POST-REMEDIATION CARE PLAN
Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, Pennsylvania

Prepared for:

Former York Naval Ordnance Plant Remediation Team

November 3, 2023
Revised January 30, 2024

Prepared by:

Groundwater Sciences Corporation
2550 Interstate Drive, Suite 303
Harrisburg, Pennsylvania 17110

POST-REMEDIATION CARE PLAN
Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, Pennsylvania

Prepared for:

Former York Naval Ordnance Plant Remediation Team

November 3, 2023
Revised January 30, 2024

Prepared by:

Groundwater Sciences Corporation

J. Neil Ketchum, P.G.
Senior Associate
Groundwater Sciences Corporation
November 3, 2023 / January 30, 2024

Christopher D. O'Neil, P.G.
Senior Hydrogeologist
Groundwater Sciences Corporation
November 3, 2023 / January 30, 2024

Table of Contents

Tables

Figures

Plates

Appendices

LIST OF ACRONYMS AND ABBREVIATIONS

11DCA	1,1-dichloroethane
11DCE	1,1-dichloroethene
12DCA	1,2-dichloroethane
µg/L	microgram per liter
Act 2	Land Recycling and Environmental Remediation Standards Act
ASTM	American Society for Testing and Materials
ARAR	applicable or relevant and appropriate requirement
AWQC	applicable water quality criteria
CAO	Corrective Action Objective
CC	confidence coefficient
cfm	cubic feet per minute
cis12DCE	cis-1,2-dichloroethene
cis/trans12DCE	cis/trans-1,2-dichloroethene
Cleanup Plan	Site-Wide Cleanup Plan
COC	constituent of concern
CVOC	chlorinated volatile organic compound
DMR	Discharge Monitoring Report
EA	EA Engineering, Science, and Technology, Inc. PBC
EC	engineering control
EQ	equalization
ERLC	Eden Road Logistics Center
ESP	Eastern Site Perimeter
FDRTC	Final Decision and Response to Comments
FSP	Field Sampling Plan
fYNOP	former York Naval Ordnance Plant
GAC	granular activated carbon
GIS	geographic information system
gpm	gallons per minute
Groundwater RA	Groundwater Human Health Risk Assessment
GSC	Groundwater Sciences Corporation
GWETS	groundwater extraction and treatment system
GWTP	groundwater treatment plant
Harley-Davidson	Harley-Davidson Motor Company, Inc.
HASP	health and safety plan
HAZWOPER	hazardous waste operations and emergency response
HDPE	high density polyethylene
HMI	human machine interface
HTG	Hydro-Terra Group
HQ	hazard quotient
IC	institutional control
LDPE	low density polyethylene
LOTO	lockout/tag-out
LUA	land use area
MAROS	Monitoring and Remediation Optimization System

MCC	motor control center
MCL	maximum contaminant level
MCP	main control panel
MDL	method detection limit
MMRP	Military Munitions Response Program
MNA	monitored natural attenuation
MSC	medium-specific concentration
MTBE	methyl tertiary-butyl ether
NP York	NP York 58, LLC
NPBA	Northern Property Boundary Area
NPDES	National Pollutant Discharge Elimination System
NSP	Northern Site Perimeter
Nutec	Nutec Design Associates, Inc.
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
PADCNR	Pennsylvania Department of Conservation and Natural Resources Bureau of Geological Survey
PADEP	Pennsylvania Department of Environmental Protection
PaGWIS	Pennsylvania Groundwater Information System
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PennDOT	Pennsylvania Department of Transportation
PFD	process flow diagram
PLC	programable logic controller
ppm	parts per million
PRCP	Post-Remediation Care Plan
PTA	packed tower aerator
PTAS	packed tower aerator system
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QL	quantitation limit
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
RSL	regional screening level
SCSA	South-Central Site Area
SHS	Statewide health standard
SPA	South Plume Area
SPBA	Southern Property Boundary Area
SRBC	Susquehanna River Basin Commission
SRI	Supplemental Remedial Investigation
TCA	1,1,1-trichloroethane
TCE	trichloroethene
TI	Technical Impracticability
USACE	United States Army Corps of Engineers

USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VFD	variable frequency drive
VOC	volatile organic compound
WPL	West Parking Lot

1.0 INTRODUCTION

This Post-Remediation Care Plan (PRCP) is a required element of the Final Report for the former York Naval Ordnance Plant (fYNOP or Site) (**Figure 1.0-1**). The PRCP was prepared to fulfill post-remediation care requirements under the Pennsylvania Land Recycling and Environmental Remediation Standards Act (Act 2) and the United States Environmental Protection Agency (USEPA) Final Decision and Response to Comments (FDRTC) under the Resource Conservation and Recovery Act (RCRA).

The post-remediation care activities are necessary to maintain the remediation standards under Act 2 and the Final Remedy in the FDRTC. The PRCP obligations will be implemented through institutional controls (ICs) and engineering controls (ECs) in Environmental Covenants. The fYNOP Remediation Team (Harley-Davidson Motor Company, Inc. [Harley-Davidson], United States Army Corps of Engineers [USACE], and their consultants) proposed the elements of this PRCP in the Site-Wide Cleanup Plan (Cleanup Plan) that was approved by the Pennsylvania Department of Environmental Protection (PADEP) and USEPA in 2020 (Groundwater Sciences Corporation [GSC], 2019a).

This PRCP does not address soil contamination, munitions, or explosives of concern in the East Campus Military Munitions Response Program (MMRP) Cleanup Area. The remedy for soil contamination, munitions, and explosives of concern in the MMRP Cleanup Area, as described in the MMRP Cleanup Plan (EA Engineering, Science, and Technology, Inc., PBC [EA], 2019) and the FDRTC, was approved by PADEP and USEPA in February 2020 and is ongoing. This PRCP does address soil contamination in the West Campus MMRP Area shown on **Figure 1.0-2** and Site-Wide groundwater contamination, including groundwater beneath the MMRP Areas. The East Campus MMRP Cleanup Area will be addressed through the submission of a separate final report/corrective action completion for soils in the MMRP Cleanup Area and this PRCP will be updated to include the East Campus MMRP Cleanup Area upon approval of the final report/corrective action completion for soils for that area.

Amendments to this PRCP may be necessary when changes in operating plans, facility design, or events occur and upon changes to regulations or guidance during post-remediation care that affect the currently approved PRCP. Amendments to the PRCP will require written approval of PADEP and USEPA prior to implementation.

This PRCP is organized into seven sections. Previous investigations and remedial actions are summarized in Section 2. Section 3 describes the ICs and ECs. Activities to evaluate performance and effectiveness of the remedy are provided in Section 4. Section 5 describes the operation and maintenance (O&M) of ECs. Reporting requirements are discussed in Section 6 and references are included in Section 7.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Ownership and Site Description

The original 232-acre fYNOP property was divided into the East and the West Campus properties in June 2012. The 174-acre East Campus currently contains an active motorcycle manufacturing facility owned by Harley-Davidson. The 58-acre West Campus, owned by NP York 58, LLC (NP York), currently contains the Eden Road Logistics Center (ERLC), a 775,000-square-foot warehouse constructed in 2016.

Figure 2.1-1 shows that U.S. Route 30 and industrial/commercial properties border the Site on the south and an industrial/commercial property, a railroad line, uninhabited wetland/wooded areas, the Codorus Creek levee, and Codorus Creek border the Site on the west. Residential properties are located along the north, east, and southeast sides of the Site.

Under Act 2 and the associated 25 Pa. Code Chapter 250 Regulations, the term "site" is defined as "*The extent of contamination originating within the property boundaries and all areas in close proximity to the contamination necessary for the implementation of remediation activities to be conducted under the act.*"

The term "Site" in this PRCP refers to the fYNOP. The term "Act 2 Site" is used when referencing the area meeting the definition of "site" under Act 2. In addition to dividing the fYNOP into the East and West Campuses, the study area was expanded and divided into seven land use areas (LUAs) in the Groundwater Human Health Risk Assessment (Groundwater RA) (Newfields, 2018).

The LUAs are illustrated on **Figure 2.1-2** and were organized based on current and anticipated future land use, and were used to identify potential receptors and exposure pathways in the Groundwater RA and the Cleanup Plan as follows:

- LUA 1 consists of the developed portion of the East Campus (Harley-Davidson Property), that includes parking lots, production buildings, roads, lawn/landscaped areas, and stormwater facilities.
- LUA 2 includes the mostly undeveloped and wooded portion of the East Campus (Harley-Davidson Property) and is located adjacent to the east side of LUA 1.

- LUA 3 consists of the West Campus (NP York property) that is developed and currently occupied by the ERLC warehouse, the West Parking Lot (WPL), and a portion of Eden Road.
- LUA 4 includes residential areas that are located adjacent to the north side of LUA 1 and along the north, east, and south sides of LUA 2.
- LUA 5 consists predominately of developed off-Site industrial areas and U.S. Route 30 and includes the quarry northwest of the Site. This broad area is located to the northwest, west, and south of the fYNOP.
- LUA 6 includes mostly undeveloped areas located between the WPL (LUA 3) and Codorus Creek (LUA 7). Most of LUA 6 is zoned industrial and within a floodplain.
- LUA 7 consists of the segment of Codorus Creek surface water impacted by Site groundwater.

For soil, two Act 2 Sites include the East Campus property (excluding the MMRP Cleanup Area) and the West Campus property. For groundwater, the Act 2 Site is defined by the maximum extent of the LUAs defined in the Groundwater RA.

2.2 Investigation History and Site Setting

Past waste disposal practices, and spills and leaks that occurred during manufacturing operations conducted from the 1940s to the early 1970s impacted soil and groundwater quality at fYNOP. Environmental investigations beginning in the 1980s discovered chlorinated volatile organic compounds (CVOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), petroleum hydrocarbons, metals, and cyanide in soils, groundwater, subsurface vapor, and surface water at the Site.

The geologic setting, containing a solution-prone limestone in the west and fractured quartzite in the east, combined with the recalcitrant nature of the contaminants, makes restoration of the aquifer impracticable in areas of the Site labeled "Technical Impracticability" (TI) Areas. Remediation to meet standards is not practicable in TI areas (**Figure 2.2-1**).

2.3 Summary of Remedy

The remedy addressed each media of concern at the fYNOP that includes soils, groundwater, and surface water. The remedy met the evaluation standards for RCRA Corrective Action and included activities to demonstrate attainment of Act 2 standards for soil, groundwater, and surface water.

The remedy consisted of a combination of ECs, ICs, and other remedial actions and obligations. ECs include groundwater extraction and treatment, caps, and vapor intrusion mitigation. ICs consist of activity-and-use limitations and notifications that prohibit or restrict residential land use, groundwater use, intrusive activities (e.g., excavation) in specified areas, building construction without vapor intrusion evaluation and/or mitigation, and control of soil and waste generated during earthwork activities.

Monitored natural attenuation (MNA) is being used to achieve the USEPA Corrective Action Objective (CAO) of resource restoration for groundwater outside of TI Area boundaries. Groundwater continues to be monitored to assess progress toward meeting USEPA maximum contaminant levels (MCLs) or regional screening levels (RSLs) for Site constituents of concern (COCs).

The estimated duration of each remedy component is greater than 30 years.

Environmental Covenants for the East and West Campus properties have been recorded with York County and copies are provided in **Appendix A**. The recorded Environmental Covenants are the enforceable mechanism for the implementation of the Final Remedy under RCRA and the post-remediation care requirements under Act 2.

3.0 INSTITUTIONAL AND ENGINEERING CONTROLS

This section describes the procedures for implementing and managing ICs and ECs to maintain the remediation standards for soil, groundwater, and surface water.

3.1 Institutional Controls

The ICs are used to limit or prohibit activities that could interfere with the integrity of the remediation standards and Final Remedy at the Site.

3.1.1 Assessments and Notifications

The East and West Campuses and former K. G. Whiteford Ltd. properties have activity-and-use limitations in Environmental Covenants that restrict use and development to non-residential as defined by Act 2 and prohibit the use of groundwater without approval of PADEP and USEPA. Assessment of land and groundwater use will be performed annually to verify these conditions.

A vapor intrusion pathway evaluation and/or presumptive mitigation measures (e.g., vapor barrier or sub-slab depressurization system) are required prior to construction of any new inhabitable structure on the East and West Campus properties.

The Groundwater RA identified the potential for utility worker exposure to shallow impacted groundwater during excavation activities on the K. G. Whiteford Ltd. property in LUA 5 and the properties in LUA 6. This potential exposure pathway to workers will continue to be addressed by annual periodic notification to the property owners in LUA 5 and LUA 6 of the potential for exposure.

The assessments and notifications are described in Section 4 and will be documented in annual PRCP reports.

3.1.2 Intrusive Activity and Waste Management Limitations and Controls

Management of Site soil, fill, and waste materials during intrusive activities (e.g., digging, excavating, drilling, grading, pile driving, and/or removal of ground cover materials) will be conducted on the East and West Campus properties. The goal is to prevent exposure of contaminated soil, shallow groundwater, and soil/shallow groundwater vapor to workers performing intrusive activities on these properties and to control the handling of soil and waste materials encountered during intrusive activities.

Details of the intrusive activity and waste management limitations and controls (a.k.a., Soil Management Plan) are described in Section 4.2 and will be documented in annual PRCP reports.

3.2 Engineering Controls

The ECs are used to contain or control potential exposure to hazardous substances and maintain the remediation standards and Final Remedy for soil and groundwater at the Site. The ECs consist of caps to prevent contact with remaining contamination and to reduce infiltration, a vapor barrier to prevent potential vapor intrusion into the ERLC warehouse building, a groundwater extraction system to control groundwater flow gradients in the Southern Property Boundary Area (SPBA) and to mitigate potential vapor intrusion in the SPBA, a groundwater extraction system in the WPL that can be used if and as necessary to prevent exceedances of the applicable water quality criteria (AWQC) in Codorus Creek (presently shut down), and a groundwater treatment system to remove dissolved-phase volatile organic compounds (VOCs) from extracted groundwater. Implementation of ECs in this PRCP include the following:

- O&M activities;
- Inspection procedures and frequency;
- Operation, maintenance, monitoring, inspection, and reporting of mechanical or physical components of the remedy; and
- Evaluation and mitigation of potential vapor intrusion into future inhabited spaces on the East and West Campus properties.

Monitoring and maintenance of the ECs is described in Sections 4 and 5, respectively, and will be documented in annual PRCP reports.

3.2.1 Caps to Eliminate Direct Contact Exposure and Reduce Infiltration

Caps are required on the East and West Campuses to protect receptors from direct contact with contaminated soil or waste, and in certain areas of the West Campus, to reduce infiltration. **Figures 3.2-1** and **3.2-2** show the locations where direct contact and infiltration reduction caps are required.

In addition to structural slabs associated with buildings, various types of materials are used as caps at the fYNOP, including asphalt pavement, concrete, soil, gravel or stone, rip rap, geomembrane/geotextile liners, and clay liners. The location and configuration of the cap types, illustrated on **Plate 3.2-1**, were determined to be suitable for protection of the required capped areas. Construction details for these caps, where available, are provided in **Appendix B**.

Generic definitions and minimum requirements for the caps are provided below. Nothing in this PRCP is intended to replace design or construction details for cap maintenance activities. Materials used to repair or replace existing capping materials must be durable and meet the minimum design requirements. Regular inspection of caps is important because contaminated soil particles or wastes can work their way through the cap, and surface water can penetrate damaged surfaces due to settlement, shifting, cracking, freeze/thaw cycles, weathering, and deterioration.

3.2.1.1 Asphalt

Asphalt (blacktop or pavement) is a composite material used to surface roads and parking areas. It consists of mineral aggregate (e.g., stones) bound together with bitumen, laid in layers, and compacted. Finished asphalt is extremely hard and durable yet offers enough flexibility to accommodate imperfections in underlying surfaces, a feature that concrete lacks.

A cap consisting of a layer of asphalt at least 1.5 inches thick is used to prevent direct contact with underlying materials at the fYNOP and to reduce infiltration. To repair an existing asphalt cap, the underlying surface should be relatively smooth, with holes/depressions filled. In those areas where asphalt is used for heavy traffic, it should have an appropriate bottom base preparation (grading, re-compaction, and dewatering) and sufficient subbase and base course to minimize freeze/thaw, settling, and shifting problems, which can cause pavement deterioration.

Asphalt is used at the fYNOP primarily for parking lots, roadways, walkways, and to cover soils in certain areas between buildings at the locations shown on **Plate 3.2-1**. Pavement thickness and overall design were based on normal paving procedures to ensure structural integrity for the intended use.

3.2.1.2 Asphalt with Soil Cover

Certain areas identified in **Plate 3.2-1** were capped using asphalt with soil cover. In most instances, the soil cover and vegetation were added for purposes of stormwater management, to increase evapotranspiration, and reduce runoff as required by the West Campus Land Development Plan (Nutec Design Associates, Inc. [Nutec], 2016). The combination of soil cover and underlying asphalt eliminates direct contact and reduces infiltration to groundwater.

3.2.1.3 Concrete

Concrete is made using aggregate (e.g., crushed rock, gravel, and sand), along with cement and water. The cement, which is typically Portland cement, acts as the binder in concrete, holding the aggregate together.

A concrete cap consisting of a layer of concrete not less than 2 inches thick is used to prevent direct contact with underlying soils or waste materials at fYNOP and to reduce infiltration. The underlying surface of concrete caps should be relatively smooth with holes/depressions filled. More substantial concrete caps (including those with reinforcement materials) may be used as building slabs and as areas for ramps and heavy truck traffic.

For repair of concrete caps, concrete thickness, steel reinforcement, and overall design must be based on anticipated loading to ensure structural integrity. Structural concrete caps must have appropriate bottom base preparation (e.g., grading, re-compaction, and dewatering) and sufficient base course thickness to avoid deterioration from freeze/thaw, settling, and shifting.

Concrete is used at fYNOP primarily for building slabs, walkways, ramps, heavy truck loading/trailer parking, and to cover potentially impacted materials in certain areas adjacent to and between buildings at the locations shown on **Plate 3.2-1**.

3.2.1.4 Soil

There are two primary types of soil used as caps at fYNOP, soil that contains enough organic matter to support plant growth (topsoil) and soil that lacks sufficient organic matter to support vegetation. Soil caps should be used on flat terrane (slopes no steeper than a 2:1 horizontal-to-vertical ratio) with a vegetative (e.g., grass) or mulch cover, when possible.

Soil is used at fYNOP at multiple locations and varying thicknesses to cover underlying material at the locations shown on **Plate 3.2-1**. A minimum of 6 inches of soil is sufficient to prevent direct contact with potentially impacted underlying materials. Soil is not suitable for infiltration reduction caps at fYNOP.

Soil cap repairs on steeper slopes may be evaluated for slope reinforcement to provide long-term stability, if required. PADEP recommends the use of warning fabrics under soil caps where a repair is made.

3.2.1.5 Gravel or Stone

Gravel can consist of small pieces of rocks, stones, or pebbles commonly mined from rivers, streams, lakes, and oceans or crushed stone composed of granite, limestone, basalt, or other rock types. (Note, the terms gravel, crushed stone, and aggregates are often used interchangeably.) Various sizes and grades of gravel and crushed stone are used based on the specific requirements of the project.

A gravel or stone cap at fYNOP is typically composed of material that is less than one-half-inch in size and at least 2 inches thick. This thickness is sufficient to prevent contact with underlying soils; however, the actual thickness could be more or less than 2 inches depending on the size and type of material being used. With larger particles, the thickness needs to be increased such that overlapping layers can prevent direct contact with potentially impacted underlying materials. Gravel and stone caps are not suitable for infiltration reduction caps at fYNOP.

When gravel or stone is used to repair an existing cap, PADEP recommends a geotextile layer be installed to prevent soil particle migration and act as a demarcation layer. The effectiveness of a gravel or crushed stone cap can be increased by compacting the underlying material as well as the cap material.

Gravel or crushed stone is used at fYNOP at multiple locations and varying thicknesses to cover underlying material at the locations shown on **Plate 3.2-1**.

3.2.1.6 Rip Rap

Rip rap, which is also known as shot rock or rubble, is rock or other material used to protect soils or structures by reducing velocities of concentrated water flows such as stormwater. Rip rap also can be used to stabilize slopes. It is typically used on slopes of 2:1 horizontal-to-vertical ratio or flatter. Rip rap is commonly composed of rocks between 4 inches and 9 inches in diameter.

Rip rap is generally not placed in locations of foot or vehicular traffic. Thus, there is a low probability that receptors could be exposed to underlying soils via direct contact. When used to line a waterway, rip rap is typically placed such that there are several layers of rock. Potentially impacted underlying soils, however, can be brought to the surface of rip rap by moving water. For this reason, rip rap is often underlain by a geotextile. Rip rap is not suitable for infiltration reduction caps at fYNOP; however, when installed with a geotextile, infiltration reduction is possible based on the type of geotextile used and the underlying soil type.

Seven (7) inches of rip rap is generally sufficient to prevent direct contact with potentially impacted underlying soils at fYNOP. The locations where rip rap is present at fYNOP are shown on **Plate 3.2-1**. Some of these locations are water channels and others are where rip rap is being used for contouring the land and to stabilize slopes.

3.2.1.7 Geosynthetic Liners

Geosynthetic caps (geomembrane and/or geotextile) are used at fYNOP for direct contact protection and infiltration reduction at the locations shown on **Plate 3.2-1**. These geosynthetic liners are either covered with soil or rip rap.

A geomembrane is an impermeable synthetic liner typically made from thin continuous polymeric sheets of high density polyethylene (HDPE), low density polyethylene (LDPE), or polyvinyl chloride (PVC). Geomembranes are nearly impermeable and can prevent direct contact with underlying soils and reduce infiltration to groundwater. Geomembranes are usually used with geotextiles to prevent puncture and sliding for roads and slope protection. Because geotextiles are less durable than geomembranes, asphalt, and concrete, geotextiles are typically used in nontraffic areas and are covered by soil, topsoil, fill material, or rock to prevent tearing, puncture, or degradation by sunlight.

Specifications for geomembranes and geotextile liners considered for repairs or new caps (vapor barriers) at fYNOP are based on their intended use.

3.2.1.8 Clay Liners

Clay liners can be a mat containing a bentonite layer between two geotextiles or can be placed and compacted in-place using clay mined from an acceptable source. Clay liners provide direct contact protection, reduce infiltration to groundwater, and are typically covered by soil to prevent drying and cracking of the clay. The bentonite mat-type clay liners were installed at fYNOP in the locations shown on **Plate 3.2-1**.

3.2.1.9 Buildings or Structure Slabs

Various buildings and structures with concrete floors (slabs) serve as caps at fYNOP to prevent direct contact with impacted soil/waste and effectively reduce infiltration to groundwater. Locations where buildings and structures are being used at fYNOP are shown on **Plate 3.2-1**.

3.2.2 West Campus Vapor Barrier

A vapor barrier was installed to prevent potential vapor intrusion from soil and groundwater into the ERLC warehouse building on the West Campus property. The vapor barrier was installed, with USEPA approval and review by PADEP, beneath the concrete slab of the warehouse building during its construction as a presumptive mitigation measure. Construction details and material specifications for the vapor barrier are in **Appendix C**.

3.2.3 Groundwater Extraction and Piping Systems

The groundwater extraction systems consist of one active and one inactive pumping system using wells, pumps, and piping. The active pumping system contains three extraction wells in the SPBA and the inactive system contains five wells in the WPL. The WPL system may become active depending on the results of surface water monitoring in Codorus Creek. The SPBA and WPL extraction system layout is shown on **Figure 3.2-3**.

The groundwater extraction system is operated in compliance with the Susquehanna River Basin Commission (SRBC) Docket No. 19980901-1.

3.2.3.1 SPBA Extraction and Piping Systems

The SPBA groundwater extraction system, operating since November 2018, captures shallow groundwater containing CVOCs and mitigates potential vapor intrusion into off-Site inhabited structures. The system consists of three extraction wells (CW-21, CW-22, CW-23) that pump groundwater containing tetrachloroethene (PCE) and trichloroethene (TCE) from the fine-grained residual soil and bedrock along the eastern-most portion of the south fYNOP property boundary.

Each SPBA collection well is fitted with an electric submersible pump controlled by a variable frequency drive (VFD) and a submersible level transducer to maintain design drawdown conditions. Groundwater extracted from the SPBA wells is conducted via underground piping from the well heads to the SPBA control building (located in the SPBA) and the combined effluent is transferred via HDPE underground conveyance piping to the groundwater treatment system in Building 41A. The SPBA control building houses the system's programable logic controller (PLC), control panel, pressure and flow transmitters, piping, and valves for each of the extraction wells.

3.2.3.2 WPL Extraction and Piping System

The WPL groundwater extraction system was brought on-line in May 1994. In September 2021, the extraction system was shut down to conduct surface water attainment monitoring using the process described in the Cleanup Plan (GSC, 2019a) and the Surface Water Compliance Report (GSC, 2022). Attainment sampling demonstrated that surface water quality criteria are met without operation of the WPL groundwater extraction system.

The inactive system is being maintained so that it can be reactivated if it is needed in the future. Alternatives to potential future WPL groundwater extraction and treatment operation will be considered as discussed in the Cleanup Plan (e.g., in-stream remediation technologies, a modeled mass-flux assessment, and consideration of in-stream alternative concentration limits). Appropriate details regarding these remedial alternatives will be included in annual PRCP reports.

The system consists of five collection wells (CW-9, CW-13, CW-15A, CW-17, and CW-20) that were operated to limit the potential for exceedances of ambient water quality criteria in Codorus Creek from groundwater discharging to the creek. Groundwater is pumped from each well by a constant-speed electric submersible pump, combined with pre-set groundwater level probes.

Groundwater from each of the WPL extraction wells was transferred underground through HDPE pipelines into the flow manifold and then directed to the equalization (EQ) tank in the groundwater treatment system (Building 41A). Power and control equipment are provided via the main control panel (MCP), motor control center (MCC), and remote-control panels. Check valves, "Y" strainers, flow meters, pressure gauges, and sampling ports for each well are present at the manifold. The groundwater flow rate for WPL wells can be controlled remotely by adjusting a motorized valve setting.

3.2.3.3 Groundwater Treatment System

Extracted groundwater is conveyed to the treatment system housed in Building 41A where dissolved-phase VOCs are removed. The treatment system consists of a 2,600-gallon EQ tank; a packed tower aerator (PTA) capable of treating up to 400 gallons per minute (gpm) of groundwater; and a 10,000-pound vapor-phase granular activated carbon (GAC) unit for PTA off-gas treatment.

The system operates and discharges treated groundwater under a National Pollutant Discharge Elimination System (NPDES) permit No. PA0085677 issued by PADEP. The air discharge from the system is operated in accordance with the plant-wide air permit from the PADEP Air Quality State Only Synthetic Minor Operating Permit (PA 67-05118) Section D Source Level Requirements, Source ID: PTAS (packed tower aerator system) with Carbon Adsorption. Both permits are maintained by the owner of the East Campus property.

Operation of the treatment system was modified from continuous treatment to batch treatment when the WPL collection wells were shut down for testing in August 2021. If only the SPBA extraction system is operating, the system will operate in batch mode. When the SPBA and WPL extraction systems operate concurrently, the treatment system will run in continuous mode. Separate O&M Manuals were developed for the batch-mode and the continuous-mode treatment systems (Hydro-Terra Group [HTG], 2019 and 2022, respectively)

As shown on the process flow diagram (PFD) in the O&M Manuals, extracted groundwater in batch mode is pumped from the EQ tank through the PTA for treatment. Simultaneous with the downward flow of contaminated water, a 4,000-cubic-foot-per-minute (cfm) centrifugal blower directs fresh air into the lower section of the tower, and up through the packing material. VOCs in the influent groundwater are "stripped" from the water, transferred into the air, and then adsorbed to the GAC in the air-phase. The treated groundwater flows by gravity to a wet well (effluent pump station) on the north side of Building 41A. It is then pumped approximately 1,600 feet via an 8-inch underground force main to Outfall No. 003 and discharged to Codorus Creek (see **Figure 3.2-3**).

The PFD for continuous treatment mode in the O&M Manuals shows the components for the treatment system necessary to reduce incoming groundwater chemical concentrations to less than one microgram per liter (µg/L) of VOCs at a flow rate of 400 gpm. The initial design influent VOC concentrations were as follows:

- Chloroform – 45 µg/L
- 1,1-Dichloroethane (11DCA) – 32 µg/L
- 1,2-Dichloroethane (12DCA) – 12 µg/L
- 1,1-Dichloroethene (11DCE) – 720 µg/L
- Cis/trans-1,2-Dichloroethene (cis/trans12DCE) – 3,900 µg/L
- PCE – 470 µg/L
- 1,1,1-Trichloroethane (TCA) – 5,200 µg/L
- TCE – 9,200 µg/L
- Vinyl Chloride (VC) – 130 µg/L

The vapor phase GAC filter system is designed to achieve a minimum of 50% adsorption of the influent VOC loading from the system off-gas prior to emitting to the atmosphere.

Automated monitoring and control of the treatment system are accomplished through a series of control panels, Allen-Bradley® PLCs, and patented operator software packages called RS View® and FactoryTalk® View. Remote computer terminals monitor collection well pumping rates and treatment processes, and the collection wells may be remotely adjusted.

4.0 POST-REMEDIATION CARE MONITORING

Post-remediation care monitoring is used to evaluate the overall performance and continued effectiveness of the remediation standards and Final Remedy. The monitoring scope, procedures, and protocol contained herein may only be revised with approval of PADEP and USEPA prior to implementation.

Details regarding the monitoring procedures, data quality objectives, and analytical methods for samples collected to determine remedy performance are included in the Field Sampling Plan (FSP) (GSC, 2012) and the Quality Assurance Project Plan (QAPP) (GSC, 2020) approved by PADEP and USEPA. Copies of the FSP and the QAPP are available on the public website, https://yorksiteremedy.com.

Post-remediation care monitoring information contained in this PRCP describes the following:

- Evaluating monitoring data that confirms the continued effectiveness of the remedy;
- Assessing continued compliance with applicable PADEP and USEPA standards, criteria, and guidance; and
- Sampling and analysis of appropriate media (e.g., groundwater and surface water).

To adequately address these issues, this PRCP provides information for the following:

- Sampling locations, protocol, and frequency;
- Information on designed monitoring systems;
- Analytical sampling program requirements; and
- Annual inspection and periodic certification, if required.

Documentation of ongoing post-remediation care activities will be provided to PADEP and USEPA in annual PRCP reports. Reporting requirements are provided in Section 7.

The post-remediation monitoring includes the following activities for the Site:

- Monitoring of caps;

- Monitoring and maintenance of the SPBA groundwater extraction system, the WPL groundwater extraction system (if necessary), and the groundwater treatment system;
- Monitoring of the West Campus vapor barrier;
- Assessment of land and groundwater use;
- Assessment of potential vapor intrusion into future inhabited spaces;
- Implementation of intrusive activity and waste management limitations and controls, including worker health and safety plans (soil management plan);
- Notification regarding potential exposure to utility workers;
- Monitoring of groundwater and surface water; and
- Maintaining records of monitoring, sampling, analysis, and measures to correct nonconformity conditions.

Post-remediation care and remedial processes are considered completed when monitoring indicates that the remedy has achieved the objectives presented in Section 3. Cessation of post-remediation care may be terminated with written approval of PADEP and USEPA when monitoring provisions set forth in this PRCP are met, the engineering controls are no longer needed, and it can be documented that the remediation standards will not be exceeded in the future.

4.1 Institutional Control Inspections and Assessments

Periodic assessments of land and groundwater use and periodic notification of nearby property owners regarding potentially complete exposure pathways to utility workers are ICs used to maintain the remediation standards. As shown on **Table 4.1-1**, periodic assessments and notifications will be performed annually, and documentation of the assessments and notifications will be included in annual PRCP reports.

If the assessment and notification activities document a change in land and/or groundwater use, an evaluation of the potential risk based on then-current conditions will be the initial corrective measure to address the discovery. Additional activities may be performed as necessary in consultation with PADEP and USEPA.

4.1.1 Assessment of Nonresidential Land Use

Current land use on the East and West Campus properties (LUA 1, LUA 2, and LUA 3) and on the K. G. Whiteford Ltd. property (LUA 5) are non-residential. The Groundwater RA determined that exposure to COCs in shallow groundwater in a residential scenario is unacceptable in LUA 6. As shown on **Figure 4.1-1**, LUA 6 contains undeveloped land, railroad tracks, and a rail trail between the Site and Codorus Creek.

Annual assessment of potential land use changes in LUA 6 will be performed by inspection and/or observation using unmanned aircraft system (drone) technology. Assessment documentation will be reviewed to verify continued non-residential use (undeveloped [tree or grass-covered] with no buildings) in LUA 6.

4.1.2 Assessment of Continued Non-Use of Groundwater

Groundwater is currently only used for environmental sampling and remediation on the East and West Campuses (LUA 1, LUA 2, and LUA 3) and non-potable use on surrounding properties (LUA 4, LUA 5, and LUA 6) shown on **Figure 2.1-2**. The East and West Campuses and former K. G. Whiteford Ltd. properties have activity-and-use limitations in their Environmental Covenants that prohibit the use of groundwater.

Annual assessment to verify continued non-use of groundwater will be performed by the owner of the East Campus property. The assessment will consist of reviewing available public records to identify potential changes to groundwater use and communicating with the local water provider to confirm non-use of groundwater.

Public records of water well data for the assessment area will be obtained from the Pennsylvania Groundwater Information System (PaGWIS) currently maintained by the Pennsylvania Department of Conservation and Natural Resources (PADCNR) Bureau of Geological Survey. Well data compiled from the PaGWIS records search will be compared to well data in the Updated Water Use Survey Report for fYNOP (GSC, 2018a) to determine if new wells have been installed in the assessment area. A letter will be sent to the local water provider, currently The York Water Company, requesting confirmation that it does not have water supply wells operating in the assessment area.

4.1.3 Assessment of Potential Vapor Intrusion into Future Inhabited Spaces

A vapor intrusion pathway evaluation and/or presumptive mitigation measures (e.g., vapor barrier or sub-slab depressurization system) are required prior to construction of any new inhabitable structure on the East and West Campus properties (LUA 1, LUA 2, and LUA 3). The goal is to prevent potential intrusion of vapor containing COCs from soil and groundwater into inhabited space. The Environmental Covenants for the East and West Campus properties include these obligations.

Vapor intrusion pathway evaluation results and/or plans for mitigation measures require USEPA approval prior to construction of any new inhabitable structure in LUA 1, LUA 2, and LUA 3. Prior to a structure with vapor mitigation being inhabited, post-construction sampling will be conducted to document the vapor intrusion exposure pathway is addressed. The PRCP will be amended to include construction details and procedures to evaluate the performance and effectiveness of vapor mitigation measures as an engineering control.

4.1.4 Periodic Notification Regarding Potential Exposure to Utility Workers

The Groundwater RA identified the potential for utility worker exposure to shallow impacted groundwater during excavation activities on the K. G. Whiteford Ltd. property in LUA 5 and the properties in LUA 6. This potential exposure pathway has been eliminated by notifying the property owners in LUA 5 and LUA 6 of the potential for exposure. The Environmental Covenant for the East Campus includes the obligation for periodic notification to the owners of these properties.

Letters will be sent annually to each property owner of record suggesting the need for reasonable caution in planning and conducting intrusive underground utility work and requesting they contact the current owner of the East Campus property if utility work is anticipated on the property. The municipality and the public water and sewer providers operating within the municipality will be copied on the notification letters.

When notified by a landowner of utility construction on a property, the owner of the East Campus property will evaluate current environmental conditions and provide notice to the landowner regarding the need for measures to protect human health and the environment during the utility work.

4.2 Performance of Intrusive Activities and Material Handling

This section of the PRCP provides procedures for conducting intrusive activities and for managing contaminated soil and fill materials disturbed or removed while performing intrusive activities on the East Campus and West Campus properties (Soil Management Plan). In this PRCP, intrusive activities are defined as earthwork, including without limitation any digging, excavating, drilling, grading, pile driving, and/or removal of any asphalt, concrete, soil, or excavating other ground cover.

Remedial investigations identified specific areas at fYNOP where additional health and safety precautions and planning are required while performing intrusive activities. These special handling areas are capped areas, historically impacted areas, ordnance hazard areas, and areas where groundwater is within 15 feet of the ground surface (due to potential exposure of construction and utility workers in excavations deeper than 4 feet). These areas are illustrated in **Figure 4.2-1**.

Materials generated during intrusive activities shall be managed in accordance with applicable federal, state, and local statutes, regulations, and documents regarding contained-in determinations at fYNOP dated June 2011 (soils), September 2011 (liquids), and December 2011 (debris) (SAIC 2011a, b, and c, respectively), approved by PADEP on June 29, 2011 (soils), September 16, 2011 (liquids), and December 30, 2011 (debris) in **Appendix D**.

4.2.1 Performance of Intrusive Activities

An intrusive activity decision flowchart is presented in **Figure 4.2-2**. The flowchart presents the stepwise process for performance of intrusive activities to maintain compliance with the Site remedy documented in the Final Report and FDRTC. Intrusive activities shall be performed in accordance with industry-standard operating procedures including the following as required by federal, state, and local laws, regulations, guidance, and policy:

- Permitting (federal, state, and/or local);
- Erosion and sedimentation control;
- Utility clearance requirements including PA One Call notification;
- Contractor health and safety;
- Waste management; and

- Record keeping including pre- and post-activity documentation (e.g., plans, photographs, reports, and laboratory reports).

The owner of the East Campus property must be notified in writing prior to the performance of any intrusive activity on the East Campus or West Campus property.

Work shall stop until a qualified environmental professional is engaged to oversee additional health and safety precautions and planning if certain suspect conditions are identified during any intrusive activity. A qualified environmental professional is one who has specific training, knowledge, and experience in performing the intrusive activity and in recognizing environmental hazards. Suspect conditions are defined as any unusual occurrence of odor, staining, discoloration, or the presence of non-soil-like materials (e.g., the presence of waste materials or debris). Suspect conditions also include encountering water.

For intrusive activities where the qualified environmental professional has determined there is a reasonable likelihood of exposure to contamination based on the nature of the intrusive activity and historical data and operations, a site-specific health and safety plan (HASP) shall be prepared and followed.

4.2.1.1 Worker Protection and Site-Specific Health and Safety Plans

Property owners and contractors are required to follow industry-standard safety guidelines and requirements when performing intrusive activities. If the qualified environmental professional determines exposure to contamination is likely, ~~W~~work shall be performed in accordance with the Occupational Safety and Health Administration's (OSHA) safety and health regulations for construction (i.e., Title 29, Part 1926 (a.k.a. 29 CFR 1926)) and other applicable federal, state, or local requirements.

~~For any major intrusive activity (intrusive activity with a depth greater than one foot below ground surface or a total surface disturbance greater than 50 square feet) or for any intrusive activity encountering suspect conditions as defined above, a~~ A site-specific ~~health and safety plan (~~HASP~~)~~ must be prepared by a qualified environmental professional. The qualified environmental professional shall have the responsibility and authority to control the work activities.

The HASP shall address the potential for worker exposure to contaminated soil, waste, and potentially contaminated groundwater. The HASP must include all applicable components of CFR Title 29 Part 1910.120, dealing with hazardous waste operations and emergency response (HAZWOPER). The HASP shall also inform workers of potential hazards and safety procedures associated with the performance of the intrusive activity and include proper decontamination procedures to ensure that Site-related chemicals are not transported off-Site by personnel or equipment.

The HASP must be provided to the owner of the East Campus property for review prior to performance of the intrusive activity.

In addition to reading and signing the HASP, all field personnel who have the potential to encounter waste, contaminated soil, or contaminated groundwater must have HAZWOPER 40-hour training, up-to-date refresher training, and participate in a medical monitoring program required by OSHA for hazardous waste operations. This includes construction or utility workers entering excavations deeper than 4 feet below ground surface in areas where the water table is potentially within 15 feet of the ground surface (see **Figure 4.2-1**).

4.2.1.2 Restricted Ordnance Hazard Area Clearance

Restricted ordnance hazard areas under the MMRP at fYNOP are illustrated on **Figure 4.2-1**. A trained munitions expert approved by the owner of the East Campus property shall oversee performance of intrusive activities inside the restricted ordnance hazard area on the West Campus. The restricted ordnance hazard area on the East Campus will be addressed through the submission of a separate final report/corrective action completion for the MMRP Cleanup Area and this PRCP will be updated to include the East Campus MMRP Cleanup Area upon approval of the final report/corrective action completion for that area.

4.2.1.3 Observation and Monitoring of Removed Material

Workers conducting intrusive activities shall visually inspect and censor for odor all materials generated during the activity. Intrusive activity work shall stop if suspect conditions as defined above are encountered and a qualified environmental professional shall be engaged prior to proceeding.

For intrusive activities requiring a site-specific HASP~~engagement of a qualified environmental professional~~, the qualified environmental professional shall, at a minimum, visually inspect and censor for odor all materials generated during the intrusive activity. The qualified environmental professional shall also screen generated materials for the presence of VOCs using a calibrated organic vapor analyzer (OVA) (e.g., photoionization detector or flame ionization detector).

4.2.2 Management of Materials Generated During Intrusive Activities

Generators of materials from intrusive activities are required to follow applicable laws, regulations, guidance, and policies regarding the handling of material generated by intrusive activities at fYNOP. This includes the site-specific documents regarding contained-in determinations at fYNOP in **Appendix D**.

A material handling flowchart is included as **Figure 4.2-3**. The flowchart presents the stepwise process to determine the proper handling of materials generated by intrusive activities at fYNOP.

4.2.2.1 Segregation of Debris and Other Inherently Waste-Like Materials

Construction materials or debris and other inherently waste-like materials generated during the performance of intrusive activities shall be segregated from soil-like materials. This segregation shall be performed during the intrusive activity or prior to analytical testing of stockpiled material. Non-soil-like materials shall not be used to backfill an intrusive activity area and shall be properly staged/containerized and characterized for proper treatment or disposal.

4.2.2.2 Potentially Contaminated Groundwater or Other Water

Groundwater at the Site contains regulated substances. Work shall stop and a qualified environmental professional shall be engaged if water is encountered during any subsurface work or if planned intrusive work will involve utility or construction workers entering excavations deeper than 4 feet below ground surface in areas where the water table is potentially within 15 feet of the ground surface (see **Figure 4.2-1**). Water generated by an intrusive activity shall be characterized. Generated water may be treated on-Site (if feasible and approved by East Campus property owner) or disposed of off-Site in accordance with applicable laws, regulations, and the site-specific determinations in **Appendix D**.

4.2.2.3 Material Generated During Emergency Intrusive Activities

When intrusive activities must be performed on an emergency basis and advanced planning is not possible (e.g., emergency to repair a water main break), materials generated by such activity must be placed in a protected stockpile as close to the location of the activity as practicable or in approved containers (e.g., drums or roll-off boxes) until the generated material is properly evaluated.

4.2.3 Imported Backfill Material Used to Restore Intrusive Activity Areas

Imported materials used to backfill areas following intrusive activities shall come from certified sources and shall not have been affected by a release of regulated substances. Materials shall meet the criteria for clean fill or regulated fill under the PADEP Management of Fill Policy. Imported backfill materials must be approved by the owner of the East Campus property.

4.3 Engineering Control Monitoring, Sampling, and Inspections

This Section contains information related to monitoring, sampling, and inspecting the ECs contained in this PRCP. These activities include inspection of caps and the vapor barrier, monitoring of groundwater extraction and treatment performance, and sampling of groundwater and surface water.

4.3.1 Cap Inspections

Inspection of caps that prevent direct contact and reduce infiltration will be performed to evaluate and document the integrity of the caps within the East and West Campuses and assess whether the existing caps deviate from the locations and materials shown on **Plate 3.2-1**. Inspections will verify whether caps require repair or replacement; have been disturbed in a manner that comprises cap integrity; and, if repaired or replaced, that acceptable materials have been used to affect the repair/replacement per criteria discussed in Section 3.2.1 of this PRCP. The inspection will also include a review with property owners to identify changed capped conditions since the previous inspection.

Cap inspection and reporting for fYNOP are as follows:

- Caps will be inspected annually in early spring before leaf-out. Cap inspections will also be conducted during planned construction activities, after an inadvertent or unplanned activity that disrupts or penetrates a cap (e.g., utility repairs), and following a severe weather event (e.g., a hurricane or tornado), as circumstances may warrant.

- Inspections will be performed by a walkover of capped areas and may be supplemented by other technologies (e.g., aerial photographs from unmanned aircraft system (drone) technology).

- The extent of the required cap areas will be documented via geographic information system (GIS) shape boundaries for compliance review purposes.

- Areas where caps have been removed or breached/damaged will be identified.

- Disruptions of capped areas, including excavation, removal, penetration, erosion, loss of vegetated topsoil, burrowing by animals, desiccation/cracking, subsidence, sinkhole formation, or any other cumulative thinning of the original cap thickness will be documented within one month of discovery. Repairs will be performed following the maintenance procedure in Section 5.1 as soon as practicable and completed, if possible, within two months of discovery.

- Minor damage not requiring immediate repair will be noted and continue to be monitored during follow-up inspections.

Cap inspections will be documented in annual PRCP reports along with a description and photographs of the nature and cause of any damage and corrective actions taken. Cap inspection records will be maintained by the property owner for a minimum period of thirty years and will be made available for PADEP and USEPA review upon request. Electronic storage and production of such inspection reports is acceptable. This obligation is memorialized in the Environmental Covenants for the East and West Campuses.

4.3.2 West Campus Vapor Barrier Monitoring

Annual monitoring of the ERLC warehouse vapor barrier consists of documentation from the owner of the West Campus property confirming the concrete slab covering the vapor barrier is intact. Integrity of the vapor barrier is assumed if the slab is intact. This obligation is memorialized in the Environmental Covenant for the West Campus.

4.3.3 Groundwater Monitoring Associated with Engineering Controls

Groundwater monitoring will be continued under this PRCP following the procedures in the FSP and QAPP. Monitoring data will be evaluated and reported annually. The obligation for groundwater monitoring is memorialized in the Environmental Covenant for the East Campus.

The monitoring-well network and frequency of monitoring may be modified as goals are achieved or changed. As a general matter, groundwater sampling will continue until the MCLs/RSLs are met outside of the TI Areas unless earlier termination is approved in writing by PADEP and USEPA.

Groundwater monitoring objectives focus on periodic tracking of COC concentrations, COC movement in groundwater and surface water, and performance of groundwater extraction and treatment systems (GWETS) at the Site. Activities provided in this PRCP to meet monitoring objectives include collecting and analyzing groundwater elevation, chemical, and flow data to determine performance of GWETS and assessing plume migration. Objectives of the monitoring program are as follows:

- Conduct groundwater and extraction system monitoring in the SPBA to verify that a groundwater gradient exists from off-Site wells located along Canterbury Lane toward on-Site wells located in the SPBA;
- Conduct groundwater and extraction system monitoring to demonstrate the WPL system operates according to established parameters, if operated;
- Conduct groundwater monitoring to verify no off-Site migration of COCs above established limits from the Northern Property Boundary Area (NPBA); and
- Conduct surface water monitoring to demonstrate compliance with AWQC in Codorus Creek.

Should the WPL be restarted, five extraction wells in TI Area 1 (CW-9, CW-13, CW-15A, CW-17, and CW-20) will be sampled to gauge performance of the groundwater extraction system. Sampling of the SPBA extraction wells inside of TI Area 2 (CW-21, CW-22, and CW-23) will be performed to assess groundwater quality affected by pumping.

Table 4.3-1 provides monitoring information for wells to be sampled during post-remediation care activities (type, depth, construction, geology, and sub-area). Construction logs for the wells are included in **Appendix E**.

4.3.3.1 SPBA Extraction System Groundwater Monitoring

Monitoring in the SPBA will be conducted to verify that a groundwater gradient exists from off-Site wells located along Canterbury Lane toward on-Site wells located in the SPBA. Monitoring will also be used to evaluate extraction system performance. Wells to be used for monitoring in the SPBA are highlighted in **Figure 4.3-1**.

Water levels in SPBA monitoring and extraction wells will be measured and evaluated quarterly. The elevation data will be used to generate potentiometric surface contours and evaluate groundwater intercepted by pumping within the SPBA. Further evaluation of SPBA pumping system influence will consist of comparing data from paired wells (on-Site extraction well with a downgradient, off-Site sentinel well) to gauge pumping effects (GSC, 2019b and 2023). Using this approach, graphed water level elevation data from well groupings CW-21 and MW-166, CW-22 and MW-167, and CW-23 and MW-168 (during pumping) will be evaluated to verify that off-Site groundwater levels are sloping toward the SPBA.

COC concentrations will be quantified in groundwater during SPBA extraction system operation. Samples of the combined influent from the extraction wells will be collected and analyzed quarterly for VOCs to monitor mass removed from the aquifer by the extraction system. Groundwater samples will be collected quarterly for VOC analysis to monitor groundwater chemistry from active extraction wells CW-21, CW-22 and CW-23 and off-Site monitoring wells MW-166, MW-167, and MW-168 located to the south of the SPBA along Canterbury Lane to assess groundwater quality affected by pumping.

SPBA groundwater extraction system performance will also be gauged by long-term average pumping rates. Average pumping rates for the SPBA will be compared to the design rates determined during system testing in 2017 (GSC, 2019b).

Monitoring data evaluated for the SPBA system performance will be included in annual PRCP reports. The reports will include information on system optimization and rehabilitation (if necessary), potential reduction in the number of wells operating, and future shutdown of the system.

The operation of the SPBA groundwater extraction will not be discontinued without written approval of PADEP and USEPA. If monitoring data indicates that the SPBA system is no longer required, a proposal to discontinue operation of the system will be included with the annual PRCP report or as a separate document to the PADEP and USEPA for comment and approval. The proposal may include groundwater quality sampling data, trends, and rebound analysis based on post-remediation concentrations.

4.3.3.2 WPL Extraction System Groundwater Monitoring

Monitoring in the WPL will be conducted to demonstrate that, while in operation, the WPL system operates according to established parameters and intercepts Site-impacted groundwater flowing westward toward Codorus Creek.

Water levels in WPL monitoring wells will be measured and evaluated annually. The elevation data is used to generate potentiometric surface contours and evaluate groundwater intercepted by pumping within the WPL. WPL groundwater extraction system performance will also be gauged by long-term average pumping rates and groundwater flow gradients developed by pumping. Average pumping rates for the WPL will be compared to the design rates determined during system testing in 2015 (GSC, 2018b).

Total VOCs and COCs will be quantified in groundwater during WPL extraction system operation. Samples of the combined influent from the extraction wells will be collected and analyzed quarterly for VOCs to monitor mass removed from the aquifer by the extraction system. Groundwater samples will be collected quarterly for VOC analysis to monitor groundwater chemistry from extraction wells CW-9, CW-13, CW-15A, CW-17, and CW-20 to assess groundwater quality affected by pumping.

Monitoring data for the WPL system will be included in annual PRCP reports and will include information on system optimization and rehabilitation (if necessary), potential reduction in the number of wells operating, and future shutdown of the system.

Successful performance of the WPL groundwater extraction system is linked to compliance with AWQC at specific locations in Codorus Creek based on surface water monitoring described in Section 5.5. Performance is also gauged by long-term average pumping rates that should exceed the design rates and groundwater elevation and gradient data.

4.3.4 Groundwater Treatment System Monitoring and Sampling

Several types of automatic equipment will be used to monitor the operation of the treatment system. The automatic equipment will consist of flow-rate monitors, pump or blower cycle counters, water level indicators, pressure indicators, pH monitors, and temperature monitors. This equipment will monitor each parameter continuously, and the information will be viewed through the FactoryTalk® View system, described in the O&M Manuals. The data will be automatically uploaded to a Microsoft Excel® data table each day. A full description of the treatment system monitoring activities is described in the O&M Manuals.

In addition to the automatic system monitoring equipment described above, several manual monitoring instructions will be in place to check the operation of key equipment. This monitoring will consist of daily checks of the FactoryTalk® View system by the operators. Operators have work instructions to perform the daily checks in the O&M Manuals. Pressure measurements will be performed twice per month, and amperage draw readings will be recorded quarterly for key equipment. Details of the manual monitoring requirements are provided below.

Manual pH readings will be taken monthly of the PTA influent and effluent. A differential air pressure magnehelic gauge will be used to monitor changes in air pressure caused by the PTA packing; and is one indicator in determining when to change the PTA packing material. An airflow pitot tube and a pressure gauge on the PTA discharge line will be used to monitor the airflow rate and in-line pressure.

Groundwater samples will be collected from various locations and throughout the year to verify the effectiveness of the treatment system. Pre- and post-GAC vapor treatment samples will be monitored twice per month.

The NPDES permit for groundwater discharge requires collecting PTA effluent samples. The PTA effluent samples will be analyzed for pH at the time of collection. The influent sample is used to calculate the mass of contaminants removed by the treatment system and estimate the VOC loading to the off-gas treatment system.

PTA influent and effluent samples will be collected from sample ports located on the PTA. The O&M Manuals provide instructions for collecting the treatment system influent and effluent samples.

4.4 Long-Term Groundwater Monitoring Plan

Groundwater monitoring will be continued under this PRCP to verify fate and transport assumptions and monitor the progress of MNA toward the resource restoration objective for areas outside of the TI Areas.

4.4.1 Site-Wide Groundwater Elevation Monitoring

Annual groundwater elevation monitoring will be conducted in WPL, SPBA, MNA, NPBA, and Codorus Creek areas of the Site. Groundwater elevation data will be collected to provide information regarding groundwater flow gradients and performance of groundwater extraction systems. Vertical and lateral groundwater gradients and groundwater chemistry are used to evaluate COC migration. Water levels will be measured in the wells and surface water locations identified on **Table 4.3-1**.

At locations with multiple well screen depths, only the groundwater level elevation from the shallowest well will be used to generate the contours for reporting purposes. Water level elevations collected from wells screened below the shallow portion of the aquifer will not be used because these data do not represent the water table surface elevation in the aquifer.

The condition of the wells will be evaluated during annual groundwater monitoring. The discovery of a condition that could potentially compromise the integrity of a well for monitoring purposes (e.g., damage to the surface completion or the well casing) will be documented within one month of discovery and repairs performed as soon as practicable and completed, if possible, within two months of discovery.

The groundwater elevation monitoring results and monitoring well corrective action taken will be documented in annual PRCP reports.

4.4.2 Monitored Natural Attenuation of Groundwater

MNA is being used to achieve the USEPA CAO of resource restoration for groundwater outside of TI Area boundaries at the Site as discussed in the following Sections.

4.4.2.1 Background and Approach

The goal of MNA monitoring is to demonstrate groundwater COC concentration trends are stable or declining. The cleanup criterion for groundwater is USEPA MCLs that are equivalent to PADEP Statewide health standard (SHS) medium-specific concentrations (MSCs). For COCs that do not have an MCL, USEPA tap water RSLs that correspond to a cancer risk level of $1x10^{-6}$ and a hazard quotient (HQ) of 1.0 are considered the groundwater cleanup goal. **Table 4.4-1** provides current USEPA MCLs, USEPA tap water RSLs, and PADEP SHS residential and non-residential MSCs for comparison.

Chemicals considered Site groundwater COCs were established in the Part 2 Supplemental Remedial Investigation (SRI) (GSC, 2018b) based on magnitude of chemical concentration, detection frequency, and potential for migration. Site COCs for the MNA portion of the groundwater remedy are CVOCs (PCE, TCE, and TCA), and CVOC degradation products (cis-1,2-dichloroethene [cis12DCE], VC, 11DCA, 12DCA, and 11DCE). Additional COCs consist of benzene, methyl tertiary-butyl ether (MTBE), and cyanide.

Annual MNA monitoring at fYNOP is performed in September and October to minimize seasonal variations and to take advantage of limited groundwater recharge typically occurring during that time of year. This approach is consistent with that used for the past 20+ years of groundwater monitoring and provides seasonally comparable groundwater gradient and chemistry data for the yearly evaluation.

The MNA monitoring network consists of wells in the NPBA, Eastern Site Perimeter (ESP), South-Central Site Area (SCSA), SPBA, South Plume Area (SPA), Codorus Creek Levee, West Side of Codorus Creek, and Northern Site Perimeter (NSP). Groundwater samples for MNA analysis are collected from forty-four (44) wells in these areas shown on **Figure 4.4-1**. **Table 4.4-2** lists the MNA wells and presents information for each well (type, depth, construction, geology, and area designations at the Site).

Groundwater samples are analyzed for the project analyte list of VOCs in the QAPP using SW-846 Method 8260C. The sample from ESP well MW-2 is also analyzed for total and available cyanide using Methods 9014 and OIA-1677 to monitor concentrations in the vicinity of the former cyanide spill area.

MNA monitoring data is used to estimate attenuation progress as follows:

- Verify that MNA is a viable approach to achieving aquifer restoration;
- Verify that COC concentrations continue to present no significant risk to human health and the environment;
- Verify that downgradient, lateral, and vertical migration of contaminants in concentrations above the MCLs do not extend beyond the current area of contamination (plume is not expanding); and
- Identify changes in groundwater gradient (flow direction) that may affect protectiveness of the MNA portion of the remedy.

Wells sampled and analyzed for VOCs and cyanide in MNA areas during annual monitoring are as follows:

- NPBA – Twelve wells total: ten monitoring wells (MW-3, MW-9, MW-12, MW-16S, MW-18S, MW-18D, MW-20S, MW-20M, MW-143S, and MW-143D), and two inactive extraction wells (CW-1A and CW-2).
- ESP – Three wells total: monitoring wells MW-2, MW-14, and MW-65S; MW-2 is also sampled for total and available cyanide.
- SCSA – Eight wells total: seven monitoring wells (MW-67S, MW-67D, MW-69, MW-79, MW-111, MW-112, and MW-115) around the Harley-Davidson manufacturing facility (Bldg3) and well MW-88 southwest of former Building 58 (Bldg58).
- SPBA – Seven wells total: monitoring wells MW-22, MW-108S, MW-108D, MW-165, MW-166, MW-167, and MW-168.
- SPA – Six wells total: monitoring wells MW-12 (Cole Steel), MW-43D, MW-110, MW-150, GM-1D, and Cole D.
- Levee Area – One well pair total: monitoring well pair MW-101S and MW-101D in the southwest area of the Site.
- West Side of Codorus Creek – One well total: Waterloo™ multilevel well MW-148A (two sample ports) on the west side of Codorus Creek.
- NSP – Four wells total: monitoring wells MW-5, MW-6, MW-82, and MW-186.

4.4.2.2 Methodology

Several lines of evidence may be used to evaluate the significance of a particular COC concentration or concentration trend and to determine MNA progress at the Site, when necessary. This evaluation may consider MNA information from previous Site studies, trend analysis, contaminant flux evaluation, plume stability assessment, and fate and transport evaluation. Changes in standard practices, policies, guidance, and regulations may necessitate modifications to the evaluation methods. Actions to address unexpected increases in concentrations or expansion of contaminated areas are also described.

This process is only intended to provide methods to evaluate groundwater MNA progress during the monitoring phase of the assessment. Methods for sampling and data analyses for the attainment phase of the MNA assessment are included in Section 4.4.2.3.

4.4.2.2.1 MNA Groundwater Trend Analysis

Groundwater concentration trends for the COCs in MNA areas will be evaluated following the process described in the Final Report using Mann-Kendall statistical analysis. The Mann-Kendall test determines if a statistically significant upward or downward trend is indicated by the data. If additional information is useful to describe trends from the Mann-Kendall analysis, Monitoring and Remediation Optimization System (MAROS) software may be used. Additional statistical trend tests may also be considered including linear regression analysis and the Theil-Sen Line Test. A confidence coefficient (CC) of 90% and 80% will be used for the Mann-Kendall test. For purposes of the statistical analysis, non-detects will be represented by the value of the method detection limit (MDL) which is the lowest level of reporting by the analytical laboratory (USEPA, 2018). The trend test methodology may be modified for certain data sets containing a high percentage of non-detect results.

4.4.2.2.2 MNA Comparison of Groundwater Concentrations to MCLs/RSLs

COC concentrations in MNA wells will be compared to USEPA MCLs and RSLs annually during the monitoring phase of the assessment. If COC concentrations on a per-well basis are less than or equal to the MCL/RSL for three consecutive years of annual monitoring and are not materially increasing, transition to attainment phase monitoring will be evaluated.

4.4.2.2.3 Additional Lines of Evidence for MNA

Additional lines of evidence that may be evaluated if a COC concentration trend is not declining when above the MCLs/RSLs include the following:

- Plume stability analysis;
- Mass flux determination of contamination in the aquifer;
- COC movement horizontally and vertically in the aquifer;
- Spatial distribution of COC concentrations;
- Occurrence and spatial distribution of COC daughter products;
- Well completion lithology affects; and
- Rate of COC decline or increase.

Additional assessments may also be required if COC concentrations rise suddenly or if increasing trends in COC concentrations above an MCL/RSL persist. A more in-depth analysis of the data may be indicated by the following conditions:

- Violation of fate and transport or Groundwater RA assumptions;
- COC concentration trends indicate unacceptable MNA progress;
- Plume migration into a previously uncontaminated area is discovered; or
- Contaminant concentrations at specified locations exhibit an increasing trend not originally predicted during remedy selection.

In these cases, well transect analysis (if sufficient data exists) or flow path evaluation may be used to evaluate plume stability. A reevaluation of a component of the Groundwater RA (NewFields, 2018) may also be warranted. **Figure 4.4-2**, discussed in Section 5.2.3.7, presents criteria for decision making during the annual review based on lines of evidence used to assess MNA data.

4.4.2.2.4 MNA Monitoring Optimization

During the annual review of MNA progress, adjustments to the monitoring frequency will be considered. It may be appropriate to decrease the monitoring frequency if natural attenuation is progressing, as expected, and little change is observed from one sampling round to the next. In contrast, the monitoring frequency may be increased if unexpected conditions (e.g., plume migration) are observed. Amendments to MNA monitoring will require approval of PADEP and USEPA prior to implementation.

4.4.2.3 MNA Performance Evaluation

The MNA Decision Flowchart shown on **Figure 4.4-2** was developed to evaluate MNA data and to determine the need for potential action based on MNA performance. During the annual review, data will be used to determine trends in COC concentrations.

The first step in the decision-making process, shown on **Figure 4.4-2**, is to determine if COC concentrations (on a per-well basis) are less than or equal to the MCL/RSL for three consecutive years of annual monitoring. If so, and COC concentration trends are stable or declining, the sample location is assumed to have successfully documented MNA remedial progress and will be evaluated for transition to attainment monitoring during the annual review. The evaluation will include an analysis of whether COC data from this location will likely be needed to assess future plume movement or stability. The attainment monitoring phase will be considered complete when the COC concentration is less than or equal to the MCL/RSL for eight consecutive quarters, and the concentration trend is not increasing.

If the COC concentration is not less than or equal to the MCL/RSL for five consecutive years of annual monitoring, and the concentration trend is declining, then continued monitoring and data analysis is warranted.

If the COC concentration is greater than the MCL/RSL, and the concentration trend is not stable or declining, then several lines of evidence will be considered to assess MNA performance as follows:

- Limited or wide-spread COC concentration exceedances;
- Plume stability;
- Presence of COC daughter products;
- Mass flux changes in COCs at certain locations in the aquifer;
- Well completion lithologies; and

- Rate of COC concentration decline or increase.

In addition to evaluation of the mentioned lines of evidence, other factors may be considered in the evaluation, such as precipitation, groundwater level fluctuation, and groundwater extraction system operation.

After the attainment monitoring phase is completed for all COCs at a well, potential future use of the well will be considered, and COC concentrations evaluated on a well-by-well basis to assess whether aquifer restoration is complete (USEPA, 2013). In some instances, it may be appropriate to continue monitoring the well, at appropriate intervals, to evaluate progress of surrounding wells or to ensure the groundwater remedy continues to address contaminated groundwater. In other circumstances, it may be appropriate to discontinue monitoring of that well. A specific mechanism to determine the need for implementation of an alternate remedy or expansion of the TI Areas is not provided. These assessments will be performed, as needed, based on the results of data analysis performed for the annual review.

The annual evaluation will verify that the MNA portion of the remedy is a viable approach to achieving aquifer restoration. If unacceptable plume migration is discovered or if a new contaminant source is identified, a more in-depth analysis may be required.

USEPA recommends that MNA remedies be evaluated to determine the need to include one or more contingency measures should MNA not meet performance objectives. A contingency measure functions as a “backup” remedy or action should the “selected” remedy not perform as anticipated. During the annual review, a contingency measure may call for modification of the selected technology, if needed, or a different technology (or technologies) may be evaluated. Additional contingency measures include reevaluation of the monitoring well network and this approach. Contingency measures will also allow for the incorporation of new information about exposure risks and technologies.

4.4.3 Groundwater Monitoring for NPBA Plume Migration Assessment

An annual assessment of plume migration is conducted to confirm off-Site migration of COCs above established limits north and west of the NPBA is not occurring. The assessment is performed by evaluating groundwater quality data and flow gradients.

Wells monitored for the NPBA assessment are shown on **Figure 4.4-3**. Water level measurements and groundwater samples for VOC analysis from these wells are collected on an annual frequency. Monitoring data and the results of the NPBA plume migration assessment will be included in annual PRCP reports.

4.4.4 TI Area 1 Perimeter Groundwater Monitoring

Quarterly groundwater monitoring is conducted around the boundary of TI Area 1 to assess potential changes in groundwater chemistry during WPL extraction system shutdown. The assessment is performed by evaluating groundwater quality data and flow gradients.

Groundwater samples for VOC analysis are collected from monitoring wells MW-5, MW-6, and MW-88 and well pair MW-101S/D (**Figure 4.4-4**). The assessment is performed by comparing COC concentrations in the quarterly samples to concentrations during WPL extraction system pumping. Monitoring data and the results of the assessment will be included in annual PRCP reports.

4.5 Surface Water Monitoring

The applicable or relevant and appropriate requirement (ARAR) for surface water is compliance with Pennsylvania AWQC. Therefore, monitoring was performed to evaluate compliance with AWQC in the creek during WPL extraction system operation and shutdown.

Monthly surface water monitoring with the WPL groundwater extraction system operating was conducted for two years (September 2019 through August 2021). In September 2021, the WPL extraction system was shut down and two years of monthly surface water monitoring was performed (September 2021 through August 2023). Results of monitoring in the Final Report verified compliance with AWQC in the Codorus Creek under pumping and non-pumping conditions and confirmed that operation of the WPL groundwater extraction system was not necessary to meet AWQC.

4.5.1 Scope of Surface Water Sampling and Analysis

Surface water monitoring and data evaluation will be conducted monthly for two additional years with the WPL extraction system off (September 2023 through August 2025). If the results verify continued compliance with AWQC in the Codorus Creek under non-pumping conditions, proposed changes to discontinue or modify the frequency of surface water monitoring will be submitted for approval of PADEP and USEPA prior to implementation.

The monitoring will be performed following the procedures described in the FSP and QAPP. Monthly surface water samples will be collected for analysis of VOCs from twelve locations in Codorus Creek that consist of three focused diffuse groundwater discharge locations (COD-SW-15, COD-SW-17, and COD-SW-26) and nine surface water sampling locations downstream of diffuse discharge locations (COD-SW-6, COD-SW-7, COD-SW-8, COD-SW-9, COD-SW-13, COD-SW-16, COD-SW-27, COD-SW-28, and COD-SW-29). These sampling locations and AWQC application assigned to each sampling location are shown on **Figure 4.5-1** and **Table 4.5-1**, respectively.

COCs in surface water were determined by magnitude of chemical concentration, detection frequency, and comparison to AWQC. Site-related COCs for the creek are PCE, TCE, cis12DCE, and VC. **Table 4.5-2** provides the AWQC for each surface water COC (i.e., fish and aquatic life criteria and human health criteria). The published human health criteria for PCE, TCE, and VC changed in July 2020 (after publication of the Cleanup Plan) from 0.69 µg/L to 10 µg/L for PCE, from 2.5 µg/L to 0.6 µg/L for TCE, and from 0.025 µg/L to 0.02 µg/L for VC. The criteria for cis12DCE did not change. The AWQC for VC is lower than can be reliably achieved using Pennsylvania-certified analytical methods. In these situations, the analytical method quantitation limit (QL) and applicable reporting limit (RL) are used to determine compliance (i.e., 1.0 µg/L for samples collected prior to May 2020 and 0.5 µg/L for samples collected on and after May 2020).

4.5.2 Surface Water Compliance Determination

Surface water monitoring results will be evaluated monthly and documented in annual PRCP reports. The evaluation will consist of comparing AWQC with the COC analytical results at points of application in Codorus Creek. The evaluation of the human health criteria will be the average concentration over time rather than each individual sample concentration.

5.0 OPERATION AND MAINTENANCE OF ENGINEERING CONTROLS

This O&M section describes the measures necessary to operate and maintain the ECs of the Site remedy as follows:

- Maintenance, repair, and replacement requirements for capped areas;
- Maintenance of the vapor barrier; and
- O&M of the GWETS.

All O&M activities will be documented in annual PRCP reports along with approval of PADEP and USEPA, as required.

5.1 Cap Maintenance, Repair, and Replacement

Intrusive activities (e.g., construction and excavation) associated with repair and replacement of caps will be controlled on the East and West Campus properties following the material and waste management procedures discussed in Section 3.1.2. The discovery of a damaged or inadvertently removed cap will be documented within one month of discovery and repairs performed as soon as practicable and completed, if possible, within two months of discovery.

Repairs will be made to prevent underlying material from migrating to the surface, where damage allows direct contact with underlying soils, or the damage is affecting the use for which the cap was intended. Replacement capping materials should be durable; meet the minimum requirements described in Section 3.2.1 for the intended use; and protect receptors from direct contact with contaminated material; and reduce infiltration in certain areas of the West Campus.

Repair and replacement caps must be designed by professionals to meet specific criteria based on planned use and materials capable of supporting the intended use of the area to maintain attainment of the remediation standards.

Cap maintenance, repair, and replacement designs will consider the following:

- Generally accepted pavement construction sources (e.g., American Association of State Highway Transportation Officials and Pennsylvania Department of Transportation [PennDOT] guidance and American Society for Testing and Materials [ASTM] specifications);

- Sealing of cracked cap material in areas requiring infiltration protection;
- Durability and compatibility with contaminants;
- Ability to meet construction and end use goals;
- Compatibility of materials with underlying contaminants;
- Specifications of the capping material, the quality control of the cap construction, and inspection requirements;
- Reliability of the cap material, inspections and maintenance will be performed for as long as the soil contaminant concentrations remain above the cleanup standards;
- Erosion from water and wind;
- Cracking and deterioration from natural influences including water saturation and freeze/thaw cycles;
- Settlement and shifting of the cap and subsurface;
- Damage from migration of groundwater into the cap;
- Contaminant migration, including migration to the surface of the cap and potential vapor migration; and
- Presence of burrowing animals.

5.2 Vapor Barrier Maintenance

Disruptions to the vapor barrier beneath the ERLC building slab, including removal, penetration, significant cracking, or other opening(s), will be addressed as soon as practicable or within a minimum of one month of the date of discovery. Special attention will be given to sealing or replacing the vapor barrier if slab disruption occurs.

Any new or replacement inhabitable buildings on the East and West Campuses must evaluate the vapor intrusion potential and incorporate mitigation measures that adequately address the potential for vapor intrusion. Such evaluation shall include an evaluation of vapor intrusion and migration pathways, and any construction shall include, if necessary for the protection of human health based on the evaluation of vapor intrusion pathways or as a presumptive mitigation measure, installation and maintenance of a vapor barrier or vapor mitigation system beneath or as part of any future inhabitable structure built on the properties.

5.3 Groundwater Extraction and Treatment System Operation and Maintenance

Operation of the GWETS in continuous and batch modes is described in the O&M Manuals (HTG, 2019 and 2022). The O&M Manuals also describe the O&M activities to be performed and documented during system operation. If an equipment reading is not within the specified operation range, equipment is observed to be malfunctioning, or the system is not performing within specifications, maintenance and repair is required as soon as practicable or within a minimum of one month of the date of discovery.

5.3.1 Treatment System Operation

As described in the O&M Manuals, Building 41A houses the treatment system that uses a Compact Logic PLC system with control software (identified as FactoryTalk® View), various analog and digital measuring devices, motor starters, and motorized valves to operate the system. Details of the FactoryTalk® View systems are provided in the O&M Manuals. Components of the MCP in Building 41A are as follows:

- Main Control System HMI – FactoryTalk® View software is installed on the human machine interface (HMI) mounted on the MCP control panel and is used for all treatment plant controls when in Building 41A. This system uses a color touch screen that is mounted within the MCP door. Touch the screen to activate the HMI and utilize the on-screen controls. Alternatively, a remote PC can be connected to the front of the MCP via an existing ethernet port for treatment system control.

- Control Panel Lights – Pilot lights are located on the MCP to indicate general equipment operation condition, presence of power, fault(s), and auto-dialer alarm activation status.

- Fault Reset Push Button – This button is used to reset all system faults. It illuminates when a fault is present.

- Auto-Dialer Switch – The Sensaphone® auto-dialer can be enabled or disabled from the MCP panel. When turned to the left, the Sensaphone® is turned on, and an amber light illuminates on the switch. When turned to the right, the Sensaphone® auto-dialer is disabled, and the amber light flashes. Both the PTA sump and the EQ tank are equipped with conductance-type level probes to control pump operation and monitor alarm conditions. These tanks are also equipped with analog-type level measuring devices that are used by the monitoring system to display water levels. PLC programming can be adjusted to control functions in the event of a malfunction of the conductance probes.

An electric sump pump is in the containment sump pit in Building 41A. Pump operation is controlled by on/off probes in the sump pit. The sump high-level float switch connected to the PLC system, when tripped, will actuate an alarm and system shutdown.

Motorized valves for the incoming groundwater from the extraction well areas are located above the EQ tank. These valves will close automatically when the water level in the EQ tank exceeds the high-high alarm set-point (140 inches). A motorized valve on top of the EQ tank is provided for drainage of the PTA riser pipe when the temperature inside or outside the building falls below the low temperature condition set point.

In batch treatment mode (WPL system off) the EQ tank will fill to 100 inches (or other set point) and the influent/transfer pump is set to "enable" on the HMI screen at the MCP (HTG, 2022), the blower will activate immediately. The influent/transfer pump will activate once the blower has established adequate airflow. Water will be pumped out of the EQ tank until the tank level reaches 25 inches (or other set point), the influent/transfer pump will cycle off, and the blower will continue to run for three minutes before cycling off. The influent/transfer pump is programmed to run at 60% capacity to allow enough time to complete O&M checks on the system.

If the WPL is operating, the treatment system can run in continuous mode. When the treatment system influent/transfer pump is set to "enable" on the HMI screen at the MCP (HTG, 2022), the blower will activate immediately, and the pump will activate after the blower has established adequate airflow. Water will continue to be pumped from the EQ tank to the PTA when the EQ tank water is delivered from the extraction well areas and maintains a level above 35 inches in the tank. The VFD connected to the PTA transfer pump automatically adjusts the influent flow rate to the PTA so that the PTA transfer pump has a minimum number of on/off cycles; and the EQ tank does not fill to a high level, which would shut down the extraction wells. If the water level in the PTA sump rises to the high-level probe, the PTA influent pump is automatically deactivated to avoid flooding the blower. If the water level in the EQ tank rises to a high-level condition, the extraction wells will be automatically deactivated to avoid overfilling the tank.

To change treatment system mode, select the Low Flow Batch Control button in the lower right on the treatment system screen. A window will open that displays the operations mode, buttons to modify the EQ tank set points, and influent/transfer pump transfer speed set point. If changing from batch to continuous flow mode, the influent pump will not start until the EQ tank reaches 36 inches. The work instructions to change operating modes are presented in the O&M Manuals.

Troubleshooting instructions for a system malfunction, or an alarm, are in the O&M Manuals and are as follows:

1. Well pump failure;
2. Analog signal failure;
3. EQ holding tank high-level alarm;
4. PTA sump high-level alarm;
5. PTA airflow fault;
6. PTA blower fault;
7. PTA pump fault;
8. All motorized valves are closed; and
9. Groundwater pump station pump fault.

5.3.2 Treatment System Maintenance

The maintenance of the treatment system will follow the schedule in the O&M Manuals and falls into three categories: routine maintenance, annual maintenance, and specialized maintenance. Maintenance requiring shutdown of a system component having an energy source must be conducted in accordance with approved lockout/tag-out (LOTO) procedures, which are attached to each component requiring LOTO. Copies of approved LOTO procedures (created by Sotaris) are included in the O&M Manuals.

Routine maintenance includes the periodic monitoring, inspection, calibration, or cleaning of the system components. The operators conduct FactoryTalk® View monitoring daily and information from the monitoring is recorded on the Groundwater Treatment Plant (GWTP) HMI Computer Daily Log (Microsoft Word® document). The information provided by FactoryTalk® View includes individual pump flow rates and daily pump cycles, total flows from extraction wells, EQ tank level, PTA flow, and influent pH.

Additional routine monitoring and maintenance activities are conducted twice per month at Building 41A, WPL Area (when active), and SPBA Building. This information is recorded on a preventative maintenance data form in the O&M Manuals, logged into a spreadsheet for monitoring long-term conditions of the system, and maintained at Building 41A.

In Building 41A, the blower, blower motor, belts, valves, plumbing, PTA ductwork, and other electrical and mechanical components are inspected twice a month. In addition, amp meter readings are recorded quarterly on the blower, and pressure gauge readings are recorded twice a month for the PTA.

The dosing rate of the chemical sequestering agent (Redux 525) pump is verified twice a year. Work instructions are presented in the O&M Manuals. The dosing rate is set at 20 parts per million (ppm) and is controlled by programing associated with the influent/transfer pump. The rate is used to calculate the amount of Redux 525 used per month and reported in the monthly Discharge Monitoring Reports (DMRs). Further maintenance details are contained in the O&M Manuals prepared for the Site.

5.3.3 Extraction Well Maintenance

For each groundwater collection area, an amp meter reading is recorded on all the extraction well pump motors on a quarterly basis. In addition, the flow and pressure of each active extraction well are recorded twice a month. Motors and pumps are replaced as necessary. The "Y" strainer and check valves at the extraction wells are checked twice a month and cleaned, if necessary. Finally, the electrical control panels and system piping at each active extraction area are visually inspected twice a month.

The following maintenance tasks are part of the inspections typically conducted at least annually for various system components of the extraction wells.

1. Liquid Level Probes – Probes shall be removed and cleaned.
2. Submersible Pumps – When required, well pumps shall be removed from extraction wells and inspected for the presence of encrustation and/or bacterial growth over the pump intake and pump casing. All foreign residues will be removed using a wire brush and, if needed, a diluted solution of muriatic acid (hydrochloric acid). Before placing a pump back in the well, the pump will be thoroughly cleaned with muriatic acid and rinsed. The pump shaft will be rotated

manually and checked for free movement. Replacement of the pump end may be necessary if the pump is severely fouled. Historically, the well pumps have not required frequent pump removal or cleaning. All well pumps will be checked via the monitoring computer and documented on a Daily Log, including any change in pumping rate or excessive pump cycles. An increase in pumping rate is warranted by the presence of a high-level warning, which is remedied by increasing the flow rate of the respective well pump. An excessive amount of pump cycles for a well is generally defined as being greater than ten cycles per hour. To remedy pumps exhibiting excessive cycling, the operator should reduce the flow rate to approximately equal the current well yield. The O&M Manuals includes a summary of well-specific information, including the expected yield range of each extraction well.

3. Extraction Wells – Wells that become encrusted or filled with precipitates will be chemically and/or physically cleaned. Well-specific instructions will be developed as conditions are discovered consistent with industry standards and procedures described in Groundwater and Wells (Driscoll, 1986). Various physical and chemical cleaning methods are cited in these references depending on the cause of the fouling. The frequency of well rehabilitation or cleaning is dependent upon observed yield degradation and other fouling symptoms. For extraction well CW-20, the following revised rehabilitation procedure will be followed: pull pump assembly, add one gallon of NW-220 (or equivalent) surfactant brushed into the water column, install a packer assembly, back flush with 12,000 gallons of clean water, and reinstall pump assembly.

5.3.4 Extraction System Piping Maintenance

The following maintenance tasks and inspections are typically conducted twice a month for various system components of the extraction system piping. The "Y" strainers and flow sensors are checked and cleaned if needed as follows:

1. "Y" strainers have been installed to remove gross suspended matter from the water prior to the flow meter on the conveyance piping for each well. The sequence is:

    a. Document the flow rate of the pump.

    b. Turn the well pump off and close the ball valves in the water line (before and after the strainer).

    c. Remove the plug from the "Y" strainer outlet.

    d. Clean the "Y" strainer with a brush and water.

    e. Open the lower ball valve.

    f. Start up the well pump and allow water to discharge into the sump for approximately 30 seconds.

    g. Turn the pump off.

h. Close the lower ball valve.

i. Reinstall the plug for the strainer outlet.

j. Open the lower ball valve.

k. Open the ball valve after the flow sensor, start the well pump, and adjust the flow rate, as necessary.

2. Flow Sensors – Flow sensor maintenance will be performed as follows:

   a. Calibration of well flow sensors will be performed once every five years. Adjustments will be made to any sensor that is not within 5% of the actual flow value.

   b. Clean/replace sensors on an as-needed basis.

6.0 POST-REMEDIATION CARE REPORTING

Annual PRCP reports will be prepared by the owner of the East Campus property and submitted to PADEP and USEPA by the end of May following the calendar year covered by the report. The objectives of the annual PRCP reports are to document the performance of the ECs and ICs and confirm they continue to be protective of human health and the environment. The methods, findings, and conclusions of the evaluations are documented in the reports along with recommendations to address identified issues found during the evaluation, if any.

Annual PRCP reports will document the following:

- Monitoring and maintenance of caps;
- Monitoring and maintenance of West Campus vapor barrier;
- Monitoring and maintenance of the SPBA groundwater extraction system;
- Potential future monitoring and maintenance of the WPL GWETS (if necessary);
- Monitoring and maintenance of the groundwater treatment system;
- Compliance with the NPDES permit and PADEP Chapter 110 (formerly Act 220) and SRBC groundwater withdrawal requirements, as and if applicable;
- Assessment of non-residential land use;
- Assessment of continued non-use of groundwater;
- Assessment of potential vapor intrusion into future inhabited spaces;
- Notification regarding potential exposure to utility workers;
- Evaluation of groundwater and surface water monitoring data;
- Completion of intrusive activities and waste management controls;
- Communications related to the public involvement;
- Evaluation of changes to land use and conditions at the Site that that could affect the protectiveness of the remedy, as necessary;
- Assessment of the overall performance and continued effectiveness of the remedy and whether MNA is progressing as expected toward meeting goals and objectives; and

- Recommendations for proposed changes to any remedy components.

In addition, annual PRCP reports will include the following:

- Site management, inspection, and field sampling documentation;

- Laboratory analysis reports, laboratory data quality assessment, and validation for collected samples in accordance with the QAPP; and

- Data summary tables and graphical representations of COCs by media (groundwater and surface water) including a listing of all compounds analyzed and applicable regulatory standards.

Contact information for annual PRCP report submittals is as follows:

- PADEP, Southcentral Regional Office, Environmental Cleanup and Brownfields Program Manager, 909 Elmerton Avenue, Harrisburg, Pennsylvania 17110.

- USEPA, Region 3, RCRA Corrective Action Program Coordinator, 1650 Arch Street, Philadelphia, Pennsylvania 19103.

In addition to annual PRCP reports, the Environmental Covenants for the East and West Campus properties (**Appendix A**) require compliance reporting within 21 days after noncompliance with activity and use limitations.

7.0 REFERENCES

Driscoll, F.G., 1986. Groundwater and Wells. Johnson Division, St. Paul, Minnesota.

EA Engineering, Science, and Technology, Inc., PBC (EA), 2019. Military Munitions Response Program Cleanup Plan for the Former York Naval Ordnance Plant, 1425 Eden Road, Springettsbury Township, York, Pennsylvania, November.

Groundwater Sciences Corporation (GSC), 2012. Field Sampling Plan for Part 2 of the Supplemental Groundwater Remedial Investigation at the former York Naval Ordnance Plant in York, Pennsylvania, April.

GSC, 2018a. Updated Water Use Survey Report, Former York Naval Ordnance Plant, 1425 Eden Road, Springettsbury Township, York, Pennsylvania, March 2018 and Revised September 2018.

GSC, 2018b. Supplemental Remedial Investigation Groundwater Report (Part 2) Former York Naval Ordnance Plant, August 2016 and Revised March 2018.

GSC, 2019a. Site-Wide Cleanup Plan, Former York Naval Ordnance Plant, 1425 Eden Road, Springettsbury Township, York, Pennsylvania, November.

GSC, 2019b. Southern Property Boundary/South Plume Areas Supplemental Remedial Investigation and Interim Groundwater Remediation Report, Former York Naval Ordnance Plant, 1425 Eden Road, York, PA, November 2018 and Revised February 2019.

GSC, 2020. Quality Assurance Project Plan, Former York Naval Ordnance Plant, 1425 Eden Road, York, Pennsylvania, Rev. 2, November.

GSC, 2022. Surface Water Compliance Report, Former York Naval Ordnance Plant, 1425 Eden Road, Springettsbury Township, York, Pennsylvania, January.

GSC, 2023. Groundwater and Surface Water Monitoring Report for 2022, Former York Naval Ordnance Plant, 1425 Eden Road, Springettsbury Township, York, Pennsylvania, July.

Hydro-Terra Group (HTG), 2019. Groundwater Extraction and Treatment System Operations and Maintenance Manual, October.

HTG, 2022. Groundwater Extraction and Treatment System Operations and Maintenance Manual, October 2019, and Revised October 2022.

Newfields, 2018. Revised Groundwater Human Health Risk Assessment, Former York Naval Ordnance Plant, November 2016 and Revised March 2018.

Nutec Design Associates, Inc., 2016. Preliminary/Final Land Development Plan, Eden Road Logistics Center, Springettsbury Township, York County, PA, July.

Science Applications International Corporation (SAIC), 2011a. "Contained-In" Waste Determination for Environmental Media, Former York Naval Ordnance Plant Remedial Actions, June.

SAIC, 2011b. Revised Addendum: "Contained-In" Waste Determination for Remediation Liquids, Former York Naval Ordnance Plant Remedial Actions, September.

SAIC, 2011c. Revised Addendum: "Contained-In" Waste Determination for Remediation Debris, Former York Naval Ordnance Plant Remedial Actions, December.

United States Environmental Protection Agency (USEPA), 2013. Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions, November.

USEPA, 2018. Groundwater Statistics Tool User's Guide, September.

Tables

Figures

Plates

Appendix A

Environmental Covenants for the East and West Campus Properties (to be inserted upon completion)

Appendix B

Construction Details for Caps

Appendix C

Construction Details for West Campus Vapor Barrier and Vapor Intrusion Assessment Report

Appendix D

Documentation for Contained-In Determinations

Appendix E

Construction Logs for Wells