6+50	1324174.11	3125057.65
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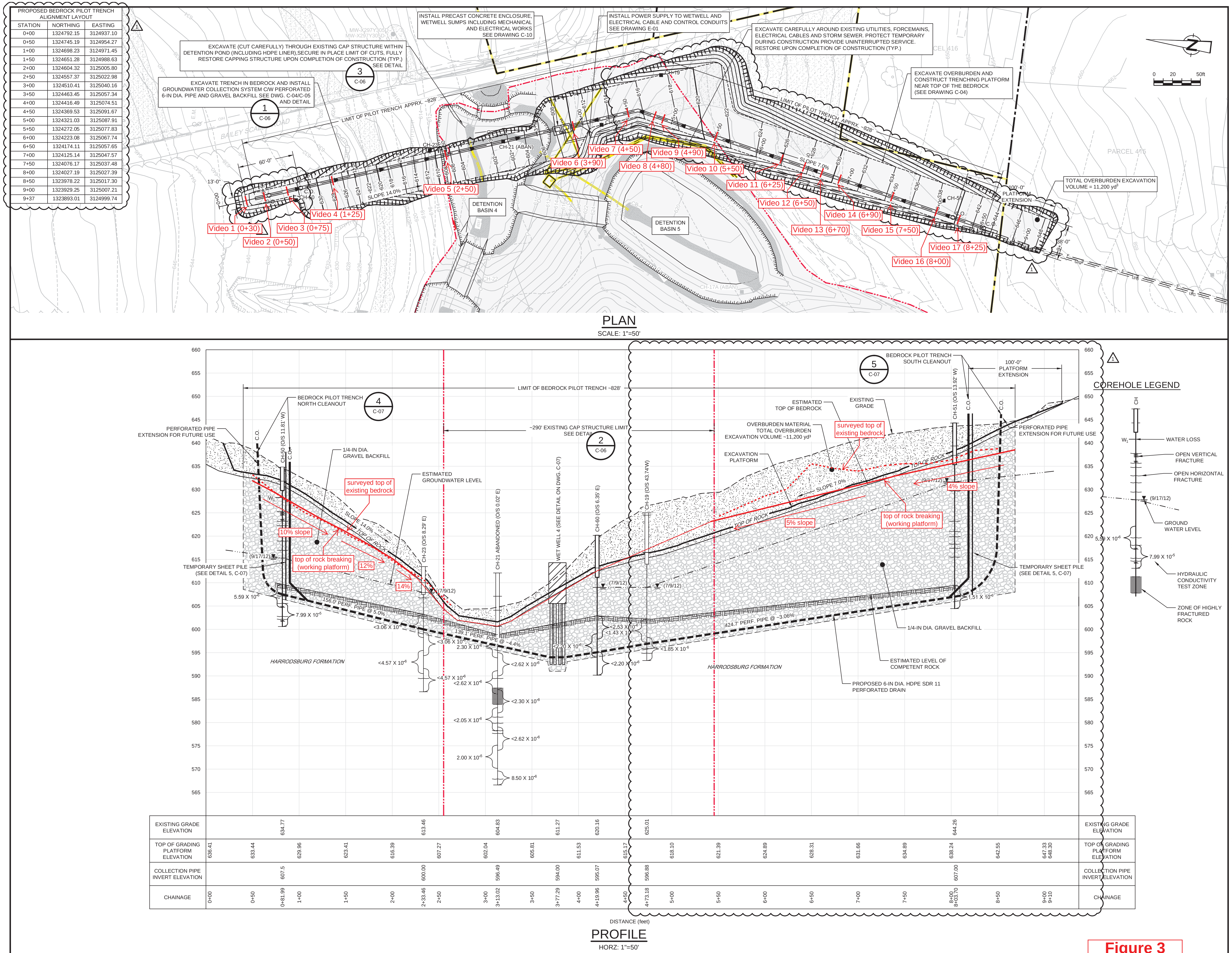
7+50	1324076.17	3125037.48
8+00	1324027.19	3125027.39
8+50	1323978.22	3125017.30
9+00	1323929.25	3125007.21
9+37	1323893.01	3124999.74



EXISTING GRADE ELEVATION			634.77				613.46			604.83		611.27		620.16		625.01							644.26			
TOP OF GRADING PLATFORM ELEVATION	636.41	633.44	629.96	623.41	616.39	607.27		602.04	605.81		611.53		615.17		618.10	621.39	624.89	628.31	631.66	634.89	638.24	642.55	647.33 648.30			
COLLECTION PIPE INVERT ELEVATION			607.5			600.00		596.49		594.00		595.07		596.88						607.00						
CHAINAGE	0+00	0+50	0+81.99	1+00	1+50	2+00	2+33.46	2+50	3+00	3+13.02	3+50	3+77.29	4+00	4+19.96	4+50	4+73.18	5+00	5+50	6+00	6+50	7+00	7+50	8+00 8+03.70	8+50	9+00 9+10	

Nº	Revision	Date	Initial
1	ADJUSTED TRENCH ALIGNMENT	SEPT 3, 2015	C.R.H.

LEGEND

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- EXISTING WATERMAIN
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- APPROXIMATE PROPERTY BOUNDARY
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- EXISTING MONITORING WELL TO/IN ROCK
- EXISTING BOREHOLE
- EXISTING CLEANOUT
- EXISTING MANHOLE
- EXISTING CATCHBASIN
- EXISTING POWER POLE
- EXISTING LIMIT OF CAPPING
- EXISTING RIPRAP EROSION PROTECTION
- EXISTING GRAVEL ROAD AREA
- UTILITIES TO BE TEMPORARILY RELOCATED
- PROPOSED PLATFORM CONTOUR
- PROPOSED EXCAVATION TRENCH PLATFORM TOP OF BANK
- PROPOSED EXCAVATION TRENCH PLATFORM BOTTOM OF BANK
- PROPOSED LIMIT OF EARTHWORK
- PROPOSED POWER SUPPLY
- PROPOSED CONTROL CONDUIT
- PROPOSED 6" Ø HDPE FORCEMAIN
- PROPOSED BEDROCK PILOT TRENCH
- PROPOSED TEMPORARY CLEANOUT

SCALE VERIFICATION

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GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - BEDROCK PILOT TRENCH

GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE

CONESTOGA-ROVERS & ASSOCIATES

Source Reference: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager:	Reviewed By:	Date:	
J.M.	C.R.H.	JULY 2015	
Scale:	Project Nº:	Report Nº:	Drawing Nº:
AS SHOWN	13968-00	365	C-05

13968-00(365)CI-WA006 SEP 3/2015

Figure 3

Location of Video Recordings Completed During Trenching

Memorandum

To:	Glenn Turchan, Jim McGuigan	Ref. No.:	013968-00
From:	Joe Rothfischer	Date:	December 16, 2015
CC:	Rick Hoekstra, Bill Steinmann, Katie Kamm		

Re: Draft GPR Survey Results
Pilot Trench Alignment
GM Powertrain Bedford Facility
Bedford, Indiana

1. Introduction

GHD Limited completed a ground penetrating radar (GPR) geophysical survey on behalf of General Motors (GM) at the Bedford Facility (Site) between October 1 and 4, 2015, and also between October 27 and 30, 2015. The focus of the investigation was the bedrock pilot trench located near the downgradient property boundary, adjacent to Bailey Scales Road. In order to characterize the nature of the bedrock subsurface and assess the degree and extent of fractures and voids, a GPR survey was completed along the bedrock pilot trench alignment prior to excavation with a rock trenching machine. Details of the GPR survey can be described as follows.

2. Geophysical Survey Method

The GPR investigation was completed with a GroundExplorer™ GPR System equipped with an 80 MHz high dynamic range (HDR) antenna. The GPR antennas were mounted to a plastic sled, which was pulled along the survey transects. GPR traces were recorded in a GPR controller, which stacked GPR traces as the sled was being pulled and distance measured with an odometer wheel. Position control was maintained by tying in GPR survey transects to the chainages painted on the bedrock surface along the pilot trench alignment. Prior to commencing the GPR work, a level survey was completed along the bedrock pilot trench alignment to facilitate topographic correction of the GPR transects.

3 GPR Data Processing

Upon return from the Site, the GPR data were downloaded to a computer and compiled for data processing and plotting. Data processing for the GPR trace plots generally consisted of the following: noise (DC) removal, background removal, amplitude correction and band-pass filtering. In addition, topographic corrections were applied to the data based on the initial level survey. Where necessary some trace plots

GHD Limited
651 Colby Drive Waterloo Ontario N2V 1C2 Canada
T 519 884 0510 **F** 519 884 0525 **W** www.ghd.com

were re-processed with slightly modified velocities, in order to correlate with corehole information (where available) regarding the presence of fractures.

4. GPR Survey Results

The GPR data were processed as four trace plots as presented in Figures 1 to 4, from north to south along the chainages provided on each figure. For Figures 1, 3, and 4 the GPR survey was completed on the excavated bedrock surface, while for Figure 2 the GPR survey was completed over the working platform consisting of coarse aggregate material. Based on these plots, it is evident that for each transect, an adequate depth of investigation was achieved with the GPR survey.

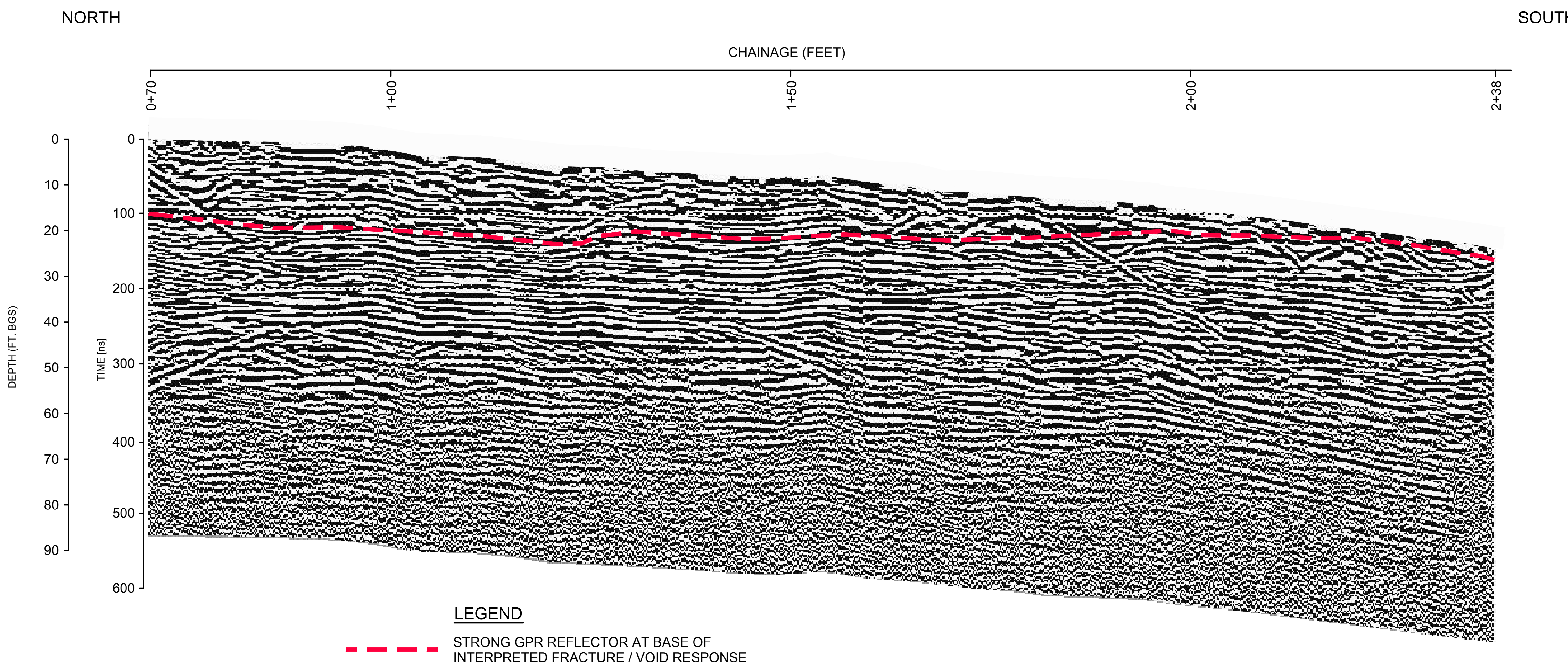
Review of Figures 1 to 4 indicates that a strong GPR reflector was identified at the base of interpreted fracture and void responses along the four transects. The depth to the strong reflector varied along the profiles as follows. At the north end of the trench, the depth to the strong reflector varied from 17 feet (ft) below ground surface (bgs) at station 0+70 to 6 ft bgs at station 2+35, adjacent to corehole CH-23. Figure 2 reveals that based on the GPR results, the thickness of the overlying coarse aggregate platform generally ranged from 3 to 5 ft bgs. The depth to the strong reflector ranged from 2 to 4 feet at the topographic trough along the alignment, and became gradually thicker to the south where a depth of 11 ft bgs was measured at station 4+75. The results presented on Figure 3 reveal that the depth to the strong reflector ranged from approximately 15 ft bgs at station 4+85 to 22 ft bgs at station 6+75, indicating that the interpreted zone of fracturing and voids become slightly thicker as chainage increased to the south. From that point (6+75), the trace plot results on Figure 4 suggest that the strong reflector appears to level out, where the depth to the interpreted reflector was a consistent 24 ft bgs.

The depth to the strong reflector as interpreted from the trace plots was transferred to the pilot trench profile, as discussed in the summary memorandum to which this memo is attached. Review of the location of the strong reflector on the trench profile indicates that based on the GPR results, an appropriate depth to the base of the trench was achieved.

5. Conclusions

Review of the GPR data provided on the trace plots demonstrates that an adequate depth of investigation was achieved along all four transects. A strong GPR reflector was also identified at the base of interpreted fracture and void responses along these transects. Comparison and ground-truthing of the GPR results to historical corehole information where available yielded final adjustment of the trace plots, which consisted of reprocessing of some trace plots with slightly modified velocities in order to account for non-homogeneous properties of the shallow bedrock.

Finally, the location of the strong GPR reflector as provided on the trench profile figure indicates that based on the GPR results, an appropriate depth to the base of the trench was achieved.



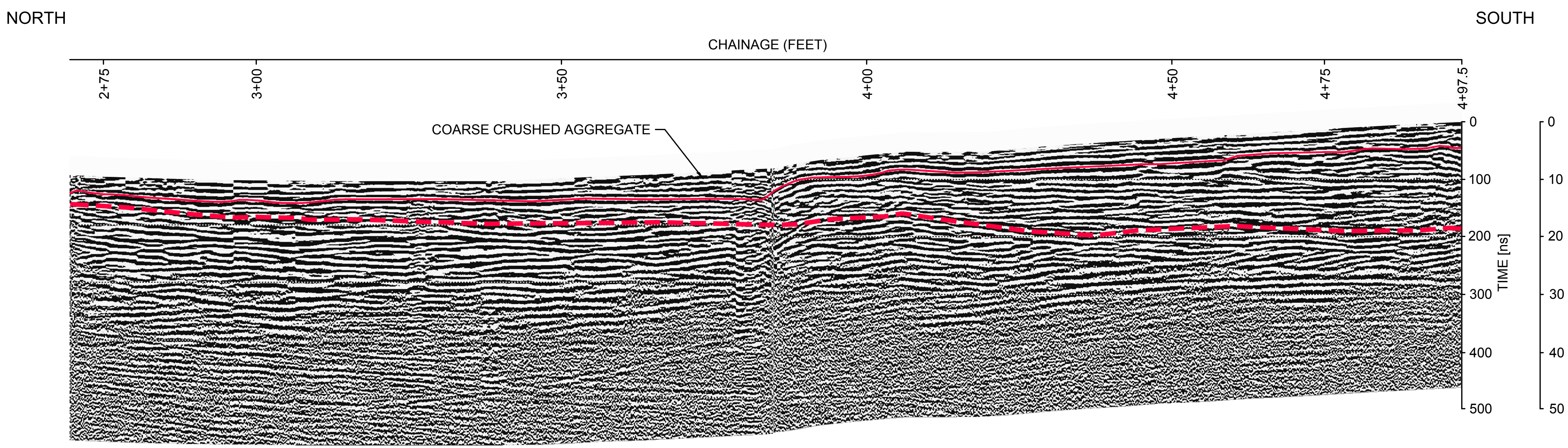
DRAFT

figure 1

GRP SURVEY RESULTS - PILOT TRENCH ALIGNMENT
STATION 0+70 FT. TO STATION 2+38 FT.
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana

GHD

13968-00(PRES258)GN-WA001 DEC 3/2015



LEGEND

GPR REFLECTOR AT INTERPRETED AGGREGATE / BEDROCK CONTACT

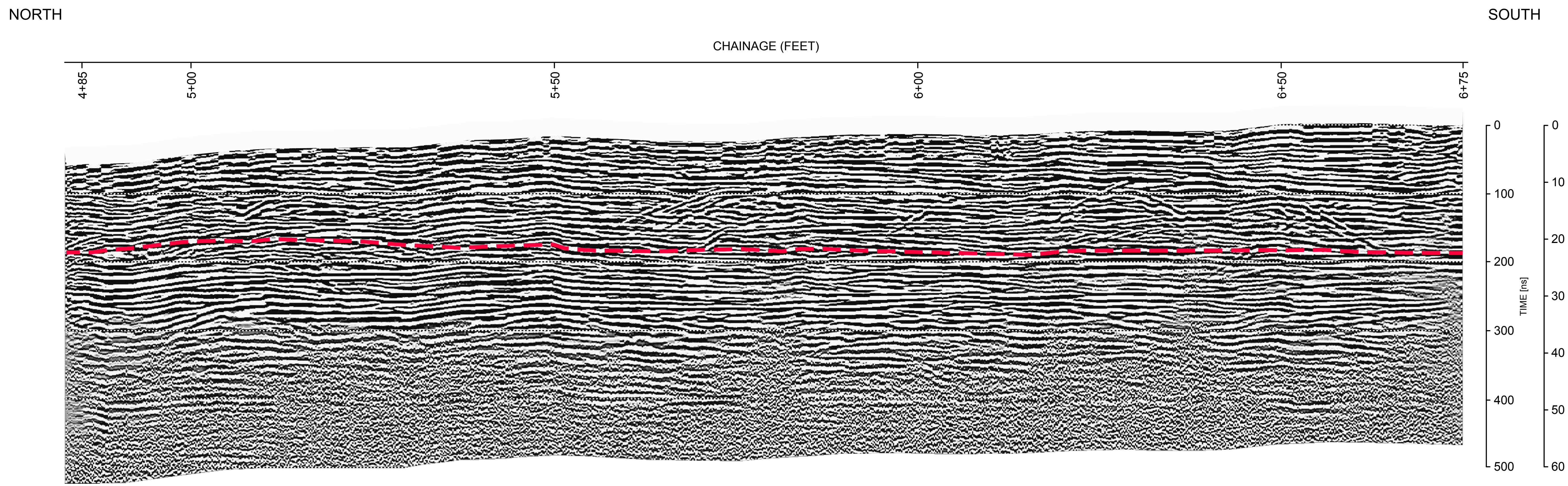
STRONG GPR REFLECTOR AT BASE OF INTERPRETED FRACTURE / VOID RESPONSE

DRAFT

figure 2

GPR SURVEY RESULTS - PILOT TRENCH ALIGNMENT
STATION 2+70 FT. TO STATION 4+97.5 FT.
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana

13968-00(PRES258)GN-WA002 DEC 11/2015



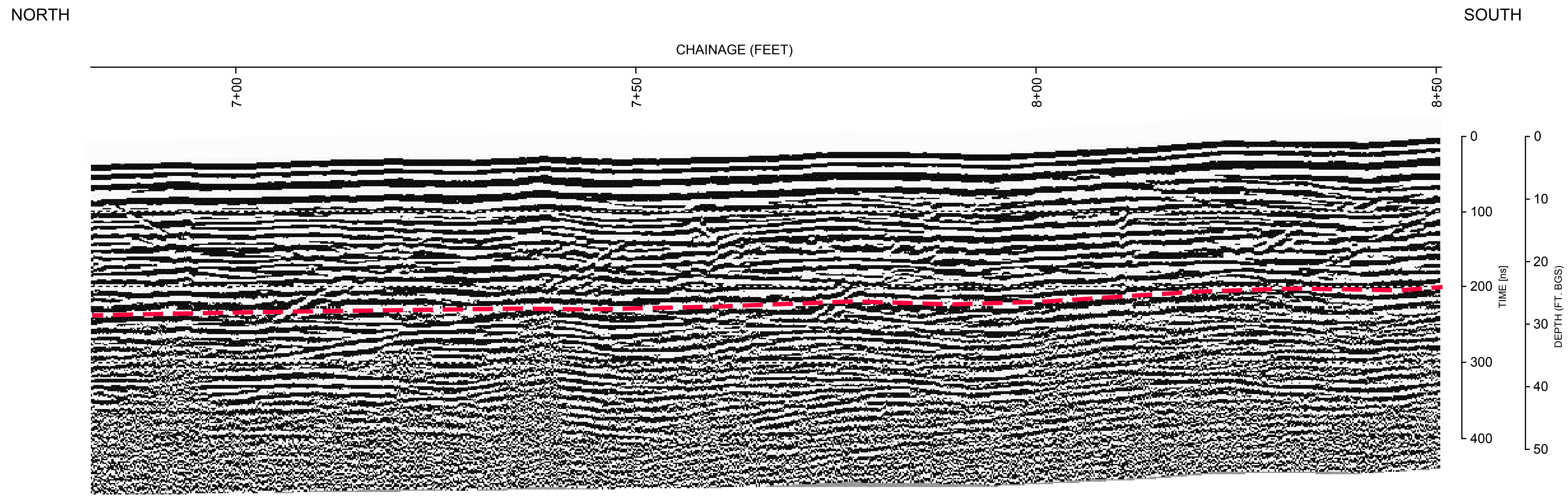
LEGEND

STRONG GPR REFLECTOR AT BASE OF INTERPRETED FRACTURE / VOID RESPONSE

DRAFT

figure 3

GPR SURVEY RESULTS - PILOT TRENCH ALIGNMENT
STATION 4+87 FT. TO STATION 6+75 FT.
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana



LEGEND

STRONG GPR REFLECTOR AT BASE OF INTERPRETED FRACTURE / VOID RESPONSE

DRAFT

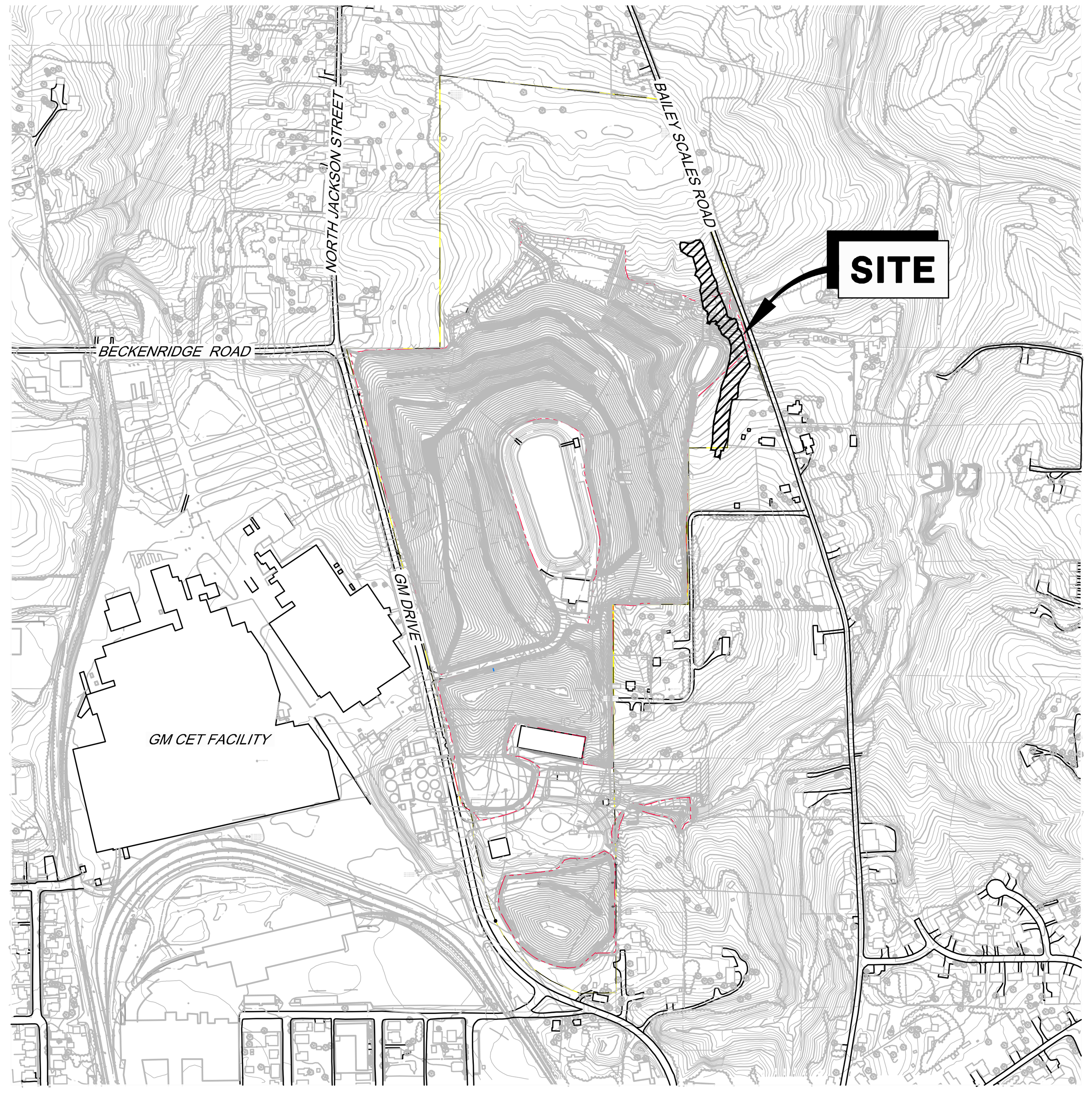
figure 4

GPR SURVEY RESULTS - PILOT TRENCH ALIGNMENT
STATION 6+75 FT. TO STATION 8+50 FT.
GM POWERTRAIN BEDFORD FACILITY
Bedford, Indiana

13968-00(PRES258)GN-WA004 DEC 8/2015

Appendix C
Final Confirmatory Videos
(videos provided separately)

Appendix D
As-Built Drawings



KEY MAP

AS-BUILT DRAWINGS

SEPTEMBER 22, 2017
(REVISED JULY 19, 2019)

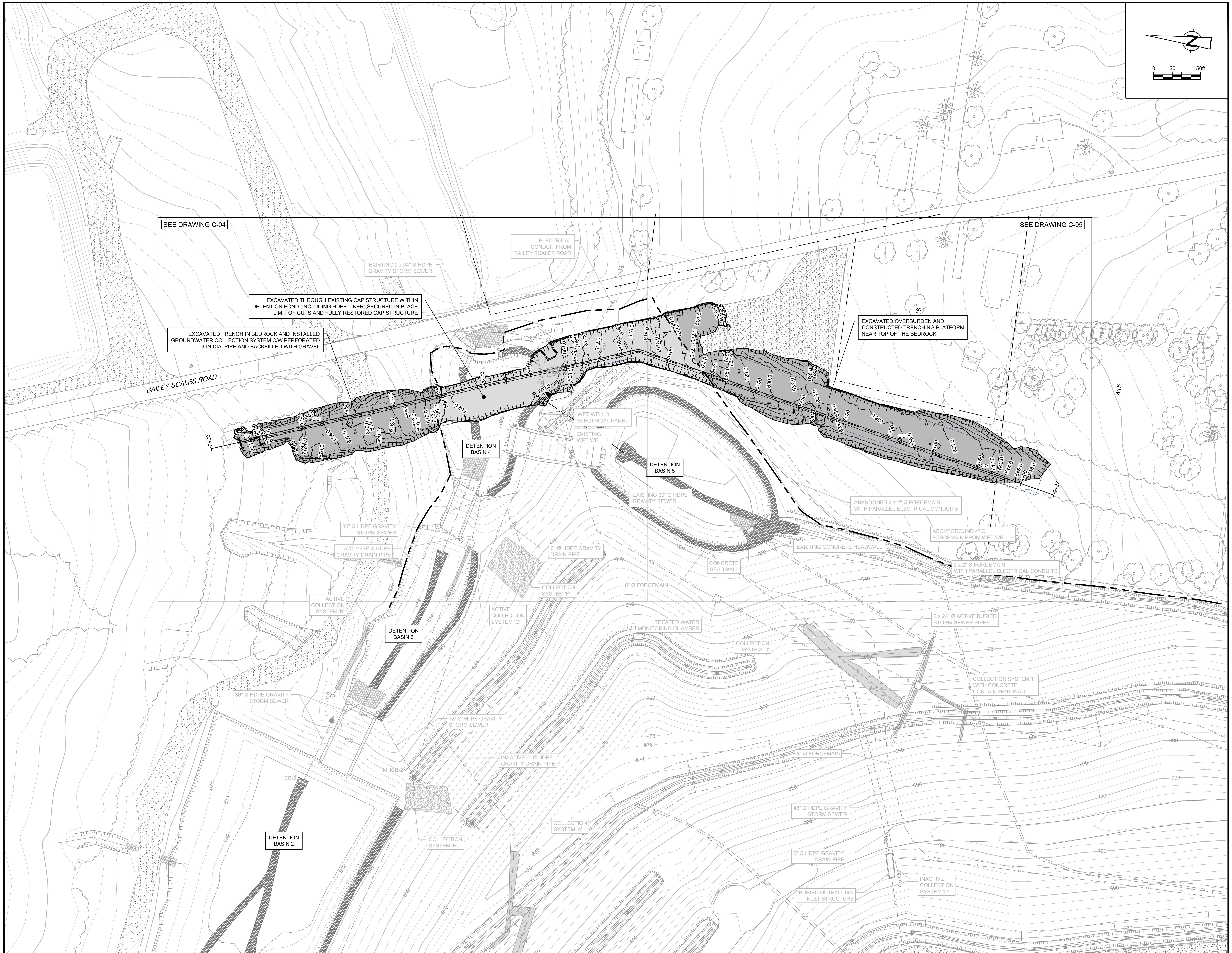
CONSTRUCTION CERTIFICATION REPORT
EAST PLANT AREA
GROUNDWATER COLLECTION SYSTEM
BEDROCK PILOT TRENCH DESIGN

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

DRAWING INDEX

DWG. No.	REV. No	TITLE
C-01	0	BEDROCK PILOT TRENCH - OVERBURDEN EXCAVATION
C-02	0	BEDROCK PILOT TRENCH - PLAN AND PROFILE
C-03	0	BEDROCK PILOT TRENCH - OVERALL RESTORATION PLAN
C-04	0	BEDROCK PILOT TRENCH - NORTH AREA FINAL CONTOURS
C-05	0	BEDROCK PILOT TRENCH - SOUTH AREA FINAL CONTOURS
C-06	0	BEDROCK PILOT TRENCH - NORTH AREA VERTICAL FRACTURES
C-07	0	BEDROCK PILOT TRENCH - SOUTH AREA VERTICAL FRACTURES
C-08	0	BEDROCK PILOT TRENCH - FINAL COVER SYSTEM 60-MIL LLDPE LINER
C-09	0	BEDROCK PILOT TRENCH - DETAILS
C-10	0	WET WELL 4 DETAILS (1 OF 2)
C-11	0	WET WELL 4 DETAILS (2 OF 2)

GHD



Nº	Revision	Date	Initial

LEGEND

- GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- VEGETATION
- FENCE LINE
- DIRT ROADS
- ROADS / PAVED AREAS
- ELECTRICAL POWER LINE
- FORCEMAIN TO TREATMENT FACILITY
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- WATERMAIN
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- E POWER SUPPLY
- U/G CONTROL CONDUIT
- F HDPE FORCEMAIN
- PILOT TRENCH
- C.O. CLEANOUT

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
CORRECTED REFERENCE TO OTHER DRAWINGS	JULY 19, 2019	C.R.H.
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

BEDROCK PILOT TRENCH OVERBURDEN EXCAVATION

GHD

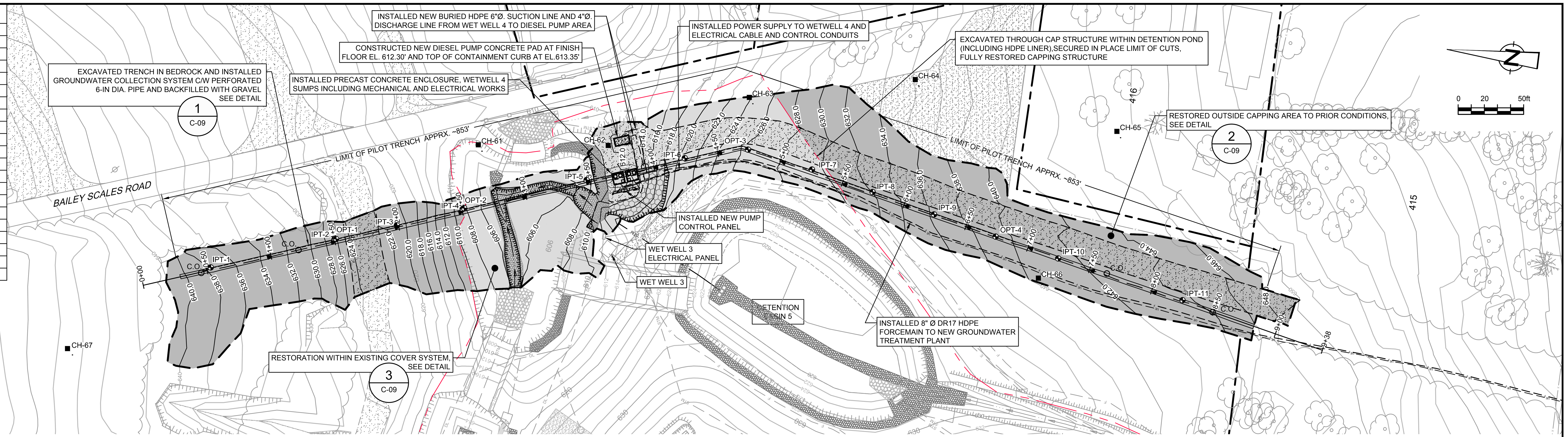
Source Reference:

BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: G.T.	Reviewed By: C.R.H.	Date: SEPTEMBER 2017	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 394	Drawing Nº: C-01

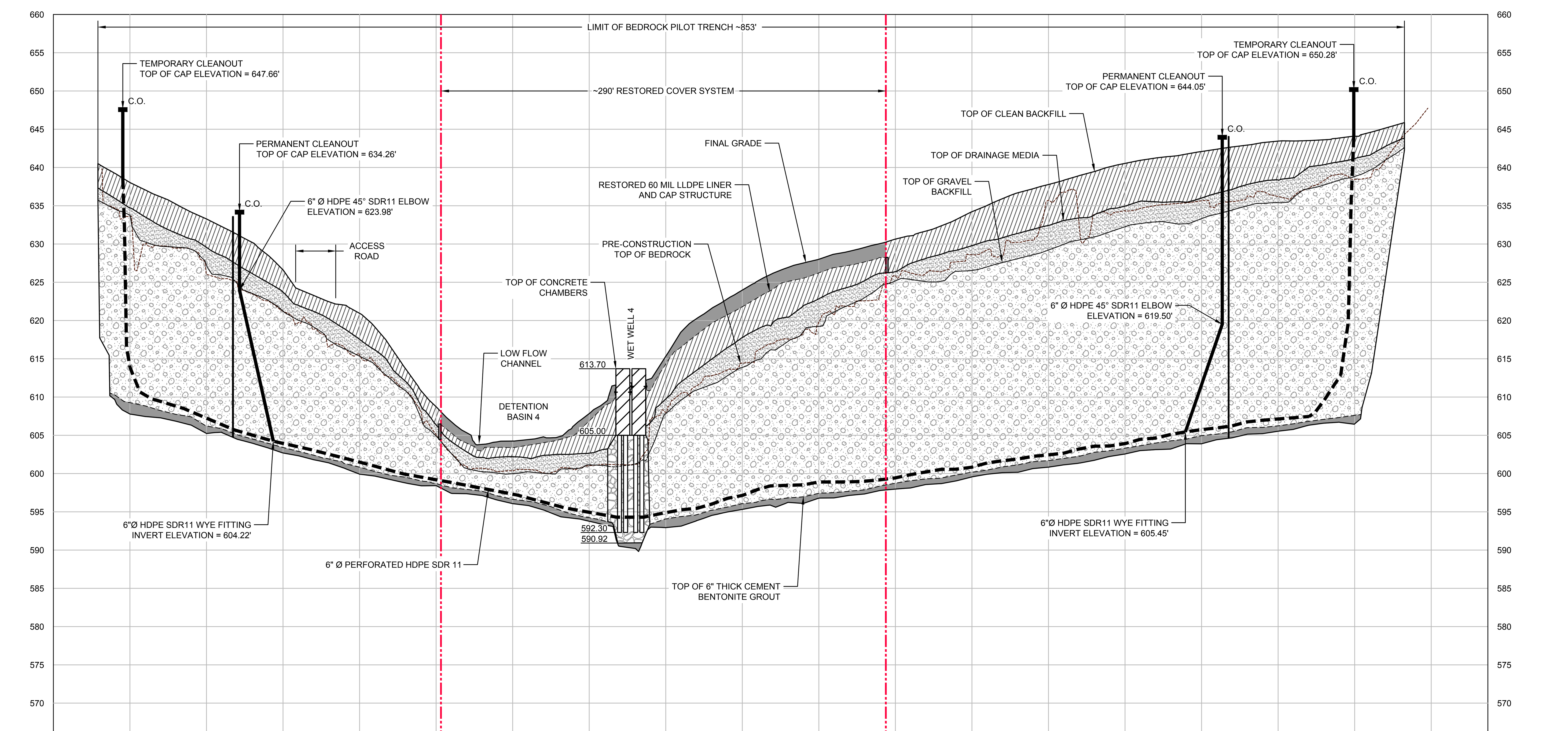
13968-00(394)CI-WA004 JULY 19, 2019

PROPOSED BEDROCK PILOT TRENCH ALIGNMENT LAYOUT		
STATION	NORTHING	EASTING
0+00	1324792.15	3124937.10
0+50	1324745.14	3124954.12
1+00	1324698.17	3124971.27
1+50	1324651.15	3124988.27
2+00	1324604.18	3125005.38
2+50	1324557.31	3125022.79
3+00	1324510.63	3125040.71
3+50	1324463.57	3125057.58
4+00	1324416.36	3125074.04
4+50	1324369.42	3125091.27
5+00	1324321.36	3125090.89
5+50	1324272.41	3125080.72
6+00	1324223.58	3125069.95
6+50	1324174.70	3125059.44
7+00	1324125.79	3125049.06
7+50	1324076.89	3125038.64
8+00	1324027.94	3125028.45
8+50	1323979.01	3125018.17
9+00	1323930.13	3125007.64
9+38	1323892.96	3124999.73



PLAN

SCALE: 1"=50'



	0+00	0+50	1+00	1+50	2+00	2+50	3+00	3+50	3+69.76 3+73.73	3+80.37 3+84.34	4+00	4+50	5+00	5+50	6+00	6+50	7+00	7+50	8+00	8+50	9+00	
FINISHED GRADE ELEVATION		638.03	633.26	626.60	620.94	608.73	604.24	607.83			615.32	623.98	628.01	630.65	634.21	637.78	640.53	642.09	643.44	644.07		FINISHED GRADE ELEVATION
TOP OF GRAVEL BACKFILL ELEVATION		633.75	627.27	621.21	615.33	604.90	599.98	601.13			607.83	613.87	619.24	625.17	626.54	629.21	632.26	633.30	635.39	638.81		TOP OF GRAVEL BACKFILL ELEVATION
COLLECTION PIPE INVERT ELEVATION		613.89	607.24	603.94	601.49	599.18	597.31	594.94	594.30	594.30	594.89	597.14	598.90	599.43	600.84	602.44	603.91	605.74	607.13			COLLECTION PIPE INVERT ELEVATION
TOP OF 6" THICK CEMENT BENTONITE GROUT		609.28	606.22	603.41	600.84	598.72	596.63	594.23			594.06	596.05	597.43	598.73	600.17	601.70	603.31	604.96	606.23	607.60		TOP OF 6" THICK CEMENT BENTONITE GROUT
CHAINAGE	0+00	0+50	1+00	1+50	2+00	2+50	3+00	3+50	3+69.76 3+73.73	3+80.37 3+84.34	4+00	4+50	5+00	5+50	6+00	6+50	7+00	7+50	8+00	8+50	9+00	CHAINAGE

DISTANCE (feet)

PROFILE

HORZ: 1"=50'
VERT: 1"=10'

Nº	Revision	Date	Initial

LEGEND

- GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- VEGETATION
- FENCE LINE
- DIRT ROADS
- ROADS / PAVED AREAS
- ELECTRICAL POWER LINE
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- F HDPE FORCEMAIN
- PILOT TRENCH
- C.O. CLEANOUT
- CH-65 ADDITIONAL COREHOLE MONITORING INSTALLATION SURVEY COMPLETED ON AUGUST 13, 2018

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
ADDED REFERENCE TO DETAIL 2	JULY 19, 2019	C.R.H.
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

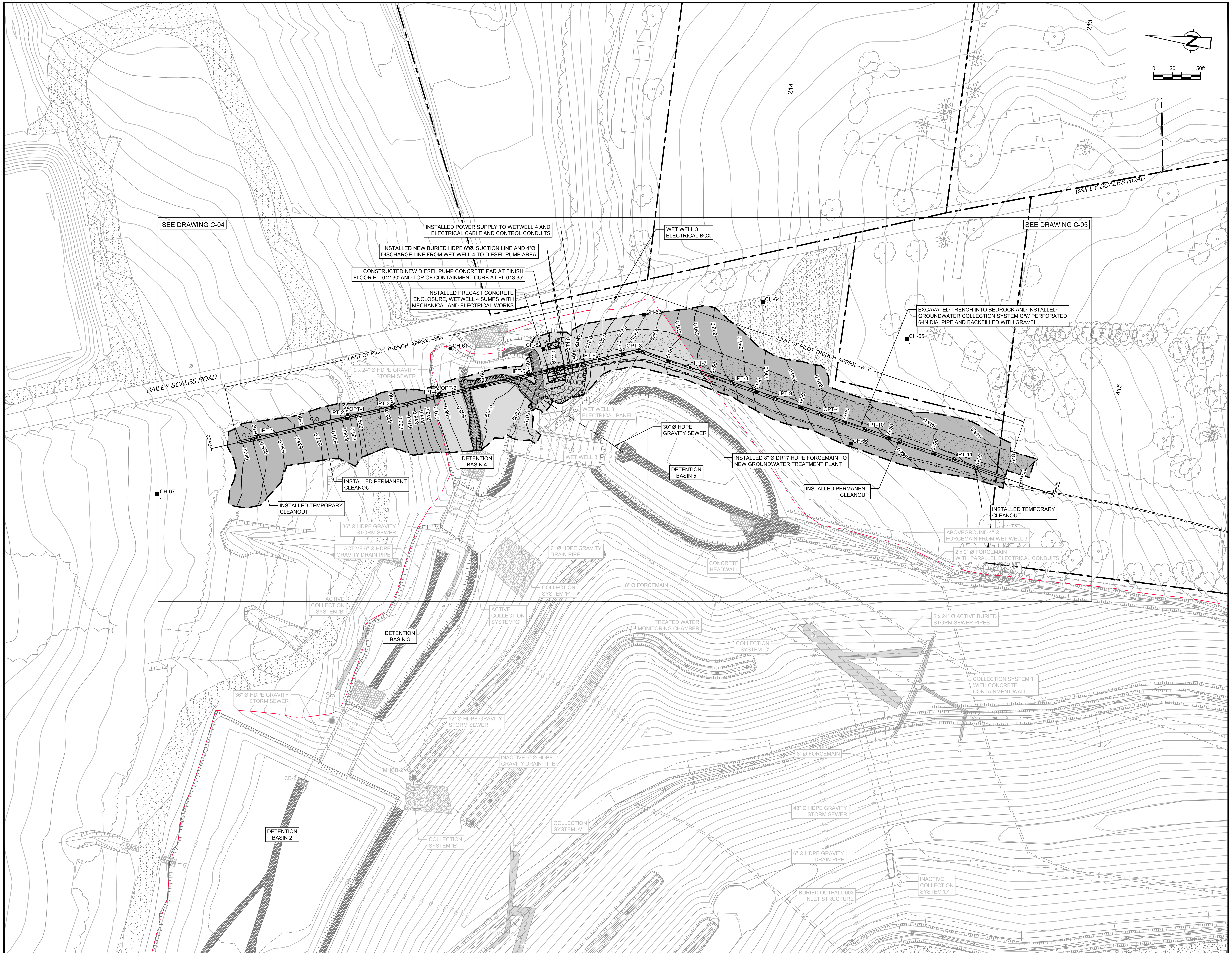
BEDROCK PILOT TRENCH
PLAN AND PROFILE

GHD

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: G.T.	Reviewed By: C.R.H.	Date: SEPTEMBER 2017	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 394	Drawing Nº: C-02

13968-00(394)CI-WA003 NOV 8, 2017



Nº	Revision	Date	Initial

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- PILOT TRENCH
- C.O. CLEANOUT
- IPT-5 PIEZOMETER

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
CORRECTED REFERENCE TO OTHER DRAWINGS	JULY 19, 2019	C.R.H.
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

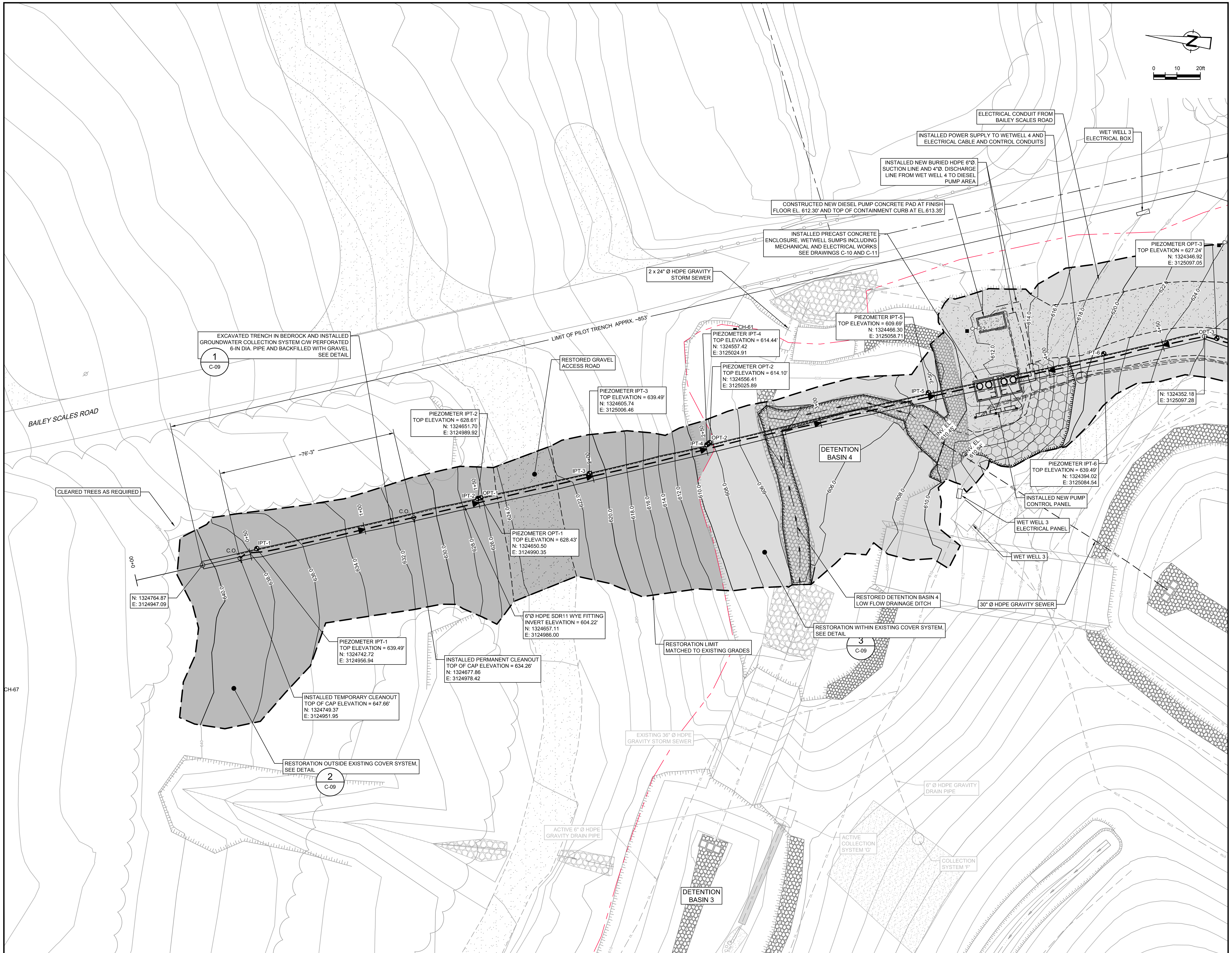
BEDROCK PILOT TRENCH
OVERALL RESTORATION PLAN

GHD

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager:	Reviewed By:	Date:	
G.T.	C.R.H.	SEPTEMBER 2017	
Scale: 1"=50'	Project Nº: 13968-00	Report Nº: 394	Drawing Nº: C-03

13968-00(394)CI-WA001 JUL 31, 2019



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- IPT-5 PIEZOMETER

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

BEDROCK PILOT TRENCH NORTH AREA FINAL CONTOURS

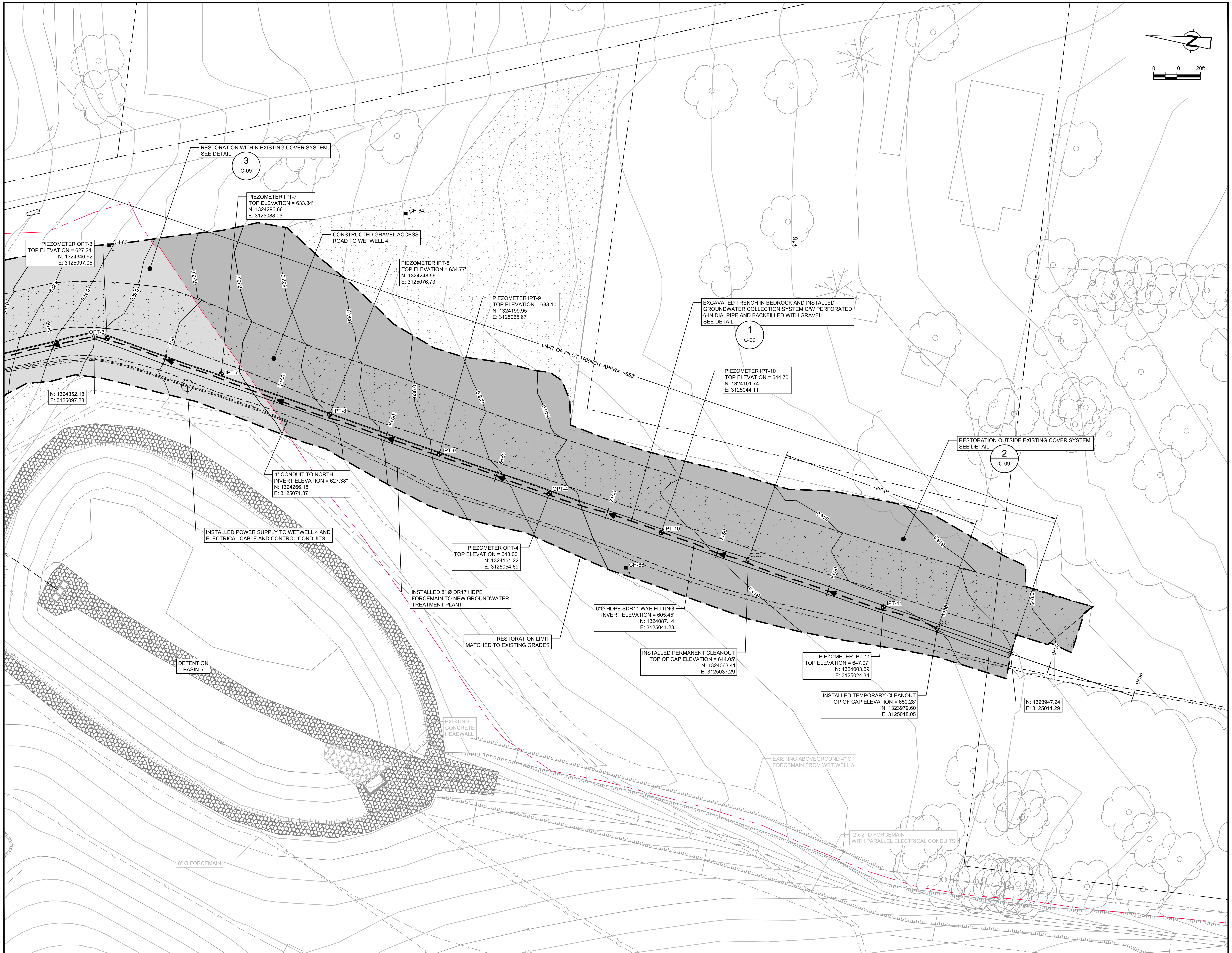
GHD

Source Reference:

BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager:	Reviewed By:	Date:	
G.T.	C.R.H.	SEPTEMBER 2017	
Scale: 1"=20'	Project Nº: 13968-00	Report Nº: 394	Drawing Nº: C-04

13968-00(394)CI-WA002 SEP 22, 2017



№	Revision	Date	Initial

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- PILOT TRENCH
- C.O. CLEANOUT
- IPT-5 PIEZOMETER

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

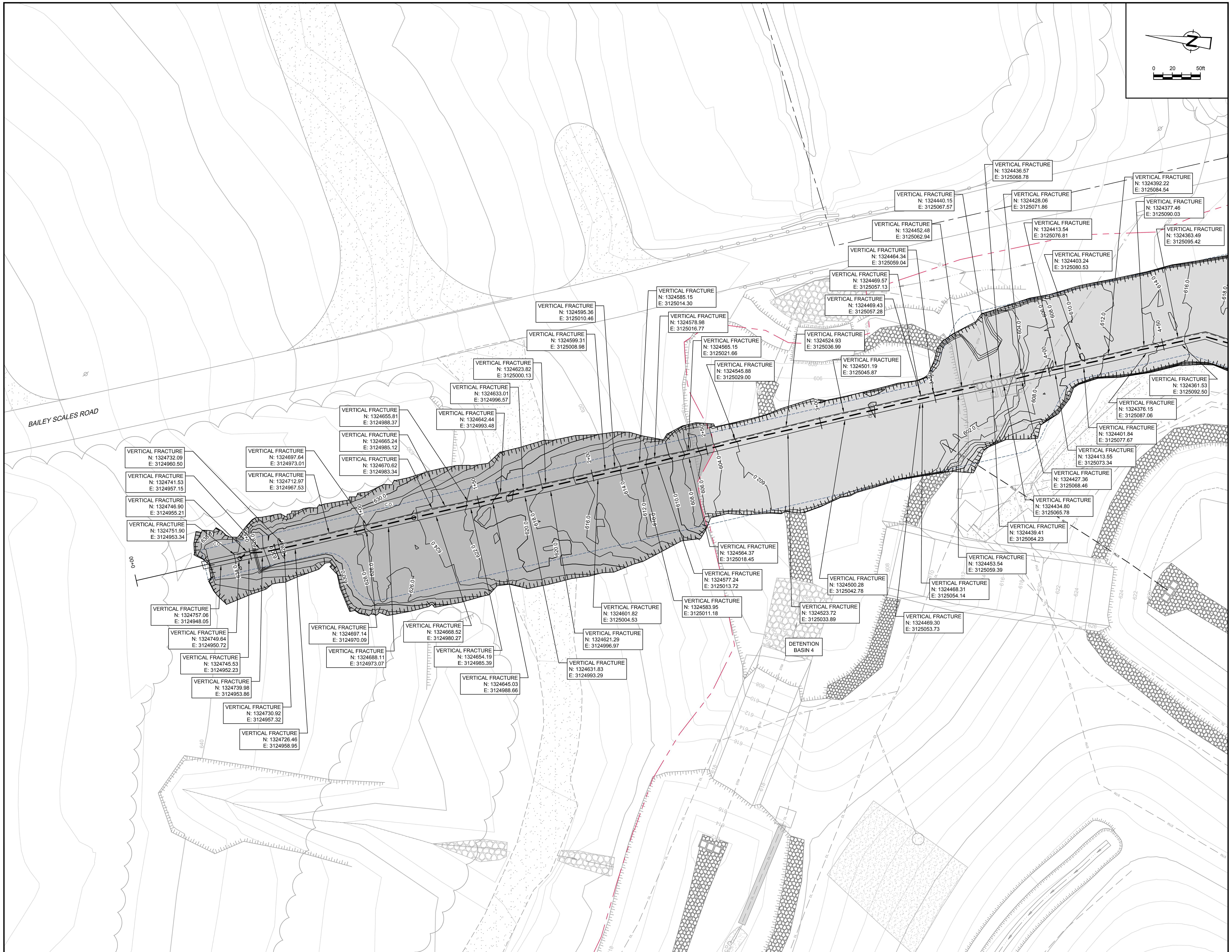
BEDROCK PILOT TRENCH
SOUTH AREA FINAL CONTOURS

GHD

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager:	Reviewed By:	Date:	
G.T.	C.R.H.	SEPTEMBER 2017	
Scale: 1"=20'	Project №: 13968-00	Report №: 394	Drawing №: C-05

13968-00(394)CI-WA002 SEP 22, 2017



Nº	Revision	Date	Initial

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SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

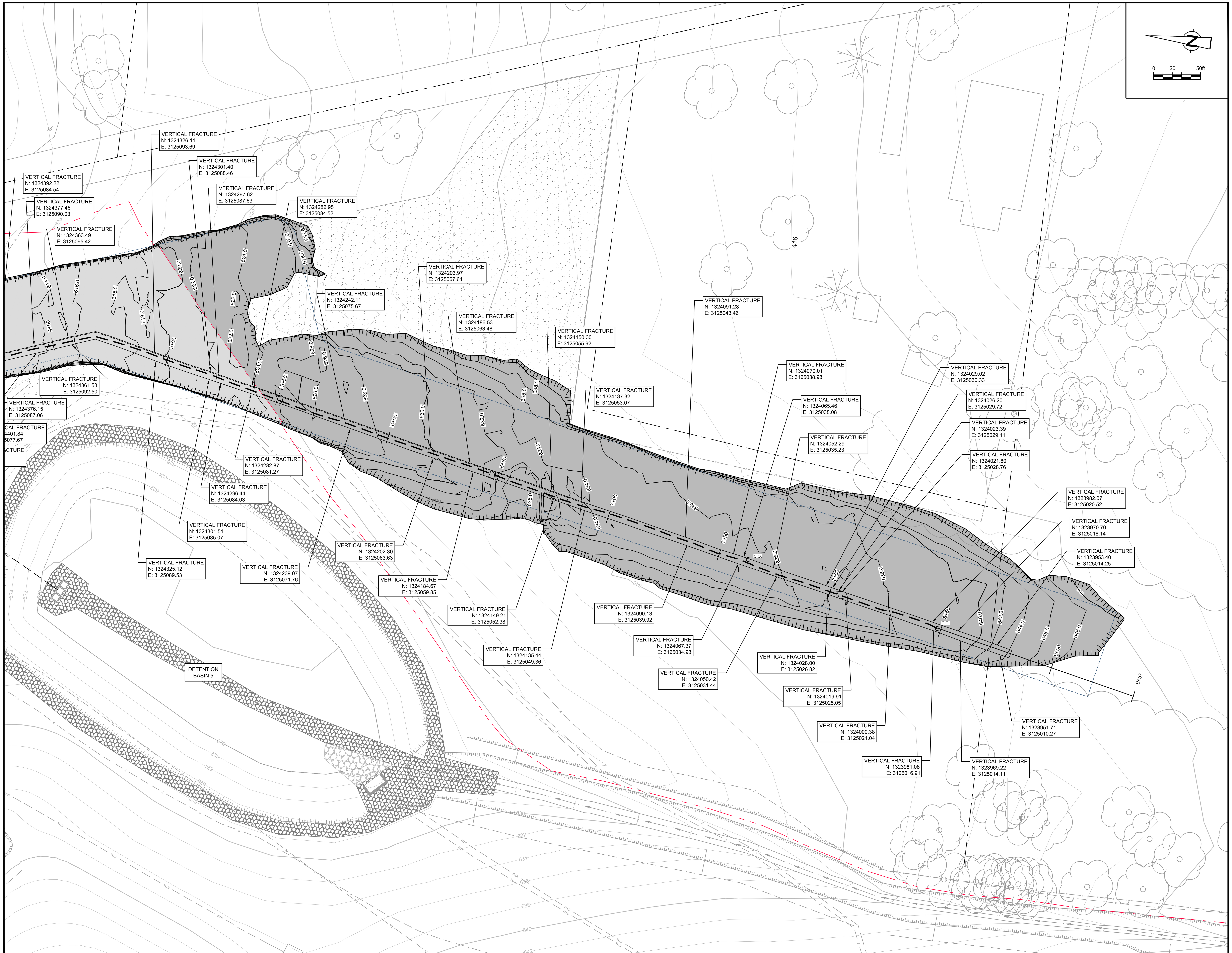
BEDROCK PILOT TRENCH
NORTH AREA VERTICAL FRACTURES

GHD

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: G.T.	Reviewed By: C.R.H.	Date: SEPTEMBER 2017	
Scale: 1" = 20'	Project Nº: 13968-00	Report Nº: 394	Drawing Nº: C-06

13968-00(394)CI-WA011 SEP 22, 2017



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- RIPRAP EROSION PROTECTION
- GRAVEL ROAD AREA
- 645 FINAL CONTOUR
- E POWER SUPPLY
- U/G CONTROL CONDUIT
- F HDPE FORCEMAIN
- PILOT TRENCH
- C.O. CLEANOUT

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

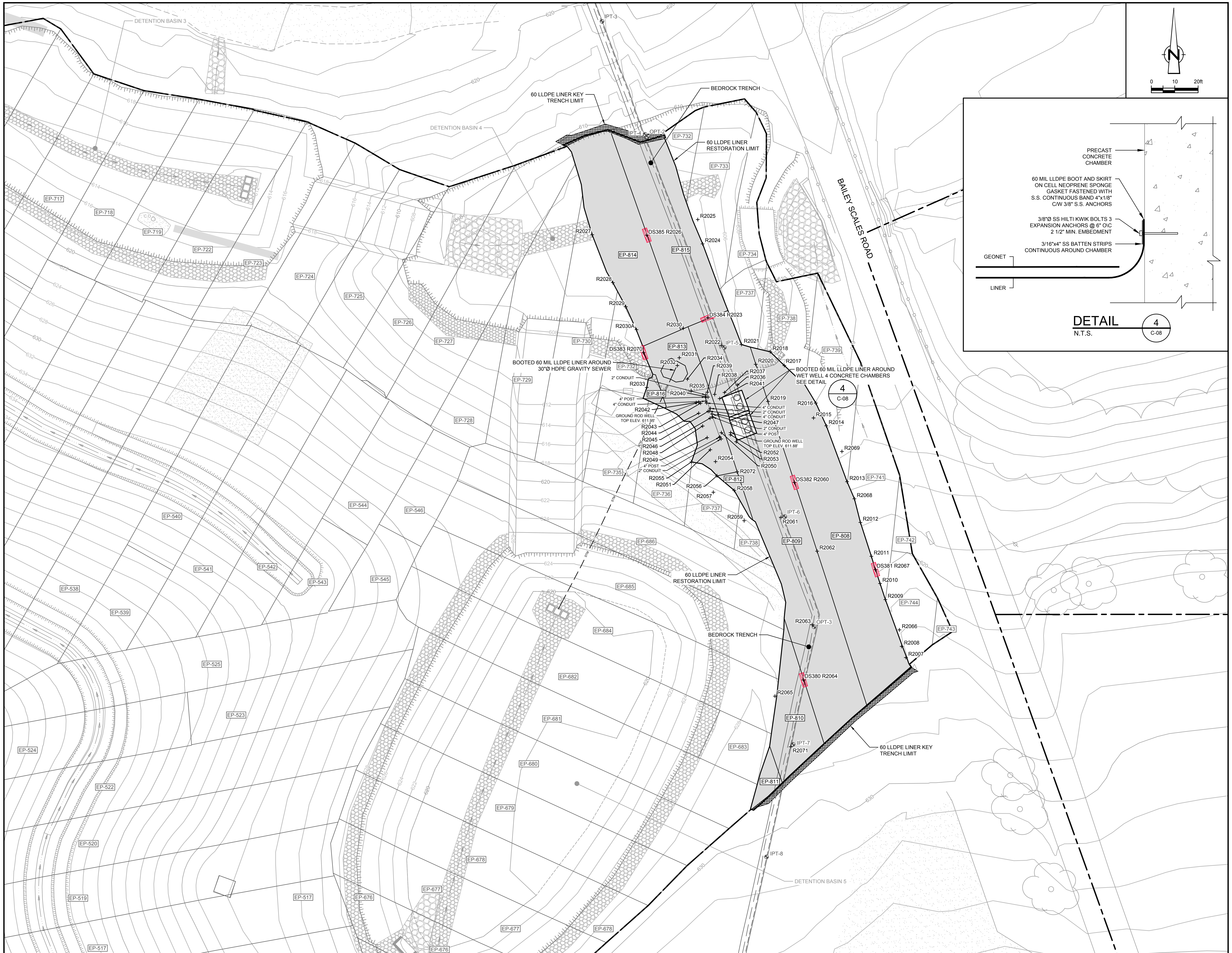
BEDROCK PILOT TRENCH SOUTH AREA VERTICAL FRACTURES

GHD

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: G.T.	Reviewed By: C.R.H.	Date: SEPTEMBER 2017	
Scale: 1" = 20'	Project Nº: 13968-00	Report Nº: 394	Drawing Nº: C-07

13968-00(394)CI-WA011 SEP 22, 2017



DETAIL 4
N.T.S. C-08

0 10 20ft

Nº	Revision	Date	Initial

LEGEND

- LINER PANEL LIMIT
- DS385 R2026 — 60 MIL TEXTURED LLDPE LINER PANEL DESTRUCTIVE / REPAIR SEAM TEST LOCATION
- + R2024 — 60 MIL TEXTURED LLDPE LINER PANEL REPAIR LOCATION
- WP-814 — 60 MIL TEXTURED LLDPE LINER PANEL IDENTIFICATION ID
- 60 MIL TEXTURED LLDPE LINER PANEL RESTORATION LIMIT

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
CHANGED DETAIL NUMBER	JULY 19, 2019	C.R.H.
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

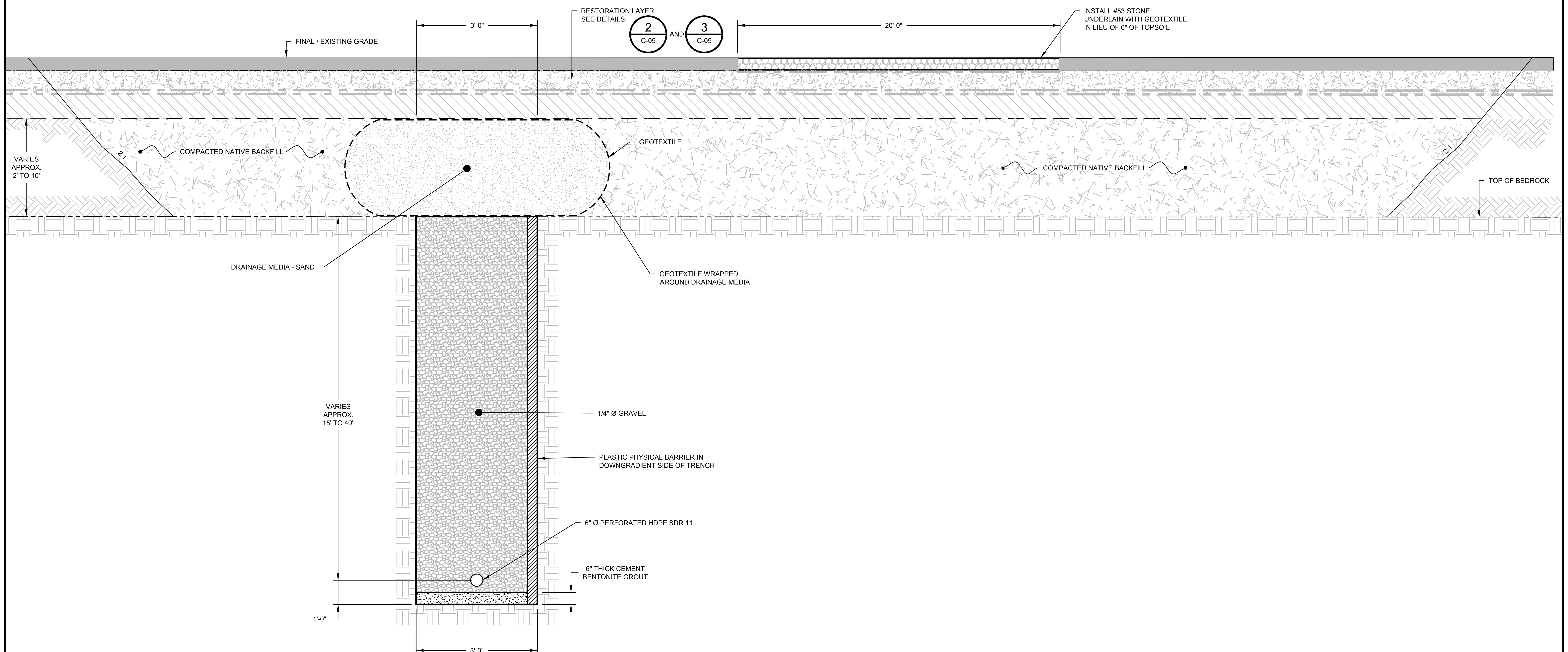
BEDROCK PILOT TRENCH
FINAL COVER SYSTEM 60-MIL LLDPE LINER

GHD

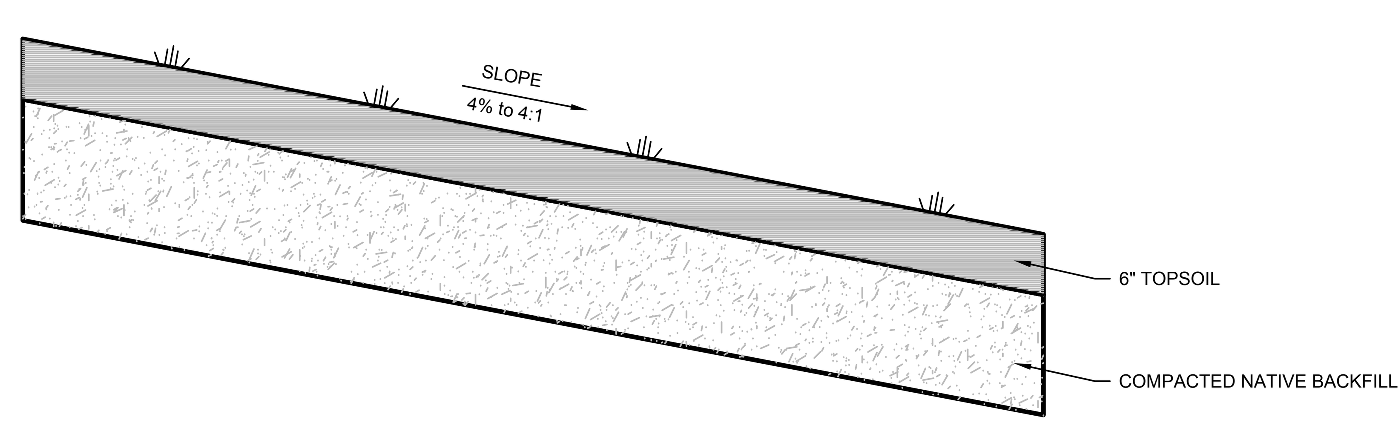
Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: G.T.	Reviewed By: C.R.H.	Date: SEPTEMBER 2017	
Scale: 1"=20'	Project Nº: 13968-00	Report Nº: 394	Drawing Nº: C-08

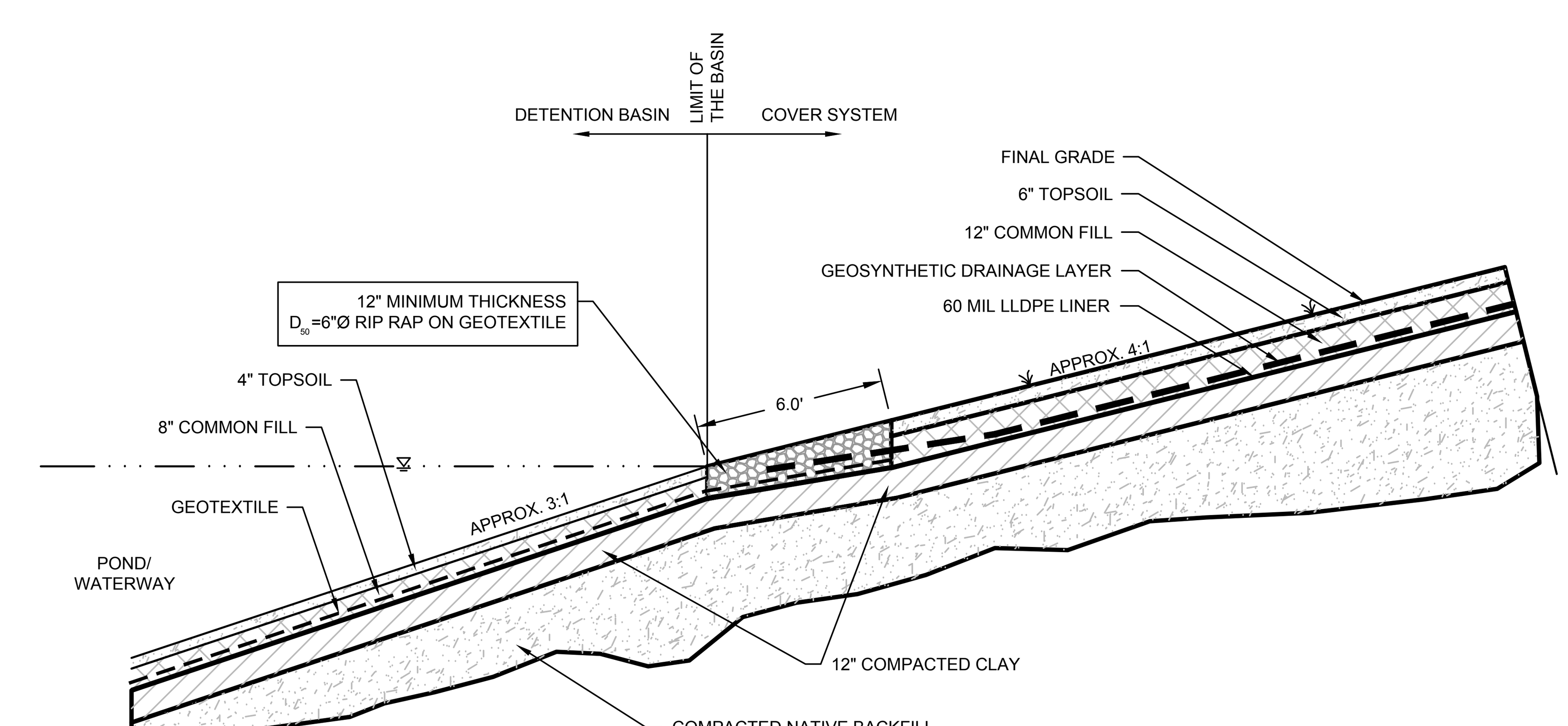
13968-00(394)CI-WA012 JULY 19, 2019



DETAIL 1 (C-02, C-03 & C-04) BEDROCK PILOT TRENCH DETAIL (THROUGH EAST PLANT COVER SYSTEM)
N.T.S.



DETAIL 2 (C-02 & C-09) RESTORATION OUTSIDE EXISTING COVER SYSTEM
N.T.S.



DETAIL 3 (C-02 & C-09) RESTORATION WITHIN EXISTING COVER SYSTEM
N.T.S.

№	Revision	Date	Initial

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
REVISED SHAPE OF WRAPPED DRAINAGE MEDIA	JULY 19, 2019	C.R.H.
AS-BUILT	SEPT. 15, 2017	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

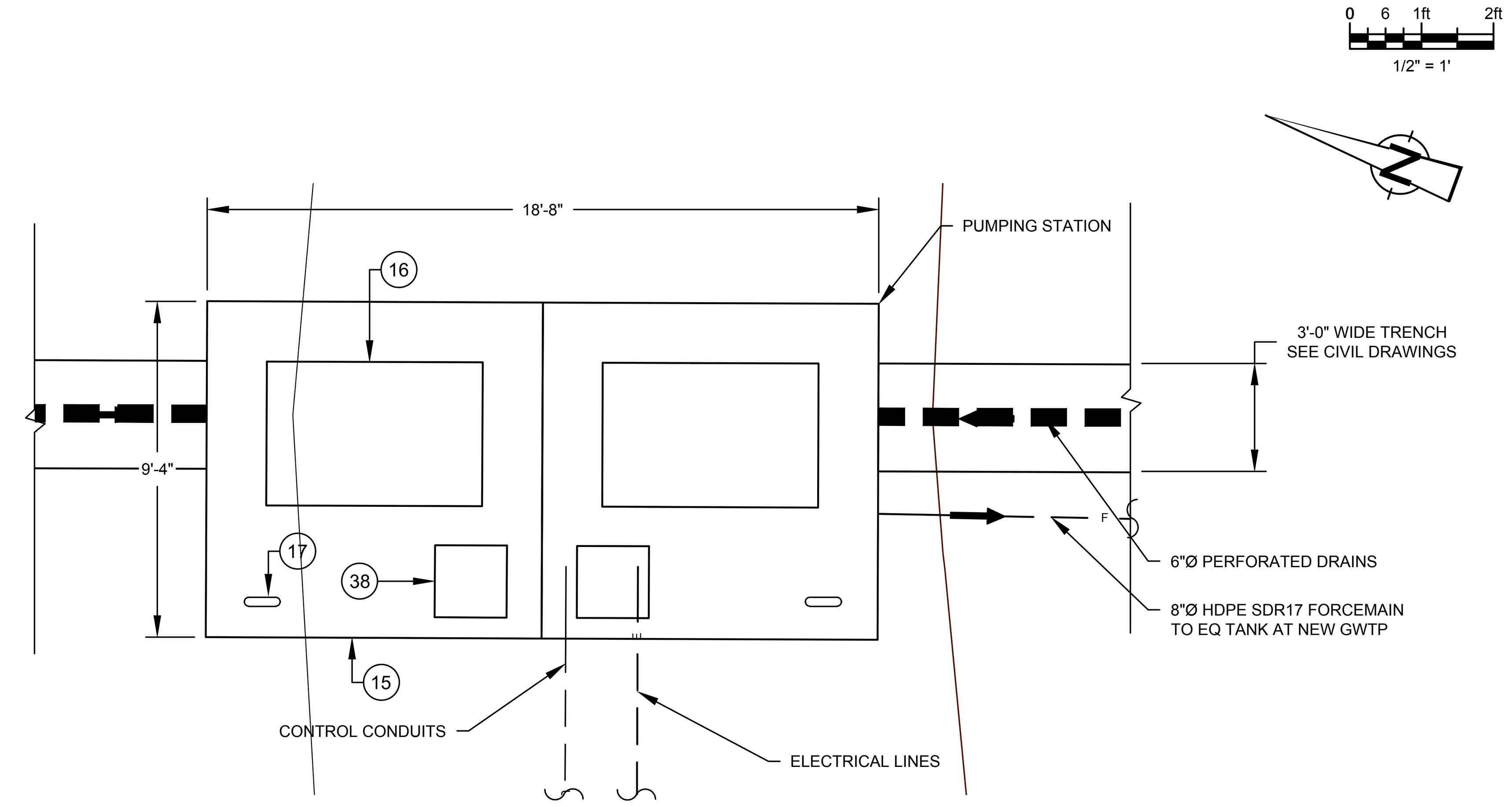
GROUNDWATER COLLECTION SYSTEM CERTIFICATION REPORT

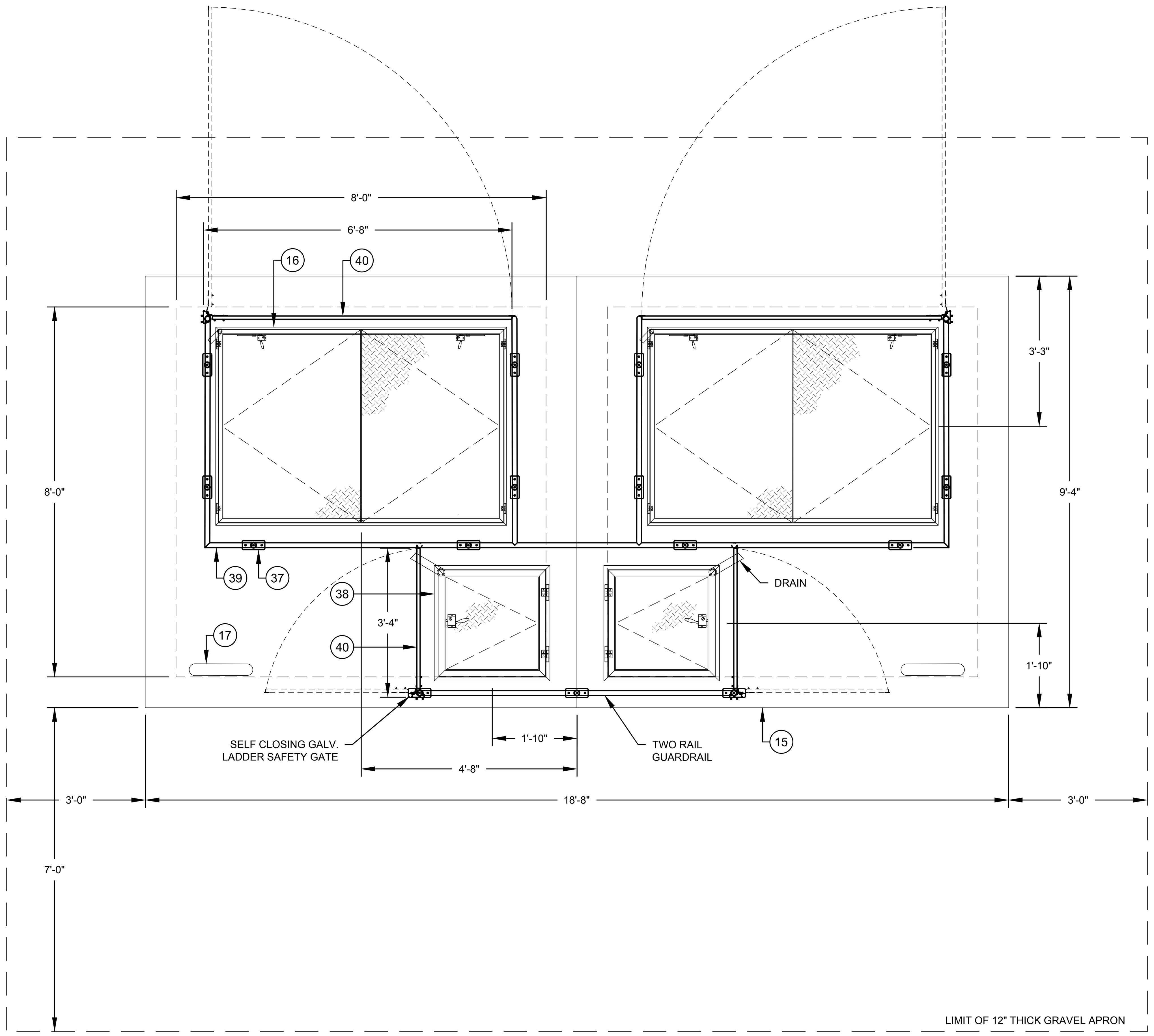
BEDROCK PILOT TRENCH
DETAILS

Source Reference:

Project Manager: G.T.	Reviewed By: C.R.H.	Date: SEPTEMBER 2017	
Scale: AS SHOWN	Project №: 13968-00	Report №: 394	Drawing №: C-09

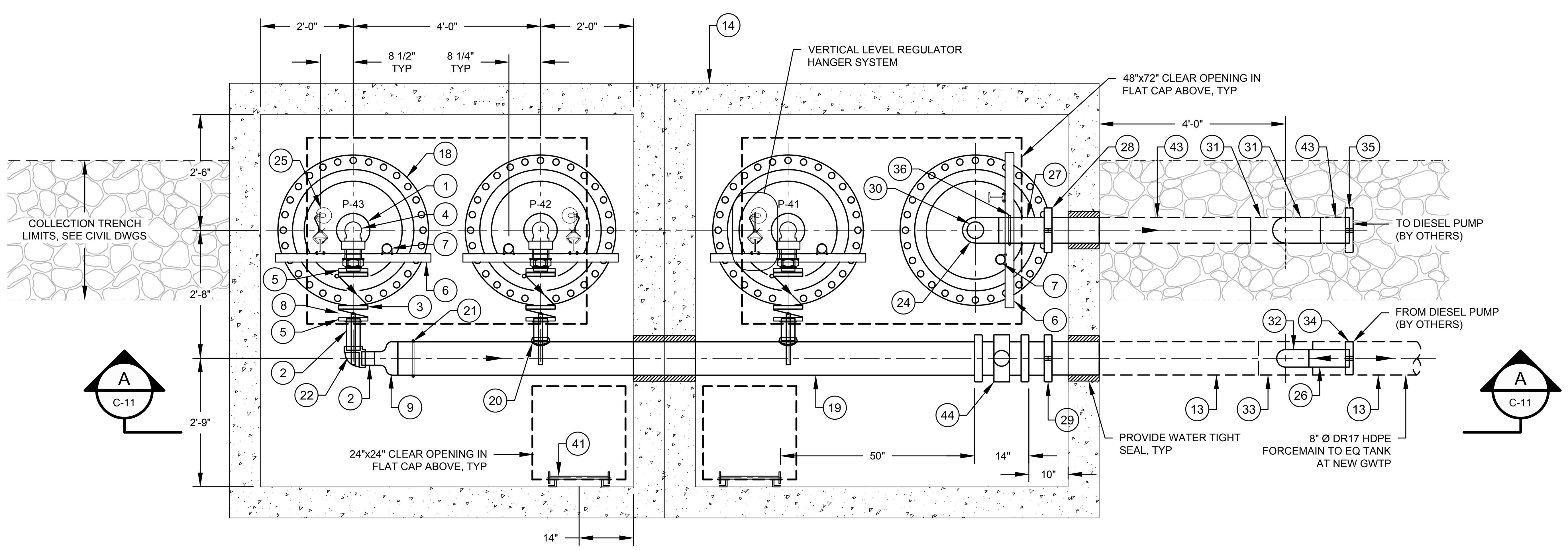
13968-00(394)CI-WA010 JULY 19, 2019





PLAN @ COVER

SCALE: 1/2"=1'-0"



NOTE:
SEE DRAWINGS C-02 AND C-03 FOR WET WELL
LOCATION AND ORIENTATION

PLAN ABOVE EL 612.00

SCALE: 1/2"=1'-0"

BILL OF MATERIALS

MARK	DESCRIPTION
1	EPG-ELECTRICAL SUBMERSIBLE PUMP SERIES S60, MODEL 60-6, 25 HP, 3 PHASE, 460 VOLTS, 3 INCH DISCHARGE, VERTICAL SUMP DRAINER, Q= 340 USGPM AT TDH=166FT. C/W STARTER CONTROL PANEL
2	3"Ø CS GALVANIZED PIPE
3	EPG 3"Ø CHECK VALVE, TYPE CVSE300
4	EPG 3"Ø PITLESS ADAPTOR NW SERIES MTD ON CHANNEL AT MID POINT
5	3"Ø NPT FLANGE ADAPTOR
6	C8X11.5 STEEL CHANNEL WELD OR BOLT TO 24" STEEL PIPE
7	EPG 2"Ø PERFORATED PVC STILLING WELL MOUNTED TO C-CHANNEL WITH 2 U-BOLT CLAMPS
8	3"Ø WAFER STYLE BUTTERFLY VALVE C/W HANDLE AND 10 POSITION NOTCH PLATE
9	3"Ø x 8"Ø CS GALVANIZED CONCENTRIC INCREASER
10	30"Ø X 18" LONG CS GALVANIZED PIPE C/W FLANGE
11	30"Ø HDPE ADAPTOR RING AND STEEL BACKING FLANGE
12	STILLING WELL LATERAL SUPPORT MOUNTED TO 30"Ø HDPE SDR9 PIPE SUMP AT 12" ABOVE WELL PIPE PERFORATIONS AND BOTTOM OF WELL PIPE AND AT MID POINT, TYP
13	8"Ø DR17 HDPE FORCEMAIN
14	8'-0"x8'-0"x8'-0" HIGH PRECAST CONCRETE VAULT SECTION
15	8'-0"x8'-0" PRECAST CONCRETE FLAT CAP C/W CAST-IN-PLACE BILCO HATCH, VERIFY SIZE WITH HATCH SUPPLIER
16	4'-0"x6'-0" CLEAR OPENING, ACCESS DOOR TYPE JD, BILCO OR EQUAL C/W LOCK, HANDLE, CAST INTO CAP, VERIFY WITH HATCH SUPPLIER
17	3"Ø GALVANIZED VENT PIPE C/W GOOSE NECK AND INSECT SCREEN
18	30"Ø HDPE SDR9 PIPE SUMP, WITH PERFORATED BOTTOM.
19	8"Ø CS GALVANIZED PIPE
20	3"Ø WELDOLET
21	6"Ø U-BOLT CLAMP AND FLOOR STANCHION
22	3"Ø x 90° THREADED CS GALVANIZED THREADED ELBOW
23	1 1/4"Ø BOLTS, NUTS AND WASHERS TO SUIT
24	6"Ø CS GALVANIZED ELBOW
25	VERTICAL LEVEL REGULATOR HANGER ASSEMBLY WITH FIBERGLASS FRP GUIDE RAIL I-BEAM MOUNTED AT BOTTOM TO WELL PIPE BASE, TO CHANNEL AT TOP OF WELL PIPE AND AT ITEM 15 UP TO U/S OF ITEM 16 WITH CHAIN HOOK
26	4"Ø DR17 HDPE PIPE
27	6"Ø CS GALVANIZED PIPE
28	6"Ø VICTAULIC SNAP-JOINT (STYLE 78) WITH GASKET SEALS
29	8"Ø VICTAULIC SNAP-JOINT (STYLE 78) WITH GASKET SEALS
30	3"Ø THREADED REMOVAL LEG WELDED TO HEEL OF 6"Ø ELBOW UP TO U/S OF ITEM 16
31	6"Ø x 90° DR17 HDPE LR ELBOW
32	4"Ø x 90° DR17 HDPE ELBOW
33	8"x4" HDPE REDUCER TEE
34	4"Ø VICTAULIC RIGID COUPLING (STYLE HP-70) WITH CAP END
35	6"Ø VICTAULIC RIGID COUPLING (STYLE HP-70) WITH CAP END
36	6"Ø U-BOLT CLAMP
37	GUARDRAIL POST ANCHORAGE
38	2'-0"x2'-0" CLEAR OPENING, ACCESS DOOR TYPE J, BILCO OR EQUAL C/W LOCK, HANDLE, CAST INTO CAP, VERIFY WITH HATCH SUPPLIER
39	42" STD OSHA RAILING SYSTEM WITH MID-RAIL, 1½"Ø GALVANIZED PIPE C/W CLAMP COMPONENTS
40	SELF CLOSING GALVANIZED LADDER SAFETY GATE
41	ALUMINUM ACCESS LADDER
42	30"Ø x 12" LONG CS GALVANIZED PIPE C/W FLANGE
43	6"Ø DR17 HDPE PIPE
44	PROLINE PROMAG 50P ELECTROMAGNETIC FLOWMETER Q_{MAX} =4850 usgpm

ALL EXPOSED PIPING FROM PITLESS ADAPTOR TO BE PROTECTED WITH 2" INSULATION TO EXIT FROM CHAMBER

ALL PIPING, VALVES, FITTINGS AND PIPE SUPPORTS, ACCESSORIES, EQUIPMENT AND SAFETY DEVICES WITHIN CHAMBER TO BE CS GALVANIZED UNLESS NOTED OTHERWISE

Nº	Revision	Date	Initial

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
AS-BUILT (COPY OF DESIGN DRAWING)	JULY 19, 2019	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - CERTIFICATION REPORT

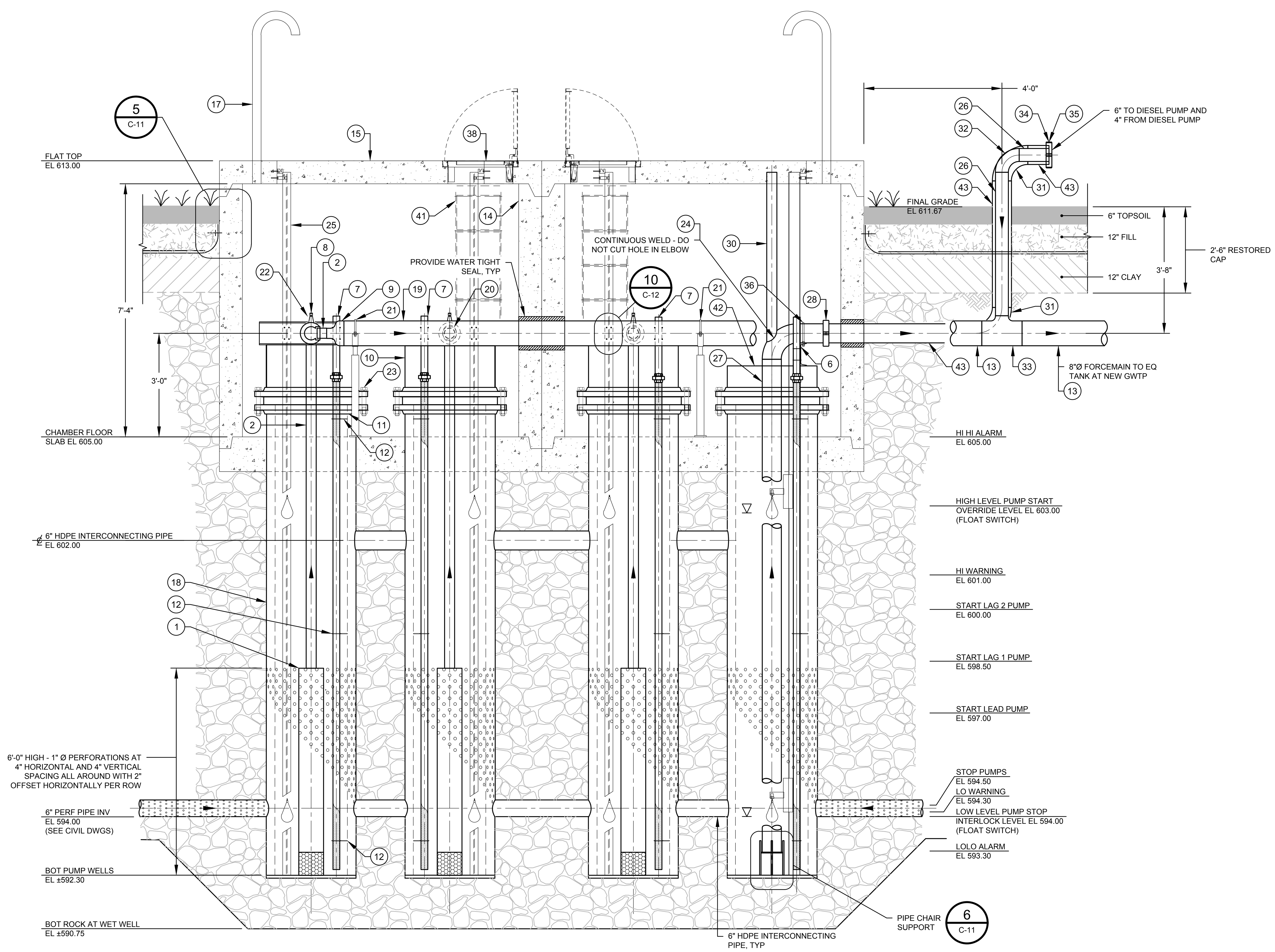
WET WELL 4
DETAILS (1 OF 2)

GHD

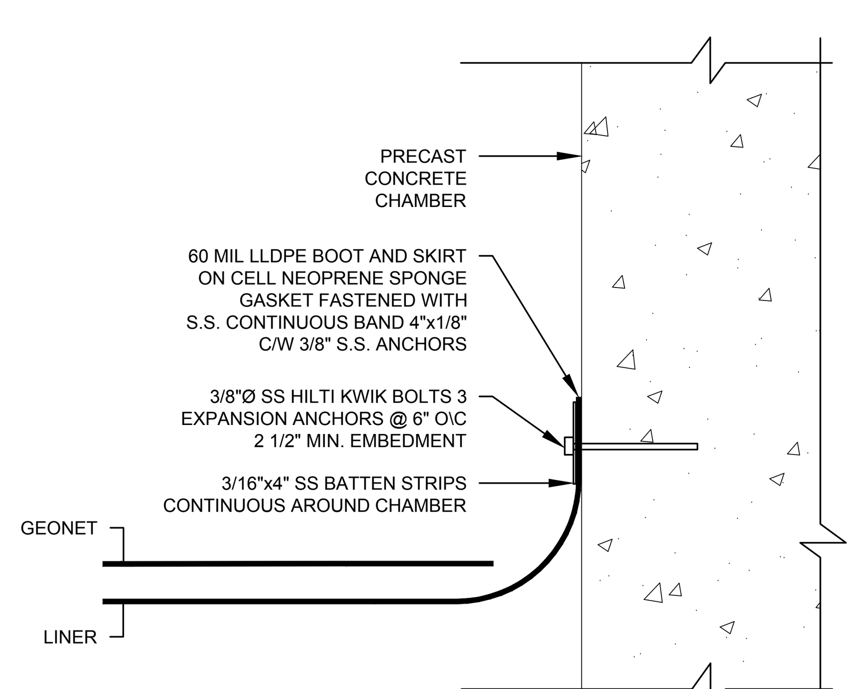
Source Reference:

Project Manager:	Reviewed By:	Date:	
G.T.	C.R.H.	SEPTEMBER 2017	
Scale:	Project Nº:	Report Nº:	Drawing Nº:
AS SHOWN	13968-00	394	C-10

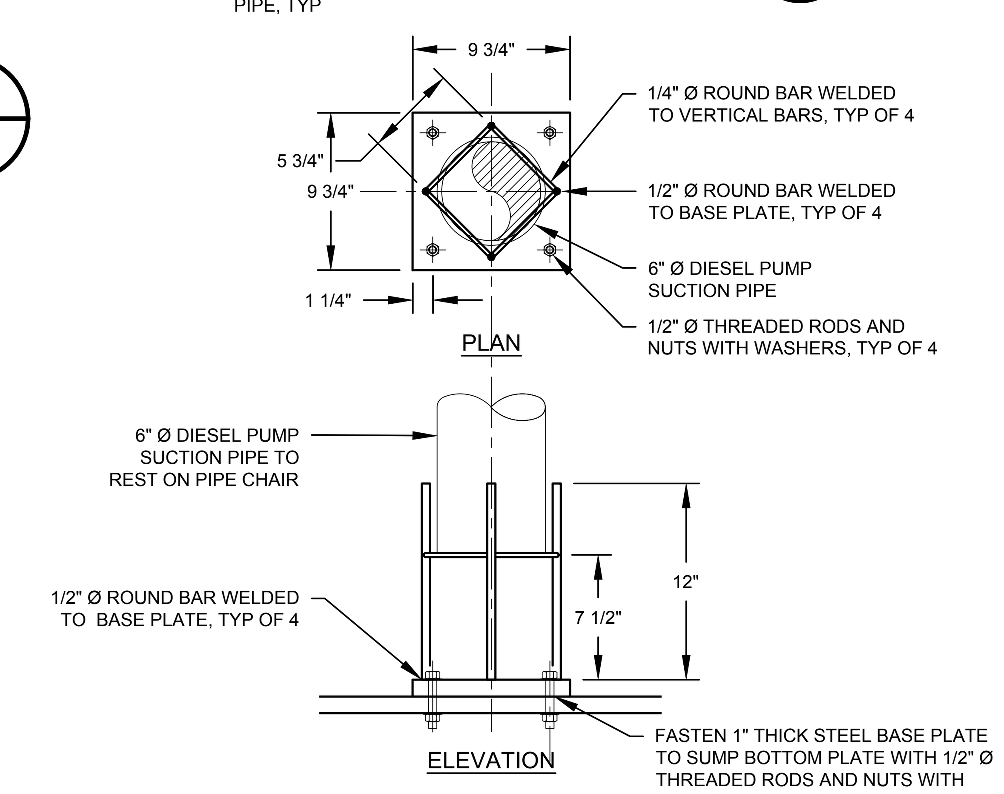
13968-00(394)CI-WA014 JUL 11/2019



SECTION A
1/2"=1'-0"
C-10



DETAIL 5
N.T.S.
C-11



DETAIL 6
N.T.S.
C-11

BILL OF MATERIALS

MARK	DESCRIPTION
1	EPG-ELECTRICAL SUBMERSIBLE PUMP SERIES S60, MODEL 60-6, 25 HP, 3 PHASE, 460 VOLTS, 3 INCH DISCHARGE, VERTICAL SUMP DRAINER, Q= 340 USGPM AT TDH=166FT. C/W STARTER CONTROL PANEL
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ALL EXPOSED PIPING FROM PITLESS ADAPTOR TO BE PROTECTED WITH 2" INSULATION TO EXIT FROM CHAMBER

ALL PIPING, VALVES, FITTINGS AND PIPE SUPPORTS, ACCESSORIES, EQUIPMENT AND SAFETY DEVICES WITHIN CHAMBER TO BE CS GALVANIZED UNLESS NOTED OTHERWISE

Nº	Revision	Date	Initial

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
AS-BUILT (COPY OF DESIGN DRAWING)	JULY 19, 2019	C.R.H.

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - CERTIFICATION REPORT

WET WELL 4
DETAILS (2 OF 2)

Source Reference:

Project Manager: G.T.	Reviewed By: C.R.H.	Date: SEPTEMBER 2017	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 394	Drawing Nº: C-11

13968-00(394)CI-WA014 JUL 11, 2019

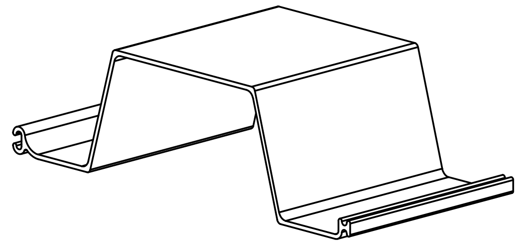
Appendix E
Vinyl Sheet Piling Technical Data Sheet

CRANE MATERIALS INTERNATIONAL

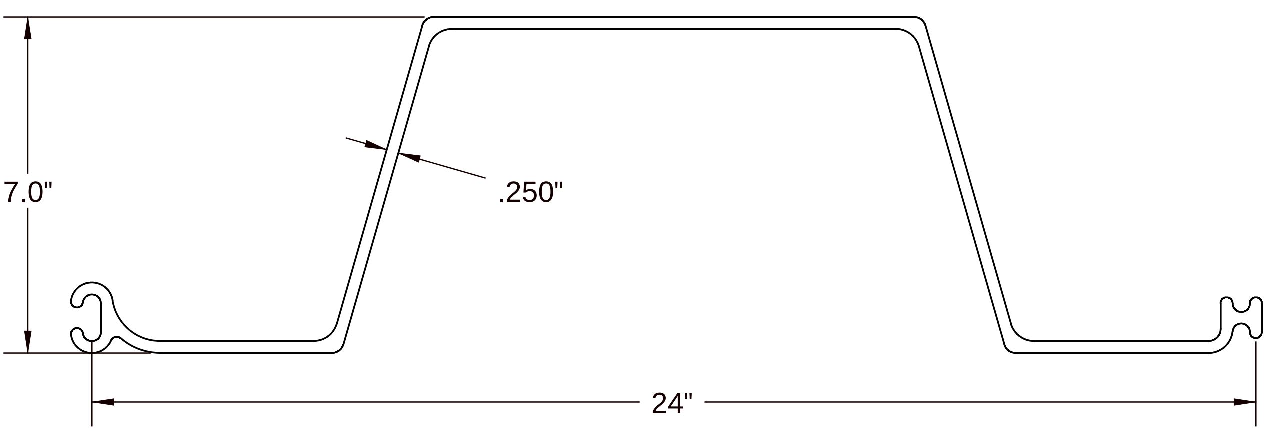
SHOREGUARD®
Synthetic Sheet Piling

Updated January 1, 2011

SG-325



Allowable Moment (M)	2,960 ft-lb/ft	13.17 kN-m/m
Section Modulus (Z)	11.1 in^3/ft	597 cm^3/m
Moment of Inertia (I)	39 in^4/ft	5,326 cm^4/m
Impact Strength	13,750 in-lbs/in^2	2,406 N-mm/mm^2
Thickness (t)	0.250 in	6.4 mm
Section Depth	7.0 in	178 mm
Section Width	24 in	610 mm
Material	Weatherable Rigid Vinyl	
Standard Colors	Grey, Clay	
Technology	Box Profile, I-Beam Lock, XCR™	
Standard Packaging	20 sheets/bundle	



4501 Circle 75 Parkway, Suite E-5370 Atlanta, GA 30339 USA Phone 866-730-9210 INTL 001-770-933-8148 Fax 770-933-8363

Appendix F
Pure Gold Gel (Bentonite) Technical Data Sheet and Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name PUREGOLD® GEL

Version # 13

Revision date 21-February-2009

Chemical description Smectite Clay

Manufacturer
CETCO
Drilling Products Group
2870 Forbs Avenue
Hoffman Estates, IL 60192 US
safetydata@amcol.com
http://www.cetco.com/
General Information (800) 527-9948
CHEMTREC® (800) 424-9300

2. Hazards Identification

Emergency overview Material can be slippery when wet

Potential health effects

Routes of exposure Inhalation.

Eyes Dust or powder may irritate eye tissue.

Skin Non-irritating to the skin.

Inhalation Repeated or prolonged inhalation may cause toxic effects. For additional information on inhalation hazards, see Section 11 of this safety data sheet.

Ingestion No significant adverse effects are expected upon ingestion of the product.

Target organs Lungs.

Chronic effects This product has the potential for generation of respirable dust during handling and use. Dust may contain respirable crystalline silica. Overexposure to dust may result in pneumocononiosis, a respiratory disease caused by inhalation of mineral dust, which can lead to fibrotic changes to the lung tissue, or silicosis, a respiratory disease caused by inhalation of silica dust, which can lead to inflammation and fibrosis of the lung tissue. Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled.

3. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments Bentonite contains naturally occurring crystalline silica (not listed in Annex I of Directive 67/548/EEC) in quantities less than 6%. Occupational Exposure Limits for impurities are listed in Section 8.

4. First Aid Measures

First aid procedures

Eye contact Flush eyes immediately with large amounts of water. If irritation persists get medical attention.

Skin contact No special measures required. Get medical attention if irritation develops or persists.

Inhalation Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Get medical attention, if needed.

Ingestion No special measures required. If ingestion of a large amount does occur, seek medical attention.

Notes to physician Provide general supportive measures and treat symptomatically.

5. Fire Fighting Measures

Flammable properties This material will not burn.

Extinguishing media

Suitable extinguishing media Use any media suitable for the surrounding fires. Dry chemical, CO_2, water spray or regular foam.

Protection of firefighters

Protective equipment and precautions for firefighters	Material can be slippery when wet
Hazardous combustion products	None known.

6. Accidental Release Measures

Personal precautions	Material can be slippery when wet. Wear a dust mask if dust is generated above exposure limits.
Environmental precautions	No special environmental precautions required.
Methods for cleaning up	Avoid the generation of dusts during clean-up. Collect dust or particulates using a vacuum cleaner with a HEPA filter. Reduce airborne dust and prevent scattering by moistening with water.

7. Handling and Storage

Handling	Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment.
Storage	Guard against dust accumulation of this material. No special storage conditions required. No special restrictions on storage with other products.

8. Exposure Controls / Personal Protection

Occupational exposure limits

ACGIH

Impurities	Type	Value	Form
INERT OR NUISANCE DUST (SEQ250)	TWA	10 mg/m3	Inhalable particles.
		3 mg/m3	Respirable particles.
QUARTZ (14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.

U.S. - OSHA

Impurities	Type	Value	Form
INERT OR NUISANCE DUST (SEQ250)	PEL	15 mg/m3	Total dust.
		5 mg/m3	Respirable fraction.
	TWA	5 mg/m3	Respirable fraction.
		50 mppcf	Total dust.
		15 mppcf	Respirable fraction.
		15 mg/m3	Total dust.
QUARTZ (14808-60-7)	TWA	2.4 mppcf	Respirable.
		0.3 mg/m3	Total dust.
		0.1 mg/m3	Respirable.
		0.1 mg/m3	Respirable dust.

Exposure guidelines	Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled.
Engineering controls	If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits. If engineering measures are not sufficient to maintain concentrations of dust particulates below the OEL, suitable respiratory protection must be worn.

Personal protective equipment

Eye / face protection	Wear dust goggles. Eye wash fountain is recommended.
Skin protection	No special protective equipment required.
Respiratory protection	Use a particulate filter respirator for particulate concentrations exceeding the Occupational Exposure Limit.
General hygeine considerations	Use good industrial hygiene practices in handling this material.

9. Physical & Chemical Properties

Appearance	Not available.
Color	Not available.

Odor	None.
Odor threshold	Not available.
Physical state	Solid.
Form	Granular. Powder. Pellets. or Chips.
pH	7 - 11
Melting point	Not available.
Freezing point	Not available.
Boiling point	Not available.
Flash point	Non-flammable
Evaporation rate	Not available.
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Non-explosive
Vapor pressure	Not available.
Vapor density	Not available.
Specific gravity	2.5497 estimated
Relative density	Not available.
Solubility (water)	Negligible
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
VOC	0 % estimated

10. Chemical Stability & Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	None known.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Chronic effects

In 1997, IARC (the International Agency for Research on Cancer) concluded that crystalline silica inhaled from occupational sources can cause lung cancer in humans. However in making the overall evaluation, IARC noted that "carcinogenicity was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monographs on the evaluation of the carcinogenic risks of chemicals to humans, Silica, silicates dust and organic fibres, 1997, Vol. 68, IARC, Lyon, France.)

In June 2003, SCOEL (the EU Scientific Committee on Occupational Exposure Limits) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. "There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis (and, apparently, not in employees without silicosis exposed to silica dust in quarries and in the ceramic industry). Therefore, preventing the onset of silicosis will also reduce the cancer risk..." (SCOEL SUM Doc 94-final, June 2003)

According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits. Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled.

Carcinogenicity

IARC Monographs on Occupational Exposures to Chemical Agents: Overall evaluation

QUARTZ (14808-60-7)	1 Human carcinogen.

US ACGIH Threshold Limit Values: A2 carcinogen

QUARTZ (14808-60-7)	Group A2 Suspected human carcinogen.

US NTP Report on Carcinogens: Known carcinogen

QUARTZ (14808-60-7)	Known carcinogen.

12. Ecological Information

Ecotoxicological data

Product	Test Results
PUREGOLD® GEL	LC50 Fish: 19005 mg/l 96.00 Hours estimated

* Estimates for product may be based on additional component data not shown.

Ecotoxicity This material is not expected to be harmful to aquatic life.

Environmental effects Based on the physical properties of this product, significant environmental persistence and bioaccumulation would not be expected.

Persistence and degradability Not available.

13. Disposal Considerations

Disposal instructions Dispose in accordance with all applicable regulations. Material should be recycled if possible.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations OSHA Process Safety Standard: This material is not known to be hazardous by the OSHA Highly Hazardous Process Safety Standard, 29 CFR 1910.119.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - No
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes

Country(s) or region	Inventory name	On inventory (yes/no)*
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

QUARTZ (14808-60-7) Listed.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

QUARTZ (14808-60-7) Listed: October 1, 1988 Carcinogenic.

US - Pennsylvania RTK - Hazardous Substances: Listed substance

QUARTZ (14808-60-7) Listed.

16. Other Information

Further information This safety datasheet only contains information relating to safety and does not replace any product information or product specification.

Recommended restrictions Workers (and your customers or users in the case of resale) should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

HMIS ratings

NFPA ratings Health: 1
Flammability: 0
Instability: 0

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The manufacturer expressly does not make any representations, warranties, or guarantees as to its accuracy, reliability or completeness nor assumes any liability, for its use. It is the user's responsibility to verify the suitability and completeness of such information for each particular use.

Third party materials: Insofar as materials not manufactured or supplied by this manufacturer are used in conjunction with, or instead of this product, it is the responsibility of the customer to obtain, from the manufacturer or supplier, all technical data and other properties relating to these and other materials and to obtain all necessary information relating to them. No liability can be accepted in respect of the use of this product in conjunction with materials from another supplier. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Issue date 21-February-2009

Other information CETCO is an AMCOL International company.

PUREGOLD® GEL

Certified to NSF/ANSI 60

DESCRIPTION

PUREGOLD GEL is a minimum 90 bbl yield, organic-free, untreated, high quality bentonite drilling fluid designed for the groundwater monitoring industry. PUREGOLD GEL is certified to NSF/ANSI Standard 60, Drinking Water Treatment Chemicals - Health Effects.

RECOMMENDED USE

PUREGOLD GEL is recommended for environmental rotary drilling where ambient groundwater quality and soil chemistry must be maintained. PUREGOLD GEL can be used in fresh or salt-water mud systems.

CHARACTERISTICS

- Chemically stable. Results from TCLP Metals Analysis are below RCRA limits for hazardous constituents
- Contaminant free. All 116 priority pollutants tested were below TCLP detection limits
- Lubricates and cools drilling bit
- Mixes quickly to achieve required viscosity
- Removes cuttings and cavings from the borehole
- Seals borehole wall to reduce fluid loss and impedes inter-aquifer groundwater movement
- Stabilizes and supports borehole wall

MIXING AND APPLICATION

PUREGOLD GEL mixing ratios in lbs per 100 gallons of water:

Normal Conditions	30-50 lbs
Sand and Gravel	50-70 lbs
Fluid Loss Control	70-80 lbs

BULK DENSITY

54 lbs/ft^3

PACKAGING

50 lb bag, 48 per pallet. All pallets are plastic-wrapped.

2870 Forbs Avenue ■ Hoffman Estates, IL 60192 ■ P 800.527.9948 ■ F 847.851.1332 ■ www.cetco.com/dpg

Appendix G
Bedford Pilot Trench Air Monitoring

Memorandum

To:	Peter Ramanauskas – U.S. EPA, Gerald O'Callaghan - IDEM	Ref. No.:	013968-25
	FOR P.G.		
From:	Jim McGuigan, Pete Bridcut, Brett Tarkington/jp/800	Date:	March 10, 2016
CC:	Cheryl Hiatt, Ed Peterson, Katie Kamm, Paul Gallaway		
Re:	**Bedford Pilot Trench Air Monitoring – Summary of Ambient Air Monitoring to date and Recommendation for Cessation of Ambient Air Monitoring Portion of Program GM CET Bedford Facility Bedford, Indiana**		

This memo has been prepared to summarize the results of the Ambient Air Quality Monitoring Plan (AAQMP) being carried out at the current construction of a Pilot Perimeter Groundwater Trench Collection System (Pilot Trench). The Ambient Air Quality Monitoring Plan is currently being performed in addition to the general contractor's (Sevenson Environmental Services (SES)) use of portable dust monitors in the immediate work area (worker's breathing zones) under the contractor's site-specific Health and Safety Plan. The ambient air monitoring program involves the real time air monitoring for dust surrounding the construction area for the Pilot Trench. The "worst case" construction activities, including; the removal of PCB impacted soils (<50 ppm) beneath the East Plant Cover System liner, transport and proper disposal of the PCB impacted soils, and the bedrock trenching during periods of low rain fall activity, have been completed. Results reported to date by the real time monitoring are consistently well below the established action level. Based on the current low results being reported on-site, we believe the real time ambient air monitoring is no longer warranted on site for the remaining stages of construction.

1. Background

This Ambient Air Quality Monitoring Plan (AAQMP) was prepared by GHD, Services, Inc. (GHD) for Interim Measure (IM) activities to be completed for the construction the Pilot Perimeter Groundwater Trench Collection System Study (Pilot Trench), at the General Motors LLC (GM) Bedford Casings, Engines and Transmissions (CET) Facility (Facility), located in Lawrence County, Indiana. The Pilot Trench is being constructed at the northeast corner of the Facility property west of Bailey Scales Road, with supporting temporary construction facilities (temporary access roads, staging areas) located to the north, west and south of the Pilot Trench with the combined Pilot Trench and support areas hereto referred to as the Site.

The Pilot Trench construction activities required the excavation of soils and bedrock potentially impacted with polychlorinated biphenyls (PCBs) at low levels (<50 mg/kg). The objective of the ambient air monitoring program is to quantify the airborne concentrations of contaminants, if any, at the locations of the nearest

GHD Services Inc.
6400 Shafer Court – Suite 400 Rosemont Illinois 60018 USA
T 773 380 9933 **F** 773 380 6421 **W** www.ghd.com

potential receptors. Based on historical sampling results, PCB concentrations in soils (within the excavation area) were reported at levels ranging from non-detect to a maximum concentration of 42.2 mg/kg. The purpose of the ambient air monitoring is to assess potential PCB and dust emissions at the perimeter of the working zone during the PCB-impacted soil excavation and subsequent loading for offsite transport and disposal, and during the bedrock trenching activities. The specific objectives included the following:

- Perform real-time air monitoring for total dust in and around the work area to characterize potential exposures to workers in the exclusion zone and those in the area around the exclusion zone.
- Perform real-time air monitoring for total dust levels to evaluate potential fugitive dust emissions containing PCBs at the property boundaries of the Site.
- Establish and implement procedures to ensure appropriate responses to elevated levels of particulate matter. This may include slowing or stopping work activities, identifying areas requiring respiratory protection, application of dust suppressants, or arranging for a timely evacuation of the work site in the event that hazardous concentrations of airborne emissions are detected.
- Perform background perimeter air monitoring to establish baseline real-time dust concentrations.
- Communicate the hazards associated with exposures to dust and PCB-impacted dust to the affected workers and other potential receptors.
- Provide recommendations for controlling site exposures, respiratory protection and other personal protective equipment (PPE) to site management.

The Site perimeter air monitoring has been conducted during work activities in which PCB-impacted soils were encountered and have the potential for creating airborne dust. The air monitoring data was collected and compiled in accordance with established guidelines. In addition, the results were communicated to GM, site workers, and others as required and/or as necessary to ensure the safety and health of potentially affected individuals.

2. Exposure Standards and Guidelines

The U.S. Occupational Safety and Health Administration (OSHA) promulgate workplace standards to protect the safety and health of workers. The administration of these standards has been delegated to the Indiana Occupational Safety and Health Administration (IOSHA), which is part of the Indiana Department of Labor. The IOSHA standards are identical to the OSHA standards and apply to all places of employment in the state, with the exception of federal government employees, the U.S. Postal Service, private sector maritime activities, and certain agricultural operations. The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) have established guidelines to protect workers from chemical hazards on the job. Table 2.1 summarizes the OSHA permissible exposure limits (PEL), NIOSH Immediately Dangerous to Life and Health (IDLH) guidelines, and ACGIH threshold limit values (TLV) for PCBs and total dust.

Table 2.1 Occupational Exposure Limits and Guidelines

Analyte	IOSHA PEL	ACGIH-TLV	NIOSH - IDLH[3]	Units
	TWA[1]	TWA[2]		
PCBs (chlorodiphenyl 54%)	0.5	0.5	5	mg/m^3
Total Dust[4]	15	10	NE	mg/m^3

Notes:
1. Permissible Exposure Limit - Time Weighted Average (PEL-TWA) = An 8-hour time weighted average. An exposure to any material listed in 29 CFR 1910.1000, Tables Z1 and Z2, in any 8-hour work shift of a 40-hour workweek shall not exceed the 8-hour time weighted average limit given for that material in the table.
2. Threshold Limit Value - Time Weighted Average (TLV-TWA) = The TWA concentration for a conventional 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect (ACGIH, 2015).
3. Immediately Dangerous to Life and Health (IDLH) = Indicates an exposure to airborne contaminants that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.
4. A TLV for Particles Not Otherwise Specified (PNOS) has not been established. ACGIH recommends that airborne concentration for these compounds be kept below 10 mg/m^3.

The U.S. Environmental Protection Agency (U.S.EPA) has established National Ambient Air Quality Standards (NAAQS) for five primary pollutants, including particulate matter (dust). The NAAQS for particulate matter are based on a 24-hour average. The NAAQS are derived at levels designed to protect public health, and are based on the known effects of each substance on human health, vegetation and other components of the environment such as soil, water, materials (e.g. metalwork and masonry), visibility and personal comfort and well-being.

There currently is no NAAQS for PCBs. However, U.S.EPA has established generic community exposure limits in the risk-based screening table (target cancer risk of 1E-6). GHD believes that the residential risk based screening level (low risk) of 0.000028 mg/m^3 is appropriate based on the limited potential exposure period (4 – 5 months). However, GHD has chosen to use the "high risk" screening level of 0.0000049 mg/m^3 to provide additional protection to members of the surrounding community.

The community exposure guideline values for the identified COI are summarized in Table 2.2:

Table 2.2 Community Exposure Guidelines (Inhalation)

Compound of Interest (COI)	Averaging Period	Exposure Standard/Guideline	Units
Particulate Matter (PM-10) [1]	24-hour	0.15	mg/m^3
PCBs	24-hour	0.0000049	mg/m^3

Notes:
1. PM10 is particulate matter 10 micrometers or less in diameter

3. Dust Action Level Derivation from PCB Data

Work area and community action levels were established to facilitate a timely and appropriate response to the detection of airborne hazards associated with airborne dust. Action levels were set at levels lower than the established exposure limits and guidelines. The purpose was to ensure that if these levels are detected, they were effectively communicated to affected workers and Site management so that appropriate actions could be taken to reduce airborne concentrations to acceptable levels. The site-specific action levels for the project are listed in Table 3.1. The real-time dust monitoring data have been compared to the PELs for dust of 15 mg/m^3. The concentration of PCB in soil (based on previous soil investigations) has been used to establish the PCB action level by estimating the concentration of airborne PCB-containing dust as outlined below.

No real-time methods exist for detection of airborne PCBs. Measuring the total dust concentration provides the quickest means of screening potential exposure to workers and the community. The total dust concentration necessary to reach the work area action level of 0.5 mg/m^3 (OSHA PEL) can be estimated from the soil sampling data. This estimate is based on calculating the Equivalent Airborne Dust Concentration based on the applicable exposure limit ($EADC_{EL}$). The $EADC_{EL}$ calculation determines what dust level would equal the exposure limit for a specific soil contaminant, in this instance, PCBs. The following equation shows this relationship.

$$EADC_{EL} = EL \times Conc^{-1}_{Contaminated\ soil} \times 10^6$$

Where:

EL	=	Exposure Limit, mg/m^3
$Conc^{-1}_{Contaminated\ soil}$	=	Inverse of the soil PCB concentration, kg/mg

The maximum soil concentration of PCBs is reported to be 42.2 mg of mg/kg of PCBs. Using the equation above, the $EADC_{EL}$ is calculated as shown below:

$$\text{Total dust} = \text{EADC}_{EL} = \frac{mg_{soil}}{m^3_{air}} = \left(\frac{0.5\ mg_{PCBs}}{m^3_{air}}\right)\left(\frac{kg_{soil}}{42.2\ mg\ _{PCBs}}\right)\left(\frac{10^6 mg_{soil}}{kg_{soil}}\right) = 11{,}848\ \text{mg/m}^3$$

Where:

EL	=	The OSHA PEL of 0.5 mg/m^3
$Conc^{-1}_{Contaminated\ soil}$	=	One kg of soil contains 42.2 mg of PCBs
10^6	=	The number of mg of soil in a kg of soil

This calculated total dust concentration (11,848 mg/m^3) for PCBs is unlikely. As such, real time air monitoring for worker exposure was based on dust readings as summarized in Table 3.1.

Table 3.1 Real Time Air Monitoring Site Action Levels

Analyte	Action Level	Description of Action
Total Dust Readings (Work Zone Action Levels)[1]	< 5.0 mg/m^3	No action required
	≥ 5.0 - < 15 mg/m^3	Apply water or dust suppressant to soils generating the dust.
	≥ 15 mg/m^3	Initiate Stop Work Authority (SWA). Notify onsite contractor safety & health officer and construction superintendent. Institute engineering controls to

Table 3.1 Real Time Air Monitoring Site Action Levels

Analyte	Action Level	Description of Action
		reduce dust levels.
Total Dust Readings[2] (Perimeter Action Levels)[3]	< 0.15 mg/m^3	No action required. Continue monitoring at upwind perimeter (background) and at up to three perimeter downwind locations. [3]
	≥ 0.15 mg/m^3	1. Initiate SWA, immediately measure the upwind background level using the same monitor. 2. Determine primary source of dust and then apply water or dust suppressant to dusting surfaces. Continue dust monitoring activities with increased focus on downwind dust levels until readings are consistently below 2.5 mg/m^3. 3. If dust suppression efforts do not reduce perimeter dust concentrations below 2.5 mg/m^3 within 15 minutes after initiate SWA and consult with the Project Manager, others as appropriate to determine an appropriate course of action to reduce dust levels to acceptable levels.

Notes:

1. Work area action Levels are based on sustained (>1 min) airborne concentrations within the worker's breathing zone. Spurious or non-sustained peak readings or surface, contact readings while cause for concern may not indicate the need for additional action requiring PPE upgrade.
2. Perimeter dust readings will be taken upwind (background) prior to initiating work.
3. Dust readings will be taken over an integrated (average) sampling period not to exceed 15 minutes.

The maximum PCB concentration in the soil samples collected was also used to determine the $EADC_{EL}$ for community exposures. The community exposure limit for PCBs GHD has chosen to use is 0.0000049 mg/m^3 Using the same maximum soil concentration reported for PCBs, the community $EADC_{EL}$ is calculated as follows:

$$\text{Total dust} = \text{EADC}_{EL} = \frac{mg_{soil}}{m^3_{air}} = \left(\frac{0.000049\ mg_{PCBs}}{m^3_{air}}\right)\left(\frac{kg_{soil}}{42.2\ mg_{\ PCBs}}\right)\left(\frac{10^6 mg_{soil}}{kg_{soil}}\right) = 0.12\ \text{mg/m}^3$$

Where:

EL = The risk based community exposure limit of 0. 0.0000049 mg/m^3
10^6 = The number of mg of soil in a kg of soil

The average dust concentration measured during the work day (10 hours) and the average background dust concentrations during non-work periods were used to calculate the 24-hour time weighted average (TWA) dust concentration. The averaged data was compared to the NAAQS for dust and the $EADC_{EL}$ for PCBs.

4. Real Time Perimeter Dust Monitoring

Real-time air monitoring for dust has been performed during work operations involving the disturbance/handling of impacted material (remedial activities) using TSI Dustrak aerosol monitors or equivalent. The instruments are calibrated and operated in accordance with the manufacturer's specifications or applicable test/method specifications. Real time air monitoring has been performed at the Site perimeter – one upwind (background) and up to three downwind locations.

DustTraks are placed at the beginning of each work day and programmed to continuously monitor dust concentrations taking 15-minute time weighted average (TWA) readings. The DustTraks are housed in environmental enclosures. Each enclosure is attached to a surveying tripod and powered by a deep cycle marine battery. Each DustTrak is connected to a Netronix modem that streams the data (in real-time) to a secure website called Environet. The Environet website allows authorized users to set custom alert levels that will send an email if an alarm or some other threshold is triggered at the site.

1. Particulate dust levels are monitored at up to four locations which include 1 upwind location to monitor dust background concentrations and up to three downwind locations to monitor dust levels leaving the site.
2. Dust levels are integrated over a period not to exceed 15 minutes; therefore the dust monitors are set to record the 15-minute time-weighted average over this period. The action level is set at 0.15 mg/m^3 over the 15 minute TWA.
3. If particulate levels are detected in excess of 0.15 mg/m^3 for two consecutive 15 minute intervals, the upwind background level is measured immediately using the same portable monitor.

5. Monitoring Results

The air monitoring program commenced on October 14, 2015 by setting the air stations up surrounding the lined portion of the landfill site in which the pilot trench was design to cross. Air readings were conducted over October 14 and 15 in order to collect background air results. The air monitoring program continued with daily air monitoring during trench construction activities commencing on October 16, 2015. The results of the daily air monitoring are summarized below in Table 5.1. The dust concentrations collected between 0700 – 1700 were used as the work shift dust concentrations. The dust concentrations collected between 1700 – 0700 were used to calculate the overall background dust concentration at each sampling locations. The daily 24 hour time weighted average (TWA) dust concentrations for each sampling location were calculated as follows:

$$24 - hour\ TWA = \frac{(C_1 \times T_1) + (C_2 \times T_2)}{24\ hours} = \frac{mg}{m^3}$$

Where:

C1 = Average concentration (in mg/m3) during the typical work shift, defined as 0700 – 1700
T1 = 10 hours
C2 = Overall project average concentration (in mg/m3) during the typical non-work hours (background), defined as 1700 – 0700
T2 = 14 hours

Table 5.1 Daily Air Monitoring Results

Date	#West Station		*North Station		*East Station		*South Station	
	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA
10/16/2015	0.007	0.026	NA	NA	NA	NA	0.040	0.037
10/19/2015	0.007	0.025	NA	NA	NA	NA	0.015	0.026
10/20/2015	0.018	0.030	NA	NA	NA	NA	0.025	0.031
10/21/2015	0.023	0.032	NA	NA	NA	NA	0.076	0.052
10/22/2015	0.029	0.035	NA	NA	NA	NA	0.073	0.051
10/23/2015	0.035	0.037	0.029	0.027	NA	NA	0.047	0.040
10/26/2015	0.012	0.028	0.007	0.018	NA	NA	0.008	0.023
10/27/2015	0.016	0.029	0.012	0.020	NA	NA	0.016	0.027
10/28/2015	0.012	0.028	**0.007**	0.018	NA	NA	0.009	0.024
10/29/2015	0.009	0.026	**0.004**	0.017	NA	NA	0.009	0.024
10/30/2015	**0.016**	0.029	0.012	0.021	NA	NA	0.014	0.026
10/31/2015	**0.019**	0.031	0.014	0.021	NA	NA	0.018	0.028
11/2/2015	0.108	0.068	0.029	0.027	NA	NA	0.014	0.026
11/3/2015	0.058	0.047	0.019	0.024	NA	NA	0.017	0.027
11/4/2015	0.079	0.056	0.026	0.026	NA	NA	**0.026**	0.031
11/5/2015	0.031	0.036	**0.024**	0.026	NA	NA	0.035	0.035
11/6/2015	0.011	0.027	**0.008**	0.019	NA	NA	0.011	0.025
11/9/2015	**0.026**	0.033	0.026	0.026	NA	NA	0.024	0.030
11/10/2015	0.036	0.037	**0.027**	0.027	NA	NA	0.040	0.037
11/11/2015	0.041	0.040	**0.067**	0.043	NA	NA	0.051	0.041
11/12/2015	0.019	0.030	**0.013**	0.021	NA	NA	0.022	0.029
11/13/2015	0.008	0.026	**0.006**	0.018	NA	NA	0.015	0.026
11/16/2015	0.033	0.036	**0.022**	0.025	NA	NA	0.025	0.030
11/17/2015	**0.026**	0.034	0.018	0.023	NA	NA	0.025	0.030
11/18/2015	0.021	0.031	**0.007**	0.018	NA	NA	0.008	0.023
11/19/2015	0.008	0.026	0.005	0.018	NA	NA	0.010	0.024

Table 5.1 Daily Air Monitoring Results

Date	#West Station		*North Station		*East Station		*South Station	
	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA
11/20/2015	**0.021**	0.032	0.016	0.022	NA	NA	0.022	0.029
11/23/2015	0.015	0.029	**0.011**	0.020	NA	NA	0.015	0.026
11/24/2015	0.031	0.036	**0.025**	0.026	NA	NA	0.031	0.033
11/25/2015	0.026	0.034	**0.016**	0.022	NA	NA	0.018	0.028
11/30/2015	**0.031**	0.036	0.032	0.029	NA	NA	0.039	0.036
12/1/2015	0.011	0.027	**0.007**	0.019	NA	NA	0.012	0.025
12/2/2015	0.029	0.035	**0.024**	0.025	NA	NA	0.033	0.034
12/3/2015	0.034	0.037	**0.030**	0.028	NA	NA	0.043	0.038
12/4/2015	0.043	0.041	0.035	0.030	NA	NA	0.047	0.040
12/7/2015	0.057	0.046	0.045	0.034	NA	NA	0.064	0.047
12/8/2015	0.043	0.040	**0.036**	0.030	NA	NA	0.043	0.038
12/9/2015	0.030	0.035	0.028	0.027	NA	NA	0.039	0.036
12/10/2015	0.056	0.046	**0.040**	0.032	NA	NA	0.059	0.045
12/11/2015	**0.078**	0.055	0.063	0.042	NA	NA	0.094	0.059
12/14/2015	0.006	0.025	**0.006**	0.018	NA	NA	0.001	0.021
12/15/2015	**0.010**	0.027	0.006	0.018	NA	NA	0.008	0.023
12/16/2015	**0.027**	0.034	0.021	0.024	NA	NA	0.033	0.034
12/17/2015	0.014	0.028	**0.012**	0.021	NA	NA	0.016	0.027
12/18/2015	0.014	0.029	**0.013**	0.021	NA	NA	0.018	0.028
12/21/2015	0.025	0.033	**0.016**	0.022	NA	NA	0.018	0.028
12/22/2015	0.030	0.035	**0.023**	0.025	NA	NA	0.032	0.034
12/23/2015	0.013	0.028	**0.006**	0.018	NA	NA	0.008	0.023
1/4/2016	0.007	0.025	0.024	0.026	NA	NA	0.008	0.023
1/5/2016	0.014	0.028	0.015	0.022	NA	NA	**0.016**	0.027
1/6/2016	**0.024**	0.033	0.019	0.023	0.014	0.020	0.023	0.030
1/7/2016	**0.029**	0.035	0.023	0.025	0.023	0.024	0.032	0.033

Table 5.1 Daily Air Monitoring Results

Date	#West Station		*North Station		*East Station		*South Station	
	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA	Work Shift Average	24-hour TWA
1/8/2016	**0.047**	0.042	0.029	0.027	0.034	0.029	0.045	0.039
1/11/2016	**0.022**	0.032	0.019	0.023	0.022	0.024	0.013	0.025
1/12/2016	0.020	0.031	0.019	0.023	**0.019**	0.023	0.025	0.031
1/13/2016	0.031	0.036	**0.027**	0.027	0.030	0.027	0.036	0.035
1/14/2016	0.030	0.035	**0.022**	0.025	0.021	0.023	0.025	0.031
1/15/2016	**0.019**	0.031	0.013	0.021	0.012	0.020	0.018	0.028
1/18/2016	0.006	0.025	0.009	0.019	**0.006**	0.017	0.010	0.024
1/19/2016	0.013	0.028	0.015	0.022	**0.013**	0.020	0.017	0.027
1/20/2016	0.030	0.035	0.024	0.025	**0.025**	0.025	0.032	0.033
1/21/2016	0.049	0.043	0.037	0.031	0.040	0.031	**0.052**	0.042
1/22/2016	0.050	0.043	0.037	0.031	**0.046**	0.034	0.056	0.043
1/25/2016	0.023	0.032	0.018	0.023	NA	NA	0.024	0.030
Minimum	0.001	0.023	0.004	0.017	0.003	0.016	0.001	0.021
Maximum	0.108	0.068	0.067	0.043	0.070	0.044	0.094	0.059
Average	0.028	0.034	0.021	0.024	0.024	0.025	0.029	0.032

Notes:

- Modem connection problem to the network denoted by "NA"
- **Bold** - denotes station generally considered to be upwind on day of readings

The maximum reading at the west station (0.108 mg/m^3 - Nov. 2) corresponded to the commencement of the bedrock trenching process at the north end of the Pilot Trench in the proximity of the initial west air station set up. Upon starting the trenching process, minimal groundwater was initially encountered. Once the trenching process continued down-gradient, groundwater was continually encountered within the trench, limiting the creation of dust during the trenching process. The maximum reading at the south station (0.094 mg/m^3 - Dec. 11) corresponded to the completion of the trenching when the trenching equipment was moved out of the trench area to the south and cleaned off prior to mobilizing to the laydown area for disassembly. These days were considered the "worst case" days in the creation of dust and similar conditions would not be anticipated as work to complete the installation of the trench components is conducted.

6. Recommendation for Cessation of Ambient Air Monitoring

The 24-hour TWA readings are considerably lower than the action level of 0.15 mg/m^3. Any continued work in completing the trench will occur while dealing with the collected groundwater within the trench and should aid in the suppression of any created dust issues.

In addition, composite samples of the created trench cuttings were collected and submitted for analyses of chemical testing for total PCBs. Sampling was performed between 0+40 to 2+00 at the north end of the trench, 2+00 to 4+00 over the shallow portion of the trench, 4+00 to 5+50, 5+50 to 7+00 and 7+00 to 8+30 as the trenching proceeded south. The results of the chemical testing were all reported below the laboratory detection limits.

At this juncture of the construction on the Pilot Trench, it does not appear that the ambient air monitoring is productive, as all results to date have been well below the action levels. The stone within the working platform around the Pilot Trench appears to act as a collection area for site run off. Along with the groundwater within the trench, the working conditions will be relatively moist during the clean out and installation of remaining components within the Pilot Trench and it appears that continued ambient air monitoring with the real time stations should not be required.

The general contractor, Sevenson Environmental Services (SES), will continue to use portable dust monitors in the immediate work area (worker's breathing zones) and at designated off-site locations (if necessary) to monitor airborne dust concentrations as part of their Health and Safety program. At the conclusion of each work shift, the recorded data from these instruments will be filed, downloaded, and stored by SES.

If airborne concentrations of dust or VOCs are detected above the action levels established for the site, designated site safety personnel, site superintendents, affected workers, and GHD representatives will be notified and appropriate actions will be taken to ensure the health and safety of the site workers as well as potential off-site receptors.

Appendix H
Photographic Log

Photo 1: Trencher at WW, looking south. Nov. 2015

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 2: Trencher at WW, looking north. Nov. 2015

Photo 3: Trencher moving south from inflection point. Nov. 2015

Photo 4: Trencher prior to inflection point. Nov. 2015

Photo 5: Tree clearing north of new GWTP. Nov. 2015

Photo 6: Trench north of bend. Nov. 2015

Photo 7: East wall of trench at 5+00. Nov. 2015

Photo 8: West wall of trench at 5+00. Nov. 2015

Photo 9: Loading contaminated soil. Nov. 2015

Photo 10: Trench from 5+75 to 6+25. Nov. 2015

Photo 11: Trench at 6+50. Nov. 2015

Photo 12: Trench at 6+50 stopped. Nov. 2015

Photo 13: Surficial void at 6+70. Nov. 2015

Photo 14: East side of vertical fracture at 6+70. Nov. 2015

Photo 15: West side of vertical fracture at 6+70. Nov. 2015

Photo 16: Vertical fracture at 6+90. Nov. 2015

Photo 17: East side of vertical fracture at 6+90. Nov. 2015

Photo 18: West side of vertical fracture at 6+90. Nov. 2015

Photo 19: East trench wall near 7+50. Dec. 2015

Photo 20: Orange marking at 7+50. Dec. 2015

Photo 21: Pink line at end of trench. Dec. 2015

Photo 22: Extended working platform. Dec. 2015

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 23: Pipe trenches to WTP. Dec. 2015

Photo 24: Exposed trench from 3+50 to 3+20. Dec. 2015

Photo 25: Connection at WTP containment area. Dec. 2015

Photo 26: PIV for new firemain. Dec. 2015

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 27: Joint restraints on firemain (deep). Dec. 2015

Photo 28: Joint restraints on firemain (shallow). Dec. 2015

Photo 29: Thrust block for firemain. Dec. 2015

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 30: Concrete breaking at MH-10 and MH-14. Dec. 2015

Photo 31: Manhole placement at MH-10 and MH-14. Dec. 2015

Photo 32: Fire hydrant at new WTP. Dec. 2015

Photo 33: Rock breaking east of GWTP. Dec. 2015

Photo 34: Pressure testing of firemain. Dec. 2015

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 35: Laying pipe in trench. Dec. 2015

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 36: Fence panels over trench. Dec. 2015

Photo 37: Pipe trench towards Adler tank. Jan. 2016

Photo 38: Pipe trench looking southeast. Jan. 2016

Photo 39: Water in pipe trench. Jan. 2016

Photo 40: Trench cleared for sheet piling. Jan. 2016

Photo 41: Sanding access road due to freezing. Jan. 2016

Photo 42: East side of pilot trench at 3+20, looking north. Jan. 2016

Photo 43: West side of pilot trench at 3+20, looking north. Jan. 2016

Photo 44: Ice in pipe trench. Jan. 2016

Photo 45: Setting pipe into MH-7. Jan. 2016

Photo 46: Grading north of GWTP. Jan. 2016

Photo 47: Trench cleanout for vinyl sheet installation. Jan. 2016

Photo 48: Vinyl sheeting installation. Jan. 2016

Photo 49: Trench cleaned out north of 4+70. Feb. 2016

Photo 50: Cleaning out trench south of 4+70. Feb. 2016

Photo 51: Buildup of fines at trench bottom. Feb. 2016

Photo 52: Clay-infused fracture as trench turns north. Feb. 2016

Photo 53: Lowering super sack for dam. Feb. 2016

Photo 54: Sump location cleaned out. Feb. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 55: South trench with cuttings removed. Feb. 2016

Photo 56: Trench cave-in. Feb. 2016

Photo 57: Trench video and survey verification. Feb. 2016

Photo 58: Sump cleanout. Feb. 2016

Photo 59: Horizontal fracture from 8+00 to 8+65. Feb. 2016

Photo 60: Sheet piling to inflection point. Feb. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 61: Runoff from working platform. Feb. 2016

Photo 62: Piezometer in trench. Feb. 2016

Photo 63: Pouring grout using concrete bucket. Feb. 2016

Photo 64: Angle connection for vinyl sheeting. Feb. 2016

Photo 65: Vinyl sheet piling to the south. Feb. 2016

Photo 66: Monitoring wells inside the trench. Mar. 2016

Photo 67: Road erosion at guard rail on east side of Bailey Scales Road. Mar. 2016

Photo 68: Flow in creek downstream of site. Mar. 2016

Photo 69: Flow just past North Jackson. Mar. 2016

Photo 70: Flow at Broomsage Bridge. Mar. 2016

Photo 71: Water in DB-5 cleared up. Mar. 2016

Photo 72: Grout placement using concrete bucket. Mar. 2016

Photo 73: Erosion protection installed by SES on east side of the Bailey Scales Road. Mar. 2016

Photo 74: Riprap at discharge under Bailey Scales Road. Mar. 2016

Photo 75: Completion of vinyl sheeting. Mar. 2016

Photo 76: Floating barge in DB-5. Mar. 2016

Photo 77: Completion of grout placement. Mar. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 78: Stone placement in base of trench. Mar. 2016

Photo 79: Gravel base placed in trench. Mar. 2016

Photo 80: Absorbent boom at SW outfall to SW pond. Mar. 2016

Photo 81: Welded perforated pipe. Mar. 2016

Photo 82: Water quality in creek downstream from site. Mar. 2016

Photo 83: Welding perforated pipe to WW sump. Mar. 2016

Photo 84: Sump and perforated pipe in north trench. Mar. 2016

Photo 85: Stone placement at northern cleanout. Mar. 2016

Photo 86: Stormwater discharge from DBs (filter socks on discharge). Mar. 2016

Photo 87: Stone backfill in north trench section. Mar. 2016

Photo 88: WTP discharge around WW4 chamber. Mar. 2016

Photo 89: Piezometers in south trench. Mar. 2016

Photo 90: Perforated pipe in south trench. Mar. 2016

Photo 91: Welding south cleanout. Mar. 2016

Photo 92: Sump pipes set into trench, surrounded by 2-inch stone. Mar. 2016

Photo 93: Filter fabric over north trench. Mar. 2016

Photo 94: Clay backfill over north trench. Mar. 2016

Photo 95: Cutting vinyl sheets to bedrock. Mar. 2016

Photo 96: Cover clay before pending rain. Mar. 2016

Photo 97: Blind flange on backwash line. Apr. 2016

Photo 98: Stone backfill in south trench. Apr. 2016

Photo 99: Cutting holes in WW chamber. Apr. 2016

Photo 100: Filtration media over north trench. Apr. 2016

Photo 101: Covered filtration media over north trench. Apr. 2016

Photo 102: Discharge from pilot trench at modutanks. Apr. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 103: Pipe manifold connection at existing WTP. Apr. 2016

Photo 104: Backfill behind sheets at sump area. Apr. 2016

Photo 105: Stone placed in south trench. Apr. 2016

Photo 106: Secure site during rainfall event. Apr. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 107: SW discharge after DBs settled. Apr. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 108: Backfilling working platform. Apr. 2016

Photo 109: Placement of filtration media at working platform. Apr. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 110: Covering of filtration media at working platform. Apr. 2016

Photo 111: Backfilling around sumps with 2-inch stone. Apr. 2016

Photo 112: Levelling subgrade with #11 stone and filter fabric at WW sumps. Apr. 2016

Photo 113: Compacting subgrade around WW4 sumps. Apr. 2016

Photo 114: Setting south chamber base for WW sumps. Apr. 2016

Photo 115: Setting top of south chamber for WW sumps. Apr. 2016

Photo 116: Backfilling around WW chambers. Apr. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 117: HDPE sleeve between WW chambers. Apr. 2016

Photo 118: Overflow pipe from WW3. Apr. 2016

Photo 119: Clay level around WW chambers. Apr. 2016

Photo 120: Bypass access road. Apr. 2016

Photo 121: Pumping DB-2 water through bag filters. Apr. 2016

Photo 122: Risers installed on firemain and forcemain MHs. Apr. 2016

Photo 123: Filtration media over south trench. Apr. 2016

Photo 124: Killdeer eggs north of GWTP. Apr. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 125: Filtration media south of WW4. Apr. 2016

Photo 126: Backfilling south trench. Apr. 2016

Photo 127: Clay from GWTP placed over south trench. Apr. 2016

Photo 128: Removal of generator for GWTP. Apr. 2016

Photo 129: Excavating north of GWTP. Apr. 2016

Photo 130: Lightning strike of tree by GWTP. May. 2016

Photo 131: Backfilling south trench. May. 2016

Photo 132: Storm drain along east side of GWTP. May. 2016

Photo 133: Excavating beside Old Barlow Lane. May. 2016

Photo 134: Excavation for 8-inch forcemain. May. 2016

Photo 135: Forcemain to EQ tank. May. 2016

Photo 136: Backfilling conduit trench to pull box. May. 2016

Photo 137: Forcemain in trench north of drive area. May. 2016

Photo 138: Storm drain from east side of GWTP to north area. May. 2016

Photo 139: First lift of stone on drive area. May. 2016

Photo 140: Blocked access road from Barlow Lane to trench. May. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 141: Transition from 12-inch to 18-inch stone at drive area. May. 2016

Photo 142: Diverted outfall pipe and flagging around WW4 chamber. May. 2016

Photo 143: Compacting stone over outfall pipe. May. 2016

Photo 144: Infiltration media south of WW4 chamber. May. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 145: Grounding loop and conduits on west side of WW4 chambers. May. 2016

Photo 146: Conduits run for WW4 cables and generator. May. 2016

Photo 147: Conduit and forcemain at south edge of liner limits. May. 2016

Photo 148: Clay over fill along south trench forcemain. May. 2016

Photo 149: Grounding inspection well by generator. May. 2016

Photo 150: Forming rebar mat for generator pad. May. 2016

Photo 151: Preparing for liner repair around power poles. May. 2016

Photo 152: Posts for electrical panel at WW4. May. 2016

Photo 153: Concrete pour for containment around generator pad at GWTP. May. 2016

Photo 154: Grading clay over south trench area. May. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 155: Liner placement over trench area. May. 2016

Photo 156: Liner repair at firemain and PIV. May. 2016

Photo 157: Geocomposite and filter fabric over liner. May. 2016

Photo 158: Backfill over power pole and guy lines. May. 2016

Photo 159: Backfilling anchor trench at north end. May. 2016

Photo 160: Placing common fill over liner. May. 2016

Photo 161: Grout sealing of MH-16. May. 2016

Photo 162: Grading #53 stone around GWTP. May. 2016

Photo 163: Re-establishing low flow channels in DB-4. Jun. 2016

Photo 164: Placing stone in DB-4 low flow channels. Jun. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 165: Backwash pipe connected for SW pond discharge. Jun. 2016

Photo 166: Power cables and fiber optic pulled to WW4 control panel. Jun. 2016

Photo 167: Riprap around DB-5 outfall pipe. Jun. 2016

Photo 168: Riprap in low flow channel for DB-4. Jun. 2016

Photo 169: Lowering pump into WW4. Jun. 2016

Photo 170: Installation of electrical panels at WW4. Jun. 2016

Photo 171: Grading topsoil over trench area. Jun. 2016

Photo 172: Grading topsoil over PIV and MHs. Jun. 2016

Photo 173: Pressure valve outside of WW4. Jun. 2016

Photo 174: Grading topsoil around WW4 and to the north. Jun. 2016

Photo 175: Seeding north of new GWTP. Jun. 2016

Photo 176: Seeding and erosion control mat over trench. Jun. 2016

Photo 177: Extending SW pipe at southeast corner of GWTP. Jun. 2016

Photo 178: Backfilling over 8-inch forcemain. Jun. 2016

Photo 179: Placing #53 stone for WW4 access road. Jun. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 180: Compaction of #53 stone for WW4 access road. Jun. 2016

Photo 181: Placement of rock southeast of WW4. Jun. 2016

Photo 182: Laying out diesel pump pad. Jun. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 183: Access road to WW4 and around DB-4. Jun. 2016

Photo 184: Seeding former modutanks area. Jun. 2016

Photo 185: Conduits between WW4 and diesel pump pad. Jun. 2016

Photo 186: Placing stone for pad around WW4. Jun. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Photo 187: Hooking up backup pump near WW4. Jun. 2016

Photo 188: Floats and transducers in WW4. Jun. 2016

Photo 189: Re-enforcing rock barrier with riprap. Jun. 2016.

Photo 190: Seeding and placing erosion control mat in DB-3. Jun. 2016

Photo 191: Shutoff valve on generator pad discharge. Jun. 2016

Photo 192: WW4 guard rails installed. Jun. 2016

Photo 193: Raising pipe into MH-7. Jul. 2016

Construction Certification Report for Pilot Perimeter Groundwater Trench Collection System

Appendix I
Copies of Field QA Records

Mon Nov 2/15
weather: 43° F Clear high 75°F
6:30 Air stations & air calibration - all units at trailer 6340
7:00 SES H&S General use of PPE

Air station set up	W	N	E	S
mg/m^3	0.018	0.021	0.025	0.025
Power/network connection	✓	✓	✓	✓

8:00 Glenn Turcham - call regarding SEC issues forwarded by C. Hiatt.
- C Hiatt has heard from GM Plant inadequate response by GHD to SES requests by Mike Reynolds (Bedford Utilities).
- 4 issues - requests escort on site.
  - GHD does not want written records.
  - concerns with concrete washout.
  - documentation from M. Reynolds on inspections
- all day issue.

- trench (today) pumped out ~8000 gallons
- SES have bridge on site for assembly - to be used by BRG for surveying depth.

16:30 Conference call J McGuigan.
K. Kamm
T. Lee / P. Bridout.
- all GHD inspections require an escort.
- if no written report → document and submit through email to filing.

17:20 SES equip't off
1730 SES off site.
Air station collection for charging.
18:15 off site.

daily SEC inspections to now be implemented.

* crew to be in a 6:30 to pump out trench for trencher to start up after safety meeting in a.m.

SUBJECT | DATE

Tues Nov 3/15

Weather: 40°F Clear high 75°F

6:30 Air Stations ∅ air cal all units at trailer 6:40am.

7:00 SES H&S: Safety around open Trench.

Air station set up. W N E S.

mg/m^3 0.024 0.025 0.023 0.024

Power/Network connection ✓ ✓ ✓ ✓

moved ~~w/o~~ for access to pumps by SES

moved ~10' N for GHD MW access.

Bill Steinmann & J. McGuigan on-site.

⟶ GM safety Training.

- site tour & trenching explanation.

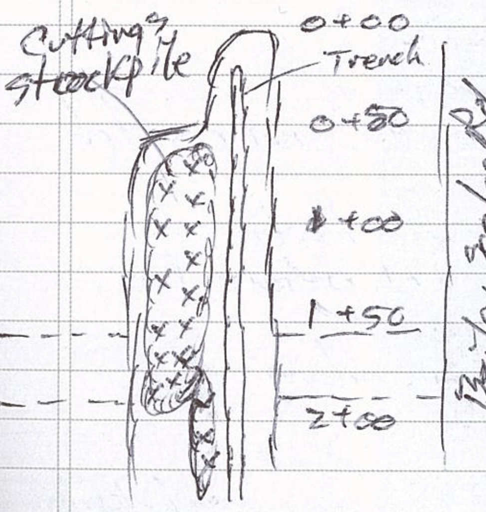
11:00 Trench spoils - sample frequency

- composite sample every 200'

- presently at 200'

- SES grading work platform with excess stone.
- cont' trenching (water truck available if needed)

↳ air monitor exceedance.



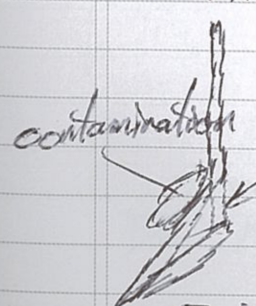
- 15 point composite sample of trench cuttings
- sample sent for total PCBs.

FedEx ⟶ taken by GM sample team.

GM Personnel on site

Chet, Hiatt, Ed Peterson, Bill McFarland, Mari Kay Scott

- on site to tour remediation, GWTP & trench.



extend N-S trench & align to original clean out location.

- shift trench alignment to avoid missed contamination removal

Chris Porter BRG Sketch to RH

Gok

1720 Eq't SES down & 17:30 SES off site.

Air station collection & charging

18:15 off site.

Wed Nov 4/15
Weather: 50°F Clear High 76°F
0630 Air station - ø air cal. all units at trailer.
7:00 SES H&S. Front End Loader Eq't.
Air station set up W N E S
mg/m^3 0.038 0.030 0.020 0.032
Power/Network Connection ✓ ✓ ✓ ✓

- trenching & backfilling. video shot @ 0+30, 0+50, 0+75, 1+00 & 1+25
- decon moxy's.
hold off / Cheryl wants video of ~~trench~~.

		SES.	GHD.
13:00	Glen Turchan	Dave, Randy, Shane.	Jim Mc.
	Jc Paz		Tim, Pete.
	Dale Charters.	Mc Intyre	Gary
	Rick H.		Wade.

generally all seepage zones observed on west side of trench.

① None. - Mc Indy.
- SES

Bill Doyle - next week Audits

i) 1+90 completed. to. first 40' not counted
ii)
② C.O. when. SES budget today to Katie
& will forward. to GM before Fri.
Rock breaking is included in C.O.
iii) RH. to have top of stone elev. along
Barlow Lane.
SES. have ~~($700 yd³ credit to move)~~
- broken into 2 line items. to move stockpile
- grading plan for stockpile. → CAD dept working on it.
SES
Construction Plan - just courtesy call.
- we can discharge
daily 1st week. daily
2nd 3rd 4th weekly
then monthly
- plant must run 1 week 5 days testing.
-

SUBJECT

DATE

- Geophyseal Testing complete. Fri.

③ Grading
None.
Tree cutting tomorrow.

④ Comp
Grnd Grid Installation.
Steel Tank 90% done.
4 Carbon Vessels in Bldg
2 more today.
Valves to comp tomorrow. - 2 trucks.
SES Dump Trucks tomorrow.

2 wk
Plumbing in Plant
Open Steel Tank.
Sprinkler in Plant
Roof on Bldg
Masonry Block on Bldg.
Switch Gear

- concrete for containment tanks. in couple wks

Fire Prevention Manager to be on site next wk.

Weather Permitting Sat & Sun.
email Plant to acknowledge.
will Cont for next month.

SES. - 160' of trench excavated
working platform
stone tomorrow to complete
batch testing
back filling trench.
2 wk - Mtl's coming next wk. - impact soil removal.
Grading Plan to move stock pile
- cont trenching & backfilling.
bypass SW pumping
trencher averaging 36'/day.
~~PS~~ - Month. Pipe installation.

GM

FOCUSED INSPECTION CHECKLIST

SECTION 6 SITE CONTROL AND DECONTAMINATION

Inspection Date: Nov 4/15

Inspector: Pete Bridcut

Project Name: GM CET Bedford.

Project Location:

Address: 320 GM Drive

City: Bedford

State: IN

Zip: 47421.

GM Project Manager: Cheryl Hiatt.

Consultant Name: GHD.

Consultant Project Manager: Jim McGuigan.

Consultant Superintendent: Katie Kamm

Consultant Site Health & Safety Officer: P.Bridcut/T. Lee.

Contractor Name: Sevenson Environmental Service

Contractor Project Manager: Jim Pazderski

Contractor's Superintendent: Randy Campbell

Contractor Site Health & Safety Officer: Dave Leising.

CHECK IF NOT APPLICABLE ☐

ITEM NUMBER	AUDIT QUESTION	YES	NO	NA	COMMENTS
1	Work areas (zones) have been clearly identified and communicated to site personnel?	☒	☐	☐	Decon of Moxys into impact stockpile zone
2	Personal decontamination procedures for the level of PPE is being followed?	☒	☐	☐	Face shield used when spraying down Trucks
3	Equipment decontamination is being conducted properly?	☒	☐	☐	
4	Decontamination waste is being handled properly?	☒	☐	☐	impact zone contained with lined clay berm.
5	Decontamination methods are being implemented to ensure contamination is not spread beyond the CRZ?	☒	☐	☐	

SECTION 6 SITE CONTROL AND DECONTAMINATION

Safety Observation Tour:

Safe Observations	Corrective Measures	Completion Dates
Worker wearing face shield during spray operation.		
Plastic under cleaned tires on access ramp.		
Raised Bed directed run off to containment zone		
Worker outside cleaning area to provide support + control water		

Unsafe Observations	Corrective Measures	Completion Dates

(8) Bill Doyle - Thurs.

separating 200' sections.

Air. ~~A~~ will be moved to

(9) SES up to speed on Documents on site.
MH's by 20th

(10) KK. Janey Shanal
- nobody / Mason Trucking.
McIntyre
nothing: currently. were not utilizing the appropriate trucking route.

(11) Large trucks on East Oolitic Road.
→ was concerned we were hauling contaminated

(12) SES - can Cheryl confirm progress payments.
1st has been submitted.
2nd to be submitted.

(13) - teeth change out are limited as of yet
pattern changes.

GM appreciated that concrete wash out replaced - GHD/McIntyre
with roll off box

1145 - 1st moxy deconned & okayed on inspection.
1430 - 2nd moxy decon inspected & ok.

1430 GM personnel off site

- trencher down (differential heating up) shut down for 20 min every couple of hours to cool down.
- due to slope, trencher does not have down force on chain that would be desired (trencher bouncing / skipping off rock) → chain expected to come off due to this
- finally happened - expected to have occurred sooner
- trench backfilled cont'd to ~17:00.

17:15 Eq't down / pump off
Air Station collection for charging
18:00 Off site

SUBJECT

Thurs Nov 5/15

DATE

Weather: 59°F Overcast high 75°F

6:30 Air station pickup - ϕ air calibr. all units at trailer 6:40

7:00. SES H&S. Accidents can occur in a single second.

Air station set up	W	N	E	S
mg/m^3	0.035	0.040	0.030	0.032
Power/network connection	✓	✓	✓	✓

- trencher down - chain drive off from trencher bearing,
- Finish backfilling trench.
- trucks hauling stone for working platform.

10:00 E station not registering on network. - network connection loose on station, reinserted & fixed.

Day 2 SES WTP sampling.

Effluent	8	40300.	0.80	14:25	MS/MSD
Lag carbon	6	40301	1.07	14:30	
Lead carbon	7.	40302	1.32	14:34	
Sand Filter 1	3	40303	1.92.	14:37	
Influent	1	40304	3.64	14:40.	

to 17:20 E Monitor for samples.

17:30 SES off site.
Air stations collected & charged.

18:15 Off site.

Fri Nov 6/15.
Weather: 65°F Overcast high 67°F.

630 Air stations ϕ aircalibr all units at trailer 640.
700 SES H&S: Dress for the Job.

Air station set up: W N. E S
mg/m^3 0.020. 0.011 0.017 0.023

Power/network.
- trenching to be up & going.
- scaffolding to be set up for trucks on Monday.
- pump crew was in at 4:00 am to pump water

- 0.82" Rain Overnight.

12:10 Jack Spires - GM security 812 276 9050,
trucks are ok for using GM scales
starting Monday
- do after shift change.

Photo download.

13:00 SES WTP Sampling. — 3rd weekly Test (2 more)
+ Sample Prep for Saturday delivery.
15:30 3rd Batch test ND → dump 3rd Adler Tank.
17:20 SES Eq't down.
Air station collection for charging.
N, E & S stations brought in for weekend.

18:15 Off site.
Cooler delivery to Fed Ex for Saturday delivery

McIntyre to be working Sat./Sun.
G. Seng to be on site for GHD.

GHD

STEVEN BAVETZ

GHD 6520 Corporate Drive Indianapolis IN 46278 USA
T 317 291 7007 **D** 317 291 7020 **M** 317 441 9588
E steven.bavetz@ghd.com **W** www.ghd.com

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

SUBJECT

Mon Nov 9/15

DATE

Weather: 32°F Clear high 56°F (late rain)

6:30 Air stations ϕ air calibrat. all units at trailer 6:40.

700 SES H&S. : JSAs contamination handling/scaffolding

Air station set up	W	N	E	S.
mg/m³	0.021.	0.030.	0.026	0.036
Power/network	✓	✓	✓	✓

- trenching to cont'
- scaffold assembly & lining of trucks for contamination.
- untarp limited area of contamin. stockpile (pending p.m. rain)
- G-Seng contacted by SES
  - unhook outfall pipe & remove bridge over bypass pipes
- Final Meeting Minutes - Oct → sent out.
- Draft Minutes 11-04-15 - sent out.

8:00 Mike Reynolds - 3rd batch sample ND. - chem results are available
1 812 788 0303
- SES will discharge Adler tank to creek.

GHD - Steve Bavetz - on site to sign manifests

as per S. Reynolds SES - only 1 set of scales operating at Twin Bridges
- trucks held up ~ 40min for weighing.
- only 2 rounds of trucks today

→ to contact Twin Bridges on clearing up issue.

12:00 M. Curtis - message that E air station was down (Brett)
- station checked (network - 3 sec flash + power → ok)

14:40 1800 301 9663 Pine Enviro - Matt Manion. ↳ left on to collect data
E air station : → Matt appears off line ~ ½ hr ago
- will look into issue.

15:45 Matt Manion - Netronics have everything up & going

11:05 J. McGuigan - C. Hiatt wants trench videos for presentat
0+75 video sent by zbig4email (780Mb)

13:00 - video taken of trench using pipes - sent to JMc. (450Mb) M. Curtis.

2 hrs.

SES WTP sampled - 4th day of testing - 1 more req'd

Emonitor - 5 day TAT file not properly saved as FSK file?

17:20 SES Eq & Trencher down → at CRAWTP outfall
Air station collection for charging.

18:00 Off site → FedEx delivery for SES water samples

0.12" Rain

Tues Nov 10/15
Weather: 43°F Fog high 59°F Cloudy
630 Air stations ∅ air calibration all units @ trailer 6:40
700 SES H&S - Spotter's Responsibility.
Airstation setup. W M E S
mg/m³ 0.027 0.028 0.018 0.021
Power / Network ✓ ✓ ✓ ✓
- trenching cont' - starting to encounter hard rock at sump (WW4)
- GPS issues at grade change (SES encountered this before)
- SES will encounter hard rock up south slope (from rock breaking)
- hauling contamination (8 Young Trucks)
RAIN 0.12" 6:45
Power ✓ all units
Network ✓ all units
9:30 not registering on network → stations checked status - lit on all unit
10:30 Phil Curtis. - Pine Enviro - could be cell carrier problem
- ~5th call today with same connection problem.
- will get back to me from trobble shooting
9:55 → Composite soil Sample - Trench Cuttings 2+00 to 4+00
- sent out 1 day TAT (dup) on 15 pt. composite sample
pcurtis@pine-environmental.com
13:30 Phil Curtis - Pine - wide spread cell carrier outage reported today by several systems.
- Keep systems on → Flash drive should recover data when back on line

Rawa Fleisher Re: SES WTP Batch Results
↔ contact for looking into status of results with TestAmerica.
- rush results from Nov 6th } will be available tomorrow p.m.
- status passed onto SES (pending rain tomorrow & next Tues)
16:30 Brett Tarkington - GHD
- will be leaving units on overnight in hope of having data retrieved if network comes back on line
- will record work hours
SES p.m activities - trenching
- south work platform grading.
in prep for trenches.
17:25 East Air station collected for charging.

17:45 Off site.

SUBJECT Wed Nov 11/15 DATE

Weather: 32°F Ptly Cldy high 66°F

6:30 Air stations & air calibration, E station at trailer 6:40

700 SES H&S. Pay attention/watch what you're doing.

Air station	W	N.	E.	S.
mg/m	0.056.	0.028	0.039.	0.049.
& air calibration	✓ restarted 7:55	restarted ✓ 7:10	trailer	restarted ✓ 7:40
Power/network	✓	& air @ 7:45 ✓	✓	✓

700 4 trucks on site for loading contamination.
- sweeping Bailey Scales.
- cont' trenching / south working platform.

11:45 - W, E & S. station on-line *N station not on-line

9:48 - Phil Curtis ~~Air~~, stations not on-line (off line as of 8:55)
- Does GPS on trencher ~~effect~~ modem?
- will check with Metronics.
- email to update Brett Tarkington, K. Kamm, P. Galloway

1300 GHD. - S.G. P. Brodeur SES - Shane, Dave. McIntyre - Ryan Griffith
T. Leo, D. Charters

pH. - KK, RH, ~~GT~~ GM Cheryl.
JMc. Ed Peterson.

(1) H&S Mc → None.
SES → None.
Tomorrow Mc & SES 3rd Party.

(2) Pilot. - Trench update

C.O. KK to Forward to Cheryl today

Requests - Revisiting pipe line grading
RH finalizing today
Action Plan - Trenching Spoils

Rubble + 6" minus + Trenching Spoils
Soil Handling
RH on site Tues, Wed to discuss on site with KK

Winterization of WTP
· Temperatures starting to drop -

Liner Sub → after Nov 1 → T&M
CH can work something out.

④ McI. GWTP
complete - update schedule sent out.
- Bldg completed.
- deliveries to be this week.
- Fire this week.
Mid Atlantic → tanks finished.
- underground piping.
- electrical in plant
- temp. lighting inside
2wk concrete pours minor.
- will coordinate with.

SES Working Platform
Past Outfall
Trucking - Mon.
ManHole Delivery Tues.

Trucking & Trenching - 2wk.

Pipe Work. to 1

with Force main → 20th of Jan

critical → 2 west lines (Fire line).

RH - will need to provide. dwgs.

chambers should be on site for Thanksgiving
(wk break for XMas).

direction of installation.

3. **Week of 11/23/15 through 11/27/15**
    a. Continue Interior piping
    b. Rentention Pad Concrete
    c. Truck Pad
    d. Interior Electrical and Lights
    e. Buildout of interior rooms
    f. Receive Switchgear and Transformer

4. **Schedule Questions:**

Change Orders:

1. C.O. #3 need to issue - Rip Rap and Building Permits
2. Fencing
3. C.O. #4 Bathroom
    a. Doors
    b. Windows
    c. Acoustical Ceilings
    d. Lights
    e. Revised heating and cooling
    f. Drywall
    g. Bathroom Fixtures: Toilet, sink, grab bars, mirror, sanitary

Open Questions/Concerns:

1. Congested area, # of lifts
2. Current set of plans - ones on table were older version
3. Painting
4.

Weekly Construction Meeting
Groundwater Treatment Plant
Tuesday, November 10th, 2015

Safety:

- GHD Safety Audit Thursday – Bill Doyle
- Pre-Task Plans for upcoming work.
    - Welding
    - Underground Pipe Work

Submittals:

1. Air Handling Units – returned with comments
2. Heat Trace and pipe insulation – need follow-up

Schedule:

1. **Week of 11/09/15 through 11/13/15**
    a. Building Trim-out
    b. Ceiling framing and deck
    c. Clean building
    d. Concrete Stairs
    e. 8″ to 6″ Pipe under Truck Pad
    f. Hang pipe
    g. Finish Overhead Doors
    h. Electrical Cable Tray and conduit
    i. Unload pump skids – Wednesday
    j. Fire Protection – Shambaugh
    k. Tank Erection (Mid Atlantic)

2. **Week of 11/16/15 through 11/20/15**
    a. Finalize Building – Architectural Build-out
    b. U/G pipe in Retention Area
    c. Receive, Unload, Set Filter Skid
    d. Continue to hang pipe
    e. Electrical Conduit
    f. Start final grading and rebar at Retention Pad

Date

Reference No. 13968 / 89428

Construction Progress Meeting Sign-in Sheet
Bedrock Pilot Trench and GWTP
GM Remediation
Bedford, Indiana

Company Name	Represented By	Telephone No.	Fax No.	Email Address
Sevenson	Randy Campbell	812-278-9584		
SEVENSON	Don LaVerdi			
Sevenson	Shane Reynolds	812-278-9584		
" "	Jim Pazderski			
" "	Larry Elia			
GHD	Dale Charters	2693770042		
SEVENSON	DAVID Leising	716-669-2902		
GHD	TIM Leo			tim.leo@GHD.com
GHD	Steven Bautz	317-441-9588		steven.bautz@ghd.com

SUBJECT

DATE

- lab is short staff.
- North Canton. is ok

payment.
- critical line item

Trench Cutting.
KK water - from Trench.
Turbidity - is ~~good~~ results.
ww3 generally < 10 ppb.
gw. appears good.

SES - 1st invoice on trench work.
- has CH received it. (has not seen it)
4903 - 2nd invoice has been forwarded. (for Oct)
4892 ~~4903~~ SES still having ~~courier~~ difficulties.
in getting invoices to GM.

Randy Campbell 3 gawkers. - stopping on Bailey Scales.
Dave -> no traffic issues. to date,

SEC Mike Reynolds - accepting verbal chemical results prior to discharge to creek.

McI - Sat & Sun last wk.

GHD awaiting response. GM to be contacted.
from McI.

~~SES~~ - crew will
HLC -> Saturdays.
HLC shut down. Thanksgiving
GM off this coming Monday. -

GM will be on-site 17th + 18th.

Flight to be booked home.

video taken at Trench location of
south end of WW 4 installation (~3+90)

- video of trench set up (Temporary sump to be installed)
  with water in base of trench.
- scaffolding bridge set up with working platform
  as base + excavator bucket set up to support
  back side (N side) while on bridge.
- video sent (2 big 4 email) → B. Steinmann
  - K Karam
  - R Hoekstra.
  - J McGuigan.
- SES WTP batch results 11-05-15 → ND.

14:30 message left for Mike Reynolds - discharging 3rd Adler tank
  - results are available for pick up
  - 5th batch sample collected from SES WTP
  - sample sent to North Canton (oked by C. Hiatt)

17:30 SES + HLC off site - N station - no network data all day
  - left running overnight.
  W, E + S stations collected + charged.

18:15 off site.

SUBJECT 0.08" Rain. DATE

Thurs. Nov 12/15.

Weather: 49° F Cldy high 56°F. Windy.

630 W, E & S. Air stations ø air calibr. at trailer 6:40.

700 SES H&S: Ladder / scaffolding safety.

Air stations	W	M	E.	S
mg/m^3	0.011	0.004	0.018	0.010.
Power/network.	✓	✓	✓	✓

→ not registering on network.

8:30 Matt Manion. - Pine Environ. - Metronix problem - modem/carrier issue
- email to B. Tarkington - M unit off line, replaced with back-up
- if no connections by afternoon - all modems pulled to replace SIM cards
Metronix FedEx Account 4399 6802 8.

- Forward video of trench work → R. Hoekstra & B Steinman.
am. 0+30, 0+50 pm.
email J. Rothfischer Chrehole info CH-19, CH-53, CH-60,

11:10 812 788 0303 Mike Reynolds - 1st 3 days of SES WTP operation complete
- all ND - in out trailer for him to pick-up
SES informed - will use as clean water for backwash.
(Test America)
No further results today from Pitts. → power down

14:00 Bill Doyle - tour of SES work area.
- signage for Confined Space (Adler tanks)
- checking all pipe lines
→ units back on network ~ 12:00.
B. Tarkington. - send 1 modem at a time for SIM card replacement

- cont' trench.
- hauling contamination. → last Truck in am. (16) 22.4 ton.
- sweeping Bailey Scales Rd. SES to check weight in a.m.

8:00 All units appear on network map
- south data not coming up
`ok - noon

Fri Nov 13/15
Weather: 39°F Clear high 55°F
700 SES H+S Mat'l Handling Safety
630 → Air Station & air calibr. at trailer all units 6:40

Air Station setup	W	Back up Modem N	E	S
mg/m³	0.010	0.007	0.012	0.016
Power/Network	✓	✓	✓	✓

- cont' trenching,
- Fill & grade SES laydown area & road access to pumps & trench
- hauling contamination (9 Young Trucks)
- sweeping Bailey Scales,

8:00 1+00 video to R Hoekstra + B. Steinmam.
- video taken prior to inflection point of trench (4+50)
- horizontal fracture ~20' depth (formation zone)

- BRG to shoot trench cutting sample location.
- met with C. Porter 0+00 - 2+00 - stockpile limits
2+00 + 4+00 - stockpile centre lines
- proposed sample adjenda
- trench cuttings every 150' to end of trench.

13:30 Mike Reynolds - provided chemical results to date.
- reported the site was ok - no defisionse
→ download of 1+00 → FAILED.

- Draft Meeting Minutes sent out.
- SES contamination stockpile tapped & secured
16:30 main crew off site
17:00 Trencher shut down for maintenance prep
- Air stations all brought in for weekend
- charged.
18:15 off site.

SUBJECT

DATE

Mon Nov 16/15.

Weather: 43°F Overcast high 56°F

6:15 Air Station ∅ air calib. all stations 6:25

Arnold Campbell to hold off pumping to Modutank until after meeting

~10' water in WW4 area sump pit. e 3' by trencher (4+80)

7:00 SES H&S: General Work site Safety.

Air stations	W	M (Backup)	E	S
mg/m³	0.030	0.018	0.023	0.036.
Power/Network	✓	✓	✓	✓

7:21 Pilot Trench Water Sample

40325 - Influent Pipe to Modutank.

Video - 4+80 → email JMc, KK, RH, BS, JR.

Soil Sample Trench Cuttings 40326 (MS/MSD)

→ surveyed in by BRG.

→ sent with sample notes. to BS.

FedEx cooler out → 17:00 picked up ✓

12:00 Rain started. (Drizzle at noon).

. trucks done after 2 rounds

- A. Groesbeek. on-site to sign manifests.

SES - hauling contamination.

Young → 2 rounds 8 trucks.

- trenching cont' / backfilling.

17:15 trencher → maintenance

backfilling/grading cont' - shut down

Air Station collection & charging.

18:15 ~~Off~~ Site → 0.05" Rain

4+50 Video Trench → KK, JMc.

* M station modem not returned by Metronix

0.09" Rain Gauge

Tues Nov 17/15
weather, 46°F Rain (light) high 60°F
6:30 Air stations ∅ air calib. all units at trailer 6:40.
7:00 SES H&S: Safe Work Decisions:

Air Stations	W	N	E	S
mg/m³	0.038	0.036	0.023	0.030
Power / Network	✓	✓	✓	✓

wouldn't start or shut off / batteries pulled & rebooted.

- no trucking due to rain
- trenching to cont'
- backfilling trench.
- water management.

- G Seng & M Curtis → Flag pole set up for video
- video attempt at ~ 4+90
- semi successful → can work out bugs.

GoPro Files

009	Trench ✓
011	0+30 ✓
012	0+50 ✓
013	0+75 ✓
014	1+00 ✓
015	1+25 ✓
016	2+50 ✓
024	3+90 ✓
026	4+50 ✓
027	4+50 ✓
029	4+80 ✓
031	4+90 ✓

Progress Meeting Agenda.

- transfer trench video to 2nd backup disk

17:00 - Trencher down - eq't maintenance.

S Reynolds & R Hoekstra → Grading plans & piping alignment
- effective sheet pile at S end - remove
- allow 1" stone → angle of repose.
- place forcemain over bedrock - no breaking required
- breaking will be required from eq'l tank at GWTP
- Find out if MH-7 (or other) is the source to storm water pond

17:45 Air Station collection & charging

~18:15 J Mc & RH. - Rock competency discussion.
- pending geophysics results on bedrock

19:00 off Site

0.07" Rain

✱ N air station modem not received.

SUBJECT

Wed. Nov 18/15

0.16 " Rain Gauge

DATE

Weather: 61°F Drizzle/Rain high 62°

6:30 Air station. ∅ air calib. all units at trailer

7:00 SES H&S ✓ Safe Driving - Seasonal Weather

Air Stations	W	N	E	S.
mg/m^3	0.015	0.010	0.012	0.016
Power/Network	✓	✓	✓	✓

→ SES WTP Chem Results ?

Randy Campbell - Results are in Day 4 & 5

8:10 - ND. - will start discharging today.

815 Mike Reynolds - chemical results are available at our trailer

- ND for 1st wk operation, SES will be discharging

→ - con't trenching / no hauling of contamination (Rain)

Cheryl Miatt & Ed Peterson.

- indicated that seepage zones ~2' above base of trench
- are we deep enough?
- CH survey every vertical fracture

EPA → trench is a cut off wall.

- GW flow to east from west.
- vertical fractures → take hydrostatic pressure off fractures by promoting drainage to WW 4.
- sealing bottom - to ensure no contamination to lower zones.
  - cannot predict fractures or if water bearing.
  - pressure relief allowing expansion of fracture
  - trench allowing preferential flow collection.
  - going deeper may create or observe unknown situations
- 1+25 vertical fractures do not go to bottom.
- CH would like BS to reason through in written form. that vertical fractures are none conductive hydraulically.
- CH needs a decision on being satisfied with trench design or whether it needs to go deeper. → this week.

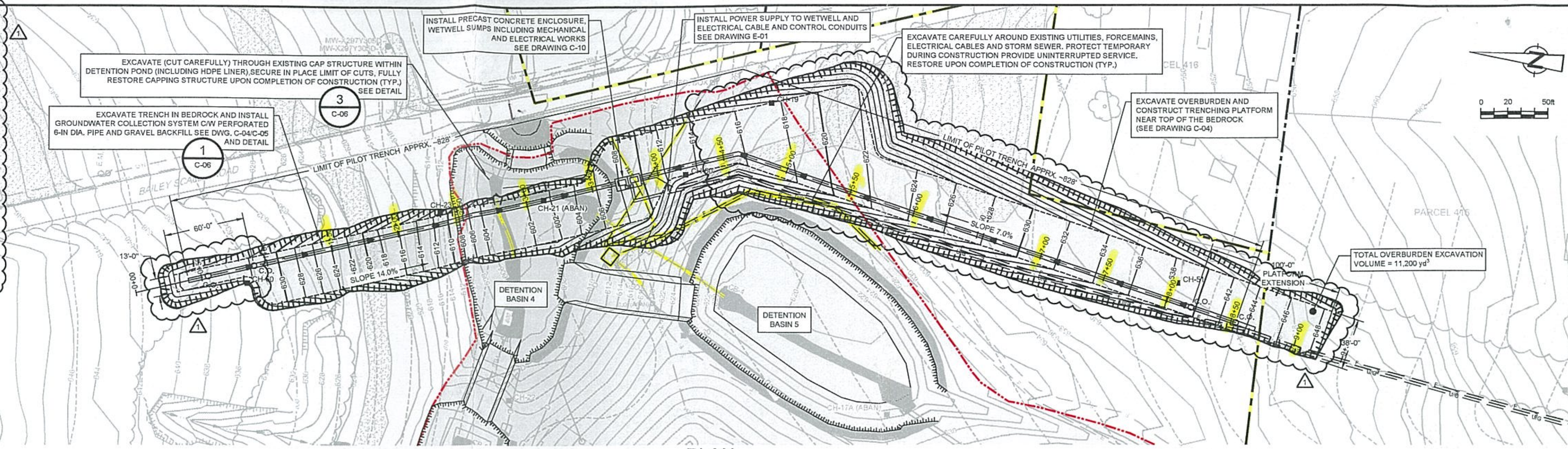
not deeper - cross contamination

- water will be drained to WW 4.

" - may go below but we won't go deeper because" - - -

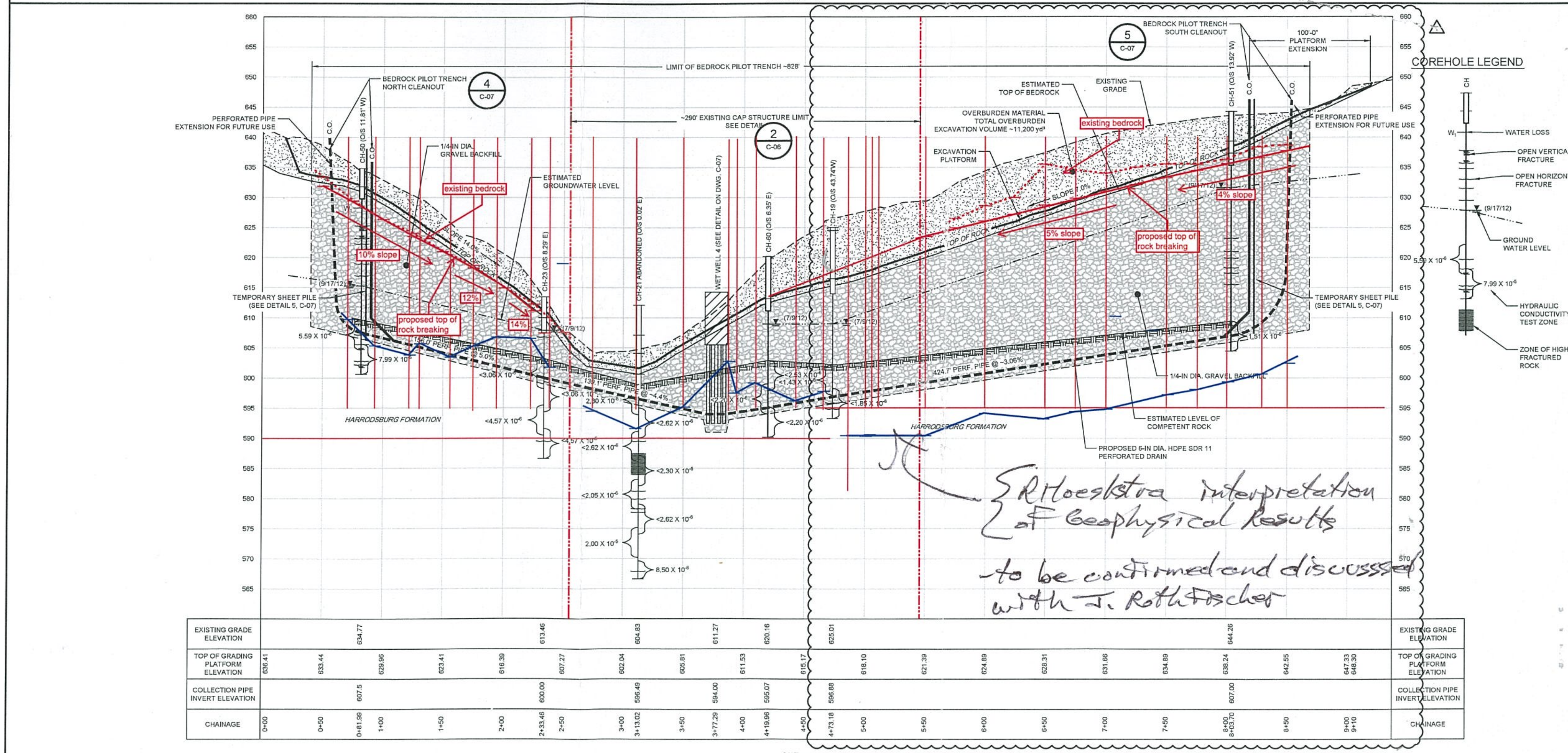
- trench release hydraulic pressure.
- is intercepting fracture networks. that cross trench.
  - collection of future migration. of contamination

PROPOSED BEDROCK PILOT TRENCH ALIGNMENT LAYOUT		
STATION	NORTHING	EASTING
0+00	1324792.15	3124937.10
0+50	1324745.19	3124954.27
1+00	1324698.23	3124971.45
1+50	1324651.28	3124988.63
2+00	1324604.32	3125005.80
2+50	1324557.37	3125022.98
3+00	1324510.41	3125040.16
3+50	1324463.45	3125057.34
4+00	1324416.49	3125074.51
4+50	1324369.53	3125091.67
5+00	1324321.03	3125087.91
5+50	1324272.05	3125077.83
6+00	1324223.08	3125067.74
6+50	1324174.11	3125057.65
7+00	1324125.14	3125047.57
7+50	1324076.17	3125037.48
8+00	1324027.19	3125027.39
8+50	1323978.22	3125017.30
9+00	1323929.25	3125007.21
9+37	1323893.01	3124999.74



PLAN

SCALE: 1"=50'



PROFILE

HORZ: 1"=50'

VERT: 1"=10'

Nº	Revision	Date	Initial
1	ADJUSTED TRENCH ALIGNMENT	SEPT 3, 2015	C.R.H.

LEGEND

- EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- EXISTING VEGETATION
- EXISTING FENCE LINE
- EXISTING DIRT ROADS
- EXISTING ROADS / PAVED AREAS
- EXISTING ELECTRICAL POWER LINE
- EXISTING FORCEMAIN TO TREATMENT FACILITY
- EXISTING OVERHEAD ELECTRICAL POWER LINE
- EXISTING WATERMAIN
- EXISTING OVERHEAD WIRES
- EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING UNDERGROUND TELEPHONE LINE
- APPROXIMATE SURFACE WATER LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE GM PROPERTY BOUNDARY
- EXISTING STORM SEWER
- EXISTING GUARD RAIL
- EXISTING GRAVITY DRAIN (HDPE SOLID WALL PIPE)
- EXISTING TOP OF BEDROCK CONTOUR
- LOW FLOW CHANNEL
- EXISTING SSC EXTRACTION TRENCH
- EXISTING MONITORING WELL TO/IN ROCK
- EXISTING BOREHOLE
- EXISTING CLEANOUT
- EXISTING MANHOLE
- EXISTING CATCHBASIN
- EXISTING POWER POLE
- EXISTING LIMIT OF CAPPING
- EXISTING RIPRAP EROSION PROTECTION
- EXISTING GRAVEL ROAD AREA
- UTILITIES TO BE TEMPORARILY RELOCATED
- PROPOSED PLATFORM CONTOUR
- PROPOSED EXCAVATION TRENCH PLATFORM TOP OF BANK
- PROPOSED EXCAVATION TRENCH PLATFORM BOTTOM OF BANK
- PROPOSED LIMIT OF EARTHWORK
- PROPOSED POWER SUPPLY
- PROPOSED CONTROL CONDUIT
- PROPOSED 6" Ø HDPE FORCEMAIN
- PROPOSED BEDROCK PILOT TRENCH
- PROPOSED TEMPORARY CLEANOUT

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS		
ISSUED FOR CONSTRUCTION	JUL 20, 2015	C.R.H.
ISSUED FOR BID	MAY 11, 2015	C.R.H.
ISSUED FOR DRAFT BID DOCUMENT REVIEW	APR. 24, 2015	C.R.H.
ISSUED FOR EPA REVIEW	DEC. 01, 2014	C.R.H.
RE-ISSUED FOR CLIENT REVIEW	NOV. 25, 2014	C.R.H.
RE-ISSUED FOR CLIENT REVIEW	NOV. 12, 2014	C.R.H.
RE-ISSUED FOR CLIENT REVIEW	SEPT. 26, 2014	C.R.H.
Status	Date	Initial

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - BEDROCK PILOT TRENCH

GROUNDWATER COLLECTION SYSTEM PLAN AND PROFILE

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager:	Reviewed By:	Date:	
J.M.	C.R.H.	JULY 2015	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 365	Drawing Nº: C-05

13968-00(365)CI-WA006 SEP 3/2015

what are we trying to prove?
-> No contamination beyond the collection trench
· monitoring wells installed every 50' in trench
E + W of trench -> not feasible. - may encounter different fractures

- if wells, may have been there previously.

· Ed Peterson. flow and
Pete - estimate PCB's concentration 250. gpm May 2016: 7.5 ppb <10 ppb
~~Est~~c - May 2016 300 gpm.

1:00 Progress Meeting.

GHD: JMc, KK, RH. TL, PB. SES: RC, SR, DL GM: CH, EP.

pH: DC GT. JP McI: W.B.

(1) Safety Issues. - McI, SES -> None.

GHD Audit. - GHD - no comment
SES - fine.
WHP

Katie to follow

(2) Trench 532' end of day
- maintaining schedule.
- slowing down with rain + depth.
should be done. -> Dec 9th. (avg 30'/day)
Public Meeting on 9th
31' on 26' depth.

C.O. -> does SES have ok. to release trencher out. stand by $4700 - 4800 / day
cleaning backfill -> N side ½
then. S side ½.
will need to video / document trench fractures
follow up behind SES

sheet piling - grout - backfill.
- every 50' 2" Monitor
7" on zig zag.
¼" stone backfill behind vinyl sheeting

SUBJECT AEG will not do unit pricing. DATE

C.O. 3 - convert liner into T&M & excess haulage.

Ch.O. 2: into GM. -> end of week.
by GM.

Manifesting for hauling contamination.
- K. Kamm. be back down. Dec 9th.
KK to look into individual for
Mon Tues next week.

(3) SES - MH behind CRA WTP MH-6.
- piping directed to MH-6 (than MH-7)
- will still go thru to SW pond.
- add a section
MH-7 outfall 002.
- order of pipe installation @ GHD request
W pipes to be installed.

Trenching spoils if clean.
- need to ask GM. where it can be used.
- Parcel 216 & spread or as Gran 'B' below drive area.
Trench. backfill. -> GHD to get back to SES
-> working platform to stay in there.
- will have excess mat'l left over.
- rubble 'broken rock' - what to do with it
GHD - to look into it.
- use a grapler to sort out rock for re-use.
GT. - Berm beside road. -> GM would not go for that.
SES - winterization of WTP
- providing a costing.
-> $63000 - heat trace - very hard to come by
- cheaper to build. containment bldg.
- M&I -> would have to remove for repairs.

- weather conditions -
what is bare minimum. stopping point. due to conditions
temporary force main. over durascrim.
-> over liner.
or SES continues to treat water.

~~27~~ ~~28~~ 29 30

⑧ GHD GWTP - carbon cells
- Flocculator in.
- SS pipe installed
- electric lights
- rip rap on outsideslopes

2" Wks Cont Mech. & Elec
Underground Pipe to Tanks
Concrete Containment Pad
Month - S-Roof Drain (North side).
S-Piping Containment Pad.
S McI.
Continuing.

SES. → N leg Pilot Trench
Batch Trenching → Discharging.
2Wk S-leg.
- grading by GWTP
- prep for piping installation.
- hauling contamination
Month. - Continuing

⑧ SES WTP Wkly for Next 3 Wks.

Completion of hauling
- sampling base.

Air Stations - relocating this week
- continue until area is contained.
- hopefully end of year.

⑨ CO 3 by SES.
⑩ KK. vagrant at CRA WTP.
was trespassing.
GM Security has been notified
⑬ Mike Reynolds - given chemical.
⑭ Next Wk's Meeting Tues p.m.

17:00 Trenching stopped for day - to relocate stations
Air stations collected for changing in a.m.
18:00 off site
0.21" Rain
End of Day

SUBJECT

DATE

Thurs Nov 19/15

Weather: 43°F Clear high 56°F

6:30 Air stations & air calib. all units at trailer 6:40

7:00 SES H&S : Handling Gas Cylinders

	W	N	E	S
Air stations	W	N	E	S
mg/m^3	0.014	0.014	0.018	0.011
Power/network	✓	✓	✓	✓

stations relocated as trencher progresses along South leg.

- hauling contamination 10 Young Trucks
- cont' trenching 28' yesterday.

9:45 Netronix - message left - Sales & Information - message left - stay online → message left

↳ emailed location change B. Tarkington

10:30 ↳ modem. to be couriered out today (N unit)

- Vasilieous not in office early this week to change out SIM cards.

11:00 - get GoPro Remote synched with Camera

14:00 - video of trench to test G. Seng 'Flag pole'

5+50 (trenching at ~ 6+10). 3' wkg platform + 26' trench.

16:30 hydraulic line on sweeper leak on Bailey Scales Rd.

16:37 ~150' N of Trib 3 → contained on road only.

1qt ← - absorbant applied on road - swept up & collected.

- leak (~gal) sweeper to SES laydown (P216) for repair.
- McAlister to be on-site for repair in a.m.

16:38 K Kamm - informed & reported to GM.

- no release to Trib 3
- only off site impact on asphalt surface Bailey Scales Rd.

- check with K Kamm as to sampling SES laydown.

- Trench Cuttings 4+00 - 5+50 ND.
- Trench Water to Modutank ND.

17:10 Eq't down (trencher / dozer / excavator).

17:20 ↳ Cleaning Bailey Scales.

Air station collected / charging.

18:15 ~~off~~ Site.

EPA to be on site next week.

Sevenson Environmental Services, Inc.
SPILL INCIDENT REPORT

DATE OF INCIDENT: 11-19-2015	TIME OF INCIDENT: 1630 (4:30 pm)

INCIDENT REPORTED BY: Shane Reynolds

DESCRIPTION OF THE INCIDENT: A pinhole in the hydraulic line of the rented street sweeper leaked approximately +/- one quart of hydraulic fluid onto Bailey Scales Road. This occurred between the truck loading area and the upper lay down area (temporary water treatment plant / office parking lot) approximately 450 feet.
The street sweeper was immediately parked in the Sevenson lay down area (office parking lot) and remaining residual oil was contained using an oil boom, absorbent material and sand. Key was removed from street sweeper to insure no further operation to cause further release of hydraulic fluid. GHD was notified via cell phone. Oil on pavement was covered with oil-dry, swept up and collected.

PERSONNEL REVIEWING INCIDENT: Shane Reynolds, Randy Campbell, David Leising.

PRIMARY CAUSE OF INCIDENT: Leak in hydraulic line of street sweeper.

SECONDARY CAUSE OF INCIDENT (IF NONE, STATE SO): None.

PRIMARY CORRECTIVE ACTION TAKEN: Spilled hydraulic fluid was contained at parked rented street sweeper. Key was removed from machine to insure no further release of hydraulic fluid. Oil on pavement was covered with oil-dry, swept up and collected. Sand was placed over leaked oil at sweeper and bermed around parked machine.

SECONDARY CORRECTIVE ACTION TO BE TAKEN (IF NONE, STATE SO): Mechanic replaced worn hydraulic hose on rented street sweeper.

PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTIONS: Randy Campbell, David Leising	TIME CORRECTIVE ACTION WAS IMPLEMENTED: 1637 TIME SPILL WAS CONTAINED & STREET CLEANED: 1715

Fri Nov 20/15
Weather: 28°F Clear high 55°F
Air stations - ∅air calib. all unit at trailer.
700 SES H+S: Flagging Safety

Air stations	W	N	E	S.
mg/m^3	0.015	0.032	0.019	0.030
Power/Network	✓	✓	✓	✓

- cont' trenching / backfill. 31' yesterday
- hauling/contamination
- silt fence prep for grading by GWTP

-FSK review with Katie.
- issues with my computer → send FSKs to Katie for review.

W air station not showing up on network
- unit checked → not connecting at unit.
- unit moved to get network connection

N station modem (32999) not received today.

→ trench ~ 300' long open ~ 28' deep from grade
- berm constructed along mid section of trench with water on trencher side pumped out to N side to keep trencher conditions dry

- contamination stockpile tarped after 2nd round trucks

13:30 Mike Reynolds - on site to fill out City of Bedford Spill Notification form - pleased with response + clean-up
- clean-up photos reviewed with Mike

16:40 trencher down for maintenance
SES setting up pumps for weekend water management
trench backfilled
17:00 Air stations collected for charging
W unit never connected after 10:00am
- will need to be relocated on Monday
17:50 off site.

1½ hrs Weekly Meeting Minutes.

SUBJECT

Mon Nov 23/15

DATE

Weather: 26° F Clear high 45°F

6:15 Air stations ϕ air calibration all unit at trailer 6:25

7:00 SES H&S: Accident Prevention.

Air stations:	W	N	E	S
mg/m³	0.028	0.023	0.022	0.023
Power/network	✓	✓	✓	✓

-cont' trenching ended at 6+50 Fri.

-hauling contamination

10 Young Trucks A. Groesbeck on site to manifest.

- sent out - Meeting Agenda + schedule change 11-22-15 ✓

- Draft Meeting Minutes 11-18-15 ✓

- Final Meeting Minutes 11-11-15 ✓

→ relocated to E side DB-5 to get network signal

-email Re: Air stations (W unit down on Fri)

→ not showing up - check to get on-line with network

-serial connection loose on E unit - reconnected ~11:10.

- power disconnected when moving S unit to get signal - reconnected ~11:15

→ 3 operators taking 8 hr refresher - will be treating water tomorrow

trench cuttings - need to get 5+50 - 7+00 sample

13:30 Pete Ramanauskas, EPA - on-site. - off site 16:00.

-tour of GWTP site + trenching operation.

- R. Campbell - can bridge be set out (6+25)

-video set up / trench open - vertical fractures evident

-will vinyl siding be ready by Dec 9? - would like to see.

- No trench schedule → Dec 9th finish - feel free to call as to schedule.

- drive around landfill road - over view - generally pleased with site

- not overly interested in GWTP - just pictures of exterior

- interested in trench video → WL's

- discussed WVV location + where hard rock encountered

→ water in trench, seepage at bottom - WL at ~10' start of day

- longer open section of trench to deal with water by building berm to pump water away from trencher

17:00 Trencher down + excavator off

Air station - collection + charging

18:00 Off site - trench video to be sent out

76→75+50

Tues Nov 24/15
Weather: 29°F Clear high 53°F
SES H&S: Carbon Monoxide

Air stations	W	N	E	S
mg/m³	0.036	0.038	0.039	0.047
Power/Network	✓	✓	✓	✓

- hauling contamination 11 Trucks (10 in p.m.)
- cont Trenching 33' yesterday

13:00 P.B. T.L. SES - RC SR. GM - CH.
McI W.B. JP.
JMc. RM GT

Safety : Self Audits.
- GHD Audit Results
- SES Bailey Scales
MR contacted.

② Trenching. - 30' / day

Sorting Stockpile. today.
West Lines to go in 1st
Grading will go W to E S to N.

McI will duct iron in on Wed.
have installer → installation Thurs.

Air Relief - ManuFact. recommended Fire Line Valve Air Release.
- Design AR not regularly used in Fire Line
being checked by RH.
JMc - Ronm by Shambaugh.
CH → Meet Plant Rq mts.
T.L. Pass Shambaugh contact onto RH.

no cost difference for upgrade

SUBJECT

DATE

③ Req't For Info.
McI / GHD – none.
SES.

BackFill – Follow up on subgrade for paving area.

MH-6 yes proceed. RH.

Schedules Provided. by GHD. & SES

McI Mech. Pipe Connections Inside
Electrical.
Floor in Bathroom.
Pipe connections outside bldg Eq & Eff tanks
-grading for concrete. next wk.
Cont' work on
Interior Bldg.

SES Trenching
Trucking & Disposal
SW Mngt.
Silt Fence for Grading / Sorting.

Next Wk Pipe Excavations
Trench Cutting
Bentonite Grout
Sheet Pile
Piping Installation.

EPA on site yesterday. – informed on current schedule.

One Month. CH gone on 14th.
McI. – X Mas break not discuss yet
24th to after New Years with SW Mngt.
over Thksg. also

WTP. Sampled today. - 2 more weekly events then monthly
Trench Cuttings 4th Sample obtained.
Air Monitoring → No Alerts.
Stockpile 2 sample to document.

- ~~OTT~~ Approval on Air Relief.
- RM Concrete Mix Design

KK has 3rd Application. - TEM on line w/crew
to forward before 14th. GMD
to GM.

CH → SES to email directly to CH.

McT - cont Saturdays
SES - SW Mngt.

CH + EP → on 8th Wed am.

cooler FedEx'd From Trailer
- SES WTP 2nd weekly Sample Event
- Trench Cuttings 5+50 → 7+00.
- 15 pt composite sample
FSK + Field Notes → B Steinmann & K. Kamm.
Email → P. Ramanauskas, EPA visit yesterday

5+50 video uploaded

1645 Trencher down.

1710 Air station collection.
→ STEP performed on McCurtis

17:50 off site

video transfer sent out at hotel

SUBJECT

DATE

Wed Nov 25/15

Weather: 33°F Clear high 60°F

6:30 Air stations & air calibration all units at trailer 6:48

7:00 SES H&S. General Construction & Holiday Safety

Air stations	W	N	E.	S
mg/m³	0.027	0.021	0.023	0.029
Power/Network	✓	✓	✓	✓

No Trucks hauling today - scaffolding taken down

Grading stockpile N of GWTP

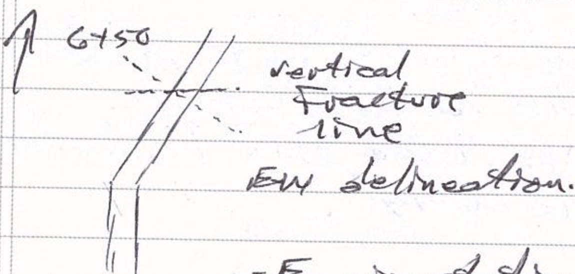
· cont' trenching 30' yesterday.

- trencher can't do full depth all at once

- shallows trenching depth then ~every 8' re-trenches to get full depth completed

STEP sent out - review with G. Seng

9:30 Trench video at 6+50.



iron staining on bottom section of vertical fracture ~28' below grade.

- E air station not showing up on network

- relocated & signal indicates connection.

11:00 off site.

Transit to Airport for 13:00 Flight / Enterprise Rental

Transit to Peterborough 20:00

Trench video for 6+50 sent out

Return Travel Nov 29th.

Memorandum

Draft for Review

To:	Cheryl R. Hiatt, Ed E. Peterson	Ref. No.:	089428
From:	Allan McMurray/ac/3	Date:	November 20, 2015
CC:	Glenn Turchan		

Re: **GM Bedford Ground Water Treatment Plant (GWTP) Treatment Compliance Testing Plan (CTP) to Certify Holdback Release**

1. Introduction

This Memorandum describes the Compliance Testing Plan (CTP) for the newly constructed GM Groundwater Treatment Plant (GWTP) located in Bedford, Indiana. The strategy of the CTP is to prove that the GWTP is functional consistent with the Proposal dated February 4, 2015 to release the "holdback" budget on the GM Purchase Order (GM PO) (WFS11033 dated 02013/15).

The GWTP was designed to be able to treat polychlorinated biphenyl (PCB) contaminated groundwater extracted from the bedrock trench system at a level up to 10 parts per billion (ppb) (consistent with the final Design Report). The expected overall influent flow was:

Flow	1,000 gallons per minutes (GPM)(maximum)
PCBs	10 parts per billion (ppb)
Temperature	4 – 25 degrees Celsius
pH	6-8 pH units
Total Suspended Solids (TSS)	<10 parts per millions (ppm)
Oil and Grease	Non-Detect

The primary goal of this CTP is to:

- Confirm that the GWTP can achieve the designed level of PCB reduction.

Furthermore this CTP also addresses the following secondary goals:

- Determine the time requirement for the system to achieve a steady state operation.
- Determine the steady state reduction of PCBs at various points throughout the system to establish a baseline mass balance throughout the system.

GHD Limited
651 Colby Drive Waterloo Ontario N2V 1C2 Canada
T 519 884 0510 F 519 884 0525 W www.ghd.com

- Confirm the efficacy of the various pieces of equipment being used throughout the system.

These goals will be accomplished by sampling groundwater throughout the system while operating following a staged and systematic approach.

2. Staged Approach

A simplified block flow diagram (BFD) of the GWTP process is shown on Figure 1 (below). Figure 1 does not include any intermediate storage tanks, backwashing, or rinsing connections that are present in the system. For the testing period, groundwaterwill be pumped from the EQ tank of the nearby existing Water Treatment Plant (WTP) via a portable diesel transfer pump to the new 250,000 gallon equalization (EQ) tank (at the GWTP). It is expected that the transfer operation will take several days, and as such testing will proceed with batches of 250,000 gallons of groundwater influent from the Source Control System.. The system was designed for a total capacity of 1000 gpm, resulting in a total operation time of approximately 4.2 hours on a single EQ tank load (neglecting bag filter recycle flowrates). To allow for a longer testing period, the testing approach will be staged such that each granular activated carbon (GAC) contactor train will be tested individually.

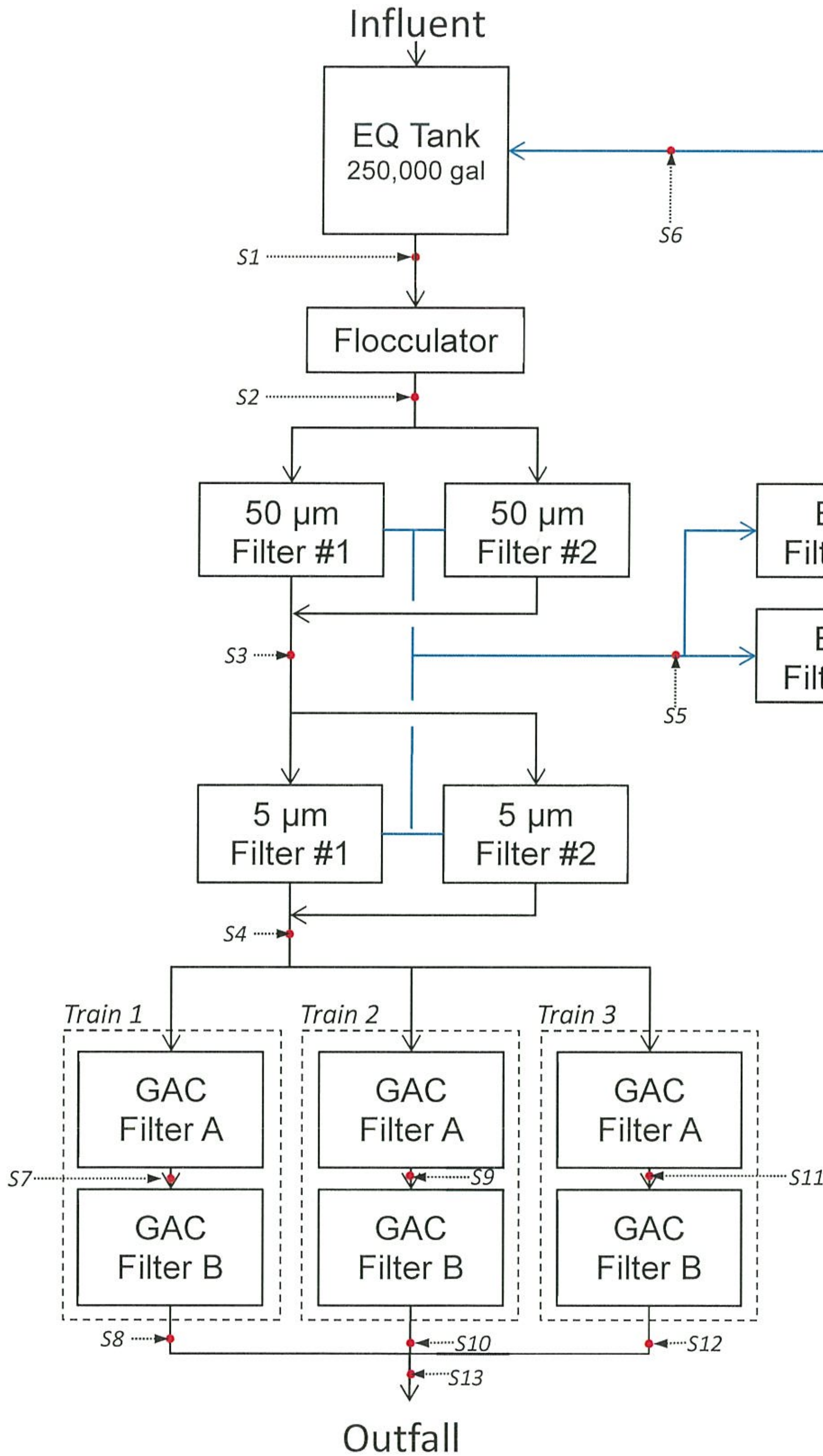


Figure 1 Ground Water Treatment Plant (GWTP) Simplified Block Flow Diagram

3. Plant Effluent Management

As per the original design, GWTP effluent will be collected in the effluent tank (100,000 gal) at the end of the system. During normal operation, this tank will be kept filled for backwashing, and the overflow will be metered and sent to the outfall. During the compliance testing, it cannot be assured that the water produced by the new GWTP will be completely free of PCBs and as such, the water overflowing from this effluent tank is to be routed to the nearby storm water lagoon for the duration of the testing for re-treatment by other water treatment plants.

4. Testing Procedure

Prior to the start of testing, the EQ tank will be filled to capacity with PCB contaminated influent groundwater from the nearby ground water treatment plant EQ tank. Following this, testing will proceed in 4 phases. Phases 1 through 3 will test each GAC contactor train individually, while phase 4 will test the system as a whole. To ensure the maximum utility for a single EQ tank loading, the transition between each phase will occur while the system is running.

4.1 Phases 1, 2, and 3

Phases 1 to 3 will test the performance of the system while operating with only one GAC train. Each phase will follow the same procedure with differing GAC trains in operation (i.e. the number of the phase). During these phases of testing, the system flowrate will be set to the maximum flowrate for a single GAC train (500 gpm).

4.2 Phase 4

Phase 4 will test the system with all GAC trains running in parallel at full design flow. The intention of this phase is to show that the system can perform as designed under fully operational conditions and under design flow. During this phase of testing, the system influent flowrate will be set for the system design flowrate (1000 gpm).

4.3 Procedure

- Prior to system startup fill the EQ tank to capacity (250,000 gallons).

Phase 1

- Isolate GAC trains 2 and 3 from the system such that all water must flow through GAC train 1.
- Set influent flowrate setpoint to 500 gpm and start system.
- Allow system to reach process steady state. This may be indicated by relatively stable influent pump demand and smooth headloss profile through the GAC contactors. Record the time to reach process steady state operation.
- Once at process steady state, allow the system to operate for 16 minutes (two empty bed contact times at design flowrate) to ensure steady state PCB removal.
- Sample water at the locations shown in Figure 1 for the contaminants listed in Table 3 for phase

Phase 2

- Ensure there is adequate volume within the EQ tank for the duration of phase 2. The recommended minimum volume is 45,000 gallons (1.5 hours at 500 gallons per minute) or a level of 3.3' (18% full).
  - If there is not enough influent water for phase 2, shut down the system and abort testing. Fill the influent EQ tank above the recommend level and re-start this procedure from step 7.
- Bring GAC train #2 into the system flow path.
- Isolate GAC train #1 from operation such that GAC train #2 is the only GAC contactors receiving flow. GAC trains #1 and #3 should both be isolated at this step
- Maintain influent flow setpoint at 500 gpm.
- Allow system to reach process steady state. This can be indicated by relatively stable influent pump demand and a smooth headloss profile through the GAC contactors. Record the time to reach process steady state operation.
- Sample water at the locations shown in Figure 1 for the contaminants listed in Table 3 for phase 2.

Phase 3

- Ensure there is adequate volume within the EQ tank for the duration of phase 3. The recommended minimum volume is 45,000 gallons (1.5 hours at 500 gallons per minute) or a level of 3.3' (18% full).
  - **If there is not enough influent water for phase 2, shut down the system and abort testing. Fill the influent EQ tank above the recommend level and re-start this procedure from step 13.**
- Bring GAC train #3 into the system flow path.
- Isolate GAC train #2 from operation such that GAC train #3 is the only GAC contactors receiving flow. GAC trains #1 and #2 should both be isolated at this step.
- Maintain influent flow setpoint at 500 gpm.
- Allow system to reach steady state. This can be indicated by relatively stable influent pump demand and a smooth headloss profile through the GAC contactors. Record the time to reach steady state operation.
- Sample water at the locations shown in Figure 1 for the contaminants listed in Table 3 for phase 3.

Phase 4

- Ensure there is adequate volume in the EQ Tank for the duration of phase 4. The recommended minimum volume is 90,000 gallons (1.5 hours of 1000 gallons per minute) or a level of 6.7' (36% full).
  - If there is not enough influent water for phase 4, shut down the system and abort testing. Fill the influent EQ tank above the recommend level and re-start this procedure from step 18.
- Increase influent flow setpoint to 1000 gpm.

- Allow system to reach steady state. This condition may be indicated by relatively stable feed pump demand, stable actuated valve position demand (flow balancing between all trains), as well as a relatively smooth GAC contactor headloss profile. Note that at this step, even though all 3 GAC trains are considered 'active' only 2 will be in operation as per the original design intent. Record the time to reach process steady state operation.
- Once at process steady state, allow the system to operate for 16 minutes (two empty bed contact times at design flowrate) to ensure steady state PCB removal.
  - **If during this test a backwash operation is requested, and another train is brought online, allow for the system to reach steady state as previously defined and allow for an additional 16 minutes of operational time to ensure steady state removal by the GAC train brought online to replace capacity from the train undergoing backwash.**
- Sample water at the locations shown in Figure 1 for the contaminants listed in Table 3 for phase 4.

Shutdown Phase

- Run system until low level alarm is reached in the influent EQ tank.
- Shutdown system.

4.4 Success Criteria

The success criteria for this testing will be if the plant effluent contaminant levels are shown to be below the levels as prescribed by the draft National Pollutant Discharge Elimination System (NPDES) permit. These are reproduced in Table 1:

Table 1 NPDES Effluent Discharge Limits

Parameter	Concentration (Maximum)	Unit
PCBs	0.0019	µg/L
Oil and Grease	10.0	mg/L
TSS	15	mg/L
pH Range	6.0 to 9.0	mg/L

5. Commissioning to Full Time Groundwater Trench Operation

At the completion of the construction GHD will prepare (under the PM PO):

- GWTP Construction Certification Report (with "as-builts")
- Operation and Maintenance (O&M) Manual

CRA will provide operations manuals including operations and maintenance manuals provided

by equipment suppliers in an electronic form that allows operators to easily reference this information.

Once the GWTP has been deemed to perform adequately following the successful completion of testing Phases 1 to 4, the system will be ready to commissioned to full scale operation with trench groundwater (after the new NPDES permit is effective) in 2016.

To ensure the system performs as designed under full loading conditions over a long period of time, a tapered frequency sampling regime will be adopted during the commissioning with bedrock trench groundwater (this is in addition to the NPDES sampling). This scheme is shown in Table 2.

Table 2 Transition to Operation Sampling Regime

Time after Startup	Sampling Frequency	Equivalent Volume at design flowrate (gal)
Week 1	Daily	1,440,000
Weeks 2 to 4	Weekly	10,080,000
Week 5 and thereafter	Monthly	43,200,000

During this transition to full scale operation, the influent water to be applied to the treatment process will be from the wet wells intended to be used in full operation. As such, it is estimated that the influent water will be limited and the plant will cycle on and off in response to groundwater availability. To obtain water samples which approximate the full scale plant operation, sampling frequency will be on the basis of equivalent throughput volume.

As per the effective NPDES permit, effluent PCB samples are to be a 24 hour composite sample of at least 3 flow proportioned sampling events. To allow for sampling during on/off cycles, sampling should occur after each 480,000 gal of water treated (at full flowrate).

Following the successful completion of the equivalent of 4 weeks of operation, the system will be allowed to discharge treated water in Outfall 004.

Table 3 Testing Sampling Locations and Parameters

Sample Location		Type	Sample Valve	Phase 1	Phase 2	Phase 3	Phase 4
EQ Tank		System Influent *(S1)*	n/a	pH (Field) Turbidity (Field) PCB TSS	pH (Field) Turbidity (Field) PCB TSS	pH (Field) Turbidity (Field) PCB TSS	pH (Field) Turbidity (Field) PCB TSS
Flocculator		Effluent *(S2)*	HV – 2016	pH (Field) Turbidity (Field)	pH (Field) Turbidity (Field)	pH (Field) Turbidity (Field)	pH (Field) Turbidity (Field)
50 um Orival Filters		Effluent *(S3)*	HV – 2031	Turbidity (Field) PCBs	Turbidity (Field) PCBs	Turbidity (Field) PCBs	Turbidity (Field) PCBs
5 um Orival Filters		Effluent *(S4)*	HV – 2030	Turbidity (Field) PCB	Turbidity (Field) PCB	Turbidity (Field) PCB	Turbidity (Field) PCB
Bag Filters		Influent *(S5)*	HV – 2036	TSS	TSS	TSS	TSS
		Effluent *(S6)*	n/a	TSS PCB	TSS PCB	TSS PCB	TSS PCB
GAC Train #1	Lead	Effluent *(S7)*	HV -3031	PCB Turbidity (Field) TSS Oil and Grease pH			
	Lag	Effluent *(S8)*	HV – 3034	PCB Turbidity (Field) TSS Oil and Grease pH			

Table 3 Testing Sampling Locations and Parameters

Sample Location		Type	Sample Valve	Phase 1	Phase 2	Phase 3	Phase 4
GAC Train #2	Lead	Effluent *(S9)*	HV – 4031		PCB Turbidity (Field) TSS Oil and Grease pH		
	Lag	Effluent *(S10)*	HV -4034		PCB Turbidity (Field) TSS Oil and Grease pH		
GAC Train #3	Lead	Effluent *(S11)*	HV -5031			PCB Turbidity (Field) TSS Oil and Grease pH	
	Lag	Effluent *(S12)*	HV -5034			PCB Turbidity (Field) TSS Oil and Grease pH	
Effluent Tank		System Effluent *(S13)*	n/a				PCB Turbidity (Field) TSS Oil and Grease pH

SUBJECT

DATE

Wed Nov 25/15

Weather: 33°F Clear high 60°F

6:30 Air stations & air calibration all units at trailer 6:48

7:00 SES H&S. General Construction & Holiday Safety.

	W	N	E.	S
Air stations mg/m³	0.027	0.021	0.023	0.029
Power/Network	✓	✓	✓	✓

No trucks hauling today - scaffolding taken down

Grading stockpile N of GWTP

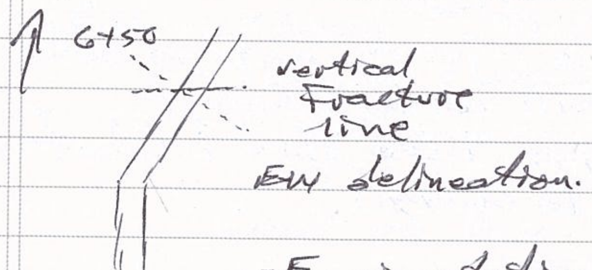
· cont'd trenching 30' yesterday.

- trencher can't do full depth all at once

- shallows trenching depth then ~every 8' re-trenches to get full depth completed

STEP sent out - review with G. Seng

9:30 Trench video at 6+50.



iron staining on bottom section of vertical fracture ~28' below grade.

- E air station not showing up on network
- relocated & signal indicates connection.

11:00 off site.

Transit to Airport for 13:00

Flight / Enterprise Rental

Transit to Peterborough 20:00

Trench video for 6+50 sent out

Return Travel Nov 29th.

Mon Nov 30/15

Weather: 39°F overcast high 49°F

0630 Air stations & air calibration all units at trailer 6+40.

0700 SES H+S Eye Protection

Air Station	W	N	E	S
mg/m^3	0.030	0.030	0.024	0.042
Power/Network	✓	✓	✓	✓

- cont' trenching
- hauling contamination 11 Young Trucks.
  all units on-line.

9:50 Netronix 215 475 5133 message left.
 -tracking # for modem?

trench inspection - vertical voids 6+70
 " fracture 6+90.

1300 video taken showing features

13 20* - UPS - 48' Tractor Trailer - pulled into Trencher Laydown
 - when turning around - pintle hook ran into front bumper
 of HLC Mechanic Truck.

→ Reported to K. Kamm - no injuries, no fluid leaks.
 has 24hrs - she will contact Cheryl.

16 45. - Reported to Hot line (as per T Lee thru D. Charters)
 - J Mc → email to Cheryl.

17:20. Trencher down / eq't off 1930 SES off site

Air Station collection - video transfer to memory stick

18:30 off site

Fed Ex to drop off expenses

6+70 video upload & email 2½ hrs hotel

* Mike Reynolds was reported to have been on site
by RC of SES → everything fine

SUBJECT Tues. Dec 1/15 BMG A66 Fed Ex. DATE 0.05" Rain Gauge

Weather: 49°F Overcast/Drizzle dropping to 45°F

6:30 Air stations ∅ air calibr all units at trailer 6:40

6+90 video upload + email.

7:00 SES H+S : wet slippery Conditions on Site

Air stations	W	N	E	S
mg/m^3	0.007	0.017	0.014	0.023
Power/Network.	✓	✓	✓	✓

7:24 Turbidimeter calibration.

7:50 Trench water sample (pump @ 7+00 Turb 352) 40334

8:20

		Time	Turb.
8	40335	8:30	1.90
6	40336	8:35	1.79
7	40337	8:39	3.15
3	40338	8:43	5.39
1	40339	8:47	11.3

SES Weekly WTP sampling #3.

Process Samples

11:00 D.C + T.L. → RC + SR - need dirty water to GWTP + discharge pipe to SW pond by Dec 23.

13:00 RH - Trench Cuttings → P 216.
- Trencher Finished by Fri (earliest) → probably Tues
- outfall pipe crosses WW-4.
  - Field fit diversion pip around it.
- Grout on Base - place ≥6" + try to maintain drainage to sump.
- ¼" gravel for behind vinyl sheets
- 4" pipe from WW-3 → extend into trench.

- con't trenching (vertical fracture at 7+50)
- hauling contamination to Young Trucks

W air station off line ~ 16:00.

- working platform extended south due to trencher working uphill rather than downhill
- work extended up to S air station. (station to be moved S)

17:00 Trencher down (extending working platform south)

17:45 ~~off~~ site.

→ work on Construction Meeting Minutes 11-18-15

Wed Dec 2/15

weather: 30°F Clear High 40°F.

630 Air stations & air calibr at trailer all units 6:40

700 SES H&S: Flash Floods / Flooding Conditions / Safety

Air station	W	N	E	S
mg/m³	0.050	0.076	0.062	0.040
Power/Network	✓	✓	✓	

- cont' trenching 30' yesterday
- hauling contamination 10 Trucks
- grading N of GWTP for piping trenches.

9:15 Pine Enviro - Natronix sent modem on Nov 12th
- please check on status.
units not showing up on network.

SES - UPS Incident Report emailed out.
Trench Photo on Progress emailed out
11-24-15 Draft Minutes " "
11-18-15 Final Minutes " "

13:00 GT. JPaz RH. JM KK.
GHD PB TL. DC.
SES R.C. SR.

14:30 trench video
7+50.
N air station back on-line
E air station -> no reception.
~~W~~, N + S units left overnight

SES Incident. - Pending.

KK -> Bill Doyle - okay Audit. verbal to KK. + onsite
- would forward. written response
Jeff Moody IDEM.

Grading - Trench mat'l may be needed.
Fire lines & to west 1st Priority then
SES ready to trench by EOD tomorrow.

Fire main to go in first
HDPE to go in with it.

Fibre optic's. -> arriving next Tues

Date

Reference No. 13968 / 89428

Construction Progress Meeting Sign-in Sheet
Bedrock Pilot Trench and GWTP
GM Remediation
Bedford, Indiana

Company Name	Represented By	Telephone No.	Fax No.	Email Address
GHD	Pete Bridcut	—	—	—
SES	Randy Campbell			
SES	Shane Reynolds			
SES	David Leising			
GHD	Dale Charters			
McIntyre Bros	Gary McIntyre			
RE Griesemer, Inc	Eric Scott			
McIntyre Bros	Wade Blackwell			
GHD	TIM LEO			

Weekly Construction Meeting
Groundwater Treatment Plant
Tuesday, December 2nd, 2015

Safety:

- GHD Safety Audit Thursday - Bill Doyle - nothing to report
- McIntyre Safety Audit
- Pre-Task Plans for upcoming work.
  - o Welding

Submittals:

1. Heat Trace and pipe insulation - need follow-up

Schedule: - See Completion List for Detail

1. **Week of 11/30/15 through 12/05/15**
   a. Pour out Containment Pad
   b. Process Piping
   c. Conduit
   d. Switchgear unload

2. **Week of 12/07/15 through 12/12/15**
   a. Truck Loading Pad
   b. Interior Sump Pumps
   c. Exterior Process Piping
   d. Process Piping
   e. Conduit and wiring
   f. Transformer unload

3. **Week of 12/14/15 through 12/19/15**

Weekly Construction Meeting
Groundwater Treatment Plant
Tuesday, December 2nd, 2015

Change Orders:

1. Rip Rap
2. Building Permits
3. Sectional Door
4. Bathroom
    a. Doors
    b. Windows
    c. Acoustical Ceilings
    d. Lights
    e. Revised heating and cooling
    f. Drywall
    g. Bathroom Fixtures: Toilet, sink, grab bars, mirror, sanitary

Open Questions/Concerns:

1. Status of Critical Items
    a. AHU
    b. Exterior Door
    c. Sump Pumps
    d. Temporary Ramp
2. Concrete Test Reports
3. Handrail
4. Water for Testing

SUBJECT

DATE

Fibreoptics. - is it compatible
DC - to check on. +
top of fire main.
-do we leave trench open. or cover pipe if bad weather.

Requests →

McI - containment pad today.
- walls (pending next week)
- truck loading area
- rest room floor
} concrete.
-electrical + power inside.
section over head door - tomorrow
- interior infrastructure.

SES - trenching
- sheet pile
- WW4 structure.
- grading dirt. - GWTP piping installation.
- contamination pad.
quadrants → 5 pts.

Com. Cont → None.

AtkE - working this Sat + Sun
- will

Has Katie reviewed SES
Progress Payment 3 → get to CH. before 14th.

RH - has requested Clay by modutanks.
to CH
Trencher standby.
Trench cuttings on P. 216

→ KK please follow.

→ JMc } comfortable that depth is fine
YES.

Thurs Dec 3/15

Weather: 26°F clear high 40° F

0.00" Rainbauge

6:30 Air Stations ϕ air calibr. E unit at trailer 6:40

7+50 video upload / e email.

7:00 SES'H&S : Use of High Pressure Lines

Air Station	SW (Field)	SM (Field)	E	S (Field)
mg/m³	0.060	0.064	0.054	0.067
Power / Network	✓	✓	✓	✓

cont' trenching 30' yesterday

hauling contamination 10 trucks.

grading N of GWTP

- hauling extra fill from trench overburden stockpile to GWTP

still not showing up on-line - powered down again - all connections resecured 9:30 ok.

- additional vertical fracture ~ 8+00 at trench.

- extending fill mat'l over DB-6
  - culverts (2) installed
  - pipe cover placed over 4" outfall Line to protect from fill cover.
  - spotters removing stone from away from pipe

17:20 R. Campbell → overhead line hit by GPS Mast on dozer

GM Security notified of incident.

17:35 K Kamm informed of incident

photos of site / secure line

18:00 J. McGuigan informed + CRA HOTLINE

18:20 R. Campbell updated - recommend Safety Stand-down tomorrow.

Collect Air Stations for charging

- email sent out to Cheryl Hiatt to report incident.

19:15 Off Site

SUBJECT | DATE

Fri. Dec 4/15

Weather: 22°F Fog/Frost high 30°F

6:30 Air Station & air calibration. all units at trailer 6:40a

7:00 SES Safety stand-down.

- Don Jackson (operator) - owned up to incident - changing from hoe to dozer.
- SES stressed severity of situation
- discussion with work crew on contributing factors.
  - operator switching eq't
  - spotters focusing on ground utilities
  - rushing to complete the task before end of day
  - poor visibility at dusk at time of event.

8:45 On-site tailgate at WTP - included Tim Leo & Ryan Griffith.

9:45 work to re-commence.

phone GM security to check phone connection at SW pond pump house.

→ NO phone connection → SES informed - to contact McIntyre to reconnect line

Air Station	W	N	E	S
mg/m^3	0.040	0.057	0.047	0.050
Power/Network	✓	✓	✓	✓

(to be video'd Mon)

Trenching cont' - vertical fracture at 8+00

Grading fill mat'l between GWTP & WTP

1400 sample of trench cuttings 7+00 - 8+50.

process samples → (Dup taken).

- phone line repaired by McIntyre - final repair on Mon
- trencher should complete trench on Mon.

16:55 Trencher down for day.

Air Station Collection for weekend storage

18:00 Off site FedEx soil sample in Bloomington

SAT Delivery

Bridcut, Pete

From:	Bridcut, Pete
Sent:	December-04-15 11:55 AM
To:	Kamm, Katie; McGuigan, Jim; Turchan, Glenn
Cc:	Cheryl Hiatt (cheryl.r.hiatt@gm.com); Project Email Filing; Shane Reynolds (SReynolds@sevenson.com); Randy Campbell (rcampbell@sevenson.com); Hoekstra, Rick; jpazderski@sevenson.com; dleising@sevenson.com
Subject:	013968 - Sevenson Safety Stand Down ~COR-013968~

Sevenson performed a site safety stand down this morning in response to contacting and pulling down the overhead telephone line yesterday. Trenching activities were delayed during the Safety Stand-down in order to have full focus on the job task analysis as the project moves forward. The hauling of contamination was called off for the day in order to focus on the Safety Stand-down. The following topics were covered:

- Sevenson wanted the work crew to understand the severity of the incident and that working around buried and overhead utilities required the utmost focus of the spotters working in conjunction with the operators;
- Sevenson stressed the importance of safety in the workplace and indicated that the purpose of the stand down was to re-focus on the safety aspect of performing any of the on-going tasks on site;
- Don Jackson, the operator that hit the line, addressed the work crew, describing the incident to everyone and owning up to operator error as the primary reason for the incident;
- Review of the JSA's for operating equipment and spotting for operators;
- Focus on how multiple contributing factors may have led to the incident occurring such as the operator switching equipment just prior to the incident occurring (reassess equipment use and the task it will be performing including equipment limitations), spotters focusing on the bigger picture of the overall work site (not just the waste water line on the ground and marked out buried utilities); rushing to complete the task (trying to grade material up to the appropriate manhole before the end of the day); and performing the task in poor conditions (at the time of the incident the sun had gone down behind the landfill producing low visibility conditions);
- Many of the points were brought up by the workers themselves and the discussion carried over to how to focus on identifying these conditions on other work activities across the site;
- An on-site tailgate was performed with the work crew to perform a Hazard Identification and Risk Assessment on their work roles for the duration of the trenching excavation work. Tim Leo and Ryan Griffith were available for the tailgate to identify concerns that may be encountered around the GWTP and to provide any assistance when the trench approached the area;

McIntyre has been contacted as to repairing the phone line that may be connected with the GM pump house. GM Security has been made aware of the issue. Work recommenced after the tailgate was completed at 9:45.

Sevenson is in the process of drafting an Incident Report which will be provided later today.

Pete Bridcut, C.E.T

GHD
T: +1 705 749 3317 | M: +1 705 768 6405 | E: pete.bridcut@ghd.com
347 Pido Road Unit 29 Peterborough ON Canada | www.ghd.com

HAZARD ID & RISK ASSESSMENT WORKSHEET

Location: GM CET Bedford GWTP
Date: Dec 4/15
Job/Task Description: Trench Excavation for Piping Installation.
Supervisor/Contractor: Randy Campbell/Sevenson.
Crew Members: Shane Reynolds, Randy Campbell, Dave Leising, Arnold Campbell, Don Jackson, Bob Jones, Todd Barnes, Brad Short, Greg Harnell, Lucas Bartlett, Travis Jeanie.

Hazard Categories	Specific Hazards	Risk Rating without Controls				Controls to Reduce Risk	Risk Rating with Controls				
		L	E	C	S		L	E	C	S	
Design: Sloped Flooring, Pinch Points, Elevation, Guarding	Manhole. Assembly. + Piping Pinch Points.	6	10	50	450.	Use equipment and spotters with strapping.	1	1	2	10.	20
Location: Near Gas Sources, Near Power Lines, Working @ Heights, Excavations, Upstream/Downstream Piping, Limited Access (i.e. – Cable Trays)	Working Beneath Power Lines. working over 4" Waste Water contamination	6	10	50	450.	Utilities located. Use spotters. site Tailgate.	1	1	10	10	100.
Ergonomics: Posture, Body Motion, Load Handled, Work Area, Tools/Grips, Vibration.	working in ~~sloped~~ trench Heavy piping handling. Compaction Eq't.	6	10	30	450.	slope sidewalls of trench. Eq't to handle piping Hearing Protection + Gloves when Compacting	1	1	2	10.	20
Housekeeping: Obstructions, Debris, Access/Egress.	working around 4" Waste Water Line	6	10	2	450.	Protective Cover over pipe spotters removing rock from fill over pipe.	0.5	0.5	2	10.	5
Environment: Heat, Cold, Toxic/Noxious Chemicals, Noise, Odors, Weather, Visibility, Dust, Slippery, Flammables/Explosives	December Weather Conditions	10	10	10	450.	Dress in layers Hand Warmers ordered.	0.5	1	10	10.	50
Energy: Stored, Mechanical, Kinetic, Gravity, Chemical, Thermal, Electrical, Nuclear	Power Lines Hydraulic Equipment.	6	10	50	450.	Spotters On site tailgate. Radios between operators + labourers	0.5	1	2	10.	10
Work Activity: Engulfment/Entrapment (Does the actual work create a specific risk?).	Work around Manholes.	6	6	6	450	Trench box or slope excavation	0.5	1	2	10.	10.
Atmosphere: O2 Deficiency/Enrichment, Gases/Vapors, Carbon Monoxide, Sulphur Dioxide, Hydrogen Sulfide, others.	N/A.	–	–	–	–						
Others: New/Young Worker, Lone Worker, Trainee, Limited Communication	No New Workers. Limited Communication.	6	10	10	450.	Radios for workers	0.5	0.5	2	10	5

Discuss with Dave.

HAZARD ID & RISK ASSESSMENT REFERENCE SHEET

NOTE: When completing the above assessment, please take into consideration potential mechanics of injury (i.e. – struck by, caught in, struck against, etc.) and potential parts of the body that could be affected

Risk Scores

>750 -	Stop Work Immediately
451 to 750 –	Take corrective actions now
91 to 450 –	Correct or Remediate
20 to 90 -	Risk easily controlled
<20 -	Risk is Negligible

RISK ASSESSMENT – LIKELIHOOD (L) X EXPOSURE (E) X POTENTIAL (C) = RISK (S)

1.	2.	3.	4.
Likelihood of Injury (L)	Exposure Factor (E)	Potential Consequences (C)	Risk Score (S)
Most Likely **10.0** Quite possible. (50/50 chance) **6.0** Unusual but possible **3.0** Only remotely possible. (Has been known to happen) **1.0** Conceivable but unlikely. (Has never happened after many years of exposure) **0.5** Practically impossible. (Has never happened.) **0.1**	Continuous (Many times Daily) **10.0** Frequent (daily) **6.0** Usually (1/wk – 1/mon) **3.0** Occasional (1/mon – 1/yr) **2.0** Rare (It has been known to occur) **1.0** Very rare (Not known to have occurred) **0.5**	Catastrophe **100.0** Several Fatalities **75.0** Fatality **50.0** Extremely Serious Injury **30.0** Disabling Injuries, reversible tissue damage **10.0** Minor cuts, bruises, irritations **2.0**	Very high **>750** High 451 to 750 Medium **91 to 450** Low **20 to 90** Perhaps risk acceptable **<20** (Column 1 x Column 2 x Column 3 = 4)

➢ **CONTROLS**

FORMS OF CONTROL	POSSIBLE SOLUTIONS
Elimination	Removal, Disposal, Neutralization, Isolation, etc
Substitution	Other ways of doing job/task.
Engineering	Safeguards built In, Changes in Process, Technological Changes, etc
Administration	Safe Standard Practices, Hazops, Policies and Procedures, Manuals, etc
Personal Protective Equipment	Gloves, Respirators, Fall Protection, Acid Resistant Gear, etc.

1. Fill out the top part of the Form (Be specific on information required).
2. List all the identified risks associated with the job/task.
3. Rate the risk(s) according to the table (Base this on FACT not CONJECTURE)
4. Apply Controls to the Risks
5. Re-rate the risk(s) after the Controls are in place
6. Document and File *NOTE: If the job/task changes before completion a new assessment must be done*

Mon Dec 7/15
Weather: 43°F Overcast high 51°F.

6:30 - Air stations & air calibr. all units at trailer 6:40
7:00 SES H&S : Stay Alert around construction work (Awareness)

	W	N	E	S
Air station mg/m^3	0.067	0.066	0.050	0.047
Power/Network	✓	✓	✓	✓

cont' trenching (to finish today - 10' left)
- 8' water in trench.

commence fire line installation.
- signage all in place, - work zone delineated.
- spotter has signal flag

→ Bridge to be set-up at 8:00 (producing water)
- west side -

- video taken at N & S sides of bridge
→ S video emailed.

→ Netronix - modem for N unit returned
(see Nov 12th)

1530 Trenching completed
12-02-15 Progress Meeting Minutes (draft)
- sent out

1730 SES off site
Air station collection for charging

1800 Off Site

→ N video emailed at hotel.

SUBJECT

DATE

Tues Dec 8/15.

Weather: 32°F Fog high 58°F

6:30 Air stations & air calibr. all units at trailer 6:40.

7:00 SES H&S: Orientations / Working with New Workers

Air station	W	N	E	S
mg/m^3	0.050	0.030	0.037	0.058
Power / Network	✓	✓	✓	✓

- clean off trencher & stage in trencher laydown area
- hauling contamination - 5 Young Trucks a.m.
  + 2 in p.m. - completed today.
  - waited during 1st round to see if trucks needed 2nd round.
- laying iron ductile fire main - GWTP.

9:00 SES WTP sampling.
Process water samples.
Fed Ex out samples.

- decon 300 excavator after final 2 Trucks in p.m.

trench for pipe deepened (frost coverage) to 3' cover
- 12" mat'l between culvert & fire main then 2' cover
- Fire line pipe to be insulated where shallow

17:15 decon shut down.
Air stations collected for charging

18:00 ~~OFF~~ Site.

Wed. Dec 9/15

Weather: 45° F Ptly Cldy High 55°F

6:30 Air Stations ∅ air calibr. all units at trailer G140.

7:00 SES H+S: JSA Pipe Installation

Air stations	W	N	E	S
mg/m³	0.025	0.026	0.027	0.028
Power/Network	✓	✓	✓	✓

- decon of excavator from contamination hauling
- Fire main trench installation.
  - 22" cover (as per RH) is all that is needed
  - info passed onto C. Porter (BRCJ)
  - → sent over to trencher laydown area to have breaker installed.

1300 GHD: TB/TL/RH/KK/JMc/PG

SES: SR/RC/DL

GM: CH

Ph: DC, GT

McI: Gary McI./Wade Blackwell/R. Griffith/Darren Woody.

① Safety. New Safety Reporting/Telephone Line 19:05 grading soil to GM. by WTP Communication line brought down

SES Incident - what happened - phone line to Pump House was re instated

- Route cause - caution tape along reinstalled line
- what's being done - site safety stand-down.
  - GPS mast painted.
  - visibility was issue.
    - signage hast been posted.
  - larger bucket for mini
  - smaller eq't to be utilized in area.

None. - McI

- work force not focus on changes of tasks
  - refocus stressed on work force
  - enfice reefficise - spotters have been reinstructed on task
  - field foremen - JSA reviewed in field with work.
  - after lunch review of tasks with
  - → 2 spotters - 1 for overhead, 1 for buried.
  - → focus was enfised on 4" ww line.

GHD Audit - KK

- house keeping items → GHD
  - → written.
  - expired items in 1st Aid kit

KK compiling H+S Audits → need by EOD tomorrow

Date

Reference No. 13968 / 89428

Construction Progress Meeting Sign-in Sheet
Bedrock Pilot Trench and GWTP
GM Remediation
Bedford, Indiana

Company Name	Represented By	Telephone No.	Fax No.	Email Address
McIntyre Bros.	Wade Blackwell	812-275-5956	812-275-7542	wadeb@hpcisp.com
McIntyre Bros	Ryan Griffith	812-583-5667		rgriffith16@gmail.com
McIntyre Bros	Gary McIntyre	812-277-6542	812-275-7542	GaryM@HPCISP.com
RE Griesemer	Eric Scott	317 428-8767		escott@regriesemer.com
GHD	Paul Gallaway	519-884-0510		paul.gallaway@ghd.com
GHD	Jim McGuigan	708-476-4793		jim.mcguigan@ghd.com
GHD	Rick Hoekstra	519-588-5143		rick.hoekstra@ghd.com
SES	Shane Reynolds	812-278-9584		sreynolds@sevenson.com
SES	Randall Campbell	812-278-9584		rcampbell@sevenson.com
SES	David Leising	716-609-2902		dleising@sevenson.com
GM	Cheryl Hiatt	313-510-4328		cheryl.v.hiatt@gm.com
McIntyre Bro.	Darrin Woody	812-675-1403		
GHD	Katie Kamm	651-295-7400		Katie.Kamm@ghd.com
GHD	Tim Luo			

00 25 00 F01 - July 2015

SUBJECT

DATE

② Trench. - N side
- removal trench.
- stockpiled on lower Modutank pad in 216.

- video - every 10' with BRG.
BRG mapping trench facing.
- GO Pro to ~~be~~ wiped cleaned
- commence tomorrow.

① Pipe Installation.
- where are we tying in fire line. PIV.
- tie in on line E to ~~[illegible]~~
- line may be in grass.
- 4 - 6' deep to connect fire line.
- T to be installed on N/S line.
- Woody will need to work on line if contamination present (40 HR trained)
- dig out contamination → put it back + line over.
- dura skrim cover, pending liner crew on site.
over area.
- Plant to be informed when working around Plant fire line
- water will be created → pump to SW pond
- Flushing water in the line cannot go to sprinkler
new.
system (contaminated)
- need line back to pond to be installed to recirculate water.
- GWTP has line SES can connect 8" HDPE to 4a take water back to sw pond (temp).
- new PIV will need to be installed.
② Height on fire hydrant.
std is 5' depth. - will look into getting 4' or 3' hydrant

6" process line will be finished in fire hydrant ~~trench~~.
- vault water
- ends on blind flange by WTP. (to be connected at later date)
↳ should make connection now while contractors are available

- all other tie-ins → no issues.

(3). Rubble → where will it go.
GM to talk to legal counsel on

- trencher schedule. - GM cannot extend at this point
- BS to discuss tomorrow
- will hear back.

GWTP - internal piping to Carbon Cells
Flocculator
- 70% electric installed
- concrete work on containment pad
& walls ~70% finished this week
- M&I - schedule to work straight thru XMas shutdown
to the

SES. - completed - trencher is done
- impact soil is done
Going f. 2wk piping finished except forcemain to trench

- trench spoils, vinyl sheeting
- piezometers, bentonite grout & stone

2 wk ~~Jan~~ - south trench will be open.

power & fibre optic to ww4 → Feb according to SES

new GWTP will need to be metered separately.

SES - Change Order - Stand by for Trencher.
- Piezometers
- winterization of WTP.

15:30 Jack Spires. - shut down diesel pumps at pumphouse.
812 276 9050. Fri 7:30 am.
- investigate fire line connection ½ day.
Mon - excavate & create 'clean' zone for pipe fitters ½ day
Tues - hot tap & connect firemain 1 day.
- trench backfilled & working platform graded.
17:15 work wrap up by SES 17:30 off site.
Air station collection & charging
18:00 off site.

SUBJECT | DATE

Thurs. Dec 10/15

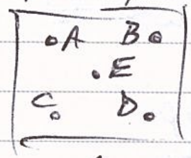
Weather: 37° F Clear High 59° F

6:30 Air stations & air calibr. at trailer all units 6:40

7:00 SES H&S: Weather Conditions

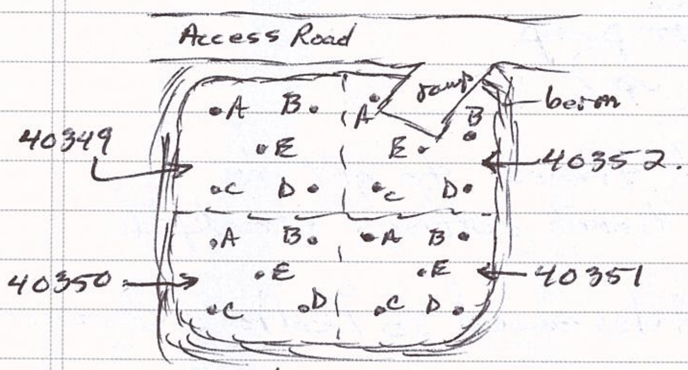
Air station.	W	N	E	S
mg/m^3	0.051	0.048	0.048	0.059
Power / Network	✓	✓	✓	✓

composite grid sample.



- to commence cleaning out trench with long stick
- cont' trenching excavation for pipe installation between WTPs.

- sampling base of <50 impacted stockpile
C. Song sample# 40349 + 40348 → Spring 18.



BRG to survey tomorrow
- presently at fire main installation.

14:20 Jack Spires - notified on Fri / Mon / Tues diesel pump shut down at SW pumphouse → okay with shut down

sump area on trench excavated with long stick
- BRG → 2/10 deep on trench depth.

- trench cuttings stockpiled on W end of Lower Medo tank pad
- BRG to survey sample locations tomorrow.

17:45 SES shut down for clean-up.
Air stations collected & charged.

J. Mc. - air monitoring to cont until contamination cover over with clay cover

18.00 Off site.

Fri. Dec 11/15
Weather: 51°F Overcast high 62°F

6:30 Air stations & air calibr. at trailer all units 6:40
7:00 SES H&S: Winter Clothing / Excavation JSA.

Air station	W	N	E	S
mg/m^3	0.080	0.069	0.062	0.102
Power / Network	✓	✓	✓	✓

- cont' pipe trenches to WTP
- contact. Security Re: turn ~~off~~ diesel pumps at SW Pumphouse
* - McIntyre has made 6" HDPE pipe with elbows to connect with vault water
- trench shifted to N to accomodate pipe
- piping to MH-6 will now cross piping twice
  - SES will Field fit.

10:20 - security to shut off pump.
+11:00 (did not show up).

- dozer across. opened trench to get to Parcel 216 to handle trench cuttings stockpile

Air tabulation to date. - Files saved to Bedford server.

Trench video shot 3+50
3+45
3+40
3+35
3+30
3+25
3+20

1700 SES shut down trench work to prep Water Management for weekend.
Air stations collected for charging.

1800 Off Site

SECTION 14 VEHICLE TRAFFIC AND CONTROL

Inspection Date: Dec 11/15

Inspector: Pete Bridcut

Project Name: GM CIET Bedford - Pilot Trench

Project Location:

Address: 320 GM Drive

City: Bedford

State: IN

Zip: 47421

GM Project Manager: Cheryl Hiatt

Consultant Name: GHD.

Consultant Project Manager: Jim McGuigan.

Consultant Superintendent: Katie Kamm.

Consultant Site Health & Safety Officer: PBridcut/Tim Lee.

Contractor Name: Sevenson Environmental Services

Contractor Project Manager:

Contractor's Superintendent: Randy Campbell

Contractor Site Health & Safety Officer

CHECK IF NOT APPLICABLE ☐

ITEM NUMBER	AUDIT QUESTION	YES	NO	NA	COMMENTS
1	High visibility safety vests meeting ANSI Class II garment requirements are being worn by personnel at all times?	☒	☐	☐	
2	Cones and other visible markers are being used to demarcate a safe work zone around the active work zone(s)?	☒	☐	☐	work signage placed along Bailey Scales Road. prior to crossing location.
3	Appropriate signage has been posted as necessary, to inform roadway/parking lot users of any additional control measures necessary to protect the public and site employees?	☒	☐	☐	
4	If project work includes working on an active roadway or along the shoulder or side of the road is necessary, has a Uniform Traffic Control Plan been established?	☐	☐	☒	Traffic Control established for work vehicle (Moxy) crossing Bailey Scales Road - no work conducted on roadway.

FOCUSED INSPECTION CHECKLIST

SECTION 14 VEHICLE TRAFFIC AND CONTROL

Inspection Date: ____________________ Inspector: ____________________

Project Name: ____________________

Project Location:
Address: City: State: Zip:

SECTION 14 VEHICLE TRAFFIC AND CONTROL

Safety Observation Tour:

Safe Observations	Corrective Measures	Completion Dates
Flagger notifies operator	on 'all clear' to cross	road
Uses Flagger STOP sign	+ radio to communicate	with operator
Public given right	of way prior to crossing.	

Unsafe Observations	Corrective Measures	Completion Dates

SUBJECT

DATE

Sat Dec 12/15

Weather: 65°F Overcast high 69°F

8:00 On-site → GO Pro.
H&S : Housekeeping / Ergonomics.

Download of trench videos

Upload of trench videos for email.

3+50 } sent from trailer
3+45
3+40 }
3+35 } sent from hotel.
3+30
3+25
3+20

- prep 12-09-15 Meeting Minutes.

- Filing maintenance → survey data.
→ chemical data
- trench
- SES WTP

- email organization.

12:45 OFF Site.

0.26" Rain

Mon Dec 14/15

Weather: 56°F Rain high 56°F

630 Air stations & air calibr. at trailer all units 6:40

700 SES H+S: Accident Prevention

Air station	W	N	E	S
mg/m^3	0.006	0.008	0.007	0.006
Power/Network	✓	✓	✓	✓

8:25 Security 812 279 7360 → Security will not shut off pumps

8:30 Tim Meyers 812 279 7239 - message left.

9:30 email sent.

- talked to GM WTP staff Dave Anderson - gone for lunch - handles lagoon 812 279 7266

11:10 Tim Meyers - pump shut down tomorrow ~ 8 hrs (one shift)
- will talk to plant & get back to me.
→ 812 277 6604.

- not receiving signal → loose serial port, tightened

- coorelate chemical data.
- meeting minutes 12-9-15
- video storage

SES - exposing GM fire line for hot tap in a.m.
- aiding HLC with trencher disassembly.
- storm water management

SES off site early

1630 trencher crew off site

Air station collection & charging

1700 Off site

SUBJECT Tues Dec 15/15 0.05" Rain

DATE

Weather: 43°F Ptly Cldy high 53°F

6:30 Air Stations & air calibr. at trailer all units 6:48

7:00 SES H&S: Stroke - Identifying Symptoms.

	W	N	E	S
Air station				
mg/m³	0.008	0.007	0.007	0.009
Power / Network	✓	✓	✓	✓

Tim Meyers 812 279 6604. - need to meet with him to go over work plan
(~~off~~ - 812 279 7239)

9:00 Tim Meyer → P Burdett / Jamie Russell (performing hot tap work)
JSA run over as part of tailgate.
- met with Tim. → will need to lock out diesel generator while working & text Tim when complete

9:43 - Tim Meyers - will call security to remotely shut of generator

10:15 Security - pump house opened for generator lock out.
→ GM Plant Video / GM Contractor Safety.
- hot tap work onto existing fire main (145psi in WTP)

14:15 lock taken off diesel pump generator

14:25 - text to Tim Meyers.
→ 13:00 Tim & Victor on site to check on scheduling
- we will be done well before 15:30.
- connection from installed valve to be performed tomorrow when proper elbows & pipe obtained.

→ pressure test on valve prior to hot tap.
200 psi ~ 15 min. → should be McIntyre's call.
(Jamie was going with 150 psi - no response.
P. Burdett)

con't trenching fire main (HDPE pipe in trench)
- pipe backfilled with sand
- conduit for fibre optic run on top of sand.

Bedrock Trench - move pumps out of working platform.

1710. Trencher crew off site / pump work complete
Air station collection / charging

1800 Off Site.

Wed Dec 16/15

Weather: 33°F Clear high 56°F

6:30 Air stations & air calibrat all units at trailer 6:40

7:00 SES H&S: Refueling Vehicles.

Trench Excavation Sidewalls to be sloped / MH - JSA.

Air station	W	N	E	S
mg/m^3	0.029	0.019	0.028	0.049
Power/Network	✓	✓	✓	✓

GWTP - trench backfill along W trench excavation
- bust out concrete W of GWTP in trench alignment.
- commence with E pipe trench excavation & MH installation.
  - McIntyre stockpiling stone & rip rap along alignment
  - McIntyre trailer in way of pipealignment to be moved by p.m.
- trencher loaded on flat bed for mobing offsite.
  - to stage at P201 overnight.
  - 5 Trucks in a.m. to load remaining trenching eq't

Ed Peterson.

pH	J. Paz	GHD.	T. Coo	SES	RC.
	G. Turch		D Charters.		SR.
	R. H JMc.		P. Bridet		DL.

McI - woody
Ryan.

Eric Scott - Griesmer

① GHD - McI - None.
GHD - SES - None,

② Piping Trench - McI - moving trailer ✓ done
so its out of way.
- SES clear to go.

Driveway to keep open   trench going across driveway

Woody to install line

Thrust Blocks on Fittings SES asking Woody
Greismers → McI to install.
Gary feels Greismer to install.

Eric Scott → Gary would look after it.
McI to install.

SUBJECT

DATE

Griesmer. - working on getting connection
to feed fire main water back to pond.
- to be looked into window to be removed.
For hose access.
drain into MH-6.

Eric Scott.
Joint Restraints will be need as pipe may
shift when pressurized.
- additional soil would be needed → not available
- how big do thrust blocks need to be.
- soil that thrust blocks are being needed.
are fill soils since 2006.
- concern with putting thrust block in fill mat'l.
- need proper sizing. for T.B.
- no thrust block in design.
- E. Scott. to provide.
- test pressure to be at 200 psi.
- SES will have information in a.m.

③ McI Concrete Poured Out
Walls & Walkways / Bathroom Floor.
Piping being worked on.
i containment area
- between Carbon Units
Elect. - cont conduit work
elect. room wiring.
- cont with exterior piping.
- archit. wood
drywall work.

Trencher being demobilized.
all Eq't ~~off~~ site ~~tomorrow~~.
- piping installation. → concentrating on.
- central portion of trench cleaned out.

Ed ? Trencher. hydraulic pump replacement 10 teeth /day met production

J-Mc - Piezometers.
-attached - zip ties. 2 holes + U Bolt.

WTP winterization → recirculating.
-C.O. okayed by GM.
Monthly Sampling in Jan.

Air Monitoring. - continue monitoring
-

Change Orders SIES ok.

latest Payment sent yesterday.

GHD. - Fire Main testing.
- Fri or Mon at latest.
For Thrust Block - sized for - silt
- sandy clay. 9 ft^2 3 x 3 16" thick.

addition cover will be needed.
-grade appropriately.
90 to be mechanically restrained
- concrete pour of thrust blocks tomorrow.
- pressure test fire line on Mon.

1530 Griesmer to req' excavator to connect fire line at WTP → SE'S off site
- will have to wait until a.m.

→ email to postpone Progress Meeting between Trench & GWTP next week.
- resume Jan 6th
17:00 Collect Air Station for charging & off site.

12/16/15

GWTP

Recently Completed:
- Truck Unloading Pad
- Walk between Containment Pad & GWTP Bldg
- Above ground piping started in Containment Area
- Bathroom Floor poured-out
- Interior Doors

Continueing Work:

- Interior Large Diameter Pipe on the GAC's
- Compressed Air Piping
- Electrical
  - Conduit
  - Wire Pulls & Terminations
  - MCC terminations

SUBJECT Thurs Dec 17/15 0.03" Rain

DATE

Weather: 31°F Clear high 35°F

6:30 Air stations & air calibr. at trailer all units 6:40

7:00 SES HS : Near Misses.

Air station	W	N	E	S.
mg/m^3	0.009	0.007	0.014	0.010
Power/Network	✓	✓	✓	✓

Tim Meyers → need to contact Re: pressurizing fire mai

cont' with piping trenches - SW of GWTP
- commencing on SE of GWTP
- trencher demobilization - arm/tracks/chain counter weights.
- fire line PIV at GWTP } installed.
- fire hydrant at NW GWTP }
- joint restraints on fire line from WTP on all joints to the 45° angle joints
- thrust blocks poured on both 45° angles.

MH 10 + MH 14 installation - eq'lzn } tanks.
- efflent }
- going north → bedrock encountered.
- rock break ensued.
- forcemain from SE of GWTP
- water line intalled with it }?
- conduit line also installed adjacent }

- trench clean out at SW corner of GWTP

17:05 SES commence securing excavations.
air stations collected for charging
17:40 Last truck with trencher eq't off site

1800 Off site

Fri Dec 18/15.
weather: 31°F Overcast high 36°F
6:30 Air stations & air calibr. at trailer all units 6:40
7:00 SES H&S: Proper use of Wrenches.

Air station	W	M	E	S
mg/m³	0.017	0.019	0.022	0.029
Power/Network	✓	✓	✓	✓

- backfilling & compacting fire main trench.
  - marking tape to be placed in trench for 6" HDPE pipe/fire main / conduit line.

- rock breaking along E GWTP. trench. N of MHs 14 & 10

Tim Meyers 812 279 6604 / 279 1239 } messages left
- will be pressure testing fire main on Mon & will need to lock out diesel pumps at SW pond.

8:40 - he will inform plant → should be okay

→ SES has 5 days budgeted (will cover thru to 23rd)
→ after that → ATP
- test pit by MH 13 & 9 → no bedrock
→ present by bedrock becoming more shallow as trenching N of MH's 14 & 10

→ MH 13 has angle in it (should be straight)
MH only provides 6" drop → probably remove it

17:20 SES securing Excavations
McIntyre to install pipe N of MHs 14 & 10 on Sat.
→ discuss with S. Reynolds
- will need to discuss with R. Hoekstra on Mon.
Air Stations collected for charging.
18:30 Off Site.

SUBJECT | DATE

Mon Dec 21/15

0.11" Rain

Weather: 41°F Rain / high 54°F

Air stations & air calibr. at trailer all units

7:00 SES H&S: Common Sense / Accident Prevention

Air station	W	N	E	S
mg/m^3	0.039	0.013	0.023	0.027
Power/Network.	✓	✓	✓	✓

- cont' trenching N from E side of GWTP.
- Griesemer on site to pressure test fire main.

8:30. Tim Meyers. 812 277 6604. - diesel pump shut down: at SW pond (security notified)

Young Trucks delivering sand (for trench backfill).

Nov 24th - Dec 2nd Final Meeting Minutes sent out

12:00 SES still connecting return line for fire main testing

12:30 Security → pump house opened for diesel pump lock out

13:00 Line flushed WTP gauge → 145 psi.

line pressure dropped to 55 psi when PIV open

	Time	WTP (145 psi)	GWTP (– psi)
13:30	30 min	55 psi	65 psi
	15 min	built up to 90 psi	85 psi
14:00	15 min	built up to 135 psi	110 psi

- pressure not increasing with compresser pump
- Griesemer to get new compressor & start again tomorrow
- test will not be able to be completed prior to shift change

17:00 SES fueling vehicle / securing excavation trench

pressure in line at GWTP → 110 psi (holding)

- possible air in line

Air stations collected

East station → single point reading for the day

- check results tomorrow.

1800 Off Site

→ 0.11" Rain in gauge at end of day

Tues Dec 22/15 → 0.17" Rain

weather: 51°F overcast high 53°F

6:30 Air stations ϕ air calibr. all units at trailer 6:40

7:00 SES H+S: Holiday Stress/Holiday Accidents

Air Station	W	N	E	S
mg/m³	0.039	0.052	0.042	0.030
Power/Network	✓	✓	–	✓

7:35 Tim Meyers - will be pressure testing fire line today
812 277 6604 - will not be locking out diesel pump - may need it to flush air out of line
- need to contact Security as alarms sound when pumps come on

7:45 Jack Spires - message left
812 276 9050 → on vacation

7:50 GM Security - spoke to them personally - ok if pump kicks on
G. Song notified of situation

- A. Campbell + T. Barnes - discharge line to be blown clear with compressor

9:05 - new pump hooked up → pressure up to 200 psi
MH-13 + Allison Smith - being installed as per design
(R Hooksta off sick) - going from 1% to steeper grade
drop down to MH-12
will send out email (S Reynolds will need confirmation for ordering)

11:05 no pressure loss - SES to use compressor to clear line
after Griesemer flushes line
(pressure at 200 psi held until after 12:05)

Dustrak unit not registering on network - single point reading for day
- similar to yesterday

14:20 Tim Meyers + Plant Security - work completed
- lock out is off pumps.
· McIntyre lock out on PIV to fire main + valve to GWTP

· old MH-13 put in place for temp line connection + for survey purposes
- Fence panels placed over open trench
+ chain link fence around work area secured

17:20 Air stations collected

18:00 off site

Dec 16 Draft Meeting Minutes completed at hotel

[signature]

SUBJECT Wed Dec 23/15

DATE

weather: 61°F Overcast high 65°F (Rain)

6:30 Air station & air calibration at trailer all units 6:40

700 SES H&S: Holiday safety:

Air station	W	N	E	S
mg/m^3	0.019	0.015	0.012	0.021
Power/Network	✓	✓	X	✓

old N unit put into service

back-up unit moved from N to E location.

- no power registering when connected to battery?
- had worked at N location?

- email to Pine Environmental.

E location Dustrak sent back

· interior sleeve/collar inside charging port came out & no longer allows charging or power functions

935 - pressure test connection

926 - rock breaking along piping excavation

937 - laying pipe from MH-10.

947 - fence panels over trench

E unit re-located at E station.

& back-up unit brought back to trailer

M. Curtis to collect air stations at end of day.

- SES to continue trenching for McIntyre to lay pipe
- primary issue → to reinstall driveway access to GWTP

10:30 OFF site

Indy to TO flight delayed from 13:55 to 15:16.

→ to 16:00 Storm Warning in Marion County

Mon Jan 4/16
weather: 24° F Cldy high 36° F
6:30 Air stations ∅ air calibr all units at trailer 6:40.
7:00 SES H&S: Return to work, Re-inspect eq't/site before starting

Air Station	W	N	E	S
mg/m^3	0.015	0.020	0.015 ~~0.153~~	0.010
Power / Network	✓	✓	✓	✓

∅ air calibr. redone in Field.

- cont trenching N along E end for GWTP
- secure ~~sediment~~ & erosion controls

13:00 Manifold connection at WTP
- GWTP & Design connections discrepancy
- GWTP needs dirty water / clean water

GWTP - Fract tank is clean (Adler).

Allison - intent to connect to eq tank
- WTP pump not strong enough to go to GWTP
- use temp pump (booster)

Rick - tie into manifold.
- T connection with cam lock.

wet wells discharge to new GWTP
- vault line to connect to manifold.
- camlock to be able to get clean water from Adler tank
- pressure test GWTP with clean water
- test effectiveness of GWTP with dirty water

120000 gal in new GWTP to get to carbon vessels

elev diff. - top of existing eq tank. } elev difference
- top of new eq tank }

pump at lift station - can it provide adequate head.
- existing pumps in wet wells. should have enough head.
- Exist pipes are insulated - heat trace on lines?
- RH to check with S. Reynolds
- still need to get water to Adler tank (clean water for back wash)

- secure SEC issues - silt ½ up at S end trencher laydown on fencing ✓ fixed
- silt/water/roots ½ up NE end GWTP silt fencing ✓ 2nd fence down gradient
- silt build up around straw bails at CB N of GWTP ✓ cleaned up
- MH's 8 & 12 installed - trench extended N. - will be 1' of fire hydrant line

* HAND DIG & stay 4' off fire hydrant line → EXISTING THRUST BLOCK (BRCJ)

17:15 SES clean up & fueling.
1800 Air stations collected & off site

SUBJECT DATE

Tues Jan 5/16.

Weather: 23° F Clear high 35°F

7:30 Air stations & air calibration all units at trailer 7:38

8:00 SES H+S: Purpose of Safety Meetings

Air Station	W	N	E	S
mg/m³	0.030	0.052	0.032	0.035
Power/Network	✓	✓	✓	✓

- cont trenching E pipe alignment N of MH's 8 & 12.
- to sample SES WTP ~10:00.
  - hold until after lunch → ports frozen

serial connection check still not registering postvak. (software reboot)

- S. Reynolds to provide costing for C.O & ATP for connection to containment manifold & Adler tank (+ pumping to GWTP)
- GWTP pipe trench. cont to MH-6 & Adler tank.
- MH13 not in yet.
- Forcemain at SE corner GWTP (8") to be shortened (to get off 12" line)
- BRCJ - shot approximate locate on sewer line from GWTP bathroom

13:30 WTP - sampled as monthly batch testing.

14:30 ① 12" to MH-6 needs to cross 8" Force main to Adler
- crossing to be done at low end of excavation trench. to allow for adequate cover mat'l

② Changing alignment on 12" to MH-6 - going further N & coming back in order to cross fire main only once.

③ MH-7 → invert will be 3" higher due to liner depth
- gave ok → will let R.H. know.

④ 8" Forcemain to Adler - re oriented to go directly to Adler

⑤ Confirmation - line by WTP containment will collect water via pump from Adler to go to GWTP → ✓ yes.

FSK & sample prep.

17:30 Air station collection.

18:25 off site → Cooler delivery to Fed Ex.

12-16-15 Final Meeting Minutes. → send out in a.m.

01-06-16 Progress Meeting Agenda → sent out.

→ Progress Photos - sent out.

Wed Jan 6/15
Weather: 22°F Clear high 43°F
6:30 Air stations & air calibr all units at trailer 6:48
7:00 SES H&S: Seat belts.

Air station	W	N	E	S
mg/m³	0.060	0.058	0.088	0.070
Power/Network	✓	✓	✓	✓

software reboot? PM-1 still recording,
TWA single point entry.

- SES → 8" line from lift station to WTP
  - Can it be abandoned + cut up?
- MH-7 top removed to cut hole in 4' barrel to be added.
  - invert raised 0.3' to stay away from joint at base

11:15 - reboot unsuccessful this morning.
Phil Curtis PineEnviron. 800 301 9663 - reset the modem
- if nothing changes by noon - replace with back-up unit when it arrives

13:00 Progress Meeting.
GHD: T.L., PB. SES: SR, RC, DL.
McI: G.Mc, Woody PW KK, JMc, GT. J. Paz
Ryan. RM.

① Safety McI: None CH.
SES: None.
- will need update on Safety Audit for Jan.

- 8" Forcemain - has been directed to Adler
  - GM not given authoriz to connect
  - maintain direction of pipe to Tank.

Pumping from Adler to be done by (drain line)?
which will be directed to GWTP via manifold line.
- connection to be done at later date.
  └ dead end line above ground with flange ~6' from Tank.
- 12" Line Crossing at low point.

Temp HDPE line - lift station to WTP at Y connection 8"
- line is presently apart.
- ww3 connection.
no longer in use - RH → get rid of.

SUBJECT

DATE

- ww3 to be connected to trench.
- ww3 to be sealed.

will then be concentrating on trench cleaning and vinyl sheeting installation

- Adler tank connection early next week.
  + pumping to eq tank. next week.

SES - priority list - ditching to be completed today.
- need to have piping put in place.

McI - to go to 10 hr days to complete piping

SES working 5 ten hr days.

CH. - SES advised that WTP will start with recirculation.
- couple of wks cold spell.
- on site week of 19th. (wed/Thurs).

CO #5 being prepared to includes temp pump & manifold. connection.

Electrical not hooked up for GWTP yet.
-email sent to State Group & await to hear back

K Kamm → prep ~6 trench videos for GM.

3+35
4+80
5+50
6+50
7+50
8+25

in envelope Attn: Victor Miranda

bought 2 additional memory stick (64GB) + 1 for GM (16GB)

17:30 SES ~~off~~ site Air stations collected
18:00 off site

Videos transferred to memory stick
- to be dropped off at GM security in am.

Thurs Jan 7/16

weather: 23°F Clear high 32°F

6:30 Air stations & air calibr. all units at trailer 6:40

7:00 SES H&S: Heart attacks.

Air station	W	N	E	S
mg/m³	0.042	0.047	0.054	0.052
Power/Network	✓	✓	✓	✓

→ MH-7 pipe comes in at liner boot strapping
- raise pipe invert to go over banding.
- may make pipe angle too high with outflow → RCampbell
→ will need deflector on discharge - will need to remove band

- backfilling operations to west of GWTP (between GWTP & slope)

8:00 - Envelope (video) dropped off for Victor Miranda.
- GM Safety Video (2016)

→ cut up 8" line (from lift station) & stockpile by trencher laydown area

- still waiting on MH-13
- straw bales placed in trenches to lessen sand base washing down with pending rain.
- G. Seng & M. Curtis delivered 'Flag pole' video sticks to trench area yesterday p.m.
- covered with plastic to prevent water/freezing

Draft Meeting Minutes → sent out

17:30 SES off site.
Air stations collected

18:00 Off Site

SUBJECT

Fri Jan 8/16.

DATE

weather: 42°F Rain high 52°F

6:30 Air Station ϕ air calibr. all units at trailer 6:40.

7:00 SES H_2S: PPE for appropriate conditions.

Air station	W	N	E	S
mg/m³	0.026	0.029	0.025	0.031
Power/Network	✓	✓	✓	✓

- prep pilot trench for cont excavation.
- check with McIntyre on pipe welding
  yes - will be working today.
- pipe placement in excavated trench (awaiting MH-13).
- if needed for GWTP - what of diverting trench water to George's WTP to clean & put to Adler tank.
  - too much fines → wait & see how long it takes for initial charging

10:15 Mike Reynolds - Monthly testing resuts are in → ND.
- he will be by the site later today.

10:30 Arnold Campbell → McIntyre running 336 excavator over fire main - instructed them not to do it.

photos taken & email sent out

As per Tim Lee → line will likely need to be pressure tested.

15:00 Woody/Shane - at site - instructed not to run over firemain.
- 2 12" & 8" forcemain to go under 4" wastewater line
- SR looking to see if $22\frac{1}{2}°$ angle fittings available
- McIntyre - everything but 90's are 2 wks order period.

17:00 SES prepping SW management for weekend.
- trench opened & cleaned out (Air Stations collected).

1730 S. Reynolds (SES) $22\frac{1}{2}°$ angle fittings ordered for 12" HDPE lines & 8" forcemain to have lines go under wastewater line from WW3
- should arrive Wed. for McIntyre to install.
- 90° angle deflector to be used at discharge.

1800 Off site

Mon Jan 11 /16

Weather 7°F Clear high 31°F

6:30 Air stations & air calibr. all units at trailer 6:40

7:00 SES H&S: Distracted Driving

Air station:	W	N	E	S
mg/m^3	0.023	0.026	0.029	0.023
Power/Network	✓	✓	✓	✓

SW Management

- unthaw any unused lines
- ensure all walkways around trench are accessible
- circulating SES WTP system worked well over weekend

→ T. Leo - after review of SES email (3' cover over fire main)
- may not be necessary to retest pressure on line

MH-13 delivered - concrete still curing
- to be set in a.m.

1530 SES off site

Air station collection - batteries (12V) left at stations (except E) to power internal micro heaters (for <30°F)

Book Flight to T.O.
Feb 5-7 LZ33K1

16:45 off site

Trenching Video → copy to Backup memory sticks
1930 - 21:00

SUBJECT DATE

Tues Jan 12/16.

Weather: 32° F Snow high 33°F dropping during day

6:30 Air stations ϕ air calibr. all units at trailer 6:40

7:00 SES: Slips/Trips/Falls

Air station	W	N	E	S
mg/m³	0.023	0.012	0.013	0.023
Power/Network.	✓	✓	✓	✓

unit knocked over by animal overnight

- weather unit resecured with zip ties

- road access to GWTP frozen from yesterday afternoon melts
- road sanded + plowed with dozer

1-2" snow 8 am. to 10:30 blowing snow

- temperature drop

MH-13. placement cancelled due to poor visibility conditions

- maintaining SW lines thru recirculation.

↳ placement completed in p.m.

R. Hoekstra flight delay - flight finally cancelled.

- work schedule limited due to weather
- will reschedule flight to next week.

1530 SES off site

Air stations collected.

- batteries left plugged in to power micro heating units
- Trench videos transferred to server

1630 off site.

TO: flight confirmation

Wed Jan 13/16
Weather: 2°F Clear high 29°F
6:30 Air stations ϕ air calibr. all units at trailer 6:40
7:00 SES H+S: Cold Medications / Proper Lifting.

Air station.	W	N	E	S
mg/m^3	0.042	0.039	0.052	0.052
Power/Network	✓	✓	✓	✓

- SES WTP - freezing issues overnight
  - pay close attention to frozen surfaces today
  - water + pumps up to Modutank ok.
- Fitting for connecting to WTP Adler tank to be delivered today

13:00. ph RH. SES SR. DL.
CH. - RC
J. Mc
KK + GT. + JP
- $22\frac{1}{2}$° angles have been delivered.

① Safety Concerns - heavy rain prior to freeze on weekend
Pipes will be grouted. by SES.

Air relief valves - pressure testing to be done prior to installation of air relief valve as per RH + TL.
- WTP frozen this morning
- nothing broken and water is running.

CH Thurs. to meet. with plant.
RH - delivery.
Carbon → 28th + 29th

#5
CO relative to Fitting to Adler tank

Progress Payment KK has P.P. #4 will check
SES to mail through to new address
invoice 3 on Dec 21th
emailed pdf CH sent in.
89 pgs.
$541000

SUBJECT

Thurs Jan 14/16.

DATE

weather: 21° F ϕ air calibr all units at trailer 6:40.

6:30 Air Station → Clear high 46°F

7:00 SES H&S: Manual & Mechanical Lifting

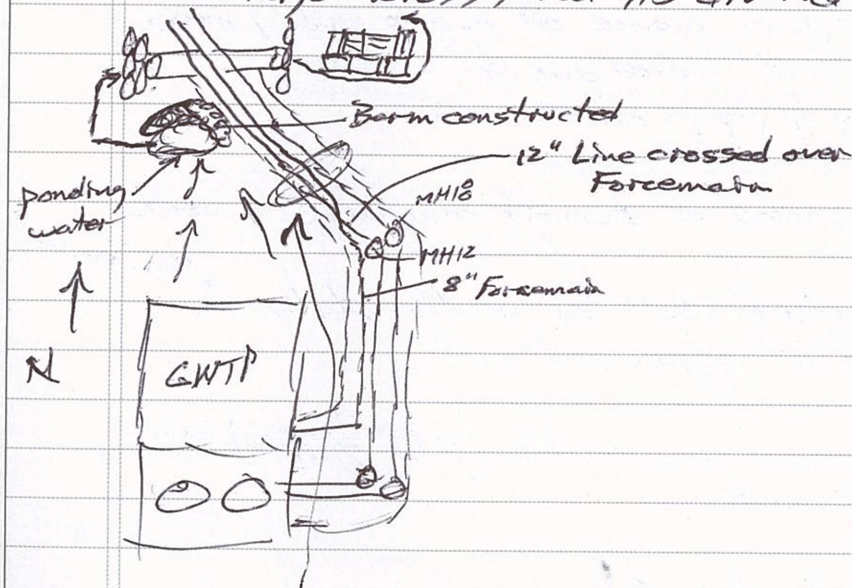
Air station	W	N	E	S
mg/m^3	0.046	0.026	0.036	0.029
Power/Network	✓	✓	✓	✓

- clean out GWTP trenches of ice & run pipe
- pipe north from MH-18/12 toward MH-7
- 12" line from MH-12 to cross 8" Forcemain prior to going under 4" Waste Water line from WW3

10:30 serial connection loose → tightened

- reconnecting lines at SES WTP to eliminate all unnecesary reducer fittings
- 12" pipe from EQ tank crossed over 8" Forcemain in E trench to WTP
- SES to grout pipe into MH's

- drainage across Parcel 413 diverted to W of trench alignments



17:00 SES Berm off ditch to try to lessen water drainage to low end of trench.

- clean eq't / tracks.

17:30 SES off site Air station collection

Progress Meeting Minutes.

1800 off site.

Fri Jan. 15/16

~~[illegible]~~ Weather: 48°F Cldy temp. dropping during day - Rain

6:30 Air stations ~~ϕ~~ air calibrat. at trailer all units 6:40

7:00 SES H+S: Basic Rules of Safety.

Air station	W	N	E	S.
mg/m^3	0.025	0.022	0.025	0.026
Power/Network	✓	✓	✓	✓

- cont' pipe work to MH's 6 & 7
- grout pipes in MH's.
- pump maintenance & realignment of piping at SES WTP for optimal recirculation.
  connect to Adler tank at WTP if time allows this afternoon

- pine trees by Barlow Lane. - will they be in driveway?
  - are they along pipe alignment from trench?
  pictures taken - email sent out

10:45 Mike Reynolds - on site to pick up SES WTP results
- no site inspection performed.

11:00 Rain started - pipe trench closed off due to muddy mess
- grouting MH#8 - halted due to weather
- work focused on setting up piping on SES WTP
  for water circulation to prevent freezing
  email sent out with photos of ~~st~~ runoff discharge to creek.

Pine Environmental → no base brackets for weather stations. *See Jan 12
- will send out replacement unit

1530 SES off site
- to have SW Management crew on site (8hr shifts) Sunday to recirculate WTP water.
- Air station collection.
- W weather station bracket repair

16:30 Off Site → 0.16" Rain

SUBJECT | DATE

Mon Jan 18/16

Weather: 2°F Clear high 14°F

6:30 Air stations ~~pair~~ calibration all units at trailer 6:40
·reconnect ~~weather~~ weather station on ~~W~~ station - secured with zip ties

7:00 SES HeS: Flammable/Combustible Liquids - handling

Air station	W	N	E	S
mg/m^3	0.010	0.006	0.008	0.009
Power/Network	✓	✓	✓	✓

- backfilling GWTP pipe trenches.
- SES WTP /circulation.
- trench clean out held off due to lack of personnel for flagging (Sean + Muscles) 8 hr night shift on WTP
- trench backfill using dozer past MH's 18+12.
  - tracer line for pipe in place.
- SES WTP recirculation.
- K. Kamm on-site → EPA to be onsite next week.

1530 SES off site.
Air station collection (Dustrak unit)
Batteries left plugged in on-site to power micro heaters

1400 STEP performed on T Curtis
wwTP Sampling at influent
post sand
post carbon
+ effluent
Review with G. Seng.

17:00 Off Site

Tues Jan 19/16

Weather: 5° F Clear: high 21° F

630 Air stations & air calibr. all unit at trailer 6:40

700 SES H+S: Burning warmers for unthawing eq't/piping.

Air stations	W	N	E	S
mg/m^3	0.020	0.022	0.020	0.022
Power/Network	✓	✓	✓	✓

- cont. pipe work @ GWTP North of MH's 12 + 18.
- clean out ice from trench + pump out water
- McIntyre welding pipe inside GWTP
- grading N of GWTP
- cleaning out trench (pilot) going N.

11:30am. 3+05 + 3+10 video.

- download + send 2big4email. started 12:50.

13:00 3+15

3+00

2+95

2+90

2+85 }

2+80 } Trench ~ 2½' deep.

2+75 }

↳ download completed at 17:20

Trench Videos transferred + renamed onto main memory stick

01-06-16 Final Meeting Minutes

- MH's 18 + 12 grouted up.

1730 SES off site.

WTP Recirculation crew to stay later.

Air station collection (Dustrak unit)

Batteries left at stations to power micro heaters.

1800 off site.

emailed out + Meeting Agenda for tomorrow from hotel

2 big 4 email not working at hotel

no Trench Video sent out.

FOCUSED INSPECTION CHECKLIST

SECTION 12 TRENCHING/EXCAVATION SAFETY

Inspection Date: Jan 19 /16

Inspector: Pete Bridcut

Project Name: CET Bedford

Project Location:

Address: 320 GM Drive

City: Bedford **State:** IN **Zip:** 47421

GM Project Manager: ~~Jim McGuigan~~ Cheryl Hiatt / Jim McGuigan

Consultant Name: GHD

Consultant Project Manager: ~~P.Bridcut / T.Leo~~

Consultant Superintendent: Katie Kamm

Consultant Site Health & Safety Officer: P.Bridcut / T.Leo

Contractor Name: Sevenson

Contractor Project Manager: Jim Pazderski

Contractor's Superintendent: Randy Campbell

Contractor Site Health & Safety Officer: Dave Leising

CHECK IF NOT APPLICABLE ☐

ITEM NUMBER	AUDIT QUESTION	YES	NO	NA	COMMENTS
1	Are employees protected from falling from heights of 6 feet or greater?	☒	☐	☐	
2	Are spoils piles maintained at least 2 feet from edge of excavation?	☒	☐	☐	Bedrock cleaned off 6' for bridge installation.
3	Are the sides of excavations sloped, shielded or shored to prevent caving in on employees?	☐	☐	☒	Bedrock
4	Is a competent person designated for the excavation?	☐	☐	☒	Bedrock cuttings being removed from Bedrock trench.
5	Has the soil type been determined by the competent person (one visual and one manual test)?	☐	☐	☒	Bedrock
6	Have inspections been conducted and documented prior to personnel entering excavations 5 feet or deeper and as needed thereafter?	☐	☐	☒	Excavation of trench cuttings only.
7	Are ladders or stairs provided as required (trenches 4 feet deep and within 25 feet of travel)?	☐	☐	☒	No one entering trench during clean out.
8	Has the proper type of protective system been chosen based on site soil classification?	☐	☐	☒	Bedrock videos assessed by geologist.
9	Have atmospheric conditions been tested in excavations of 4 feet or deeper for oxygen, LEL and other toxics?	☐	☐	☒	No one to enter bedrock
10	Excavation / Trenching Safety Inspection Checklists available on site for use by the competent person?	☐	☐	☒	

SECTION 12 TRENCHING/EXCAVATION SAFETY

Inspection Date: ____________________ **Inspector:** ____________________

ITEM NUMBER	AUDIT QUESTION	YES	NO	NA	COMMENTS
11	Are barriers placed around excavations near pedestrian or vehicle thoroughfares to control access and protect personnel?	☒	☐	☐	operators & inspection personnel only allowed in work zone.
12	If employees are required to enter an excavation greater than 20 feet deep, has the protective system been designed by a Registered Professional Engineer?	☐	☐	☒	Trench only 3' ~~wide~~ x 4' No one to be within 6' of trench
13	Surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, have been removed?	☒	☐	☐	Labourer using tag line to aid in bridge placement & as escort for inspection personnel to bridge. Caution tape replaced when work stoppages occur.

SECTION 12 TRENCHING/EXCAVATION SAFETY

Safety Observation Tour:

Safe Observations	Corrective Measures	Completion Dates
Labourer on site for escort during work		
Spotter for Off road truck hauling cuttings		
Flagger used for road crossing & for dumping cuttings		
Caution flagging erected during work stoppages.		
Unsafe Observations	**Corrective Measures**	**Completion Dates**

SUBJECT

Wed Jan 20/16

$2\frac{1}{2}$" behind GHD Trailer

DATE

Weather 18°F Snow. high 26°F

630 Air station & air calibr. at trailer all units 6:40

700 SBS H+S: Hypothermia.

Air Station.	W	N	E	S.
mg/m^3	0.038	0.032	0.022	0.032
Power / Network	X ✓	X	✓	✓

set up at noon after battery charged.

~~A~~ batteries dead at station - taken back to trailer to charge

→ spare battery connected to W station

- clear + sand road to GWTP
  - delivery ~ 9:00 (to be done 1st)
- clear + sand road to WTP for generator + fittings delivery
- trench clean out called off due to snow.
  - unsafe to cross Bailey Scales Road + work around trench

email of 3+15 video of trench - started ~ 9:00

→ done 12:30

1300 pH JM. GHD: KK, T.L. SES: RC, SR, DL.

J Paz. PB.

RH. McI: Ryan Br.

CH absent.

① SES, McI, } no safety issues - ice + snow issues. due to late week rain followed by Sunday freeze.

② Pipe Trenching completed.

- 8+2 12" completed. (eastern pipe trench excavation)
- no pilot trenching today due to snow.
- MH-7 to be dug around.
- WTP recirculation is time consuming + difficult with use of manpower
- WTP road cleared + pump down at WTP.
- freezing issues with line to GWTP once pumping.
- around tree. - drive area. - Field Fit.

- paving should be revisited - vs. original road design plan.
- RH to review next week. with SES.
- end of March. beginning of April - for pavement schedule

O Mara not around

E+B - unacceptable safety record

Milestone. → will probably be used.

- CH to be asked about tree issues.
- KK to go over issue with CH.

all eq't in place
- mechanical in place
- elec. conduit in place.
- some. loose wire connections for pending connections.
- carbon shipment delayed to Feb.
- carbon change out at existing WTP.

1st fill 200 000. gall
will use ½v then re-fill.
this volume to charge system.

EPA to be onsite next Thurs. (several people)
- to look at trench primarily.

C/O committee - approved. SES CO & were notified by KK.

DL to give safety. briefing. to EPA prior to going on site.

- no Community Contacts.
- Progress Payment - no problems.
Cold Weather days have led to multiple 8 hr days.

→ Mike Reynolds on-site last week to collect. Jan. SES WTP results
- stopped by SES yard. but not greatly interested. due to heavier work load on Bedford Utls. due to cold weather.

E ~~air~~ station battery check. → died ~ 10:00 am.

15:30 SES off site
SES WTP circulation crew to stay late.
Air stations collected. including batteries - check on recharging stations.

17:00 Off site.

SUBJECT

DATE

Thurs Jan 28/16

weather: 18°F Overcast high 28°F.

630 Air Stations & air calibration all units at trailer 6:40

7:00 SES H+S: Frostbite.

Air station	W	N	E	S
mg/m³	0.037	0.032	0.029	0.039
Power/Network	✓	✓	✓	✓

- cont' pipe + vent valve thaw out on SES WTP
- clean out fill around MH-7 remove belt strap + liner
- hole cleared out for 12" HDPE line
- plastic (durascrim) lowered into MH to collect concrete debris
- concrete saw 4 7/8" - hole drilled thru side of MH → 5"
  - 2 lag bolts on concrete hole section.
    - pulled on while exterior hammered
    - hole pulled clear, excess debris collected in durascrim
    - pulled from MH → No confined space entry required

- BRCJ survey 12" HDPE cross over of 8" forcemain
  - 2" styrofoam placed between pipes during backfill
    ∴ pipes kept off contact with each other
  - survey/verification on Pilot Trench sent to R. Hoekstra for review + acceptance
  - Format acceptable ✓

→ trench backfilled with 6" sand up to liner limit.
- at liner → 2" sand then styrofoam

[illegible] SES Off Site.
Air stations collected with batteries for charging.

1800 Off Site

Mike Branham
Lawrence County Sheriff

Andrew Tillett
Officer
atillett@lawrencecounty.in.gov

Lawrence County Sheriff's Office
1420 I Street
Bedford, Indiana 47421

Telephone: (812) 275-3316
Fax: (812) 277-2007
www.LawrenceCountySheriff.com

Date: ____________ CFS/OFFENSE #: ____________

Fri. Jan 22/16.
weather: 24°F Overcast High 28°F.
630 Air Stations & air calibr: all units at trailer 6:40
700 SES H+S: GM Safety Orientation Review.

Air station.	W	N	E	S
mg/m³	0.032	0.039	0.059	0.039
Power/Network	Battery Charge yesterday ✓	spare used 100% ✓	80% ✓	80% ✓

E Battery at 66%
9:00 → reset power
← serial connection

- cont' backfilling trench up to liner.
- A. Campbell on using excavator to backfill sand.
  - should be okay - hydrant line at 3' depth
    - 8" of frost in area of trench.
    - will not be directly over it.
- Adler tank connection for GWTP

9:10 → Bedford/N Lawrence Police @ trailer
- warrant out for Frankie Bachelor with SES.
- Shane Reynolds informed.

→ styrofoam & 2" sand backfill to 4" Waste Water line from WW3

- pump set up by Adler tank.
- piping connections onto GWTP line.

commencing pumping from trench for trenching

Final Meeting Minutes 01-13-16.
Draft Meeting Minutes 01-20-16.

1530 SES off Site
Air stations collected.
Base bracket for W station cracked at fixed point during pack-up - reglued

1630 Off Site

	Max	Min	Avg.
W	0.102	0.005	0.028
N	0.07	0.004	0.020
E	0.043	0.003	0.018
S	0.096	0.001	0.028

SUBJECT Sat Jan 23/16

DATE CSV

Eq't maintenance at laydown Area & Eq't storage

Eq't delivery + maintenance

Weather: 14°F Clear high 32°F

H&S: Ergonomics.

	W	N	E	S
Oct 15	Background Completed			
16	0.009	–	0.005*	0.049
19	0.01	–	0.007*	0.017
20	0.02	–	0.069*	0.025
21	0.026	–	0.018*	0.068
22	0.033	–	0.022*	0.079
23	0.042	0.024	0.022*	0.092
26	0.011	0.006	0.003*	0.009
27	0.018	0.013	0.008*	0.018
28	0.013	0.007*	0.007	0.009
29	0.01	0.004*	0.032	0.009
30	0.016*	0.01	0.01	0.014
31	0.016*	0.009	0.009*	0.014
Nov 2	0.102	0.02	0.005*	0.016
3	0.066	0.014	0.012*	0.019
4	0.092	0.02*	0.039	0.028*
5	0.03	0.022*	0.018	0.035
6	0.01	0.007*	0.008	0.011
9	0.023*	0.023*	0.012	0.025
10*	0.036	0.025*	0.025	0.039
11	0.037	0.025*	0.019	0.043
12	0.017	0.012*	–	0.022
13	0.008	0.007*	0.005	0.015
16	0.033	0.022*	0.019	0.024
17	0.027*	0.019	0.012	0.025
18	0.024	0.007*	0.004	0.007
19	0.008	0.006	0.007*	0.010
20	0.021*	0.019	0.011	0.025
23	0.015	0.012 ~~0.009~~*	0.010	0.015
24	0.033*	0.028*	0.019	0.033
25	0.028	0.017*	–	0.018

	W	N	E	S
Nov 30	0.031*	0.033 ~~0.013~~	0.017	0.039
Dec 1	0.009	0.007 ~~0.014~~*	0.006	0.011
2	0.035	0.027 ~~0.018~~*	–	0.035
3	0.034	0.031 ~~0.023~~*	0.024	0.043
4	0.036	0.031 ~~0.027~~	0.020*	0.038
7	0.058	0.046 ~~0.018~~	0.030*	0.062
8	0.047	0.04 ~~0.0~~*	0.024	0.045
9	0.032	0.03	0.022*	0.041
10	0.058	0.049*	0.032	0.064
11	0.08*	0.07	0.039	0.096
14	0.006	0.005*	–	0.001
15	0.009*	0.005	–	0.007
16	0.025*	0.021	–	0.032
17	0.013	0.012*	–	0.045
18	0.016	0.014*	–	0.019
21	0.025	0.016*	–	0.018
22	0.029	0.023*	–	0.032
23	0.013	0.005*	–	0.008
Jan 4	0.007	0.013	–*	0.008
5	0.016	0.014	–	0.020*
6	0.025*	0.018	0.022	0.024
7	0.031*	0.023	0.025	0.034
8	0.045*	0.027	0.033	0.044
11	0.021*	0.018	0.02	0.012
12	0.019	0.017	0.018*	0.024
13	0.03	0.026*	0.028	0.032
14	0.031	0.023*	0.022	0.031
15	0.018*	0.012	0.012	0.017
18	0.005	0.008	0.006*	0.009
19	0.013	0.014	0.013*	0.017
20	0.022	0.008	0.004**	0.028
21	0.048	0.036	0.04	0.052**
22	0.047	0.037	0.043**	0.049

upwind

Backup Modem utilized.

– modem issues

* Run overnight to allow modem to upload to network.

** battery died at 9:49

Snow Event Sanding Road.

Mon Jan 25/16.
weather: 26°F Cldy high 45°F

6:30 Air stations ϕair calibr all units at trailer 6:40.

7:00 SES H+S: Flu Vaccination.

Air Station.	W	N	E	S
mg/m^3	0.038	0.042	0.039	0.035
Power/Network	✓	✓	✓	✓

- cont' laying pipe to MH-7 + Adler tank.
- grout up pipe in MH-14 + 18.
- backfill around MH's 8 + 12.
- 22° angle on discharge at MH-7 - pipe fed into MH-7
  ? - no welding by McIntyre
  - track issues on Welder → maintenance
- pump + line connected with Adler tank in prep for pumping water to GWTP
- WTP will be using water for backwash
  - pumping could commence as early as Wed (as per G. Seng) (probably Thursday)
- SES had dedicated crew dealing with SES WTP regarding recirculation issues
- vinyl sheeting trial connections at trench.
- shortest sheets (8' long) to be cut for shallow section of trench. (42" deep)
- S Reynolds to discuss forcemain pressure testing with McIntyre
  - piping needs to be completed ASAP.

1530. SES off.
Air station collection.
Air monitoring Letter revised by J. McGuigan

1700 Off site.
↳ Air direction Revisions. for Memo

SUBJECT | DATE

0.17" Rain.

Tues. Jan 26/16.

weather: 35°F Overcast high 35°F

6:15 → Air monitoring letter revisions → emailed 6:45

Air stations ~~&~~ air calibr all units at trailer 6:40

7:00 SES H&S: Accident Prevention.

Air station	W	N	E	S.
mg/m^3	0.035	0.032	0.038	0.042
Power / Network	✓	✓	✓	✓

cont' laying pipe N to Adler tank & over to MH-6.

- grouting MH-20 west of GWTP
- cleaning out trench to commence working with vinyl sheets.
- trench videos
  - 2+70 download
  - 2+65 download
  - 2+60 download
  - 2+55 download
  - 2+50 download

  get RH to copy file before leaving

- pipe laid to bend to Adler tank & MH-6.

- pressure test on 6" HDPE → 125 psi ok as per RH.

- vinyl sheeting commenced installation
  - using inflated tire tubes to hold sheets up
  - measuring bedrock depth → cutting sheets to length.
  - caulk joint & lift over for installion
  - → spray paint bottom 6" for defining grout depth

- SES WTP → treated ~ 400 000 gal 19" in Modutank.

1730 SES off Site

Air stations collected for charging.

1800 off Site.

SUBJECT | DATE

Tues Jan 26/16. 0.17" Rain.

weather: 35°F Overcast high 35°F

6:15 → Air monitoring letter revisions → emailed 6:45

Air stations & air calibr all units at trailer 6:40

7:00 SES H&S: Accident Prevention.

Air station	W	N	E	S
mg/m^3	0.035	0.032	0.038	0.042
Power/Network	✓	✓	✓	✓

cont' laying pipe N to Adler tank & over to MH-6.

- grouting MH-20 west of GWTP
- cleaning out trench to commence working with vinyl sheets.
- trench videos 2+70 download
  2+65 download
  2+60 download
  2+55 download
  2+50 download
  get RH to copy files before leaving
- pipe laid to bend to Adler tank + MH-6.
- pressure test on 6" HDPE → 125 psi ok as per RH.
- vinyl sheeting commenced installation
  - using inflated tire tubes to hold sheets up
  - measuring bedrock depth → cutting sheets to length.
  - caulk joint & lift over for installion
  - → spray paint bottom 6" for defining grout depth
- SES WTP → treated ~ 400 000 gal 19" in Modutank.

1730 SES off Site

Air stations collected for charging.

1800 Off Site.

Wed Jan 27/16

Weather: 27°F Overcast high 35°F

6:30. Air stations & air calibrat. all units at trailer 6:40

7:00 SES H&S: Vinyl/sheeting JSA - Installation discussion

Air station.	W	N	E	S
mg/m^3	0.033	0.039	0.030	0.032
	✓	✓	✗	✓

Power/Network.

- cont piping to blind flange at Adler - discussed with Matt
- pressure testing 8" - SR to find rating on 90° to discuss with Matt
  backfill lines 2" sand/styrofoam
- pipe to MH-6.
- grading North of GWTP
- installation vinyl sheeting in trench.
- sweeper up at GM Parcel 205 - put into use 9:00 am

9:30 - modem not signalling - power reset.

Bentonite for grout 17 Bags / Concrete Truck.

- depending on molded or fabricated elbows 73 or 92 psi
- as per T. Lee & R Hoekstra 70 psi ok

13:00. Weekly Meeting.

J. Mc
J Par.
C Hiatt
ph

① McI - none.

② SES. none.

② Pilot Trench - started vinyl sheeting installation

installation to cont tomorrow.

grouting scheduled Fri.

- questions for RH on design questions

Pressure Testing - is presently underway & will commence pumping.

Manifold Connection after done with use of Adler in getting water to GWTP.

Cheryl Hiatt to review and Air Monitoring.

CH - Payment #4. for SES GM checking.

Design questions
- sump connection - are they needed.
- grout placement with flowing water (will wash out Portland)

Carbon Cell Supplier → last half of February.

- for commissioning.

- MCC commissioning is scheduled for Monday Feb 1

SUBJECT | DATE

Post Meeting - RM back from lunch
- discussion on placing grout at base of trench
- presently consistent flow along base of trench
→ flow will wash out Portland in mix
- dam up trench - if no flow → pour & place 6" grout.
- if sidewall seepage - add downstream dam.
- pour grout & allow to set under water

1325 - Pressure test on 6" Forcemain to GWTP by McIntyre.
-set at 70 psi
1425 - Pressure held in line at 70 psi - test okayed.
- McIntyre to re-plumb line connection.
Commence pumping water to GWTP from Adler tank.
-oversight by C. Seng & M. Curtis.

1420 Hydraulic line on long stick blew - couple of quarts
↳ reported by A. Campbell
- spray areas covered with oil absorbent.
- boom had been pulled out of trench & placed on absorbent sheets
- SES Niagara Falls Office - mineral based environmental oil.
- eq't had been previously on dredging job.
- email of incident to K Kamm & J. McGuigan.
1540 - message left for Mike Reynolds, Bedford Utls.

- GWTP piping completed - need to grout up pipe in MH's.
& backfill with sand & styrofoam.
17:00 SES → eq't maintenance - no more work on trench
1730 Off site
Air Stations collected
1800 Off site

Thurs Jan 28/16
Weather: 32 °F Overcast high 41°F

630 Air stations & air calibr. all units at trailer 6:40.
7:00 SES H+S: Fall Arrest.

Air station	W	N	E	S
mg/m^3	0.042	0.049	0.049	0.048
Power/Network	✓	✓	✓	✓

- EPA on site to witness vinyl sheeting installation
- mud up MHs 6 + 7
- sand and styrafoam over pipes to MH's.
- vinyl sheeting installation - continuing N from 2+78
  - EPA on site to inspect installation
  - sheeting proposed 3+40 → 2+40.
  - 100' of trench to be prepped for grout

Trench Video 2+45, 2+40 } download & saved on server

- hydraulic line wooden bumper placed on long stk.
- trench clean out of silt for grout
- dam placement for up-gradient ~~for~~ trench.
- working platform graded for access with concrete truck

M-Curtis 57220 gal → pumped to GWTP yesterday.

1700 Eq't down - prep of area to keep SW lines out of way for grouting.
Air station collection for charging.
1730 SES off site.

1800 Off Site

SUBJECT Fri Jan 29/16.

DATE

Weather : 32°F Cldy high 39°F

630 Air stations & air calibr all units at trailer 6:48

700 SES H+S: GM Sentinel Event - Proper Prep for Lifting.

Air station	W	M	E	S
mg/m^3	0.031	0.038	0.023	0.028
Power/Network	✓	✓	✓	✓

- Finish backfill at GWTP pipe trenches.

9:00 · concrete truck coming 6yds → 12 bag Bentonite
- to be filled at SES laydown.

- set dam at both ends of vinyl sheeting.
- GWTP pipe → To be backfilled
→ - Flagger used for eq't / concrete truck.
→ grout had to be poured directly to trench.
- section of sheeting bolted to end of bucket on long stick to aid in spreading grout.

BRCJ - surveyed 2+60 → 3+10.
- seepage noted at 2+20 ~ 10' below top of bedrock on West side of trench.
→ steady flow since yesterday (EPA noted flow)

Weekly Progress Meeting Minutes 01-27-16.

Progress Photos

48700 gal to GWTP yesterday

- cleaning out trench at N end

T. Leo → pumping to cease after today to avoid potential overflow on weekend

clear out trench at North end.

grouting → section of vinyl sheeting adapted onto bucket of long stick to smooth out grout surface

1700 SES shutting down + prep for weekend SW management
Air stations collected for weekend

1930 SES off site.

1800 off site.

Mon. Feb 1/16.

Weather: 40°F Overcast high 54°F.

630 Air stations & air calibr. all units at trailer 6:40

700 SES H+S: Hard Hats.

Air station.	W	N.	E	S
mg/m^3	0.019	0.033	0.021	0.033
Power/Network.	✓	✓	✓	✓

- Excavating out North end Trench.
- 2 trucks hauling Fill to E side Bailey Scales Road.
- scheduling next grout pour for Thurs.
  - Flaggers utilized.
- Finishing grout & lid placement on MHs @ GWTP

812 675 1403 Darrin Woody

~ 640' pipe welded for pipe trench line. (when will it be excavated)

Friday Adler tank to GWTP ~ 30000 gal.

Trench video shot
2+35
2+30 } taken using 15' pole (lowered)
2+25
2+20
2+15 } 24' pole - sticks at bottom
2+10 5' & top 10'

2+05 → pulley jammed with silt from base of trench

17:00 Eq't clean up & Fueling
Air stations collected

17:30 SES Off Site.

1800 Off Site

SUBJECT | DATE

Tues Feb 2/16.

Weather 39 °F Cldy high 62°F

6:30 Air stations & air calib. all units at trailer 6:48

7:00 SES H&S: Complacency.

Air Station	W	N	E	S.
mg/m^3	0.052	0.053	0.051	0.023
Power/Network.	–	✓	✓	✓

- cont' vinyl sheeting from 2+46.
- set up issues - staging vinyl sheets - getting crew aligned.

10:30 trench videos to stay ahead of sheeting.

2+35, 2+30, 2+25, 2+20, 2+15, 2+10 } video taken before lunch. → copy files
- delete files to allow storage space on GOPRO memory card. (32 GB)

13:00 S Reynolds - Re: conference call with L. Fitzpatrick about trench cuttings

↳ T. Lee. - Electric Poles for installation thru liner
- SES will need C.O. to handle soil.

afternoon Trench video 2+05, 2+00, 1+55, 1+50, 1+95, 1+90, 1+45, 1+40., 1+85, 1+80, 1+35, 1+30, 1+75, 1+70, 1+25, 1+20 → disk on camera full., 1+65, 1+60.

Rain at 16:00.

vinyl sheeting ended at 1+70

start video in a.m. @ 1+15.

1700 staging sheeting for a.m. / eq't fueling

1730 SES ~~off~~ Site.

Air stations collected.

- G. Seng Carbon Vessels appear to req. repair / rust build up on tank where epoxy worn thru.
- water to GWTP on hold.
- 0.10" Rain in gauge.

18:00 off Site.

7:00pm. – 11:30

127 2+00. 02-01-16.

117	2+35	am.	
118	2+30		
119	2+25		
120	2+20		
121	2+15		
122	2+10		
123	2+05	BS. restore	X
124	2+05		X
125	2+05		X
126	2+05		
127	2+00		
128	1+95	BS.	X
129.	1+95		X
130	1+95		
131	1+90.		

132	1+85	
133	1+80	
134	1+75	
135	1+70	
136	–	
137	1+65	
138	1+60	
139	1+55	
140	–	
141	1+50	
142	1+45	
143	1+40	
144	1+35	

0132
-0149
copied.

145	1+30	
146	–	
147	1+25	–
148	1+20	–
149	1+15	X

136 → X 140 → X

GOPRO → Memory Stick PB / CoM
→

HOMEWOOD SUITES BY HILTON

HILTON HHONORS

Wed Feb 3/16. 1.00" Rain

Weather: 51°F Clear dropping (46°F) Windy.

630 Air stations ϕ air calibr all units at trailer 6:40

700 SES H+S: Lightning

Air Station	W	N	E	S
mg/m^3	0.025	0.028	0.023	0.023
Power/Network	✓	✓	✓	✓

- cont vinyl sheeting installation N from 1+70
- trench video of N trench
  - trench cleaned out where sheeting installed in order to be ready for tomorrow.

8:45 a.m. Mike Reynolds - asking when the grout is being done
- tomorrow morning

Trench video - started 1+15
every five feet to 0+60

12:30 - to complete to 0+40 after meeting

1300. T.L. McI Gary Mc. SES S.R
P.B. R.C
D.L.

pH: JP GT RH.
CH J.Mc.

1. Safety - None
2. GW being pumped to GWTP
160,000 gal pump - all from GW system.
both tanks have water. -

viny sheet + grout at North end by EOD tomorrow.
- tailings to be removed next week.
- to be stockpiled. in dedicated. area.

CH → problems? sheets tied off. + inner tubes
grouting went well on shallow section.
- pipe not installed yet.

[Mike Reynolds - on site - no issues
- spill notification filled out - no issues]

28 - 30"

- significant more water treated by. SES WTP
after last nights rain - hard to tell if surface run off to trench

PB - noticeably more seepage from yesterday at 1+00 + 0+50

SUBJECT

DATE

C.O - generator & switch. 125 KW.
- vendor 9-12 wks. Kohler
- pending SES prepar
- ATP to follow

Work Schedule to be maintained.

13:30 trench video. shot. 0+55
0+50.
0+45
0+40 → EO Trench
-download video.

-vinyl sheeting stopped at 0+55 (bedrock step)
1630 SES done sheeting due to accessibility at N end
& fall arrest set up

1730 SES off site.
Air Stations collected.
1800 off site.

Thurs Feb 4/16.

Weather: 32°F Overcast high 34°F

630 Air stations & air calibr. all units at trailer 6:40

700 SES H&S: Look Before You Leap - Awareness of Surroundings.

Air station	W	N	E	S
mg/m^3	0.013	0.017	0.021	0.018
Power/Network	✓	✓	✓	✓

- Finish vinyl sheeting along N end of trench
- pumper truck on site - concrete to arrive ~ 8:30
  - 2 trucks (18yd³) - 1 truck 2 trips
- bentonite to fill truck → causing overfill/grout starting to set
  - no gradient for shute to pumper truck to dump grout

10:30 - 11:00 - pumper truck off site - too long between trucks

- grout to be run directly to trench

11:00 → Mike Reynolds - truck dumped in E 216 containment area
- will be on site to inspect

13:00 - site inspection with Mike Reynolds (email sent)
→ ok with site + concrete/grout washout

→ grout from 0+40 to previous grout end

15:30 - site cleaned up + secured.
- water lines collected + set-up for moving out of way for continued trench excavation to south.

- trench cuttings from N end of trench stockpiled in E216
  - Flagger used

1730 SES off site.
Air station collection
→ serial connection noted to be loose at end of day
- no data for E station

1800 Off Site

SUBJECT

DATE

Fri Feb 5/16.

Weather: 21°F Clear high 42°F

630 Air stations & air calibr. all unit at trailer 6:40.

700 SES H+S: GM Defiance OH - Fall Sentinel Event

	W	N	E	S
Air station.				
mg/m³	0.033	0.017	0.035	0.038
Power/Network	✓	✓	✓	✓

- mobilize eq't from N end of trench to S side.
- disconnect WTP discharge line to clean out central portion of trench.

→ W Battery not powering station.
- spare used as replacement.

→ A Campbell notified G. Seng.

* electrical issues with GHD trailer brought up by T. Leo.
→ email by T. Leo to K. Kamm → Williams Scotsman.

01-20-16 Final Meeting Minutes → email.
02-03-16 Draft Meeting Minutes → email.

→ T curtis to retrieve air stations at end of day

1500 Flight Indy → TO.
Car Rental set up with Enterprise
GHD → $104 - can't go on credit card
no account → $53

Mon Feb 08/16.

Weather. 35°F Overcast high 35°F Rain.

630 Air stations & air calibr all units at trailer 6:40.

700 SES H+S: Medication at work.

Air Station.	W	N	E	S
mg/m³	0.021	0.019	0.022	0.017
Power/Network	✓	✓	✓	✓

- cleaning out south end of trench
- stockpile of cuttings in trencher laydown area.
- GM legal has given ok pending IDEM approval on relationship to bedrock cuttings → J. McG. got ok on Fri
- hauling stone for trench backfill } stockpiled W of trench
  - and for behind. vinyl sheeting. } area in PZ16.

- grout thickness shot by BRCJ (only 3" in spots) }
  - email sent to RH on response to this.
- grading N end of piping from GWTP
  - SES wants to know if it can be field fit.
  - email to RH for response.

trench video shot - 3+55
→ 4+05

1700 SES → fuel + clean eq't (clean off tracks)
Air stations collected. - E station stand after weekend
- plastic brackets on legs cracking
(light colour discolouration from photo degradation from sunlight)

1730 SES off site.

1800 Off site.

Trench video download.
Back-up video on memory stick. prepared for B. Steinmann (to be on site tomorrow for Trench inspection).

Bridcut, Pete

From: Kamm, Katie
Sent: February-10-16 10:16 AM
To: Bridcut, Pete; McGuigan, Jim
Subject: RE: 013968 - Expenses

Charge the expense to the project and put it under field supply. That should work.

From: Bridcut, Pete
Sent: Wednesday, February 10, 2016 7:24 AM
To: Kamm, Katie; McGuigan, Jim
Subject: 013968 - Expenses

As the Canadian BST has several Administration versions, I could not find one to put three quarts of oil to under Health and Safety. It was entered under 013968 to get it on my expenses and I'm sure someone will wonder about this.

I got an oil change on Monday last week and put that on the expenses. I mentioned to Tim and Mike that I could smell the faint tinge of oil afterwards. The oil level was ok and Mike said it was probably some oil that dripped on the manifold during the change. No oil leak was noted at the trailer or hotel over the week.

Friday on the way to the airport the low oil light came on and I stopped in Martinsville. I stopped at the AutoZone and the oil level appeared fine. The service counter indicated that they have heard this problem before with oil changes not being fully topped with only 5 or 6 quarts instead of 8 quarts. I added oil at the AutoZone since he offered use of the funnel, and the indicator light went off.

When I checked at the service center on Monday, they inspected the vehicle and indicated that the oil filter gasket appeared to be not properly seated which may have led to the indicator light. The oil level was overfilled but should not be an issue. The oil filter was replaced to ensure the light would not come back on again.

Pete Bridcut, C.E.T

GHD
T: +1 705 749 3317 | M: +1 705 768 6405 | E: pete.bridcut@ghd.com
347 Pido Road Unit 29 Peterborough ON Canada | www.ghd.com

Memory Stick

*Pete Maintained on Site	Pilot Trench Stick 2	0+40 -3+50	
GM	Pilot Trench Stick 2	0+40 -3+50	Backup
*Pete.	Pilot Trench Clean Out 1+20 +Fails.	Trenching Videos -3+50	
GM	Pilot Trench Clean Out	Trenching Videos 1+20 - 3+50	Backup
*Pete	Pilot Trench Backup	3+55 - 4+05	
Bill	Pilot Trench Backup	0+40 - 3+50	

SUBJECT

DATE

Tues Feb 9/16.

Weather 21°F Snow high 25°F

630 Air stations & air calibr. all units at trailer 6:40.

7:00 SES H&S: Care around Trucking Operations / Dumping.

Air Station	W	N	E	S
mg/m^3	0.030	0.038	0.031	0.028
Power / Network	✓	✓	✓	✓

- clean out trench + haul to trencher laydown area.
- grading cuttings at laydown area.
- memory sticks obtained (video files to send to Chicago)
  - trench video download for B. Steinmann.

→ Trench head south from inflection point.

9:00 Mike Reynolds on site.
- unable to perform monthly sampling at SES WTP due to cold weather
- will get sampling done when weather warms
  → ok with this.

Trench Video 4+10 - 4+15
- 24" Flagpole for GOPRO not working
  sleeve with camera won't slide up & down
- sediment + water freezing along flagpole + pulley jamming.

B. Steinmann on site → Trench Inspection.

a.m. - seepage zones noted at 0+50 + 1+00.

pm. 4+20 → 4+90. Video.
- survey rods used with 4' sections added as camera lowered.
- trench cuttings not fully cleared past 4+90
  (excavator arm not long enough).

→ Grout issue with SES - areas of only 3" will need to be filled in.
  - as per R Hoekstra + JMcG.

→ Filter Media over trench area.
  - SES proposing thinning out (no slope).

* - need to obtain Proctor of clay → ? 216.

S Reynolds - WTP Circulation costing - last wk of Jan. needed.

1650 SES fueling + staging eq't (clean tracks)

Air stations collected.

E station - leg brackets on stand cracked off from temp. drops

1800 Off site.

Trench Video download

Backup video on memory stick prepared for K-Kamm.

Wed. Feb 10/16. → ~2" (more in Bloomington)
Weather: 13°F Snow high 22°F
6:15 Air stations & air calibr all units at trailer 6:40.
700 SES H+S: Care around Moving Eq't.

Air Station	W	N	E.	S
mg/m^3	0.031	0.034.	0.029	0.027
Power / Network.	✓	✓	✓	✓

- clean out trench + haul cuttings to trencher laydown area
- Circulate water in SES WTP.
- BRCJ trench bottom points → Forward R.H.
  - may need to build up grout in low areas to meet with design grade
  - SES - previous discussion → 6" min + ensure flow.
- K Kamm - Trench Video couriered to Chicago Office for storage + distribution.

13:00 Progress Meeting
GHD T-L. P.B McI Gary Ryan SES DL. SR RC. pH J.P. SES C.M. GM RH. J.McG. } GHD.

MI } None
SES.

SES - Grout Placement. N.
- Clean Out S.
- sheets next week → grouting / stone + pipe work.

McI - Commission Eq't Installed
State Group Mobilized to Site
Fire Alarm System.
GWTP 180 000 gallon presently
can take 60 000 when ready by George

Request - Schedule. has WTP download mid next month.
- will need. budget.
- will need to have clean water TSS from Wash Stone
- At this point, can't give a direct answer
  - will become an issue next month
- SES wanted to, start conversation
- Alan McMurray.

SUBJECT

DATE

No further requests for Info.

SES received ATP yesterday. regarding power pole installation.
- back wash pumping

Submit CO by End of Week.

SES not purchasing backup generator for GWTP
RH to confirm.

Mike Reynolds. - on site this week + mentioned that SES WTP was in recirculation mode → will be sampled when system is back treating water.

Air sampling continuing. - low results continuing.

Work Schedule being maintained.

- excavator (360) used to clean down to bedrock.
- re-excavate 4+70 → 6+00 to clean out lower 10' of trench cuttings.

1700 Eq't Fueling / staging + clean tracks.
Air station collection.

1730 SES Off Site

1800 Off Site.

Thurs Feb 11 /16.
Weather: 11°F Clear high 27°F
6:30 Air stations & air calibr. all units at trailer 6:48
7:00 SES H&S: Rigging.

Air station	W	N	E	S
mg/m^3	0.052	0.051	0.053	0.051
Power/Network	✓	✓	✓	✓

- clean out south end of trench.
- long stick brought across to S side of WTP WW line
- base of trench 4+20 - 4+70 clean with flat blade on long stick. for BRCJ to ensure bedrock base for placement of grout.
- shot at 3+80 (WW line removed) + 3+85 measured S end of sump.

pm. - video deleted of memory stick for GOPRO.
4+75 4+85 4+95
4+80 4+90
- cleaning out trench at 4+70 allowed sediment flow N to sump & pump out
- pump issues at sump due to sediment.

no excavator for moving bridge
- all available labourers on SW Management

memory stick/SIM card purchased for GOPRO backup & elimination of deleting memory card

- pull out Adler Tank for mobilization off site.

1700 Excavating of trench done. - tracks cleaned
- road swept.

1730 SES off site
Air station collection.
1800 Off site

SUBJECT

Fri. Feb 12/16.

DATE

Weather: 23°F Overcast 30°F high.

630 Air stations & air calibr. all units at trailer 6:40.

700 SES H&S: General Safety Measures.

Air station	W	N	E	S
mg/m³	0.031	0.027	0.036	0.035
Power / Network	✓	✓	✓	✓

- work on getting pump from sump working.
- clean out trench
- grade trencher laydown area.
- Adler tank pick up.

→ long stick to clean out in a.m + get far enough along trench that 360 could follow behind to move trench.

Final Meeting Minutes 01-27-16 } emailed out
Draft Minutes 02-10-16 }

Trench Video

5+00 5+10 5+20 5+30
5+05 5+15 5+25 5+35

1630 Work shut down to clean tracks + secure trench for weekend + pending snow. Air stations collected for weekend.

1730 SES OFF site

1800 OFF site

Saturday Feb 13/16.

Video download and back up 2 hrs.

Mon Feb 15 [illegible]

weather: 22°F Overcast high 42°F

6:30 Air stations ∅ air calibration all units at trailer 6:40

7:00 SES H+S: slips/Trips/Falls - Melting Snow/General Safety

Air station	W	M	E	S
mg/m³	0.094	0.091	0.095	0.092
Power/Network	✓	/	—	—

noticeably high - humidity/Fog?

- excavating by GWTP for bedrock exposure
- break rock for power pole installation
  - ↳ to be done by State Group
- access road sanding (due to snow).
- taking SES WTP off recirculation for treatment.
- welding metal guard for hydraulics on arm of long stick.

* C Hiatt completed review of air monitoring memo.
  - update Table 5.1 for last three weeks.
  - email to P. Galloway + S Deitner

not registering on network after 2 pm.

- battery left to allow download once network connects.

Modu tank ~30" → treating water in a.m.

1400 Eq't fueling/staging

power pole set & backfilled.

Air stations collected

1800 Off Site

10:00 am Randy/Shane/Arnold - SES

- trench clean-out is becoming a problem.
- needs to be clean for grout placement

Arnold → carbon bag for damming off fines to sump

Randy - great but use stone.

↳ what about clay in seams.

PB - generally an issue with runoff through working platform

- should not be an issue once trench capped & sealed off and groundwater flow maintained at low level in trench.

SR/RC - vac truck to be on site this week to clean out trench.

SUBJECT | DATE

Tues Feb 16/16.

Weather: 30°F Cloudy high 38°F

630. Air stations ϕ air calibration all units at trailer 6:40
↳ except W unit → done in field

700 SES H_2S: Borns

Air station.	W	N	E	S
mg/m^3	0.107	0.079	0.098	0.095
Power / Network	✓	✓	✓	✓

↳ high values again (fog as snow melts)?

- filter bag construction → to dam up trench.
  - contain fines from flowing to sump.
- priority → sump clean-out from fines flowing in.
- metal plate guard installation on arm of long stick to protect hydraulics

C Hiatt - send photos.
- send Jan GM H_2S Audits
  - get out of previous field book.
- Trench Video - K Kamm to order memory sticks

11:15 SES WTP Monthly Sampling.
FSK + Sample Prep.

14:15 Clay sampling (Parcel 216) former Modutank base
- sample taken for proctor analysis.
- S Deitner to obtain PO for having testing done with PSI
- sample maintained in sealed 5 gal pail

↳ carbon bag filled with stone + connected with cable (for mobility + removal) for dam placement along trench to lessen silt build up in sump.

1700 Eq't. clean-up + secure site
Air station collection.

1800 Off Site.

Wed Feb 17/16.
Weather: 32°F Overcast high 36°F
630 Air stations & air calibration all units at trailer 6:40
700 SES H&S: Review of Trench JSA.

Air Station / mg/m³	W	N	E	S
	0.057	0.052	0.060	0.062
Power / Network	✓	✓	✓	✓

→ vac truck on site.
- Operation training for truck with operators
- grade trencher laydown area.
- plastic over East Clay Berm - cuttings graded over berm to E to clear area.
- State Group - power pole access & auger prep by GWTP
- SES - clean out of trench sump using vac truck.
- SES WTP repairs from freezing/recirculation.

1300 - Progress Meeting.

GHD	McI	SES	Ph.	SES
KK	Gary	D.L.		J. Paz
PB	Ryan.	SR.		RH.
TL		RC.		C. Hiatt.
				J. Mc.

Safety Issues - no near misses. - work being done is newly established work and is being closely scrutinized
- SES GM audit for Jan to be forwarded
- will need one for Feb.

② Clay coming into trench.
RH - to look into. ~~[illegible]~~
- gabion fence / sand sack with stone

Sheets thru Sump → Sheets across sump
- work on completing N end

GWTP - ice plug in plum
- 160 000 gal in 250000.
60 000 in 100 000.
could use ~60 000 gal more.

- German Shephard broke his chain
KK to talk to owner Re: chaining dog.
SES to catch dog & return.
Schedule for work. Is being maintained by McI & SES.

SR did CH receive SES Invoice CH to look into it.
KK has looked at it, SES has forwarded.
CO 6 to be forward to CH by KK this wk.

SUBJECT | DATE

pm Work Activities.
- sump cleanout with vac truck
- vac truck water discharge → do <u>not</u> drain thru working platform
  - direct discharge to trench
  so as not to reintroduce fines
  that would collect in sump

- sump clean at end of day.
  · to be reinspected in a.m. for comparison.
  (S. Reynolds / A. Campbell)

· long stick to drag fines from S end of trench
down to sump (then vac truck clean out)

1700 Vac truck dumped & trench prepped for tomorrow
Air stations collected.
1730 SES OFF Site.
1800 OFF Site.

Thurs Feb 18/16

Weather: 24° F Clear High 46° F

630 Air stations & air calibr- all units at trailer 646

700 SES H&S: Nicks, Cuts, Scrapes

Air station	W	M	E	S
mg/m³	0.074	0.061	0.078	0.117
Power/Network	✓	✓	✓	✓

relatively high values

- SES aiding State Group with powerpole installation thru line
- handling soils from beneath liner (contamination)
- trench clear-out & sump vac out.

CWTP - 2nd power pole installation thru liner
- liner exposed & cut
- plastic over excavation with hole for augering hole for pole installation (to contain spoils)
- Lucas in Tyvek - on polysheeting to clean off auger into lined Bobcat bucket
- escort of Bobcat for dumping into lined loader bucket

CoM Feb Safety Audit performed.

entire south end of trench cleaned
- fines scraped down to sump & vac'd out.

1745 Contaminant collected & shut down.
Mat'l stored on liner & covered at SES yard

Air stations collected.

1800 SES Off Site

Off Site.

GM

FOCUSED INSPECTION CHECKLIST

SECTION 6 SITE CONTROL AND DECONTAMINATION

Inspection Date: Feb 18/16

Inspector: Pete Bordcut

Project Name: CET Bedford

Project Location:

Address: 320 GM Drive

City: Bedford **State:** IN **Zip:** 47421

GM Project Manager: Cheryl Hiott

Consultant Name: GHD.

Consultant Project Manager: Jim McGuigan

Consultant Superintendent: Katie Kamm

Consultant Site Health & Safety Officer: P. Bordcut / T. Lee.

Contractor Name: Sevenson Environmental

Contractor Project Manager: Jim Pazderski

Contractor's Superintendent: Randy Campbell

Contractor Site Health & Safety Officer: Dave Leising

CHECK IF NOT APPLICABLE ☐

ITEM NUMBER	AUDIT QUESTION	YES	NO	NA	COMMENTS
1	Work areas (zones) have been clearly identified and communicated to site personnel?	☒	☐	☐	locations with liner exposed & pulled back covered with ~~poly~~. Hole in poly for auger. Spoils on auger contained in work area,
2	Personal decontamination procedures for the level of PPE is being followed?	☒	☐	☐	Labourer cleaning auger in Tyvek. Decon contained over poly sheets
3	Equipment decontamination is being conducted properly?	☒	☐	☐	All waste contained in poly sheet, transferred to lined Bobcat bucket & transferred to lined loader bucket.
4	Decontamination waste is being handled properly?	☒	☐	☐	Material triple lined, all wastes & PPE stored in secure location at SES yard
5	Decontamination methods are being implemented to ensure contamination is not spread beyond the CRZ?	☒	☐	☐	

SECTION 6 SITE CONTROL AND DECONTAMINATION

Safety Observation Tour:

Safe Observations	Corrective Measures	Completion Dates
Spotters utilized during eq't	mobilization transporting mate	rial.
Activities carried out under	direct supervision of HES officer	
Dedicated poly sheet for lab	ourer cleaning auger to	walk on.

Unsafe Observations	Corrective Measures	Completion Dates

SUBJECT | DATE

Fri. Feb 19/16.

weather : 50°F Cloudy/windy high 60°F
630 Air stations & air calibr. all units at trailer 6:40.
700 SES H&S: Eye Protection.

Air station	W	M.	E	S
mg/m^3	0.023	0.016.	0.025	0.027
Power/Network	✓	✓	✓	✓

- Sand bag poly sheeting by power pole installation.
- trench clean out to sump.
- vac out sump.
- long stick with bucket attachment to scrape trench. clean from south to north to collect fines in sump.

9 am. Trench video. 5+40 5+50 5+60 5+70 5+80 5+90
5+45 5+55 5+65 5+75 5+85 5+95

noon down load to memory stick

pm. video 6+00 6+10 6+20 6+30 6+40
6+05 6+15 6+25 6+35 6+45

1530 most of SES off site.
1610 - trench video done for day.
16/30 SES off site.
14:53 Air monitor warning from W air station
- no dust creating activities (wind related issue)
- email sent out
Air stations collected for weekend.
1800 Off site

Sat. Feb 20

Video down load to memory sticks.
- replace GM back-up.
- 2 site back-up + 1 for Katie.
6+45 - pics on GOPRO malfunctioned email to KK & J Mc.
- check wind direction from weather station.
Draft Minutes 02-17-16.
Final Minutes 02-10-16. 6 hrs.

Mon. Feb 22/16.

6:15 Air stations & air calibr. all units at trailer 6:40

7:00 SES H&S: Eq + Hazards - Tree Explosion

Air station	W	N	E	S
mg/m³	0.032	0.039	0.042	0.059
Power/Network	✓	✓	✓	✓

weather station needs to be plugged in.

- clean out sump from weekend rain event.
- vinyl sheet installation.

email: W air station appear to have been opposed station at warning on Fri.

am trench video.

6+45	6+60	6+75	6+90	7+05
6+50	6+65	6+80	6+95	7+10
6+55	6+70	6+85	7+00	7+15

GOPRO checked - video fine (battery probably low on Fri)
memory card full → replaced.

pm. trench video

7+20	7+35	7+50	7+65	7+80
7+25	7+40	7+55	7+70	7+85
7+30	7+45	7+60	7+75	

17:00 Vac truck being emptied.
Vinyl sheeting installed to ~ 4+10.
(past WTP WW line & sump).
- N end of trench flushed
- water to sump → clear.
Air stations collected.

1730 SES off site.
1800 off site.

Video download & storage at hotel
Photo download & Progress Photo email.

SUBJECT DATE

Tues Feb 23/16

Weather 33° F Clear high 56°F

630 Air stations ø air calibration all units at trailer 6:40

700. SES H&S: Noise - Hearing Protection.

Air Station	W	N	E	S.
mg/m^3	0.032.	0.047	0.038	0.052
Power/Network.	✓	✓	✓	✓

- dam off N end of trench (~3+00) with sand bags
- dam off S end of trench (~4+60) with super-sack
- pump out sump to N section of trench
- pump N end of trench to Mode tank
- 6 yds grout with bentonite (to sump)
- 4 yds grout with bentonite (finish sump) + to south of sump (~4+10)

a.m. trench video. 7+80 7+90. 8+00
7+85 7+95 8+05

noon M. Reynolds - SES WTP Results.
- site Inspection of Trench.

- vinyl sheet installation.
→ completed to point of inflection.

- from 8+00 to end of trench.
- horizontal fracture at 13' depth below top of bedrock

pm trench video 8+10 8+25 8+40 8+55
8+15 8+30 8+45 8+65
8+20 8+35 8+50
end of trench

16:00 SES shut down for pending rain tonight
- pump prep & fueling
Eq't staged & fueled
Air Stations collected.

1730 off site

Video download / screening.
Progress Meeting Agenda.
email RH - water in trench.

0.94" Rain

Wed Feb 24/16

Rain in Bloomington

weather: 39°F Overcast high 49°F Rain

6:30 Air station & air calibr all units at trailer 6:40

7:00 SES H&S: Accident Prevention.

Air station	W	M	E	S
mg/m^3	0.004	0.004	0.004	0.004
Power/Network	✓	✓	✓	✓

Storm Water Management

- Trench Video → courier to Chicago.
- 12V Battery Case Replacement for East station.
- Grading by GWTP to deter water into plant

13:00 Progress Meeting

GHD	T.L.	SES	D.L.	Mc I	R.G.	Ph.	J.Paz
	PB		SR.		WB		R.H.
			RC.				J.Mc.
							CH.
							KK.

① Muddy conditions - site secured with chain link fence + caution tape maintained around trench.

② Hard getting trench cleaned.
- vinyl sheeting & grout to sump.
- dams being used to contain fines.

- GWTP → 35,000 gallons this week.
  - checking tanks, no leaks
  - eq't supplier on site.
  - checking communications between PLCs.
    - computer connections & instrumental connections

Trench. - next week split shifts.
- gravel at north, / vinyl sheeting & grout at south
- sump installation commencing next week
  RH Mar 7th wk to be onsite.
- McI installing sump interior.
  CH → check with EPA on air monitor.

SR ATP Request Backup Generator.
& " Diesel Pump
RK awaiting EP

SUBJECT Thurs. Feb 25/16

DATE

Weather: 34°F Overcast high 37°F

630 Air stations & air calibr all units at trailer 6:40

700 SES H+S: Knife Use / Safety.

Air station	W	N	E	S.
mg/m³	0.046 ✓	0.037 ✓	0.032 ✓	0.048 ✓

Power / Network

- SW Management - Secure Site.
- installation of piezometers along N end of trench
  - laid out by BRCJ

as per SR, SES - Sump Off set by ~1' to south.
- due to actual Field measurements of N + S. limits of sump base by BRCJ
- BRCJ to include pdf X-section to aid in visualizing when verification results sent.

- courier Trench Video to K. Kamm.
- work on concrete bucket for tomorrow's grout placement
- grading access for concrete truck.

1530 SES OFF site.
Air stations collected

as per SR. - 80' short on vinyl sheets as per submittal
- N end to have finished ~ 0+80
- actual placement moved N from new clean out (0+80) due to seepage zone at 0+55 needing to be contained.
- not caught at time by SES → sheeting shifted N by 40'

→ SES submittal 8A → 0+80 to 8+15
- submittal was approved - However
- not viable due to seepage zones.

- sheeting needs to extend to 8+55 not 8+15 due to seepage
- water will get behind vinyl sheets.
∴ 80' short on vinyl sheets (40 sheets short)
- sheeting discussion / inventory with A. Campbell for further installation protocol.

JB - can leave sheets short of top of bedrock - should not impact water or trench functionality.

1700 OFF site.

Fri. Feb 26/16

Weather: 32°F Overcast High 42°F

630 Air stations & air calibr. all units at trailer - 6:40

700 SES H&S: Housekeeping.

	W	N	E	S
Air station mg/m³	0.013 ✓	0.018 ✓	0.014 ✓	0.016 ✓

Power / Network

- grouting trench
- concrete truck to be on site. 8:30.
  - fill in shallow sections N of sump
  - extend grout south of sump.
- vinyl sheet installation to continue past point of inflection

1330 Brett Tarkington - email air monitoring tables & EPA Memo

1430 Mike Reynolds - on site - photos of water discharge from containment area with grout washout.

- soil pile in Entact yard needs down-gradient flow barrier.

- vinyl sheeting performed past inflection point to ~5+20.

16:30 SES off site.

1700 Off site

SUBJECT

Mon Feb 29/16.

DATE

Weather: 38°F Overcast high 56°F

0630 Air stations & air calibr all units at trailer 6:40.

0700 SES H+S: Concrete - Safe Handling.

Air station	W	N	E	S
mg/m^3	0.022	0.013	0.022	0.026
Power/Network	✓	✓	✓	✓

- vinyl sheet installation.

SR - P216 containment area needs to be pumped out

- Former Entact laydown area soils to be tarped.

1040 Mike Reynolds 812 788 0303

- discharge thru straw bales from P216 containment (~40yds upgradi of creek)

- on site to inspect discharge → ENTACT yard soils to be tarped.

SR - grout ordered for 1330 - vinyl sheets to 5+60 by lunch (noon).

Alan Murray - on site to see GWTP.

Walt Pochron & Greg with RMDP } GM Contractor Safety Orientation.

Tailgate - Slippery Conditions/Muddy On-site

- will be conducting their own tailgate meetings this week.

1505 SR - transmission fluid leak along Bailey Scales N from Entact Laydown area (Paved 215)

Mike Reynolds - message left for spill notification

grout from 4+60 → ~5+50 ish.

cont vinyl sheeting → ~5+80

1700 SES eq't off - tarping soil in P215

Air stations collected

1800 Off Site

Tues Mar 1/16

Weather: 34°F Cloudy high 52°F Rain.

6:30 Air stations & air calibr: all units at trailer 6:40

7:00 SES H&S: Situational Awareness

	W	N	E	S
Air station				
mg/m³	0.022	0.028	0.030	0.019
Power / Network	✓	✓	✓	✓

- vinyl sheet installation to cont' from 5+82

M. Reynolds - message left - trench/trailer or M St. & Peerless (drill site)

- piezometer photos (west side of sheets) re-sent

RH - email on WW-4 structure

- need to cut 8" galvanized pipe & reconnect with Viaductile joint clamp

↳ ok but keep off & away from structure walls.

Bill Doyle
Rob Robertson
Alan Murray
→ on site for GWTP

9:50 T-storms - SES/Drilling shutdown.

0.48" at noon.

11:00. SES work crew sent home.

SW Management crew maintained on site

11:30 Chris Porter BRCJ - will shoot additional borehole by P431 once storm clears.

- Labels & CoCs for Matt

14:00 Complaint over discharge of SW to creek.

Notified SES - SR - discharge off pending inspection of situation.

- some run off to DB-2 from access road

- straw bales placed along runoff route

- DB-5 → discharging clay water

- pump turned off to allow DB to settle.

- GWTP north slope to CB-5 - 3 straw bale check dams installed

- may have been due to recent grading operations around GWTP

- 2nd level of straw bales placed around CB-5

1530 Water Management 1 operator 1 labourer left on site.

Trench Video 5+40 → 8+65 couriered to C. Hyatt.

Fed Ex in Bloomington.

1700 Air stations collected.

1730 Water Management Crew for SES off site.

1800 Off site

→ E Station Serial Connection
Loose all day

Unsafe Act / Unsafe Condition / Stop Work Authority (SWA) Report

Reported by:	Pete Bridcut	Employee's office:	Peterborough
RSHM:	Steve Gagne	Date: Mar 1/16	Time: 9:50
Employee's supervisor:	~~Nyle McIlveen~~	Employee's principal:	Nyle McIlveen.
Project related:	☐ No ☒ Yes	If yes, name of client:	GM
Client contact (if applicable):	Cheryl Hiatt.	Project no (if applicable):	013968

Re: (check all that apply) ☐ **Unsafe act** ☒ **Unsafe condition** ☒ **Stop work authority (SWA)**

Location: (check one) ☐ Driving ☐ Field ☐ Office

Date reported to supervisor/PM:	Mar 1/16.	Date corrected:	
Time reported to supervisor/PM:		Time corrected:	

Describe the unsafe act, unsafe condition or SWA situation

working on site performing oversight. GM contractor installing vinyl sheets in bedrock trench. Lightning and thunder occurred.

List corrective action(s) implemented

Stop Work Authority implemented. Followed 30 minute work shut down until 30 minutes after last observed lightning or thunder heard.

Did the corrective action(s) mitigate the unsafe act/unsafe condition?

Yes.

For SMART administrators use only:

Category:	**Chevron category:**	**Causative factor:**	**Energy source:**
☐ PPE Personal Protective Equipment	☐ A Person or People	☐ 1 Insufficient training for task	☐ G Gravity
☐ BP Body Positioning	☐ B Equipment	☐ 2 Hurrying to complete the task	☐ M Motion
☐ WE Work Environment	☐ C Environmental	☐ 3 Easier if proper process not followed	☐ ME Mechanical
☐ OP Operating Procedures	☐ D Procedures/ Processes/	☐ 4 Took shortcuts without prior incident	☒ E Electrical
☐ TE Tools and Equipment	☐ JSA-review/revise	☐ 5 Incomplete or no procedures	☐ P Pressure
☐ CU Computer Usage	☐ E Visitors	☐ 6 Procedures not known or enforced	☐ T Temperature
☐ PD Pre-Driving		☐ 7 Improper PPE	☐ B Biological
☐ OPP Operating Procedures – Parking		☐ 8 Improper tools	☐ C Chemical
		☐ 9 Improper workplace layout	☐ R Radiation
		☒ 10 Exposure to conditions	☐ S Sound

Are additional actions required? ☐ No ☐ Yes If yes, what?

SUBJECT

Wed Mar 2/16.

0.73" Rain
Weather Underground

DATE

Weather: 26°F Overcast high 43°F

630 Air station & air calibr. all units at trailer 6:40

700 SES H&S.: Fall Arrest Systems.

Air station.	W	N	E	S
mg/m^3	0.012	0.017	0.012	0.013
Power/Network	✓	✓	✓	✓

- vinyl sheet installation from ~ 6+20.

Walt & RH DP - abandoned Residental Well E of GWTP
- cut off wells + bollard at SW of GWTP

- sheets installed to ~6+70 by noon.
- grout ordered for 1330:
→ GM SAFETY AUDIT

1300 Progress Meeting.

~~RH~~
~~BP~~

GHD T.L. P.B. | McI | SES D.L. R.C. S.R. | Ph. KK. GT. CH. J.Mc.

GWTP { Bill Doyle, Bart Bartholomy, Walt Pochron, Rob Robertson, Delameta }

① Truck - Line Replaced. - Report Sent Out.
- Absorbent & Sweep.

McI none.

GMK

② Sheet & Gravel Placement.

Sump Barrel back from McI / Gravel Placement and

Next Week → Sump & North Pipe

CH. → Water Quality Good.

⇒

Piezometer - RH & BS.

CB-5 - getting clay into it.
- check dams installed.

current discontinued pumping.

CH. - grout discharge to berm area unacceptable
- grout to be cleaned out to roll off box only
anything else is will not be tolerated

FOCUSED INSPECTION CHECKLIST

SECTION 11 HEAVY EQUIPMENT OPERATIONS

Inspection Date: Mar 2/16.

Inspector: Pete Bridcut.

Project Name: CET Bedford Pilot Trench

Project Location:

Address: ~~[illegible]~~ GM Drive

City: Bedford **State:** IN **Zip:** 47421.

GM Project Manager: Cheryl Hiatt.

Consultant Name: GHD.

Consultant Project Manager: Jim McGuigan

Consultant Superintendent: Katie Kamm

Consultant Site Health & Safety Officer: Tim Lee / Pete Bridcut

Contractor Name: Sevenson

Contractor Project Manager: Jim Pazderski.

Contractor's Superintendent: Randy Campbell

Contractor Site Health & Safety Officer Dave Leising.

CHECK IF NOT APPLICABLE ☐

ITEM NUMBER	AUDIT QUESTION	YES	NO	NA	COMMENTS
1	The daily inspection of equipment has been conducted and documented?	☒	☐	☐	
2	Back up alarms are in use and can be heard?				
3	Equipment operators being observed are operating in a safe manner?	☒	☐	☐	
4	Personnel working in close proximity to the heavy equipment wearing the proper PPE including safety vests?	☒	☐	☐	
5	Cab windshields are free of cracks and obstructions?	☒	☐	☐	Excavator in use to transport and place vinyl sheets in bedrock trench. Dedicated spotter used while excavator carries & guides sheets in place.
6	Barriers are set up to prevent personnel from entering the swing radius of equipment?	☐	☒	☐	
7	Buckets and attachments are placed in the down or dead position when not in use?	☒	☐	☐	

SECTION 11 HEAVY EQUIPMENT OPERATIONS

Safety Observation Tour:

Safe Observations	Corrective Measures	Completion Dates
Ground personnel keep radio contact with operator		
Only spotter and sheet placement crew within operator swing radius		
Pylons and caution tape delineate excavator travel route		
Operator maintaining eye contact with spotter + work crew during sheet placement		
~~Unsafe Observations~~	**Corrective Measures**	**Completion Dates**
Dedicated personnel for each task to maintain consistency in work process		

Unsafe Act / Unsafe Condition / Stop Work Authority (SWA) Report

Reported by:	Pete Bridcut	Employee's office:	Peterborough
RSHM:		Date: Mar 2/16	Time: 16:30
Employee's supervisor:	Steve Gagne	Employee's principal:	Nyle McIlveen.
Project related:	☐ No ☐ Yes	If yes, name of client:	G.M.
Client contact (if applicable):	Cheryl Hiatt	Project no (if applicable):	013968.

Re: (check all that apply) ☐ **Unsafe act** ☒ **Unsafe condition** ☒ **Stop work authority (SWA)**

Location: (check one) ☐ Driving ☒ Field ☐ Office

Date reported to supervisor/PM:	Mar 2/16.	Date corrected:	
Time reported to supervisor/PM:	18:00.	Time corrected:	

Describe the unsafe act, unsafe condition or SWA situation

GM contractor working on installing vinyl sheeting in bedrock trench. Sun was setting and operator of excavator lifting sheets for placement in trench was unable to see labourer directing him due to sun light shining directly at him.

List corrective action(s) implemented

Stop Work Authority implemented. Work crew to commence clean up and perform no more work around trench that is 3' wide and 28' deep due to unsafe conditions, even with fall arrest due to visual limitations.

Did the corrective action(s) mitigate the unsafe act/unsafe condition?

Yes.

For SMART administrators use only:

Category:
- ☐ **PPE** Personal Protective Equipment
- ☐ **BP** Body Positioning
- ☐ **WE** Work Environment
- ☐ **OP** Operating Procedures
- ☐ **TE** Tools and Equipment
- ☐ **CU** Computer Usage
- ☐ **PD** Pre-Driving
- ☐ **OPP** Operating Procedures – Parking

Chevron category:
- ☐ **A** Person or People
- ☐ **B** Equipment
- ☐ **C** Environmental
- ☐ **D** Procedures/ Processes/ ☐ JSA-review/revise
- ☐ **E** Visitors

Causative factor:
- ☐ **1** Insufficient training for task
- ☐ **2** Hurrying to complete the task
- ☐ **3** Easier if proper process not followed
- ☐ **4** Took shortcuts without prior incident
- ☐ **5** Incomplete or no procedures
- ☐ **6** Procedures not known or enforced
- ☐ **7** Improper PPE
- ☐ **8** Improper tools
- ☐ **9** Improper workplace layout
- ☒ **10** Exposure to conditions

Energy source:
- ☒ **G** Gravity
- ☐ **M** Motion
- ☐ **ME** Mechanical
- ☐ **E** Electrical
- ☐ **P** Pressure
- ☐ **T** Temperature
- ☐ **B** Biological
- ☐ **C** Chemical
- ☐ **R** Radiation
- ☐ **S** Sound

Are additional actions required? ☐ No ☐ Yes If yes, what?

CO Status from Katie
2 to be looked at
1 KK has to look at.
Review Status on Payment 5
CM has turned in.
KK reviewing Payment 6.
End of Month
- WTP - status. on T&M basis.
- Finish commissioning WTP.

Email from Ryan McDuffee
- use of Emergency Generator
- Air Permit. - will be our responsibility
For Air Permit Rules

Stone & Sump Installation next week
GR to follow up on Generator wiring.

KK - Eq't Delivery. by. GM - avoid West Side of
GMD Parking area
Schedule for MOI & SES to be maintained

- grout placed to ~ 6+00
- vinyl sheeting completed to ~ 6+90.

1630 SWA - sunlight in operator's eyes
- sheet placing crew having problems with sun

Secure Site & clean track / Fuel eq't
Air station collection.
1730 SES off Site.
1800 - Write up on Unsafe Conditions
& Lightning Work Stoppage.
1830 off Site.

SUBJECT | DATE

Thurs. Mar 3/16.

Weather: 34°F Overcast high 40°F Rain/Snow.

630 Air station ϕ air calibrat. all units at trailer 6:48

700 SES H&S: CFL lights - mercury content.

Air station.	W	N	E	S
mg/m^3	0.031	0.029	0.031	0.032
Power/Network.	✓	✓	✓	✓

- beef up sediment control measures P413
- roll off box → transfer mat'ls.

Mike Reynolds 7:15 - message left to stop at trailer
7:30 - phone off - immediately to message.
9:00 - message left to call K. Kamm at trailer

City of Bedford 812-279 6555
- MR. not in office - probably still off sick.

9:30 Grout truck available in a.m. → called in.
- grout placement from 6+00 → 6+70
- wash out in roll off box in P216.
+ concrete bucket → cleaned out into roll off box
- vinyl sheeting to 7+30

→ noon: MR - should be back tomorrow.
- will meet myself & KK at GHD trailer in a.m.

1700 Stage eq't / Fueling.
Air station collection.

1730 SES off site.
- discussion with KK & TL.
Re: Handling SEC measures
- conversations with CH

1820 off site

Fri Mar 4/16. 0.09" Rain.

weather: 32°F Overcast high 46°F.

6:30 Air stations & air calibr all units at trailer 6:40

7:00 SES H&S: Martinsville Construction Fatality
"Ricky Brewer - caught between vehicles - use of spotters - high vis. clothing

Air station	W	N	E	S
mg/m³	0.065	0.068	0.062	0.078
Power/Network	✓	✓	✓	✓

8:00 - Mike Reynolds + K. Kamm.
- Transmission leak on Bailey Scales Road
photos are available
- MR - is report necessary?
- TB - no release to enviro.
- contained.
- no report generated
- as per K. Kamm - will not be using berm
- roll off box (as per GM) for grout clean out.
- turbid release to creek on Tues - pumping shut off when noted
- extra SEC measures put in place.
- will inform him of any on-site changes → welcome his input
- he is satisfied with current situation → no concerns.
KK - offered written report & photos → MR - not necessary

- vinyl sheets to 7+90 (all available sheets used up by 14:30.)

1330 - grout placed to ~ 7+40

1500 GWTP carbon vessels off site.
- SES will clean GM roads after GWTP vehicles are off site

Air stations collected.

1700 off site.

SUBJECT

Mon. Mar 7/16.

DATE

Weather: 44°F Overcast high 65°F

6:30 Air stations ∅ air calibr. all units at trailer 6:40.

700 SES H&S: Focus on PPE use on site.

	W	N	E	S
Air station.				
mg/m³	0.023	0.024	0.045	0.029
Power/Network	✓	✓	✓	✓

- additional sheets to be delivered today.
- build up SEC measures: at Bailey Scales Road E+W sides
  - Parcel 413 add silt fence & straw bales
  - silt fence by CB-5.
- install vinyl sheets when delivered.
- vinyl sheets installed to 8+10.
  - windy conditions - SWA.
    - crew to grade P413
  - additional check dams installed with straw bales backed with silt fence
  - silt fencing along E side of culvert draining to CB-5
  - rip rap installed on W side Bailey Scales
  - road side erosion at E side B.S. Rd guard rail repaired.

1320 SES WTP Monthly Sampling.

1730 SES off site.

Air stations collected. - Progress Photos.

1820 Off site.

Tues Mar 8/16.
weather: 57°F Cloudy high 69°F

6:30 Air stations & air calibr. all units at trailer 6:40

7:00 Hard Hats.

Air station.	W	N	E	S
mg/m³	0.039	0.029	0.027	0.039
Power/Network	✓	✓	✓	✓

- install vinyl sheeting. past 8+10.

11:05 - vinyl sheets installed to 8+55
  - all sheets used up ~~done~~
- grading N of GWTP (P413).
  - check dams replaced

14:30 - grout placement 7+40 → end of trench.
  - base of sheeting grouted and secured. against east wall with long stick. (no gap).
  - grout started at S end and poured going N to 7+40

15:30 George + Mike → Water Samples from WTP
Katie + George on Conference call
Processed Samples
2 coolers → Test America.
1 cooler → Tri Matrix
3 CoCs → 1 day TAT

1730 SES OFF Site.
Air stations collected.

1815 OFF Site.
Cooler delivery to FedEx Bloomington.
Progress Meeting Agenda → email.

SUBJECT

DATE

Wed Mar 9/16.

weather: 56°F Drizzle high 68°F.

630 Air stations. ∅ air calibr. all units at trailer 6:40

700 SES H+S: Safe Fueling Operations - Static Electricity

	W	N	E	S
Air station.				
mg/m^3:	.044	0.039	0.043	0.039
Power/Network	✓	✓	✓	✓

- placement of stone in base of trench commencing at N end → Piezometer relocation (inside 1+00 to outside MH50)
- stone placed using concrete bucket

AOI-8 MH2
- Ryan McDuffee, Tim Meyers, K Kamm. - video of MH interior.

1300 Progress Meeting

KK	DL.	pH: CH.	~~Mk.~~ Mc	G. Mc.
TL.	RC	GT		Ryan G.
PB	SR	J. Mc.		
RH.	~~JT.~~			

Vinyl Sheets + Grout → Done
1+60 Stone placement.
- pipe welding tomorrow + N. sump.

GWTP - Storage Tanks full.
- Carbon (6) cells filled
- Eq't confirmed common
- instrumentation connected
- valves all working
- backflushing Carbons
- will need water a in a wk.

sch - 2wks commissioning.

- pipes/stone./ backfill.
liner sch for end of March/Apr.

Reynolds, Shane

From:	Bridcut, Pete <pete.bridcut@ghd.com>
Sent:	Wednesday, March 02, 2016 3:44 PM
To:	Campbell, Randy; Reynolds, Shane
Cc:	Chris Porter (cporter@brcjcivil.com)
Subject:	013968 - Piezometer Relocation

Attached is the final decision on piezometer locations (and a summary of Rick's notes below). The black locations were already existing, and the red locations are relocated to the east side of the vinyl sheeting. The northern well at 1+00 will need to be relocated and an additional well placed along the north end of the trench on the east side of the sheeting.

North of Wet Well 4

Inside Piezometers

- 3+50 – screen length = 10 feet, with 5 feet of PVC casing (total = 15 feet)
- 2+50 – screen length = 5 feet, with 10 feet of PVC casing (total = 15 feet)
- 2+00 – screen length = 15 feet, with 5 feet of PVC casing (total = 20 feet)
- 1+50 – screen length = 5 feet, with 20 feet of PVC casing (total = 25 feet)
- 0+50 – screen length = 5 feet, with 25 feet of PVC casing (total = 30 feet)

Outside Piezometers

- 2+50 – screen length = 5 feet, with 10 feet of PVC casing (total = 15 feet)
- 1+50 – screen length = 20 feet, with 5 feet of PVC casing (total = 25 feet)

South of Wet Well 4

Inside Piezometers

- 4+25 – screen length = 5 feet, with 20 feet of PVC casing (total = 25 feet)
- 5+25 – screen length = 5 feet, with 25 feet of PVC casing (total = 30 feet)
- 5+75 – screen length = 20 feet, with 15 feet of PVC casing (total = 35 feet)
- 6+25 – screen length = 5 feet, with 30 feet of PVC casing (total = 35 feet)
- 7+25 – screen length = 25 feet, with 15 feet of PVC casing (total = 40 feet)
- 8+25 – screen length = 5 feet, with 35 feet of PVC casing (total = 40 feet)

Outside Piezometers

- 4+75 – screen length = 15 feet, with 15 feet of PVC casing (total = 30 feet)
- 6+75 – screen length = 25 feet, with 15 feet of PVC casing (total = 40 feet)

The changes for the northern portion of the pilot trench would be to pull the existing piezometer inside the sheet piling at 1+00 (20 feet of well screen with 10 feet of PVC casing) and reinstall this piezometer outside the sheet piling at 1+50, shortening the casing portion from 10 to 5 feet. The other change for the northern portion would be to install the other outside piezometer at 2+50 using the materials previously planned for 7+25 (5 feet of well screen with 35 feet of PVC casing) but shortening the casing portion form 35 to 10 feet. This needs to be done as soon as possible if planning to backfill the northern portion of trench by the end of this week.

For the southern portion of the trench, we simply took the planned piezometers at 4+75 and 6+75 and flipped these to be located outside of the sheet piling. The lengths of screen and casing are unchanged. We also took the previously planned piezometer at 7+75 (25 feet of well screen with 15 feet of PVC casing) and shifted it to 7+25 (replacing the piezometer we moved to the outside piezometer at 2+50).

Let me know if you have any questions.

- sch. liner - once clay is ready AEG.
liner will have to cover. it.
- ~~poper~~ power pole - need priority. prior to tensioning cable
AEG mob - $15000
- State Group - polling cable today.

- extra straw bales check dams (4 series)
- suction on DB-5 has been placed on float
- additional silt fence GWTP
- reseeded stockpiles.
- rip rap & Creek straw bales.
W of Bailey Scales E of Bailey Scales

Mike. Reynolds - meeting with KK - no concerns.
on site this wk.

WTP Sampling - on Monday / will be talking to Mike Reynolds to get him results.

Air Monitoring Memo.

N of GWTP - graded
- do we want to topsoil?
or seed the fill mat'l.
- $15000 SES / $10000 for Ben's Topsoil.
CH - seed fill & see.
Placement of stone by GWTP
grade is presently 6" down.
- just ramp to get access to GWTP (no ponding)
- will be done this spring.
- stone included back where transformer pad is.

2 CO into CH. & CO 8 will be reviewed
(6 & 7) & forwarded.
pole installation & back wash pump
increase units budget to account for backup pump & generator
CH 25000 EP 500000 will be gone for month 17th.
SES may have info from BRCT on fill amounts
schedule being maintained
~~Fast~~ - gravel placed up to sump location ~3+20
1730 SES off site.
Air Stations collected
1750 off site → Cooler delivery to FedEx in Bloomington

SUBJECT Thurs. Mar 10/16 0.96" Rain DATE

Weather: 58°F Rain high 61°F

630 Air stations & air calibr. all units at trailer 6:40

700 SES H&S: Ladder Safety / Inspections.

	W	N	E	S
Air station.	W	N	E	S
mg/m³	0.042 ✓	0.046 ✓	0.042 ✓	0.059 ✓

Power/Network

- check storm water discharge.
- inspect all sediment & erosion control measures.
- silt fencing to be installed around DB-2

not reading on network -> current spike

- battery change out with spare.

8:00 Mike Reynolds - inspecting site..

- SES WTP Results not in yet - will check on status
- WTP sampled Monday.

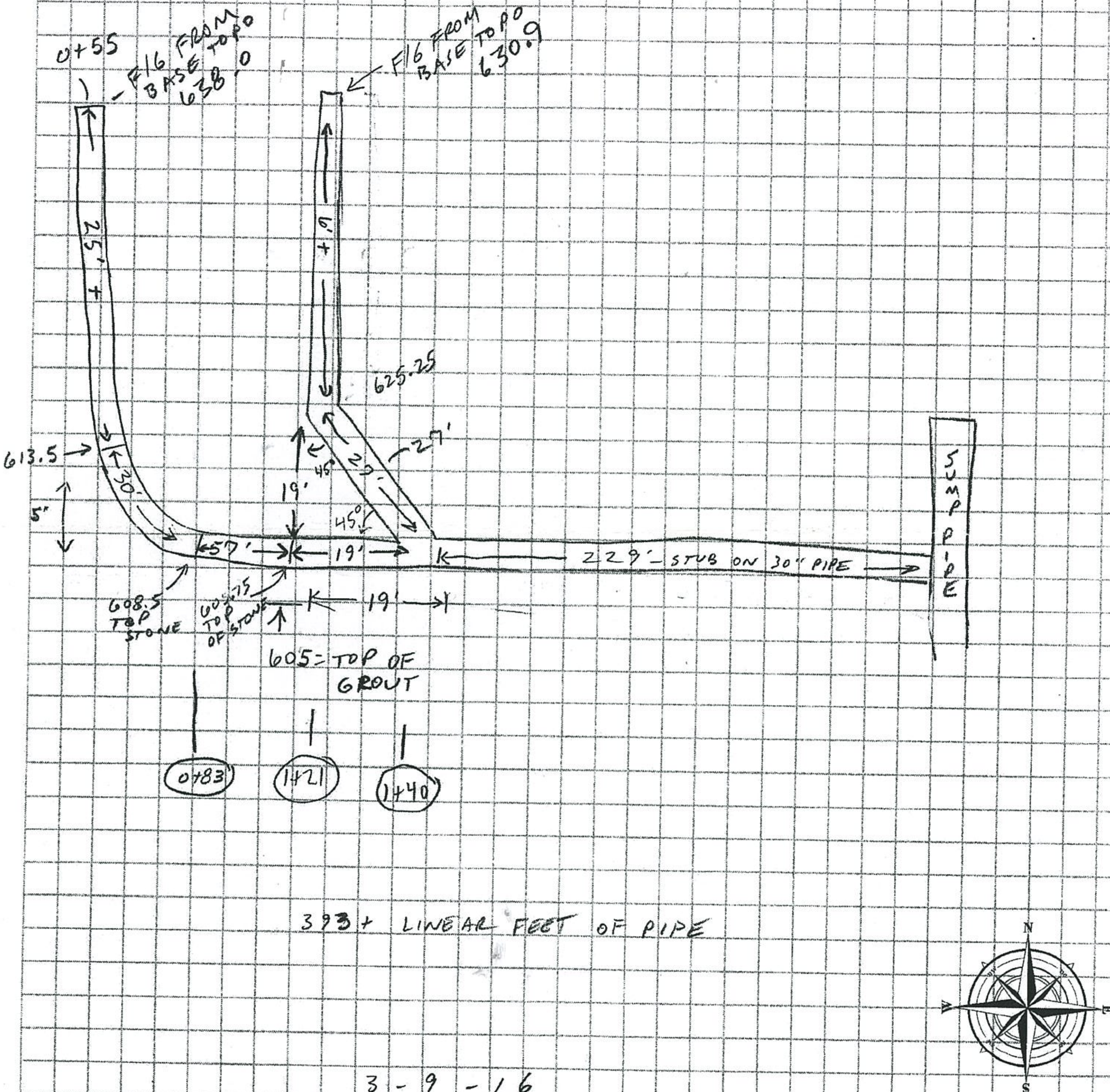
Draft. Meeting Minutes 03-09-16 } emailed out
Final Meeting Minutes 02-24-16 }

1430 On site to collect SES WTP Results (ND)

- text sent - Filter socks placed over discharge
- status passed onto MR.

1530 SES Off Site (sw Management crew to stay)
Air stations collected.

1630 Off Site.


0+55
F16 FROM BASE TOPO 638.0
F16 FROM BASE TOPO 630.9
25' +
6' +
625.25
613.5
30'
27'
19'
45°
45°
5"
57'
19'
229' - STUB ON 30" PIPE
SUMP PIPE
608.5 TOP STONE
605.75 TOP OF STONE
19'
605 = TOP OF GROUT
0+83
1+21
1+40
393 ± LINEAR FEET OF PIPE
N
E
S
W

3-9-16

0.64" Rain

Fri Mar 11/16.
Weather: 42°F / Ptly Cldy high 61°F

630 Air stations ϕ air calibrat, all units at trailer 6:40
700 SES H+S: Pipe Welding JSA Review.

Air station	W	N	E	S.
mg/m^3	0.052	0.034	0.028	0.047
Power/Network	✓	–	✓	✓

- piping layout along N end of trench provided by BRCJ
- SEC measures to be inspected
  - personal inspection – no concerns.
  - Mike Reynolds on site
- welding of pipe for placement along N end of trench
- not to install sump (N section) until Mon.

8:00 R. McDuffee, T. Meyers, Lisa LaLouver, K. Kamm.
- video taken MH-2 AOI-8 to inspect potential pipe leakage
- pole inserted to N outflow pipe (Flow to SW pond) (no residual product)
- end of pipe wrapped + taken to WTP for decon.
  - carbon removal underway (truck in access bay)

R. Robertson - jars needed for sampling carbon - GWTP locked
- K Kamm - checked conex box → 32oz wide mouth
- delivered to WTP - Safety Inspection by GM
  - no phone signal
- inspection of SEC measures P413 → K Kamm observed at WTP
  - propane cylinder at WTP (not allowed at GM plant)
  - aluminum ladder - not allowed at GM plant - does not extend >3'
  - 3' set back (Floor to ceiling) to all circuit breakers (potential arch Flash)

10:45 SR SES - maintain all personnel well away from trench
- stress Fall arrest use on all personnel.

11:00 OFF site - M Curtis or G. Seng to collect Air Stations.

1500 Indy Flight to T.O.
Avg speed to Ptbo 57 km/hr.

SUBJECT

DATE

Mon Mar 14/16

Weather: 53°F Cldy high 63°F

630 Air stations & air calibrat. all units at trailer 6:40.

700 SES H&S: Pipe Welding Safety/Spill Kits

Air stations	W	N	E	S
mg/m³	0.017	0.012	0.015	0.027

Power/Network

- pipe welding for N end of trench *
- pipe installation
- 3 loads #2 stone for sump

Jim Fontana - email to reset Defensive Driving Course

9:00 Rain → only 2 welds completed

SW Management Crew maintained on site.

noon 0.53" Rain

SEC Inspection → ok.

1530 Xtra SW crew for SES off site.

1 operator + 1 labourer to stay to pump DB's & monitor

Air Stations collected

discharge from DB's → clear.

1630 Offsite

pm. → Defensive Driving online course 3 hrs.

welding 6" pipe (cut for flush joint)

(ends heat to 450°)

connection made + set for 10 min (Min).

Tues, Mar 15/16.
weather: 46 °F Fog High 72°F.

630 Air stations ϕ air calibr. all units at trailer 6:40
700 SES H+S: Housekeeping (Tools Storage + Care) Slips/Trips/Falls

Air station	W	N	E	S
mg/m³	0.013	0.023	0.011	0.015
Power/Network	✓	✓	✓	✓

- 3140 yds³ at GWTP to be removed to allow for placement of 18" of stone.
- asphalt cut at WTP to run pipe to manifold at containment area + electrical line into WTP.

pm.
- pipe welding at N end of trench.
- pipe laid into trench. - N end secured + tied off
  - pipe laid using sling moving southward along pipe
  - Till used to support clean out at 1420
- N sump structure mobed to trench area.
- section of perforated pipe welded to structure.

1700 SES clean up + Fuel eq't.
Air station collection.
1730 SES off site.
1800 off site.
3 Cooler delivery to Bloomington Fed Ex for WTP

Photo email + Progress Meeting Agenda.

Defensive Driving. 1 hr.

GM

FOCUSED INSPECTION CHECKLIST

SECTION 25 SLIP / TRIP / HIT / FALL

Inspection Date: Mar 15/16

Inspector: Pete Bridert

Project Name: CET Bedford Pilot Trench

Project Location:

Address: GM Drive

City: Bedford

State: IN

Zip: 47421

GM Project Manager: Cheryl Hiatt

Jim McGuigan

Consultant Project Manager:

Consultant Name: GHD

Consultant Superintendent: Katie Kamm

Consultant Site Health & Safety Officer: Tim Leo / Pete Bridert

Contractor Name: Sevenson Environmental Services

Contractor Project Manager: Jim Pazderski.

Contractor's Superintendent: Randy Campbell

Contractor Site Health & Safety Officer: Dave Leising

CHECK IF NOT APPLICABLE ☐

ITEM NUMBER	AUDIT QUESTION	YES	NO	NA	COMMENTS
1	The project work site is well maintained in an orderly manner?	☒	☐	☐	work welding pipe beside trench & placing pipe in trench with excavator
2	Slip/trip and fall hazards are not present in personnel walk ways?	☒	☐	☐	work area cleared prior to commencing work for unobstructed access for workers & excavator

SECTION 25 HIT / TRIP / HIT / FALL

Safety Observation Tour:

Safe Observations	Corrective Measures	Completion Dates
Area cleared ~~from~~ easy acc	ess prior to removing	
barriers for excavators to p	lace piping into bedrock tr	ench

Unsafe Observations	Corrective Measures	Completion Dates
Muddy conditions with	Wooden pallet put across	SWA - performed to ensure
ponded water/slippery	work surface of welding area	safe working condition
	to create temporary	
	boardwalk	

Stop Work Authority.

SUBJECT | DATE

Wed Mar 16/16.

Weather: 54°F Clear high 64°F

630 Air Station ϕ air calibr. all unit at trailer 6:40

700 SES H+S: Communication - Walkie Talkie usage.

Air Station	W	N	E	S
mg/m^3	0.007	0.007	0.005	0.009
Power/Network	✓	✓	✓	✓

- weld N sump structure onto pipe in trench.
- set N sump structure in place - straighten + centre pipe
- set 2nd structure.

1300 Progress Meeting.

ph. RH GHD: T.L. McI.: RG. SES: RC.

SR JMc. P.B. DL.

JP KK.

- PB to forward Daily Site Progress.

SR word from GM 6 + 7 signed.
KK 8 to be forwarded followed by 9.

SEC. - none.

McI -

② Pilot Trench Status - pipe installed N end.
2 - sumps installed.
stubs cut with Fumnco couplers.

GWTP - switching plan from GM.
- to tap power
- disconnect on Easter Monday.
→ taps on following week.
- start up. continuing.

Pipe connection at WTP shut down.

- send proctor test to PSI - Air monitoring can cease as per EPA
- will probably not hear from IDEM.

- #2 stone around sump structure #8 stone placed in trench.

1700 SES finished filling trench to 2+55 to surface over to N sump structure
- pipe covered over N section to cleanout @ 1+20
- cleanout plumbed up.

1730 off Site

Thurs Mar 17/16.   224 484 8042
K Komm Home

weather! 44°F Clear 61°F.

6:30 Defensive Driving Certificate

700 SES H&S: Tools - Inspections + Storage.

- backfilling trench with stone.
- plumbing & centring clean out at H2O.
- backfill stone around clean-out.

- lifting flanges on sump structre

SES - can they be cut off?

- RC checked with RH → ok.

- stone on exterior (east) sides of sheeting.

- if filled prior to trench interior

→ pushes sheets out from wall.

- sheets appear to hold up when trench filled

up to 20' along N end.

- north end of pipe pulled up.

(2nd clean out at 0+40).

- Air stations packaged up

- to be sent out by ground delivery.

- pick up way bills at Bloomington.

GM-receipt of email by SES

Safety
Stand Down

1730. SES off site.

Cooler delivery to Fed Ex Bloomington. (WTP).

- no longer have Ground Delivery Way Bills.

SUBJECT | DATE

Fri Mar 18/16.

Weather: 36°F Clear high 53°F

630 On site.

700 SES H&S: Quarterly EEO Meeting (Equal Employment opportunity).

- GM Safety Stand Down - Focus on fall hazards
  - pretask planning to account for changes in task.
  - on site risk assessments
  - inspecting eq't & site condition.
  - site personnel/management communications

- backfilling trench (M section) #5 stone.
- vinyl sheets cut off at top of bedrock.
- backside of sheeting filled in (#11 stone).
- stone graded flush

Draft Meeting Minutes 03-16-16. } emailed.
Final Meeting Minutes 03-02-16 }

- Ground Way Bills not available at Fed Ex.
  - packages have to be brought in to Bloomington & entered by computer.

WTP water samples to be prepped.

11 coolers Brad } FedEx pickup.
4 coolers Mike }

1700 Air Monitoring eq't to Bloomington Fed Ex
10 boxes
Way bills generated & sent off #208.

1800.

Mon Mar 21/16.
weather: 34°F Clear high 53°F

630 onsite.

700 SES H+S: General Site Safety
- work transitioning to S end of trench.

George's WTP Waste Water Line
- can we disconnect
- system shut down (48 hr to settle after rain event)
- won't be treating until tomorrow.

3 Trucks (Young) hauling stone (#5)
- stockpile in trencher laydown.

SES missing fitting (line reconnected ~ noon)

Tailgate Meetings + Safety Stand Down → emailed.

- to place 6" stone along S end of trench.
- mob eq't to south side of trench.
- concrete barriers + fall arrest cable set up.

1700 SES eq't staging/fueling
1730 SES OFF Site

SUBJECT Tues Mar 22/16. DATE

Weather : 42°F Clear high 64°F

630 On site.

700 SES H&S : Equal Employment Opportunity Policies.

-3 Trucks (Young) hauling stone #5 (60 loads total to trencher laydown area)

-to switch to #11 stone

-GHD WTP to be treating water today.

-SES to relocate ww line tomorrow.

-George to shut down 1st thing in a.m.

900 - rescheduled.

1200 -WTP discharge line reverted.

p.m. #5 stone switched to #11 stone

#5 stone being placed in south trench.

SES concerns.

- Filter media over trench - to be stone (vs sand)

SES - request lessening 5' horiz. extension of filter media from trench down to 2-3'

- geotextile beneath adjacent road (#53 stone) to be changed to woven geotex. (vs. unwoven)

- 'boney' fill mat'l → ok to lose it in deep cuts in trench?

KK. → SES sampling of Sand & Carbon for decommissioning WTP

→ emailed to RH.

1800 Off site.

Wed Mar 23/16.
Weather: 55°F Clear high 62°F Windy.
630 On Site.
700 SES H&S: Indiana Severe Weather Preparedness

745 RH - Stone over trench - 2' horizontal with fabric out from trench ok
- extend filter media over where ever trench is.
- RM to check on woven geotextile under #53 road.
- GWTP 'boney' fill mat'l → can lose mat'l in bottom 5' (outside cap area) 5+50 - 7+50 & top with clay & compact
- 3140 yds by GWTP removed for 18" stone → backfill for trench.
- bedrock - end of job to line access roads.

- backfill over N section of working platform (leave opening/ditch for filter media)
- 6" stone #5 in S end of trench
- previously ended at clean-out from original steel sheets at ends of trench (redesign removed them)

1300 Progress Meeting:

GHD.	KK	SES	RC	Mc	RG.	+H:	JMc.
	TL.		SR				RH.
	PB		DL.				GT.

① Fri. Safety Stand Down.
Mc. - SES - None
GHD - 30th - Tornado Drill, to be conducted by GM.
- PB GS TL. / RC SR DL.
- Plant forms to be used for inspection on tanks.
8:00 tomorrow. meet at GHD trailer
Nate will go over forms.

② N side filled with stone.
Backfilling N side
6" Stone in South. - piezometers installed.

SUBJECT

DATE

GWTP. - cont' overhead line in place
commissionin
- met with Plant Staff walk thru
on switching plan.
shutting down capacitor banks Sunday.
- power tap next week.
- carbon backflushed for preliminary testing
pumps are presently being fixed!

Pilot Trench
- ditch for fibre optic & pipe.
- filling trench & backfilling

CH & KK - lining trench? → RH
- extend liner - width
to reduce surficial infiltration.
- backfilling started.
CH - continue backfilling.
SR. - check inventory on
more water to south
liner width rolled out, over trench.
- south end. - will connect to next section of trench.
- will require protector clay fabric below clay over
- common fill used → run sheeps ~~feet~~ over to compaction
(no proctor) → respond. by 3

- fabric to be purchased.
- liner onsite to cover DB-4 1st then see what's available
Req for Info
RH → woven fabric.
CH & KK working on C.O. 9
Scope change > 500000 will need to go to committee. Ed back on 28th. Meeting end next wk.
Schedule for Easter Weekend
Mon - GWTP to start
SES - to cut off at noon Fri.

JM get & align N Structures pending rain - clay around trench covered with polysheeting to ensure runoff

Thurs. Mar 24/16.

weather: 62°F Overcast high 64°F T-storms.

6:30 on site.

7:00 SES H+S: Rigging Safety & Work Review of Yesterday's Tasks

- placement of fill mat'l over N end of trench.
- south structures to be set.
- GM Tornado Drill → Mar 30th 10:00 am.
  - text all clear to G. Seng.

Craig Gebhart, Principal on site for H+S.

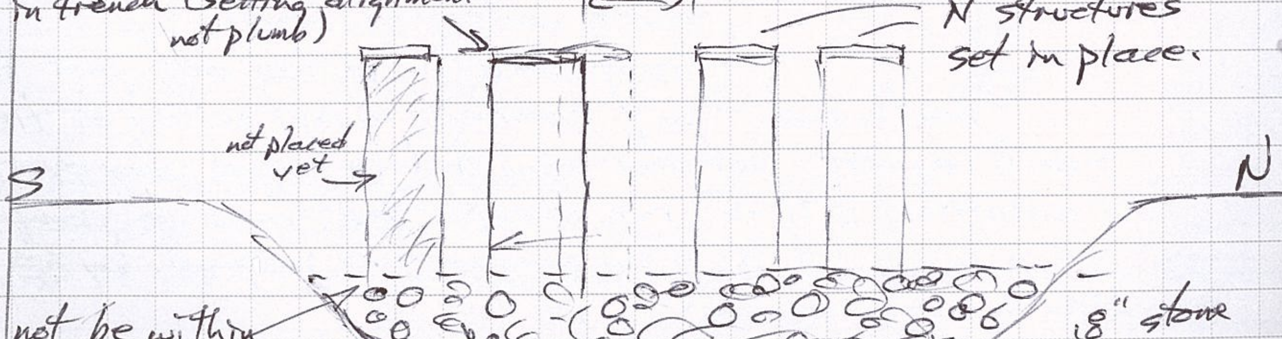
8:30 Confined Space Entry / Fall Arrest + Ladder Safety } 8:30 - 16:00 H+S. 7½ hrs

10:00 Rain - SES not able to set 3rd sump structure to S

- trench slightly off plumb (vinyl sheets set in trench plumb)
- structure to be set within sheeting inset to accomodate fitting in trench.

sump structures won't fit over N+S. sets

3 structure moved to next inset S · will be 1.6' apart with structures
· base will still be set on 18" stone



- doesn't matter → it's the W.L. above the stone that counts

17:00 - acceptable - should be fine
- Waterloo - Good Friday Holiday tomorrow.
- will hear back from.

17:00 SES Off Site

17:30 Off Site.

0.48" by noon

Roll off Box delivered to GHD trailer yesterday

SUBJECT

Fri Mar 25/16.

DATE

Weather: 34°F Overcast High 52°F

6:30 On Site. 0.90" rain

7:00 SES H&S: Holiday Travel. - Seat Belts - Drinking & Driving.

- Finalize setting of 1st South Structure.
- Fuel up pumps & generators by WW2
- rain pending on weekend.
  - prep SW measures

* need to get email to RH
  Re: sump structure relocation.

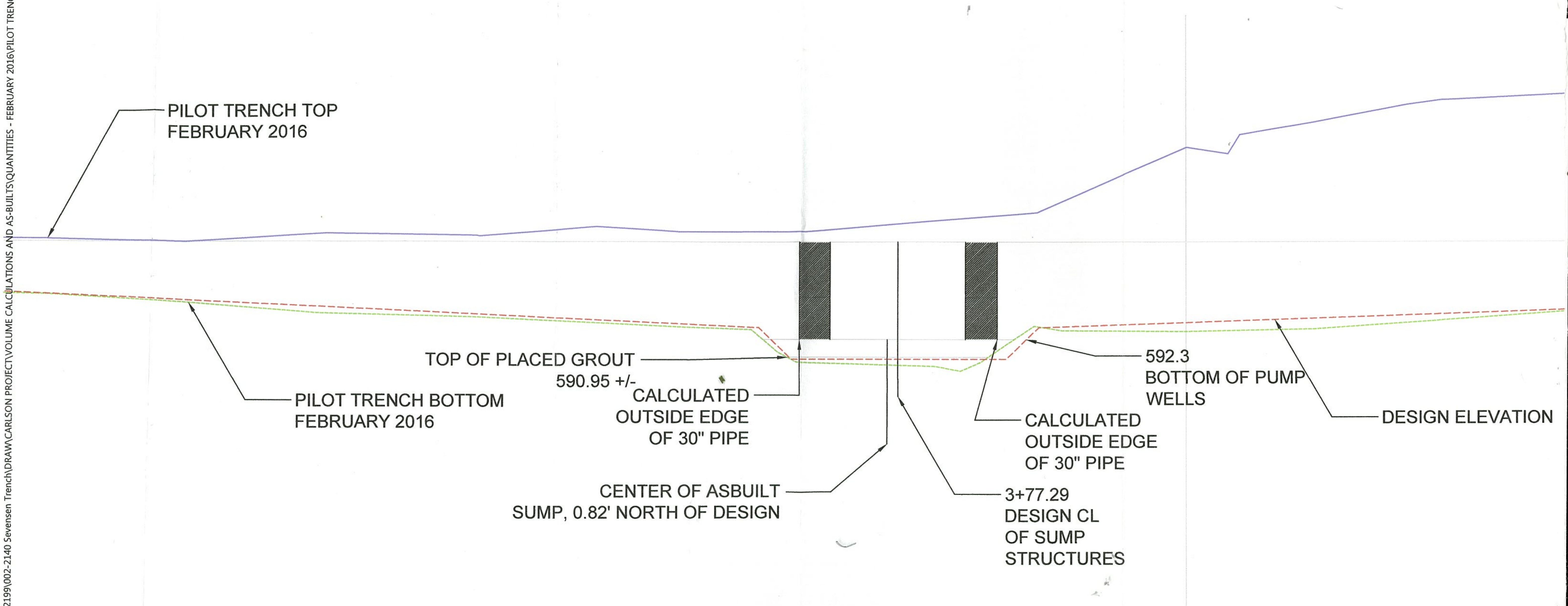
· mice infested mat'l from Coney box
  → roll off box for disposal.

· 160' of perforated pipe welded for S end of trench.

Draft Meeting Minutes 03-23-16 } emailed
Final Meeting Minutes 03-09-16 }

Chris ~~Porter~~ BRCJ - pdf sketch of relocation

13:30 Off Site.



M:\JOBS\002-2100-2199\002-2140 Sevensen Trench\DRAW\CARLSON PROJECT\VOLUME CALCULATIONS AND AS-BUILTS\QUANTITIES - FEBRUARY 2016\PILOT TRENCH ASBUILT - FEBRUARY 2016.dwg

Mon Mar 28/16
Weather: 43°F Overcast high 57°F

6:30 On site.

7:00 SES, H&S: Pipe welding, Trip Hazards, Proper Communication.
Cont' pipe welding for S end of trench.
- setting southern most sump structure.

9:10 Heather Van Valkenburg (Pine Enviro) - email that weather station not returned
713 331 3924 - message left.

9:40 Pine Environmental - talk to someone in receiving Re: weather unit.
800 301 9663 - was sent with one of 5 air stations returned
- received - sent to factory to repair base bracket.

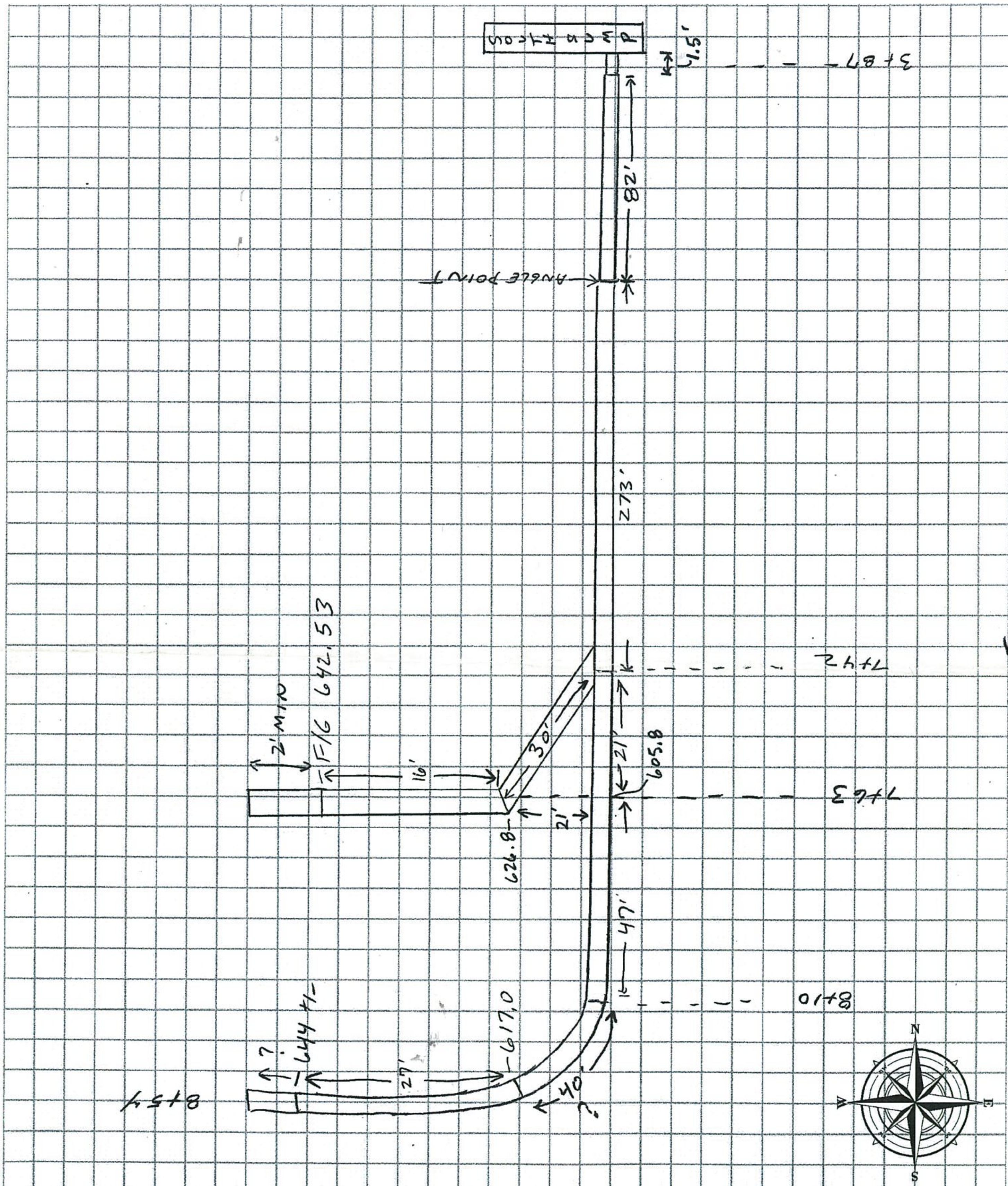
10:00 RH: Re: is stone infiltration still needed if apply clay cap. → yes
- 1.6' gap between sump structures
- connecting pipe may need to go to HDPE from galvanized outside structure
or concrete fill for continuous boot with liner

1300 SES/McI - tapping at WTP manifold
- McI responsible for LOTO woody → Whaaaat?

- South structure set + placed with perforated pipe connected
- perforated pipe welded up past south clean out (9463)

1730 SES off site
Progress Photos Sent out.

1800 Off Site.



Bledsoe Riggert Guerrettaz
LAND SURVEYING · CIVIL ENGINEERING
www.brgcivil.com

Bloomington
812.336.8277
Bedford
812.275.0001
Paoli
812.723.2900

SUBJECT

Tues Mar 29/16.

DATE

Weather: 33°F Clear high 60°F

630 On Site

700. SES H+S: Site safety concerns, rigging + suspended loads

730 G. Seng / P. Burdett / T. Lee - meeting at WTP containment area.
- Flow/valve/drainage at manifold + WW3 (N connection)
WW1+2 (S connection)

SR. + McI - workscope review
- SES already diverted WW3 water to SES WTP
· N connection isolated + drained (to be done 1st)
· G. Seng to personally pump down WW1+2 + man pump for S connection
- lines can be isolated - minor potential impact water
- durascrim placed under manifold + sand bagged (contingent measure)

- SES placing perforated pipe into S end of trench.
- piping being welded S of Y connector at clean out
a.m - placing filter fabric over N trench section.
- clay backfill placed both sides of trench in 1-1½' lifts

p.m backfilling S trench with #5 stone
· excavator filled from sump to inflection point (4+67)
· loll dumping stone directly from bucket S of 4+67

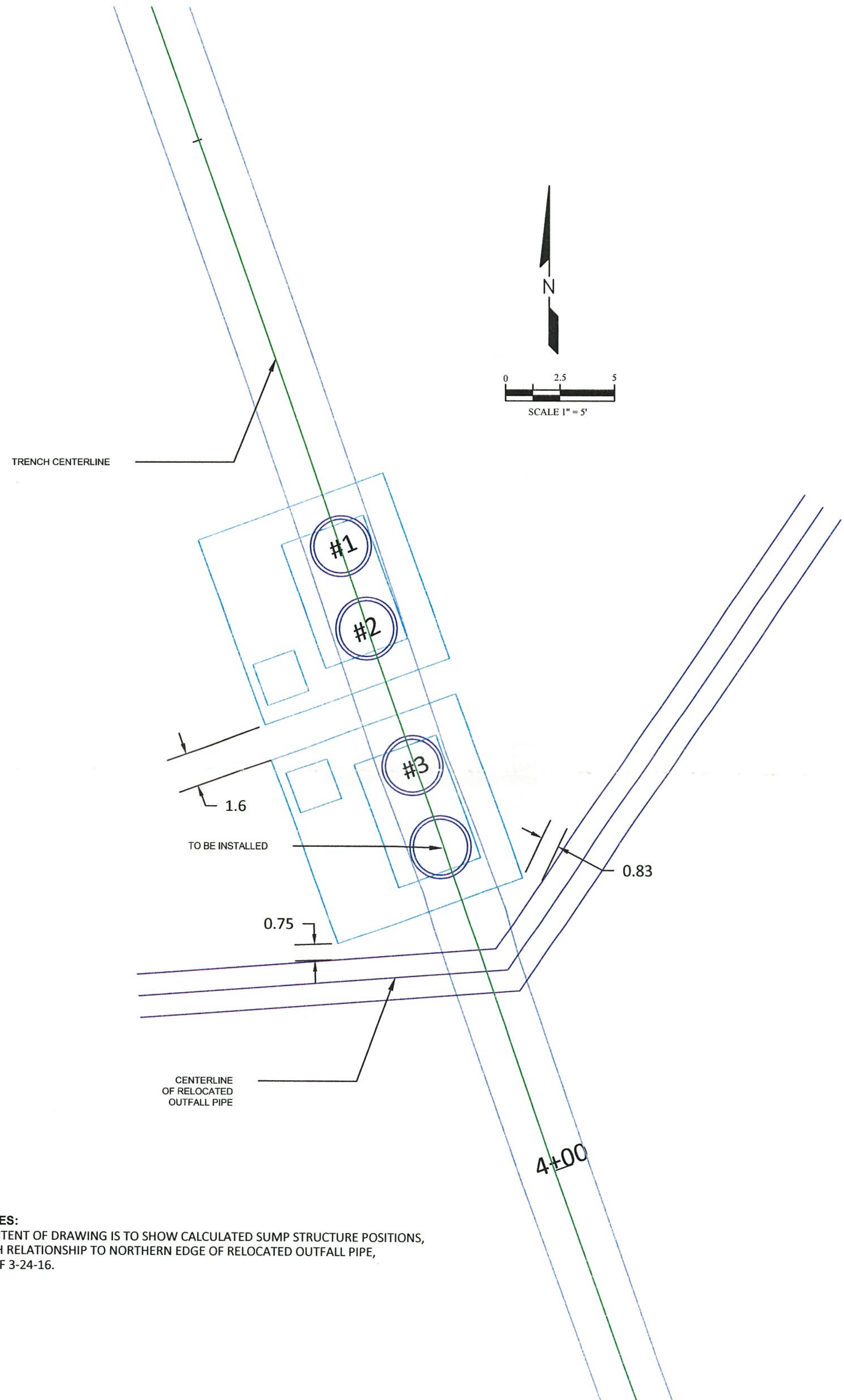
1700 SES staging eq't / fueling.

1730 SES off site
SES Progress Reports.

1800 off site.

Electrical Wire Tap by State Group
- 1 of 2 wires completed.
- Powered back up (as per Tim Meyers)
- completion of electrical connection to GWTP
on standby

SUMP BARREL LOCATIONS
AS OF 3-24-2016



NOTES:
1. INTENT OF DRAWING IS TO SHOW CALCULATED SUMP STRUCTURE POSITIONS, WITH RELATIONSHIP TO NORTHERN EDGE OF RELOCATED OUTFALL PIPE, AS OF 3-24-16.

SHEET 1 OF 1
PROJECT NO. 2-2140
TOPOGRAPHIC SURVEY
SURVEYED BY: CP, NK &DM
DRAWN BY: CP
CHECKED BY:
DATE: 3-25-16
DRAWING NO.:

GM POWERTRAIN FACILITY
BEDFORD, IN
FOR
SEVENSON ENVIRONMENTAL SERVICES, INC

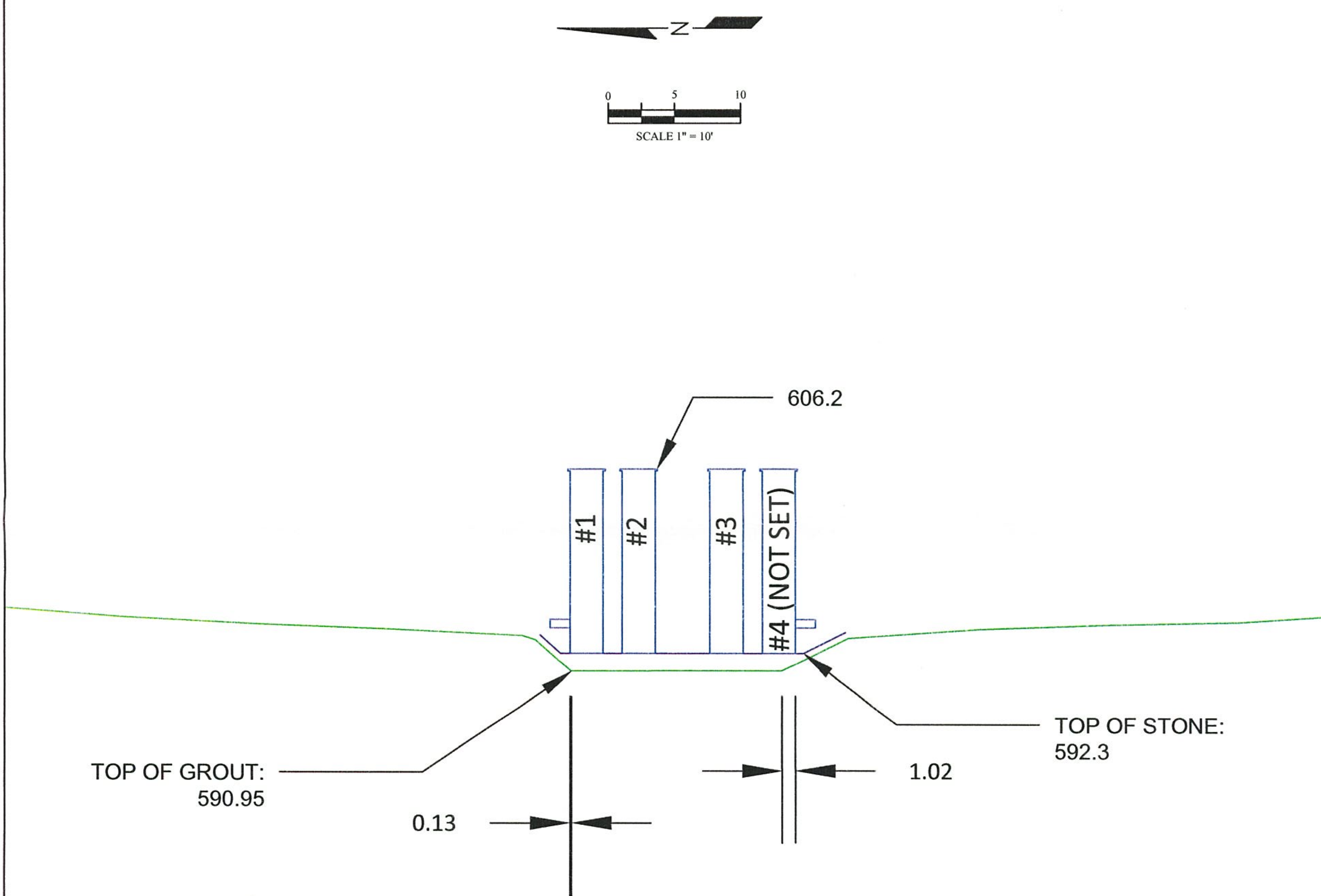
Bledsoe Riggert Cooper James
BRCJ
LAND SURVEYING • CIVIL ENGINEERING • GIS
516 X Street
Bedford, IN 47421
P: 812-275-0001
E: callen@brcjcivil.com

NOTES:

SCALE CERTIFICATION
ABOVE BAR MEASURES 1" ON THE ORIGINAL.

M:\JOBS\002-2100-2199\002-2140 Sevenson Trench\DRAW\CARLSON PROJECT\VOLUME CALCULATIONS AND AS-BUILTS\SUMP PIPE ASBUILT_3-24-16\SUMP PIPE ASBUILT_3-24-16.dwg

SUMP BARREL LOCATIONS
AS OF 3-24-2016



NOTES:
1. INTENT OF DRAWING IS TO SHOW RELATIONSHIP OF SUMP BARRELS WITH THE TOP OF GROUT IN THE LOWEST PORTION OF SUMP, AS OF 3-24-16.

PROJECT NO. 2-2140

SHEET 1 OF 1

TOPOGRAPHIC SURVEY

DRAWING NO.:
DATE: 3-25-16
CHECKED BY:
DRAWN BY: CP
SURVEYED BY: CP, NK &DM

GM POWERTRAIN FACILITY
BEDFORD, IN
FOR
SEVENSON ENVIRONMENTAL SERVICES, INC

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NOTES:

SCALE CERTIFICATION
ABOVE BAR MEASURES 1" ON THE ORIGINAL.

M:\JOBS\002-2100-2199\002-2140 Sevenson Trench\DRAW\CARLSON PROJECT\VOLUME CALCULATIONS AND AS-BUILTS\SUMP PIPE ASBUILT_3-24-16\SUMP PIPE ASBUILT_3-24-16.dwg

Wed Mar 30/16
Weather: 37° F Ptly Cldy high 68° F
6:30 On site.
7:00 SES H&S: Bugs, Ticks, Chiggers, Etc.
- backfilling. N end of trench
- prep fabric & stone for filter media installation.
- backfill S trench with #5 stone.
8:30 - G Song / K. Kamm - if no notification of Tornado Drill from GM by 10:05, G.S. to make drill.

10:05 Text from G. Song - he can hear a Plant siren but received no text.
10:06 Safety Dave received text & iniated drill
10:12 Text to G. Song I had mustered at Drive Church
10:15 SES - all accounted for text sent.
10:18 G Song ~~sent~~ out All Clear message from GM.

→ inside sections of sheeting to be filled up to bedrock contact with #11 stone
- Voids can be backfilled with #5 stone

1300 Progress Meeting.

GHD T.L. TB.	McI RG.	SES: DL. SR. RC.	pH. J. Paz. CH. KK. RH. J Mc. Ed P.

GM Tornado Drill
G.S. iniated drill at 10:05

McI - GHD - Tornado Drill → okay State Group. & McI,
- T. Lea. - last night powering back up. E of GM Drive
- circuit would not properly engage
- motor driven connection for circuit breaker
- switch did not work 12 - 15X
- power did not come on - disconnect manually
- don arch flash suit to manually switch.
- Power Train WTP & GWTP
- will revise switch with Dave Adams.
SES - no issues.
↳ no schedule for power outage
- waiting on authorization from Plant
- K Kamm talked to Tim Meyers
- needs his schedule.

SUBJECT | DATE

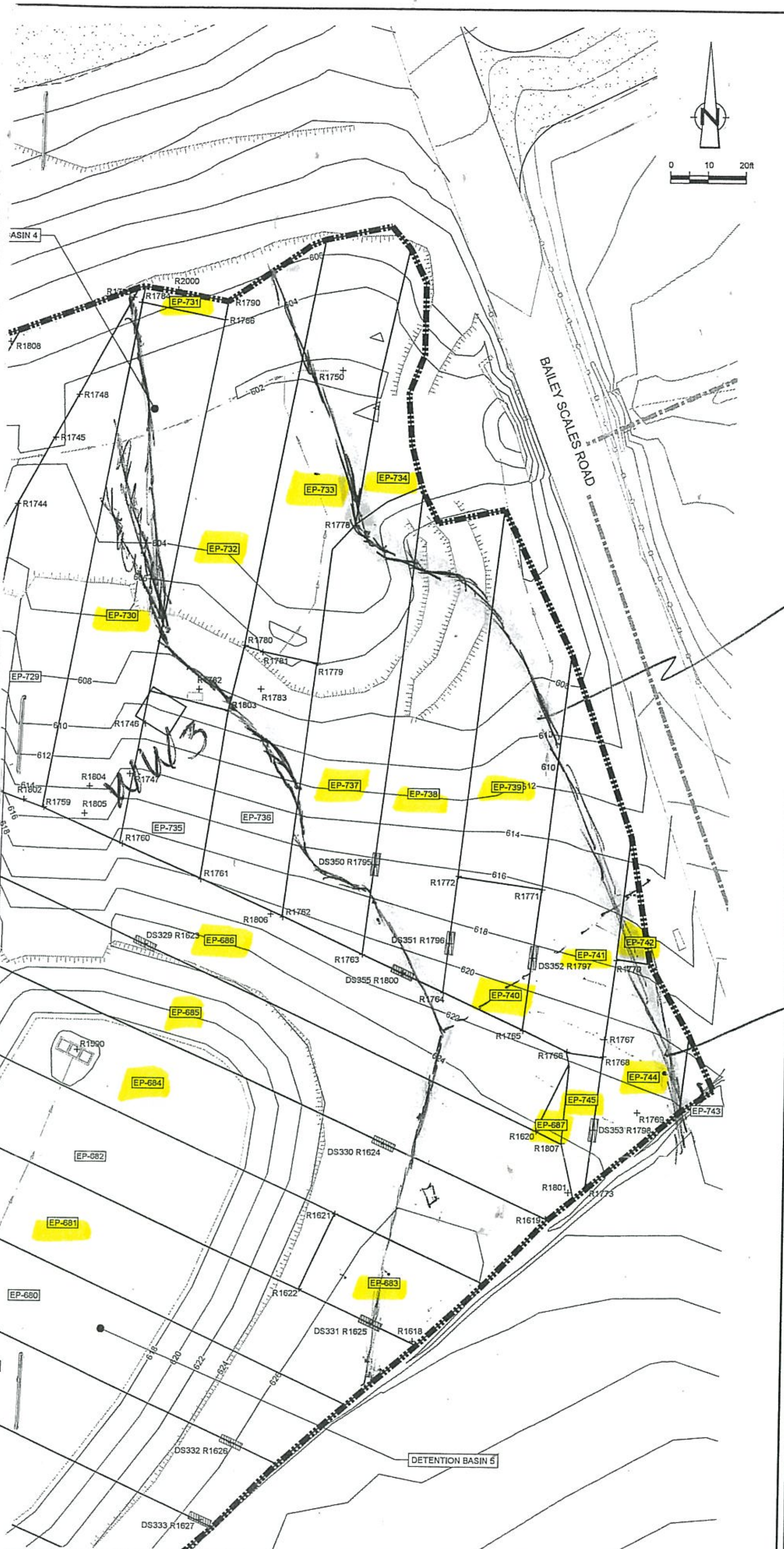
② CWTP - none.
- schedule → cont start up & commissioning
Power.

Pilot Trench. - SES 6" base
Perforated pipe.
Backfill of trench
} done.
- showers after midnight. & tomorrow.
- backfill on N end
- excavator down.

KK CO meeting next monday.
SR sent ATP - KK to look into it.
→ schedule day. of call.
~~attn~~

- South end trench backfilled with # 9 stone to ~7+00
- Fall arrest barriers to be moved south to allow backfill access with loader & hill
- water truck used to keep dust down between stone pile (trencher laydown) & working platform along the trench.
- clay backfill over N section of trench covered with poly with pending rain overnight.

1730 SES ~~off~~ site.
~~Off~~ site.



Nº	Revision	Date

LEGEND

(symbol)	LINER PANEL LIMIT
DS4 R20	60 MIL TEXTURED LLDPE LINER PANEL DESTRUCTIVE / REPAIR SEAM TEST LOCATION
+ R48	60 MIL TEXTURED LLDPE LINER PANEL REPAIR LOCATION
WP-16	60 MIL TEXTURED LLDPE LINER PANEL IDENTIFICATION ID

Last Panel EP 807
Next Panel EP 808
Last Repair R 2001
Next Repair R 2002
Last Destruct DS 379
Next Destruct DS 380,

Zone with liner pulled back

trench limits

RECORD DRAWINGS

THIS RECORD DRAWING HAS BEEN PREPARED, IN PART, BASED ON INFORMATION FURNISHED BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, CRA CAN NOT AND DOES NOT WARRANT ITS ACCURACY AND/OR COMPLETENESS, AND THUS SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED HEREIN AS A RESULT. THOSE RELYING ON THIS RECORD DRAWING ARE ADVISED TO OBTAIN VERIFICATION OF ITS ACCURACY AND/OR COMPLETENESS BEFORE USING IT FOR ANY PURPOSE.

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial
AS-RECORDED - ISSUED FOR EPA REVIEW	MAR. 02, 2015	CRH

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

EAST PLANT AREA COVER SYSTEM CERTIFICATION REPORT

FINAL COVER SYSTEM 60-MIL LLDPE GEOMEMBRANE PLAN 4 OF 19

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001

Project Manager:	Reviewed By:	Date:	
J.M.	C.R.H.	MARCH 2015	
Scale:	Project Nº:	Report Nº:	Drawing Nº:
1" = 20'	13968-00	350	C-35

13968-00(350)CI-WA017 MAR 2/2015

Thurs. Mar 31/16.

Weather: 56°F Rain (0.48") high 70°F

630 on-site

700 SBS H&S : Inspections. on Eq't.

as per SR - RH inform have onsite 4 x 4' barrels for MH's 19 & 18
due to Air Relief Vales sticking up above
lip of existing MH barrels (NW of GWTP)
-use existing on-site barrels or obtain 2' rings ??

MH-18 (Fire hydrant) ~6" above top of Barrel.
MH-19 (6" HDPE) ~12" above top of Barrel.

Blind Flange placed on 8" Backwash line
- to check with SR → has it been pressure tested?

- backfilling S end of trench with #5 stone.
- inside of vinyl sheets fill with #11 stone
- BRCJ on-site to shoot pipe from clean out to south end

13:45 Mike Rogers ~~leaving~~ WTP - looking to inform G. Seng.

14:55 Lightning & Thunder SWA.

1530 SBS off site.
1 operator + labourer for site clean-up
& SW management
↳ emailed to Louise Scott.

1540 - resumed work (30 minute rule)

1600 off site

SUBJECT DATE

Fri Apr 1/16.

Weather: 46°F Clear high 62°F Windy.

630 On site.

700 SES H+S.: Lightning Safety - review of yesterday's SWA.

- backfilling S- end of trench #5 stone
- getting clean-out stick-up + plumbing up pipe.
  - $2\frac{1}{2}$ stick up above finished grade (2' called for)
- bend up end pipe ~ 8+50 (within sheeting)
  - slightly off plomb (N-S)
  - okay - do not want to kink pipe or move clean-out.
  - backfill south end to secure end pipe.
- temp. fence to ~~continence~~ commence disassembly
  - fence to be removed once trench backfilled - as per CHatt.

→ 7+64 clean out location

Draft Meeting Minutes 03-30-16
Final Meeting Minutes 03-16-16 } emailed out.

- liner QA/QC forms sent from Waterloo.
  Next - Panel # EP808.
  - Repair # R 2002
  - Destruct # DS 380.

- #5 stone used up
- Trucks for Monday - stone needed for infiltration media.

1730 SES Off Site.
off site - drop ~~off~~ Monthly Expenses to Fed-Ex in Bloomington

Bridcut, Pete

From:	Hoekstra, Rick
Sent:	April-01-16 10:33 AM
To:	Reynolds, Shane; Campbell, Randy
Cc:	Kamm, Katie; Bridcut, Pete; McGuigan, Jim; Laskus, Art; Wesolowski, Andrew
Subject:	Wet Well 4 and Adjacent Structures

Randy and Shane:

ATTENTION ALL: DON'T BOTHER TRYING TO READ THIS EMAIL ON YOUR HAND-HELD DEVICES AS IT IS FAR TOO LONG!

Due to the recent discussion of how to address the gap between the two concrete structures for Wet Well 4 and the need to install a permanent diesel pump adjacent to Wet Well 4, I started to look at the area around Wet Well 4 to determine how things will fit in this "not very accessible" area. I believe we have a workable solution for the gap between the concrete structures, but there are several structures that need to be positioned around the wet well chamber and there are not a lot of options as to where to place them.

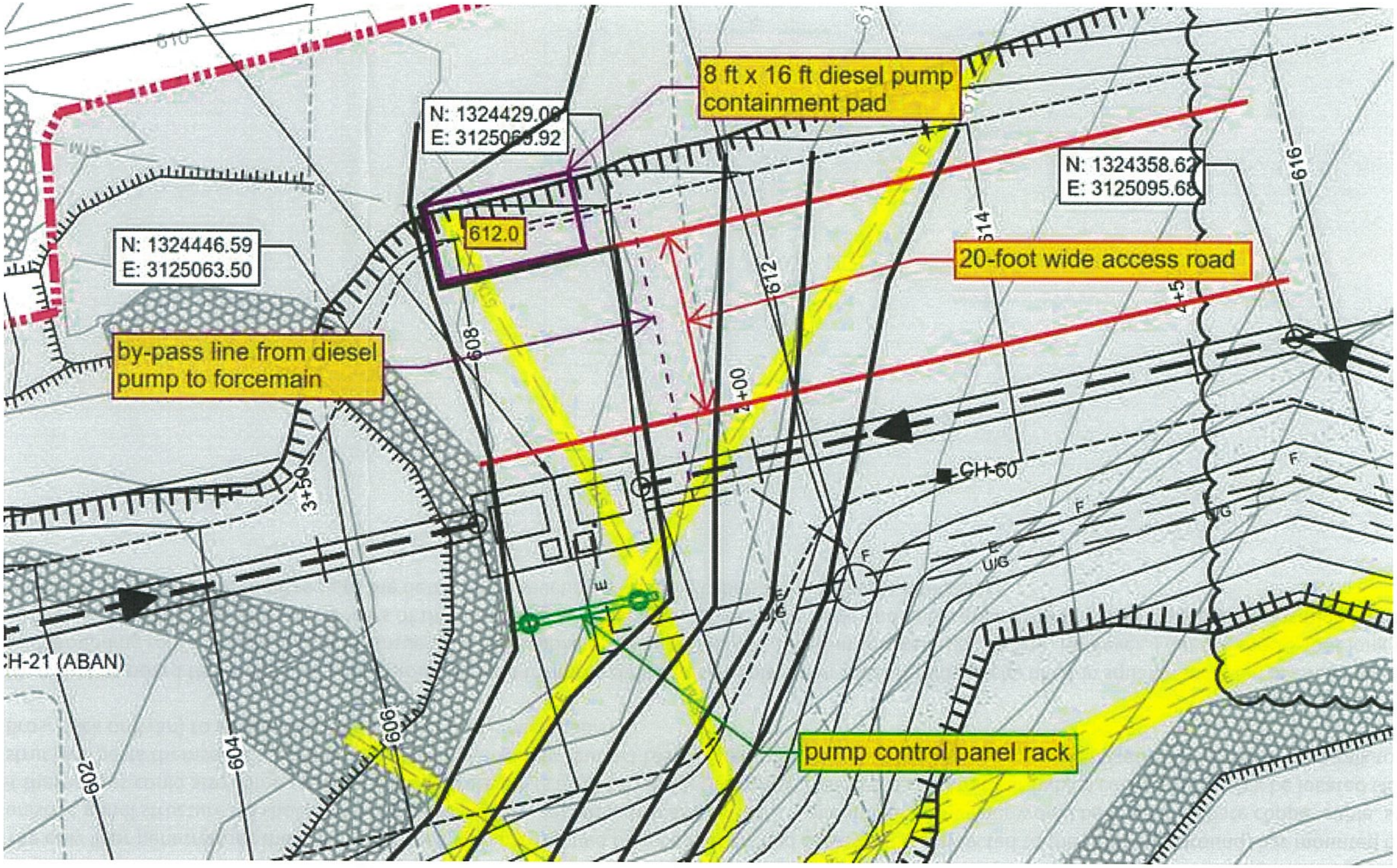
As I said previously, we need to install a permanent diesel pump adjacent to Wet Well 4 as backup in case one or more of the electric pumps stops working (or the combination of electric pumps cannot keep up with the total flow during high flow events). On Drawing C-11, we simply show the two discharge pipes exiting the south side of the wet well chamber, with a 6-inch pipe sucking water to the diesel pump and a 4-inch pipe discharging the water to the forcemain via tee connection. However, as the ground elevation goes up very quickly to the south, that would not be an appropriate location for a concrete pad, particularly as it looks like we need a pad with dimensions of approx. 8 feet by 16 feet to contain any fuel leakage and provide adequate space inside the concrete pad for walking.

Due to the future access road coming down the slope along the east side of the wet well chamber and the existing detention basin to the north, the only available location appeared to be on the west side of the wet well chamber, although even that was not the ideal location as ground also sloped up to the west (just not as steeply as to the south). Then Shane asked where the pump control panel structure was to be constructed in relation to the wet well chamber, as we did not specifically detail any location for the rack location upon which all the control panels and associated electrical appurtenances would be installed (see Drawing E-03).

The rack structure itself will be over 12 feet long and will require at least 3 feet on either side for safe access to the panels. Ideally, the pump starter panels should face the wet well chamber and be lined up with the three electric pump locations, so it should be installed on either the west or east side of the Wet Well 4 chamber. With the access road coming down along the east side, this area should be kept free for access such as pump maintenance where a crane may be positioned on the access road. As such, the pump control panel rack structure needs to go on the west side of the Wet Well 4 chamber and should be located approx. 4 to 6 feet from the chamber to provide appropriate access. As well, there should be a similar 4 to 6 feet of access (flatter ground) on the other (west) side of the rack structure for access to the other panels.

Therefore, there does not appear to be any available room on any side of the wet well chamber for the diesel pump containment pad to be constructed in close proximity to Wet Well 4. As such, my next thought was to construct the pad on the other (east) side of the access road (as shown below). Since the only connection between the fourth wet well sump where the diesel pump suction line will be installed and the diesel pump itself is the two by-pass pumping lines (to and from the pump), this possible solution would simply involve some additional underground piping beneath the access road before coming up vertically next to the concrete pad for connection to the diesel pump. In reality, this actually provides better access to the diesel pump for maintenance and re-fueling.

Does anyone see any problems with this potential location for the diesel pump containment pad? The sketch below shows the pad extending into the slope of the working platform, but that will not be a problem as the working platform would be backfilled to previous grades before constructing the access road and concrete containment pad. I have also shown some potential re-contouring to create a flat area for the containment pad. I have assumed the pad would be constructed at approx. 612 feet in elevation (with curb set at 612.5), so I wrapped the revised 612 contour around three sides of the new pad. This will allow for easy access from the road for both maintenance and re-fueling of the diesel pump.



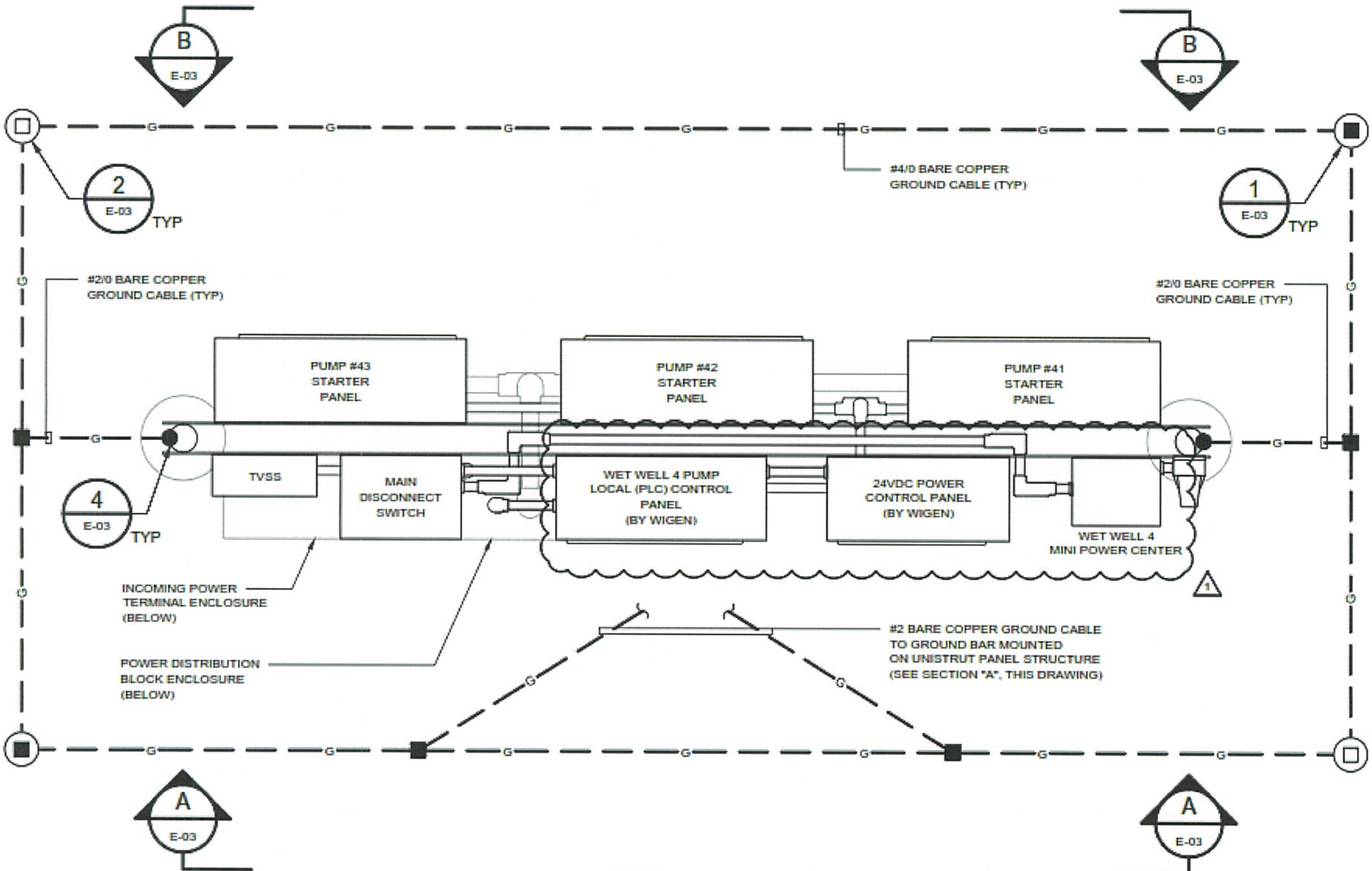
If this solution seems workable to most people, then I will have a detailed drawing prepared next week while I am on vacation. This should not prevent Sevenson from continuing with backfilling and even re-constructing the landfill cover system.

However, as I say that I notice that there is another issue with regards to all that needs to be constructed around Wet Well 4. That is the grounding plan shown on Drawing E-03 (and copied below). The problem is the grounding rods shown in the upper right hand and lower left hand corners (filled-in squares inside circles). Referring to Detail 1 from this same Drawing E-03, which I have copied below the grounding plan in this same email, you can see that the grounding rods are 15 feet long so they extend well below (and effectively through) the landfill liner. However, these two grounding rods are to be installed within inspection wells (boxes) that extend 2.5 feet below ground. As such, the inspection wells (boxes) would be set on the top of native fill (before clay placement) and the liner can be booted to the inspection wells (boxes) at the required 18 inches below ground (top of 12-inch clay layer).

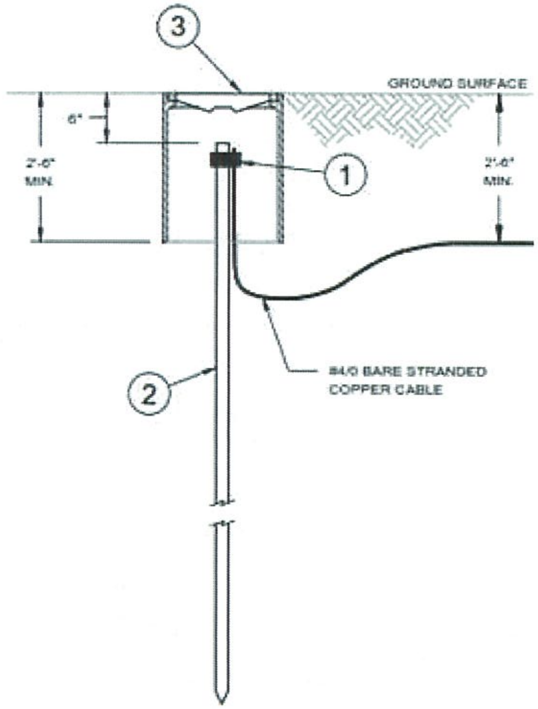
The rest of the details shown below illustrate how the other two grounding rods (open squares inside circles) and the rest of the grounding wires are connected. The other two grounding rods do not need to extend to ground surface though inspections wells (boxes), so these should be kept below the liner to avoid additional penetrations. It would be suggested that the entire grounding wire network be installed on the native backfill surface prior to clay placement, as the detail calls for the grounding wire to be placed 2.5 feet below ground anyway. It appears that the only other penetrations through the liner would be the grounding connections to the structure posts (Detail 4) and to the structural steel (Detail 3). Obviously, the structure posts extend through the liner and need to be booted, but it could be that the welded tab to which the grounding wire is connected is actually below the liner (I don't know).

The only liner penetrations that I am concerned with are the two bare copper ground cables to be connected to the steel bus (ground) bar mounted on the unistrut panel structure, as shown on the grounding plan copied below and Detail 3. I am not sure how liner would be booted to bare copper cable, so I wonder if these wires could also come up along the structure posts and then make the connection to the steel bus bar (which could presumably be located closer to the structure posts themselves). I am not an electrical engineer, but Art Laskus suggested this modification but I would suggest that Sevenson also talk to McIntyre Bros. (Rick or Ryan) to ensure that this modification is acceptable.

[It should be noted that Detail 2 shows a grounding rod for three different symbols (open square inside circle, filled-in square, and filled in circle), besides the two grounding rods installed within the inspection wells (boxes) shown on Detail 1 (filled-in square inside circle). However, I believe the 15-foot long grounding rods are only required at the four corners of the grounding grid (filled-in square inside circle and open square inside circle), so the other locations (filled-in square and filled in circle) only require the detail for connecting grounding cables from different directions].



PLAN
3/4" = 1'-0"
GROUNDING
PLAN



1 CONNECTOR: CADWELD CAT. No. GR (1 CABLE) OR GT (2 CABLES)

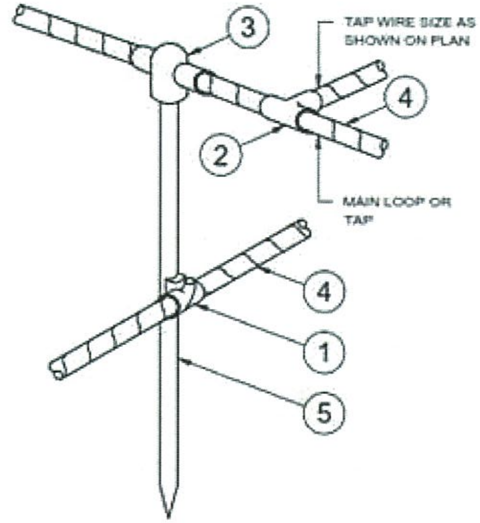
2 GROUND ROD: COPPERWELD, 3/4" DIA. x 15' LG.

3 INSPECTION WELL: KISTNER PULL-BOX W/CAST IRON FRAME & COVER 15" DIA. x 20" LG., PART No. PB-15S

DETAIL 1 / E-03

NTS

GROUNDING ROD INSTALLATION INSPECTION TYPE



1 CONNECTOR: CADWELD TYPE "GY" CONN. (USED FOR 2 HORIZONTAL CABLE TAPS OR THROUGH CABLE OR END OF RUN)

2 CONNECTOR: GROUNDING TAP "T" OR "X"

3 CONNECTOR: CADWELD TYPE "GT" CONN.

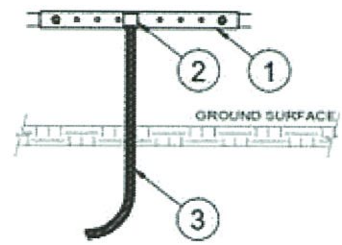
4 #4/0 BARE COPPER GROUNDING CONDUCTOR MAIN LOOP

5 GROUND ROD: COPPER-WELD STEEL 3/4" x 15' LONG

DETAIL 2 / E-03

NTS

GROUNDING ROD CONDUCTOR CONNECTION DETAIL



1 STEEL BUS BAR, 2 x 3/8" LENGTH TO SUIT, WITH 9/16" DIA. HOLES PRE-DRILLED OR PUNCHED 1/2" ON CENTER TO ACCOMMODATE CONNECTORS. MOUNT TO CROSS BRACE USING STAND-OFFS.

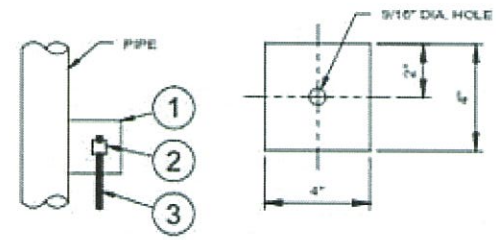
2 GROUNDING CONNECTOR, CONDUCTOR TO FLAT BAR, CADWELD "VB"

3 GROUNDING CONDUCTOR (SIZE PER PLAN)

DETAIL 3 / E-03

NTS

GROUNDING TYPICAL CONNECTIONS TO STRUCTURAL STEEL



NOTE: TAB MAY BE SUBSTITUTED BY HOLE IN EQUIPMENT OR EQUIPMENT SUPPORT

1 WELDED TAB, 1/4" x 4" STEEL

2 GROUNDING CONNECTOR, CONDUCTOR TO FLAT BAR, CADWELD "VB"

3 GROUNDING CONDUCTOR (SIZE PER PLAN)

DETAIL 4 / E-03

NTS

GROUNDING TYPICAL CONNECTIONS TO WELDED TAB

As I said at the start of this email, this was going to be a long one. However, as I will be on vacation next week, I wanted to make sure everyone was aware of the work still required (both design and implementation) around Wet Well 4 and the implications to the liner installation and revised ground contours. Andrew Wesolowski will work with CADD to prepare a more detailed plan of the structures to be placed adjacent to Wet Well 4 and any ground re-contouring, which I will review upon my return from vacation and then issue to Sevenson. It should be noted that I have likely over-estimated the general size of the diesel pump containment pad, as Andrew tells me that the fuel tank is only 100 US gallons. As such, we likely only need about 6 inches of space around the pump skid, which is only 4 feet wide by 10 feet long. As such, the outside dimensions of the containment pad may be as small as 5 feet by 11 feet.

P.S. I will be travelling down to Bedford the week after my vacation. I should be on site later Tuesday afternoon and there all day Wed. And Thurs. (not flying home until Friday morning this time). As such, we can review the drawing that will be prepared and discuss any remaining issues at the time.

Rick

C. R. (Rick) Hoekstra, P.Eng. (ON & NS)
Manager / Environmental Design Services

GHD
T: 1 519 884 0510 x7296 | F: 1 519 884 0525 | M: 1 519 588 5143
E: rick.hoekstra@ghd.com | www.ghd.com
Mailing address: 651 Colby Drive Waterloo Ontario N2V 1C2 Canada
Office address: 435 King St. N, Unit 2 Waterloo Ontario N2V 1V6 Canada

Mon Apr 4/16.

Weather: 56°F Cloudy dropping to 54°F

630 On-site email out last week's tailgate meetings

700 SES H&S: General Safety - Accident Prevention Tips.

4 Trucks (Young) - hauling #5 stone

- 2 rounds for N end of trench for infiltration media

- rest of day to S end of trench.

8:50 SES WTP Monthly Sampling Event.

9:30 GM/ Contractor Safety Review

with crew for WTP (Flocculation Guns)

→ Process Water Samples.

pm. - backfilling outer side of vinyl sheets with #11 stone

C. Porter BRCJ - original topo along N end of trench

had undulating surface feature.

PB → maintain consistent slope for final grade.

- grade to promote runoff over clay cover

- infiltration media stone thickness may end up being sacrificed (maintained low)

- thickness may be low but within 6"

- maintain clay thickness at 1'

1510 PSI 317 876 7723 Johnathon

- inquiring on proctor results → will look into status & get back to me

1630 to SR - running low on #11 stone - has anyone contacted him

- still need to fill outer side of sheets from sump location (3+60) to inflection point (4+70)

SR response - GM has not paid Ingram

- SES is pay for #5 stone presently.

- will talk to K Kumm in a.m.

1730 SES Off Site

→ Off Site

SUBJECT

DATE

Tues Apr 5/16.

Weather: 27°F Clear high 54°F

630 On site.

700 SES H+S: Review Temp. Fence Removal JSA.

- 2 Trucks hauling #5 stone.
- commence hauling clay from E Parcel 216.
- ~~re~~-establish W P216 SES access road across trench.
- out of #11 stone. (SR) - SES has no budget to get more until GM pays Ingram.

→ send out oil change receipts to Enterprise

→ ~4 loads dumped off to complete outside of sheeting with exception of 2+60 ~4+00 (rock breaking req'd)

SR - email summary of rings req'd for MH 18 + 19
- similar additional ring needed for MH17 in drive area
- wants to relocate MH17 S to pine tree area.
- would be easier to ~~lower~~ MH-17 + 16 base (as per RC)

1415 Pilot Trench Discharge
Turbidity field measurements at Modutank
3 readings 16.3, 18.5, 17.3.

→ will still need to fill by sump + 8+25 → 8+55

- clay cover over infiltration trench to be maintained at 1' (min)
- stone layer or common fill thickness can be sacrificed.

→ PB to CP with BRCJ
- limits potential surface infiltration
- maintain final grade to promote runoff

- plastic placed over potential runoff areas to prevent sediment into trench. (potential rain tonight)

1730 SES Off Site
→ WTP Samples/Coolers delivery to Bloomington FedEx.

Identifier	Diameter	Location Description	Design T/G EL	Inv EL	Base EL	Top ARV EL	Top of Concrete barrel not including lid	Difference (G minus H)	Riser Needed	Proposed T/G El	Working Height
MH-15	4'-0"	Combination air valve on the 6" DR17 HDPE future backwash line	699.14	694.52		698.15	696.94	1.21	2.50	700.44	1.96
MH-16	4'-0"	Combination air valve on the 8" DR17 HDPE forcemain from WW#4	668.90	664.90	662.75	668.80	667.40	1.40	2.50	670.90	1.77
MH-17	4'-0"	Combination air valve on the 8" DR17 HDPE forcemain from WW#4	702.45	698.45	696.35	702.35	701.00	1.35	2.50	704.50	1.82
MH-18	4'-0"	Combination air valve on the 8" ductile iron fire main	700.66	696.66		699.45	698.95	0.50	1.25	701.20	1.42
MH-19	4'-0"	Combination air valve on 6" DR17 HDPE forcemain from the existing secondary containment to the EQ tank at the new GWTP	700.63	696.63		700.06	699.03	1.03	1.25	701.28	0.89

Notes:

1)MH-17 is in the middle of the truck approach area and currently has a final design elevation only 0.10' above the top of the ARV. I would suggest we relocate this manhole to the south into the pine tree area so the height can be adjusted to allow for installation of a 30" standard riser.

2) Working height is the estimated height above the ARV to the underside of the lid for removal/replacement if necessary in the future

3) Top of ARV on MH-15, MH-16 and MH-17 is estimated based on the actual height of the ARV in MH-19 which was 2.9'. This was added to the actual top of pipe in MH-15 and to the estimated top of pipe elevation in MH-16 & MH-17

Description	QTY	Unit $	Total
30" Riser (2.5') = $335.00 each includes taxes & O/P	3	$ 335.00	$ 1,005.00
15" Riser (1.25') = $255 each includes taxes & O/P	2	$ 255.00	$ 510.00
Custom height risers are $400 each and are a 2 week lead time for manufacturing	5	$ 400.00	$ 2,000.00
Freight to Bedford is one flatbed load $825	1	$ 825.00	$ 825.00
Total as proposed above			**$ 2,340.00**
Total if custom height risers are required			**$ 2,825.00**

Wed Apr 6/15
Weather: 45° F Overcast high 64° F Rain in pm

630 On-site

700 SES H+S: Maintaining Focus on Work Tasks
- complete filling in outside of vinyl sheets #11 stone

- T.O. Airport Enterprise Apr 8 -> 10764929180
-> 8+25 to south end complete
+ continuing with sheets by sump location.

8:30 Mike Reynolds no issues.
- sampled Monday - should have results today

10:38 PSI - results to be in later today.
-> will call when results are in

13:00 Progress Report

GHD	PB	SES	DL.	MoE R.G.	ph. KK
	TL		SR		CH
			RC.		J. Pat.
					J. Mc

① Lightning, others.
MoE / GHD

② Stone installed.
1' layer of Clay past N access road
-> re-established
- common fill
- infiltration media.

GWTP / - pump repair on back wash
8" line for pressures.
- cell 4: decommission
-> Temp Fence removal. - maintain min
+ cutting off sheets.
- backfill to outfall
- then to S side.
- driveway at GWTP - directly backfill
to trench.
- 3 wks - SES will demob at end of month?
- when will GWTP be able to receive?
- developing trench with current
- acceptable turbidity?

FOCUSED INSPECTION CHECKLIST

SECTION 14 VEHICLE TRAFFIC AND CONTROL

Inspection Date: April 6/16.

Inspector: Pete Bridcut.

Project Name: CET Bedford Pilot Trench

Project Location:

Address: GM Drive

City: Bedford **State:** IN **Zip:** 47421

GM Project Manager: Cheryl Hiatt

Consultant Name: GHD

Consultant Project Manager: Jim McGuigan.

Consultant Superintendent: Katie Kamm

Consultant Site Health & Safety Officer: Pete Bridcut / Tim Leo.

Contractor Name: Sevenson Environmental

Contractor Project Manager: Jim Pazderski

Contractor's Superintendent: Randy Campbell

Contractor Site Health & Safety Officer: Dave Leising

CHECK IF NOT APPLICABLE ☐

ITEM NUMBER	AUDIT QUESTION	YES	NO	NA	COMMENTS
1	High visibility safety vests meeting ANSI Class II garment requirements are being worn by personnel at all times?	☒	☐	☐	
2	Cones and other visible markers are being used to demarcate a safe work zone around the active work zone(s)?	☒	☐	☐	
3	Appropriate signage has been posted as necessary, to inform roadway/parking lot users of any additional control measures necessary to protect the public and site employees?	☒	☐	☐	
4	If project work includes working on an active roadway or along the shoulder or side of the road is necessary, has a Uniform Traffic Control Plan been established?	☒	☐	☐	

SECTION 14 VEHICLE TRAFFIC AND CONTROL

Inspection Date: April 6/16

Inspector: P. Bridault

Project Name:

Project Location:

Address: City: State: Zip:

SECTION 14 VEHICLE TRAFFIC AND CONTROL

Safety Observation Tour:

Safe Observations	Corrective Measures	Completion Dates
Both escort vehicle and Flagger used as temporary fencing transported to Sevenson yard - appropriate signage in place at both ends of work area along Bailey Scales Road.		

Unsafe Observations	Corrective Measures	Completion Dates

SUBJECT | DATE

media in carbon & sand vessels
Waste profile similar to George WTP

- WTP - is a target turbidity.
+ Al - TSS less than 10.
SES WTP - results are ND.

weekly sampling - PCB's & TSS.
+ Field Turbidity

Mike Reynolds - this morning

will include sediment in Modutank.
-> this is from runoff over grout & runoff through working platform

Cold Weather on Weekend. - WTP.
KK -> SR to send C.O. #10
risers for MH
KK to wrap up lastest
SR to send out invoice @ this wk.
Cheryl tree survived the winter!
<-> coming down 25th meeting 26th

1400 812 788 0303 Mike Reynolds.
- discharge results from SES WTP -> ND (copy at our trailer)
14:15 Field Turbidity SES discharge from Pilot Trench
1415 9.35
14:18 10.30
14:21 10.03

- complete filling in outside of vinyl sheets with #11 stone
- 8" Backwash line from GWTP being worked on.
- McI to pressure test - leak at valve at GWTP
1730 SES Off Site (Rain started)
1800 Off site

Thurs. Apr 7/16.
weather: 44°F F Light Rain. High 49°F Rain.

6:30 On-site → 0.13" Rain.
7:00 SES H+S : Safety Related Habits.
- topping up trench with #5 stone
- SW Management.

8:15 Field Turbidity SES discharge from Pilot Trench
8:10 20.0 NTU.
8:13 16.5 NTU.
8:16. 17.6 NTU
} run off from overnight rain - slightly elevated.

LOTO. - locks to handle 50 lbs pressure.
- sole control over area - no lock needed.
- contractors need LOTO program but use G+D protocols

Progress Photos.
Progress Meeting Minutes Draft 04-06-16.
Progress Meeting Minutes Final 03-23-16
} emailed.

GM Safety Audit → sent out.

→ trench backfill + grading completed.

15:30 SES Off Site
16:30 Off Site

- Rain starting at 15:30.

SUBJECT Fri. Apr 8/16. DATE

weather: 33°F Cloudy high 50°F Rain.

6:30 On-site. 0.02" Rain.

700 SES H&S: General Safety Tips. - Slippery Conditions On-site

SW Management

1 labourer + 1 operator to stay on site.

MH-15 to be pumped out to install Pressure Relief Valve

McI - pressure testing 8" Backwash line

7:20 GWTP 74 psi WTP 88 psi

8:20 74 psi 88 psi

email sent out - line tested ok

9:00 Field Turbidity SES discharge from Pilot Trench

- sump pump not pumping
- switch to back-up pump
- discharge resumed at 9:30.
- initially noticeable turbid.

→ cleared after ~15 min.

Time.	Turbidity
9:50	27.5 NTU.
9:53	37.6
9:56	30.9

15:00 Indy - TO Flight

Sun 12:50 TO - Indy Flight

delayed ½ hr due to maintenance

+ baggage pull for 2 no shows

Mon Apr 11/16.

Weather: 56°F Rain High 59°F Rain

0630 On-site 0.42" Rain in gauge

0700 SES H+S: Communication on site - visual + audible

- SW Management

- one operator + labourer maintained on-site

10:00 Field turbidity at SES discharge from Pilot Trench

Time	Turbidity (NTU)
10:15	52.9
10:18	54.8
10:21	49.8.

~~Upd~~ Update Progress Reports / SEC Rule 5 inspection

DBs allowed to settle

DB-5 pumped as level rose to elevated level.

- discharged monitored.

15:45 0.40" Rain since a.m. cont'g

1600 Off site

25th. 20th.

SUBJECT | DATE

Apr 12/16

Weather: 32°F Clear high 57°F

6:30 On site: 0.55" Rain.

7 00 SES H&S: Critical Task Analysis.

- service eq't.
- SW Management + SEC measures.
- to inspect SEC Rule 5.
  - Field repairs around CB-5 in P413.

1040 K-Kamm - GM files for Critical Task Analysis
- Trench Sampling.
- Chain Link Fencing

message left

sent to Bedford server

will sample for TSS after trench covered

KKamm to talk with C Hiatt + E. Peterson.

pm Rock Breaking around Sump Structures.

- poly placed over 2" stone to keep clay/sluff from falling into stone area.
- filter fabric over pump structures to keep out sediment.
- Sump turned off (pump) to allow eq't access to break bedrock to south of pump structures (under WTP outfall pipe)

15:15 Sump Pump started up (very turbid for 1st 5 min)

Time	Turbidity (NTU)
15:22	29.8
15:25	24.1
15:28	24.9

prep Progress Meeting Agenda

1530 SES off site

1600 R Hoekstra on site.

Daily Reports - emails - project update with RH.

1800 off site.

Wed. April 13/16.

Weather: 33°F Clear high 63°F

630 On site — No Rain

700 SES H&S: Safety Habits (Knives, Ladder, Fueling)

- backfilling north end of trench
- 6" of topsoil to be imported.

8:45 Field Measurements - Turbidity from Pilot Trench Discharge

Turbidity (NTU)	Time
5.60	8:46
5.71	8:49
4.99	8:52

10:00 Conference Call - GM Critical Task Analysis

. establishing WTP Task Inventory.

- QS&MC - to assess each task for next week (as to 'Critical' status)

1300 Progress Meeting.

GHD.	SES	McI	RG.	DH.	GT.	Ed P.
RH	RC					
TL	SR				JMc.	
PB	DL				CH.	
					RK.	

Katie Sl.

SES - none

- none

GWTP - carbon cells backflushing

- pump repairs complete
- State Group. Wire Tap.

- commissioning this & next week

- work on getting Utility Power from Plant

- generator will not be needed.

SES - common fill graded - bedrock breaking.

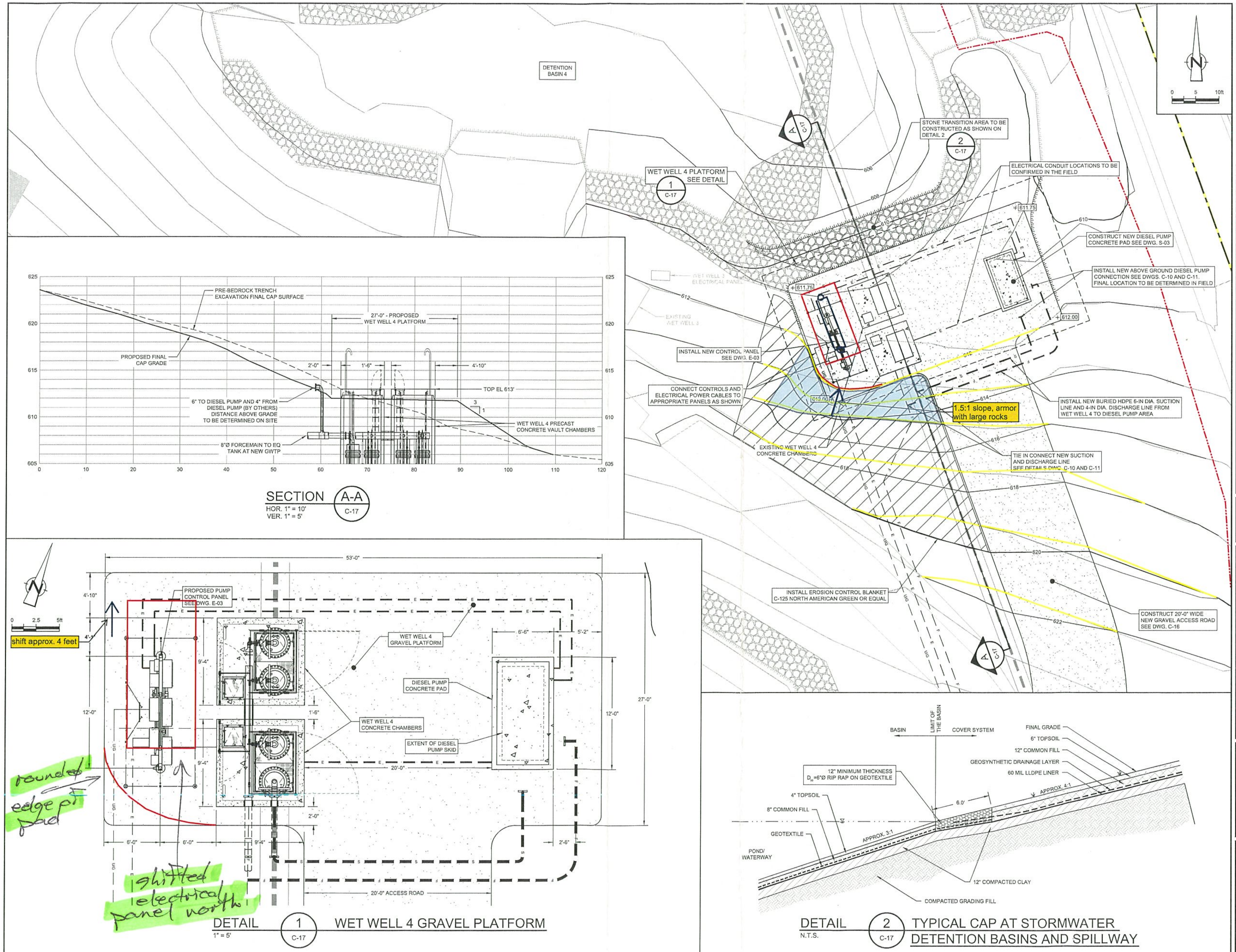
- clay placement
- filtration media to be placed.
- stone all grade & sheets cut.

- Work past Outfall pipe.
- Liner crew scheduled for 25th.

Requests → placement under chambers

#53 stone (fabric wrapped)

- pipe from CW 3 → to filtration stone with screen on discharge



Nº	Revision	Date	Initial

LEGEND

- EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- EXISTING VEGETATION
- EXISTING FENCE LINE
- EXISTING DIRT ROADS
- EXISTING ROADS / PAVED AREAS
- EXISTING ELECTRICAL POWER LINE
- EXISTING FORCEMAIN TO TREATMENT FACILITY
- EXISTING OVERHEAD ELECTRICAL POWER LINE
- EXISTING WATERMAIN
- EXISTING OVERHEAD WIRES
- EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING UNDERGROUND TELEPHONE LINE
- APPROXIMATE SURFACE WATER LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE GM PROPERTY BOUNDARY
- EXISTING STORM SEWER
- EXISTING GUARD RAIL
- EXISTING GRAVITY DRAIN (HDPE SOLID WALL PIPE)
- EXISTING TOP OF BEDROCK CONTOUR
- LOW FLOW CHANNEL
- EXISTING SSC EXTRACTION TRENCH
- EXISTING MONITORING WELL TO/IN ROCK
- EXISTING BOREHOLE
- EXISTING CLEANOUT
- EXISTING MANHOLE
- EXISTING CATCHBASIN
- EXISTING POWER POLE
- EXISTING LIMIT OF CAPPING
- EXISTING RIPRAP EROSION PROTECTION
- EXISTING GRAVEL ROAD AREA
- PROPOSED CONTOUR
- PLATFORM TOP OF BANK
- BOTTOM OF BANK
- POWER SUPPLY
- CONTROL CONDUIT
- 6" Ø HDPE FORCEMAIN
- PROPOSED POWER/CONTROL PVC 2"Ø CONDUITS
- PROPOSED GRAVEL ROAD AREA
- PROPOSED EROSION CONTROL BLANKET

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - BEDROCK PILOT TRENCH

WET WELL 4
GRADING PLAN

GHD

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: J.M.	Reviewed By: C.R.H.	Date: APRIL 2016	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 365	Drawing Nº: C-17

13968-00(365)CI-WA017 APR 13/2016

SUBJECT

DATE

Forcemain to GWTP
- ~~do~~ place to west side of trench
- drawing forthcoming for panel placement & diesel pad. for WW4
↳ above liner

KK CO 10 #5 stone & concrete riser
↳ - also received invoice will email to GM.
SES to forward invoice to GM.

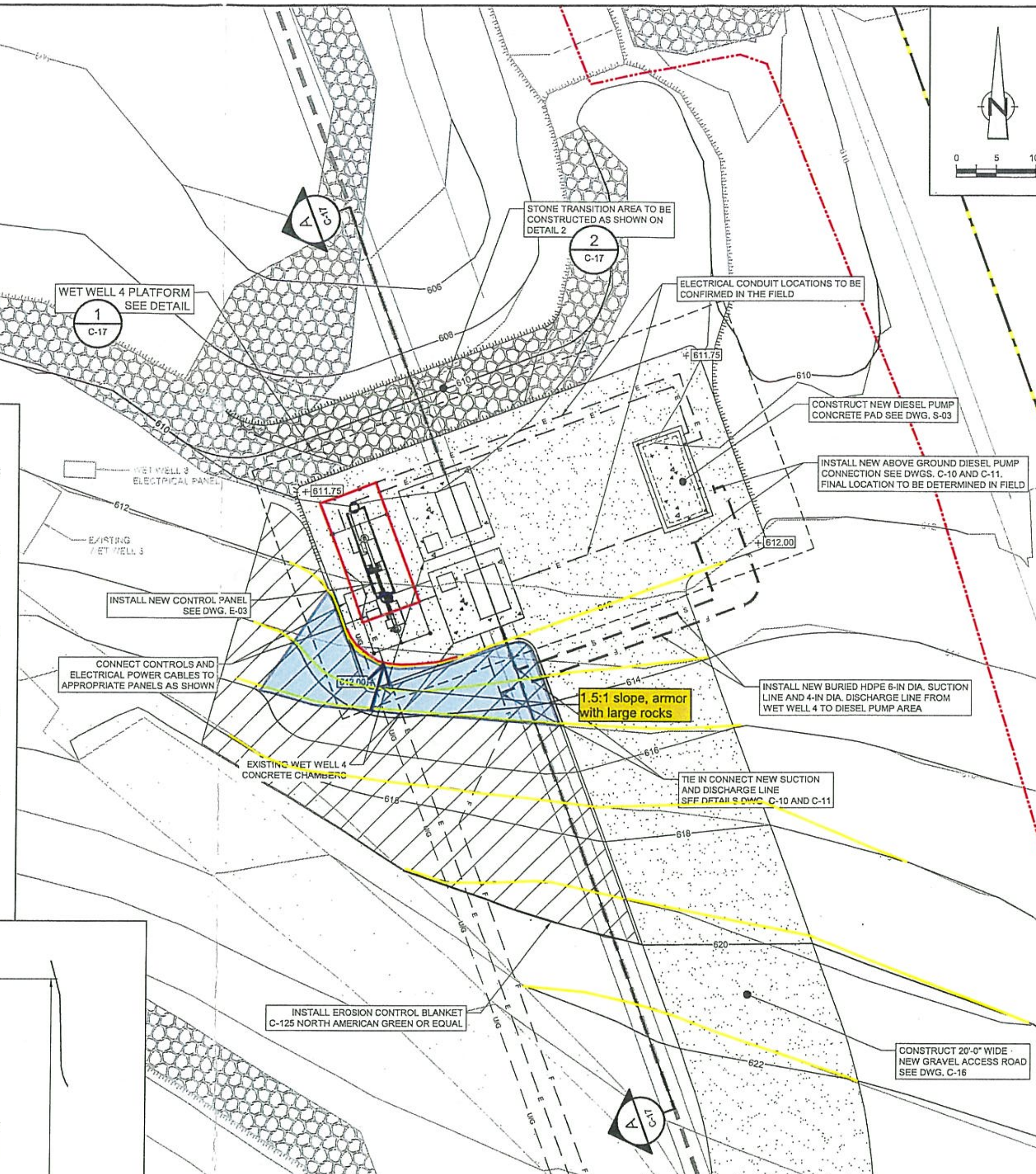
- Schedule to be maintained.

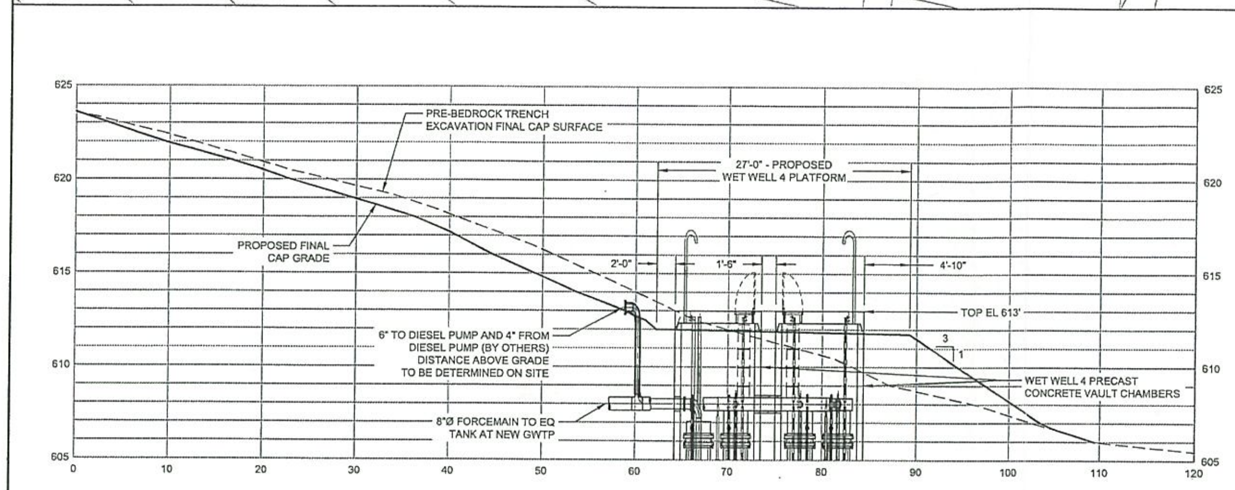
RH - proposed design for pump pad & electrical pad (WW4)
RC - design may not be feasible due to WTP outfall pipe. located to south of pump chamber
- liner will need to be 18" below top of chamber (1' clay + topsoil)
· slope at SW corner & outfall pipe → not feasible

RH - inspected site & sump location, BRCJ marked chamber & pad location (elevation)
- may need to deviate from rectangular pad

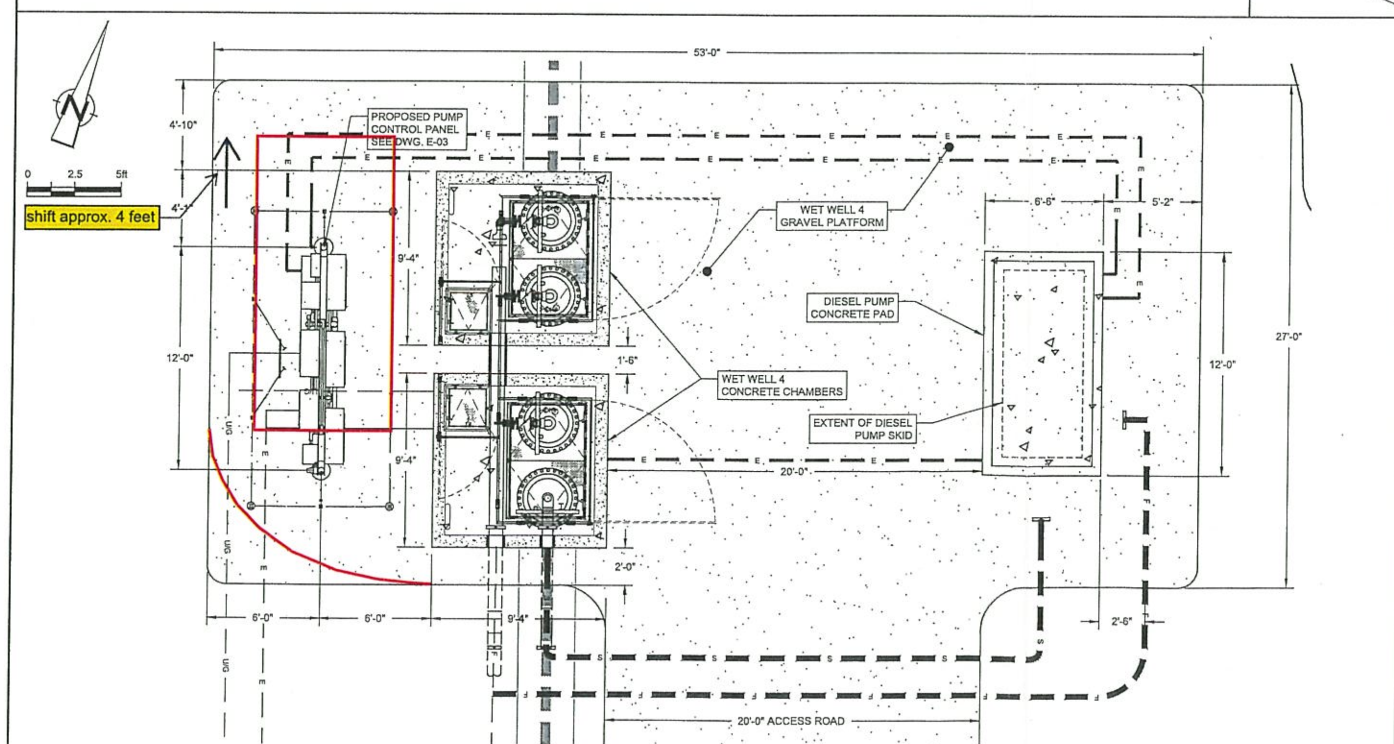
- backfilling clay in liner area
- installation of fabric & filtration media over trench

1700 Staging eq't & fueling & final grading for day
1730 SES Off Site

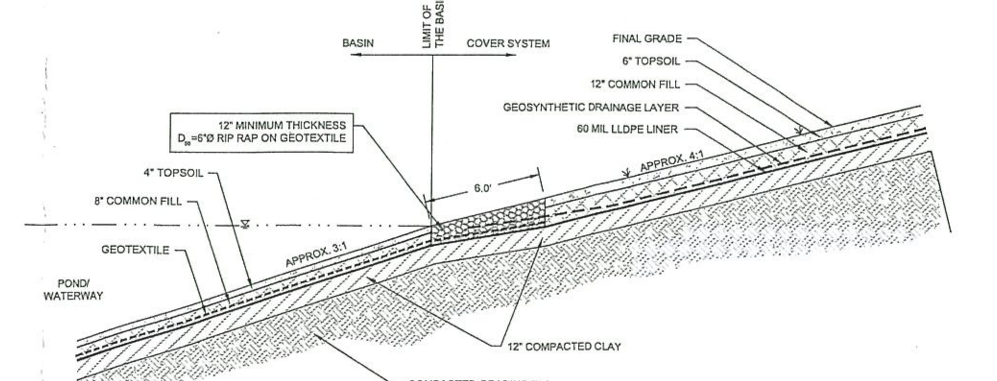




SECTION A-A
C-17
HOR. 1" = 10'
VER. 1" = 5'



DETAIL 1 WET WELL 4 GRAVEL PLATFORM
C-17
1" = 5'



DETAIL 2 TYPICAL CAP AT STORMWATER DETENTION BASINS AND SPILLWAY
C-17
N.T.S.

Nº	Revision	Date	Initial

LEGEND

- EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- EXISTING VEGETATION
- EXISTING FENCE LINE
- EXISTING DIRT ROADS
- EXISTING ROADS / PAVED AREAS
- EXISTING ELECTRICAL POWER LINE
- EXISTING FORCEMAIN TO TREATMENT FACILITY
- EXISTING OVERHEAD ELECTRICAL POWER LINE
- EXISTING WATERMAIN
- EXISTING OVERHEAD WIRES
- EXISTING UNDERGROUND ELECTRICAL LINE
- EXISTING UNDERGROUND TELEPHONE LINE
- APPROXIMATE SURFACE WATER LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE GM PROPERTY BOUNDARY
- EXISTING STORM SEWER
- EXISTING GUARD RAIL
- EXISTING GRAVITY DRAIN (HDPE SOLID WALL PIPE)
- EXISTING TOP OF BEDROCK CONTOUR
- LOW FLOW CHANNEL
- C.O. EXISTING SSC EXTRACTION TRENCH
- EXISTING MONITORING WELL TO/IN ROCK
- CH-20 EXISTING BOREHOLE
- C.O. EXISTING CLEANOUT
- MH-2 EXISTING MANHOLE
- CB-3 EXISTING CATCHBASIN
- EXISTING POWER POLE
- EXISTING LIMIT OF CAPPING
- EXISTING RIPRAP EROSION PROTECTION
- EXISTING GRAVEL ROAD AREA
- PROPOSED CONTOUR
- PLATFORM TOP OF BANK
- BOTTOM OF BANK
- E POWER SUPPLY
- UG CONTROL CONDUIT
- F 6" Ø HDPE FORCEMAIN
- E PROPOSED POWER/CONTROL PVC 2"Ø CONDUITS
- PROPOSED GRAVEL ROAD AREA
- PROPOSED EROSION CONTROL BLANKET

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - BEDROCK PILOT TRENCH

WET WELL 4 GRADING PLAN

GHD

Source Reference: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: J.M.	Reviewed By: C.R.H.	Date: APRIL 2016	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 365	Drawing Nº: C-17

13968-00(365)CI-WA017 APR 13/2016

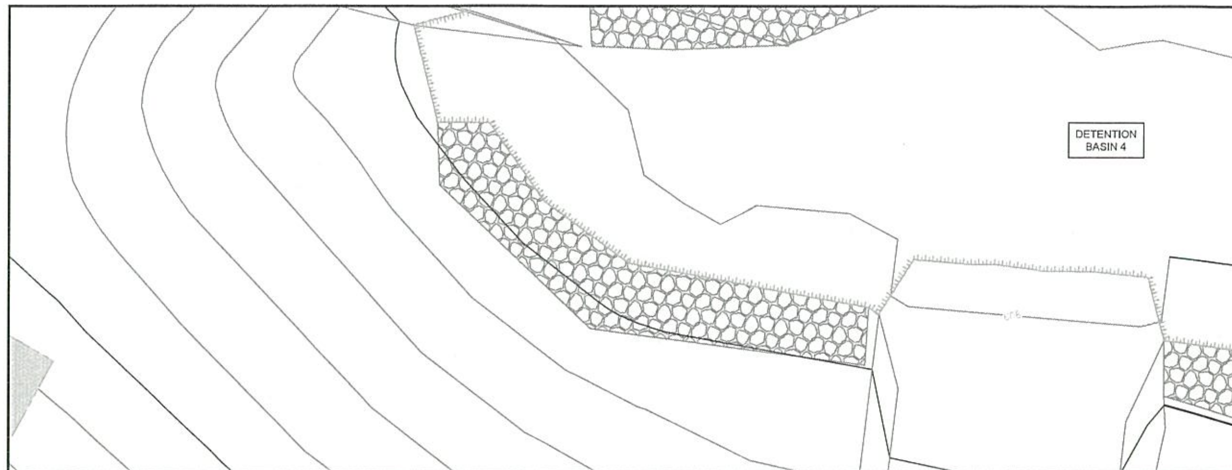
Thurs Apr 14/16
Weather: 39°F Clear high 70° F

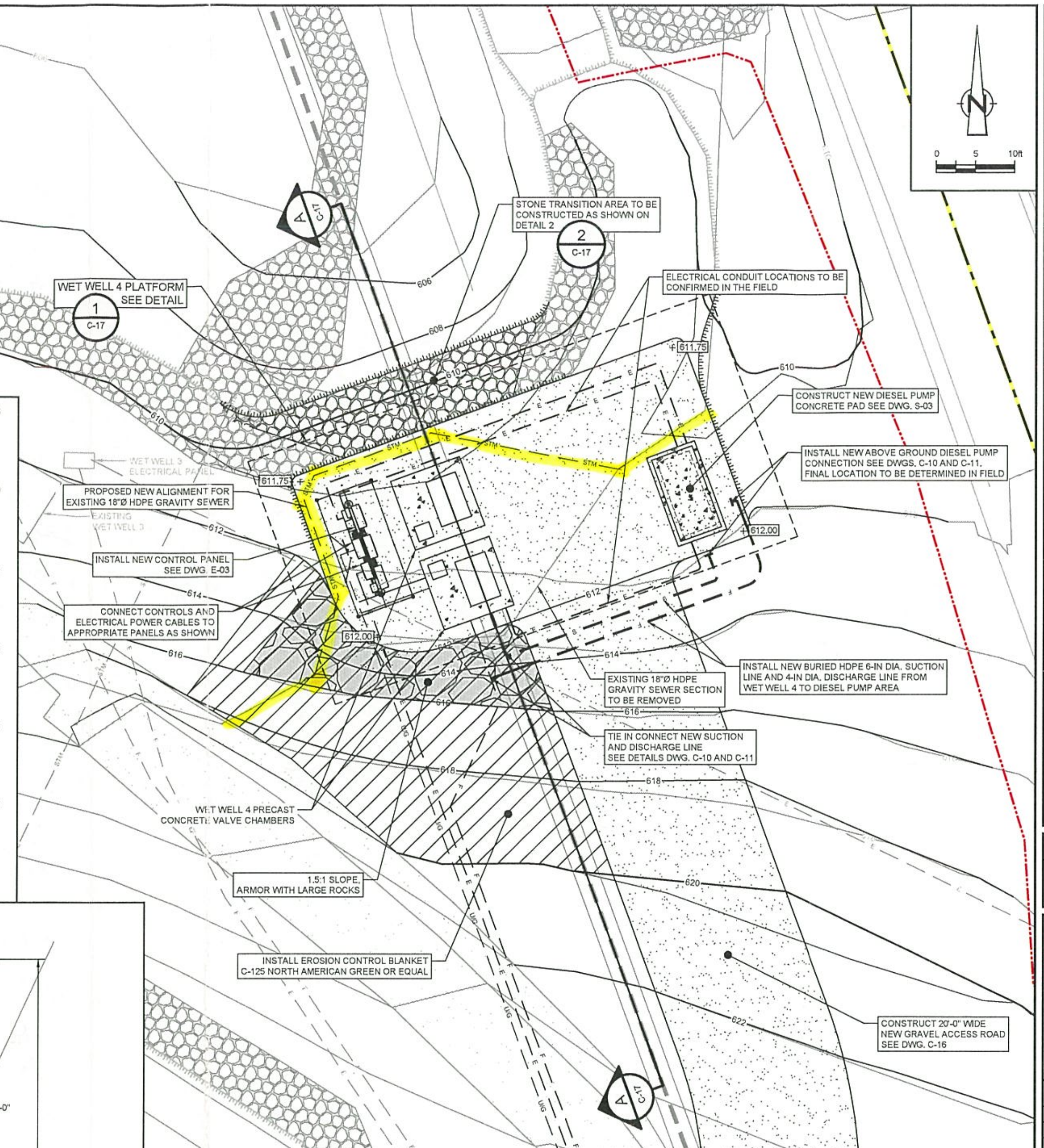
630 On site
700 SES H&S: Ladder Safety.
- backfilling N end of trench.
- completing Filtration media to sump location.
- Filterfabric laid down around pump structures.
- sump shut down in a.m. for eq't access
- mini working on east side of sump backfilling
-- 300 with swivel bucket on west side.
↳ turned back on at noon
- wl approaching top of bedrock.

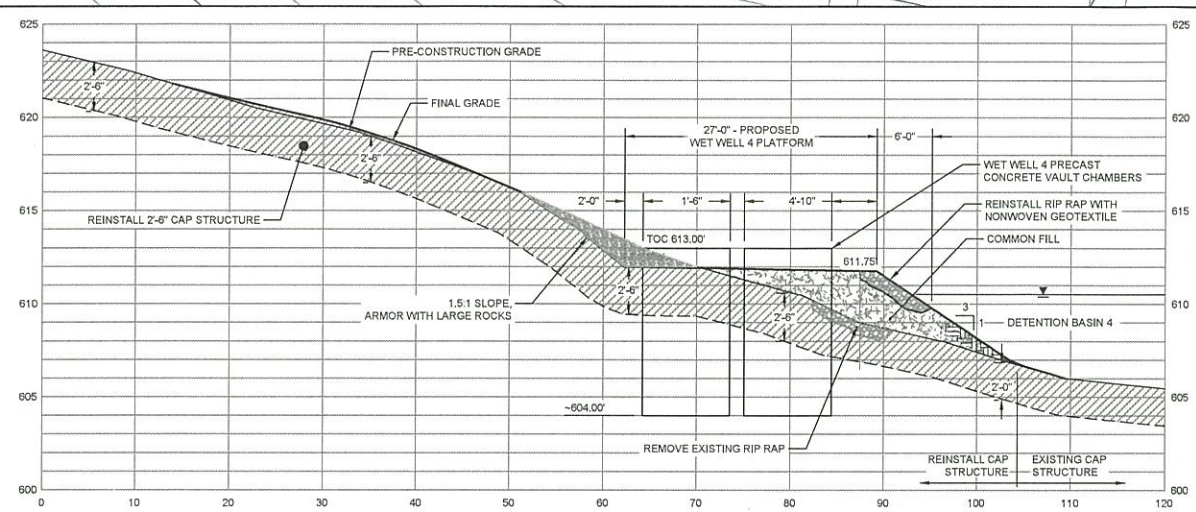
1310 Field Turbidity of Discharge from Sump
Time	Turbidity (NTU)	
13:12	170	greyish colour (fines from placing stone in area)
13:15	176	
13:18	186	

1330 sump disconnected for p.m work [restarted 15:45]
April 25th → liner crew.
∴ McIntyre will need to complete subgrade electrical for WW-4 & plumbing next week.
∴ diversion road needed around sump area to get clay from E Parcel 216 to S side of trench.
→ road to be completely directly E of working platform.
17:00 SR & RH - Forcemain from WW-4 to GWTP
- exits S end of pump chamber → to be below liner
- exits pump chamber at elev. of outfall pipe from WTP diverted around S end of structure
RH - to redivert outfall pipe around N side of chamber & maintenance pad to miss electrical grounding loop.
→ Sump Discharge.
Time	Turbidity	
17:18	102	brown clay colour.
17:21	95.0	
17:24	86.9	

17:30 SES off site
18:00 off site







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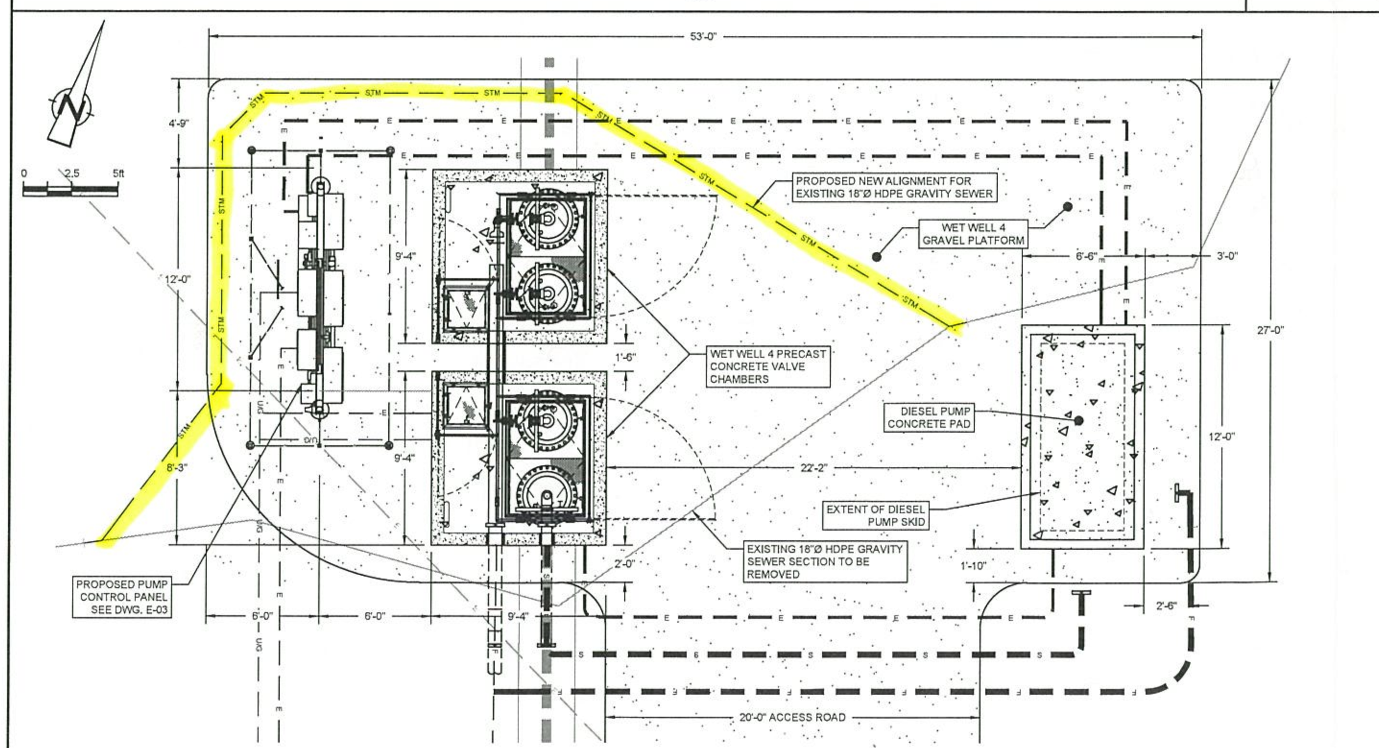

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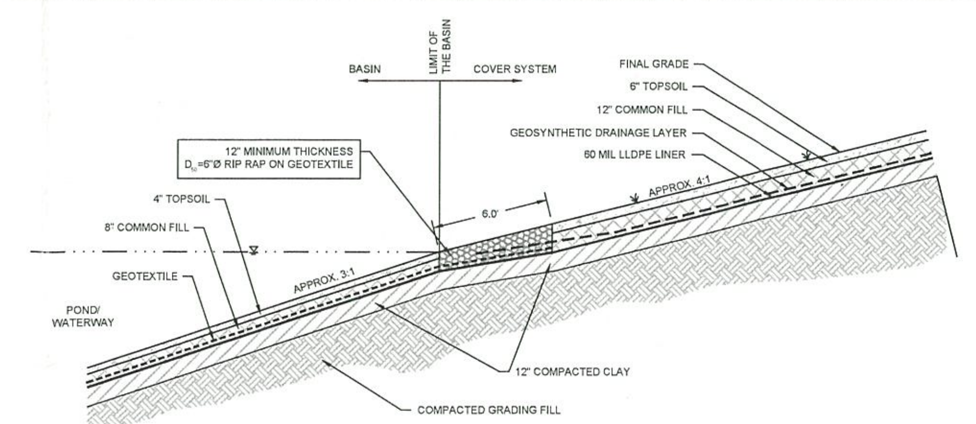

DETAIL 2 C-17 TYPICAL CAP AT STORMWATER DETENTION BASINS AND SPILLWAY
N.T.S.

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- BOTTOM OF BANK
- POWER SUPPLY
- CONTROL CONDUIT
- 6" Ø HDPE FORCEMAIN
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- PROPOSED GRAVEL ROAD AREA
- PROPOSED EROSION CONTROL BLANKET

SCALE VERIFICATION

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Approved

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Status	Date	Initial

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - BEDROCK PILOT TRENCH

WET WELL 4
GRADING PLAN

GHD

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager:	Reviewed By:	Date:	
J.M.	C.R.H.	APRIL 2016	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 365	Drawing Nº: C-17

13968-00(365)CI-WA017 APR 15/2016

SUBJECT

Fri Apr 15/16.

DATE

weather: 45°F Clear high 75°F

6:30 On Site. calibr Turbidimeter

7:00 SES H+S: Personal Safety Habits.

PSI on site for compaction.

7:20 Field Turbidity Measurements

Time	Turbidity	
7:15	3.56.	- sump pump to be disconnected to backfill + compact around
7:18	3.02	pump structures.
7:21	3.87	- turbidity measured to assess trench development overnight

9:00 compaction testing - liner area N side of outfall pipe

① 95.6% moisture 18.1 - area flat rolled

② retested 98.6% 16.1 moisture

101% 15.2 moisture

97.8% 20.5 moisture

by DB-2 outfall - will need to be drained + rolled

~~- compaction test passed~~

- backfill 2" stone wrapped in filter fabric around pump structures
  - 2" stone brought up to 1' below chamber base
- fabric placed for backfill with #53 crush stone for chamber subgrade base + compacted

- crane pad constructed south of outfall pipe for setting ww4 chambers → area compacted

Time	Turbidity (NTU)	
14:30	276	- compacting stone around pump structures
14:33	303	
14:36	286	

Progress Meeting Minutes Draft 04-19-16 } emailed

Final 03-30-16

1630 SES off site.

off site.

Professional Service Industries, Inc.
5362 West 78th Street
Indianapolis, IN 46268

Phone: (317) 876-7723
Fax: (317) 876-8155

psi Information To Build On
Engineering • Consulting • Testing

Proctor Report

Report No: PTR:00141392-29-S1
Issue No: 1

Client: GHD SERVICES, INC.
200 WEST ALLEGAN STREET,
SUITE 300
PLAINWELL, MI 49080

CC: DALE CHARTERS
PETE BRIDCUT
TIM LEO

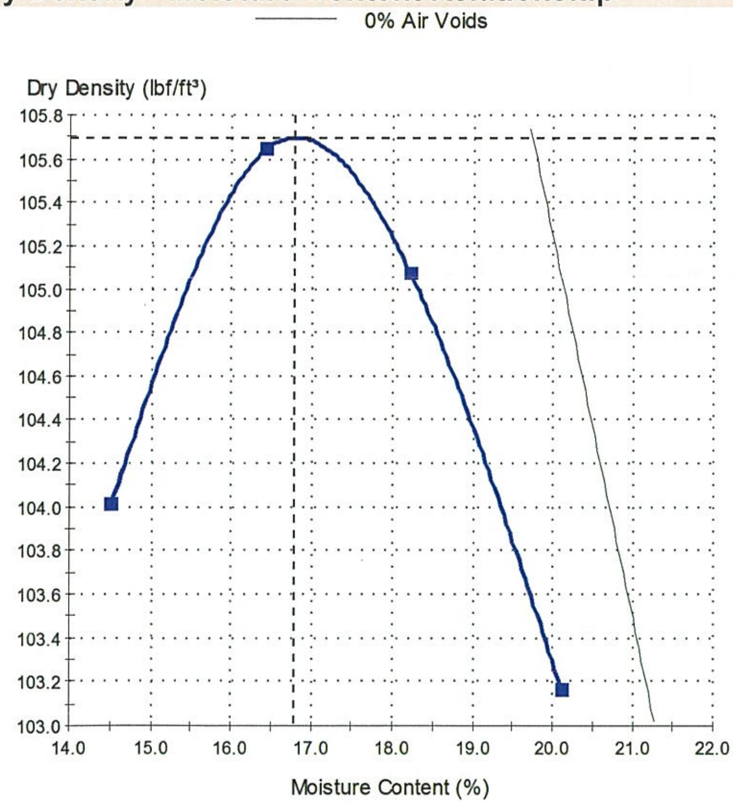
Project: GROUNDWATER TREATMENT PLANT
BEDFORD, IN

Approved Signatory: Johnathon Keith (Project Manager)
Date of Issue: 4/6/2016

Sample Details

Sample ID:	00141392-29-S1	**Date Sampled:**	3/22/2016
Sampled By:	Client	**Specification:**	D698/T99 Standard Proctor
Material:	Red Clay	**Sampling Method:**	Client Sampled
General Location:	For use as structural fill	**Location:**	Structural fill
Tested By:	Nicholas Meeker	**Date Tested:**	4/4/2016

Dry Density - Moisture Content Relationship



Test Results

ASTM D 698

Maximum Dry Density (lbf/ft^3):	**105.7**
Optimum Moisture Content (%):	**16.8**
Method:	A
Preparation Method:	Dry
Specific Gravity (Fines):	2.55
Specific Gravity Method:	Estimated
Retained Sieve No 4 (4.75mm) (%):	0
Passing Sieve No 4 (4.75mm) (%):	100

ASTM D 4718

Corrected Maximum Dry Density (lbf/ft^3):	**105.7**
Corrected Optimum Moisture Content (%):	**16.8**

Comments

Mon Apr 18/16

weather: 42°F Clear high 84°F

6:30 On Site. weekly Tailgate H+S Turbidimeter calibr.

7:00 SES H+S: Rigging, Crane Operations & Overhead Loads

McIntyre on site with crane

- getting pump chambers for WW-4

7:15 Field Measurements Turbidity SES Sump Discharge

Time	Turbidity (NTU)
7:15	3.70
7:18	3.96
7:21	3.52

- trench allowed to develop over weekend.

a.m. pump chambers set and aligned - BRCJ on-site

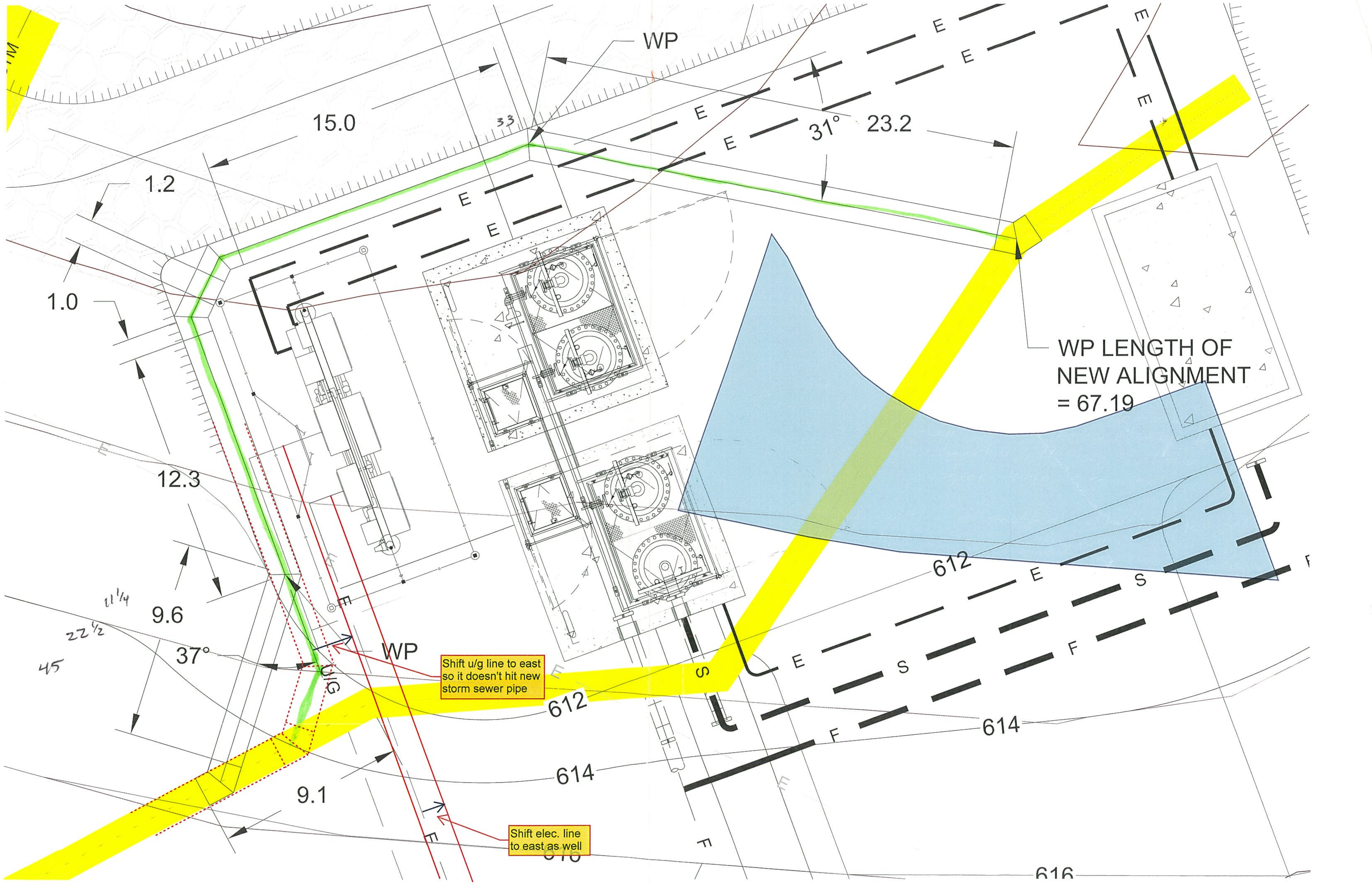
SR - RH provided outfall pipe re-alignment to N of pump chamber
↳ & proposed maintenance pad
↳ forwarded to R.C & myself.

p.m. backfill around pump chamber with clay
- trench for WW-3 overflow pipe to be dug after fill placed around chambers
- overflow pipe to be directed to filtration media to N of pump chambers.

JN on-site to coordinate with G.S & MC on Critical Task Analysis

1730 SES Off Site

1800 Off Site


WP
15.0
33
31°
23.2
1.2
1.0
WP LENGTH OF
NEW ALIGNMENT
= 67.19
12.3
9.6
11 1/4
22 1/2
45
37°
WP
U/G
Shift u/g line to east
so it doesn't hit new
storm sewer pipe
612
612
614
614
9.1
Shift elec. line
to east as well
616

SUBJECT Tues Apr 19/16

DATE

Weather: 52°F Cloudy high 82°F

630 On site Turbidimeter calibr.

700 SES H&S: Maintaining Healthy Life Style

- Containment area to be built at SES yard for drums (as per GMSPSS)
- WW-3 overflow pipe to be laid out to drain to filtration media
- road for hauling clay to be constructed east of working platform to go from SES access road to crane pad south of outfall pipe

7:45 Field Turbidity measurements of sump discharge

Time	Turbidity (NTU)
7:49	22.0
7:50	24.1
7:54	26.2

- clay backfilled & compacted around chamber yesterday with pump intake lengthened to be dropped into sump from top of structure

→ completed with photo forwarded to K. Kamm.

→ pipe drainage diverted to south of pump chambers to avoid future electrical panel foundation

- pipe run along established alignment - measured & welded
- drains directly south of pump chambers
- directed to filtration media south of sump

→ stockpiled mat'l in Entact laydown & trencher laydown areas used to construct working platform by-pass clay access road

- compacted with sheepsfoot

→ sump shut off while working on trenching WW-3 line

1730 SES off site

1800 Off site

Bridcut, Pete

From: Hoekstra, Rick
Sent: April-19-16 11:13 AM
To: Reynolds, Shane
Cc: cporter@brcjcivil.com; Campbell, Randy; Bridcut, Pete; Suserski, Branko
Subject: RE: 13968 (279) Quantities for New Diesel Pump Pad
Attachments: 13968-00(365)CI-WA017-C-17 (WW4 grading plan) - rev cover system elev.pdf

Shane :

I have my CADD guy (Branko) working on the additional fill quantity for the (almost) level gravel area around the wet well chambers. This quantity may be comprised on common fill below the cover system or #53 stone above the cover system (or replacing part of the cover system).

As discussed on the phone this morning, relocation of the storm sewer around the north side of the wet well chambers results in a conflict with the currently planned liner elevation beneath the gravel area (if replaced at the previous as-built elevations). As a result, I took a look at the required elevations of the relocated storm sewer as it goes around the wet well chambers (see attached sketch), assuming an even slope of 2.67% along the 67.3 feet of relocated storm sewer. The west end of the storm sewer is estimated to be 609.36 (back into the existing slope), with the east end surveyed to be at 607.56. Asa result, the relocated storm sewer will slope approx, 0.45 feet across the north side of the gravel area, sloping from approx. 608.70 to 608.25.

Looking at the cross-section on the attached sketch, the top of the storm sewer elevation is expected to be 608.25, which is 3.5 feet below the planned final elevation of 611.75. Assuming we place the 2.5-foot cover system directly over the storm sewer, the liner could be placed at 609.25, followed by 12" of common fill and 18" of gravel (replaces 6" of topsoil and incorporates additional 12" of fill required to meet new grade of 611.75). Looking to the northwest corner of the gravel area, the storm sewer rises almost 0.5 feet, so the liner would need to be placed at 609.75, followed by 12" of common fill and 12" of gravel. As shown on the attached sketch, the base of the cover system (top of clay) would need to be constructed at 609.50 in the southwest corner of the gravel area, and continue at this elevation along the entire south limit of the gravel area.

Another location along the relocated storm sewer where we need to ensure the liner is placed above the storm sewer pipe is the point where we need to reconnect to the existing storm sewer where it exits the excavation on the east side. The surveyed top of pipe elevation at this location was 607.56, so with the required 12" of clay the liner should be installed at 608.56. Looking to the northeast corner of the gravel area, the liner should continue to slope to an elevation of approx. 607.75. As a result, this would be covered with 12" of common fill and 36" of gravel to build up this corner to 611.75 (almost 2 feet higher than the previous ground elevation prior to construction). The liner would then need to slope up to 608.50 beneath the adjusted 610 contour located approx. 6 feet to the east of the new gravel area (as shown on the attached sketch). This will direct subsurface flows over the liner (via the geonet) to DB-4.

Based on the information described above and illustrated on the attached sketch, I assume you will need a revised TIN surface (bottom of cover system and top of proposed ground) for this area. Or can you (and BRG) work with the elevations provided on the attached sketch? Let me know if you would like revised TIN surfaces or simply the CADD file for the revised ground contours or you (or BRG) can work from there.

Rick

P.S. I see that you also requested quantities for rip rap and #53 stone. With the adjusted liner elevations, the additional fill will be comprised of common (or native) fill beneath the cover system, such that les #53 stone will be required for the gravel area. As the pricing for common fill and #53 stone are the same, do you need these quantities separated? As for the rip rap, are you referring to the stone along the DB-4 embankment which is essentially replacement of what was excavated, or are you asking for the quantity of the large rocks to be used as armor stone? I'm assuming you would not place the 6" of topsoil on this steep embankment and replace with armor stone, recognizing that the rocks could easily be larger than 6 inches so the elevation (and quantity) may be higher (and greater). The area of armor stone shown on the attached sketch is approx. 350 sf.

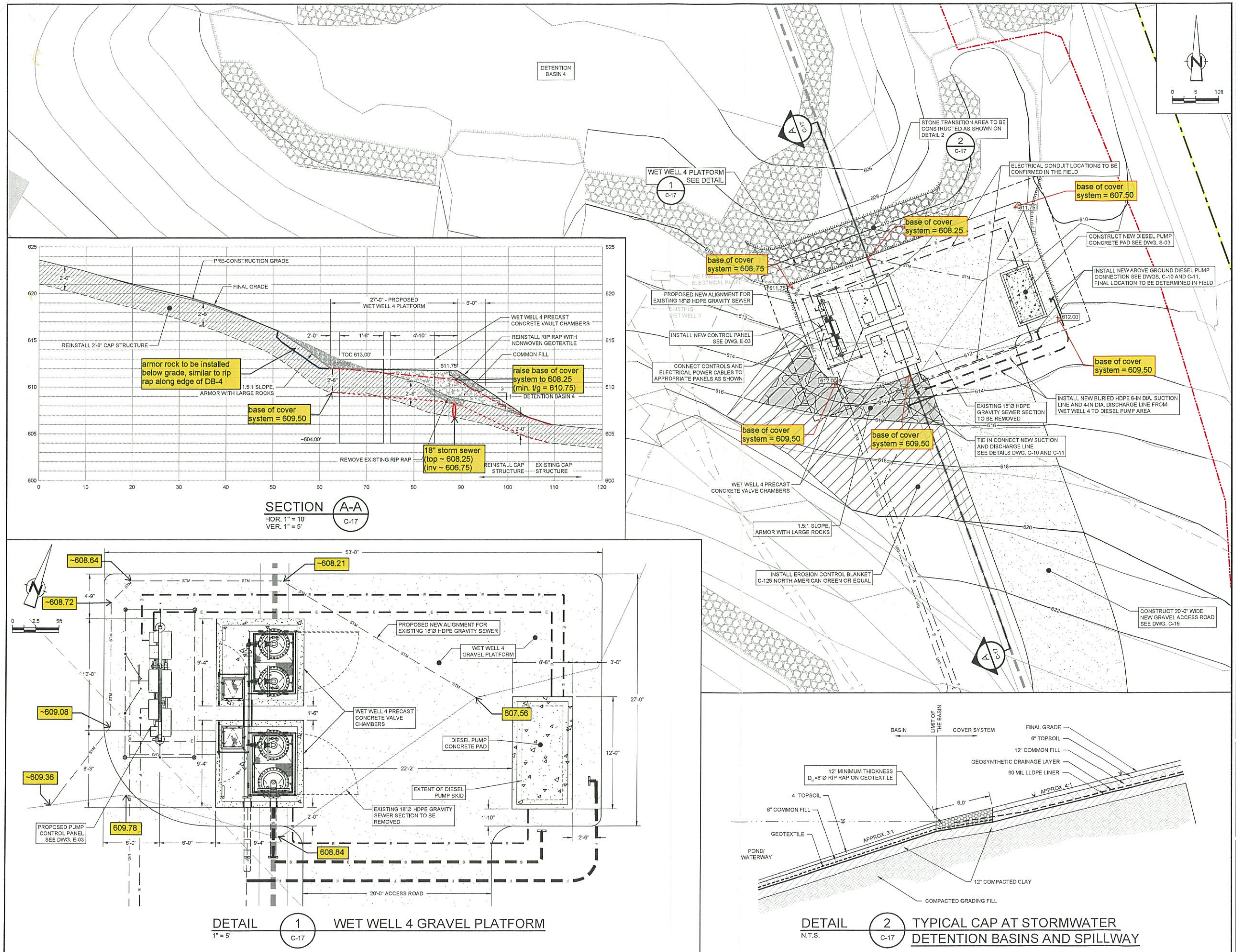
From: Reynolds, Shane [mailto:SReynolds@sevenson.com]
Sent: Tuesday, April 19, 2016 9:43 AM
To: Hoekstra, Rick
Cc: cporter@brcjcivil.com; Campbell, Randy; Bridcut, Pete
Subject: 13968 (279) Quantities for New Diesel Pump Pad

Rick,

Could you provide some quantities for the additional fill, rip rap and #53 stone associated with the new pad to be constructed for the backup diesel pump? I want to be sure I have sufficient budget for these and be sure I address the hauling and placement of the rip rap needed for the armoring as there is not a unit contract rate for this.

Thanks,

Shane Reynolds
sreynolds@sevenson.com
Office 812.278.9584
Cell 716.523.0596
Sevenson Environmental Services
801 Bailey Scales Road
Bedford, IN 47421



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BEDFORD, INDIANA

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Project Manager: J.M.	Reviewed By: C.R.H.	Date: APRIL 2016	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 365	Drawing Nº: C-17

13968-00(365)CI-WA017 APR 15/2016

Wed Apr 20/16

Weather: 54°F Clear high 81°F

630 On site - Turbidimeter Calibr.

700 SES H&S: Allergy Medication at Work

- BRCJ on site to survey WW-3 overflow pipe
- plastic geonet screening placed over discharge
- discharge placed into sump of 2" stone excavated into compacted 53 stone south of pump chamber - covered with filter fabric
- pipe backfilled with 53 stone & compacted
- pipe location flagging placed over stone layer

- clean-up around MH-6 & MH-7 & Fire hydrant PIV
- pipe to west of P413 (from WWs 1&2) to be cleaned up
  stored east of GWTP

BRCJ to lay out WW-4 pad → can RH provide coordinates for new outfall pipe layout?
12:15 email sent.

1300 Progress Meeting
GHD - PB. SES: RC
SR -
DZ
pH: RH
KK
JMc.
GT

Critical Task Analysis

(5) - All stone in trench
- filtration N side
- pump structures set.

clay to N.
~~liner~~

- start at S end with clay berms for infiltration.

-

Forcemain
McI → 2 wks on chambers.

liner crew May 3

Stripping around GWTP next.

SUBJECT | DATE

liner crew mobe contingent on
approval of lastest C.O.
= dependent on fittings. for outfall.

latest invoice to K.K.
R.C. off site Fri to May 2nd.

-pipe from WW's 1 & 2 cleaned up (west of GWTP)

-diversion access road east of trench.
- to be tarped in event of rain

720am Field Turbidity of Groundwater from Pilot Trench.

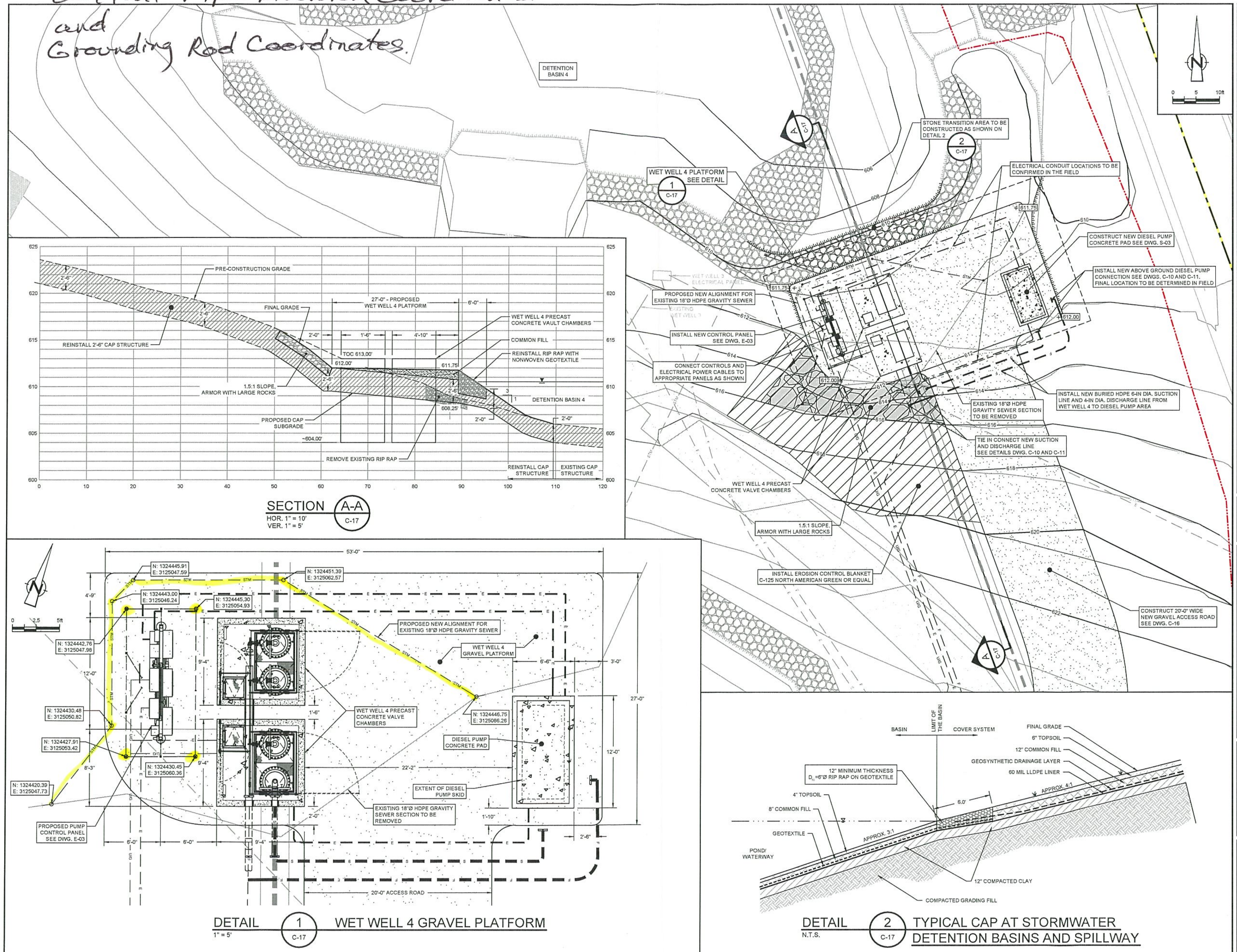
7:20	24.3 NTU
7:23	26.2
7:26	25.2

BRCJ to layout → WW-4 pad.
-outfall pipe. → RH can we get coordinates?
- location of grounding rods.

1730 SES off site
→ off site

C
1
40

Outfall Pipe Diversion Coordinates
and
Grounding Rod Coordinates.



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- EXISTING CLEANOUT
- EXISTING MANHOLE
- EXISTING CATCHBASIN
- EXISTING POWER POLE
- EXISTING LIMIT OF CAPPING
- EXISTING RIPRAP EROSION PROTECTION
- EXISTING GRAVEL ROAD AREA
- PROPOSED CONTOUR
- PLATFORM TOP OF BANK
- BOTTOM OF BANK
- E POWER SUPPLY
- U/G CONTROL CONDUIT
- F 6" Ø HDPE FORCEMAIN
- E PROPOSED POWER/CONTROL PVC 2"Ø CONDUITS
- PROPOSED GRAVEL ROAD AREA
- PROPOSED EROSION CONTROL BLANKET

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

GM CET BEDFORD FACILITY
BEDFORD, INDIANA

GROUNDWATER COLLECTION SYSTEM - BEDROCK PILOT TRENCH

WET WELL 4
GRADING PLAN

GHD

Source Reference:
BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI. APRIL 2001

Project Manager: J.M.	Reviewed By: C.R.H.	Date: APRIL 2016	
Scale: AS SHOWN	Project Nº: 13968-00	Report Nº: 365	Drawing Nº: C-17

13968-00(365)CI-WA017 APR 20/2016

Appendix J
Pilot Trench Interim Groundwater Monitoring Program and Operations Schedule (Pilot Trench Performance Monitoring Plan (PMP) provided separately)

Pilot Trench Performance Monitoring Plan

GM GPS – Bedford Facility
105 GM Drive
Bedford, Indiana
EPA ID# IND006036099
AOC Docket No. RCRA 05 2014 0011

GHD | 651 Colby Drive Waterloo Ontario N2V 1C2 Canada

013968| Report No 404 | September 24, 2019

Table of Contents

Table of Contents

Figure Index

Table Index

Appendix Index

Acronyms List

AOC	Administrative Order on Consent
CA	Corrective Action
COC	Contaminant of Concern
Cover System	East Plant Area Final Cover System
DNAPL	Dense, Non-Aqueous Phase Liquid
Facility	GM GPS Bedford Facility
GAC	Granular Activated Carbon
GM	General Motors, LLC
GPS	Global Propulsion Systems
GUS	Gravel Underdrain System
GWTP	Groundwater Treatment Plant
HDPE	High Density Polyethylene
HQ	Standard Core Drill Barrel Size
IM	Interim Measure
LCS	Leachate Collection System
LDS	Leak Detection System
NAPL	Non-Aqueous Phase Liquid
PCBs	Polychlorinated Biphenyls
Pilot Trench	Pilot Perimeter Groundwater Trench Collection System
PMP	Performance Monitoring Plan
RCRA	Resource Conservation and Recovery Act
SSC	Site Source Control
U.S. EPA	United States Environmental Protection Agency
WW4	Wet Well 4

1. Introduction

This Pilot Trench Performance Monitoring Plan (PMP) has been prepared by GHD Services Inc. (GHD) to evaluate and monitor the groundwater collection hydraulic performance of the Pilot Perimeter Groundwater Trench Collection System (Pilot Trench) constructed at the General Motors (GM) LLC Global Propulsion Systems (GPS) Bedford Facility (Facility), located in Bedford Indiana. The Pilot Trench was installed as part of the Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) activities being conducted under the Administrative Order on Consent (AOC) (effective date August 4, 2014) between United States Environmental Protection Agency (U.S. EPA) and GM LLC for the Facility (Docket No. RCRA-005-2014-0011).

The Pilot Trench is part of a perimeter groundwater collection trench system to be installed through the karst bedrock and designed to collect the shallow, PCB-impacted groundwater beneath the East Plant Area, thereby intercepting potential shallow groundwater migration from the Facility. The inherent capture and removal of groundwater by the constructed Pilot Trench, located along a portion of the hydraulically downgradient Facility boundary associated with a bedrock valley drainage feature, is intended to accentuate the existing hydraulic gradients to define the hydraulic capture performance of the completed installation. Thus, the Pilot Trench may have a practical horizontal collection zone that exceeds the mere length of the trench by producing an inward flow path upgradient of the trench location.

The Perimeter Groundwater Trench Collection System is intended to be installed in two or more phases of work, with the Pilot Trench segment constructed to demonstrate installation techniques, attainment of trench depth at or below the competent/karstic bedrock interface, and to assess the effectiveness of the horizontal groundwater hydraulic collection zone. Installation and subsequent inspection of the Pilot Trench has validated the appropriateness of the construction techniques and confirmed attainment of the required depth. This PMP is intended to further define and assess prior monitoring information that indicates (1) overall groundwater flow in the northern portion of the East Plant Area is controlled by an east-west trending bedrock valley that conducts groundwater towards the Pilot Trench, and (2) horizontal and vertical hydraulic capture of groundwater above the competent bedrock at the Pilot Trench effectively prevents contaminated groundwater from migrating off-site at levels which would result in unacceptable risk to human health and the environment (See the Problem Statements in Section X).

Monitoring wells located in select areas in the vicinity of the Pilot Trench, and periodically monitored throughout the various seasons, will be used to monitor and measure the hydraulic performance of the capture zone of the Pilot Trench. The proposed installation of additional monitoring locations will be completed to augment the current monitoring network in this area.

Furthermore, dye trace investigations will be implemented immediately upgradient of the trench to assist in the understanding of groundwater flow in the area of the trench and to provide more information on the broader capture potential from areas on the upgradient side of the East Plant Area. Each of these components, along with other geologic, hydrogeologic and chemical data, will be integrated into a lines of evidence approach to evaluate the overall performance of the hydraulic capture of the Pilot Trench operation.

The Pilot Trench PMP is organized into the following sections:

1) Section 2 presents the Conceptual Site Model (CSM), including a generalized description of the local geologic and hydrogeologic conditions, groundwater movement, and contaminant transport

2) Section 3 presents a description of the Pilot Trench construction

3) Section 4 presents the proposed Performance Monitoring Plan, including monitoring well installation and multiple studies (thermal imaging reconnaissance, groundwater sampling, hydraulic monitoring, and dye tracer studies) that will be used to monitor the performance of the Pilot Trench

4) Section 5 describes the reporting of results from the monitoring activities

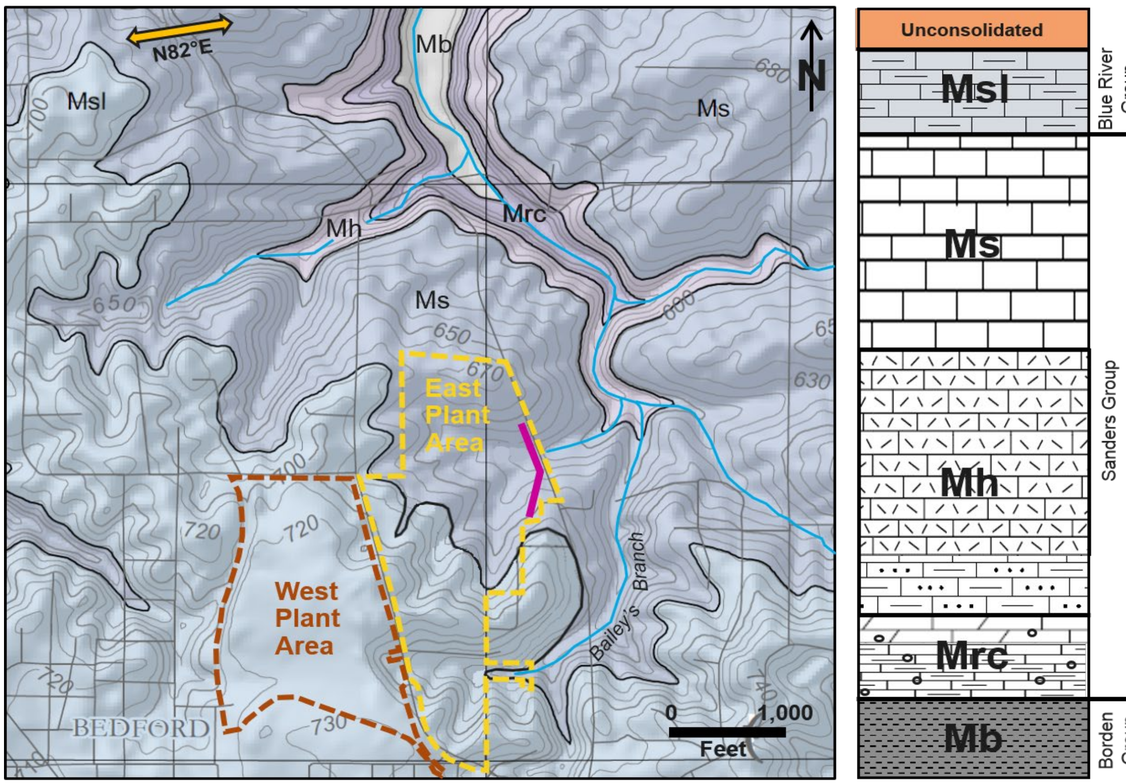
5) Section 6 presents the references referred in completing this work plan

2. Conceptual Site Model – Pilot-Trench Area

2.1 Physical Setting

The Facility is in the Mitchell Plateau physiographic province, a carbonate karst plateau dissected by a few major stream systems. The term karst describes a terrane underlain by soluble rocks, where openings in the rocks are widened through dissolution, creating unique networks of preferential groundwater flow and, frequently, features including caves, sinkholes, and springs. The main Facility structures are situated on a flat hilltop in the West Plant Area (Inset 1). The land surface comprising the East Plant Area generally slopes to the east and is underlain by a veneer of recently placed fill materials situated on limestone bedrock. The bedrock surface is incised by two narrow, roughly east-west trending valleys that convey groundwater eastward to Bailey's Branch creek. The Pilot Trench is constructed across the northernmost of these two bedrock valleys.

Inset 1. (Left) Bedrock geology map with topographic contours (after Thompson et al., 2008, with adjustments based on site-specific data); **(Right)** generalized stratigraphic column showing unit relationships. The thickness of the Blue River and Sanders Group Formations shown are relative to the approximate average thickness of formations penetrated at the site. Unit abbreviations explained in text. Yellow arrow denotes strike of regionally dominant joint set (Powell, 1976 [Plate 1]). Pilot trench shown in magenta.



2.2 Geologic Conditions

This section provides an overview of relevant geologic conditions at and around the Facility. Details regarding geologic conditions are contained in the draft RCRA Facility Investigation (RFI) Report (GHD, 2015).

2.2.1 Geologic Materials

The geology of the site and surroundings consists of a thin veneer of unconsolidated clay-rich and finer grained material overlying bedrock comprised of several Mississippian geologic formations (Inset 1). In descending order (youngest to oldest), these are the St. Louis Limestone (Msl) of the Blue River Group, the Salem Limestone (Ms), the Harrodsburg Limestone (Mh), the Ramp Creek Formation (Mrc) of the Sanders Group, and the Edwardsville Formation of the Borden Group (Mb)[1].

[1] The bedrock geologic map prepared by Thompson et al. (2008) does not differentiate between the three formations that comprise the Borden Group. All three are denoted by the symbol "Mb".

Karst can form in all these formations except the Borden, which is not comprised of soluble rock. Figure 2.1 depicts the current surface topography with the underlying top of bedrock surface across the Facility.

Descriptions of the unconsolidated material and bedrock formations beneath the site follow.

Unconsolidated Material

Unconsolidated, native materials overlying the bedrock at the Facility are relatively thin and consist chiefly of loess (silt deposited by wind) underlain by residuum. Residuum is mineral material that accumulated in place as the carbonate bedrock dissolved and disintegrated (chemically weathered). The residuum at the facility is described as predominantly clay with traces of silt and gravel, clayey sand, and silty sand.

Fill materials placed at the Facility consist of gravel with varying amounts of finer-grained material. Debris such as wood, plastic, brick, and metal are occasionally encountered in the fill.

St. Louis Limestone

The St. Louis Limestone in Indiana is divided into two parts based on lithology: the upper St. Louis and the lower St. Louis. Only the lower St. Louis is present at the Facility. The lower St. Louis consists mostly of thin-bedded, generally micritic, limestone with thin beds of calcareous shale and silty dolostone (Carr, 1986). The average matrix (i.e., primary) porosity of samples tested from rock cores collected at the Facility was 8.6%. The St. Louis Limestone thins from the southwest to northeast across the Facility, with an average thickness of approximately 21 feet (GHD, 2015). This formation grades into and conformably overlies the Salem Limestone.

Salem Limestone

The Salem Limestone comprises the youngest unit of the Sanders Group. The most widely known rock type of the Salem Limestone is cross-bedded calcarenite[2] that is medium to coarse grained, porous, and fairly well sorted which occurs in exceptionally thick beds. The individual grains consist of microfossils and fossil fragments cemented with calcite. Other rock types comprising the formation include biocalcirudites[3], very fine grained argillaceous dolostone, and dense argillaceous limestone (Pinsak, 1957).

The average thickness of the Salem Limestone beneath the Facility, where overlain by the St. Louis Limestone, is approximately 61 feet. In the northeast portion of the Facility, where the St. Louis Limestone has been eroded away, the Salem Limestone thins due to weathering. The base of the Salem Limestone grades into and conformably overlies the Harrodsburg Limestone. The average matrix porosity of samples tested from rock cores collected at the Facility was 9%.

Harrodsburg Limestone

The Harrodsburg Limestone has been divided in the literature into an upper and a lower unit. The upper unit at the Facility consists of bioclastic calcarenite and calcirudite with beds of variable

[2] Calcarenite is a type of limestone that is composed predominantly of sand-sized carbonate grains.

[3] Biocalcirudite is a limestone formed predominantly of fossil fragments that are larger than sand (>2 millimeters).

thickness. Occasional shale laminae and small vugs were also present (GHD 2015). The average matrix porosity of samples tested from rock cores of the upper unit collected at the Facility was 5.4%. The thickness of the upper unit beneath the site averaged 51 feet. The lower Harrodsburg Limestone consists predominantly of fine-grained limestone with beds of variable thickness and contains interbedded shale laminae and thicker shale beds. Small vugs occur throughout the lower unit, with small siliceous geodes present near its base. The average thickness of the lower unit is approximately 26 feet. The matrix porosity of the lower unit was not measured.

Ramp Creek Formation

The Ramp Creek Formation beneath the site consists of very fine- to medium-grained, evenly-bedded, dolomitic limestone with occasional shale seams. Vugs and geodes are numerous throughout the formation. The average thickness of the formation beneath the Facility is approximately 20 feet. The matrix porosity of the unit averaged 26%.

Edwardsville Formation

Only a few feet of the Edwardsville Formation were penetrated by borings at the Facility and consisted of relatively soft calcareous shale. The top of this formation was observed to contain a thin layer of glauconitic shale with small crystals of pyrite, which is consistent with information provided by Nicoll and Rexroad (1975). In addition to shale, Stockdale (1931) reports that the Edwardsville Formation also contains beds of siltstone and fine-grained sandstone, and that the formation thickness ranges from 40 to 200 feet in Indiana.

2.2.2 Bedrock Structure

Regionally, all the bedrock formations dip gradually toward the southwest at about 30 to 250 feet per mile (Powell, 1976). Mapping performed as part of the RFI indicates that the dip of the strata locally is on the order of 40 to 100 feet per mile. Local dip angle and direction can vary significantly from the regional trend (Perry and Smith, 1958) due to local folding of strata.

The type, orientation, and frequency of fractures are important factors governing karst development and the movement of groundwater through the bedrock. Fractures represent a form of secondary porosity of the rock. Fractures present in the bedrock are divided into two types: bedding-plane fractures and joints.

As their name implies, bedding-plane fractures occur along bedding planes. Because the bedding-plane fractures are nearly horizontal, they are the type of fractures most-commonly intercepted by vertical borings. While bedding-plane fractures were identified in all the bedrock formations penetrated, their frequency tended to decrease with depth. Also, because bedding planes are less common in the Salem Limestone, bedding-plane fractures in this formation were also less common than in the other limestone formations.

For the purposes of this CSM, joints are defined as rock fractures that are not aligned along bedding. Powell (1976) conducted an extensive study of jointing of Mississippian rocks in southwest Indiana and their implications in terms of karst formation and groundwater movement. He determined that the jointing was common in rocks in the region, including the Blue River and Sanders Groups. The joint system in the area consists of two sets of near-vertical joints, denoted "master" and "cross". The joints in the master-joint set normally transect more than one bed of rock vertically, are longer than cross joints, and have a preferred orientation that, in the region, is roughly east-west. Cross-joints commonly terminate at master joints, to which they are nearly normal (intercept at right angles) and generally transect only one bed. Powell (1976) notes that the spacing of master joints in the Salem Limestone ranges from 10 to 50 feet.

2.2.3 Karst

Karst refers to geologic terrain that is comprised of and underlain by soluble bedrock. Such terrains often have diagnostic landforms like sinkholes and hydrologic features such as sinking streams and springs. A karst aquifer is comprised of bedrock whose permeability has been enhanced by dissolution processes. A karst aquifer can be present even if there are no karst landforms nearby.

Regionally, karst has been shown to form in all four of the limestone formations that underlie the site (the St. Louis, Salem, Harrodsburg, and Ramp Creek). Although it is calcite-rich, thick-bedded, and possesses the requisite secondary porosity, the Salem Limestone appears less susceptible to karstification than does the St. Louis Limestone (Thornbury 1969).

Karst aquifers represent triple-porosity systems comprised of primary (matrix), secondary (fracture), and tertiary (solution or "conduit") porosity. Worthington, et al. (2000) examined the storage and movement of groundwater in four well-studied karst aquifers. They found that, in all cases, more than 90% of the groundwater in the aquifers was stored in the matrix porosity and more than 90% of the flow through the aquifers occurred in the conduit porosity, with fractures playing an intermediate role. Hydraulic-head and groundwater-quality data from wells screened across conduit porosity, therefore, are most important in assessing the movement of contaminants dissolved in, or adsorbed to particulates moving with, groundwater in the bedrock.

Solution-widened pathways in karst aquifers enlarge and become integrated over time forming networks of conduits that typically have apertures in the millimeter to centimeter range (Worthington and Ford 2009). These networks converge in the downgradient direction, focusing groundwater flow, and discharging at springs.

2.3 Groundwater Movement

Groundwater in karstic terrain moves, on a macro scale, from areas of relatively higher to lowest pore pressure. On this macro scale water flows principally within regions of the karstic rock where the voids are larger and more densely inter-connected, thus allowing easy communication (i.e., low pressure gradient) between them. On a micro scale, groundwater in the matrix porosity, or in closed or poorly interconnected fractures, drains more slowly towards nearby inter-connected fractures and/or conduits and requires much higher pore pressure gradients to achieve such movement. In practice, groundwater within these interconnected fractures and conduits drains relatively rapidly through the bedrock and discharges to the ground surface or within surface water bodies at seeps and springs.

In the East Plant Area, as described in the RCRA Facility Investigation Report (Section 4.4.2), these interconnected conduits are preferentially located in the upper portion of the karstic rock. This vertical fracture/void density gradient tends to result in a strong shallow horizontal groundwater flow component in the East Plant Area.

In the northern portion of the East Plant Area, where the Pilot Trench is located, potentiometric mapping of groundwater in the shallow bedrock via monitoring wells, along with previous dye tracer testing results, suggests that prior to trench installation groundwater flowed to the east, with little vertical flow, and discharged to springs located along the historical and current Tributary 3. However, the imperfect knowledge of the bedrock permeability structure in such karst aquifers renders validation of these local groundwater flow directions using only potentiometric maps less certain than in non-karst settings. Nevertheless, supported by other available data (e.g., previous dye tracer testing results, observed geology) and professional experience with karst aquifers, it is reasonable to infer that, prior to trench installation, shallow groundwater in the northern portion of the East Plant Area indeed discharged to springs along Tributary 3 and/or Bailey's Branch, but is now be expected to be captured by the Pilot Trench.

To better characterize groundwater movement in karst aquifers, dye tracer studies are often used to supplement hydraulic data collected from monitoring wells and therefore provide better overall confidence in the characterization of groundwater flow. This PMP describes two such post-construction tracer studies to be conducted as part of the performance monitoring program for the Pilot Trench, described later in this document.

The bedrock aquifer is recharged by infiltration of precipitation. Historical water-level data demonstrate that the water levels in some monitoring wells respond rapidly to storm events whereas in other wells they do not. The rapid response suggests that recharge occurs rapidly and is focused along solution-widened fractures. In general, wells that respond rapidly are better-connected hydraulically to the active flow system, while wells with muted responses (or no response) are poorly connected. Samples analyzed from the former represent the quality of groundwater that is in transit through the aquifer whereas samples analyzed from the latter represent the quality of groundwater that is essentially in storage in the aquifer. However, it is noted that rapid responses occur at greater magnitude at this site at wells that are not under the cover system materials. While, those wells that are located under the cover system, do show direct responses at some locations, however those responses are more muted (Figure 4.17 shows a graph of the transducer data that have been collected at the Facility, where these conditions can be observed.

Comparison of groundwater elevation data from wells screened shallow (i.e., in the St. Louis or upper Salem Limestones) with those screened deeper (i.e., in the Harrodsburg Limestone or Ramp Creek Formation) demonstrates that a strong downward gradient exists. If all the limestone formations above the Edwardsville Formation represented one well-integrated karst aquifer, such a large vertical gradient would not exist. This observation is evidence that an interval of more competent rock exists at depth beneath the East Plant Area that retards downward movement of groundwater.

2.4 Contaminant Transport

Prior to the RCRA Corrective Action activities, the East Plant Area was used for the disposal of wastes, including PCB impacted soil and debris. In the northern portion of this area extensive soil sampling was conducted to assess the nature of this fill material and elsewhere in the East Plant Area. The East Plant Area Interim Measure resulted in the removal and on-site containment of PCB material > 50 mg/kg in the landfill vault, and the placement of additional < 50 mg/kg floodplain soil and sediment as grading material prior to installation of a multi-component cover system.

To date, PCBs have not been detected in samples of pilot-trench effluent, indicating that PCBs have not been migrating appreciably in the groundwater collected by the trench. Fill soils in the East Plant Area of the Facility have lower levels of PCBs, typically much less than 50 mg/kg. Such levels typically do not lead to appreciable levels of dissolved PCBs in groundwater because PCBs have low solubility and a high affinity to adhere to soil particles. Groundwater in certain areas upgradient of the pilot trench, including that issuing from select former seeps and springs, has been shown to contain PCBs (GHD, 2015) in either the total or dissolved fraction.

The interpretation of PCB detections in groundwater samples located beyond the installed trench as a primary line of evidence is insufficient in determining Pilot Trench effectiveness because PCBs have low solubility and a high affinity to adhere to soil particles. Positive detections of PCBs downgradient of the Pilot Trench could be remnant artifacts of historic migration that have become entrained on soil particles, which can be inadvertently introduced into the groundwater sample collection process or they may become intermittently mobile in the fracture network of karstic terrain.

Site Source Control (SSC) systems installed in northern portion of the East Plant Area prior to trench installation collect and separately route this groundwater for treatment. As noted in the previous section, springs represent discharge points for conduit networks. These springs result from natural conduit networks that are convergent and drain nearly all the local groundwater moving through the bedrock. Groundwater in the primary porosity and non-weathered fractures moves slowly toward, and discharges into, the conduit networks. The presence of springs upgradient of the Pilot Trench indicates that one-or-more local conduit networks exist in the area and are collecting and transporting impacted groundwater to the SSC systems. There is no evidence that PCB DNAPL is transported by the network(s); specifically, DNAPL has not accumulated in any wells in the area west (upgradient) of the pilot trench, nor has separate-phase oil been identified in the treatment plant that receives the water collected by the SSC systems. Based on this information, it is possible that all impacted groundwater upgradient of the pilot trench is being collected by the SSC systems, which would explain the absence of PCBs in water pumped from the trench.

If a deeper conduit network in the bedrock exists, and impacted groundwater has reached such a network, the impacted groundwater would migrate through the network and would be expected to discharge to one-or-more springs located along Tributary 3 downstream of the pilot trench or along Bailey's Branch.

PCB concentrations in groundwater migrating through fractures toward conduit networks will be significantly attenuated by matrix diffusion, as noted by Dr. Kueper in Appendix J.2 of the draft RFI Report (GHD 2015). Additionally, due to the converging nature of karst conduit networks, contaminant concentrations in groundwater flowing through such networks are commonly reduced with distance downgradient, as tributary conduits containing clean groundwater join the flow system. Seepage of clean groundwater into the network from the rock matrix and unweathered fractures would also play a role in reducing concentrations (i.e., through dilution).

Based on the above discussion, and the length of time since the release of the contaminants, it is likely that the maximum extent of groundwater impacts due to sources in the northern portion of the East Plant Area has been attained, that is, the distribution and migration of contaminants in this area is at quasi-steady state. Under this condition, contaminant concentrations will gradually decline over time. Short term fluctuations in contaminant concentrations detected in samples collected from monitoring wells and springs can be expected. Storm events of a certain magnitude may create ephemeral, turbulent-flow conditions. Such “threshold” storms may temporarily mobilize stored contaminants, potentially including contaminants sorbed to aquifer sediments. If this transport mechanism occurs at the site, it has arguably been occurring periodically since the contaminants were released decades ago and can be characterized by implementing an appropriate storm-event-based sampling program. This condition would be more accentuated for locations outside of the cover system and may not be applicable to those locations under the cover system.

The conceptual model for karst groundwater flow described herein has several implications regarding contaminant characterization and transport:

- With distance downgradient of a source area, impacted groundwater will be increasingly confined to the conduit network. This means that a conventional “plume” of impacted water will not develop; rather, the limits of impacted water will represent the architecture of the conduit network transmitting it.
- Because the architecture of conduit networks cannot be characterized in detail, and individual monitoring wells often do not intercept the networks, more uncertainty exists regarding the details of groundwater flow and quality in the bedrock than in non-karst settings.
- Some storm events likely result in a temporary reversal of the hydraulic gradient in the conduit network. Ewers, et al. (2012) note that in situations where such reversal of flow occurs, and contaminated groundwater is present in a major conduit, impacted groundwater can invade surrounding solution and fracture porosity during storm events. The invading water returns to the conduit when the flood is past; however, contaminants can remain outside the conduit due to various mechanisms. This would result in a “halo” of impacted groundwater and/or sediments in the solution porosity and fractures surrounding the conduit that is transmitting impacted groundwater (or had done so at some time, or many times in the past). Similarly, modeling performed by Smart (1999) implies that during flow-reversal storm events, clastic sediment will be transferred from primary conduits into the aquifer and will remain there rather than being transported back to the conduits when flow reverses after the storm peak passes. If such sediments are contaminated, those transported out of the primary conduits and into surrounding solution and fracture porosity may remain there indefinitely. If a monitoring well happens to tap into a fracture containing such sediments, they may be mobilized during sampling, resulting in a sampling artifact (that is, the detected contaminants were not moving with the groundwater but rather were mobilized by the sampling process).
- Given the extreme heterogeneity of karst aquifers, water-quality data collected from monitoring wells must be interpreted with care and sound judgement. Data from some groundwater samples may represent sample collection artifacts, the quality of groundwater that is stored in (or moving very slowly through) the aquifer or the quality of groundwater moving relatively rapidly through the aquifer. Data collected from still other wells will represent some unique combination of storage and transport components. Chemical concentrations in samples

collected from some wells be affected by antecedent and current weather conditions, whereas samples from other wells will be largely unaffected by such conditions.

- Samples from springs represent the average quality of the water drained by the conduit network feeding them. Such data are useful for assessing potential exposure risks posed by the spring water as well as for detecting potential changes in aquifer conditions and contaminant-transport conditions over time.

2.5 Summary

The Pilot Trench is constructed across the northernmost of two bedrock valleys in the East Plant Area. Both valleys are tributaries to Baily's Branch, which drains northward near the Facility. The geology of the area surrounding the Pilot Trench consists of a relatively thin layer of unconsolidated material overlying bedrock. The unconsolidated material consists chiefly of residuum, the clay-rich, insoluble remnants of limestone bedrock that has been weathered in place, fill material or consolidated creek floodplain soil and sediment from the prior removal action. Bedrock beneath the area consists of four limestone formations deposited atop the Borden Group, a thick sequence of insoluble rocks – predominantly shales, siltstones, and fine-grained sandstones.

In the region, all four limestone formations have been known to develop karst. In this process, certain pathways in the rock are enlarged by dissolution. These pathways converge downgradient, forming an enhanced drainage network in the rock, and discharge at springs. As the bedrock dissolves, crevices are enlarged and cavities are formed. While mitigated as a result of the installation of a cover system, unconsolidated material can move into these openings in the rock and can be intermittently transported through the conduit network. These networks occupy only a small percentage of the rock volume – most of the bedrock is sparsely fractured, particularly at depth, and poorly transmissive. However, because they are such efficient drains, 90 percent or more of the groundwater moving through the rock does so through the conduit network. Hydraulic head data collected from monitoring wells at the site exhibit a strong downward gradient across most of the East Plant Area. These data are evidence that all four limestone formations do not form a single, hydraulically-well-connected aquifer.

Characterizing the movement of groundwater and contaminants in karst aquifers is made challenging by their extreme heterogeneity and anisotropy (i.e., unpredictability). Characterization approaches that work definitively in most other settings do not work as well in karst aquifers. Data collected from monitoring wells, while a necessary part of a characterization effort, must usually be supplemented with other data, including those collected from tracer studies. Such a study is an element of the performance monitoring plan presented in this document.

Groundwater samples collected from those monitoring wells that are poorly connected to the conduit network draining the bedrock represent the quality of groundwater that is essentially stored in the aquifer or moving very slowly toward the network. Groundwater samples collected from monitoring wells that are well connected to the network represent the quality of groundwater moving through the site. With distance downgradient, most of the impacted groundwater is isolated in the conduit network; therefore, a conventional "plume" of impacted water does not develop. A mode of contaminant transport that is important in some karst aquifers is the episodic movement of sediments through the rock in response to storm events. Storm events may also cause a temporary reversal of flow – from the conduits into narrower fractures and other openings in the rock. This process can form a "halo" of contaminants outside the conduits. Because most conduits cannot be remotely sensed and mapped, they cannot be targeted for installation of monitoring wells. This reality means that the extent of contamination in karst aquifers cannot be characterized as precisely as in non-karst aquifers. As such, identifying and mitigating potential risks to receptors is an essential element of groundwater remedial strategies in karst aquifers – arguably more important than in non-karst settings. PCB concentrations in groundwater migrating through fractures will be significantly attenuated by matrix diffusion, and the converging nature of karst conduit networks serves to reduce dissolved PCB concentrations with distance downgradient, as tributary conduits containing clean groundwater join the flow system. Samples from springs represent the average quality of the water drained by the conduit network feeding them. Such data are useful for assessing potential exposure risks posed by the spring water as well as for detecting potential changes in contaminant-transport conditions over time.

Given the nature of the karst aquifer at the site and the length of time since the release of the contaminants, the maximum extent of groundwater impacts due to sources in the northern portion of the East Plant Area is interpreted to have been attained. Under this condition, groundwater contaminant concentrations will gradually decline over time.

Figure 2.2 presents the Conceptual Site Model for the construction Pilot Trench (Section 3). This block diagram attempts to conceptually illustrate some of the groundwater movement and potential contaminant migration mechanisms presented above.

3. Description of Pilot Trench Construction

3.1 Pilot Trench Location and Description

The Pilot Trench is approximately 800 feet in length, and was installed at the northeast corner of the East Plant Area along the downgradient extent of the groundwater table beneath the property. The surface expression of the Pilot Trench alignment is perpendicular to the geomorphic valley feature defined by a drainage channel referred to as Tributary 3. Tributary 3 is the surface expression of a subsurface ravine incised into bedrock.

Groundwater flow in karstic shallow bedrock regimes, such as present beneath the Facility, are typically highly influenced by bedrock topography. Figure 2.1 shows the top of bedrock contours beneath the East Plant Area, with the Pilot Trench shown in the northeast corner. The approximate current and historical bedrock drainage channels are indicated by large arrows directed to the northeast.

The location and alignment of the Pilot Trench was designed to work in conjunction with the local geology/hydrogeology and other East Plant Area Interim Measures (IM) to provide horizontal control of groundwater migration in the northern portion of the East Plant Area. The Pilot Trench exploits the intrinsic control of groundwater flow by the bedrock topography, which includes the northeasterly trending bedrock valley that consolidates the shallow bedrock groundwater flow as well as surface water flow along the topographic and bedrock valley axis. The Pilot Trench transects, and is oriented roughly perpendicular to, this bedrock valley. In addition, the East Plant

Area Final Cover System (Cover System) has reduced overall local groundwater recharge, thereby moderating and/or reducing the flow of groundwater through the karstic rock and into the Pilot Trench. In order to further demonstrate the effectiveness of the installed Pilot Trench, hydraulic monitoring of these wells, combined with a dye trace investigation and chemical testing (described in Section 4), in addition to data collected to date (hydraulic head measurements, observed geology through observation of retrieved bedrock cores, visual and video inspection of the pre-constructed vault area and completed trench walls, packer-pressure testing, etc., will document the hydraulic performance of the Pilot Trench.

3.2 Pilot Trench Components

The Pilot Trench section of the potential Perimeter Groundwater Trench Collection System is being used to evaluate the performance of the overall groundwater collection system. Construction of the Pilot Trench consisted of removal of the overlying overburden soil, excavation of a bedrock trench, installation of collection system components, backfilling of the trench, and re-construction of the engineered cover system. The bottom design elevation of the Pilot Trench was determined based on direct observation of bedrock cores collected during pre-design drilling activities, and further verified by geophysical testing performed after removal of the overburden and prior to excavating the bedrock. The base of the excavated trench was positioned just below the bottom, of identified transmissive fractures (both vertical and horizontal) in the epi or upper karst features in the erosional bedrock surface. These fracture features are the main conduits for shallow bedrock groundwater movement in a karstic environment. The general hydraulic gradient along the Pilot Trench was designed to allow collected groundwater to naturally fall via gravity to a water collection sump, which then would pump the water to the groundwater treatment system, located to the south.

The Pilot Trench (2 feet wide, with variable depth) was cut into bedrock using a Trencor 1660 rock trenching machine, owned by H.L. Chapman Pipeline Construction, Inc. (HL Chapman), a specialty sub-contractor retained by Sevenson Environmental Services Inc, as general contractor. The rock cuttings were removed from the trench to allow for visual inspection of the trench walls and floor, along with obtaining survey data, to determine if an acceptable depth had been achieved.

After the trench depth was confirmed by field survey and cleaned (i.e., rock removed), the collection system was installed.

A physical barrier of vinyl sheet piling was installed on the east (back or downgradient) wall of the trench. The purpose of the vinyl sheet piling was to reduce the potential for groundwater entering the trench from the upgradient area to the west from passing through the downgradient trench wall. A cement-bentonite grout mixture was then poured on the trench floor to a depth of 6 inches up the sheet piling. The grout provided a low permeability seal to prevent water entering the trench from going beneath the bottom of the vinyl sheet piling, as well as to reduce the potential for downward migration.

A 6-inch diameter perforated High Density Polyethylene (HDPE) drain pipe was placed on top of the hardened grout to facilitate conveyance of collected groundwater via gravity drainage towards Wet Well #4 (WW4).

The WW4 chamber was constructed to house two dual vertical 2-foot diameter HDPE sumps at the low point within the Pilot Trench. Each sump was designed to accept a single extraction pump and to permit the free flow of groundwater into WW4 from the 6-inch diameter HDPE drain pipe. Water collected in WW4 is transferred to the on-Site Groundwater Treatment Plant (GWTP) for filtration and granular activated carbon (GAC) treatment prior to discharge at Outfall 004 under the National Pollutant Discharge Elimination System (NPDES) Permit No. IN0064424.

The excavated rock trench was backfilled around the HDPE drain pipe and to the top of the bedrock with clean imported granular material. Piezometers were installed along the east (downgradient) wall within the Pilot Trench, both along the upgradient and downgradient sides of the sheet piling. Above the granular backfill, a geotextile layer was placed to act as a filtration control to separate the granular backfill from the overlying soil. In the area where the trench extends beneath the Cover System, a sand component was added over the geotextile layer to create a vertical extension of the Pilot Trench. This extension creates a downward pathway into the trench for overburden groundwater that has been in contact with the cover system grading soils.

For the portion of the Pilot Trench located within the limits of the East Plant Area Cover System, the area was restored consistent with the previously installed cover system design. In areas outside of the cover system, common fill was used to return the topography to pre-construction elevations.

A full description of the Pilot Trench Construction can be found in the Pilot Trench Construction Certification Report (GHD, May 2, 2018).

3.3 Groundwater Treatment Plant (GWTP)

A GWTP was designed and constructed for treating PCB-impacted groundwater collected from the Pilot Trench, SCC Wet Wells #1, #2, and #3 (WW1, WW2, and WW3), and Vault collection systems [gravel underdrain system (GUS), leak detection system (LDS), and leachate collection system (LCS)], with the treated water being discharged to Bailey's Branch Creek (Creek) via Tributary 3 under a NPDES permit. The treatment processes include an equalization tank, Orival ™ filtration, and GAC. Construction of the GWTP occurred concurrent with the Pilot Trench construction. Since July 2016, the constructed GWTP has treated and discharged approximately 43 million gallons of groundwater in accordance with the requirements of NPDES Permit No. IN0064424.

4. Performance Monitoring Plan

4.1 Objectives

The objectives of this PMP are to determine if groundwater above the competent bedrock in the northern portion of the East Plant Area preferentially flows into the northern bedrock drainage valley and to the Pilot Trench, and to present multiple lines of evidence to assess whether the Pilot Trench operates as designed in capturing contaminated groundwater present above competent bedrock, thereby preventing contaminated groundwater from migrating beyond the trench at levels which would result in an unacceptable risk to human health and the environment.

Both of these objectives will be assessed during various seasons of the year. Constructed groundwater contour maps and data analyses will assist in visual depiction and analytical interpretation of the influenced hydraulic gradients, observations of the underlying geology as determined through bedrock coring retrieval, visual observations of the pre-constructed vault area and the completed trench wall, historical and new chemical data as a secondary line of evidence, thermal aerial mapping of the current spring system, and completion of a dye tracer test in this area of the Facility. Well installation logs for the existing monitoring wells can be found in Appendix A.

The proposed Pilot Trench PMP includes completion of a thermal image reconnaissance to identify seeps and springs, installation of new monitoring wells, conduct of two dye tracer tests to assess groundwater flow remote from and close to the trench, recording water levels from monitoring wells, piezometers and surface water staff gauges, further assessment of geological features, and the collection of secondary evidence through the analysis of groundwater, surface water, and spring water samples for PCBs. Details of the monitoring activities are provided in the following sections.

4.2 Groundwater Monitoring Well Installations

Prior to completion of this PMP, GM has installed ten groundwater monitoring wells in the vicinity of the Pilot Trench in order to obtain additional sampling location for monitoring of the performance of the trench (CH-61 through CH-70). These locations are provided on Table 4.1.

Seven new vertical groundwater monitoring locations were installed preceding this plan using a 6-inch diameter outer steel casing set approximately two feet into the top of the bedrock surface in order to obtain a seal from the overburden materials. The steel casing was then grouted into place using a cement-bentonite grout mixture. Once the grout was set, bedrock coring continued below the depth of the outer steel casing using a HQ core barrel. Upon completion of the coring, the corehole remain open so that the length of the cored section of bedrock is open to groundwater, where present. All monitoring wells were completed with a concrete base and a locking cap at the surface. Additional bollards were also installed around the completed monitoring wells. All wells were developed and surveyed for ground and top of casing elevations. Total depths at each location were approximately 10 feet below the bottom elevation of the constructed Pilot Trench. Table 4.1 presents the installed monitoring wells, the rationale and intended use of each of the locations, and the schedule of the proposed monitoring for the activities described herein.

Three additional groundwater monitoring wells were installed at a 30-degree angle (from vertical) to be used as additional monitoring locations to assess the performance of the Pilot Trench. These three locations were completed using an angled installation (approximately 30 degrees from vertical) in order to enhance the possibility of locating the same fractures, or fracture system identified in the videos of the completed Pilot Trench. These angled coreholes were oriented in a north-south direction in an attempt to intersect the east-west trending vertical fracture. One of the paired coreholes was located upgradient and the other one will be located downgradient of the installed Pilot Trench. Figure 4.1 show the completed locations (CH-69 and the paired locations CH-68 and CH-70). Each of these newly proposed monitoring wells were cored via HQ coring techniques and were completed at depth to a similar elevation as the previously installed wells (approximately 580 feet above mean sea level (ft. AMSL).

4.3 Groundwater and Spring Water Monitoring for PCBs

4.3.1 Background

Historical detections of PCBs in groundwater have been detected during the RFI. . Groundwater results in the area of the Pilot Trench have historically detected concentrations of PCBs at locations upgradient of the Pilot Trench location. Detections of estimated PCBs have been detected at 8 groundwater samples from 6 different wells in the shallow groundwater flow system in the area that is included within this study, ranging from estimated concentrations of 0.042J ug/L (MW-X143Y245D-1) to 2.978J u/L (MW-X143Y193CG). In all, there have been 8 detections of total PCBs from 92 samples collected. In addition, detections of PCBs were reported at 510 ug/L and 5.1 ug/L, within the intermediate groundwater flow system at monitoring well MW-X178Y367D-2 and MW-X178Y367D-3, respectively) out of 57 samples collected. However, these detections occurred during a period (May 2006) where the laboratory reported analytical issues related to a previous batch of samples that had been analyzed (non-project related). There were no detections of PCBs from samples collected in the deep groundwater flow system out of 21 collected. Spring water All results and locations are presented in Appendix H and Figures 7.1.1 through 7.1.5 located in the draft RFI Report, GHD, September 30, 2015). Figure 4.2 of this workplan also presents the historical PCB detections in groundwater.

Historical detections of PCBs in seep and spring water have been detected during the RFI. Note that many of these detections were prior to completion of Interim Measures (IM) activities. The seep water is perched groundwater located upgradient and beneath former AOI 4, which was historically discharging to the ground surface near the northern limits of the fill material in the East Plant Area. These seeps and perched groundwater have been captured through implementation of the Site Source Control (SSC) systems in those areas. This groundwater is now all being drained to Wet Well #3 and is treated prior to discharge via a NPDES permit.

There have been 4 estimated detections of the 17 surface water samples collected at the Tributary 3-3 location ranging from 0.067J to 0.13J ug/L, prior to the completion of the SSC systems and prior to the installation of the surface cap and installations of the drainage basins. There have been no detections since May 2014 at the Tributary 3-3 location. Groundwater and surface water results are presented on Figure 4.2.

There have been several springs identified during an aerial infra-red, thermal survey conducted in 2004 and subsequently verified at the ground surface. These seeps and springs were included in the Site Source Control (SSC) Study, where several samples were collected during an approximately 3 year study (note that some springs were sampled prior to the SSC program). Many of these springs have been included in subsequent soil removal and surface water controls as part of Interim Measures implementation. The following provides a brief summary for the samples collected from the seeps and springs located within and near the current Pilot Trench Monitoring Plan (many of these results were from samples collected prior to IMs):

- Four springs were previously sampled out of six identified along the Northern Tributary. Out of the 33 samples collected in total, there were 6 positive (some estimated) results for total and/or dissolved PCBs. The range of detections was from 0.33 to 6.05J ug/L located in the headwaters of the Northern Tributary. This area has since undergone an extensive soil removal IM. One additional detection of PCBs was identified further downstream at an estimated concentration of 0.947J (16 samples were collected from this location with only the one estimated detection collected during the middle of the SSC program).

- From Outfall 002 (former and current), along Bailey's Branch to the confluence of Tributary 3, Eight springs were identified prior to the completion of the water control and soil IMs. Of these 8 springs, 5 were sampled during and prior to the SSC. Detections near the headwaters (Seep 001 at Outfall 002), ranged from 0.14J (2007) to 9.9 ug/L (2004). An SSC collection system was installed during this time period. One other detection was reported from Spring 013 at 0.27 ug/L during 2004.
- There were 6 springs identified from Bailey's Scales Road along Tributary 3 to the confluence with Baily's Branch. All of these spring were located along the southern bank on Parcel 15. Of the 17 total samples collected, there was one estimated detection of PCBs at 0.096J ug/L.
- From the confluence of Tributary 3 and Bailey's Branch to the confluence of Bailey's Branch and the Northern Tributary, and including smaller ephemeral tributaries (exclusive of Spring 018, Spring 018B, and Spring 018C), Sixteen seeps and springs were identified and sampled during the SSC program. In total, 14 locations were sampled with 21 detections out of 111 samples collected along this stretch. Of those, 5 springs were located immediately downgradient of Spring 0018 Area (prior to containment). Of the 21 total detections, 14 exhibited detections ranging from 0.11J to 810 ug/L in 2004. Containment at the Spring 018 Area and remediation of the creek material has occurred subsequent to this time. The other 7 estimated detections were a little further downstream and ranged from 0.038J to 0.12J ug/L.

Figure 4.3 presents the locations and historical databoxes of the previous seeps and springs along with the currently identified thermal anomalies identified during the 2019 unmanned aerial systems (UAS) study. Several of the previous seeps and springs do not currently exist due to IM implementation. However, several current anomalies were determined to be previous seeps and springs that have been sampled for total and dissolved PCBs. All 2019 identified anomalies will be field verified, where access is granted.

4.3.2 Proposed Groundwater Monitoring

Groundwater samples for total and dissolved PCBs will be collected at 42 locations near the vicinity of the Pilot Trench and will be used as a secondary line of evidence to support and evaluate current conditions related to the performance of the Pilot Trench. Eleven of these samples will be collected from groundwater monitoring wells (existing and newly installed) and two will be collected from the two Wet Wells (3 & 4). Of the 42 locations, 7 are included in either the CA750 monitoring program or during the monthly collections at Wet Wells 3 & 4. Table 4.1 presents a list of monitoring wells and Figure 4.2 shows the locations where it is proposed to collect samples under this program.

All groundwater samples will be collected using a zero-purge sampling protocol under low-flow sampling procedures. All samples will be submitted to Test America Laboratories (TAL) for analysis of total and dissolved PCBs under normal chain of custody protocol. Samples that are not part of the CA750 program (or monthly collection) that have positive detections will be considered for inclusion in part under the CA750 program or as a separate program specifically designed for the evaluation of the trench performance. That decision will be discussed with the U.S. EPA prior to any future sampling events.

4.4 Hydraulic Monitoring Locations

The existing wells that are most appropriate for monitoring to assess performance of the Pilot Trench are listed in Table 4.1. Figure 4.1 presents the forty-nine existing locations to be monitored during this activity to assess the overall performance evaluation of the Pilot Trench, including existing monitoring wells and piezometers, the newly installed and newly proposed monitoring well locations, and staff gauge. Table 4.1 also presents the proposed schedule of water elevation collections, method of monitoring, and rationale for each location.

4.5 Piezometer Locations within Pilot Trench

Fifteen, 2-inch diameter piezometers were installed at approximate 50-foot intervals along the Pilot Trench alignment during construction. Of the 15 installed piezometers, 7 were installed to the north of WW4 and 8 were installed south of WW4. Eleven of those piezometers were installed within the Pilot Trench, along the inside groove of the vinyl sheet piling and rested on the grout base. The other four piezometers were installed along the outside groove of the vinyl sheet piling to similar depths. The purpose of installing these trench piezometers is to assist in the evaluation of the Pilot Trench hydraulic performance. Piezometer locations along the trench alignment are shown on Figure 4.1. Table 4.1 presents the frequency, method of hydraulic monitoring, and rationale two of the 15 piezometers.

4.6 Well/Piezometer Monitoring

Hydrostatic water levels will be recorded from monitoring of existing coreholes/wells/piezometers and proposed monitoring wells located downgradient and upgradient of the Pilot Trench. The proposed monitoring wells for pressure-transducer and hand measurements of hydraulic head, and schedule for monitoring are provided in Table 4.1. Water level recordings from both the installed transducers, as well as manual readings, will help to evaluate the Pilot Trench performance. Pressure transducers/data loggers will be set to record head readings every 15 minutes and will be downloaded monthly (the back-up sump at Wet Well 4 will be monitored with a pressure-transducer so that the working pump will not interfere or damage the equipment). Should it be determined that fewer, different or more locations are desirable for pressure transducers, they can be removed, moved, or added to in the future. All locations are presented on Figure 4.1. All hydraulic head measurements will be recorded more frequently during the first month of monitoring, then monthly, then quarterly in order to increase the opportunity to capture rainfall events and variable pumping rates from the operation of the trench.

4.7 Staff Gauge Monitoring

In addition to the existing and proposed monitoring wells and piezometers, one surface water staff gauge will be installed within Tributary 3, downgradient of the Pilot Trench (refer to Figure 4.1). The staff gauge will be mounted on a pipe installed within the bottom of the creek. The staff gauge will be graduated and surveyed to determine the elevation of the reference point for measurement.

Monitoring the surface water elevations will be included in the hydraulic assessment of the trench performance to help assess the groundwater-surface water interaction downgradient of the Pilot Trench. The rate of recording the surface water elevations will be the same as the hand measurement.

4.8 Thermal Imaging Reconnaissance

Prior to the preparation of this plan GM conducted a thermal image reconnaissance study along the upper portions of Bailey's Branch to identify any existing and current springs flowing into those surface waters (areas approximate coverage area is shown on Figure 4.3). The purpose of this study was to identify any new, or previously unknown springs that can be used to monitor for the presence of dye (Section 4.9) and for the collection of sample for analysis of PCBs.

To prevent the administrative burden and timing of securing access agreements and to mitigate the risks associated with a ground-based survey, unmanned aircraft systems (UAS) affixed with visible-light and infrared cameras were determined to be the best solution for identifying groundwater seeps and springs. A remote pilot certified by the Federal Aviation Administration completed operations in public airspace to collect non-identifiable imagery of the creek systems north, east, and northeast of the Facility operations. As a courtesy to neighboring property owners, GM distributed mail-out flyers to the community notifying them of the proposed UAS operations. The survey was conducted during the week of March 18, 2019, in order to capture temperature differences between the warmer groundwater and the cooler ground surface and surface water.

The thermal infrared camera utilized for this application was an uncooled VOx microbolometer with a 13mm lens capable of capturing 640x512 pixel resolution radiometric images. The sensor has a spectral band of (7.5-13.5 μm) and a scenic range -25° to 135°C. At 150 ft. above ground level, the sensor can scan a 200 ft. wide area, measure distinct thermal anomalies greater than/equal to 0.90 ft^2, and detect a temperature difference (ΔT) of 0.05 °C.

Imagery was then compiled into a thermal report, side-by-side video of visible light and identified thermal anomalies, and a visible light mosaic of the area flown.

4.9 Dye Tracer Testing

Standard Operating Procedures for the collection and analyses for the dye tracing studies presented below are described in Appendix B.

4.9.1 Previous Dye Tracer Study Near The Proposed Dye Tracer Study

Overview

On March 22, 2005, a dye trace test was conducted at the GM GPS Bedford Facility consisting of two separate injection of separate dyes near the Pilot Trench Area. The purpose of these traces was to identify groundwater flow-paths at the site. Injections were conducted in monitoring wells (bedrock and overburden). Below is a brief description of the lessons learned and results of the 2005 tests (Figure 4.7).

Lessons Learned

- AOI4 dye trace showed groundwater flow predominantly to the east, in the direction of the Pilot Trench.
- AOI4 dye trace highlighted the complicated nature of injecting dye into wells as no dye was recovered from injections at three wells. The lack of detections was likely due to poor communication with existing conduits through the system at the injection locations, resulting in inconclusive testing results.

AOI4 – Dye Trace Summary

Injection Well 1: TMW-X193Y251.

Formation: Overburden.

Injection Elevation: 659.5 ft to 654.5.35 ft.

Dye Used: Fluorescein

Injection Date: 3/22/05

Detections: 12 locations, See Table 1.

Travel Time Range: 18.6 ft/day (SSC System F) to 1.5 ft/day (SSC System B).

Arrival Time Range: 36 days (SSC System E) to 1 year 7 months (SSC System B).

Travel Direction: Predominantly east, slight northerly component.

Injection Well 2: MW-X145Y245S.

Injection Formation: St Louis Limestone.

Injection Elevation: 681.35 ft to 670.35 ft.

Dye Used: Rhodamine WT

Injection Date: 3/22/05

Detections: None. Inconclusive results.

Travel Time Range: NA.

Travel Direction: NA.

4.9.2 Goals and Objectives for Proposed Dye Tracer Study

In order to assist in assessing project requirements, the following goals and objectives are provided:

1. Enhance the understanding of the karst flow system upgradient of the Pilot Trench
2. Assist in the evaluation of the lateral and vertical extent of capture of Pilot Trench to demonstrate the effectiveness of the Pilot Trench in capturing groundwater and minimizing by-pass

4.9.3 Background Monitoring for Proposed Dye Tracer Study

In order to enhance the data collected during hydraulic head measurements, a dye tracer test will be conducted in the area of the Pilot Trench. This area was previously dye tracer tested in 2005 (HGI, 2006) with fluorescent dyes being injected in the overburden (Fluoroscein), and shallow bedrock (Rhodamine WT). These two dyes are preferred when using two at one time due to the larger wavelength separation in laboratory detection techniques, in case of potential mixing of dye-injected water. Prior to injection of any new dyes, the proposed network will be sampled for background conditions to determine whether any prior dyes remain in the system before new testing at the locations described in Table 4.1 and depicted on Figures 4.5 and 4.6

4.9.4 Dye Injection for Proposed Dye Tracer Study

GM will monitor a large network of monitoring well locations, as well as surface water and spring water locations for the presence of dye, including a thorough dye background monitoring program prior to the final selection of dye types and prior to dye injection. The base set of surface water and spring water sampling locations will be based on the previous locations sampled during the AOI4 dye tracing study, where locations are still available. Additional surface water and spring water locations may be added based on the thermal photographic and visual reconnaissance that was conducted as part of this PMP (Section 4.8).

The overall success of any dye tracing is a direct result of the appropriateness and inter- connection of the dye introduction locations. It is undesirable to introduce dye into a location that is in poor connection to the bedrock drainage network, which could result in inconclusive results. It should be noted that PCBs have been primarily found in the shallow karstic groundwater system, and as such, it is appropriate to inject into that system. GM will not be evaluating injection locations in units where PCBs have not been identified in the past sampling. The following text discusses two general testing locations as they relate to distance from the Pilot Trench (Near Field and Far Field). The Near Field locations were chosen based on existing and proposed locations that can best demonstrate the horizontal performance of the Pilot Trench in capturing any groundwater in the vicinity of the trench. The second test, Far Field, was chosen by virtue of the vault underdrain system to distribute dye into the karst flow system , that it represents a potential PCB-impacted groundwater source and to assist in the understanding of the potential for groundwater in the northern portion of the East Plant Area to be captured by the Pilot Trench.

Two dye tracer tests are being proposed under the PMP. The first test will be to inject dye in three areas immediately upgradient of the Pilot Trench. The initial injection is proposed at CH-20 (mid-section of the trench which extends deeper into the bedrock), with a second injection of the same fluorescent dye at either end of the Pilot Trench, at a minimum of one month after the first, at the proposed angled wells (CH-68 and CH-69) and will include up to six months monitoring at downgradient locations (referred to as the Near Field testing). These injections will be focused on potential pathways in the immediate upgradient area of the trench to gauge the vertical and horizontal effectiveness of the Pilot Trench at collecting groundwater that flows within this northern bedrock valley. Figure 4.5 presents the proposed tracer injection and monitoring locations. The purpose of this testing, along with the results of head measurements, will be to assist in the assessment of the hydraulic capture of the Pilot Trench operation. Table 4.1 presents the proposed locations to be monitored for both of these injections.

At the conclusion of the Near Field test, a second dye trace test, referred to as the Far Field test, will inject a different fluorescent dye within the Vault Gravel Underdrain System (GUS) using the Vault cleanouts and will be monitored at the same locations as the first dye injection. In addition, the monitoring network will be expanded to include other locations south and north of the injected area. Table 4.1 presents the locations to be monitored during this separate dye tracer study.

This second study (Far Field) will be conducted at the GUS to evaluate groundwater flow farther upgradient of the Pilot Trench in an area hydraulically connected to the northern bedrock valley. In addition, the GUS has PCB-impacted groundwater and is hydraulically connected to the shallow groundwater flow system. Figure 4.6 presents the dye injection location and monitoring locations for the GUS dye tracing testing. Monitoring at well locations under this program will also be for a duration of six months. Given that the surface and spring water locations are potentially longer travel times from the injection location, the sampling for dye at surface water and spring water, as identified through completion of the thermal and visual reconnaissance, may be extended for three additional months. While exact travel times are not necessary to assess either general groundwater flow nor the Pilot Trench capture potential, this evaluation (using charcoal packs) will record relative travel times for dyes to reach various sampling locations.

The final PMP monitoring locations for sampling for dissolved and total PCBs at surface water and spring water locations will be dependent on only those locations with positive dye detections. The proposed monitoring sampling network will be sampled regardless of the outcome of the dye tracing study. The monitoring well and final surface water/spring water PCB sampling will help assess the broader understanding of the distribution of PCBs in the area of the trench, as well as potentially assist in the assessment of the performance of the Pilot Trench. Locations noted above may be re-sampled during the subsequent CA750 sampling event if PCB concentrations above the reporting limit are detected. This decision will be discussed with the U.S. EPA prior to future sampling events.

The water that will be injected with dye tracers will likely be captured via Wet Well 3 and Wet Well 4, which will be sent to the groundwater treatment plant for treatment with activated granular carbon. The discharge of the treated water (Outfall 003/004) is then sent to a common discharge location on the Facility property prior to reaching the surface waters of Tributary 3. This location will be monitored for the presence of any dye that may not have been removed through the treatment process. Though unlikely, if dye is detected within the discharged water and allowed to move downstream, any potential future dye detections downstream of the Outfall may be compromised and the analysis/interpretation of those results may be impossible to distinguish between groundwater discharge of dyed water downstream and the discharged water from the treatment process. Surface water within portions of Bailey's Branch and Tributary 3 are known to recharge the groundwater prior to returning to discharge downstream to the surface water.

4.9.5 Dye Monitoring and Schedule for Proposed Dye Tracer Study

Monitoring for background conditions and for the detection of the injected dyes will be at the locations presented in Figures 4.5 and 4.6. Monitoring will be completed through the collection of groundwater samples at the locations identified by means of pumps installed at the Waterloo well locations and through the placement and retrieval of charcoal packs, as described in Table 4.1. The frequency of sampling will vary by locations. Table 4.1 presents the locations, anticipated method of sample collection, and anticipated schedule and duration for the twenty-three locations to be monitored for the presence of dye after injection. It should be noted that if a dye is not detected within a six month period, then the test will be deemed complete and that the fractures did not connect enough to form a pathway to the trench. In this case, the need for any additional testing will be evaluated and discussed with the U.S. EPA.

4.9.6 Quality Assurance/Quality Control

Field and laboratory standard operational procedures for the collection and analysis of fluorescent dye samples can be located in Appendix B to this PMP.

4.10 GWTP Monitoring

Monitoring activities for the GWTP includes sampling of the treated discharge as required by the NPDES permit. The discharged water is tested monthly for PCBs, Oil and Grease (HEM), and Total Suspended Solids (TSS). The GWTP monitoring will be reviewed as part of the scope of the Pilot Trench monitoring. GWTP operational samples include monthly monitoring of the system influent (including wet wells and vault sumps). All sampling regarding the GWTP will be reported in Quarterly Progress Reports and the CA750 Reports.

4.11 Data Quality and Analyses

4.11.1 Data Quality Objectives

Problem Statements

- Does the groundwater above the competent bedrock in the northern portion of the East Plant Area preferentially flow into the northern bedrock drainage valley and to the Pilot Trench?
- Do lines of evidence support a determination that the Pilot Trench operates as designed in capturing contaminated groundwater present above competent bedrock, thereby preventing contaminated groundwater from migrating beyond the trench at levels which would result in an unacceptable risk to human health and the environment?

Study Goals

The goal of this study is to assess groundwater flow in the northern portion of the East Plant in relation to the groundwater above competent bedrock horizontal capture performance of the installed Pilot Trench with respect to this area. The study will gather relevant data and information, employ various techniques and use a multiple lines of evidence approach (e.g., existing geologic conditions as observed through bedrock corings and trench face evaluation through visual and video observation, ground penetrating radar, packer-pressure testing, groundwater head measurements and evaluation, PCB sampling of groundwater and spring water, dye tracer testing results, etc.), to evaluate the performance of the Pilot Trench relative to the design intent of capturing the horizontal groundwater flow above competent bedrock. Each line of evidence is described below.

Information Inputs

The following types of data input will be evaluated during this study.

Each of these lines of evidence, while individually not adequately define the overall capture performance of the Pilot Trench, can be used to assess trench performance:

- Existing overall geologic conditions as determined through installation of coreholes, visual examination or collected cores, packer-pressure testing for hydraulic conductivity, downhole geophysical data collection and evaluation, the evaluation of the completed trench faces through the design process, and the installation of new vertical and angled coreholes post trench construction.
- Hydraulic head measurements will be collected from a suite of monitoring wells at differing elevations that will provide the direction of groundwater flow, evaluation of hydraulic gradients, and seasonal and weather-related episodic conditions. Data will be collected both manually and with pressure transducers installed in select monitoring wells.
- Sampling of PCBs in groundwater monitoring wells, collected trench water and spring and surface water will also be collected as part of the multiple line of evidence approach. These data will be evaluated as part of the multiple lines of evidence approach.
- Dye tracer studies can provide information on groundwater flow from point A to point B so as to create a general picture of where groundwater may be flowing through the subsurface karstic system. They can also be used, in combination with other supporting lines of evidence, to assess where groundwater may not be readily flowing (within the time constraints of the study). In addition, dye introduced in a source area that subsequently shows at a distal location is not a sole indicator that any contamination would ever have been detected at the distal location, as the dye tracer is more soluble and conservative than a contaminant migrating. Conversely, the absence of dye at a distal location does not necessarily indicate that such a sampling point have never, nor would ever receive any migrating contamination from the point of introduction.

Because there are no other scientific methods available to be able to map the actual subsurface conduits, this study will use each line of evidence together to provide a reasonable review of the Pilot Trench Performance.

Study Boundaries

Vertically, the study is primarily bounded by the shallow groundwater flow system, which is underlain by the top of the competent bedrock. While, there will be checks on monitoring wells in the intermediate and deep flow systems, data to date have shown that the majority of the contamination at the Facility is limited to the upper portions of groundwater flow which is dominated by karstic and significantly fractured rock. Horizontally, the study will include upgradient, side gradient, and downgradient locations within the northern portion of the East Plant Area of the Facility, near the Pilot Trench Area (The attached figure presents the horizontal physical boundaries). Each study, or line of evidence, will have slightly different boundaries specific to that task, as described in the above scope of work

Analytic Approach

- Continuing assessment of the geologic conditions will be augmented through the installation of the new vertical and angled coreholes
- Hydraulic head measurement will be completed through hand measurement and pressure-transducers, in accordance with the existing QAPP for the RFI
- Groundwater, collected trench water, surface water, and spring water will be sampled in accordance with the existing QAPP for the RFI

Dye tracer tested will be completed by fluorescent dye injection, sampling of grab and charcoal packs, and analyses at a fixed facility laboratory, in accordance with Appendix B.

Performance or Acceptance Criteria

The collected analytical data will be evaluated as follows:

- Hydraulic head will be measured to the nearest 0.01'. These data will be plotted on graphs showing head trends at each location along with recorded rainfall. These data will also be selectively presented as potentiometric surface figures in order to illustrate relationships between rainfall and the pumping operations at the Pilot Trench. The pumps within WW#3 and WW#4 may also be temporarily shut down in order to monitor the recovery of the aquifer and then re-started to monitor the response to pumping. GM will also be recording the staff gauge for surface water elevations at the Tributary 3-3 location. These head evaluations will provide, in part, a more complete definition of the general capture zone for the Pilot Trench operations.
- Groundwater, collected trench water, surface water, and spring water sampling will include total and dissolved PCBs. Interpreting sample results can be challenging due to the potential for particulates, which preferentially retain PCBs, being inadvertently introduced into the sample during the collection process. The results of this sampling will provide a current condition for the presence or absence of PCBs at individual locations. Groundwater sampling will continue at twice per year thereafter at the locations included in the EI CA750 program. Additional locations may be added for further evaluation and will be discussed with the U.S. EPA prior to proceeding.
- Dye tracing results will be analyzed from grab and charcoal sample collected at locations presented in Table 4.1. Final spring and seep sample locations, will be agreed upon in consultation with the U.S. EPA, and will be based on current conditions resulting from the completed thermal study, as well as previously collected seep and spring samples. The actual dyes that will be used will be based on a thorough background sampling to identify if any previously used dyes are still present within the groundwater system. The results of the monitoring after dye injection will assist in the evaluation of the performance of the Pilot Trench operations and will provide a better understanding of flow patterns in the area. Specific rates of travel through the karstic rock, though not the goal of, nor needed for, the study, will also be calculated based on distance traveled and sample collection time associated with a positive laboratory result.

4.11.2 Data Analysis

The shallow groundwater potentiometric surface in the area of the Pilot Trench is influenced by the topography of the historical bedrock drainage valley defining Tributary 3 (Figure 2.1). The shallow groundwater potentiometric contouring in the Pilot Trench area shown on Figure 4.8 illustrates this influence prior to the completion of the East Plant Area Cover System. The potentiometric contours shown on Figure 4.8 are based on groundwater conditions in December 2010. Figures 4.9 to 4.12 present the shallow groundwater potentiometric contours from yearly monitoring prior to the Pilot Trench completion and yearly monitoring after the Pilot Trench construction. Figures 4.13 to Figure 4.16 depict the shallow groundwater potentiometric surfaces after operation of the Pilot Trench began in March 2016, Figure 17 depicts a graphical chart of hydraulic heads from selected existing wells in the area prior and subsequent to the Pilot Trench completion. As can be seen in the progression of potentiometric surfaces, the influence of the Pilot Trench has lowered the potentiometric surface near the trench and increased the hydraulic gradients toward the trench at upgradient and side-gradient locations, as well as increased the area of capture of the shallow groundwater. Because the pump operates in a cyclic manner (i.e., activated by a high-float switch), steady-state conditions may never be technically realized. However, it is anticipated that a steady-shape will be clearly demonstrated. Continual monitoring of the proposed network will provide useful data for the evaluation to be completed under the Corrective Measures Proposal (CMP). The data collected from the dye tracing (Section 4.9) and the hydraulic head monitoring will be evaluated in a similar fashion as shown in Figures 4.8 to 4.16. Other analyses may include point-by-point data evaluation between monitored locations, time trends for seasonal pumping fluctuations and precipitation, hydraulic gradients, surface water-groundwater interaction downgradient of the trench, and comparison to previous dye tracing for a more complete evaluation of the performance of the Pilot Trench.

U.S.EPA has requested that GM include PCB sampling as a “secondary line of evidence” to supplement the dye trace testing and hydraulic monitoring. GM has stated its concerns with relying on PCB groundwater results without additional lines of evidence for purposes of assessing the performance of the Pilot Trench collection system. Some of these concerns include:

- There is a possibility for sampling artifacts. It is possible that PCBs migrated beyond the Pilot Trench prior to its installation and came to be adsorbed onto unconsolidated materials lining weathered fracture faces or unconsolidated materials deposited in grikes or other solution-widened elements of the bedrock drainage network. If such features happen to be penetrated by a monitoring well located downgradient of the Pilot Trench, the sampling process could mobilize particulate matter to which PCBs are adsorbed, entraining them in the sample. Thus, the PCBs detected in the sample would not be indicative of PCBs moving with the groundwater, but rather of historical, immobile PCBs sorbed to the aquifer matrix and would have no relation to the operation of the Pilot Trench.
- There is a possibility that some groundwater in more stagnant portions of the bedrock downgradient of the trench (for example, in tight fractures or in the matrix pore water) contains PCBs from historical migration prior to installation of the Pilot Trench. Such “pre-existing” PCBs, which would be moving very slowly toward more active elements of the bedrock flow system, would not be relevant to the performance of the trench.

- There are potential challenges associated with the ability of laboratories to consistently and accurately detect and report very low concentrations of PCBs in groundwater samples and sometimes false detects occur. To minimize this potential GM will rely on one laboratory so that a consistent detection/non-detection and identification of the specific Aroclor patterns will be reported. An additional laboratory may be used if any difficulties are noted at the original lab.
- There are potential challenges associated with potential entrained sediment, or colloidal material, from surface water and/or spring water, after remediation to the cleanup standards (Ewers, et.al., 2012)

If PCBs are detected downgradient of the Pilot Trench, they will be evaluated in light of the above potential issues with the data, which may include additional sampling or other potential additional investigation.

As a result, data analysis of each monitoring activity individually, and in combination, will sufficiently document the hydraulic capture capability of the installed Pilot Trench. Individually, the dye tracer results will show a conservative groundwater flow pathway from the point of injection to points of detection qualitatively. The detailed hydraulic head evaluation through time will show a generalized flow pattern of the Shallow groundwater flow system in this area. PCB sampling will provide a current snapshot of existing concentrations in groundwater and surface water, which may result in additional sampling in the future. All, in combination, will provide demonstration of the overall performance of the Pilot Trench in the capture and treatment of the Shallow groundwater flow system in reducing, or eliminating, potential contaminant migration in this system from moving off-Site.

5. Reporting

Note that not all data collected under the thermal and dye tracer studies, or the PCB sampling may end up being directly related to the performance of the Pilot Trench. However, all data will be provided, summarized, and described as to the relative usefulness in evaluating the performance of the Pilot Trench hydraulic control. All results of the activities described under the PMP will also be evaluated as to any data gaps identified that may be relevant to the Pilot Trench and/or any potential future IMs at the Facility.

GM may also request future modifications to this proposed performance monitoring program based on the performance of the Pilot Trench through evaluation of the data, described herein.

6. References

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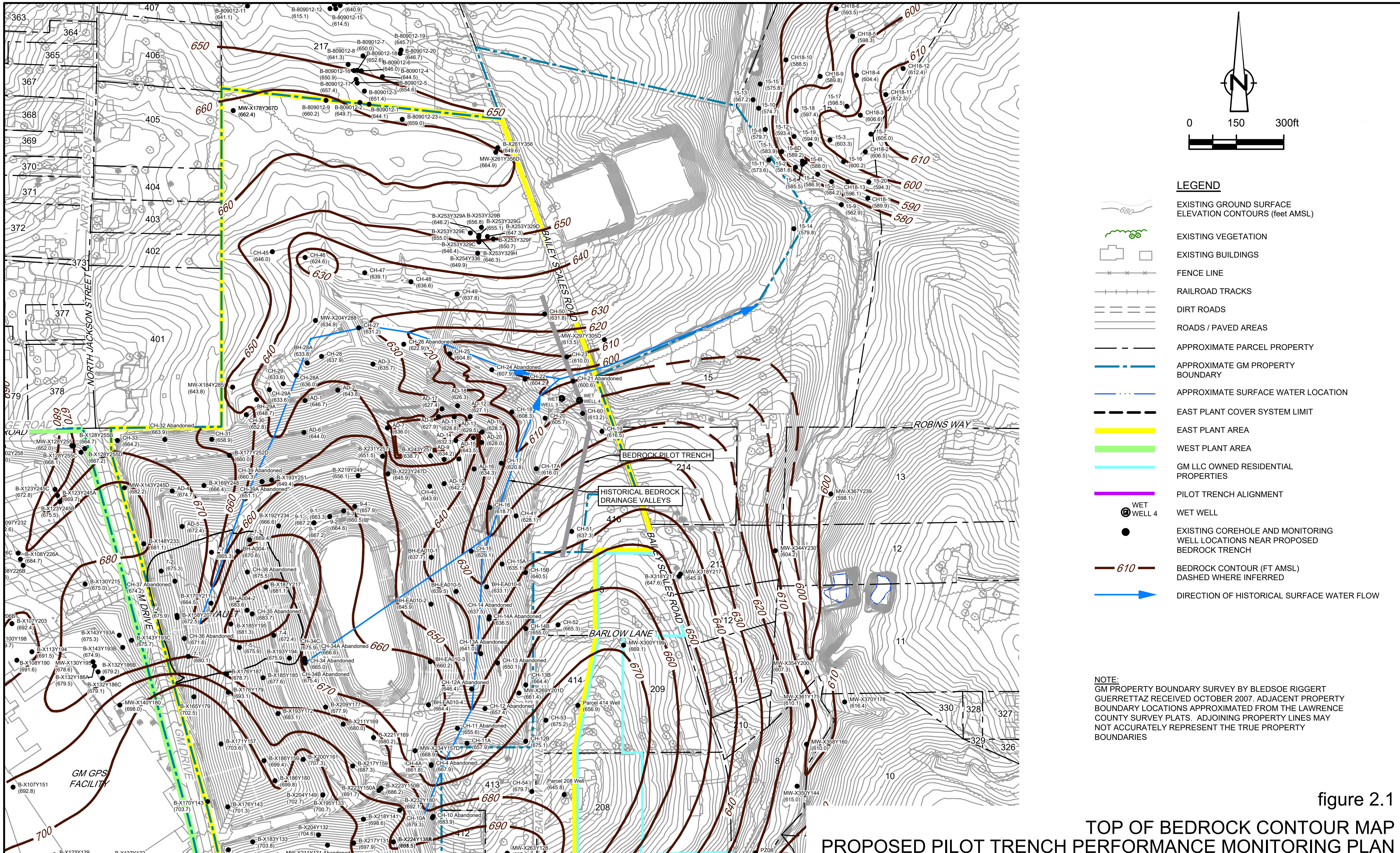

NOTE:
GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

figure 2.1

TOP OF BEDROCK CONTOUR MAP
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

GHD

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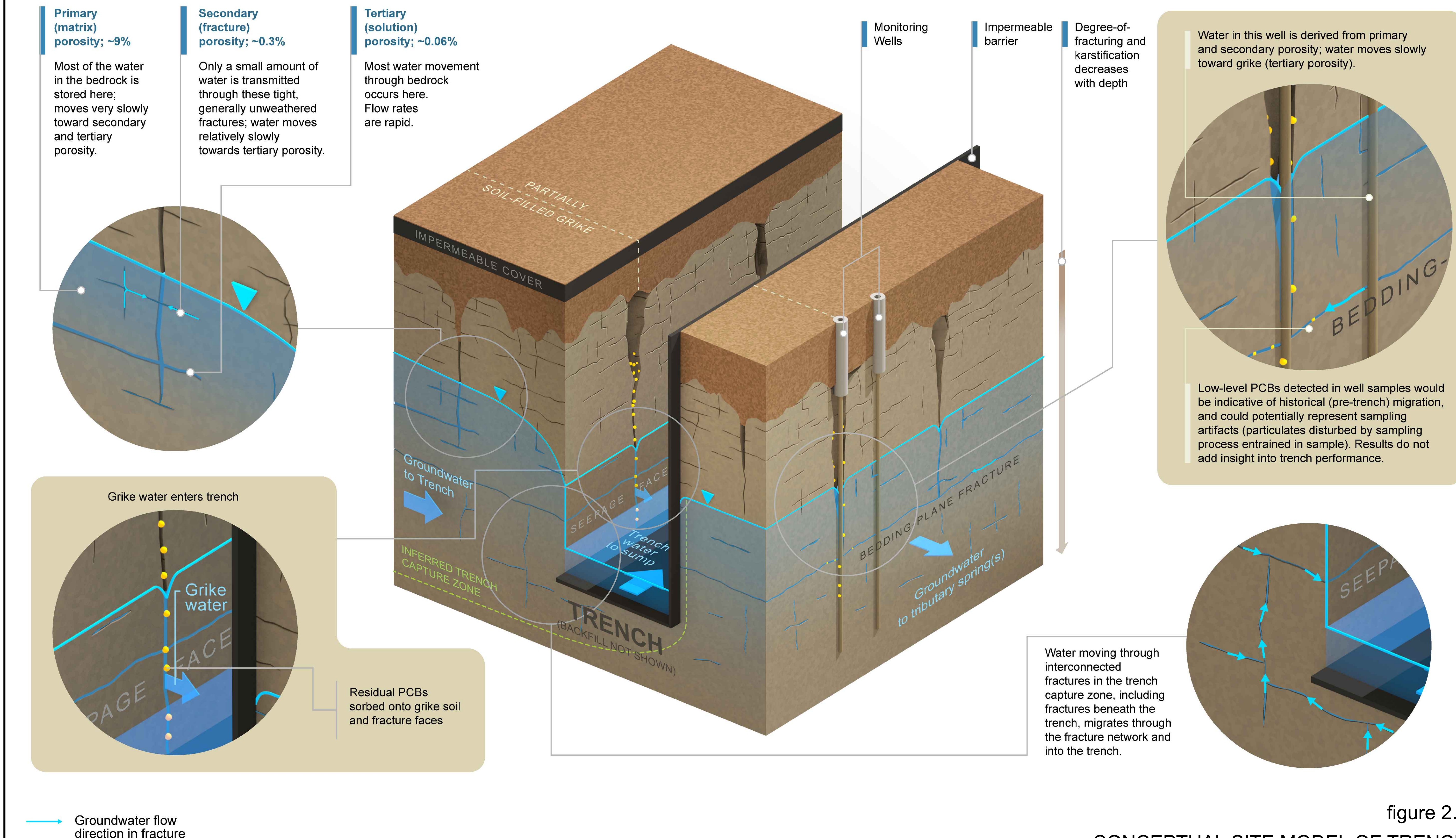

GHD

NOT TO SCALE

figure 2.2

CONCEPTUAL SITE MODEL OF TRENCH
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
Bedford, Indiana

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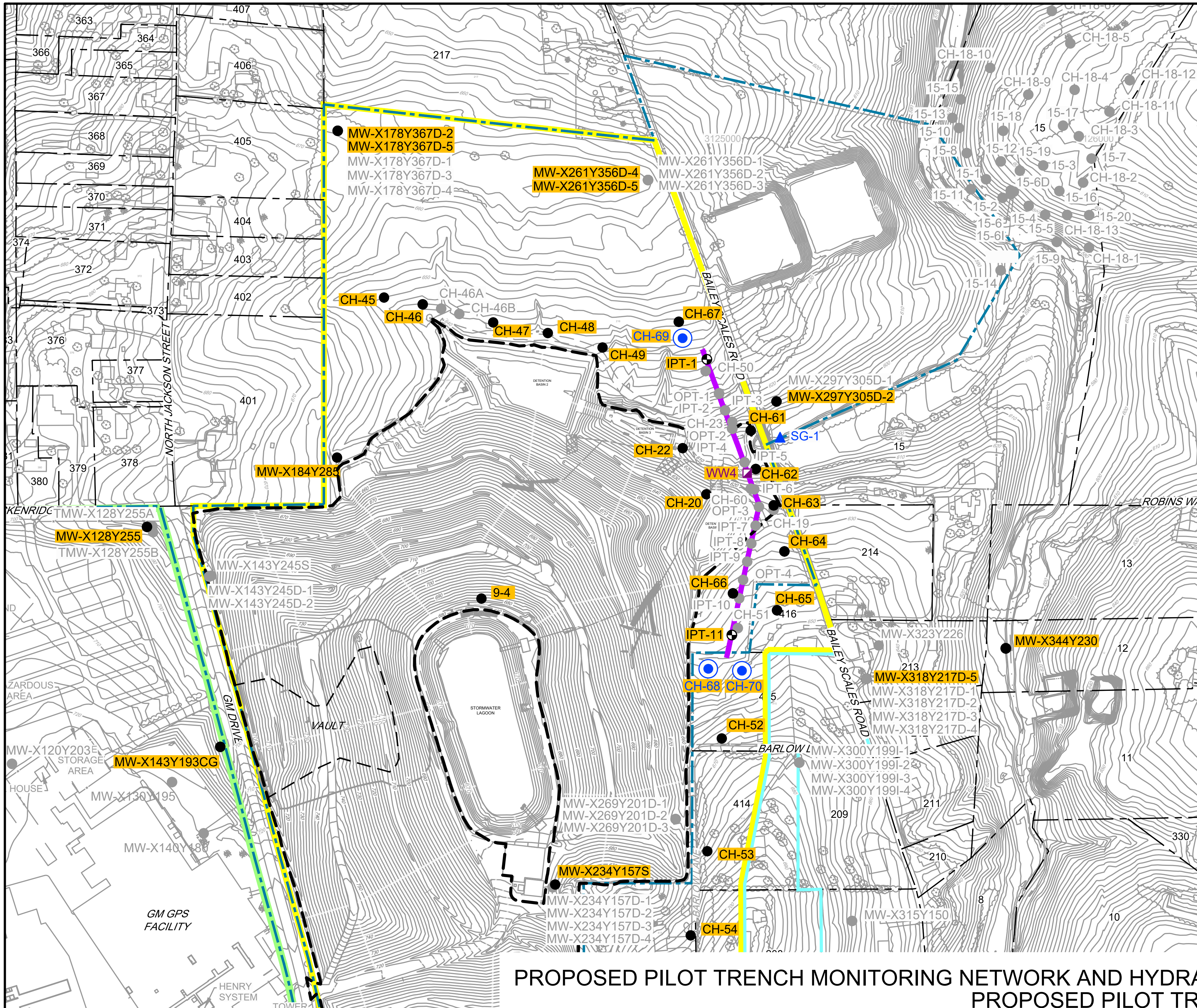

LEGEND

- GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- FENCE LINE
- SURFACE WATER
- APPROXIMATE GM PROPERTY BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY
- STAFF GAUGE LOCATION
- EAST PLANT COVER SYSTEM LIMIT
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- WET WELL
- EXISTING COREHOLE AND MONITORING WELL LOCATIONS NEAR PROPOSED BEDROCK TRENCH
- EXISTING PIEZOMETER LOCATION
- LOCATION TO BE MONITORED FOR HYDRAULIC CONTROL
- RECENTLY INSTALLED MONITORING WELL AND PIEZOMETER LOCATION
- EXISTING MONITORING WELL LOCATIONS NOT BEING USED IN INVESTIGATION

NOTE:
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figure 4.1

PROPOSED PILOT TRENCH MONITORING NETWORK AND HYDRAULIC CONTROL MONITORING LOCATIONS
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

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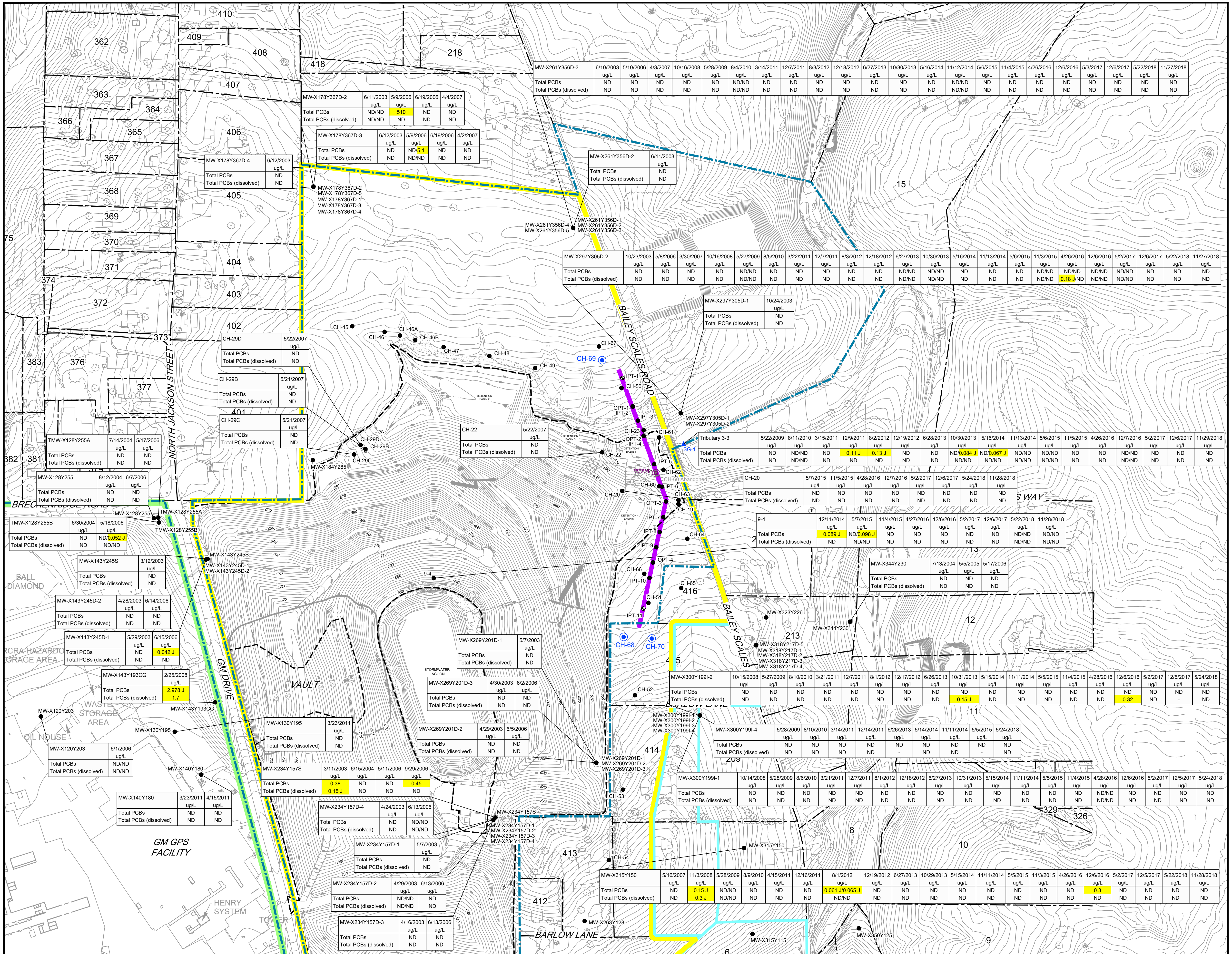

MW-X261Y356D-3	6/10/2003 ug/L	5/10/2006 ug/L	4/3/2007 ug/L	10/16/2008 ug/L	5/28/2009 ug/L	8/4/2010 ug/L	3/14/2011 ug/L	12/7/2011 ug/L	8/3/2012 ug/L	12/18/2012 ug/L	6/27/2013 ug/L	10/30/2013 ug/L	5/16/2014 ug/L	11/12/2014 ug/L	5/6/2015 ug/L	11/4/2015 ug/L	4/26/2016 ug/L	12/6/2016 ug/L	5/3/2017 ug/L	12/6/2017 ug/L	5/22/2018 ug/L	11/27/2018 ug/L
Total PCBs	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND	ND	ND

MW-X178Y367D-2	6/11/2003 ug/L	5/9/2006 ug/L	6/19/2006 ug/L	4/4/2007 ug/L
Total PCBs	ND/ND	510	ND	ND
Total PCBs (dissolved)	ND/ND	ND	ND	ND

MW-X178Y367D-3	6/12/2003 ug/L	5/9/2006 ug/L	6/19/2006 ug/L	4/2/2007 ug/L
Total PCBs	ND	ND/5.1	ND	ND
Total PCBs (dissolved)	ND	ND/ND	ND	ND

MW-X178Y367D-4	6/12/2003 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

MW-X261Y356D-2	6/11/2003 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

MW-X297Y305D-2	10/23/2003 ug/L	5/8/2006 ug/L	3/30/2007 ug/L	10/16/2008 ug/L	5/27/2009 ug/L	8/5/2010 ug/L	3/22/2011 ug/L	12/7/2011 ug/L	8/3/2012 ug/L	12/18/2012 ug/L	6/27/2013 ug/L	10/30/2013 ug/L	5/16/2014 ug/L	11/13/2014 ug/L	5/6/2015 ug/L	11/3/2015 ug/L	4/26/2016 ug/L	12/6/2016 ug/L	5/2/2017 ug/L	12/6/2017 ug/L	5/22/2018 ug/L	11/27/2018 ug/L
Total PCBs	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND/ND	ND/ND	ND	ND	ND	ND/ND	ND/ND	ND/ND	ND/ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND/ND	ND/ND	ND	ND	ND	ND/ND	0.18 J/ND	ND/ND	ND/ND	ND	ND	ND

MW-X297Y305D-1	10/24/2003 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

CH-29D	5/22/2007 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

CH-29B	5/21/2007 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

CH-29C	5/21/2007 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

CH-22	5/22/2007 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

TMW-X128Y255A	7/14/2004 ug/L	5/17/2006 ug/L
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

MW-X128Y255	8/12/2004 ug/L	6/7/2006 ug/L
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

TMW-X128Y255B	6/30/2004 ug/L	5/18/2006 ug/L
Total PCBs	ND	ND/0.052 J
Total PCBs (dissolved)	ND	ND/ND

Tributary 3-3	5/22/2009 ug/L	8/11/2010 ug/L	3/15/2011 ug/L	12/9/2011 ug/L	8/2/2012 ug/L	12/19/2012 ug/L	6/28/2013 ug/L	10/30/2013 ug/L	5/16/2014 ug/L	11/13/2014 ug/L	5/6/2015 ug/L	11/5/2015 ug/L	4/26/2016 ug/L	12/7/2016 ug/L	5/2/2017 ug/L	12/6/2017 ug/L	11/29/2018 ug/L
Total PCBs	ND	ND/ND	ND	0.11 J	0.13 J	ND	ND	ND/0.084 J	ND/0.067 J	ND/ND	ND/ND	ND	ND	ND/ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND/ND	ND	ND	ND	ND	ND	ND/ND	ND/ND	ND/ND	ND/ND	ND	ND	ND/ND	ND	ND	ND

CH-20	5/7/2015 ug/L	11/5/2015 ug/L	4/28/2016 ug/L	12/7/2016 ug/L	5/2/2017 ug/L	12/6/2017 ug/L	5/24/2018 ug/L	11/28/2018 ug/L
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND	ND

9-4	12/11/2014 ug/L	5/7/2015 ug/L	11/4/2015 ug/L	4/27/2016 ug/L	12/6/2016 ug/L	5/2/2017 ug/L	12/6/2017 ug/L	5/22/2018 ug/L	11/28/2018 ug/L
Total PCBs	0.089 J	ND/0.098 J	ND	ND	ND	ND	ND	ND/ND	ND/ND
Total PCBs (dissolved)	ND	ND/ND	ND	ND	ND	ND	ND	ND/ND	ND/ND

MW-X143Y245S	3/12/2003 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

MW-X344Y230	7/13/2004 ug/L	5/5/2005 ug/L	5/17/2006 ug/L
Total PCBs	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND

MW-X143Y245D-2	4/28/2003 ug/L	6/14/2006 ug/L
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

MW-X143Y245D-1	5/29/2003 ug/L	6/15/2006 ug/L
Total PCBs	ND	0.042 J
Total PCBs (dissolved)	ND	ND

MW-X269Y201D-1	5/7/2003 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

MW-X143Y193CG	2/25/2008 ug/L
Total PCBs	2.978 J
Total PCBs (dissolved)	1.7

MW-X269Y201D-3	4/30/2003 ug/L	6/2/2006 ug/L
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

MW-X300Y199I-2	10/15/2008 ug/L	5/27/2009 ug/L	8/10/2010 ug/L	3/21/2011 ug/L	12/7/2011 ug/L	8/1/2012 ug/L	12/17/2012 ug/L	6/26/2013 ug/L	10/31/2013 ug/L	5/15/2014 ug/L	11/11/2014 ug/L	5/5/2015 ug/L	11/4/2015 ug/L	4/28/2016 ug/L	12/6/2016 ug/L	5/2/2017 ug/L	12/5/2017 ug/L	5/24/2018 ug/L
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND	ND	0.15 J	ND	ND	ND	ND	ND	0.32	ND	-	ND

MW-X130Y195	3/23/2011 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

MW-X269Y201D-2	4/29/2003 ug/L	6/5/2006 ug/L
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

MW-X300Y199I-4	5/28/2009 ug/L	8/10/2010 ug/L	3/14/2011 ug/L	12/14/2011 ug/L	6/26/2013 ug/L	5/14/2014 ug/L	11/11/2014 ug/L	5/5/2015 ug/L	5/24/2018 ug/L
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	-	ND	ND	-	ND

MW-X120Y203	6/1/2006 ug/L
Total PCBs	ND/ND
Total PCBs (dissolved)	ND/ND

MW-X234Y157S	3/11/2003 ug/L	6/15/2004 ug/L	5/11/2006 ug/L	9/29/2006 ug/L
Total PCBs	0.38	ND	ND	0.45
Total PCBs (dissolved)	0.15 J	ND	ND	ND

MW-X300Y199I-1	10/14/2008 ug/L	5/28/2009 ug/L	8/6/2010 ug/L	3/21/2011 ug/L	12/7/2011 ug/L	8/1/2012 ug/L	12/18/2012 ug/L	6/27/2013 ug/L	10/31/2013 ug/L	5/15/2014 ug/L	11/11/2014 ug/L	5/5/2015 ug/L	11/4/2015 ug/L	4/28/2016 ug/L	12/6/2016 ug/L	5/2/2017 ug/L	12/5/2017 ug/L	5/24/2018 ug/L
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND

MW-X140Y180	3/23/2011 ug/L	4/15/2011 ug/L
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

MW-X234Y157D-4	4/24/2003 ug/L	6/13/2006 ug/L
Total PCBs	ND	ND/ND
Total PCBs (dissolved)	ND	ND/ND

MW-X234Y157D-1	5/7/2003 ug/L
Total PCBs	ND
Total PCBs (dissolved)	ND

MW-X315Y150	5/16/2007 ug/L	11/3/2008 ug/L	5/28/2009 ug/L	8/9/2010 ug/L	4/15/2011 ug/L	12/16/2011 ug/L	8/1/2012 ug/L	12/19/2012 ug/L	6/27/2013 ug/L	10/29/2013 ug/L	5/15/2014 ug/L	11/11/2014 ug/L	5/5/2015 ug/L	11/3/2015 ug/L	4/26/2016 ug/L	12/6/2016 ug/L	5/2/2017 ug/L	12/5/2017 ug/L	5/22/2018 ug/L	11/28/2018 ug/L
Total PCBs	ND	0.15 J	ND/ND	ND	ND	ND	0.061 J/0.065 J	ND	ND	ND	ND	ND	ND	ND	ND	0.3	ND	ND	ND	ND
Total PCBs (dissolved)	ND	0.3 J	ND/ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

MW-X234Y157D-2	4/29/2003 ug/L	6/13/2006 ug/L
Total PCBs	ND/ND	ND
Total PCBs (dissolved)	ND/ND	ND

MW-X234Y157D-3	4/16/2003 ug/L	6/13/2006 ug/L
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

Nº	Revision	Date	Initial

0 75 150ft

LEGEND

- GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- FENCE LINE
- SURFACE WATER
- APPROXIMATE GM PROPERTY BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY
- PROPOSED STAFF GAUGE
- EAST PLANT COVER SYSTEM LIMIT
- EAST PLANT AREA BOUNDARY
- WEST PLANT AREA BOUNDARY
- GM LLC OWNED RESIDENTIAL PROPERTIES
- PILOT TRENCH ALIGNMENT
- WET WELL
- MONITORING WELL LOCATION
- EXISTING PIEZOMETER LOCATION
- RECENTLY INSTALLED MONITORING WELL AND PIEZOMETER LOCATION
- DETECTION

NOTE:
GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

GM GPS BEDFORD FACILITY
BEDFORD, INDIANA

PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM

GROUNDWATER
ANALYTICAL RESULTS

GHD

Source Reference:

Project Manager: K. Kamm	Reviewed By: J. Luzwick	Date: August 2019	
Scale: as shown	Project Nº: 13968-00	Report Nº: 404	Drawing Nº: figure 4.2

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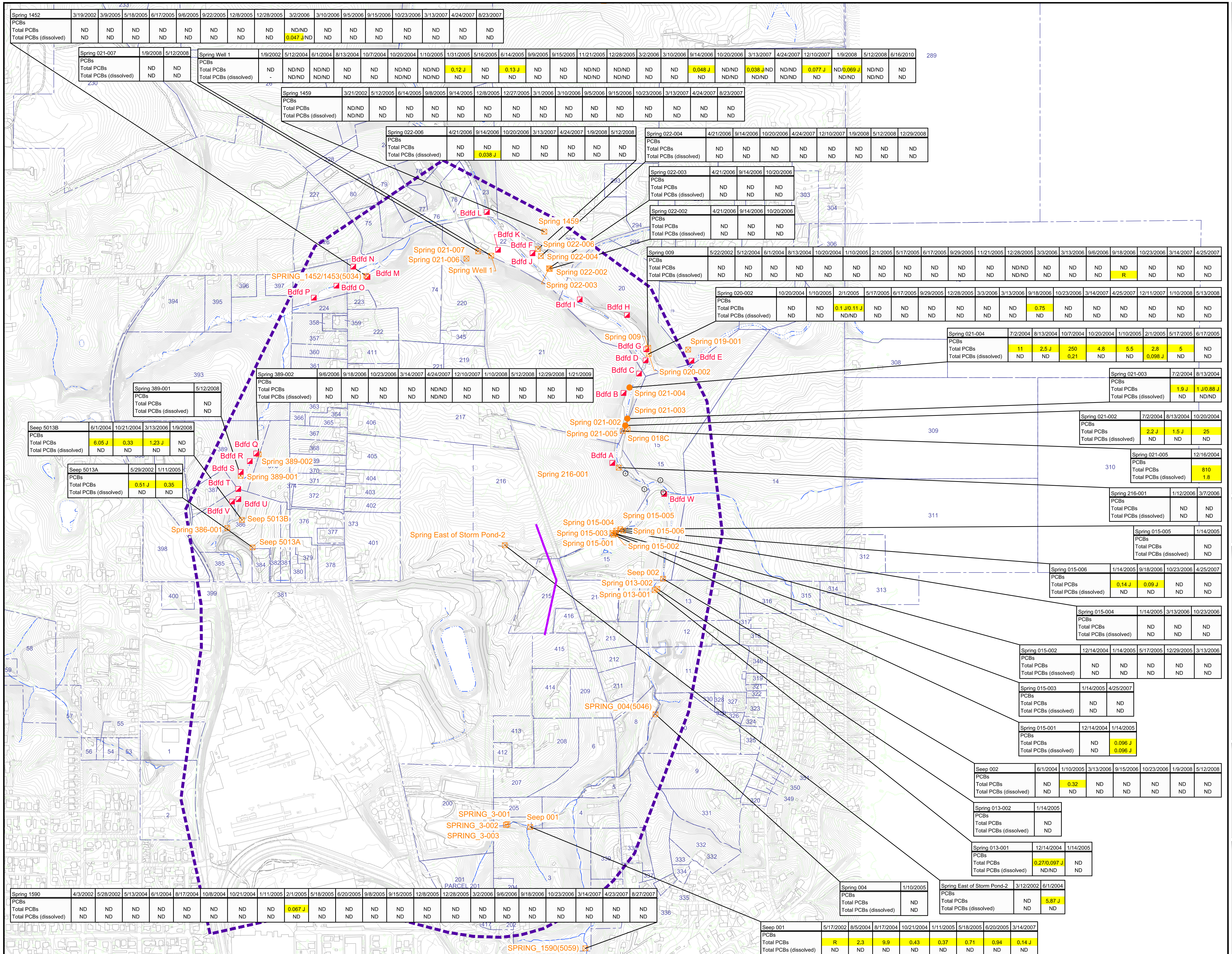

Spring 1452	3/19/2002	3/9/2005	5/18/2005	6/17/2005	9/6/2005	9/22/2005	12/8/2005	12/28/2005	3/2/2006	3/10/2006	9/5/2006	9/15/2006	10/23/2006	3/13/2007	4/24/2007	8/23/2007
PCBs																
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND	ND	0.047 J/ND	ND	ND	ND	ND	ND	ND	ND

Spring 021-007	1/9/2008	5/12/2008
PCBs		
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

Spring Well 1	1/9/2002	5/12/2004	6/1/2004	8/13/2004	10/7/2004	10/20/2004	1/10/2005	1/31/2005	5/16/2005	6/14/2005	9/9/2005	9/15/2005	11/21/2005	12/28/2005	3/2/2006	3/10/2006	9/14/2006	10/20/2006	3/13/2007	4/24/2007	12/10/2007	1/9/2008	5/12/2008	6/16/2010
PCBs																								
Total PCBs	ND	ND/ND	ND/ND	ND	ND	ND/ND	ND/ND	0.12 J	ND	0.13 J	ND	ND	ND/ND	ND/ND	ND	ND	0.048 J	ND/ND	0.038 J/ND	ND/ND	0.077 J	ND/0.069 J	ND/ND	ND
Total PCBs (dissolved)	-	ND/ND	ND/ND	ND	ND	ND/ND	ND/ND	ND	ND	ND	ND	ND	ND/ND	ND/ND	ND	ND	ND	ND/ND	ND/ND	ND/ND	ND	ND/ND	ND/ND	ND

Spring 1459	3/21/2002	5/12/2005	6/14/2005	9/8/2005	9/14/2005	12/8/2005	12/27/2005	3/1/2006	3/10/2006	9/5/2006	9/15/2006	10/23/2006	3/13/2007	4/24/2007	8/23/2007
PCBs															
Total PCBs	ND/ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND/ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Spring 022-006	4/21/2006	9/14/2006	10/20/2006	3/13/2007	4/24/2007	1/9/2008	5/12/2008
PCBs							
Total PCBs	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	0.038 J	ND	ND	ND	ND	ND

Spring 022-004	4/21/2006	9/14/2006	10/20/2006	4/24/2007	12/10/2007	1/9/2008	5/12/2008	12/29/2008
PCBs								
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND	ND

Spring 022-003	4/21/2006	9/14/2006	10/20/2006
PCBs			
Total PCBs	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND

Spring 022-002	4/21/2006	9/14/2006	10/20/2006
PCBs			
Total PCBs	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND

Spring 009	5/22/2002	5/12/2004	6/1/2004	8/13/2004	10/20/2004	1/10/2005	2/1/2005	5/17/2005	6/17/2005	9/29/2005	11/21/2005	12/28/2005	3/3/2006	3/13/2006	9/6/2006	9/18/2006	10/23/2006	3/14/2007	4/25/2007
PCBs																			
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND/ND	ND	ND	ND	R	ND	ND	ND

Spring 020-002	10/20/2004	1/10/2005	2/1/2005	5/17/2005	6/17/2005	9/29/2005	12/28/2005	3/3/2006	3/13/2006	9/18/2006	10/23/2006	3/14/2007	4/25/2007	12/11/2007	1/10/2008	5/13/2008
PCBs																
Total PCBs	ND	ND	0.1 J/0.11 J	ND	ND	ND	ND	ND	ND	0.75	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND/ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Spring 021-004	7/2/2004	8/13/2004	10/7/2004	10/20/2004	1/10/2005	2/1/2005	5/17/2005	6/17/2005
PCBs								
Total PCBs	11	2.5 J	250	4.8	5.5	2.8	5	ND
Total PCBs (dissolved)	ND	ND	0.21	ND	ND	0.098 J	ND	ND

Spring 021-003	7/2/2004	8/13/2004
PCBs		
Total PCBs	1.9 J	1 J/0.88 J
Total PCBs (dissolved)	ND	ND/ND

Spring 021-002	7/2/2004	8/13/2004	10/20/2004
PCBs			
Total PCBs	2.2 J	1.5 J	25
Total PCBs (dissolved)	ND	ND	ND

Spring 021-005	12/16/2004
PCBs	
Total PCBs	810
Total PCBs (dissolved)	1.8

Spring 216-001	1/12/2006	3/7/2006
PCBs		
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

Spring 015-005	1/14/2005
PCBs	
Total PCBs	ND
Total PCBs (dissolved)	ND

Spring 015-006	1/14/2005	9/18/2006	10/23/2006	4/25/2007
PCBs				
Total PCBs	0.14 J	0.09 J	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND

Spring 015-004	1/14/2005	3/13/2006	10/23/2006
PCBs			
Total PCBs	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND

Spring 015-002	12/14/2004	1/14/2005	5/17/2005	12/29/2005	3/13/2006
PCBs					
Total PCBs	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND

Spring 015-003	1/14/2005	4/25/2007
PCBs		
Total PCBs	ND	ND
Total PCBs (dissolved)	ND	ND

Spring 015-001	12/14/2004	1/14/2005
PCBs		
Total PCBs	ND	0.096 J
Total PCBs (dissolved)	ND	0.096 J

Seep 002	6/1/2004	1/10/2005	3/13/2006	9/15/2006	10/23/2006	1/9/2008	5/12/2008
PCBs							
Total PCBs	ND	0.32	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND

Spring 013-002	1/14/2005
PCBs	
Total PCBs	ND
Total PCBs (dissolved)	ND

Spring 013-001	12/14/2004	1/14/2005
PCBs		
Total PCBs	0.27/0.097 J	ND
Total PCBs (dissolved)	ND/ND	ND

Spring 004	1/10/2005
PCBs	
Total PCBs	ND
Total PCBs (dissolved)	ND

Spring East of Storm Pond-2	3/12/2002	6/1/2004
PCBs		
Total PCBs	ND	5.87 J
Total PCBs (dissolved)	ND	ND

Seep 001	5/17/2002	8/5/2004	8/17/2004	10/21/2004	1/11/2005	5/18/2005	6/20/2005	3/14/2007
PCBs								
Total PCBs	R	2.3	9.9	0.43	0.37	0.71	0.94	0.14 J
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND	ND

Spring 1590	4/3/2002	5/28/2002	5/13/2004	6/1/2004	8/17/2004	10/8/2004	10/21/2004	1/11/2005	2/1/2005	5/18/2005	6/20/2005	9/8/2005	9/15/2005	12/8/2005	12/28/2005	3/2/2006	9/6/2006	9/18/2006	10/23/2006	3/14/2007	4/23/2007	8/27/2007
PCBs																						
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND	0.067 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Spring 389-001	5/12/2008
PCBs	
Total PCBs	ND
Total PCBs (dissolved)	ND

Spring 389-002	9/6/2006	9/18/2006	10/23/2006	3/14/2007	4/24/2007	12/10/2007	1/10/2008	5/12/2008	12/29/2008	1/21/2009
PCBs										
Total PCBs	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND
Total PCBs (dissolved)	ND	ND	ND	ND	ND/ND	ND	ND	ND	ND	ND

Seep 5013B	6/1/2004	10/21/2004	3/13/2006	1/9/2008
PCBs				
Total PCBs	6.05 J	0.33	1.23 J	ND
Total PCBs (dissolved)	ND	ND	ND	ND

Seep 5013A	5/29/2002	1/11/2005
PCBs		
Total PCBs	0.51 J	0.35
Total PCBs (dissolved)	ND	ND

No	Revision	Date	Initial

0 175 350ft

LEGEND

EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)

EXISTING BUILDINGS

FENCE LINE

APPROXIMATE SURFACE WATER LOCATION

LIMITS OF 2019 THERMAL STUDY

RAILROAD TRACKS

DIRT ROADS

ROADS / PAVED AREAS

THERMAL ANOMALIES IDENTIFIED VIA UAV

PREVIOUSLY IDENTIFIED SPRING/SEEPS

1 J/0.88 J — PARENT/DUPLICATE RESULT

J — ESTIMATED

ND — NOT DETECTED ABOVE LIMIT

DETECTION

Spring 021-005	12/16/2004
PCBs	
Total PCBs	810
Total PCBs (dissolved)	1.8

SAMPLE IDENTIFICATION

SAMPLE DATE

RESULT µg/L

PARAMETER

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

GM GPS BEDFORD FACILITY
BEDFORD, INDIANA

PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM

SEEPS AND SPRINGS ANALYTICAL RESULTS

Source Reference: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

Project Manager:	Reviewed By:	Date:	
B. STEINMANN	J. LUZWICK	September 2019	
Scale: AS SHOWN	Project №: 13968-00	Report №: 404	Drawing №: figure 4.3

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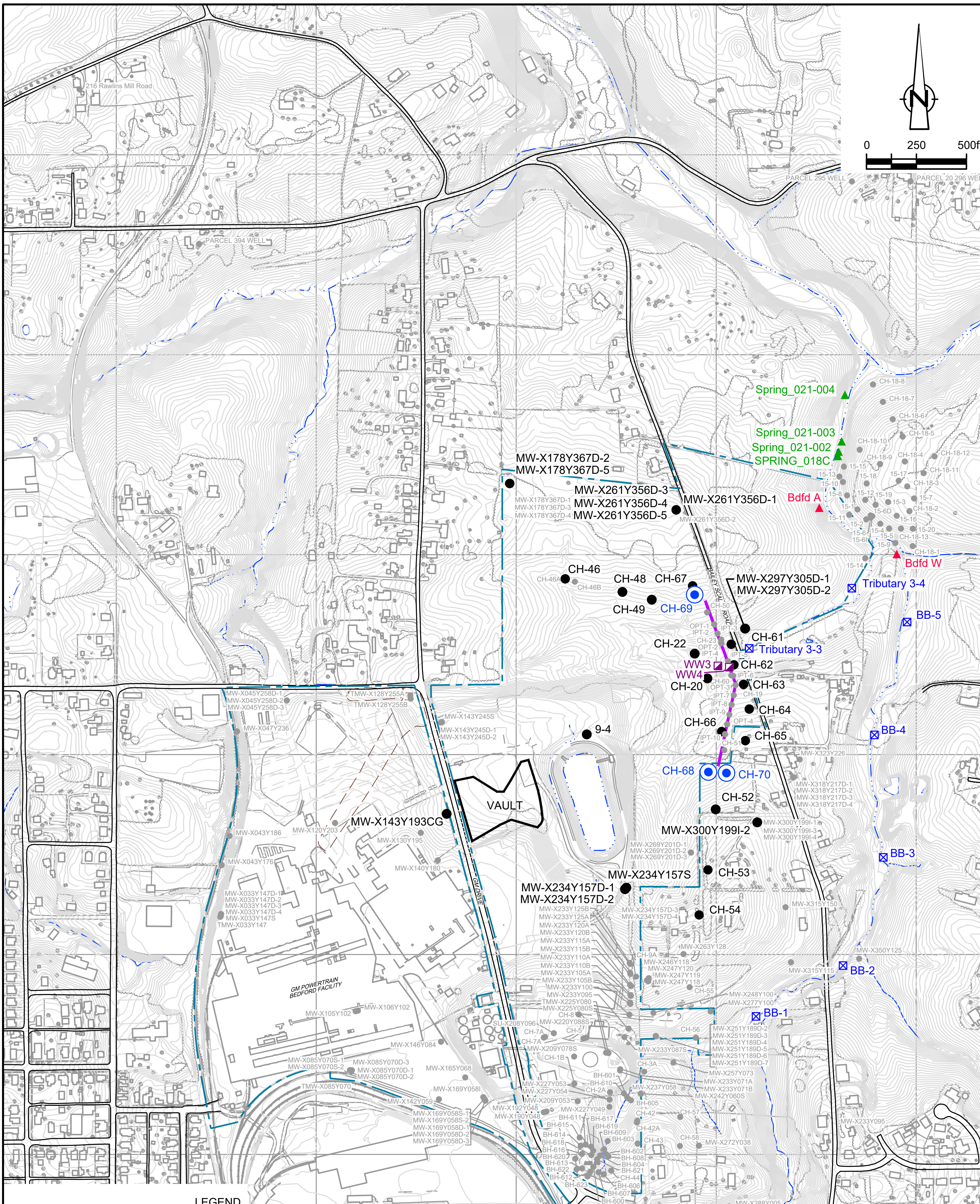

LEGEND

600	GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
	FENCE LINE
	SURFACE WATER
	APPROXIMATE GM PROPERTY BOUNDARY
	TENTATIVE SPRING WATER LOCATION (PENDING RESULTS OF CREEK RECONNAISSANCE)
	TENTATIVE SPRING SAMPLE LOCATION (LOCATION HAS BEEN DEMONSTRATED TO BE CONNECTED TO THE SURFACE WATER VIA SWALLETS. DETECTIONS MAY BE THE RESULT OF SURFACE WATER CONVEYANCE)
	EAST PLANT COVER SYSTEM LIMIT
	EAST PLANT AREA BOUNDARY
	WEST PLANT AREA BOUNDARY
	GM LLC OWNED RESIDENTIAL PROPERTIES
	PILOT TRENCH ALIGNMENT (2016)
	SURFACE WATER MONITORING LOCATION
	WET WELL
	EXISTING COREHOLE AND MONITORING WELL LOCATIONS NEAR PROPOSED BEDROCK TRENCH
	EXISTING MONITORING WELL LOCATIONS NOT BEING USED IN INVESTIGATION
	RECENTLY INSTALLED MONITORING WELL AND PIEZOMETER LOCATION

NOTES:

- ALL SPRING SAMPLE LOCATIONS AND SURFACE WATER LOCATIONS ALONG BAILEY'S BRANCH ARE DEPENDANT UPON ACCESSIBILITY.
- SPRING AND SURFACE WATER SAMPLE LOCATIONS WILL BE SAMPLED FOR PCBs ONLY IF DYE IS DETECTED.
- GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES.

figure 4.4

PROPOSED LOCATIONS FOR PCB SAMPLING
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

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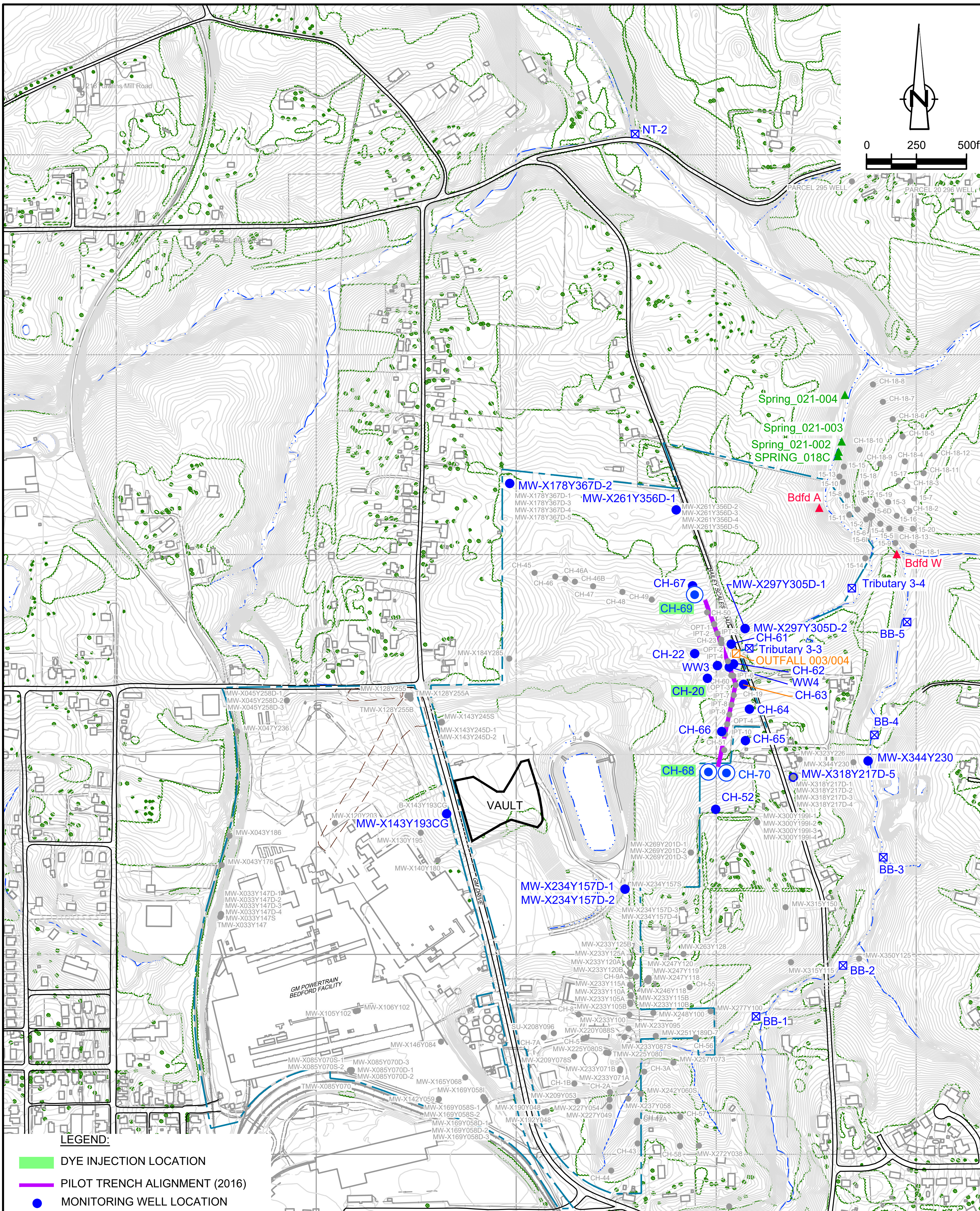

LEGEND:

- DYE INJECTION LOCATION
- PILOT TRENCH ALIGNMENT (2016)
- MONITORING WELL LOCATION
- SURFACE WATER MONITORING LOCATION
- RECENTLY INSTALLED MONITORING WELL AND PIEZOMETER LOCATION
- TENTATIVE SPRING WATER LOCATION (PENDING RESULTS OF CREEK RECONNAISSANCE)
- TENTATIVE SPRING SAMPLE LOCATION (LOCATION HAS BEEN DEMONSTRATED TO BE CONNECTED TO THE SURFACE WATER VIA SWALLETS. DETECTIONS MAY BE THE RESULT OF SURFACE WATER CONVEYANCE)
- EXISTING MONITORING WELL LOCATIONS NOT BEING USED IN THIS PHASE OF INVESTIGATION
- OUTFALL LOCATION

NOTE:
- ALL SPRING SAMPLE LOCATIONS AND SURFACE WATER LOCATIONS ALONG BAILEY'S BRANCH ARE DEPENDANT UPON ACCESSIBILITY.

figure 4.5

PROPOSED PILOT TRENCH MONITORING LOCATIONS
FOR DYE TRACER MONITORING (NEAR FIELD)
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

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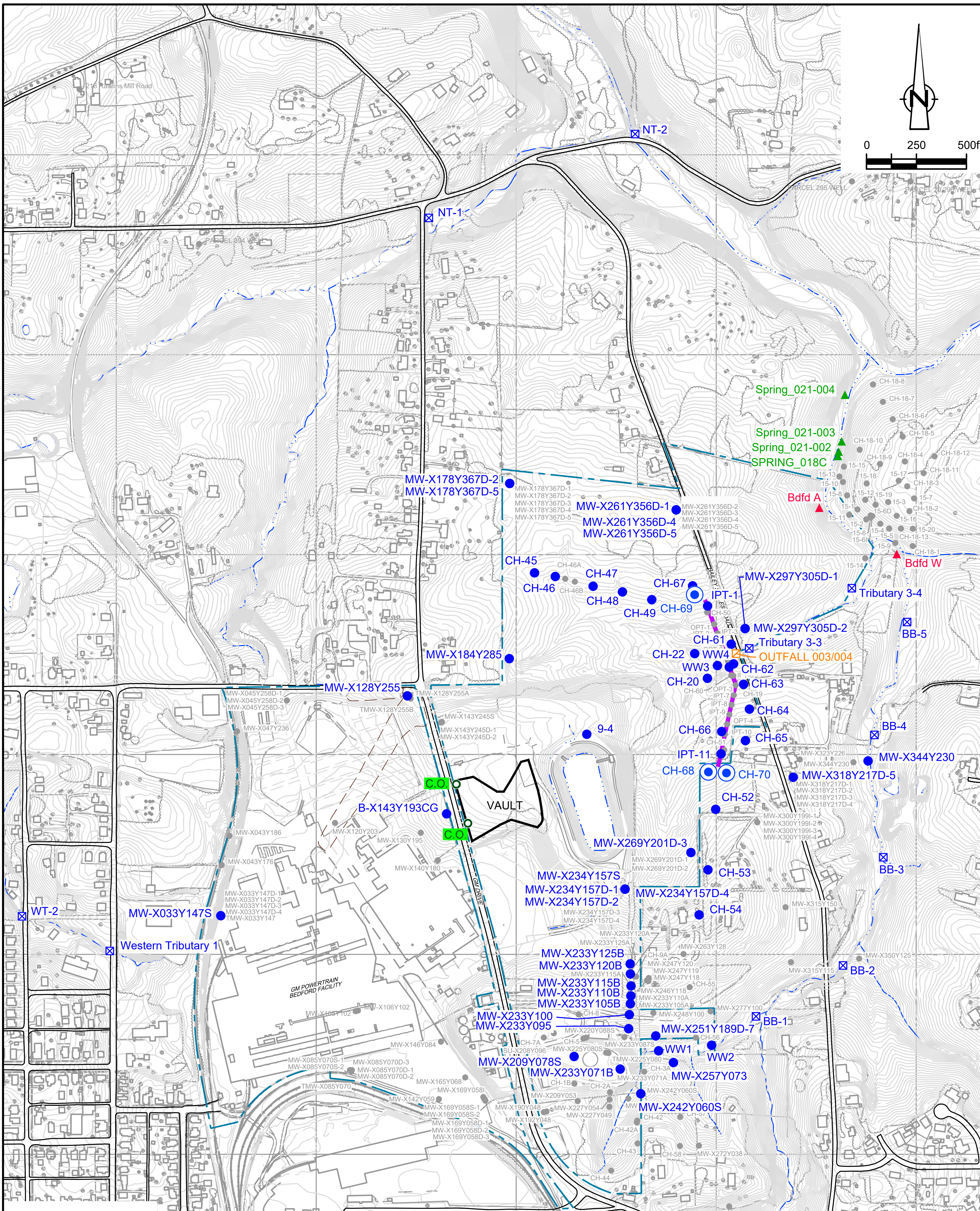

LEGEND:

- DYE INJECTION LOCATION
- PILOT TRENCH ALIGNMENT (2016)
- MONITORING WELL LOCATION
- TENTATIVE SPRING WATER LOCATION (PENDING RESULTS OF CREEK RECONNAISSANCE)
- TENTATIVE SPRING SAMPLE LOCATION (LOCATION HAS BEEN DEMONSTRATED TO BE CONNECTED TO THE SURFACE WATER VIA SWALLETS. DETECTIONS MAY BE THE RESULT OF SURFACE WATER CONVEYANCE)
- SURFACE WATER MONITORING LOCATION
- OUTFALL LOCATION
- CLEAN OUT DYE INJECTION LOCATION
- RECENTLY INSTALLED MONITORING WELL AND PIEZOMETER LOCATION
- EXISTING MONITORING WELL LOCATIONS NOT BEING USED IN THIS PHASE OF INVESTIGATION

NOTES:

- ALL SPRING SAMPLE LOCATIONS AND SURFACE WATER LOCATIONS ALONG BAILEY'S BRANCH ARE DEPENDANT UPON ACCESSIBILITY.
- LOCATIONS ARE DEPENDENT UPON COMPLETION OF THE THERMAL STUDY AND ACTUAL FLOW.

figure 4.6

PROPOSED PILOT TRENCH MONITORING LOCATIONS FOR DYE TRACER MONITORING (FAR FIELD)
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

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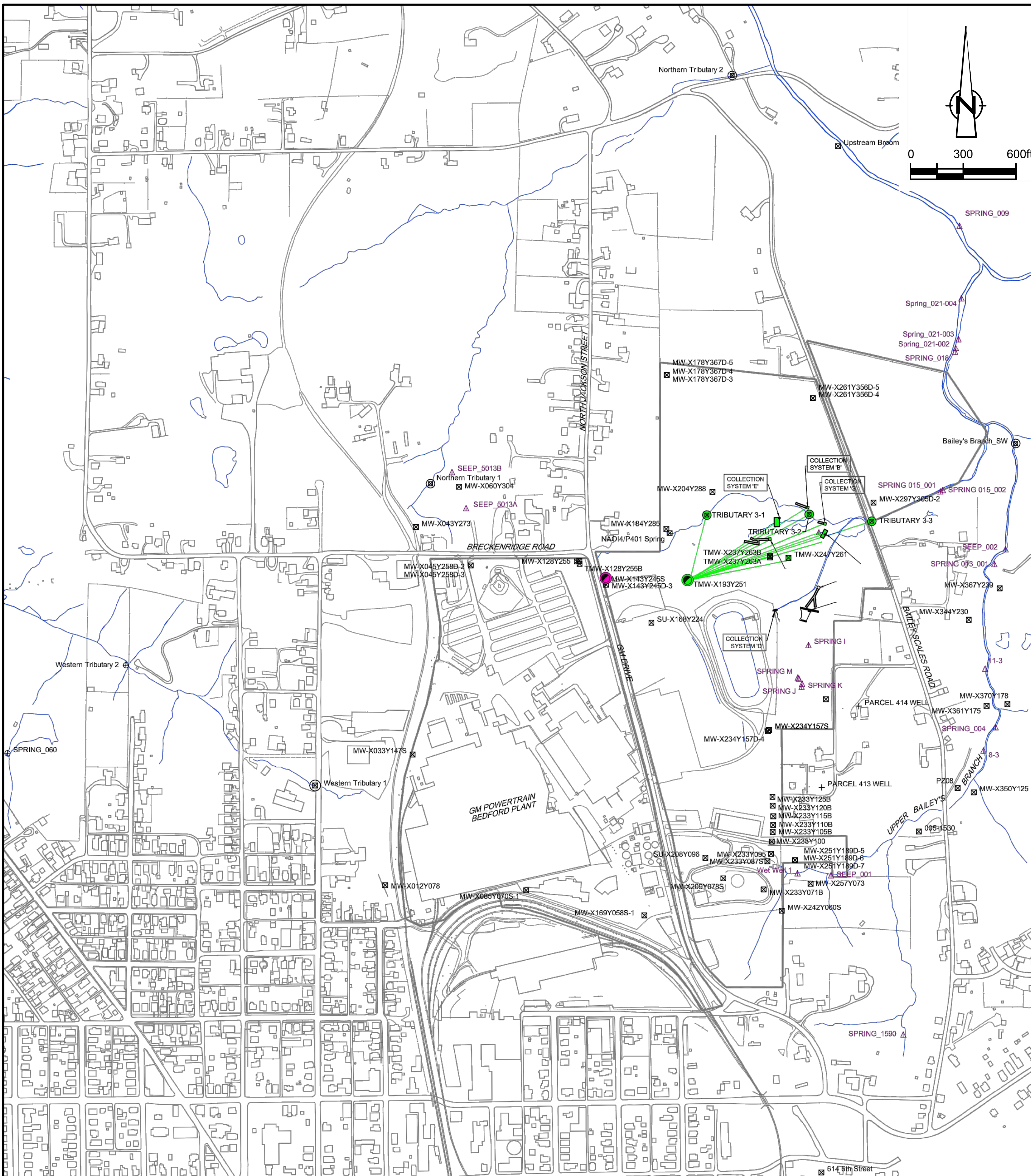

LEGEND

- EXISTING BUILDINGS
- RAILROAD TRACKS
- DIRT ROADS
- ROADS / PAVED AREAS
- APPROXIMATE SURFACE WATER LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- SSC COLLECTION/EXTRACTION TRENCH
- SSC SUMP STRUCTURE
- SPRING SAMPLE LOCATION, DYE NON-DETECT
- SPRING SAMPLE LOCATION, FLUORESCEIN DETECTION
- GRAB AND PORT SAMPLE LOCATION, DYE NON-DETECT
- GRAB AND PORT SAMPLE LOCATION, DYE DETECTION
- SURFACE WATER SAMPLE LOCATION, DYE NON-DETECT
- RHODAMINE WT INJECTION WELL
- FLUORESCEIN INJECTION WELL
- ILLUSTRATIVE DYE TRAVEL PATH
- ABANDONED COREHOLE LOCATION
- COREHOLE LOCATION

NOTE:

(1) PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. LOCATIONS MAY NOT ACCURATELY REPRESENT THE TRUE BOUNDARIES.

figure 4.7

PREVIOUS DYE TRACING RESULTS AT AO14
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

BASE SOURCE: HYDROGEOLOGY INC.

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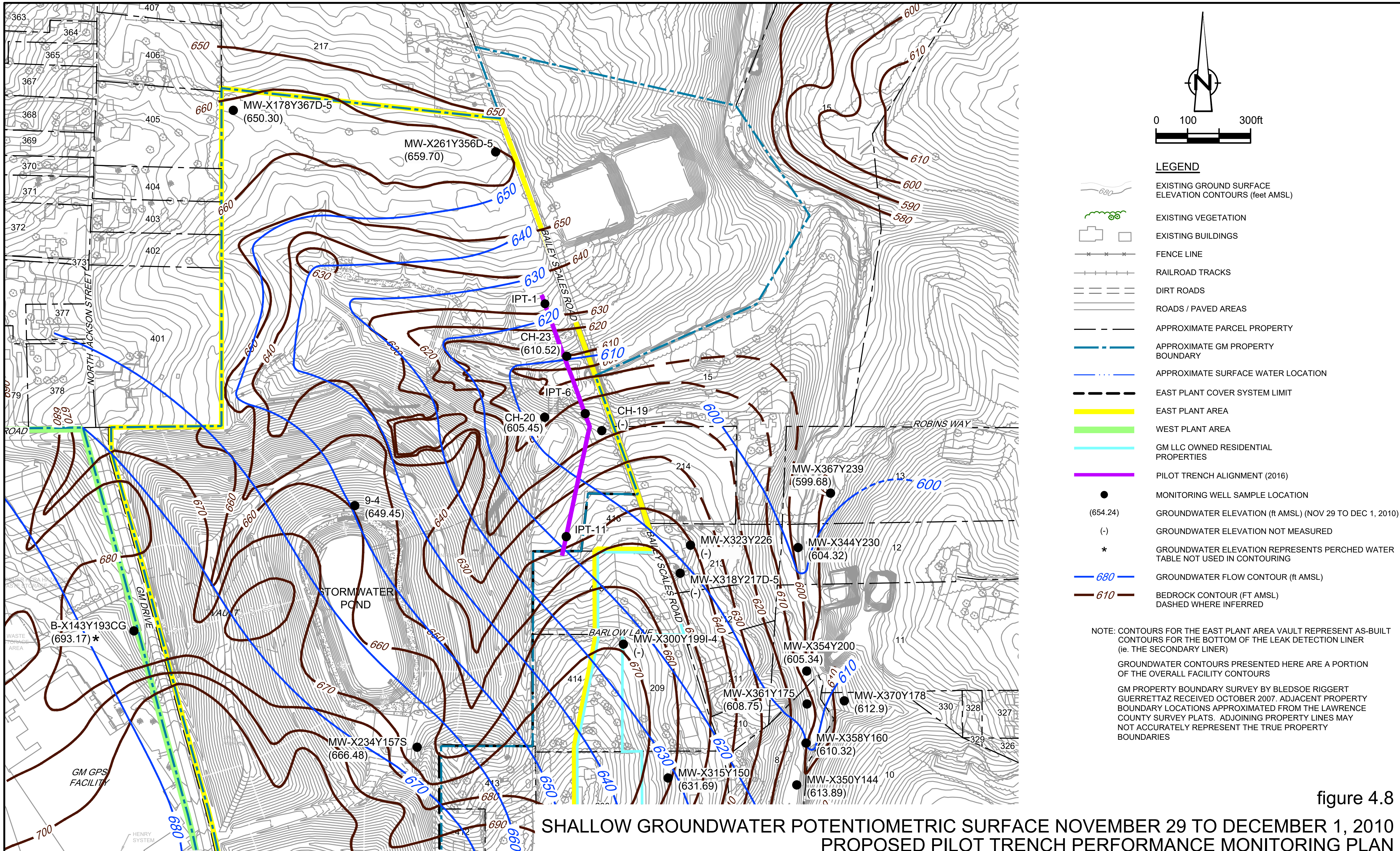

figure 4.8

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE NOVEMBER 29 TO DECEMBER 1, 2010
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

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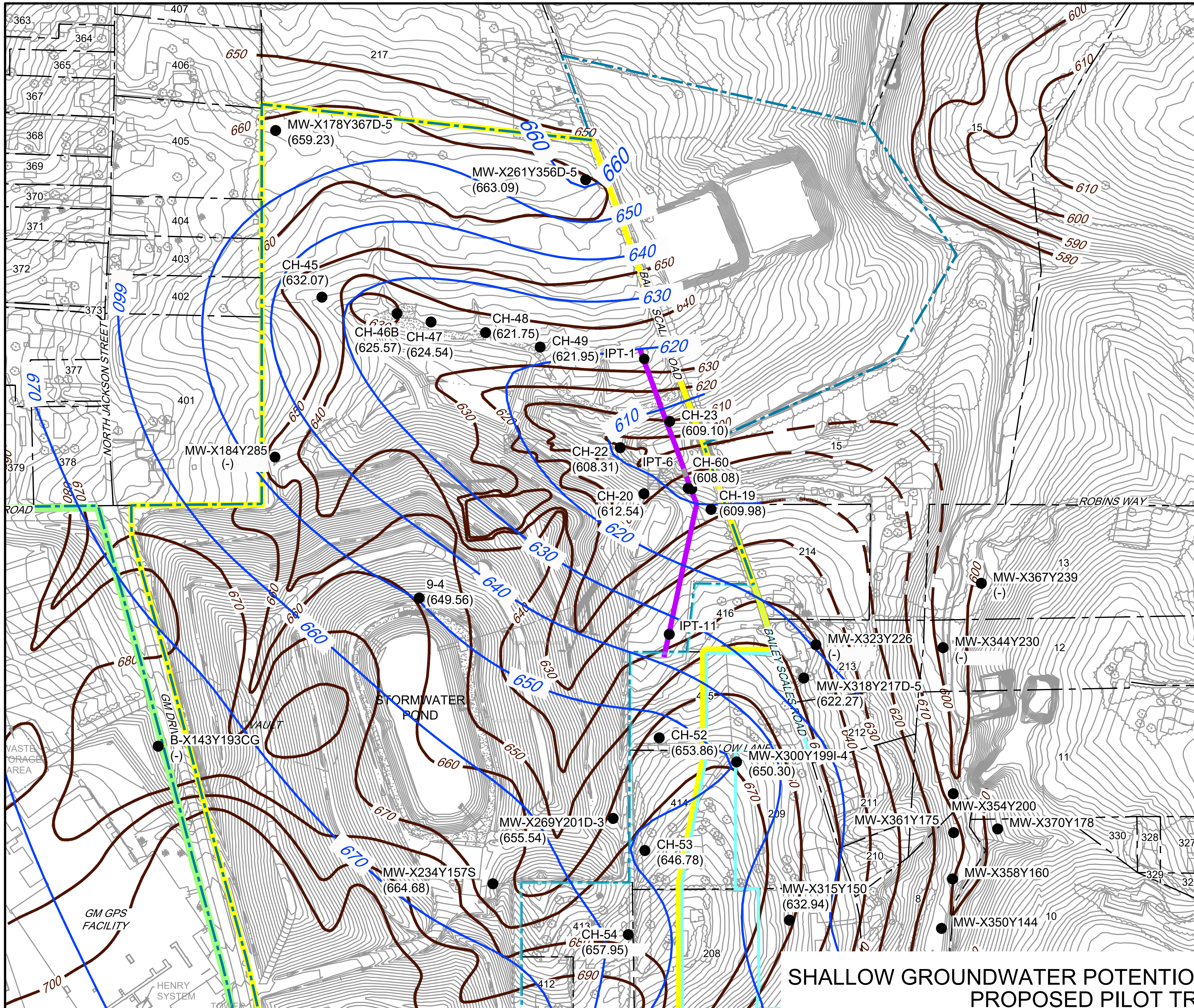

0 100 300ft

LEGEND

EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)

EXISTING VEGETATION

EXISTING BUILDINGS

FENCE LINE

RAILROAD TRACKS

DIRT ROADS

ROADS / PAVED AREAS

APPROXIMATE PARCEL PROPERTY

APPROXIMATE GM PROPERTY BOUNDARY

APPROXIMATE SURFACE WATER LOCATION

EAST PLANT COVER SYSTEM LIMIT

EAST PLANT AREA

WEST PLANT AREA

GM LLC OWNED RESIDENTIAL PROPERTIES

PILOT TRENCH ALIGNMENT (2016)

MONITORING WELL SAMPLE LOCATION

(654.24) GROUNDWATER ELEVATION (ft AMSL) (DECEMBER, 2017)

(-) GROUNDWATER ELEVATION NOT MEASURED

* GROUNDWATER ELEVATION REPRESENTS PERCHED WATER TABLE NOT USED IN CONTOURING

680 GROUNDWATER FLOW CONTOUR (ft AMSL)

610 BEDROCK CONTOUR (FT AMSL) DASHED WHERE INFERRED

NOTE: CONTOURS FOR THE EAST PLANT AREA VAULT REPRESENT AS-BUILT CONTOURS FOR THE BOTTOM OF THE LEAK DETECTION LINER (ie. THE SECONDARY LINER)

GROUNDWATER CONTOURS PRESENTED HERE ARE A PORTION OF THE OVERALL FACILITY CONTOURS

GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

figure 4.9

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE FEBRUARY 5 TO 6, 2015
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

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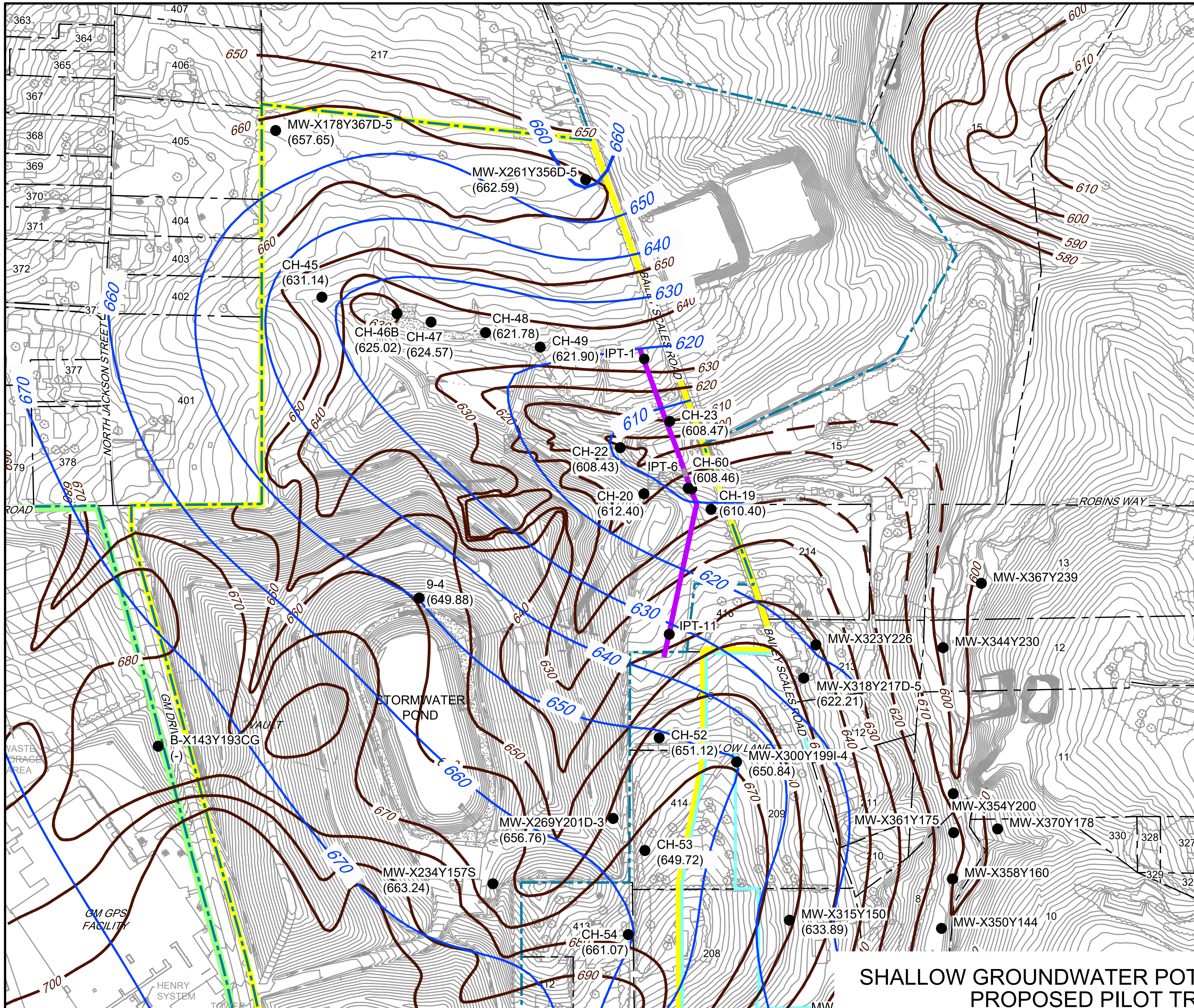

0 100 300ft

LEGEND

EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)

EXISTING VEGETATION

EXISTING BUILDINGS

FENCE LINE

RAILROAD TRACKS

DIRT ROADS

ROADS / PAVED AREAS

APPROXIMATE PARCEL PROPERTY

APPROXIMATE GM PROPERTY BOUNDARY

APPROXIMATE SURFACE WATER LOCATION

EAST PLANT AREA

WEST PLANT AREA

PILOT TRENCH ALIGNMENT (2016)

MONITORING WELL SAMPLE LOCATION

(654.24) GROUNDWATER ELEVATION (ft AMSL) (DECEMBER, 2017)

(-) GROUNDWATER ELEVATION NOT MEASURED

* GROUNDWATER ELEVATION REPRESENTS PERCHED WATER TABLE NOT USED IN CONTOURING

680 GROUNDWATER FLOW CONTOUR (ft AMSL)

610 BEDROCK CONTOUR (FT AMSL) DASHED WHERE INFERRED

NOTE: CONTOURS FOR THE EAST PLANT AREA VAULT REPRESENT AS-BUILT CONTOURS FOR THE BOTTOM OF THE LEAK DETECTION LINER (IE. THE SECONDARY LINER)

GROUNDWATER CONTOURS PRESENTED HERE ARE A PORTION OF THE OVERALL FACILITY CONTOURS

GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

figure 4.10

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE MAY 4 TO 5, 2015
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

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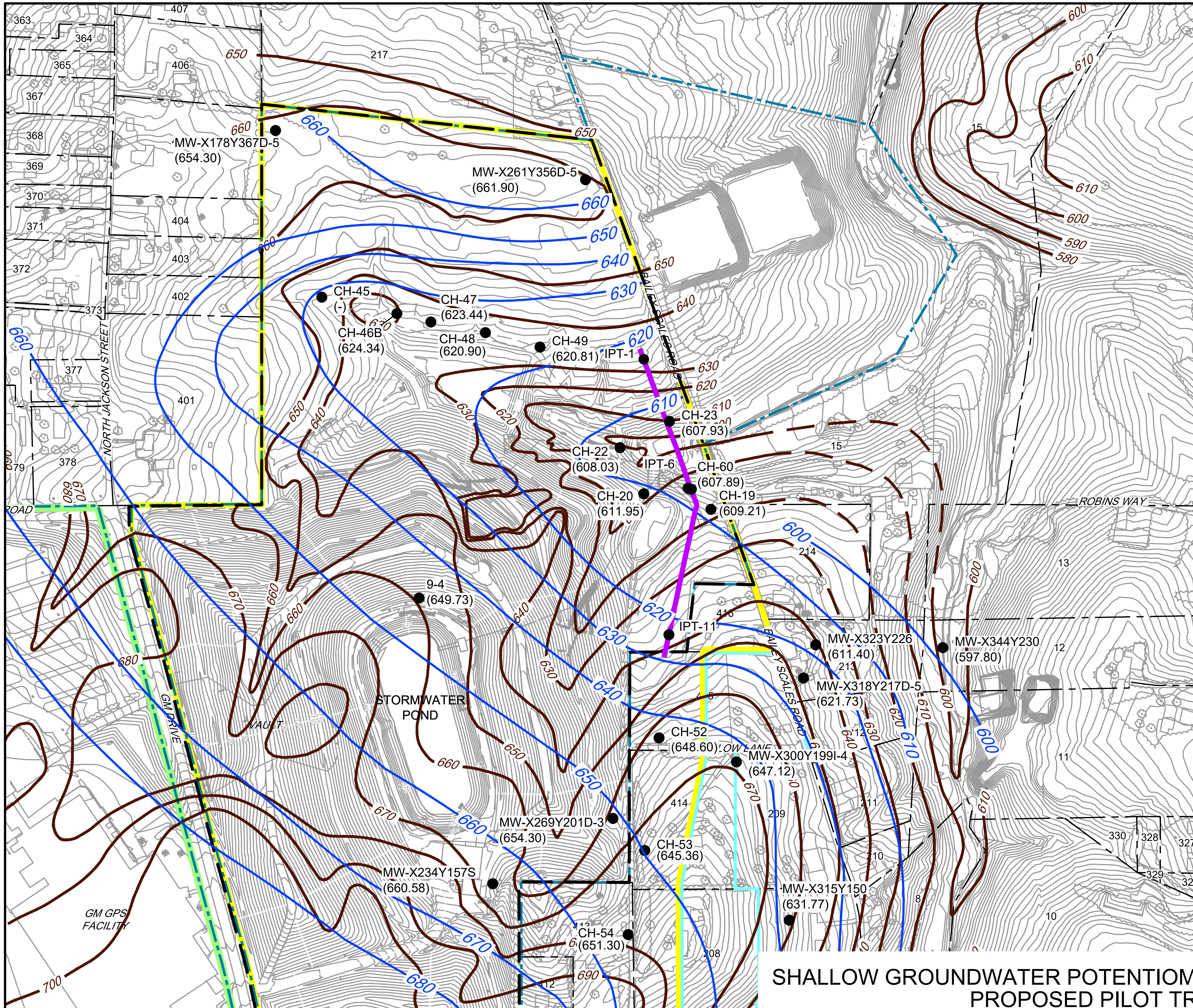

0 100 300ft

LEGEND

EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)

EXISTING VEGETATION

EXISTING BUILDINGS

FENCE LINE

RAILROAD TRACKS

DIRT ROADS

ROADS / PAVED AREAS

APPROXIMATE PARCEL PROPERTY

APPROXIMATE GM PROPERTY BOUNDARY

APPROXIMATE SURFACE WATER LOCATION

EAST PLANT AREA

WEST PLANT AREA

PILOT TRENCH ALIGNMENT (2016)

MONITORING WELL SAMPLE LOCATION

(654.24) GROUNDWATER ELEVATION (ft AMSL) (SEPTEMBER 2 TO 3, 2015)

(-) GROUNDWATER ELEVATION NOT MEASURED

* GROUNDWATER ELEVATION REPRESENTS PERCHED WATER TABLE NOT USED IN CONTOURING

680 GROUNDWATER FLOW CONTOUR (ft AMSL)

610 BEDROCK CONTOUR (FT AMSL) DASHED WHERE INFERRED

NOTE: CONTOURS FOR THE EAST PLANT AREA VAULT REPRESENT AS-BUILT CONTOURS FOR THE BOTTOM OF THE LEAK DETECTION LINER (ie. THE SECONDARY LINER)

GROUNDWATER CONTOURS PRESENTED HERE ARE A PORTION OF THE OVERALL FACILITY CONTOURS

GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

GHD

figure 4.11

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE SEPTEMBER 2 TO 3, 2015
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

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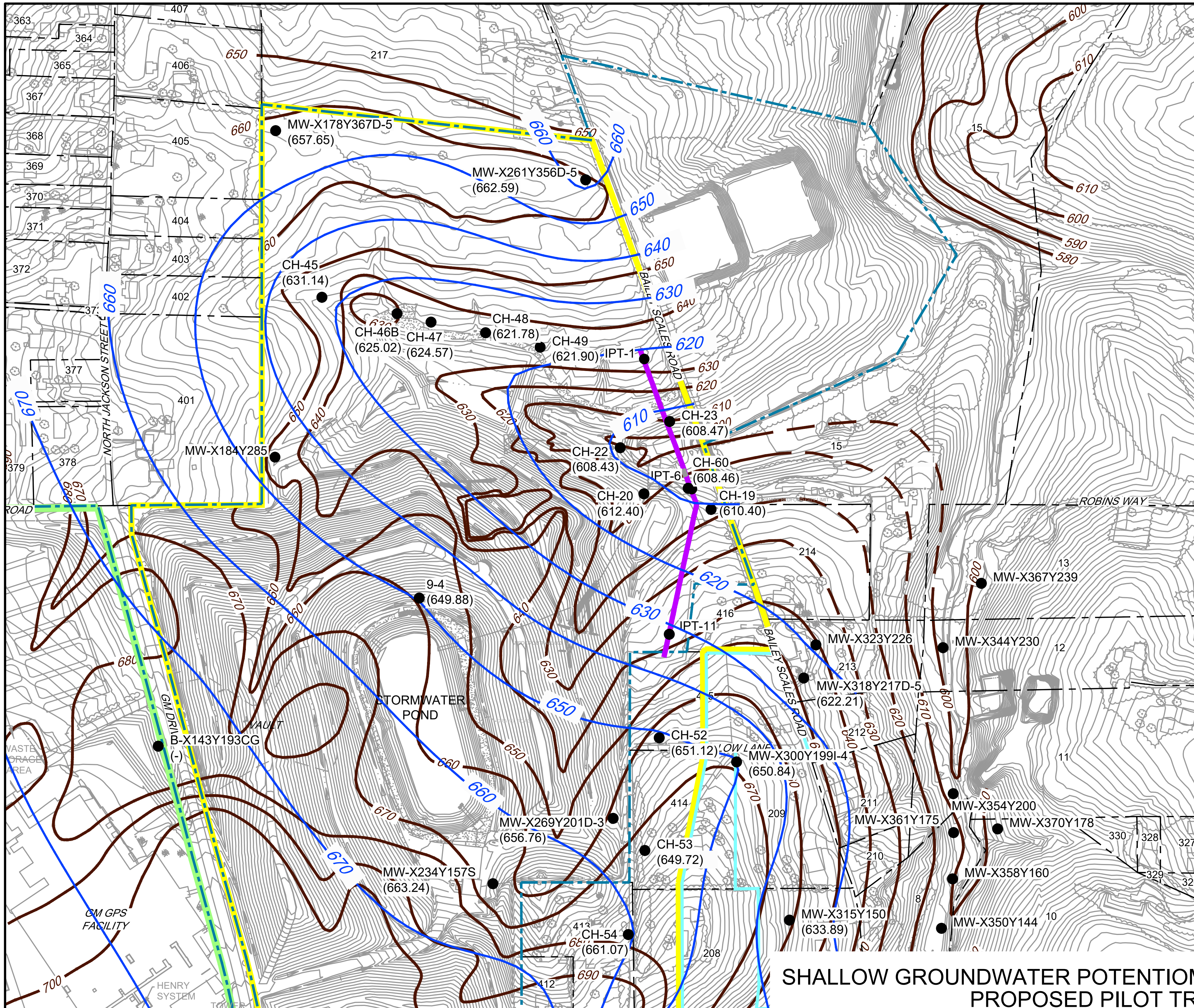

LEGEND

EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)

EXISTING VEGETATION

EXISTING BUILDINGS

FENCE LINE

RAILROAD TRACKS

DIRT ROADS

ROADS / PAVED AREAS

APPROXIMATE PARCEL PROPERTY

APPROXIMATE GM PROPERTY BOUNDARY

APPROXIMATE SURFACE WATER LOCATION

EAST PLANT AREA

WEST PLANT AREA

PILOT TRENCH ALIGNMENT (2016)

MONITORING WELL SAMPLE LOCATION

(654.24) GROUNDWATER ELEVATION (ft AMSL) (DECEMBER, 2017)

(-) GROUNDWATER ELEVATION NOT MEASURED

* GROUNDWATER ELEVATION REPRESENTS PERCHED WATER TABLE NOT USED IN CONTOURING

680 GROUNDWATER FLOW CONTOUR (ft AMSL)

610 BEDROCK CONTOUR (FT AMSL) DASHED WHERE INFERRED

NOTE: CONTOURS FOR THE EAST PLANT AREA VAULT REPRESENT AS-BUILT CONTOURS FOR THE BOTTOM OF THE LEAK DETECTION LINER (ie. THE SECONDARY LINER)

GROUNDWATER CONTOURS PRESENTED HERE ARE A PORTION OF THE OVERALL FACILITY CONTOURS

GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

figure 4.12

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE NOVEMBER 2 TO 3, 2015
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

GHD

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001
AND CRA SURVEYS 2002 TO 2013.

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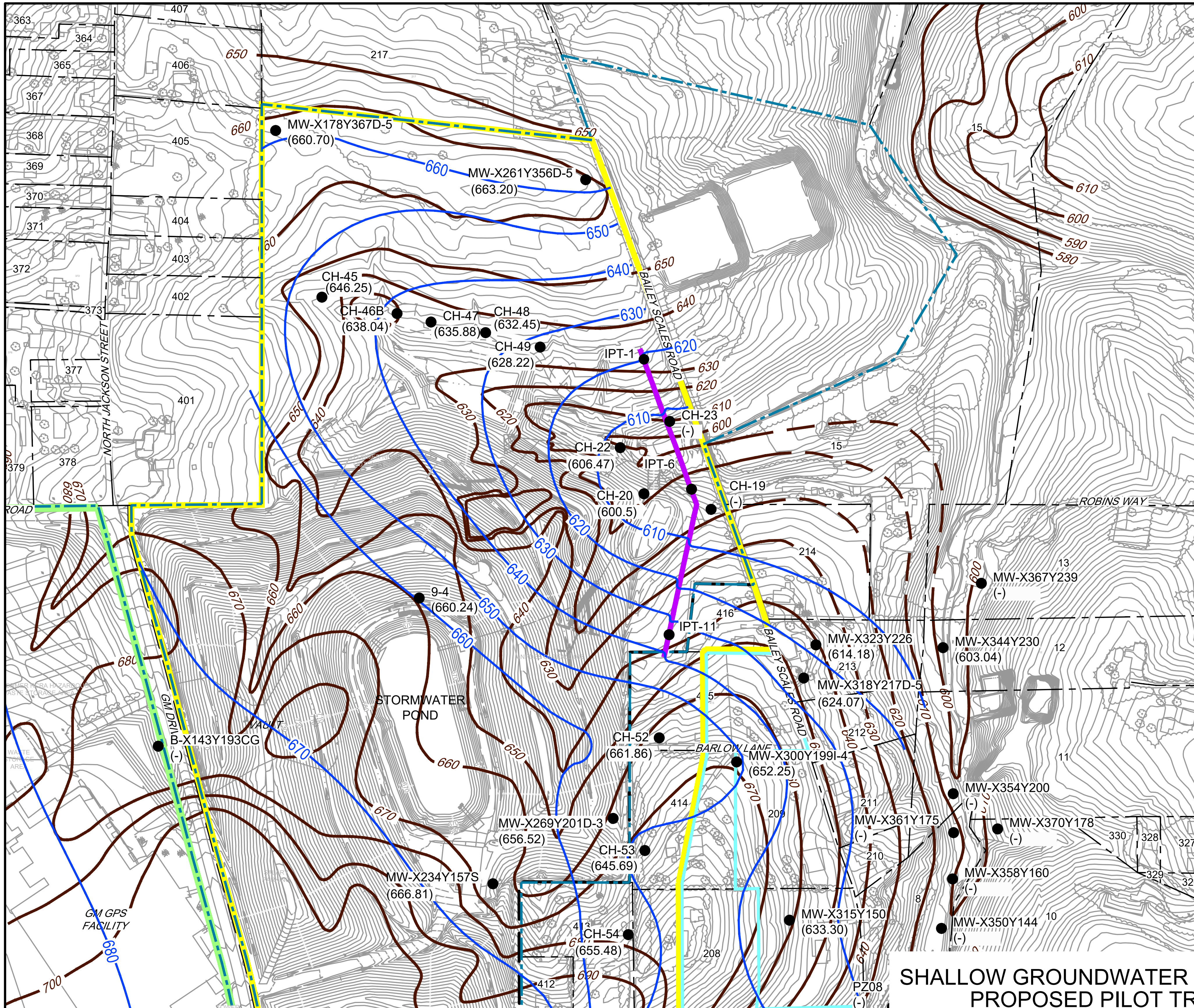

0 100 300ft

LEGEND

680	EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
	EXISTING VEGETATION
	EXISTING BUILDINGS
	FENCE LINE
	RAILROAD TRACKS
	DIRT ROADS
	ROADS / PAVED AREAS
	APPROXIMATE PARCEL PROPERTY
	APPROXIMATE GM PROPERTY BOUNDARY
	APPROXIMATE SURFACE WATER LOCATION
	EAST PLANT AREA
	WEST PLANT AREA
	PILOT TRENCH ALIGNMENT (2016)
●	MONITORING WELL SAMPLE LOCATION
(654.24)	GROUNDWATER ELEVATION (ft AMSL) (MARCH, 2017)
(-)	GROUNDWATER ELEVATION NOT MEASURED
*	GROUNDWATER ELEVATION REPRESENTS PERCHED WATER TABLE NOT USED IN CONTOURING
680	GROUNDWATER FLOW CONTOUR (ft AMSL)
610	BEDROCK CONTOUR (FT AMSL) DASHED WHERE INFERRED

NOTE: CONTOURS FOR THE EAST PLANT AREA VAULT REPRESENT AS-BUILT CONTOURS FOR THE BOTTOM OF THE LEAK DETECTION LINER (ie. THE SECONDARY LINER)

GROUNDWATER CONTOURS PRESENTED HERE ARE A PORTION OF THE OVERALL FACILITY CONTOURS

GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

figure 4.13

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE MARCH, 2017
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

GHD

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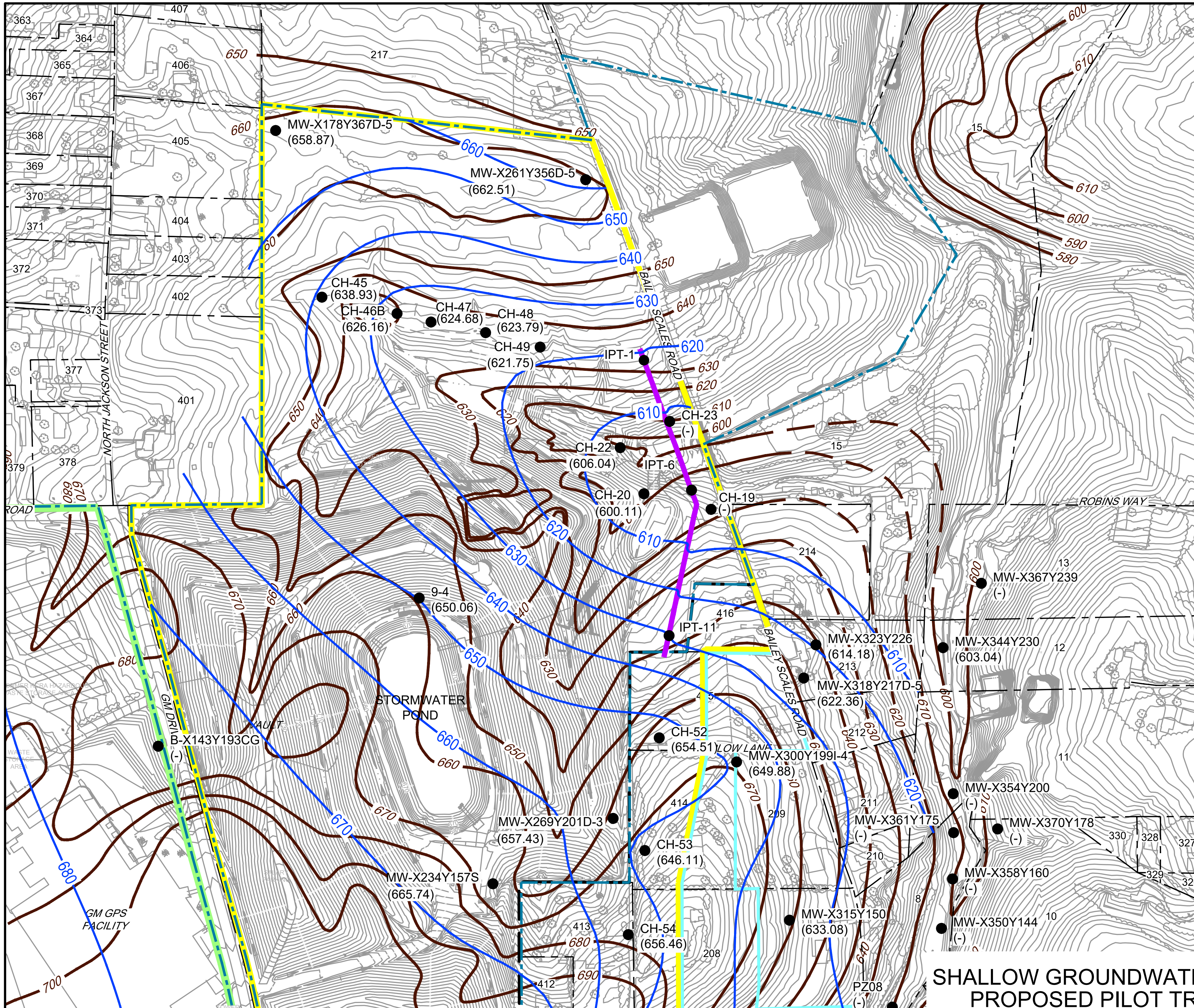

N

0 100 300ft

LEGEND

680	EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
	EXISTING VEGETATION
	EXISTING BUILDINGS
	FENCE LINE
	RAILROAD TRACKS
	DIRT ROADS
	ROADS / PAVED AREAS
	APPROXIMATE PARCEL PROPERTY
	APPROXIMATE GM PROPERTY BOUNDARY
	APPROXIMATE SURFACE WATER LOCATION
	EAST PLANT AREA
	WEST PLANT AREA
	PILOT TRENCH ALIGNMENT (2016)
●	MONITORING WELL SAMPLE LOCATION
(654.24)	GROUNDWATER ELEVATION (ft AMSL) (MAY, 2017)
(-)	GROUNDWATER ELEVATION NOT MEASURED
*	GROUNDWATER ELEVATION REPRESENTS PERCHED WATER TABLE NOT USED IN CONTOURING
680	GROUNDWATER FLOW CONTOUR (ft AMSL)
610	BEDROCK CONTOUR (FT AMSL) DASHED WHERE INFERRED

NOTE: CONTOURS FOR THE EAST PLANT AREA VAULT REPRESENT AS-BUILT CONTOURS FOR THE BOTTOM OF THE LEAK DETECTION LINER (I.E. THE SECONDARY LINER)

GROUNDWATER CONTOURS PRESENTED HERE ARE A PORTION OF THE OVERALL FACILITY CONTOURS

GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

GHD

figure 4.14

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE MAY, 2017
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

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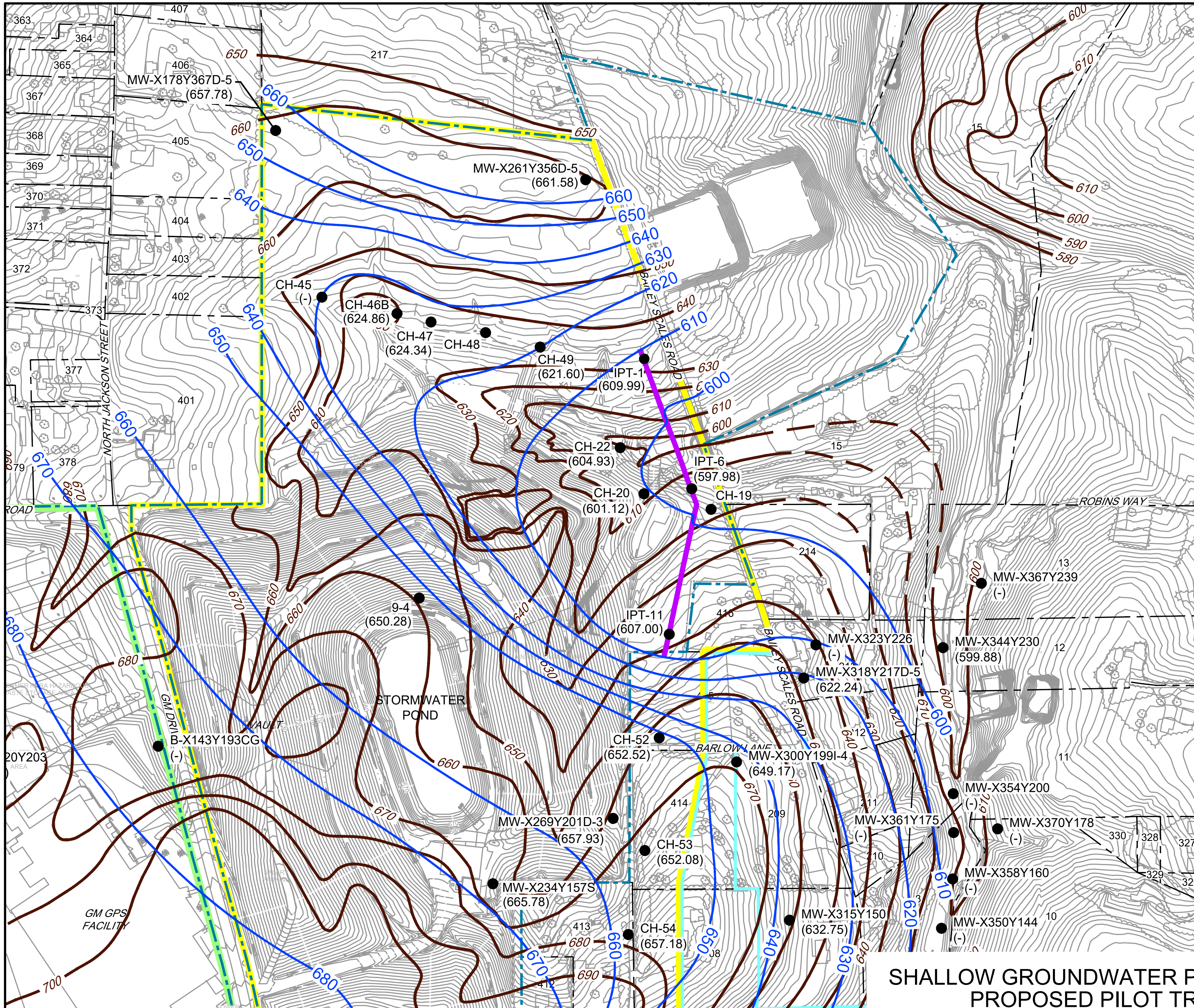

0 100 300ft

LEGEND

- EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
- EXISTING VEGETATION
- EXISTING BUILDINGS
- FENCE LINE
- RAILROAD TRACKS
- DIRT ROADS
- ROADS / PAVED AREAS
- APPROXIMATE PARCEL PROPERTY
- APPROXIMATE GM PROPERTY BOUNDARY
- APPROXIMATE SURFACE WATER LOCATION
- EAST PLANT AREA
- WEST PLANT AREA
- PILOT TRENCH ALIGNMENT (2016)
- MONITORING WELL SAMPLE LOCATION
- (654.24) GROUNDWATER ELEVATION (ft AMSL) (AUGUST, 2017)
- (-) GROUNDWATER ELEVATION NOT MEASURED
- * GROUNDWATER ELEVATION REPRESENTS PERCHED WATER TABLE NOT USED IN CONTOURING
- 680 GROUNDWATER FLOW CONTOUR (ft AMSL)
- 610 BEDROCK CONTOUR (FT AMSL) DASHED WHERE INFERRED

NOTE: CONTOURS FOR THE EAST PLANT AREA VAULT REPRESENT AS-BUILT CONTOURS FOR THE BOTTOM OF THE LEAK DETECTION LINER (I.E. THE SECONDARY LINER)

GROUNDWATER CONTOURS PRESENTED HERE ARE A PORTION OF THE OVERALL FACILITY CONTOURS

GM PROPERTY BOUNDARY SURVEY BY BLEDSOE RIGGERT GUERRETTAZ RECEIVED OCTOBER 2007. ADJACENT PROPERTY BOUNDARY LOCATIONS APPROXIMATED FROM THE LAWRENCE COUNTY SURVEY PLATS. ADJOINING PROPERTY LINES MAY NOT ACCURATELY REPRESENT THE TRUE PROPERTY BOUNDARIES

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

GHD

figure 4.15

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE AUGUST, 2017
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

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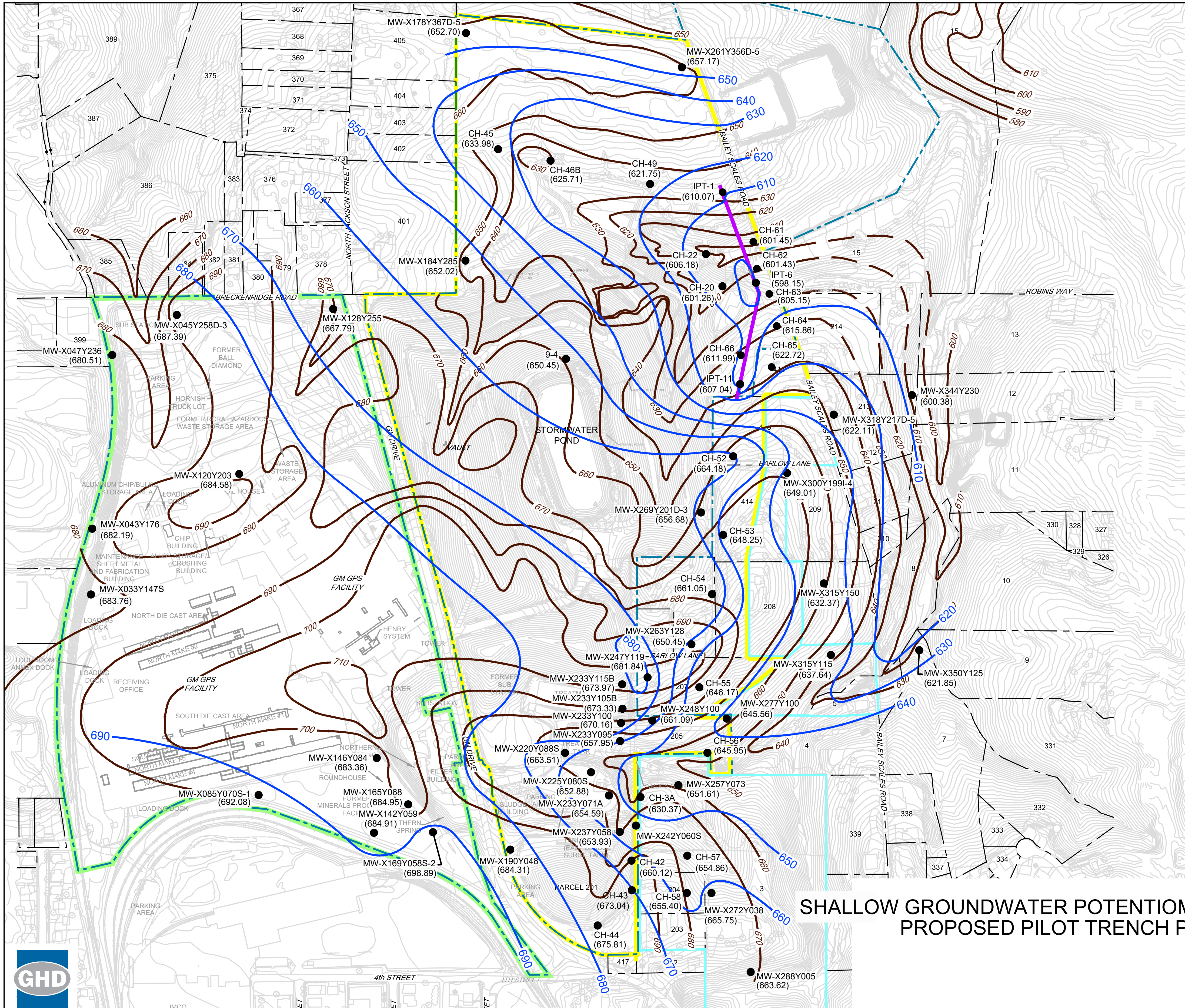

0 200 400ft

LEGEND

680	EXISTING GROUND SURFACE ELEVATION CONTOURS (feet AMSL)
	EXISTING VEGETATION
	EXISTING BUILDINGS
	FENCE LINE
	DIRT ROADS
	ROADS / PAVED AREAS
	APPROXIMATE PARCEL PROPERTY
	APPROXIMATE GM PROPERTY BOUNDARY
	APPROXIMATE SURFACE WATER LOCATION
	EAST PLANT AREA
	WEST PLANT AREA
	PILOT TRENCH ALIGNMENT (2016)
	MONITORING WELL SAMPLE LOCATION
(653.98)	GROUNDWATER ELEVATION (ft AMSL) (DECEMBER, 2017)
680	GROUNDWATER FLOW CONTOUR (ft AMSL)
610	BEDROCK CONTOUR (FT AMSL) DASHED WHERE INFERRED

SOURCE: BASE MAP COMPLETED BY AIR-LAND SURVEYS, FLINT, MI, APRIL 2001 AND CRA SURVEYS 2002 TO 2013.

figure 4.16

SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE DECEMBER 2018
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

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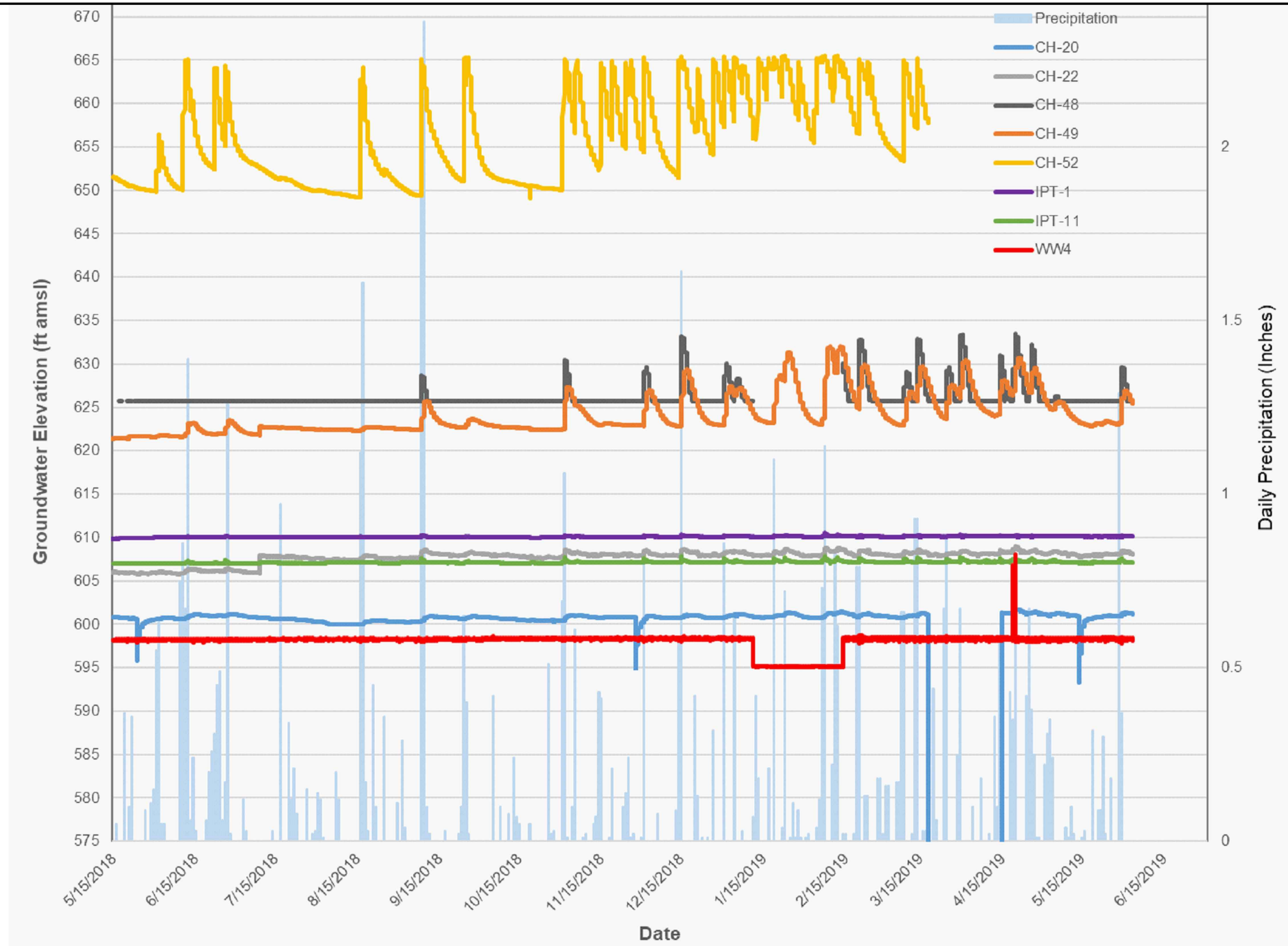

figure 4.17

SHALLOW GROUNDWATER TRANSDUCER DATA INSTALLED IN 2019
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

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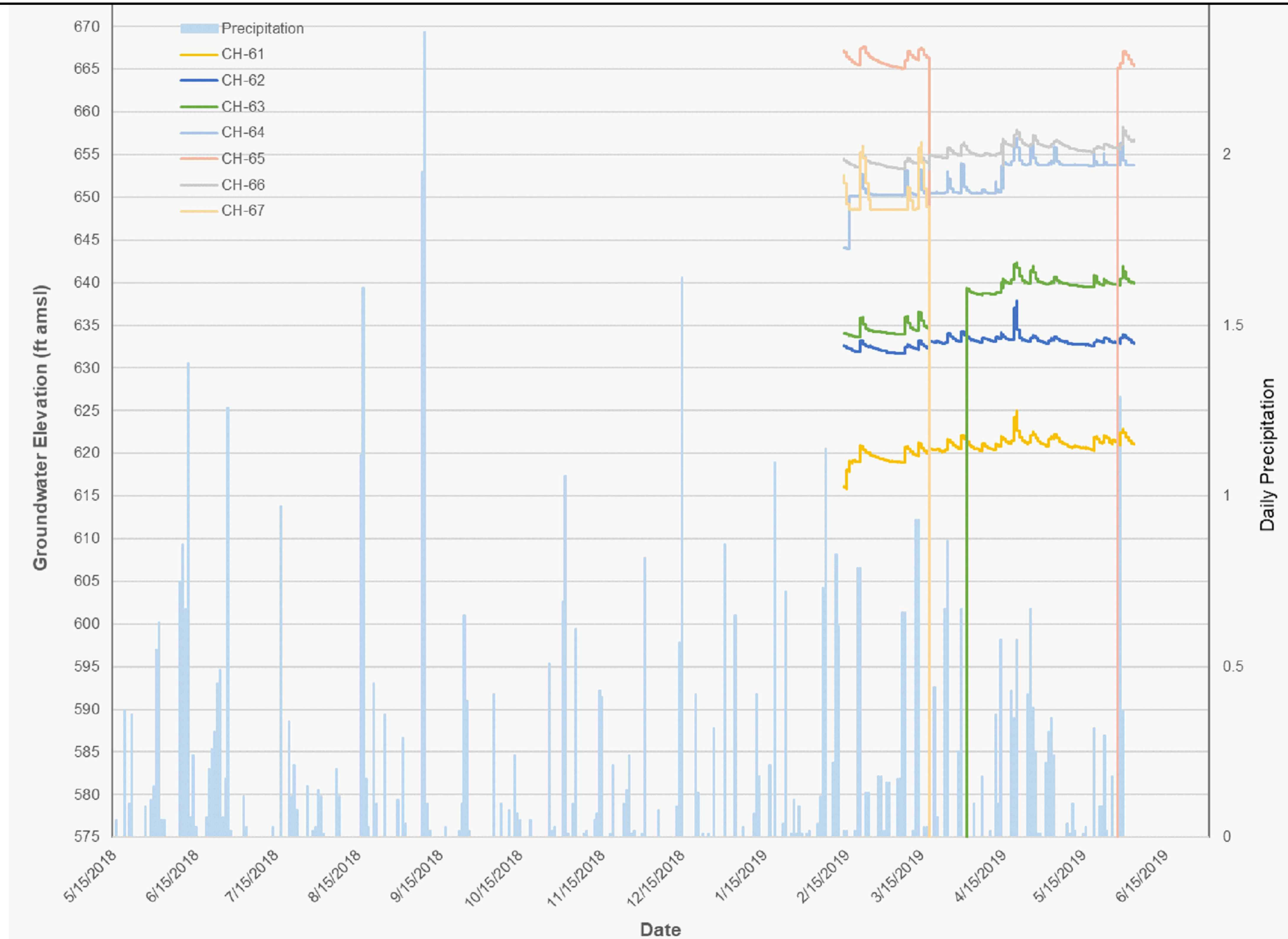


figure 4.18

SHALLOW GROUNDWATER TRANSDUCER DATA INSTALLED IN 2019
PROPOSED PILOT TRENCH PERFORMANCE MONITORING PLAN
TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

Table 4.1

Monitoring Locations and Rationale

	Location ID	Location Type	Measurement Type	Frequency	Qualifier	Rationale[1]
Hydraulic Monitoring (Figure 4.2)	IPT-1	Trench Piezometer	Pressure Transducer	15 Minutes/Monthly Download		Provide control point for pumping level in the northern portion of the pilot trench
	IPT-11	Trench Piezometer	Pressure Transducer	15 Minutes/Monthly Download		Provide control point for pumping level in the southern portion of the pilot trench
	9-4	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence of the Pilot Trench
	CH-20	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence of the Pilot Trench
	CH-22	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence of the Pilot Trench
	CH-45	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the northwest of the Pilot Trench
	CH-46	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the northwest of the Pilot Trench
	CH-47	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the northwest of the Pilot Trench
	CH-48	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download	Obstruction may prevent location	Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the northwest of the Pilot Trench
	CH-49	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the northwest of the Pilot Trench
	CH-52	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the south of the Pilot Trench
	CH-53	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the south of the Pilot Trench
	CH-54	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the south of the Pilot Trench
	CH-61	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	CH-62	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	CH-63	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	CH-64	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	CH-65	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	CH-66	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	CH-67	Monitoring Well	Pressure Transducer	15 Minutes/Monthly Download	Obstruction may prevent location	Data will allow for the collection of head measurements to evaluate the upgradient extent pf pumping influence to the north of the Pilot Trench
	CH-68	Monitoring Well	Hand Measurement	Weekly up to the time of dye injection		Data will allow for the collection of head measurements to evaluate the upgradient extent pf pumping influence of the Pilot Trench
	CH-69	Monitoring Well	Hand Measurement	Weekly up to the time of dye injection		Data will allow for the collection of head measurements to evaluate the upgradient extent pf pumping influence of the Pilot Trench
	CH-70	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	MW-X128Y255	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent pf pumping influence to the west of the Pilot Trench
	MW-X143Y193CG	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent pf pumping influence to the west of the Pilot Trench
	MW-X184Y285	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent pf pumping influence to the northwest of the Pilot Trench
	MW-X297Y305D-2	Waterloo	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	MW-X178Y367D-2	Waterloo	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence in the Intermediate Flow System to the north of the Pilot Trench
	MW-X178Y367D-5	Waterloo	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the northwest of the Pilot Trench
	MW-X234Y157S	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the southwest of the Pilot Trench
	MW-X261Y356D-4	Waterloo	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the north of the Pilot Trench
	MW-X261Y356D-5	Waterloo	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the upgradient extent of pumping influence to the north of the Pilot Trench
	MW-X318Y217D-5	Waterloo	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	MW-X344Y230	Monitoring Well	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	SG-1	Staff Gauge	Hand Measurement	Weekly for 1 month, then monthly for 5 months		Data will allow for the collection of head measurements to evaluate the downgradient influence, if any, of pumping at the Pilot Trench
	WW-4	Collection Sump	Pressure Transducer	15 Minutes/Monthly Download		Evaluate pumping level at pumping location
Dye Tracing Injection and Monitoring (NEAR FIELD)						
Pilot Trench (Figure 4.5)[3]						
First Injection						
	CH-20	Injection	NA	NA		For the near injection of a a dye tracer into the shallow groundwater flow system upgradient and near the middle portion of the Pilot Trench.
	CH-22	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess tracer movement.
	CH-46	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess tracer movement.
	CH-48	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess tracer movement.
	CH-49	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess tracer movement.
	CH-52	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess potential tracer movement south of the Pilot Trench.
	CH-61	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
	CH-62	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
	CH-63	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
	CH-64	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
	CH-65	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
	CH-66	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess tracer movement.
	CH-67	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Obstruction may prevent location	Data will be used to help assess potential tracer movement north of the Pilot Trench.
	CH-68	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess potential tracer movement north of the Pilot Trench.
	CH-69	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess potential tracer movement north of the Pilot Trench.
	CH-70	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
	MW-X178Y367D-2	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to help identify the potential for other, upgradient dye in the area and within the intermediate flow system.
	MW-X234Y157D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to help identify the potential for other, upgradient dye in the area and within the deep flow system.
	MW-X234Y157D-2	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to help identify the potential for other, upgradient dye in the area and within the intermediate flow system.
	MW-X261Y356D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
	MW-X297Y305D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
	MW-X297Y305D-2	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
	MW-X318Y217D-5	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
	MW-X344Y230	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye travel beyond the trench to Bailey's Branch
	BB-1	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to monitor the background fluorescence of water in the head waters of Bailey's Branch throughout the tracer study for inputs of non-site-related dye into the study area.
	BB-2	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-1 and this location.
	BB-3	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-2 and this location.
	BB-4	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-3 and this location.
	BB-5	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-4 and this location.
	Tributary 3-3	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye positive location for AOI4 Dye Trace. Data will be used to evaluate the potential for dye to discharge to-Tributary 3 upstream of this location.
	Tributary 3-4	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge toTributary 3 upstream of this location and prior to joining Bailey's Branch.
	WW-3	Collection Sump	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye travel to the existing collections systems located upgradient of the Pilot Trench
	WW-4	Collection Sump	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		These data will be used to evaluate recovery of dye in water pumped from the trench.
	Outfall 003/004[4]	NPDES Outfall	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		These data will be used to assess the viability of downstream dye detections.
	NT-2	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northward movement of dye. Potential access issues exist for any remaning springs. Location is primarily intended to bound the observed flow direction
	Spring 021-004	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
	Spring 021-003	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
	Spring 021-002	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
	Spring 018C	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
Second Injection						
	CH-68	Injection	NA	NA		For the near injection of a a dye tracer into the shallow groundwater flow system upgradient and near the southern extent of the Pilot Trench operations
	CH-69	Injection	NA	NA		For the near injection of a a dye tracer into the shallow groundwater flow system upgradient and near the northern extent of the Pilot Trench operations
	CH-22	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess tracer movement and, if dye is detected, estimate straight-line groundwater velocity.
	CH-52	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess potential tracer movement south of the Pilot Trench.
	CH-61	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
	CH-62	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
	CH-63	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
	CH-64	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.

Table 4.1

Monitoring Locations and Rationale

Location ID	Location Type	Measurement Type	Frequency	Qualifier	Rationale[1]
CH-65	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the-Pilot Trench at this location.
CH-66	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to help assess tracer movement.
CH-67	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Obstruction may prevent location	Data will be used to help assess potential tracer movement north of the Pilot Trench.
CH-70	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
MW-X178Y367D-2	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Intermediate Flow System.
MW-X234Y157D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
MW-X234Y157D-2	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Intermediate Flow System.
MW-X261Y356D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
MW-X297Y305D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
MW-X297Y305D-2	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
MW-X318Y217D-5	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
MW-X344Y230	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye travel beyond the trench to Bailey's Branch
BB-1	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to monitor the background fluorescence of water in the head waters of Bailey's Branch throughout the tracer study for inputs of non-site-related dye into the study area.
BB-2	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-1 and this location.
BB-3	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-2 and this location.
BB-4	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-3 and this location.
BB-5	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-4 and this location.
Tributary 3-3	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye positive location for AOI4 Dye Trace. Data will be used to evaluate the potential for dye to discharge to-Tributary 3 upstream of this location.
Tributary 3-4	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to discharge toTributary 3 upstream of this location and prior to joining Bailey's Branch.
WW-3	Collection Sump	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye travel to the existing collections systems located upgradient of the Pilot Trench
WW-4	Collection Sump	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		These data will be used to evaluate recovery of dye in water pumped from the trench.
Outfall 003/004[4]	NPDES Outfall	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		These data will be used to assess the viability of downstream dye detections.
NT-2	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northward movement of dye. Potential access issues exist for any remaning springs. Location is primarily intended to bound the observed flow direction
Spring 021-004	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
Spring 021-003	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
Spring 021-002	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
Spring 018C	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
GUS (Figure 4.6)[3] (FAR FIELD)					
Vault CO1	Injection	NA	NA		To distribute dye into the shallow bedrock groundwater flow system within the north-eastern portion of the Facility
Vault CO2	Injection	NA	NA		To distribute dye into the shallow bedrock groundwater flow system within the north-eastern portion of the Facility
9-4	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye presence at this location will serve to confirm the successful introduction of dye to the shallow bedrock flow system. Dye absence would indicate that the well is poorly connected to the flow system.
CH-20	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye presence at this location will serve to confirm the successful introduction of dye to the shallow bedrock flow system. Dye absence would indicate that the well is poorly connected to the flow system.
CH-22	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye presence at this location will serve to confirm the successful introduction of dye to the shallow bedrock flow system. Dye absence would indicate that the well is poorly connected to the flow system.
CH-45	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Postive dye detections at this location would indicate that a portion of the northeastern area of the Facility includes a northerly component
CH-46	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Postive dye detections at this location would indicate that a portion of the northeastern area of the Facility includes a northerly component
CH-47	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Postive dye detections at this location would indicate that a portion of the northeastern area of the Facility includes a northerly component
CH-48	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Obstruction may prevent location	Postive dye detections at this location would indicate that a portion of the northeastern area of the Facility includes a northerly component
CH-49	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Postive dye detections at this location would indicate that a portion of the northeastern area of the Facility includes a north-easterly component
CH-52	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Postive dye detections at this location would indicate that a portion of the northeastern area of the Facility includes a south-easterly component
CH-53	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Postive dye detections at this location would indicate that a portion of the northeastern area of the Facility includes a south-easterly component
CH-54	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Postive dye detections at this location would indicate that a portion of the northeastern area of the Facility includes a south-easterly component
CH-61	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
CH-62	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
CH-63	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
CH-64	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
CH-65	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
CH-66	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
CH-67	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Obstruction may prevent location	Data will be used to evaluate the potential for dye travel from the injection location around to the north-northeast of the Pilot Trench
CH-68	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye presence at this location will serve to confirm the successful introduction of dye to the shallow bedrock flow system. Dye absence would indicate that the well is poorly connected to the flow system.
CH-69	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye presence at this location will serve to confirm the successful introduction of dye to the shallow bedrock flow system. Dye absence would indicate that the well is poorly connected to the flow system.
CH-70	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye travel from the injection location around to the north-northeast of the Pilot Trench
MW-X033Y147S	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for westward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X128Y255	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northwestward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X143Y193CG	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for westward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X184Y285	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X209Y078S	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X233Y071B	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye positive location for AOI6 Dye Trace. Monitor for southward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X233Y095	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X233Y100	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X233Y110B	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X233Y115B	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X233Y120B	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X233Y125B	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-234Y157S	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye positive location for AOI4 Dye Trace. Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X234Y157D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
MW-X234Y157D-2	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Intermediate Flow System.
MW-234Y157D-4	Waterloo	Hand Collect	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye positive location for AOI4 Dye Trace. Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X242Y060S	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X251Y189D-7	Waterloo	Hand Collect	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X257Y073	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X269Y201D-3	Waterloo	Hand Collect	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X297Y305D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
MW-X297Y305D-2	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location.
MW-X178Y367D-2	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Intermediate Flow System.
MW-X178Y367D-5	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X261Y356D-1	Waterloo	Hand Collection	Weekly for 8 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
MW-X261Y356D-4	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X261Y356D-5	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X318Y217D-5	Waterloo	Hand Collection	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
MW-X344Y230	Monitoring Well	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye travel beyond the trench to Bailey's Branch
BB-1	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access	Data will be used to monitor the background fluorescence of water in the head waters of Bailey's Branch throughout the tracer study for inputs of non-site-related dye into the study area.
BB-2	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access	Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-1 and this location.
BB-3	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access	Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-2 and this location.
BB-4	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access	Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-3 and this location.
BB-5	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access	Data will be used to evaluate the potential for dye to discharge to Bailey's Branch between location BB-4 and this location.
Tributary 3-3	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye positive location for AOI4 Dye Trace. Data will be used to evaluate the potential for dye travel to the existing collections systems located upgradient of the Pilot Trench
Tributary 3-4	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		These data will be used to evaluate recovery of dye in water pumped from the trench.
NT-1	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northward movement of dye. Potential access issues exist for any remaning springs. Location is primarily intended to bound the observed flow direction
NT-2	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for northward movement of dye. Potential access issues exist for any remaning springs. Location is primarily intended to bound the observed flow direction
Western Tributary 1	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for westward movement of dye. Potential access issues exist for any remaning springs. Location is primarily intended to bound the observed flow direction
WT-2	Surface Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for westward movement of dye. Potential access issues exist for any remaning springs. Location is primarily intended to bound the observed flow direction
WW-1	Collection Sump	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye positive location for Outfall 002 Dye Trace. Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
WW-2	Collection Sump	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Monitor for southeastward movement of dye. Location is primarily intended to bound the observed flow direction
WW-3	Collection Sump	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye travel to the existing collections systems located upgradient of the Pilot Trench

Table 4.1

Monitoring Locations and Rationale

	Location ID	Location Type	Measurement Type	Frequency	Qualifier	Rationale[1]
	WW-4	Collection Sump	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		These data will be used to evaluate recovery of dye in water pumped from the trench.
	Outfall 003/004[4]	NPDES Outfall	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		These data will be used to assess the viability of downstream dye detections.
	Spring 021-004	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Dye positive location for Swallet 1, 2 and 5 dye traces. Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
	Spring 021-003	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Dye positive location for Swallet 1, 2 and 5 dye traces. Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
	Spring 021-002	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Dye positive location for Swallet 1, 2 and 5 dye traces. Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
	Spring 018C	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Dye positive location for Swallet 1, 2 and 5 dye traces. Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
	Bdfd A	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months		Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
	Bdfd W	Spring Water	Charcoal	Daily for 2 weeks, weekly for 6 weeks, monthly for 4 months	Pending Access and Thermal Reconnaisance	Data will be used to evaluate the potential for dye to travel beyond the Pilot Trench, and if so, document where dyed water discharges to the surface.
PCB Sampling[3] (Figure 4.4)	9-4	Monitoring Well	Zero Purge/Low Flow	CA750 (bi-annually)[2]		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. This well is also included as part of the CA750 sampling program.
	CH-20	Monitoring Well	Zero Purge/Low Flow	CA750 (bi-annually)[2]		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. This well is also included as part of the CA750 sampling program.
	CH-22	Monitoring Well	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the curent overall shallow groundwater conditions in the northeast portion of the Facility.
	CH-46	Monitoring Well	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	CH-48	Monitoring Well	Zero Purge/Low Flow	Baseline	Obstruction may prevent location	Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	CH-49	Monitoring Well	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	CH-52	Monitoring Well	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	CH-53	Monitoring Well	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	CH-54	Monitoring Well	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	CH-61	Monitoring Well	Zero Purge/Low Flow	Baseline, if PCB detections, then resample during CA750		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-62	Monitoring Well	Zero Purge/Low Flow	Baseline, if PCB detections, then resample during CA750		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-63	Monitoring Well	Zero Purge/Low Flow	Baseline, if PCB detections, then resample during CA750		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-64	Monitoring Well	Zero Purge/Low Flow	Baseline, if PCB detections, then resample during CA750		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-65	Monitoring Well	Zero Purge/Low Flow	Baseline, if PCB detections, then resample during CA750		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-66	Monitoring Well	Zero Purge/Low Flow	Baseline, if PCB detections, then resample during CA750		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-67	Monitoring Well	Zero Purge/Low Flow	Baseline	Obstruction may prevent location	Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-68	Monitoring Well	Zero Purge/Low Flow	Baseline		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-69	Monitoring Well	Zero Purge/Low Flow	Baseline		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	CH-70	Monitoring Well	Zero Purge/Low Flow	Baseline		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. New installation
	MW-X143Y193CG	Monitoring Well	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the immediately west of the Vault.
	MW-X234Y157S	Monitoring Well	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility. Static groundwater elevations indicate response to rainfall events.
	MW-X178Y367D-2	Waterloo	Zero Purge/Low Flow	Baseline		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Intermediate Flow System.
	MW-X178Y367D-5	Waterloo	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	MW-X234Y157D-1	Waterloo	Zero Purge/Low Flow	One Time		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
	MW-X234Y157D-2	Waterloo	Zero Purge/Low Flow	One Time		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Intermediate Flow System.
	MW-X261Y356D-1	Waterloo	Zero Purge/Low Flow	One Time		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
	MW-X261Y356D-3	Waterloo	Zero Purge/Low Flow	CA750 (bi-annually)[2]		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall groundwater conditions within the intermediate flow system in the northeast portion of the Facility.
	MW-X261Y356D-4	Waterloo	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	MW-X261Y356D-5	Waterloo	Zero Purge/Low Flow	Baseline		Upgradient of Pilot Trench. To assist in the evaluation of the existing overall shallow groundwater conditions in the northeast portion of the Facility.
	MW-X297Y305D-1	Waterloo	Zero Purge/Low Flow	One Time		Data will be used to evaluate the potential for dye to travel beneath the Pilot Trench at this location in the Deep Flow System.
	MW-X297Y305D-2	Waterloo	Zero Purge/Low Flow	CA750 (bi-annually)[2]		Data will be used to evaluate the potential for dye travel from the injection location beneath the bottom of the Pilot Trench
	MW-X300Y199D-2	Waterloo	Zero Purge/Low Flow	CA750 (bi-annually)[2]		Downgradient of Pilot Trench. To assist in the evaluation of the existing overall groundwater conditions within the intermediate flow system in the northeast portion of the Facility.
	Spring 021-004	Spring Water	Grab	Baseline	Pending Access and Thermal Reconnaisance	Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	Spring 021-003	Spring Water	Grab	Baseline	Pending Access and Thermal Reconnaisance	Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	Spring 021-002	Spring Water	Grab	Baseline	Pending Access and Thermal Reconnaisance	Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	Spring 018C	Spring Water	Grab	Baseline		Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	BB-1	Surface Water	Grab	Baseline	Pending Access and Thermal Reconnaisance	Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	BB-2	Surface Water	Grab	Baseline	Pending Access and Thermal Reconnaisance	Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	BB-3	Surface Water	Grab	Baseline	Pending Access and Thermal Reconnaisance	Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	BB-4	Surface Water	Grab	Baseline	Pending Access and Thermal Reconnaisance	Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	BB-5	Surface Water	Grab	Baseline	Pending Access and Thermal Reconnaisance	Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	Trib 3-3	Surface Water	Grab	Baseline		Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	Trib 3-4	Surface Water	Grab	Baseline		Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	WW-3	Wet Well	Spigot	Baseline		Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.
	WW-4	Wet Well	Spigot	Baseline		Provide a current "snapshot" of the concentration of PCBs in groundwater discharging from this spring under base-flow conditions, if tested positive for dye. If PCBs are detected, a second, confirmatory sample will be collected and analyzed.

NOTES:

1: The rationale are representative of GM's current understanding of the data and the potential use of such in each category. However, actual use of the data will be in conjunction with, and in context with, other collected information and will be part of a multiple lines of evidence approach.
2: Currently collected bi-annually as part of the CA750 program
3: At any monitoring location where dye is positively detected, a straight-line groundwater velocity will be estimated.
4: Outfall 003/004 is the location where treated groundwater discharges to Tributary 3. Any dye detections after the groundwater is treated will nullify, or complicate, interpretations of any dye presence within Tributary 3 and downstream thereof (See Section 4.9.3).
5: Currently collected monthly

Appendices

Appendix A
Existing Monitoring Well Logs

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: GM BEDFORD RFI
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: 9-4
DATE COMPLETED: July 19, 2005
DRILLING METHOD: 6 1/4" HSA & HQ CORE
FIELD PERSONNEL: D. DEITNER

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	SAMPLE NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID (ppm)
	TOP OF CASING	681.8						
	GROUND SURFACE	679.2						
	ML-SILT (FILL), with fine grained sand, with clay, trace fine round gravel, loose, light brown, dry							
2				1	P/S	2.4		0.0
	CL-CLAY (FILL), with silt, soft, low plasticity, black, moist	676.2						
4	- 2-inches of concrete at 4.2ft BGS - trace silty clay sand at 4.4ft BGS							
6				2	P/S	2.4		0.0
	SP-SAND (FILL), compact, fine grained, poorly graded, black, moist - 2.5-inches of silty clay at 6.6ft BGS	673.0						
8	- trace fine round gravel, dark gray at 7.7ft BGS - 1/2-inch light gray lens at 8.6ft BGS - odor present at 8.7ft BGS - 1/2-inch light gray at 9.2ft BGS							
10			4" DIA. STEEL CASING	3	P/S	2.5		0.0
12	- 2.5-inches of wood debris at 11.6ft BGS							
14	- 7.3 feet of metal, plastic and wood debris observed in soil cuttings during drilling at 14.0ft BGS - 1/2-inch yellow staining lens at 15.1ft BGS - 1/2-inch yellow staining at 15.3ft BGS			4	P/S	1.8		0.0
16								
18	- strong odor at 18.0ft BGS			5	P/S	2.2		0.0
	CL-CLAY (FILL), with silt, trace fine grained sand, soft, low plasticity, black, moist, moderate odor	660.7						
20	CL-CLAY, with silt, stiff, low plasticity, brown, moist	660.2		6	P/S	1.3		0.0
	END OF OVERBURDEN HOLE @ 21.3ft BGS		CEMENT / BENTONITE SEAL					
22								
24								
26								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: GM BEDFORD RFI
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: 9-4
DATE COMPLETED: July 19, 2005
DRILLING METHOD: 6 1/4" HSA & HQ CORE
FIELD PERSONNEL: D. DEITNER

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	RUN NUMBER	CORE RECOVERY %	RQD %
			CEMENT / BENTONITE SEAL			
	LIMESTONE (SALEM FORMATION), weathered and fractured, thin bedded, gray, medium grained	657.9				
22	- no longer fractured rock at 21.9ft BGS					
24	- set 4" steel casing at 24.0ft BGS					
26	- horizontal fracture at 26.1ft BGS			1	100	100
28						
30						
32	- horizontal fracture at 32.2ft BGS					
34						
	- horizontal fracture at 35.0ft BGS - open stylolite at 35.4ft BGS			2	100	100
36	- open stylolite at 36.2ft BGS - stylolite at 36.7ft BGS - stylolite at 37.0ft BGS					
38	- medium grained, gray, calcite content at 37.6ft BGS - open stylolite at 38.2ft BGS - 5-feet of porous section at 39.0ft BGS - stylolite at 39.2ft BGS		4" DIA. COREHOLE			
40						
42	- stylolite at 42.7ft BGS - stylolite at 43.1ft BGS					
44	- stylolite at 44.9ft BGS					
46	- stylolite at 45.7ft BGS - open stylolite at 45.9ft BGS					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: GM BEDFORD RFI
HOLE DESIGNATION: 9-4
PROJECT NUMBER: 013968
DATE COMPLETED: July 19, 2005
CLIENT: GENERAL MOTORS CORPORATION
DRILLING METHOD: 6 1/4" HSA & HQ CORE
LOCATION: BEDFORD, INDIANA
FIELD PERSONNEL: D. DEITNER

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	RUN NUMBER	CORE RECOVERY %	RQD %
	- open stylolite at 49.3ft BGS		4" DIA. COREHOLE	3	100	98
54	END OF BOREHOLE @ 54.1ft BGS	625.1				

Depth scale: 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74

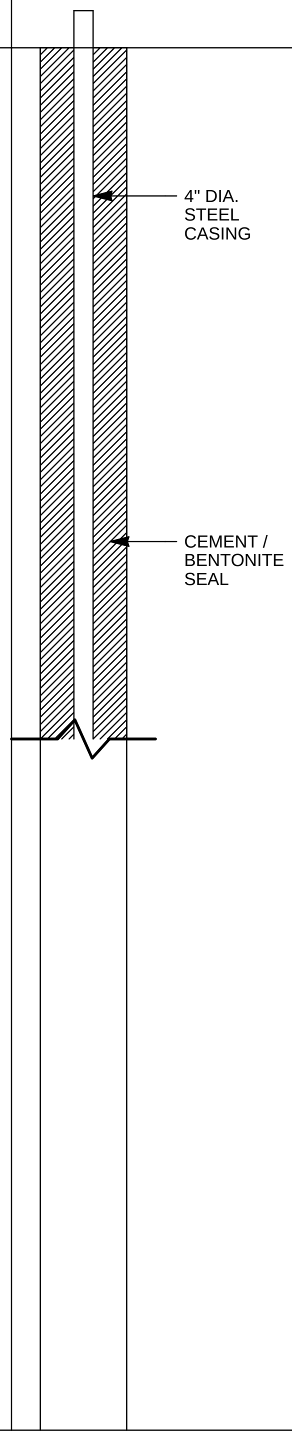
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: GM BEDFORD RFI
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: CH-20
DATE COMPLETED: June 7, 2005
DRILLING METHOD: 6 1/4" HSA & HQ CORE
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	SAMPLE NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID (ppm)
	TOP OF CASING	621.8					
	GROUND SURFACE	619.2					
0	CL-CLAY (FILL), with silt, gravel, firm, low plasticity, brown, moist						
2	ML-SILT (FILL), little clay, compact, beige, wet, dilatant	617.2	1	P/S	3.0		0.0
6	CL-CLAY (FILL), little silt, soft, medium plasticity, dark gray, very moist to wet	613.2	2	P/S	4.0		0.0
10			3	P/S	3.0		0.0
13			4	P/S	2.0		0.0
13.5	Rock fragments	605.7					
14	END OF OVERBURDEN HOLE @ 14.0ft BGS						



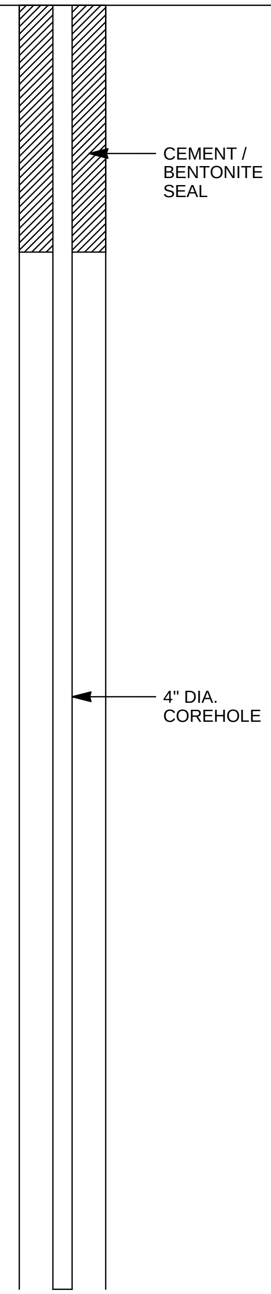
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: GM BEDFORD RFI
HOLE DESIGNATION: CH-20
PROJECT NUMBER: 013968
DATE COMPLETED: June 7, 2005
CLIENT: GENERAL MOTORS CORPORATION
DRILLING METHOD: 6 1/4" HSA & HQ CORE
LOCATION: BEDFORD, INDIANA
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	RUN NUMBER	CORE RECOVERY %	RQD %
13.5	Rock fragments	605.7			
14	LIMESTONE (SALEM FORMATION), medium grained, gray with brown in color	605.2			
17.0	- set 4-inch steel casing at 17.0ft BGS				
17.6	- stylolite at 17.6ft BGS				
18	LIMESTONE (UPPER HARRODSBURG FORMATION), medium to coarse grained, gray/tan	601.2			
20.8	- horizontal fracture at 20.8ft BGS				
22.7	- horizontal fracture at 22.7ft BGS		1	100	100
23.4	- shale parting at 23.4ft BGS				
23.8	- shale parting at 23.8ft BGS				
24.4	- shale parting at 24.4ft BGS				
25.4	- 1/2-inch vug at 25.4ft BGS				
26.0	- open stylolite at 26.0ft BGS				
27.5	- stylolite at 27.5ft BGS				
27.9	- fossils present at 27.9ft BGS				
28.6	- 8-inch slightly porous section at 28.6ft BGS				
30.4	- stylolite at 30.4ft BGS				
30.9	- stylolite at 30.9ft BGS				
31.5	- stylolite at 31.5ft BGS				
32.1	- open stylolite at 32.1ft BGS				
33.3	- 10-inch slightly porous section at 33.3ft BGS		2	100	100
33.7	- horizontal fracture at 33.7ft BGS				
35.1	- stylolite at 35.1ft BGS				
37.1	- horizontal fracture at 37.1ft BGS				
38	END OF BOREHOLE @ 38.0ft BGS	581.2			

COREHOLE



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

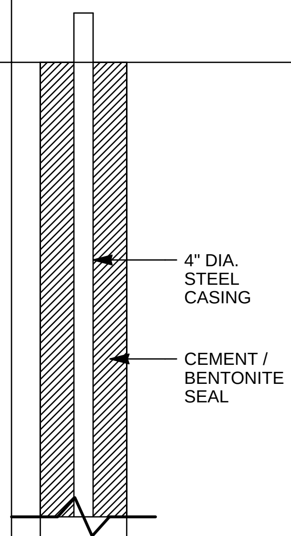
STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: GM BEDFORD RFI
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: CH-22
DATE COMPLETED: June 1, 2005
DRILLING METHOD: 6 1/4" HSA & HQ CORE
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	SAMPLE NUMBER	INTERVAL	REC (ft)	'N' VALUE	PID (ppm)
	TOP OF CASING	615.9					
	GROUND SURFACE	613.4					
0–9.2	CL-CLAY (FILL), some silt, trace gravel, firm, low to medium plasticity, strong brown, moist						
2			1	P/S	3.0		0.0
6			2	P/S	3.0		0.0
8.6			3	P/S	1.0		0.0
9.2	END OF OVERBURDEN HOLE @ 9.2ft BGS						

COREHOLE



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: GM BEDFORD RFI
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: CH-22
DATE COMPLETED: June 1, 2005
DRILLING METHOD: 6 1/4" HSA & HQ CORE
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	RUN NUMBER	CORE RECOVERY %	RQD %
10	LIMESTONE (SALEM FORMATION), fine to medium grained, occasional calcite content, thin bedded, gray	604.2	CEMENT / BENTONITE SEAL			
12	- set 4-inch steel casing at 12.0ft BGS					
14	LIMESTONE (UPPER HARRODSBURG FORMATION), fine to medium grained, occasional calcite content, thin bedded, gray - stylolite at 13.9ft BGS - stylolite at 14.1ft BGS	599.9				
16	- open stylolite at 14.5ft BGS - stylolite at 15.0ft BGS - vertical fracture at 15.5ft BGS			1	100	100
18	- open stylolite at 16.3ft BGS - 1.4 feet of porous section at 17.5ft BGS - stylolite at 18.8ft BGS					
20	- stylolite at 19.7ft BGS - stylolite at 19.8ft BGS - open stylolite at 20.7ft BGS		4" DIA. HQ COREHOLE			
22						
24	- open stylolite at 23.4ft BGS - stylolite at 24.0ft BGS - 3 feet of porous section at 24.9ft BGS					
26						
28	- stylolite at 27.1ft BGS - stylolite at 27.5ft BGS - open stylolite at 28.2ft BGS - 4 feet porous section at 28.8ft BGS			2	100	100
30	- horizontal fracture at 30.5ft BGS					
32	- horizontal fracture at 31.6ft BGS - horizontal fracture at 31.8ft BGS - horizontal fracture at 32.1ft BGS END OF BOREHOLE @ 32.6ft BGS	580.8				
34						

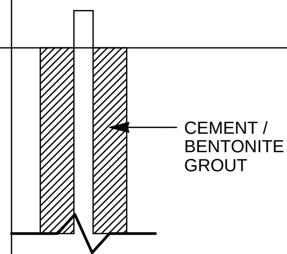
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: INVESTIGATORY BEDROCK COREHOLES
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: CH-49
DATE COMPLETED: August 23, 2012
DRILLING METHOD: HSA / HQ CORE
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (ft)	SAMPLE 'N' VALUE
	TOP OF CASING	643.8					
	GROUND SURFACE	641.1					
	CL-SILTY CLAY, little silt, firm, medium plasticity, strong brown, moist						
2							
	END OF OVERBURDEN HOLE @ 3.5ft BGS						
4							
6							
8							
10							
12							
14							
16							
18							
20							
22							
24							



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: INVESTIGATORY BEDROCK COREHOLES

PROJECT NUMBER: 013968

CLIENT: GENERAL MOTORS CORPORATION

LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: CH-49

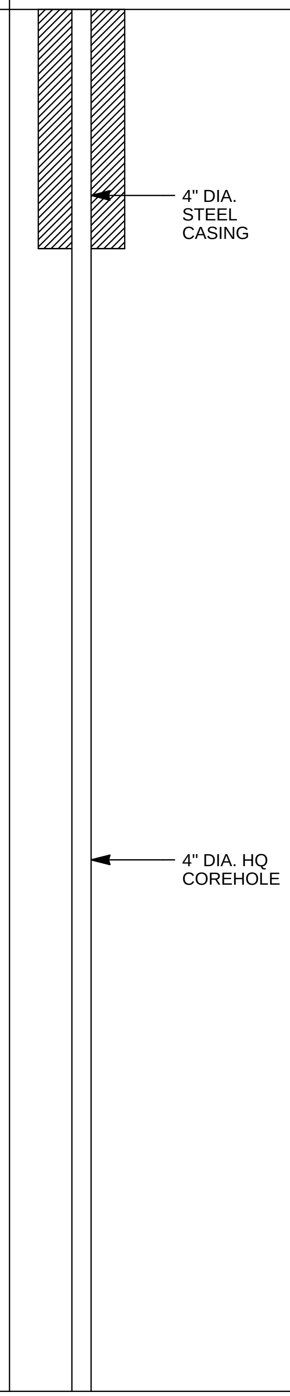
DATE COMPLETED: August 23, 2012

DRILLING METHOD: HSA / HQ CORE

FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	RUN NUMBER	CORE RECOVERY %	RQD %
3	LIMESTONE (SALEM FORMATION), fine grained, thin bedded, calcite content, light grey	637.6			
6.5	- set 4-inch steel casing at 6.5ft BGS				
7.3	- stylolite at 7.3ft BGS				
8.1	- horizontal fracture at 8.1ft BGS				
9.8	- stylolite at 9.8ft BGS				
10.2	- horizontal fracture at 10.2ft BGS				
7–15			1	98	98
12.3	- open stylolite at 12.3ft BGS				
13.1	- horizontal fracture at 13.1ft BGS				
14.3	- horizontal fracture at 14.3ft BGS				
15.9	- stylolite at 15.9ft BGS				
16.3	- horizontal fracture at 16.3ft BGS				
15–24.2			2	100	100
19.8	- 7-inch vertical fracture at 19.8ft BGS				
20.9	- horizontal fracture at 20.9ft BGS				
23.2	- horizontal fracture at 23.2ft BGS				
24.7	- stylolite at 24.7ft BGS				
27.1	- open stylolite at 27.1ft BGS				

COREHOLE



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: INVESTIGATORY BEDROCK COREHOLES
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: CH-49
DATE COMPLETED: August 23, 2012
DRILLING METHOD: HSA / HQ CORE
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	RUN NUMBER	CORE RECOVERY %	RQD %
	- stylolite at 28.6ft BGS - 6-inch medium grained section at 29.6ft BGS - fine grained at 30.0ft BGS - open stylolite at 30.9ft BGS - trace small fosil content at 31.0ft BGS		4" DIA. HQ COREHOLE	3	100	100
34.2	END OF BOREHOLE @ 34.2ft BGS	606.9				

Depth scale: 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: INVESTIGATORY BEDROCK COREHOLES
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: CH-52
DATE COMPLETED: August 28, 2012
DRILLING METHOD: HSA / HQ CORE
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (ft)	SAMPLE 'N' VALUE
	TOP OF CASING GROUND SURFACE	671.0 668.3					
	CL-SILTY CLAY, little silt, firm, low plasticity, strong brown, moist		CEMENT / BENTONITE GROUT				
3.0	END OF OVERBURDEN HOLE @ 3.0ft BGS						

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: INVESTIGATORY BEDROCK COREHOLES

HOLE DESIGNATION: CH-52

PROJECT NUMBER: 013968

DATE COMPLETED: August 28, 2012

CLIENT: GENERAL MOTORS CORPORATION

DRILLING METHOD: HSA / HQ CORE

LOCATION: BEDFORD, INDIANA

FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	RUN NUMBER	CORE RECOVERY %	RQD %
	LIMESTONE (SALEM FORMATION), fine grained, thin bedded, light grey, trace calcite	665.3				
4						
	- set 4-inch steel casing at 5.0ft BGS		4" DIA. STEEL CASING			
	- 1-feet broken rock at 5.5ft BGS					
6						
8						
	- horizontal fracture with clay infill at 8.5ft BGS					
10				1	89	89
	- horizontal fracture at 10.4ft BGS					
	- open stylolite at 11.9ft BGS					
12						
	- open stylolite at 13.8ft BGS					
14						
16	- oxidized horizontal fracture at 16.0ft BGS					
	- horizontal fracture at 17.8ft BGS					
18						
20			4" DIA. HQ COREHOLE	2	100	100
	- horizontal fracture with half-inch clay fill at 20.3ft BGS					
22						
	- horizontal fracture at 23.0ft BGS					
24						
26						
	- horizontal fracture at 27.8ft BGS					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: INVESTIGATORY BEDROCK COREHOLES
HOLE DESIGNATION: CH-52
PROJECT NUMBER: 013968
DATE COMPLETED: August 28, 2012
CLIENT: GENERAL MOTORS CORPORATION
DRILLING METHOD: HSA / HQ CORE
LOCATION: BEDFORD, INDIANA
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	RUN NUMBER	CORE RECOVERY %	RQD %
	- horizontal fracture at 28.4ft BGS - open stylolite at 28.9ft BGS - medium grained at 29.4ft BGS					
30				3	100	100
32	- stylolite at 32.1ft BGS - open stylolite at 33.0ft BGS					
34	- stylolite at 34.0ft BGS - medium grained, high calcite content, gray at 35.0ft BGS - stylolite at 35.6ft BGS					
36	- horizontal fracture at 36.5ft BGS					
38	- stylolite at 38.4ft BGS - horizontal fracture at 39.2ft BGS					
40	- horizontal fracture at 40.4ft BGS - half-inch open stylolite at 40.9ft BGS - fine grained at 41.0ft BGS		4" DIA. HQ COREHOLE	4	100	99
42	- stylolite at 43.3ft BGS					
44	- horizontal fracture at 44.0ft BGS - stylolite at 45.0ft BGS					
46						
48	- horizontal fracture at 47.9ft BGS - stylolite at 48.0ft BGS - horizontal fracture at 48.8ft BGS					
50	- stylolite at 50.3ft BGS - horizontal fracture at 51.3ft BGS - horizontal fracture at 51.8ft BGS			5	100	100
52	- horizontal fracture at 52.9ft BGS - brown in color at 53.0ft BGS					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: INVESTIGATORY BEDROCK COREHOLES
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA

HOLE DESIGNATION: CH-52
DATE COMPLETED: August 28, 2012
DRILLING METHOD: HSA / HQ CORE
FIELD PERSONNEL: K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	COREHOLE	RUN NUMBER	CORE RECOVERY %	RQD %
	- stylolite at 54.0ft BGS - horizontal fracture at 54.7ft BGS					
	END OF BOREHOLE @ 55.0ft BGS	613.3				
56						
58						
60						
62						
64						
66						
68						
70						
72						
74						
76						
78						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: GM BEDFORD RFI
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA
DRILLING CONTRACTOR: RDNP

HOLE DESIGNATION: MW-X297Y305D
DATE COMPLETED: June 23, 2003
DRILLING METHOD: 6 1/4-INCH HSA
FIELD PERSONNEL: J. MC COMBS & K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
	TOP OF RISER	616.0				
	GROUND SURFACE	614.5				
	TOPSOIL	614.2	4" DIA. STEEL CASING			
	LIMESTONE (SALEM FORMATION), medium to coarse grained fossiliferous, granular, calcite, thick bedding, gray to dark gray		CEMENT / BENTONITE GROUT			
2	- pair of horizontal fractures, unweathered at 2.9ft BGS					
4						
	- horizontal fracture, slightly weathered at 5.3ft BGS					
6	- open stylolite, brown, weathered at 5.6ft BGS			1	95	85
	- horizontal fracture at 7.3ft BGS					
8	- horizontal fracture at 8.5ft BGS					
10	- horizontal fracture, unweathered at 10.4ft BGS					
	- stylolite at 11.6ft BGS					
12	- stylolite, brown and parted at 12.7ft BGS	602.0				
	LIMESTONE (UPPER HARRODSBURG FORMATION), well cemented bioclastic calcarenite and calcirudite, stylolite, brown and parted			2	96	97
14	- stylolite, gray at 13.0ft BGS					
16	- 2-inch near vertical clean non-continuous opening at 14.8ft BGS					
	- stylolite, gray at 15.6ft BGS					
18						
	- 1.2-feet near vertical fracture, stylolites at 19.0ft BGS					
20	- 2 thin stylolites at 19.8ft BGS					
	- horizontal fracture, dissolved at 21.5ft BGS					
22	- 2 centimeter thick stylolite at 22.6ft BGS					
	- slightly dissolved horizontal fracture at 23.4ft BGS			3	103	99
24	- stylolite, dark gray at 24.1ft BGS					
	- 1 to 4 centimeter dissolution vugs at 25.4ft BGS		4" DIA. HQ COREHOLE			
26	- stylolite, parted, dark gray at 26.7ft BGS					
	- stylolite, dark gray at 27.0ft BGS					
28	- 2 stylolites, parted, dark gray at 28.7ft BGS					
	- stylolite, parted, slightly weathered and oxidized at 28.8ft BGS		NON-MONITORING ZONE			
30	- horizontal fracture, stylolite, slightly oxidized at 29.4ft BGS					
32	- 3.5-inch near vertical non-continuous opening at 30.7ft BGS					
	- near vertical fracture, parted, 0.8-feet section of darker limestone with fossil hash at 31.3ft BGS					
34	- stylolite at 32.1ft BGS			4	100	100

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: GM BEDFORD RFI
HOLE DESIGNATION: MW-X297Y305D
PROJECT NUMBER: 013968
DATE COMPLETED: June 23, 2003
CLIENT: GENERAL MOTORS CORPORATION
DRILLING METHOD: 6 1/4-INCH HSA
LOCATION: BEDFORD, INDIANA
FIELD PERSONNEL: J. MC COMBS & K. VANDER MEULEN
DRILLING CONTRACTOR: RDNP

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
36	- horizontal fracture at 32.6ft BGS - stylolite, parted, dark gray at 34.0ft BGS - stylolite, parted, weathered at 35.3ft BGS - thin shale seam, dark gray at 35.5ft BGS					
38						
40	- stylolite, dark gray at 39.8ft BGS - stylolite, dark gray at 40.7ft BGS					
42	- horizontal fracture, shale parting at 42.0ft BGS - stylolite, dark gray at 42.6ft BGS					
44	- stylolite, dark gray at 43.7ft BGS			5	100	99
46	- near vertical horizontal fracture, slightly weathered, some fossils, thin mineralized fracture at 45.8ft BGS					
48	- stylolite, 2 centimeter mineralized vug at 47.1ft BGS - open stylolite, dark gray at 48.3ft BGS - pair stylolite, dark gray at 49.3ft BGS		4" DIA. HQ COREHOLE			
50	- stylolite, dark gray at 50.5ft BGS			6	100	99
52	- 3-inch of unconsolidated limestone, mud wash at 50.7ft BGS - horizontal shale parting, weathered at 51.1ft BGS					
54	- horizontal shale parting, weathered at 52.0ft BGS - horizontal fracture, slightly weathered at 52.3ft BGS			7	100	90
56	- stylolite, dark gray at 52.7ft BGS - stylolite, parted/fractured, weathered / washed at 54.1ft BGS		DOW PACKER			
58	- horizontal fracture, weathered at 54.6ft BGS - horizontal shale parting, 1-feet thin vertical fracture at 55.0ft BGS					
60	- stylolite at 56.8ft BGS - stylolite at 57.7ft BGS - stylolite, parted, slightly weathered at 58.5ft BGS					
62	- stylolite, white at 60.8ft BGS - stylolite, white at 61.4ft BGS - stylolite, white at 61.8ft BGS	551.3				
64	- stylolite, white at 62.6ft BGS LIMESTONE (LOWER HARRODSBURG FORMATION), horizontal fracture, interbedded thin layers of shale			8	102	99
66	- horizontal fracture at 64.2ft BGS - 1-inch shale seam at 64.5ft BGS					
68	- 1-inch shale seam at 65.6ft BGS - horizontal fracture at 66.1ft BGS - horizontal fracture at 66.4ft BGS		SAMPLE ZONE 2			

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: GM BEDFORD RFI
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA
DRILLING CONTRACTOR: RDNP

HOLE DESIGNATION: MW-X297Y305D
DATE COMPLETED: June 23, 2003
DRILLING METHOD: 6 1/4-INCH HSA
FIELD PERSONNEL: J. MC COMBS & K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
72	- shale seam at 66.5ft BGS - 7-inch section of shale at 66.7ft BGS - horizontal fracture at shale at 67.7ft BGS - stylolite at 68.0ft BGS		DOW PACKER			
74	- stylolite at 69.0ft BGS - stylolites, dark gray at 69.8ft BGS - stylolites, dark gray at 70.0ft BGS			9	99	98
76	- stylolites, dark gray at 70.1ft BGS - 1 centimeter thick stylolite, dark gray and parted at 70.6ft BGS - horizontal fracture at 71.7ft BGS					
78	- thin shale seam at 72.6ft BGS - 0.1-feet thick shale seam at 73.6ft BGS - 1 centimeter thick stylolite, dark gray and parted at 74.7ft BGS		NON-MONITORING ZONE			
80	- shale seam, parted at 75.7ft BGS - 0.1-feet thick shale seam, dark gray at 76.0ft BGS					
82	- 0.2-feet thick shale seam at 76.7ft BGS - horizontal fracture along shale parting, dark gray at 78.2ft BGS					
84	- horizontal fracture, interbedded thin layers of shale at 79.6ft BGS - 1-centimeter thick shale stringer at 80.0ft BGS			10	100	99
86	- 1-centimeter thick shale stringer at 81.6ft BGS - 0.3-feet thick zone of shale stringers, dark gray with pyrite crystals at 83.4ft BGS					
88	- stylolite, wash out at 84.8ft BGS - 0.4-feet thick geode within shale zone, bottom of zone contains near vertical shale partings at 86.2ft BGS		DOW PACKER			
90	- horizontal fracture, slightly oxidized at 87.7ft BGS					
92	- horizontal fracture, shaley, 1-feet long vertical non-continuous opening at 88.0ft BGS	522.0				
94	- shale parting at 89.0ft BGS - stylolite, dark gray at 89.4ft BGS - 1-feet thick shale seam at 89.6ft BGS			11	100	100
96	- horizontal fracture, slightly weathered at 92.3ft BGS LIMESTONE (RAMP CREEK FORMATION), very fine grained, even bedded, shaley with geodes		4" DIA. HQ COREHOLE			
98	- 1-feet thick section of geodes, white, quartz at 94.8ft BGS					
100	- 0.1-feet thick geode, tabular parted, white with calcite / quartz and pyrite minerals, slightly dissolved at 97.0ft BGS					
102	- 0.1-feet thick vug slightly mineralized at 99.1ft BGS - 3.4-feet thick section of shaley limestone with quartz geodes at 100.1ft BGS					
104	- horizontal fractures, shale partings at 103.1ft BGS - 0.8-feet light gray limestone with shale					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: GM BEDFORD RFI
PROJECT NUMBER: 013968
CLIENT: GENERAL MOTORS CORPORATION
LOCATION: BEDFORD, INDIANA
DRILLING CONTRACTOR: RDNP

HOLE DESIGNATION: MW-X297Y305D
DATE COMPLETED: June 23, 2003
DRILLING METHOD: 6 1/4-INCH HSA
FIELD PERSONNEL: J. MC COMBS & K. VANDER MEULEN

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. ft AMSL	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
106	stringers, fossiliferous at 103.5ft BGS - horizontal fracture at 105.1ft BGS - horizontal fracture at 106.5ft BGS		SAMPLE ZONE 1	12	99	100
108	- horizontal fracture along shale stringer at 108.5ft BGS					
110	- 0.4-feet thick section of fossiliferous limestone, shale stringers, light gray at 109.6ft BGS	504.5	4" DIA. HQ COREHOLE			
112	SHALE (EDWARDSVILLE FORMATION), moderately dense, pyrite, dark gray / blue, soft, slightly fissile			13	99	100
114						
	END OF BOREHOLE @ 114.8ft BGS	499.7				
116						
118						
120						
122						
124						
126						
128						
130						
132						
134						
136						
138						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

Appendix B
Hydrogeology, Inc. SOP for Dye Tracer Analysis

hydrogeology inc.
1211 S Walnut St
Bloomington, IN 47401

FIELD AND LABORATORY PROCEDURES FOR ANALYSIS OF FLUORESCENT DYES IN CHARCOAL AND WATER SAMPLES

January 28, 2019

Jason N. Krothe
President
Hydrogeology Inc.

1. Introduction

This document describes the standard field and laboratory operating procedures used by Hydrogeology Inc. (HGI) for the analysis of charcoal and water samples for the presence of fluorescent dyes. In some situations, these procedures are altered, and are noted as such in the laboratory report.

2. Fluorescent Dyes

The following dyes are typically used for tracing studies. These dyes have been used successfully and safely for groundwater tracing for the past 40 years.

Common Name: Pyranine
Color Index Number: 59040
Color Index Name: Solvent Green 7

Common Name: Fluorescein
Color Index Number: 45350
Color Index Name: Acid Yellow 73

Common Name: Eosine
Color Index: 45830
Chemical Name: Acid Red 87

Common Name: Phloxine B
Color Index Number: 45410
Color Index Name: Acid Red 92

Common Name: Rhodamine WT
Chemical Name: Acid Red 388

Common Name: Sulforhodamine B
Color Index Number: 45100
Color Index Name: Acid Red 52

3. Field Procedures

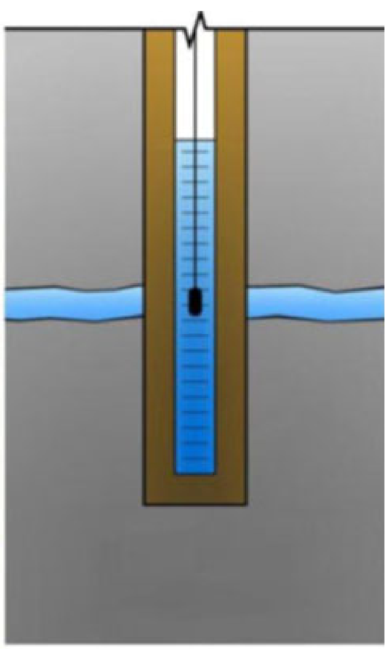
3.1 Activated Charcoal Sample Preparation

Activate Charcoal Sample (ACS) packets are constructed using fiberglass screen. The screen is formed into approximately 2-inch by 2-inch pouches for spring and surface water locations and 3-inch by 0.5-inch cylindrical pouches for wells. The pouches are filled with 10 grams of Calgon 207C coconut shell carbon. Prior to being placed in the field, all ACS packets are washed with de-ionized water, until there are no carbon particulates visible in the water. This process typically requires three rinses. After rinsing, ACS packets are placed in plastic containers or plastic bags for transport.

Example of well ACS packet.

3.2 Well ACS Installation

In the case of monitoring well sampling, ACS packets are typically deployed to the mid-point of the targeted screen interval at each monitoring well using a non-colored nylon string and stainless-steel bolts as weights. However, each well will be evaluated on an individual basis to determine areas of high flow, with the possibility of multiple ACS packets being installed in a single well. Wells with no obvious high flow zones will have one ACS packet deployed for every 15 feet of well screen



Example of ACS installation.

3.3 Surface Water ACS Installation

ACS packets deployed at surface water locations including springs and streams are connected to an anchored wire and submerged in the location with the highest estimated flow.

3.4 ACS Sample Collection

HGI staff will be responsible for all ACS sample collection. All collected samples will be logged on a form with notes documenting any irregularities with the sample collection. ACS packets are collected in 250 milliliter opaque HDPE bottles. One out of every 100 sample bottles are analyzed for fluorescence. The ACS packet is removed from the nylon line with gloved hands and placed in the bottle. All ACS samples will be stored in a cooler after collection and delivered same day to the HGI laboratory and refrigerated until analysis.

3.5 Water Sample Collection

HGI staff will be responsible for all water sample collection. All collected samples will be logged on a form with notes documenting any irregularities with the sample collection Surface water samples obtained from springs and streams are collected by direct dip with the sampling bottle, a method that is in general accordance with U.S. EPA operating procedures (specifically SESDPROC-201-R4).

Subsurface groundwater sampling from monitoring well locations is typically conducted using the "Standard/Well-Volume" method. If there is either a physical or chemical reason to reduce the rate of discharge or purge volume, "Low-Stress (low-flow)" sampling methods are employed during sampling. Both "Standard/Well-Volume" and "Low-Stress (low-flow)" methods are conducted in general accordance with U.S. EPA operating procedures (*Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers - EPA 542-S-02-001, May 2002*).

All water samples are collected in Cincinnati Container brand 2-ounce amber round bottles and stored in a cooler. One out of every 100 sample bottles are analyzed for fluorescence. Amber bottles are used to decrease potential UV exposure. All waters samples will be delivered same day to the HGI laboratory and refrigerated until analysis.

For reference, excerpts of the referenced EPA guidance regarding water sample collection methods is included as Attachment 1.

4. Laboratory Procedures

4.1 ACS Laboratory Preparation

During preparation in the laboratory, ACS packets are rinsed with de-ionized water to remove all excess sediment and particulates that can interfere with analysis. All wash water used to clean ACS packets is processed through a de-ionizing system to remove chlorine. The water is analyzed for fluorescence prior to rinsing any ACS packets. Once the ACS is properly rinsed the packet is manually opened (with a gloved hand) and the contents are poured back into the original HDPE sampling container. The ACS container is then filled with 10 mL of eluting solution which is composed of 5 parts alcohol, 3 parts de-ionized water, and 2 parts aqueous ammonia. The eluting solution is analyzed for fluorescence prior to being applied to the sample. The loose charcoal sits in this solution for one hour and then 4 mL is poured into a cuvette for analysis. The remaining solution is reserved in the event it is needed for a secondary analysis.

After one hour of eluting, approximately 4 milliliters (mL) of the elutant is poured into a disposable polyethylene cuvette. These cuvettes are designed for fluorometric analysis and are clear on all four sides. The cuvettes have a spectral range of 340 to 800 nanometer. The cuvette is then placed in the Shimadzu RF-5301PC and analyzed as noted Section 4.3.

All cuvettes with elutant are placed in a constant temperature cell designed to maintain a temperature of 4º Celsius prior to analysis. The constant temperature cells are placed in an ice-bath with one temperature blank sample. A digital thermometer is placed in the temperature blank to ensure the samples maintain a constant temperature of 4º Celsius.

4.2 Water Sample Laboratory Preparation

Approximately 4 ml of the water sample is poured into a disposable polyethylene cuvette. These cuvettes are designed for fluorometric analysis. The cuvettes have a spectral range of 340 to 800mm. The cuvette is then placed in the Shimadzu RF-5301PC and analyzed as noted below.

All water sample cuvettes are placed in a constant temperature cell designed to maintain a temperature of 4º Celsius prior to analysis on the RF-5301PC. The constant temperature cells are placed in an ice-bath with one temperature blank sample. A digital thermometer is placed in the temperature blank to ensure the samples maintain a constant temperature of 4º Celsius. The fluorescence intensity of fluorescein, eosine and pyranine is pH dependent. Water samples for those dyes are adjusted to pH 9.5 or higher prior to analysis. The water samples are placed in a high ammonia atmosphere for up to two (2) hours to achieve a pH of 9.5.

4.3 Analysis on the Shimadzu RF-5301PCPC

The Shimadzu RF-5301PC spectrofluorophotometer (RF-5301PC) is used for all sample analysis. This is a synchronous scanning model and is controlled by LabSolutions RF software. The Shimadzu RF-5301PCPC is operated and maintained in accordance with the manufacturer's recommendations. Shimadzu Scientific Instrument technicians provided the initial installation and training of all HGI staff that operate the RF-5301PC.

The standard excitation and emission slit widths used for the RF-5301PC can be seen in Table 1. Synchronous scanning of the excitation and emission wavelength is standard with a 17 nanometer (nm) separation between excitation and emission wavelengths. The following are the standard parameters used for analysis with the RF-5301PC:

Scanning Speed = Fast
Scanning Interval = 0.2 nanometers
Sensitivity = High

The fluorogram produced for each sample plots the emission wavelength (nanometer) versus the intensity (unitless). The fluorogram is inspected by the lab technician who identifies any fluorescence peaks indicative of the dyes used for the trace. For a sample to have been considered a potential dye positive a peak in the appropriate range must be identified in the LabSolutions RF interface.

Table 1: Typical excitation and emission slit widths for dye analysis

Matrix	Excitation Slit Width (EX)	Emission Slit Width (EM)
Water	5	5
Elutant	3	5

4.4 PeakFit Analysis

All samples with a potential dye peak are imported into PeakFit for additional analysis. PeakFit is a non-linear curve matching program designed for spectroscopy. PeakFit allows for the separation of potential peaks from background noise. The peak wavelength, peak height and peak area are recorded for all samples analyzed with PeakFit. To quantify dye concentration, the peak area is calculated and compared to the appropriate dye calibration curve.

4.5 Dilution

Dilution of water and elutant samples is often required. Any sample with an intensity peak above the recordable range will be diluted prior to analysis on the RF-5301PC. Diluted samples will be identified in the laboratory report.

4.6 Sample Retention

After analysis, the cuvettes with elutant are stored in a freezer located at HGI's office for possible re-analysis.

5. Quality Assurance / Quality Control

5. 1 Trip Blanks

ACS and water trip blanks will be collected for each sampling event. ACS trip blanks consist of one ACS packet placed in a 250 ml HDPE bottle, which is then placed in the sample storage cooler. The ACS blank will remain in the cooler for the duration of the sampling event. Water trip blanks consist of 2-ounce amber round bottle filled with laboratory de-ionized water. The water trip blank is kept in the sample storage cooler for the duration of the sampling event.

Blank ACS packets exhibit a unique signal when analyzed on the RF-5301PC, with two fluorescence peaks that fall within the accepted emission wavelengths for Fluorescein and Rhodamine WT. The peaks are taken into consideration for potential detections of Fluorescein and Rhodamine WT.

5.2 Laboratory Blanks

Elutant and water blanks are analyzed for fluorescence prior to all lab sessions. De-ionized water used for rinsing ACS packets and elutant applied to ACS packets are also analyzed for fluorescence prior to use.

5.3 Dye Standards

Dye standards are run prior to and after all analysis on the RF-5301PC. Dye standards are also run every 100 samples. The typical elutant standards used are as follows:

I. Pyranine in elutant at concentrations of 1 & 10 ppb
II. Fluorescein in elutant at concentrations of 0.1 & 1 ppb
III. Eosine, Phloxine B, Rhodamine WT and Sulphorhodamine B in elutant at concentrations of 1 & 10 ppb

Laboratory standards are prepared on a quarterly basis. Standards are kept refrigerated and in amber bottles to prevent photodegradation. The following procedures are followed in the event that a dye standard shows +/- 5 nanometer deviation from the accepted excitation wavelength range and/or a +/- 2% deviation in the accepted emission intensity for a given standard:

1. Re-analyze standard.
2. Shutdown Lab Solutions RF Software, then re-analyze standard.
3. Adjust Xenon Lamp per RF-5301PC manual, then re-analyze standard.
4. Contact manufacturer.

6.0 Determination of Positive Dye Recovery for Water and Elutant

The fluorescent emission wavelength ranges for all the dyes used have been established and are listed in Table 2. The following criteria are used to determine a dye positive in water and elutant samples:

1. Fluorescence peak within +/- 5 nanometers of accepted emission range for the dye in question.

2. Fluorescence peak must have typical sharp symmetrical peak exhibited by fluorescent dyes.

3. The fluorescence peak must be ten times greater than the detection limit for the sample for that location.

4. The fluorescence peak must be ten times greater than any fluorescent peak within the typical range observed in the background samples for that location.

5. It must be reasonable that the dye detection came from the dye injection and no other source. Factors such as local hydrogeology are considered as part of this step.

All fluorescence peaks that meet the above criteria are reported as dye positives. However, the following secondary set of qualifying terms are also applied to dye positives:

1. High Confidence Result – Any location with two or more dye positives for the same dye and/or a concentration at least double the quantitation limit.

2. Low Confidence Result – Any location with a single result, a concentration less than double the quantitation limit, or any other factor that calls the result into question.

Quantification

The magnitudes of fluorescent peaks for all dyes used are determined using a series of dye standards. Dye concentrations are calculated based on the area of the fluorescence peak. The accepted emission wavelengths for each dye can be seen in Table 2 and the Limit of Detection (LOD) and Limit of Quantitation (LOQ) for each dye can be seen in Table 3. Please note the LOQ is ten times the LOD.

Table 2: Elutant Emission Wavelength Ranges

Dye	Emission Wavelength Range (nm)
Pyranine	485.6 to 495.6
Fluorescein	508.6 to 518.6
Eosine	535.1 to 545.1
Phloxine B	557.2 to 567.7
Rhodamine WT	564.3 to 574.3
Sulforhodamine B	573.0 to 583.0

Table 3: LOD/LOQ

Dye Name	Matrix	Limit Of Detection (ppb)	Limit Of Quantitation (ppb)
Pyranine	Elutant	0.55	5.5
Fluorescein	Elutant	0.007	0.07
Eosine	Elutant	0.029	0.29
Phloxine B	Elutant	0.016	0.16
Rhodamine WT	Elutant	0.014	0.14
Sulforhodamine B	Elutant	0.026	0.26

7.0 Flagged Results

Samples often meet some of the positive dye criteria but not all. Those samples are reported as flagged non-detects. The flagged results are described below.

7.1 ND^J

The ND^J designation indicates the analyte (in this case dye) is greater than any background level but the result is less than the quantitation limit. The ND^J designation is common in analytical chemistry. Locations with this designation would be considered to have weak evidence of dye present.

7.2 ND^P

Samples can have fluorescence peaks near, but outside the typical range for the dye used for the trace. Samples that display peaks near, but outside the typical range are given the ND^P designation.

Appendix K
Responses to Comments received from U.S EPA regarding Pilot Trench Construction Certification Report, dated June 22, 2018

Responses to Comments received from U.S. EPA on September 7, 2018, as well as July 13, 2018 Comments (received via email), regarding Pilot Trench Construction Certification Report (dated June 22, 2018)

I. GENERAL COMMENTS

GENERAL COMMENT 1: The Construction Certification Report, Pilot Perimeter Groundwater Trench Collection System, dated June 22, 2018 (CCR) does not include adequate details on the vertical control of contaminated groundwater transport. Section 1.1, General, indicates vertical control of contaminated groundwater transport is part of the purpose of the Pilot Trench.

For example, Section 3.3, Bedrock Quality Verification, indicates the final videos documented 59 vertical and 26 horizontal fractures and notes the majority of the vertical fractures terminate before the bottom of the trench. Further, Table 3.4, Summary of Vertical Horizontal Fractures from Final Confirmatory Videos, includes notes of numerous vertical fractures near the bottom of the trench including fractures with flow (0+55, 1+50 – 1+60, 2+00, 2+20, 8+05, 8+10). However, despite this information in the CCR, the text does not provide a rationale or significant discussion of these fractures and their potential impact on the vertical control. While Section, 3.3 does indicate the majority of the vertical fractures terminated before the bottom of the trench and fractures at 1+00 and 8+05 narrowed significantly to very thin fractures as they approached the base of the trench; the CCR does not include a cross-section or statistical analysis of the fracture locations. A stationed-based cross-section would support the station by station summary in Table 3.4 by allowing for spatial reference to the information being presented. This analysis may provide support for the conclusion of Section 3.3, that the video survey, demonstrated that the rock fractures decreased with depth and that the base of the trench was completed within competent, more massive, bedrock.

While it is understood and agreed, as stated in Appendix B, Field Data Interim Review - GPR and “Trial” Bedrock Quality Verification Video, that the bedrock Pilot Trench cannot collect 100 percent of the groundwater, and that there were concerns with trenching too deep and encountering the next geologic unit; it still appears that the CCR should be revised to include additional details on the vertical control of the trench, as installed, including a cross-section.

GHD RESPONSE:

Clarification. Please note that while the intent of the Pilot Trench operation is to vertically control potentially contaminated groundwater transport within the fractured bedrock, the construction (implementation) aspect of the Pilot Trench was to merely achieve rock excavation into competent bedrock. Additional supporting information, including two cross-sections of the Pilot Perimeter Groundwater Trench west and east sidewalls and discussion of the fractures near the basal termination of the trench, will be added to supplement the conclusion that the bottom of the Pilot Trench had encountered competent bedrock.

GHD has prepared the attached station-based cross-section along the length of the east wall of the Pilot Trench (Figure 3.2) illustrating the visually observed horizontal and vertical fractures to allow for spatial reference of the information presented in the Pilot Trench CCR. Please note that a number of deeper fractures were approximately located as they could not be visually identified from the top of the trench (i.e., too close to the edge of the open rock trench for survey personnel to safely work) and therefore could not be accurately surveyed). Note also that many of the horizontal features within the Harrodsburg Formation are thin bedding features and not necessarily fractures or voids that can transmit water as part of the flow regime. The attached cross-section drawing provides the spatial representation to allow for a complete evaluation of the fracture locations relative to the final depth of the Pilot Trench.

Text will be added to aid in the assessment of this cross section in the revised CCR and to document the decision process related to the final depth of the Pilot Trench, specifically the use of multiple lines of evidence collected prior to, during, and after trench construction. This will include a qualitative assessment of the vertical fractures in the attached cross-section figure as well as other evidence, such as that derived from the series of pre-design coreholes installed along the proposed trench alignment to identify where competent bedrock generally exists along the east side of the East Plant Area. These coreholes, combined with borings generally located within the East Plant Area, were used to complete the trench design depth. Subsequent to the design, other evidence such as geophysical and direct observations were employed to validate the base of the trench was constructed within the competent bedrock. Several examples of these lines of evidence are provided below.

Visual observation of the post-construction cross-section (Figure 3.2) clearly shows a decreased frequency and density of the significant vertical fractures with depth within the Salem Formation. These vertical fractures are prevalent in the Salem Formation karstic features. The vertical fractures all terminate at or above the base of the Pilot Trench. The ability for corehole fractures to convey water was also assessed. Fractures identified in cores were measured and pressure testing of fractures was conducted. Section 2.7 of the RFI presents a discussion of the site hydrogeologic characterization, including a mathematical evaluation of the hydraulic aperture width of fractures as it relates to transport of groundwater and DNAPL. Appendix J of the RFI presents the calculations performed by Dr. B.H. Keuper and subsequent testing, while Figures 2.41 and 2.42 present graphs of the data with respect to hydraulic aperture width. When discussing the pressure testing results, the RFI also indicated that statistically the hydraulic conductivity of the rock decreased with depth. The revised CCR will also include a reference to implementation of a Pilot Trench Performance Monitoring Plan (PMP) to further evaluate the vertical and horizontal hydraulic performance of the Pilot Trench.

To supplement the pre-design corehole data and the post-construction observations, ground penetrating radar (GPR) was performed immediately before rock trenching (after overburden removal) to confirm the design base of the Pilot Trench would be constructed within more massive, competent rock. During construction (as the rock trencher proceeded from north to south), high definition quality "trial" video recordings were conducted at pre-determined critical locations along the Pilot Trench alignment, specifically near the two ends of the trench, beneath Detention Basin #4, in the immediate vicinity of the proposed WW#4, and at a few select locations in between. Finally, confirmatory video inspections were performed at 5-foot intervals along both the west and east sidewalls immediately before trench completion (i.e., placement of grout, drainage pipe, and stone backfill) as the final bedrock competency verification step to document that the previous selection of competent bedrock depths were achieved along the entire alignment of the Pilot Trench. It should also be noted that a Performance Monitoring Plan (PMP) will be implemented, including dye trace studies, to further support the observations that the Pilot Trench was sufficiently constructed into competent bedrock.

Furthermore, additional discussion of the grout placed at the base of the trench will be provided with the revised CCR. This additional protective measure, along with the installation of the sheet piling on the downgradient side of the Pilot Trench, was designed to inhibit groundwater from bypassing trench, either by flowing vertically out the bottom or horizontally through the trench. Detail 1 on Drawing C-09 of the Bedrock Pilot Trench Record (As-Built) Drawings presented in Appendix D of the Pilot Trench CCR illustrates that the base of the excavated rock trench was entirely covered with a 6-inch minimum thickness of cement bentonite grout prior to placement of the perforated HDPE drain pipe and granular backfill. The grout layer was installed to not only cover over any remaining fractures still present at the base of the trench, but also to prevent any groundwater that had entered the Pilot Trench via the horizontal and vertical fractures present in the sidewalls from escaping collection by exiting through the bottom of the Pilot Trench. The cement bentonite grout layer was placed after installation of the plastic sheet piling on the back (east) side of the excavated rock trench, such that the base of the plastic sheet piling was embedded into the grout layer to ensure complete containment of all collected groundwater. As such, this provides both vertical and horizontal control of contaminated groundwater.

GENERAL COMMENT 2: Section 7, Record Keeping, of the CCR indicates field records including inspection logs, field notes were collected; however, these records are not included as an appendix to the CCR. As such, the CCR does not include a full record of construction activities to demonstrate the appropriate quality assurance

(QA) procedures were followed and that the construction met the requirements in the design. For completeness, provide these documents as an appendix to the CCR.

GHD RESPONSE:

Agreed. Additional records including field notes, daily QA/QC logs, and photos will be included as an appendix to the CCR. Due to the volume of documentation, these additional data will be provided in an electronic format.

GENERAL COMMENT 3: The CCR includes several references to QA activities that are not documented in the report or cases where QA process was not included. For example:

- Section 3.4.1, Physical Barrier, indicates that vinyl sheet piles were visually inspection to ensure they were free from damage; however, documentation of this process, in field notes or other forms, is not referenced or included.
- Section 3.4.1 indicates the vinyl sheet pile tongue and grove joints were individually sealed; however, a QA process is not discussed nor is documentation referenced or provided.
- Section 3.4.6, Geotextile, indicates that prior to installation, SES and Quality Assurance (QA) personnel visually inspected the geotextile material to ensure the material was free from damage and contamination; however, documentation is not referenced or included.
- Section 3.4.8, Stockpiled Fill Placement, and Section 3.4.9.4, Common Fill Layer, indicates fill material was compacted, but documentation was not referenced or included.

Revise the CCR to address these issues.

GHD RESPONSE:

Clarification. The examples listed in the comment above were associated with activities that were not planned to incorporate, or need, QA documentation as described below.

Visual inspections of all materials used were performed on an ongoing basis as the work progressed, however no specific written forms were generated during construction to document these visual inspections. With regards to the plastic sheet piling, there were no instances of damaged sheets that precluded them from being used for the Pilot Trench. The geotextile materials were inspected upon delivery to the site and no rolls were deemed to have been damaged and returned to the supplier.

With regards to sealing of the tongue and groove joints, the groove of each sheet pile was filled with the sealing compound in a horizontal position, prior to lifting the sheet and sliding along the tongue of the vertical sheet pile within the trench. A continuous bead of the sealing compound was placed within the groove, which was visually observed for uniformity by the field QA personnel. It should be noted that the sealing compound was purchased separate from the plastic sheet piling as the sheet pile manufacturer did not supply this material, hence there were no manufacturer's installation procedures related to sealing of the tongue and groove joints in the plastic sheet piling (sealing was added as a design component to provide for an impermeable barrier on the back side of the trench).. The sealing compound used was a hydrophilic waterstop that was designed for sealing smooth to very irregular construction joints and pipe penetrations. The sealing compound cures and swells in the presence of moisture or water. A field photo will be added to the photographic log if it clearly illustrates the sealing process.

As for compaction of the stockpiled excavated material and the imported common fill, these fill materials were field compacted with the construction equipment, but no formal compaction testing was performed (or required per the specifications). As the underlying clay is either (1) the impermeable layer for the East Plant Area final cover system or (2) a clay cover placed over the trench in areas outside the final cover system to reduce surface water recharge directly into the trench. Only the compaction testing of these clay layers is critical to achieving the specifications for cover permeability, not the stockpiled or common fill. Also, with the liner and drainage geocomposite being placed over the clay layer comprising the final cover system, it would not be appropriate to compact the overlying common fill layer due to the potential for damaging the drainage geocomposite and/or liner. It should be noted that this same process was followed during implementation of the East Plant Area final cover system, with compaction of the common fill only being completed using standard construction equipment and no compaction testing being performed.

GENERAL COMMENT 4: The CCR does not include descriptions of deviations from the design. Further, the CCR does not include a reference to the design. While the lessons learned provided in the CCR were useful, specific deviations and their relationship to the design still appear warranted to document that the Pilot Trench was complete as designed, excluding the specific deviations and an analysis on whether the deviations affected the purpose of the Pilot Trench. Revise the CCR to address this issue.

GHD RESPONSE:

Clarification: Sections 2.2 and 3.0 of the CCR will be revised to include a specific references to the final design report dated February 19, 2016. Section 2.2 will also be amended to include a more complete summary of the trench design elements.

With regards to any deviations from the design, these are currently included in Section 8.0, Lessons Learned During Pilot Trench, however for clarity, the CCR will be revised to include a new Section 3.5 specifically listing the design deviations that are currently part of Section 8.0. The second bullet describes the process of backfilling the excavated trench with the rock cuttings for health and safety purposes during trench construction. The fifth bullet discusses lengthening of the distance between the primary and secondary cleanouts, which was performed for ease of construction (thus eliminating the need for sheet piling at the trench ends), although this had no effect on the design. The sixth (last) bullet discusses the addition of a clay cap over the full length of backfilled trench (not just the section within the East Plant Area Cover System), which was performed to reduce the potential for surface water infiltration (with no effect on the design of the trench itself).

GENERAL COMMENT 5: The CCR includes several references to drawings that appear to be incorrect. For example:

a. Section 3.4.4, Wet Well Chamber (WW#4), indicates as-built details of the WW#4 sumps and chamber construction are presented on Drawing C-06; however, this detail is not provided on Drawing C-6 and while Drawing C-8 has a WW#4 drawing, it has minimal details.

b. Section 3.4.7, Drainage Media Sand, indicates details are provided on Drawing C-04; however, these details appear missing and the correct reference may be Drawing C-09. In addition Drawing C-04 references Drawing C-01B, which was not included.

c. Section 3.4.9.2, Linear Low Density Polyethylene Liner, references Drawing C-05 in the last sentence of this section; however, the correct reference appears to be Drawing C-08.

Revise the CCR to ensure the drawing references are correct.

GHD RESPONSE:

a. Agreed. The reference to as-built details for the WW#4 sumps and chamber construction being presented on Drawing C-06 is incorrect. In fact, the WW#4 details are not currently shown on any of the as-built drawings, as the chamber was largely constructed in accordance with the design. The location of the WW#4 chamber was surveyed and the as-built location is shown on the drawings, including the field adjustment where the space between the two chambers was filled with additional concrete. To complete the as-built drawings, the original chamber design layout will be added to the as-builts, although it should be noted that the internal piping was not surveyed within the WW#4 chamber as to the exact positioning within the chamber, but it closely replicates the original design. During installation of the equipment and instrumentation within the WW#4 sump, the elevation settings for the pumps and alarms were set to the design elevations.

b. Agreed. The reference to as-built details regarding the drainage media sand placement being presented on Drawing C-04 is incorrect. The drainage sand media placement over the top of the Bedrock Pilot Trench is shown on Drawing C-09, as suggested. The text within Section 3.4.7 of the CCR will be appropriately corrected. Furthermore, the references on Drawing C-03 to Drawings C-01A and C-01B will be revised to correctly reference Drawings C-04 and C-05.

c. Agreed. The reference to Drawing C-05 for the liner installation panel layout, including destructive seam test and seam repair locations, will be corrected to Drawing C-08.

GENERAL COMMENT 6: Section 3.3 indicates the vertical fractures near the base of the Pilot Trench narrowed to very thin fractures and Section 8, Lessons Learned During Pilot Trench, indicates no fractures yielding a substantial volume of water were observed in the basal portion of the Pilot Trench; however, both descriptions are qualitative. As such, it is not clear what the decision criteria was, and how this affected the conclusion that the base of the trench was completed within competent, more massive, bedrock. Revise the CCR to discuss this issue.

GHD RESPONSE:

Agreed. Due to the overall depth of the Pilot Trench, observation of fractures, both vertical and horizontal, could only be performed through remote inspection via video camera lowered into the narrow excavated rock trench at approximate 5-foot intervals along the trench alignment. Qualitative observations of rock fractures, groundwater flow, and comparison of general rock competency to expectations based on the pre-design investigation were the only remote methods available for visual inspection of the trench sidewalls due to safety concerns with respect to standing too close to the edge of an open rock trench. This qualitative decision process will be discussed further in the revised CCR. Based on limited (very thin) fractures near the base of the Pilot Trench and the observation that these fractures did not appear to produce substantial water, the Pilot Trench was determined to have been excavated into competent bedrock. For confirmation, the final trench depth was also in compliance with bedrock coreholes used for design of the Pilot Trench.

GENERAL COMMENT 7: Appendix B, Field Data Interim Review (Ground Penetrating Radar and “Trial” Bedrock Quality Verification Videos) includes important discussions on the appropriateness of the final trench excavation depth to re-confirm the design considerations and information on the fractures; however, it appears this information should also be included in the main text of the CCR. Revise the CCR to address this issue.

GHD RESPONSE:

Agreed. GHD will revise the text within Section 3.3 of the CCR to restate the major conclusions of the “Bedrock Trench Field Data Interim Review Memorandum”, as presented in Appendix B.

II. SPECIFIC COMMENTS

SPECIFIC COMMENT 1: Section 3.1.1, Working Platform, Page 5, indicates top of bedrock elevations were found to be higher than expected in some locations, as compared to the investigative corehole drilling data and as a result, rock breaking was performed; however, this is not included in Section 8, Lessons Learned During Pilot Trench. As such, it is not clear if additional coreholes would have provided additional information prior to construction and increased the efficiency of construction. Revise this.section or Section 8, as necessary to address this issue. Ensure this discussion addresses the potential for propagation of factures as a result of the rock breaking and how or if the CCR makes this assessment.

GHD RESPONSE:

Clarification. The balance between the pre-construction design corehole spacing and the amount of rock removed during construction is not considered a "Lessons Learned" or a construction efficiency issue as much as it was a description of the activities necessary to prepare a wide level surface for the rock trencher. An irregular bedrock surface was anticipated based on prior work on the project and the primary mass rock removal work required for the construction of the trench was related more to leveling the top of bedrock surface across the entire width of the working platform (west to east) rather than incomplete knowledge of the precise rock topography (north to south) as defined on the drawings.

Although better identification of bedrock outcrops might have created more pre-construction knowledge, it is unclear whether such knowledge would have enhanced the construction efficiency of the mass rock breaking task. GHD will add a discussion of the irregularity of the top of the epi-karst bedrock surface to Section 8.0 - Lessons Learned During Pilot Trench, however it should be noted that there is little that can be done during design to obviate the potential for additional rock removal during construction of the working platform.

It should be noted that GHD did apply this lesson learned from construction of the Pilot Trench to the design for the future Phase II Trench by recognizing that the bedrock surface has a general cross slope from west to east, such that rock removal would likely be required on the upslope (west) side of the trench alignment in order to construct a level working platform (side to side). This lesson learned does not change the fact that rock removal will be required, but does allow us to recognize this fact and include an estimated quantity of rock breaking on the Form of Bid for the construction contractor so this cost can be accounted for up front.

SPECIFIC COMMENT 2: Section 3.1.2, Electrical Resistivity Imaging, Page 5, indicates the results were found to be inconclusive; however, this is not included in Section 8, Lessons Learned During Pilot Trench. Revise this section or Section 8, as necessary to address this issue. Ensure the discussion addresses what if anything could be done to affect a different result for the Phase II Trench, or why the remaining assessments methods are sufficient without this additional information.

GHD RESPONSE:

Agreed. GHD will add a discussion of the implementation of the ERI survey and its inconclusive results for the Pilot Trench to Section 8.0 – Lessons Learned During Pilot Trench. This investigative method was not as useful as the GPR survey data which yielded much better resolution in the identification of significant fractures and voids in the bedrock in the area of the Pilot Trench.

Text will also be added to the CCR to confirm that the other assessment methods used during trench excavation were sufficient for determination of rock fractures and voids and confirmation of the depth of competent rock beneath any future bedrock trench installations. During design and planning for the next phase of trenching, GHD will evaluate other geophysical methods that might provide better resolution or better identify the competent rock surface.

SPECIFIC COMMENT 3: Section 3.2, Trench Excavation, Page 7, indicates that treated water was batched and tested prior to discharge; however, the discharge location and sample data is not provided. For clarity, provide the discharge location and sample results.

GHD RESPONSE:

Agreed. The text of the Pilot Trench CCR will be revised to include additional information regarding remediation water treatment, including a summary of the discharge location and discharge analytical results.

SPECIFIC COMMENT 4: Section 3.3, Bedrock Quality Verification, Page 8 and 9, indicates seepage from fractures diminished over the dry winter months; however, this section does not provide an analysis of this observation in relation to fracture flow or a discussion on the impact on the Pilot Trench performance. Revise this section to discuss the impacts of this observation on the trench performance and the ability to assess the fractures.

GHD RESPONSE:

Clarification. The comment in the Pilot Trench CCR that "seepage from the water bearing fractures was noted to have diminished over the dry winter months" was an observation made by field personnel during performance of the final confirmatory videos conducted at a later time than the initial trial videos. This general observation that trench seepage appeared to decrease is an intuitive outcome of drier weather and does not appear to result in any inciteful analysis of trench performance. The inferred impact would be that the long-term operational productivity (i.e., groundwater removal) of the Pilot Trench would therefore reduce during drier weather.

GHD is unsure how these visual observations of reduced flow can quantitatively be related to bedrock fracture flow, but a general discussion of the expected long-term trench performance based on the observations of lower flows during drier weather will be added to the CCR, as requested.

SPECIFIC COMMENT 5: Section 9, Operation, Maintenance, and Monitoring, Page 19, indicates the Pilot Trench Interim Groundwater Monitoring Program and Operation Schedule (Interim Monitoring Program) is included in Appendix I; however, this document was not provided. Include this document in the final CCR. Further, no Operations, Maintenance and Monitoring (OMM) is provided for the Pilot Trench. Include text reflective of OMM for the Pilot Trench.

GHD RESPONSE:

Agreed. The Pilot Trench Performance Monitoring Plan (PMP) document, with its discussion of operation, maintenance and monitoring will be added to the Pilot Trench CCR once approved.

SPECIFIC COMMENT 6: Table 3.4 Summary of Vertical Horizontal Fractures from Final Confirmatory Video, includes column entitled "Fill" with most stations noted as "Clay"; however, it is unclear what this description means. Revise the text of the CCR or Table 3.4, to include a description of the meaning of this column.

GHD RESPONSE:

Agreed. The column entitled "Fill" references the material within the vertical fracture at the time that the final confirmatory videos were recorded. For better clarification, this heading will be revised to be "Fracture Cavity Appearance". The observed conditions include "clay-filled" and "void" (instead of "nothing"). The Pilot Trench CCR text will be revised as follows:

> "Table 3.4 presents the stations and approximate depths and/or lengths of the fractures observed from the confirmatory videos. Observations of the fracture cavities made during the review of the final confirmatory videos are provided on Table 3.4 and include both a determination if the cavity formed by the fracture was filled with native material (e.g., clay) or was void of material and an indication if the fracture showed evidence of water flow.

III. EMAIL COMMENTS (7/13/2018)

EMAIL COMMENT 1: Section 3.3 discusses GHD's review of "trial" videos used to determine that the trench had been completed in competent rock and to release the trencher from the site. GM/GHD should further explain how this review in conjunction with the GPR results determined competent rock. Discuss any field decision criteria as part of Construction Quality Assurance that GM/GHD may have used based on conditions observed during trenching activities to decide whether or not to release the trencher, continue potential deeper trenching, or perform "additional exploratory drilling" as noted in the Phase II Trench Design Response to Comment #4b.

GHD RESPONSE:

Clarification. Please refer back to GHD's response to General Comment 1 for a discussion regarding verification that competent rock was encountered along the length of the Pilot Trench. GM extended an invitation for EPA to observe trench construction and kept EPA informed of the progress regarding depth via the confirmatory videos and the "Field Data Interim Review" Memorandum sent to EPA prior to demobilization of the rock trencher.

Although the "trial" videos were not performed at the frequency that the confirmatory videos were performed, the 17 high definition quality "trial" video recordings were conducted at pre-determined critical locations along the Pilot Trench alignment, specifically close to the two ends, beneath Detention Basin #4, in the immediate vicinity of the proposed WW#4, and at select locations in between. Upon review of these "trial" videos, in conjunction with the pre-design coreholes, four GPR surveys that previously correlated the strong reflector to the design top of competent bedrock, and visual observation during field implementation, it was determined by GHD and GM that the rock trencher had achieved the required depth along the entire alignment of the Pilot Trench.

The "Field Data Interim Review" Memorandum that is included in Appendix B of the CCR also discusses some additional considerations that were taken into account when determining that the rock trenching performed had achieved the appropriate depth. It should be noted that draft "Field Data Interim Review" Memorandum was provided to U.S EPA prior to release of the rock trenching machine (within a few days of trench completion), with the subsequent confirmatory videos being performed solely for the purpose of thoroughly documenting the fractures present on both walls of the trench.

EMAIL COMMENT 2: In the discussion of horizontal fractures, two fractures on the west side of the trench at Stations 1+55 and 8+65 were noted to have minimal flow. In both cases it is stated that the observed flow from the horizontal fractures appeared to be hydraulically connected with water sources along the overburden/bedrock interface suggesting contribution from the overburden regime.

- What is the basis for this interpretation?
- Could the flow observed within vertical and horizontal fractures be potential "flow through" within bedrock coming from the west plant or north of the east plant area, for example?

GHD RESPONSE:

Clarification. The horizontal fractures within the trench excavation that were observed to have minimal flow were also visually noted to appear hydraulically connected to the overburden regime based on visual observations of the water quality (i.e., clarity/turbidity) and quantity.

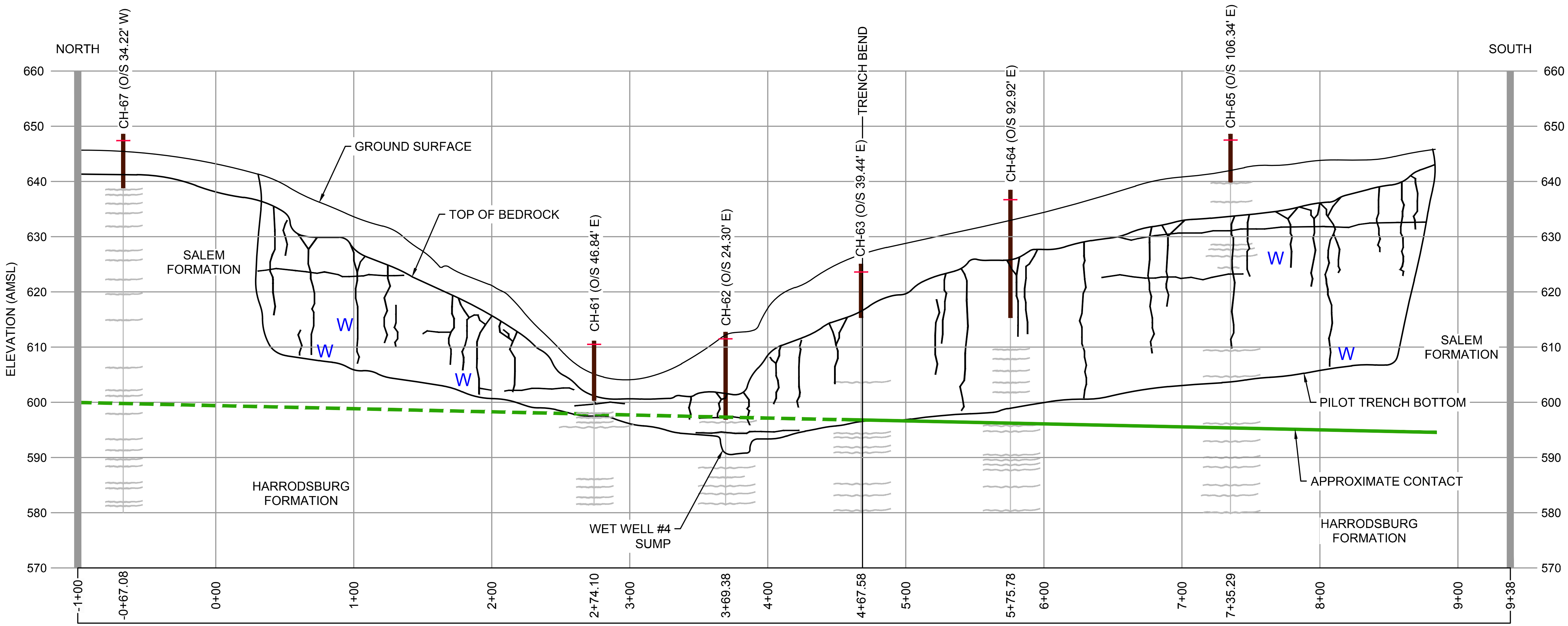
For the fracture located at Station 1+55, Table 3.4 specifically indicates that there was a large V-notch at the top of the trench connected to a vertical fracture at the same station. Although the horizontal fracture was observed to be approximately 3/4 of the way down the trench wall (approx. 15 feet), there was a clear visual connection of the vertical fracture originating from the top of the bedrock to the horizontal fracture at depth.

As for the fracture located at Station 8+65, Table 3.4 notes that this horizontal fracture was 1/4 of the way down the trench wall (approx. 30 feet), but there was a vertical fracture in close proximity (Station 8+60). It should be noted that the horizontal fracture was estimated to extend from Station 8+60 to 8+65, with the vertical fracture at Station 8+60 extending vertically from the top of the trench to the mid-depth (i.e., past the horizontal fracture). As such, it was postulated that the flow observed in the horizontal fracture originated from the vertical fracture that extended down from the top of bedrock. Although it is possible that groundwater flow observed in horizontal and vertical fractures could be considered potential "flow through" within the bedrock formation, the observations in the field during at the two fractures in question appeared to indicate vertical flow from the overburden/bedrock interface was more likely.

EMAIL COMMENT 3: Table 4.1 is missing units.

GHD RESPONSE:

Agreed. The units on Table 4.1 should be mg/m^3. This will be corrected in the revised CCR.



HORIZONTAL SCALE 1"=80'
VERTICAL SCALE 1"=20'

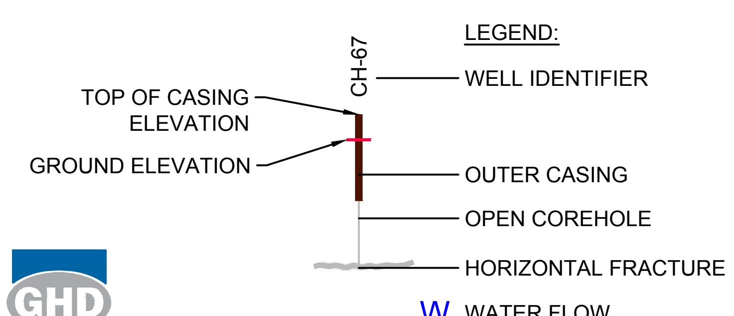


figure 3.2

PILOT TRENCH EAST SIDE SCHEMATIC
CONSTRUCTION CERTIFICATION REPORT, PILOT PERIMETER
GROUNDWATER TRENCH COLLECTION SYSTEM
GM GPS BEDFORD FACILITY
Bedford, Indiana

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

Rick Hoekstra
Rick.Hoekstra@ghd.com
519.340.4153

www.ghd.com