SIXTH FIVE-YEAR REVIEW REPORT FOR
DELAWARE SAND & GRAVEL LANDFILL SUPERFUND SITE
NEW CASTLE COUNTY, DELAWARE

AUGUST 2020

Prepared by

U.S. Environmental Protection Agency
Region 3
Philadelphia, Pennsylvania

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Date

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LIST OF ABBREVIATIONS AND ACRONYMS

1,2-DCA	1,2-Dichloroethane
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
AROD	ROD Amendment
BCEE	Bis(2-chloroethyl)ether
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
COC	Contaminant of Concern
DDA	Drum Disposal Area
DNREC	Delaware Department of Natural Resources and Environmental Control
DS&G	Delaware Sand & Gravel
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FOIA	Freedom of Information Act
FS	Feasibility Study
FYR	Five-Year Review
GMZ	Groundwater Management Zone
IC	Institutional Control
LFG	Landfill Gas
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
µg/kg	Microgram per Kilogram
µg/L	Microgram per Liter
mg/kg	Milligram per Kilogram
ng/L	Nanogram per Liter
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PCB	Polychlorinated Biphenyls
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SBA	Surface Barrier Area
SSDS	Sub-Slab Depressurization System
SVOC	Semi-Volatile Organic Compound
UAO	Unilateral Administrative Order
UPCUTZ	Upper Potomac Confining Unit Transition Zone
UU/UE	Unlimited Use and Unrestricted Exposure
VOC	Volatile Organic Compound

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR Reports such as this one. In addition, FYR Reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the sixth FYR for the Delaware Sand & Gravel Landfill Superfund site (the Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of the operable units (OUs) shown in Table 1. All OUs are addressed in this FYR.

Table 1: Site OUs

OU	Description
1	Grantham South Area
3	Inert Area
4	Drum Disposal Area (DDA) and Ridge Area – slurry wall and excavation of waste
5	DDA and Ridge Area – soil bioremediation system
6	DDA Source and Groundwater
Note: OU2 is not included in this FYR because it was superseded by OUs 4 and 5 when EPA amended the selected remedy in 1993.	

The EPA remedial project manager (RPM) led the FYR. Additional participants from EPA included the EPA community involvement coordinators (CICs), human health and ecological risk assessors, a hydrogeologist and an air quality specialist. The Delaware Department of Natural Resources and Environmental Control (DNREC) project manager also participated in the review. Skeo provided EPA contractor support for this FYR. The potentially responsible party (PRP) group was notified of the initiation of the FYR. The review began on December 10, 2019.

Site Background

The 27-acre Site is two miles south of the city of New Castle, Delaware (Figure 1). The Site is a former sand and gravel quarry, which later operated as a permitted landfill from 1968 to 1976. The landfill includes four waste disposal areas. Landfill operators deposited materials, including hazardous substances, into three unlined gravel pits (Grantham South Area, Inert Area and Drum Disposal Area [DDA]) (see Figure 2). The fourth waste disposal area, known as the Ridge Area, was used for temporary storage of chemical waste. Soil became contaminated with metals, polychlorinated biphenyls (PCBs) and other organic contaminants; groundwater also became contaminated with metals and organic compounds.

The Site is bordered to the north by Norfolk Southern railroad tracks and to the west and north by Army Creek, which discharges into the Delaware River less than one mile east of the Site (Figure 1). In addition to the landfill area, the Site includes areas to the south and west where groundwater has become contaminated due to releases of hazardous substances from the landfill. Another Superfund site, Army Creek Landfill, is located immediately west of the Site, on the opposite side of Army Creek.

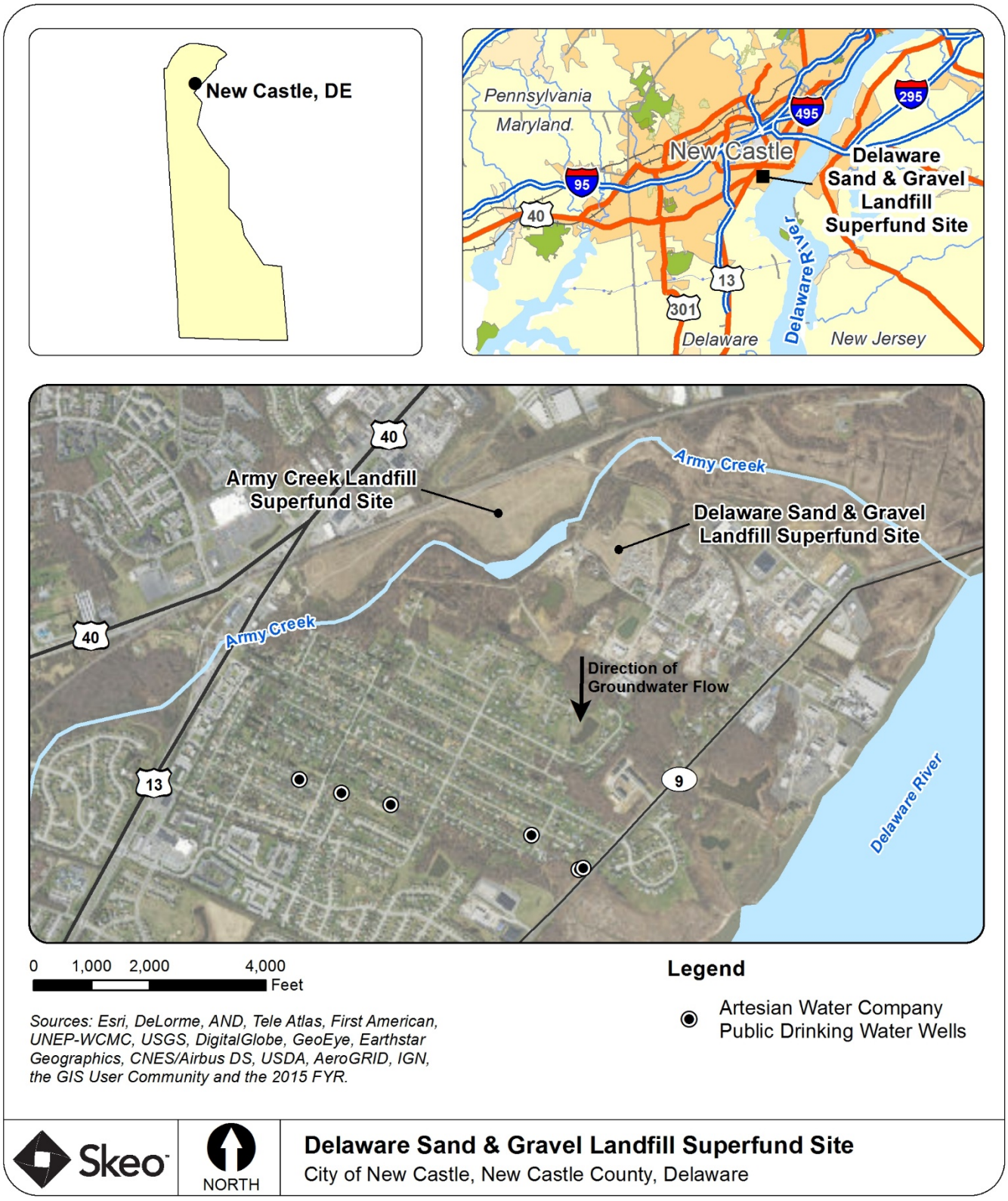
Geologic formations beneath the Site include the Columbia Formation and the Potomac Formation. The Columbia Formation consists of sands with beds of clay and silt. It ranges in thickness from about 10 feet to over 100 feet and is the surficial water table aquifer in the area of the Site. The underlying Potomac Formation is a several hundred-foot-thick sand deposit divided by silty clays and clays into the Upper, Middle and Lower Potomac Aquifers. Site investigations have focused on the Columbia Aquifer and the Upper Potomac Aquifer. These two formations are separated by the Upper Potomac Confining Unit, which is comprised of clay or silty clay. However, areas have been identified where the Upper Potomac Confining Unit has been breached or eroded; in these areas, the Columbia Aquifer is separated from the Upper Potomac Aquifer only by a layer of sandy clay, silt and silty sand referred to in site documents as the Upper Potomac Confining Unit Transition Zone (UPCUTZ). Within the Upper Potomac Aquifer there is an intermittent clay unit, referred to in site documents as the Upper Potomac Dividing Clay, which separates the Upper Potomac Aquifer into two sand units, the upper sand and lower sand. Appendix C, Figure C-1 presents a conceptual cross-section of the Site's geologic layers.

Regionally, the natural groundwater flow direction in the Columbia Aquifer and the Upper Potomac Aquifer is to the east and southeast, toward the Delaware River. In the site area, groundwater in the Upper Potomac Aquifer flows south, toward the Artesian Water Company's Llangollen public drinking water well field (Figure 1). The Artesian Water Company (Artesian) treats groundwater from the Llangollen well field to address site-related contaminants. The state of Delaware has implemented a Groundwater Management Zone (GMZ), which restricts installation of new public or domestic water supply wells to prevent exposure to contaminated groundwater. There are no private wells in the area of the Site.

The former landfill has various current land uses. A 5-acre portion of the 11-acre fenced Inert Area (referred to as the Surface Barrier Area; see Figure 2) is used for storage of impounded vehicles, propane tanks and salvage material. The owner of most of the site property maintains a residence adjacent to the Grantham South Area. Portions of the site property are fenced and unused, including a 3-acre area containing the DDA, where ongoing remediation work currently precludes use of the land, and the steeply sloped 2-acre Grantham South Area.

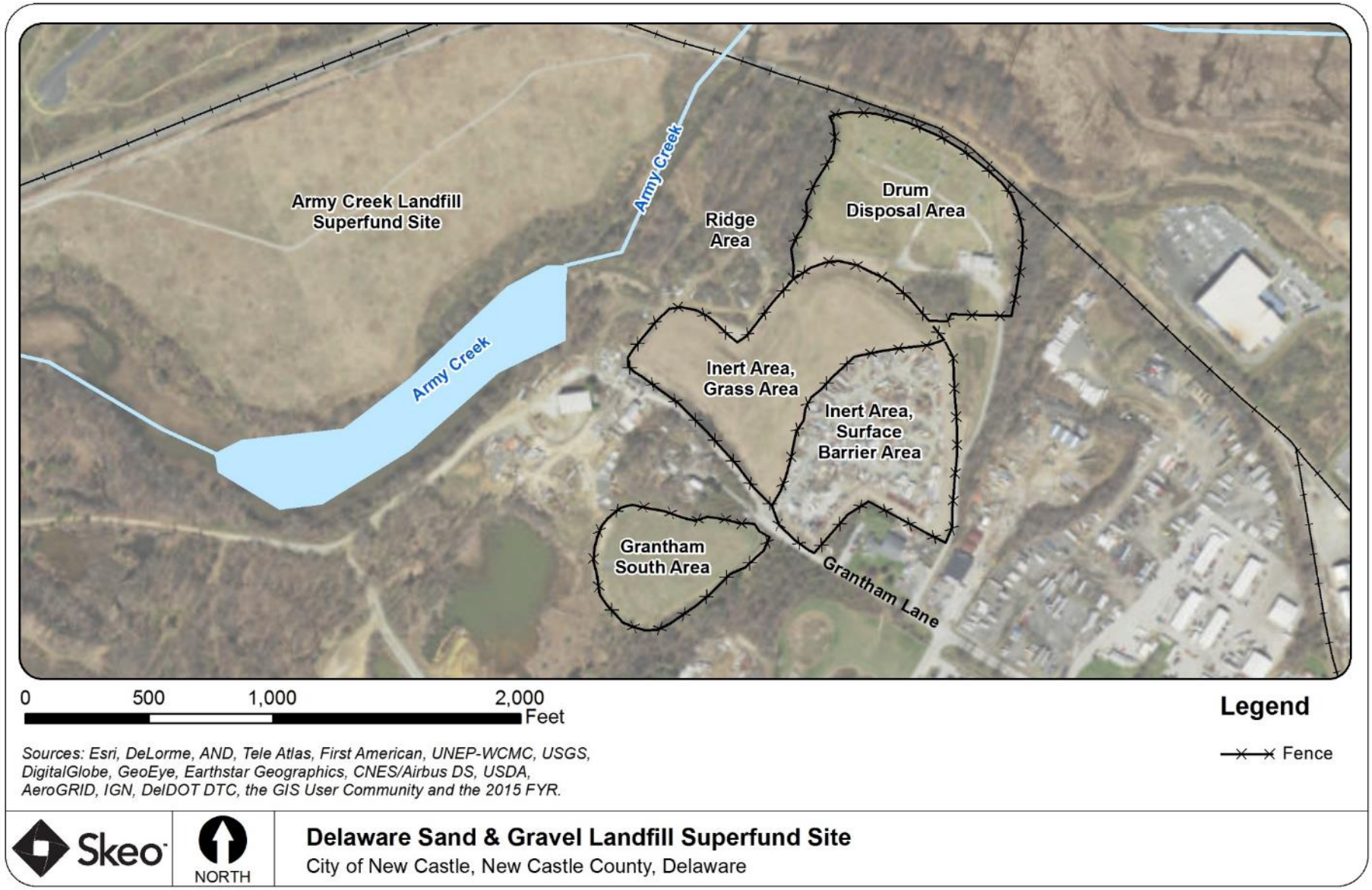
Land uses around the landfill include commercial/light industrial uses to the east, residential areas to the south, wildlife habitat at the Army Creek Landfill Superfund site to the west, and open space to the north. EPA expects that a similar mix of land uses will continue in the future. Refer to Appendix A for additional resources and to Appendix B for the Site's chronology of events.

Figure 1: Site Vicinity Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Figure 2: Detailed Site Map



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FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Delaware Sand & Gravel Landfill		
EPA ID: DED000605972		
Region: 3	**State:** DE	**City/County:** New Castle / New Castle
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the Site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name: Debra Rossi, with additional support provided by Skeo		
Author affiliation: EPA Region 3		
Review period: 12/10/2019 – 8/28/2020		
Date of site inspection: 2/13/2020		
Type of review: Statutory		
Review number: 6		
Triggering action date: 8/28/2015		
Due date *(five years after triggering action date)*: 8/28/2020		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action and Response Actions

Delaware Sand & Gravel Company disposed of about 550,000 cubic yards of industrial and municipal wastes and construction rubble at the Site, including at least 13,000 drums containing liquids and sludge from chemical production, manufacturing and petroleum refining processes. Local officials first detected groundwater degradation due to releases from the Site and from Army Creek Landfill in 1971, when landfill leachate constituents were discovered in a residential well near the landfills.

In 1973, New Castle County installed a series of groundwater recovery wells in the Upper Potomac Aquifer between the landfills and the public water supply wells to intercept and contain the contaminant plume.

In 1975, the state of Delaware initiated enforcement action against the owner and operator of the landfill for violations of the state solid waste permit. The state ordered the landfill's closure in 1976. In 1980, the county replaced some recovery wells with recovery wells closer to the landfills in an effort to increase the rate of contaminant removal while reducing the rate of uncontaminated groundwater withdrawal. In 1980, the state reduced and capped the permitted groundwater withdrawal rate from the Llangollen well field, and Artesian

extended public water supply lines to residences along Grantham Lane and to a residential subdivision south of the Site.

EPA proposed listing the Site on the Superfund program's National Priorities List (NPL) in December 1982 and finalized the NPL listing in September 1983. From March 1984 through May 1984, EPA and DNREC conducted an emergency removal action, removing more than 1,600 drums from the surface of the DDA.

The remedial investigation and feasibility (RI/FS) determined that potential exposure to contaminated groundwater and soil (direct and indirect) was associated with significant human health risks. EPA determined that the contaminants in groundwater and soil would contribute to unacceptable levels of carcinogenic risk for any exposed individuals and would also have the potential to cause adverse noncancer health effects. The contaminants of concern (COCs) for soil and groundwater include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), inorganic compounds and PCBs (soils only). Full lists of soil and groundwater COCs are included in Tables 3 and 4.

Remedy Selection – OU1, OU3, OU4 and OU5
In April 1988, EPA issued a Record of Decision (ROD). EPA issued a ROD Amendment (AROD) in 1993 and an Explanation of Significant Differences (ESD) in 2003.

The 1993 AROD included the following remedial action objectives (RAOs) for the Site:

- Prevent direct contact with contaminated soil.
- Protect groundwater from hazardous substances leaching from contaminated soil.
- Reduce soil contaminant concentrations to levels that would not cause groundwater contaminant concentrations in the Upper Potomac Aquifer to:
    - Present an exposed individual with a cumulative excess lifetime cancer risk above the 1×10^{-6} risk range, or
    - Cause adverse health effects in an exposed individual (i.e., result in a Hazard Index [HI] greater than or equal to 1.0).

Table 2 lists the major components of the remedy selected in the 1988 ROD, as modified by the 1993 AROD and the 2003 ESD. The selected remedy also included continued recovery and treatment of contaminated groundwater, environmental monitoring and institutional controls to prevent installation of drinking water wells sitewide.

Table 2: Major Remedy Components for OU1, OU3, OU4, OU5 (1988 ROD, 1993 AROD and 2003 ESD)

Site Area	Remedy Selection
Grantham South Area (OU1)	• Impermeable, multi-layer landfill cap • Perimeter fencing • Gas venting system • Institutional controls to prevent any future use that could compromise remedy effectiveness
Inert Area (OU3)	• Removal of existing surface debris • Impermeable, multi-layer landfill cap • Perimeter fencing • Institutional controls to prevent any future use that could compromise remedy effectiveness

Site Area	Remedy Selection
Ridge Area/DDA – Slurry Wall and Excavation of Waste (OU4)	DDA • Installation of slurry wall around the DDA and contaminated soils at the base of the Columbia Aquifer • Dewatering interior of the slurry wall with on-site or off-site treatment and disposal of extracted water • Excavation, treatment and/or disposal of drummed materials and highly contaminated soils • Construction of multi-layer landfill cap above soils within the slurry wall after completion of bioventing (OU5) • Perimeter fencing • Institutional controls to prevent any future use that could compromise remedy effectiveness Ridge Area • Removal of surface debris • Excavation of shallow soil with contaminant concentrations exceeding Ridge Area soil cleanup standards (see Table 3 below) • Transfer of excavated soil to the DDA for treatment by bioremediation (bioventing) (OU5) • Regrading and placement of a soil cover on the Ridge Area
Ridge Area/DDA – Construction of Bioremediation System (OU5)	• Construction of a soil vapor extraction/bioventing system within the excavation area created by drum removal in the DDA (depth of about 15 feet) • Implementation of in situ vertical soil vapor extraction and bioremediation system to treat contaminated soils below the drum excavation (deeper than 15 feet) and in the saturated zone within the boundaries of the slurry wall

The 1993 AROD specified soil cleanup goals for the DDA and the Ridge Area (Table 3).

Table 3: Soil Cleanup Goals, DDA and Ridge Area

Soil COC	Cleanup Goal (µg/kg)	
	DDA[1]	Ridge Area[2,3]
Acetone	5,000	NA
Benzene	831	NA
Bis(2-chloroethyl)ether (BCEE)	5	0.77
Bis(2-chloroisopropyl)ether	576	93
Chlorobenzene	5,000	NA
1,2-Dichloroethane	250	NA
Ethylbenzene	45,660	NA
Methylene chloride	1,000	812
2-Methylphenol	485	NA
4-Methylphenol	1,213	NA
Naphthalene	560	NA
PCB-1248	10,930	NA
PCB-1254	52,170	NA
Phenols	5,000	NA
Styrene	1,000	NA
Tetrachloroethylene	1,000	NA
Trichloroethylene	1,000	NA
Toluene	5,000	NA
Xylenes, total	5,000	NA

Soil COC	Cleanup Goal (µg/kg)	
	DDA[1]	Ridge Area[2,3]

Notes:
Source: Tables 2 and 3 of the 1993 AROD
µg/kg = micrograms per kilogram

1. Soil cleanup goals based on state and federal standards, developed to ensure that releases from the remediated soil to groundwater would not result in unacceptable risks for individuals exposed to the groundwater.
2. Calculated based on the protection of groundwater.
3. Soil cleanup standards for the DDA assumed the existence of the slurry wall and the multi-layer cap, whereas site-specific cleanup standards for the Ridge Area did not include the engineering controls; therefore, the soil cleanup standards applicable for the Ridge Area are more stringent than those calculated for the DDA.

NA = not applicable (no cleanup goal selected for this COC at this area)

Remedy Selection – OU6
The selected remedies described in Table 2 for groundwater and for soil in the DDA did not perform as expected because of gaps in the conceptual site model, specifically: 1) unrecognized holes and transmissive zones in the clay layer underlying the DDA, which prevented dewatering and adequate containment of contaminated media within the slurry wall at the DDA, and 2) previously unidentified contamination in the UPCUTZ, which represents a long-term secondary source of contamination to the groundwater in the Upper Potomac Aquifer.

The PRPs, referred to as the Delaware Sand & Gravel (DS&G) Remedial Trust, conducted additional site characterization work and found that site contaminants were present in both the saturated and unsaturated soils within the slurry wall containment area and in the UPCUTZ. In addition, a groundwater contaminant plume extends from the DDA through the Upper Potomac Aquifer to the Llangollen well field, about 1 mile downgradient. The primary COCs are bis(2-chloroethyl)ether (BCEE) and 1,4-dioxane, but metals and manganese are also present. Concentrations of certain contaminants in soil and/or groundwater suggest the potential presence of residual nonaqueous phase liquid in the Columbia Aquifer at the DDA and in the UPCUTZ in the immediate vicinity of the DDA.

In 2017, EPA issued a second AROD to address contaminated groundwater in the Upper Potomac Aquifer, contaminated soil and groundwater within the slurry wall surrounding the former DDA and potential vapor intrusion at any new construction that may occur adjacent to the Inert Area and Grantham South Area. The 2017 AROD for soil and groundwater in the DDA is generally applicable to the OU6 remedy, although the OU is not specified.

The 2017 AROD included the following RAOs:

- Prevent direct contact with contaminated soil enclosed within the slurry wall at the DDA.
- Prevent migration of contaminants from the DDA that would cause contaminant concentrations in the groundwater of the Columbia Aquifer outside the DDA or the Upper Potomac Aquifer within the Area of Attainment (Figure C-2 in Appendix C) to exceed MCLs, nonzero maximum contaminant level goals (MCLGs) or acceptable risk- and health-based concentrations.
- Prevent direct contact with groundwater containing contaminants from the Site at levels that exceed MCLs, non-zero MCLGs or acceptable risk- and health-based concentrations (see Table 4 for preliminary remediation goals [PRGs]).
- Restore groundwater within the Area of Attainment (throughout the contaminant plume, at and beyond the boundary of the Waste Management Area)[1] to its beneficial use in a reasonable time frame.

[1] The Waste Management Area includes the four site areas (Grantham South, Inert Area, DDA and Ridge Area) as well as the small parcels that connect them.

- Prevent contaminant migration from subsurface vapor intrusion into indoor air that would result in unacceptable levels of risk.

The 2017 AROD includes both modified components and new remedy components as follows:

Modified Components

- Hydraulic control of contaminated groundwater within the DDA's slurry-wall enclosure using an enhanced low-flow groundwater extraction system (LFExS).
- Installation and operation of extraction wells in areas determined to optimize capture and removal of contaminant mass from the more highly impacted areas of the Upper Potomac Aquifer, including the UPCUTZ.
- Discharge of groundwater pumped from the DS&G extraction wells to the Wilmington Wastewater Treatment Plant.

New Components

- Pre-design investigations to develop supplemental information regarding source and extent of contamination in the Upper Potomac Aquifer and hydraulic connections between hydrostratigraphic units within the Upper Potomac Aquifer, and confirm target capture zones within the Upper Potomac Aquifer.
- Continued groundwater extraction at Llangollen well field with treatment utilizing existing systems for BCEE and 1,4-dioxane and, if necessary, additional treatment systems targeting other COCs such as manganese.
- A groundwater monitoring program to ensure that the remedial action is meeting the short-term goal of plume containment and will meet the long-term goal of aquifer restoration within a reasonable time frame.
- Institutional controls to prevent potential future exposure to site contaminants in indoor air.

Table 4: Preliminary Remediation Goals (PRGs) for the Upper Potomac Aquifer

COC	PRG (µg/L)	Basis[a]
1,2,4-Trimethylbenzene	5.7	Non-carcinogenic
1,3,5-Trimethylbenzene	6.1	Non-carcinogenic
1,4-Dioxane	4.6	Carcinogenic
Arsenic	0.52	Carcinogenic
Benzene	4.6	Carcinogenic
Bis(2-chloroethyl)ether (BCEE)	0.14	Carcinogenic
Cobalt	6.0	Non-carcinogenic
Ethylbenzene	15	Carcinogenic
Iron	13,939	Non-carcinogenic
Manganese	260	Non-carcinogenic
N,N-Dimethylaniline	25	Carcinogenic
Naphthalene[b]	0.63	Non-carcinogenic
Total xylenes[b]	21	Non-carcinogenic

Notes:
µg/L = micrograms per liter
a. PRGs were selected using the following criteria: The lower values of the non-carcinogenic PRG (COC-specific HQ) and the carcinogenic PRG (Target Risk of 1.0×10^{-5}) or the MCL, such that the cumulative risk from COCs at the PRG does not exceed a risk of 1.0×10^{-4} or target organ specific HI of 1.0.
b.. Based on inhalation exposure pathway

Status of Implementation

Grantham South Area (OU1)

In June 1989, EPA completed a remedial design for the Grantham South Area landfill cap. EPA's contractor began on-site work in July 1990. Following clearing and grubbing, the waste disposal area was capped with not less than 24 inches of fill, followed successively by a 40-millimeter very-low-density polyethylene membrane, drainage net, geotextile and 24 inches of cover soil. A perimeter security fence, two gas vents and four gas monitoring wells were also installed. The work was completed when EPA, the U.S. Army Corps of Engineers and the state conducted the final inspection in September 1991.

Inert Area (OU3)
In June 1992, EPA entered into an Administrative Order on Consent (AOC) for Removal Action with 22 site PRPs, who agreed to design a RCRA Subtitle C cap for the Inert Area. EPA approved the PRPs' remedial design in July 1993. The United States and the state of Delaware entered into a Consent Decree with 31 PRPs (Settling Defendants) in June 1995. The Settling Defendants formed, and are represented by, the DS&G Remedial Trust. The DS&G Remedial Trust implemented the remedial action for the Inert Area in accordance with the Consent Decree and the 1988 ROD and 1993 AROD. In August 1996, EPA approved an addendum to the cap design that provided for a 6-acre gravel covered Surface Barrier Area (SBA) to accommodate the property owner's reuse of the land. The rest of the Inert Area is referred to as the Grass Area. The DS&G Remedial Trust's contractor mobilized to begin construction of the cap in September 1996. Activities included removal and off-site disposal of existing debris, installation of a multi-layer cap and venting system and installation of perimeter fencing. EPA accepted the Remedial Action Report for the Inert Area in September 1997.

DDA and Ridge Area (OU4 and OU5)
In 1994, the DS&G Remedial Trust installed a slurry wall around the DDA and surrounding contaminated soils in the Columbia Aquifer. The slurry-wall system consists of a 3-foot thick, soil-bentonite slurry wall keyed into the underlying Upper Potomac Confining Unit, where present, and ranges in depth from 17 to 57 feet below ground surface. The area within the slurry-wall system is divided by a partition wall, which isolates the portion of the DDA with contaminated soils (containment area) from the area where the clay is thin, discontinuous or not present (partition area). In February 1995, EPA accepted the PRPs' certification of completion of slurry wall construction.

From 1995 to 1997, the DS&G Remedial Trust completed remedial action and construction activities at the DDA and the Ridge Area. Approximately 5,000 tons of PCB-contaminated soil, drum carcasses, contaminated solids, asbestos-containing materials and hazardous liquids were excavated or removed and transported to permitted facilities for disposal. The remainder of the soil excavated from the Ridge Area and the DDA was combined with woodchips, sand and diammonium phosphate to encourage bioremediation of the soil contaminants and placed in a biocell within the slurry wall surrounding the DDA. A dewatering system and a bioventing system were installed to enable circulation of oxygen-enriched air throughout the contaminated soil within the slurry wall, and a temporary cap was constructed over the bioremediation area. A perimeter fence was also installed. EPA issued a Preliminary Close Out Report documenting the completion of construction activities for all cleanup actions at the Site in August 1997.

The DS&G Remedial Trust began operating the dewatering and bioventing systems at the bioremediation area in 1997. In 1998, the DS&G Remedial Trust's consultant noted that upward seepage from the Upper Potomac Aquifer into the Columbia Aquifer due to artesian pressure would likely preclude the complete dewatering of the soil at the bioremediation area.

In 1999, BCEE, a site-related COC, was detected in groundwater at the Llangollen well field. In 2000, Delaware's Department of Health and Social Services proposed an interim health advisory level for BCEE (0.096 micrograms per liter [µg/L]), and Artesian installed a granular activated carbon system to remove BCEE from groundwater pumped from the Llangollen well field prior to its distribution to customers.

In May 2004, the DS&G Remedial Trust suspended the dewatering of the bioremediation area for a six-month slurry wall flood test and discovered that soil contamination remained at the bioremediation area that was continuing to impact shallow groundwater. In June 2004, the county conducted a pilot study and suspended

operation of the Army Creek Landfill groundwater treatment system to focus on recovery of BCEE downgradient of the DDA. The county shut down the Army Creek Landfill groundwater recovery wells in October 2004 and began pumping groundwater from extraction well PW-1 to capture releases from the DDA and discharging the groundwater to the city of Wilmington's wastewater treatment plant. Based on observations during the slurry wall flood test and the pilot study, EPA concluded that the remedial action at the DDA was not performing as intended. EPA's third FYR Report for the Site, issued in 2005, recommended that the DS&G Remedial Trust reassess the response actions at the DDA.

In 2008, EPA requested that the DS&G Remedial Trust implement additional response actions at the DDA to provide hydraulic containment of the DDA source area. In May 2009, the DS&G Remedial Trust terminated bioventing operations at the bioremediation area and began operating a low-flow groundwater extraction system (LFExS) within the slurry wall to mitigate the release of contaminants from the DDA into the Upper Potomac Aquifer. Groundwater from the system is discharged directly to the city of Wilmington's wastewater treatment plant. Vertical head differences observed between the Columbia Aquifer and the Upper Potomac Aquifer in the vicinity of the DDA indicate that the LFExS has generally induced an upward gradient across the most impacted portions of the slurry-wall containment area since October 2012 and, as such, has mitigated the release of contaminated groundwater from the DDA into the Upper Potomac Aquifer.

DDA Soil and Groundwater (OU6)
In May 2018, EPA and PRPs signed an AOC for Remedial Design, under which the PRPs submitted work plans for a Preliminary Design Investigation and remedial design. The Preliminary Design Investigation is currently underway. Forty-nine monitoring wells and five extraction wells were installed during the Preliminary Design Investigation. Some of the monitoring wells were installed to evaluate potential releases from the Grantham South Area, the Inert Area and the Army Creek Landfill site. The extraction wells were used for aquifer testing during the Preliminary Design Investigation and are not yet operational for groundwater recovery as part of the updated remedy.

In October 2013 and April 2015, EPA obtained groundwater samples from selected site monitoring wells and analyzed the samples for perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS) and other per- and polyfluoroalkyl substances (PFAS). PFOA was detected at concentrations exceeding EPA's 70 parts per trillion health advisory level. Groundwater is being monitored for PFAS as part of the Preliminary Design Investigation. Aquifer testing was completed and used to update the groundwater flow model to support the remedial design.

Vapor Intrusion
In 2006, the DS&G Remedial Trust conducted a vapor intrusion investigation at buildings in the immediate vicinity of the Site and concluded that VOCs in soil gas did not present an unacceptable risk to residents or workers in the buildings near the Site. In April and June 2013, the DS&G Remedial Trust collected indoor and outdoor ambient air samples at the office building adjacent to the Inert Area after low levels of methane were detected in the building's basement during a quarterly monitoring event. Several VOCs were detected at concentrations above EPA's industrial screening levels in one or both of the indoor air samples that were collected from the basement of the office building. Based on the results and the persistent detection of methane near the building, it was evident that landfill gas migration was occurring.

In November 2014, the DS&G Remedial Trust installed and began operating a sub-slab depressurization system (SSDS) in the office building and the adjoining automotive repair shop to mitigate the potential for migration of vapors, including methane, into the building. The SSDS is being operated in accordance with an Addendum to the 2012 Revised O&M Plan for the Grantham South and Inert Areas per the 1995 Consent Decree. Operation of the SSDS is being performed as an additional response action under the 1995 Consent Decree.

Landfill Gas Mitigation System
Migration of landfill gas beyond the perimeter of the Inert Area and the Grantham South Area has been documented in quarterly O&M reports. From July to September 2017, the DS&G Remedial Trust installed a

landfill gas (LFG) mitigation system along the perimeter of those sections of the Inert Area and the Grantham South Area that are adjacent to existing habitable structures, to prevent the migration of landfill gas toward potential receptors. The system construction, initially permitted with a candlestick flare, was completed and commenced operation in September 2017. As the result of low methane content, the flare was demobilized in August 2018, and replaced with a direct-venting system in December 2018, under a DNREC operating permit.

Institutional Control (IC) Review

Table 5 summarizes the Site's institutional controls as required by the 2003 ESD and the 2017 AROD.

In accordance with the 2003 ESD, which required land and groundwater use restrictions, EPA issued Unilateral Administrative Orders (UAOs) to the three site property owners in 2004, 2006 and 2008. The UAOs required respondents to provide site access and implement institutional controls to establish land and groundwater use restrictions. Respondents to the 2006 and 2008 UAOs complied with the terms of their respective UAOs. EPA continued working to secure full compliance from the owner of most of the site property per the 2004 UAO. The United States, on behalf of EPA, filed a complaint in September 2017 seeking to enforce the 2004 UAO. The United States' claims were resolved through a Consent Decree entered on August 13, 2019, wherein the property owner agreed to implement certain operation and maintenance measures at the SBA and record a notice of institutional controls, among other things. The notice was recorded in February 2020 in compliance with the 2019 Consent Decree. Figure 3 shows the areas of the Site subject to recorded notices of institutional controls.

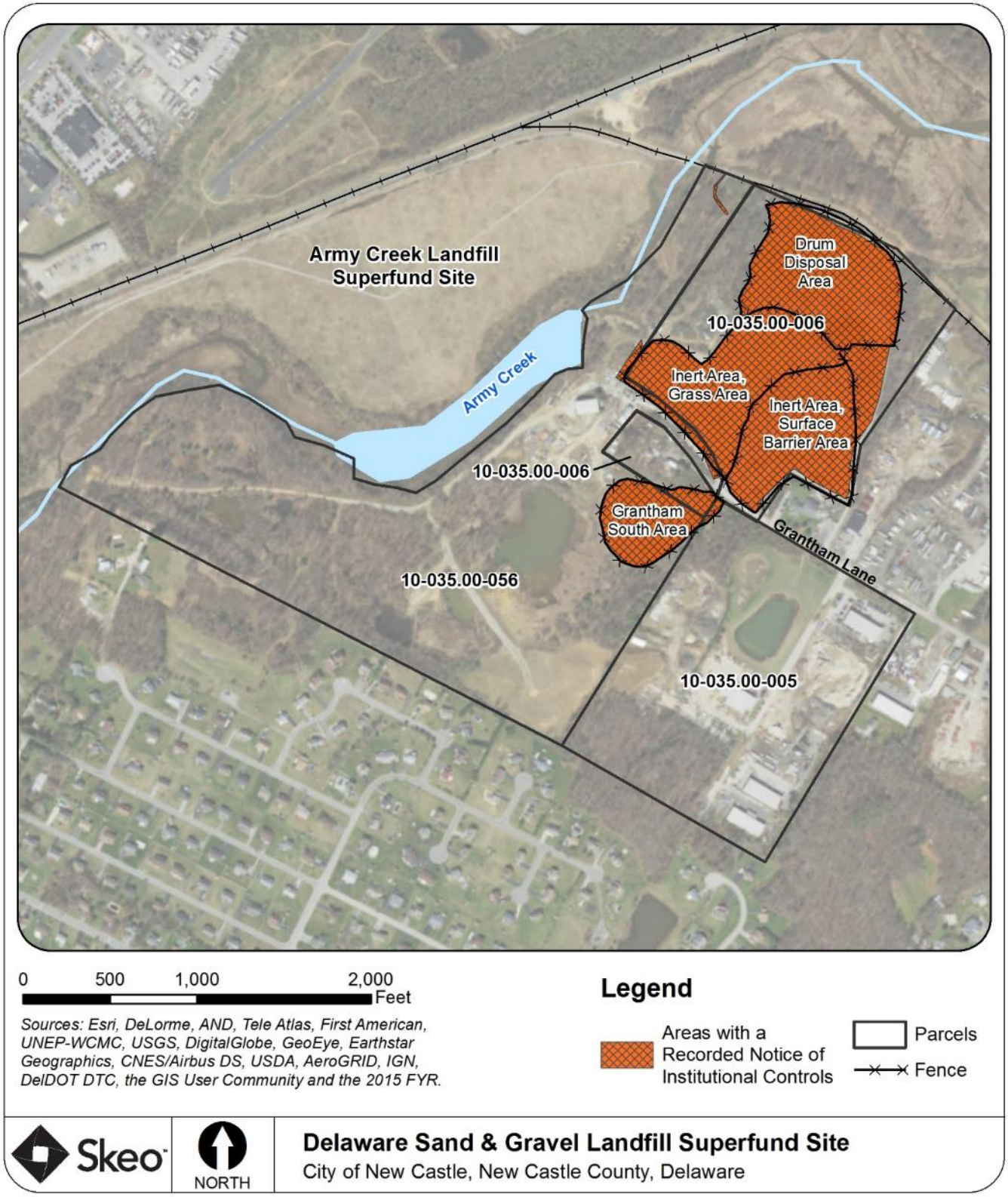
In 2006, DNREC established a GMZ for the Site and the adjacent Army Creek Landfill site that restricts installation of new public or domestic water supply wells and non-potable wells (see Figure 4). DNREC determined that two GMZ Areas were appropriate to manage releases from source areas and prevent potential exposure of the public to contaminated groundwater. No new water supply wells are allowed in Area A of the GMZ. Within Area B, new water supply wells may be permitted, following joint review by DNREC's Division of Waste and Hazardous Substances (DWHS) and Division of Water (DW), if wells will be constructed in a manner that is expected to prevent the movement of contaminants into the well and groundwater, if contaminated, will be treated to applicable standards. Monitoring, observation and contaminant recovery wells may be installed in Area A and B following joint review and approval by DWHS and DW.

The 2017 AROD called for the delineation of areas outside the influence of the LFG mitigation system and adjacent to the Inert Area and the Grantham South Area potentially impacted by subsurface migration of landfill gas. Delineation of these areas was required to ensure that institutional controls would be implemented, where necessary, to prevent potential future exposure to contaminants in landfill gas at any new habitable buildings constructed in these areas. During the Preliminary Design Investigation, barhole probes were advanced beyond the boundaries of the Inert Area and Grantham South Area and screened for landfill gases. The results of the screening, performed in November 2018 and March 2019, showed no evidence of landfill gas migration beyond the boundaries of the Inert Area and Grantham South Area in areas located outside the influence of the LFG mitigation system. Based on this finding, EPA determined that institutional controls to prevent potential exposure to landfill gas constituents in indoor air are not needed at this time. Upon attainment of the LFG mitigation system performance standards, EPA will determine if an additional barhole probe assessment should be conducted to evaluate potential landfill gas migration beyond the boundaries of the Inert Area and the Grantham South Area following shutdown of the LFG mitigation system.

Table 5: Summary of Institutional Controls (ICs)

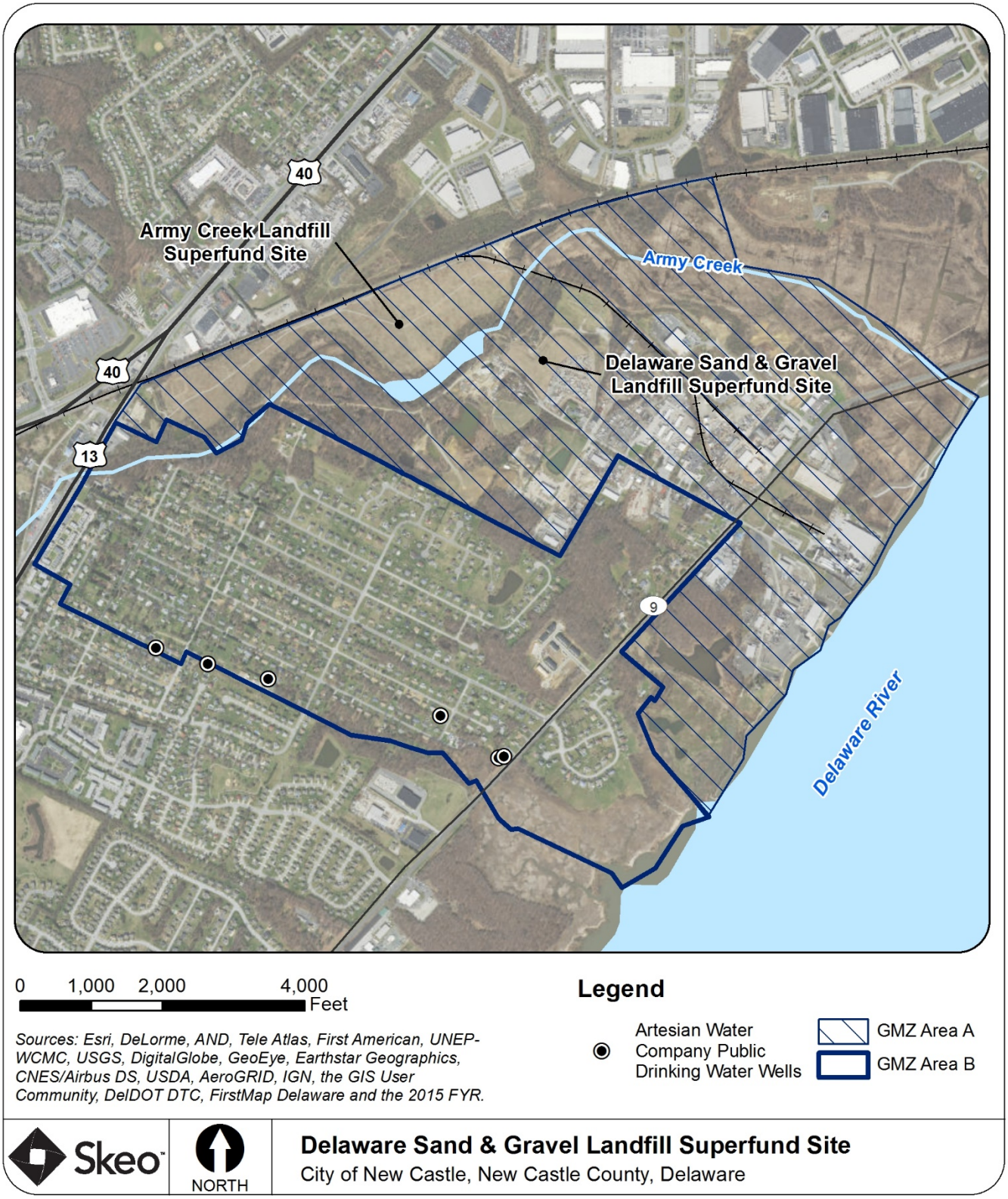
Media, Engineered Controls, and Areas That Do Not Support UU/UE Based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	IC Objective	Impacted Parcels	Title of IC Instrument Implemented and Date
Soil	Yes	Yes	Prevent any use that could compromise the remedy	10-035.00-006	2020 Notice of Institutional Controls
				10-035.00-056	2008 Notice of Institutional Controls
				10-035.00-005	2006 Notice of Institutional Controls
Groundwater	Yes	Yes	Restrict installation of new public or domestic water supply wells and non-potable wells	10-035.00-006	2020 Notice of Institutional Controls
				10-035.00-056	2008 Notice of Institutional Controls
				10-035.00-005	2006 Notice of Institutional Controls
				Areas impacted by contaminated groundwater	Groundwater Management Zone (Areas A and B)
Indoor Air	No	Yes	Prevent exposure to site-related vapor intrusion	None at this time	To Be Determined. Based on sampling in 2018 and 2019, EPA determined that ICs to prevent potential exposure to landfill gas constituents in indoor air are not needed at this time.

Figure 3: Institutional Control Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Figure 4: Groundwater Management Zone



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Systems Operations/Operation and Maintenance (O&M)

In 2012 and 2016, the DS&G Remedial Trust revised the O&M plan for the Inert Area and Grantham South Area. The revisions incorporated new objectives and procedures for landfill gas monitoring, established action levels and response actions for methane in indoor air, and incorporated recommendations for the SSDS. Groundwater monitoring was conducted in accordance with the October 2011 Feasibility Study Work Plan, Revision 2 through 2018. In 2019 and 2020, groundwater monitoring was conducted in accordance with the March 2019 Pre-Design Investigation Work Plan, Revision 2, and modifications approved by EPA for the April 2020 monitoring event. The DS&G Remedial Trust is conducting the following long-term O&M activities at the Site:

Grantham South Area
O&M activities include:

- Quarterly monitoring of combustible gases and oxygen at gas vents and gas monitoring wells using a combustible gas indicator; monitoring of combustible gases and oxygen levels in the indoor air of nearby buildings, if warranted.
- Quarterly inspection of the cover system, surface water control features and perimeter fence, as well as implementation of corrective measures, as necessary.
- Annual grass cutting.

Quarterly and annual O&M reports indicate routine maintenance including fence repair, minor burrows and erosion repair are occurring as necessary. Animal burrows were noted during this FYR's site inspection. During this FYR period, the elevation of the pond adjacent to the Grantham South Area was measured and photographed at least monthly to track the level of surface water. As noted in the quarterly inspections and during the FYR site inspection, the pond level has been increasing and has reached the fence surrounding the Grantham South Area.

Inert Area
O&M activities include:

- Quarterly monitoring of combustible gases and oxygen at gas vents and gas monitoring wells using a combustible gas indicator; monitoring of combustible gases and oxygen levels in the indoor air of nearby buildings, if warranted.
- Surveying of settlement markers (once every five years).
- Quarterly inspection of the cover system, including the SBA, surface water control features, gas venting system, settlement monuments, access roads and perimeter fence, as well as implementation of corrective measures, as necessary.
- Annual grass cutting.
- Cap settlement monitoring every five years.

During this FYR period, monitoring activities were conducted as required on the Inert Area (Grass Area) and the SBA. Minor issues were noted on the Grass Area and are addressed annually. During the FYR site inspection, vegetation was noted on the fence and a hole in the fence was also observed where a gate was ripped out. Cap settlement monitoring was conducted in 2015 and the next monitoring event is scheduled for fall 2020. Results from 2015 were generally consistent with historical results and no concerns with settlement were noted.

The 2017 inspection of the SBA noted the following conditions:

- Truck appears to be leaking fluid (oil/gas).
- Oil spots staining observed near automobiles.
- New buildings-small sheds placed on SBA.
- Unmarked 55-gallon drums.
- Woody plants throughout.

The 2017 inspection and 2020 FYR inspection also noted rutting on the SBA from runoff in and around vehicles and along roadways. EPA continues to inform the owner of the SBA of his responsibilities for maintenance under the 2019 Consent Decree.

LFG Mitigation System
O&M activities include:

- Operation and monitoring of the LFG mitigation system and equipment, including responding to alarm conditions, system adjustments and condensate management.
- Inspection and maintenance of components of the LFG mitigation system installed on the Site and areas located on the adjacent properties, including well heads, condensate sumps, vaults, piping, access roads and security fence.

As documented in the quarterly reports, O&M of the LFG system is occurring as appropriate, and no significant issues have been noted in recent years.

SSDS
O&M activities include:

- Annual inspection of electrical connections, piping, suction point sealant, exhaust fan operation and building construction changes that could affect system performance.
- Collection of indoor air samples at the office building and the adjoining automotive repair shop for VOC analysis every five years.

Ridge Area
O&M activities include:

- Quarterly visual inspection of vegetation and evidence of disturbance.

No issues were noted during the quarterly inspections or FYR inspection of the Ridge Area.

DDA - LFExS
The DS&G Remedial Trust conducts O&M activities as needed and reports on a quarterly basis. O&M activities include cleaning and servicing pumps and piping. The LFExS discharges directly to the New Castle County sewer system. The DS&G Remedial Trust has implemented many measures to maintain consistent operation and improve the reliability of the system. The monthly and semi-annual extraction rates are shown in Figure H-1 in Appendix H. The combined and individual mass removal rates for the LFExS are shown in Figures H-2 and H-3 in Appendix H.

PW-1
On October 15, 2012, the Trust assumed hands-on responsibility for the operation and maintenance of extraction well PW-1 from New Castle County. The well PW-1 system discharges directly to the New Castle County sanitary sewer system. The New Castle County sewer discharge permit was modified to include the discharge from both the LFExS and pumping well PW-1 with the total combined flow now permitted at 51 gpm. On October 3, 2013, the Trust began addition of Redux 620 to reduce iron fouling in the well. Since beginning Redux 620 addition to well PW-1, maintenance requirements for this well have decreased significantly due to the decreased iron fouling, and more consistent extraction rates have been maintained. The Trust collects quarterly samples and maintenance is conducted annually. O&M activities associated with PW-1 are shown in Figure H-4 in Appendix H. The mass removal rates are shown in Figure H-5 in Appendix H.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the previous FYR as well as the recommendations from the previous FYR and the status of those recommendations.

Table 6: Protectiveness Determinations/Statements from the 2015 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Short-term Protective	The remedy at the Grantham South Area (OU1) currently protects human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled through a landfill cap and a perimeter fence. Institutional controls are in place to restrict the current and future use of 1.85 acres of the Grantham South Area. For the remedy to be protective over the long term, the Respondent to the 2004 UAO must record a notice of institutional controls in the land records of New Castle County to restrict future use of 0.15 acres of the Grantham South Area. In addition, corrective measures may be needed if encroachment of surface water onto the Grantham South Area continues or has the potential to interfere with the remedial action. Furthermore, institutional controls addressing potential vapor intrusion for new construction need to be developed and implemented for those areas near the landfill boundary where landfill gas may be migrating.
3	Short-term Protective	The remedy at the Inert Area (OU3) currently protects human health and the environment. Exposure pathways which could result in unacceptable risks at the Inert Area are being controlled through a landfill cap and a perimeter fence. For the remedy to be protective over the long term, the Respondent to the 2004 UAO must record a notice of institutional controls in the land records of New Castle County. The Respondent must also comply with provisions in the 2004 UAO to ensure safe use of the Surface Barrier Area. In addition, the vapor intrusion mitigation system installed at a nearby office building must be operated and maintained and institutional controls addressing potential vapor intrusion for new construction need to be developed and implemented for those areas near the landfill boundary where landfill gas may be migrating.
4/5	Short-term Protective	The remedy at the Ridge Area (part of OUs 4 and 5) is protective of human health and the environment. Soil with contaminant concentrations exceeding the cleanup standards was excavated and placed at the DDA. Unacceptable exposure pathways have been eliminated at the Ridge Area. The remedy at the DDA (part of OUs 4 and 5) currently protects human health and the environment. The potential for direct contact with contaminated soil is being controlled by containment and security measures. For the remedy to be protective over the long term, additional response actions are needed at the DDA due to the failure of the constructed remedy to meet performance standards for groundwater protection. In addition, the property owner must record a notice of institutional controls to restrict future use of the DDA in accordance with the 2004 UAO. The Site's groundwater response currently protects human health and the environment because there is no exposure to contaminated groundwater. For the remedy to be protective over the long term, remedial action is necessary to address contaminated groundwater. A feasibility study is being performed to develop a comprehensive remediation strategy to address groundwater contamination and the DDA source area.

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-term Protective	The remedy at the Site currently protects human health and the environment for the following reasons: caps and fencing prevent exposure to contaminated soil; the State of Delaware has implemented a Groundwater Management Zone which places restrictions on the installation of new public or domestic water supply wells to prevent exposure to contaminated groundwater; and treatment is provided by Artesian Water Company to address site-related contaminants in the groundwater at the Llangollen well field. For the remedy to be protective over the long term, additional response actions are needed at the DDA due to the failure of the constructed remedy to meet performance standards for groundwater protection. Additional response actions are also needed to address contaminated groundwater in the Upper Potomac Aquifer and vapor intrusion affecting existing buildings. The PRPs are currently conducting a feasibility study to develop a comprehensive remediation strategy to address these areas of concern. To further ensure the long-term protectiveness of the remedy, the Respondent to EPA's 2004 UAO must record a notice of institutional controls in the land records of New Castle County to document restrictions on future use of the site property, including the DDA, the Inert Area and 0.15 acres of the Grantham South Area. The Respondent must also comply with provisions in the 2004 UAO for safe use of the Surface Barrier Area. Corrective measures may be needed if encroachment of surface water onto the Grantham South Area continues or has the potential to compromise the effectiveness of the remedial action. In addition, institutional controls addressing potential vapor intrusion for new construction need to be developed and implemented for those areas near the landfill boundaries where landfill gas may be migrating.

Table 7: Status of Recommendations from the 2015 FYR

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date
4, 5	The remedies selected for groundwater and for soil in the DDA did not perform as expected.	Complete the feasibility study currently underway and issue a ROD for groundwater and the DDA source area.	Completed	EPA issued an AROD in 2017 to address contaminated groundwater in the UPCUTZ and groundwater pumped from the Artesian Llangollen wellfield, contaminated soil and groundwater within the slurry wall, and potential vapor intrusion at new construction adjacent to the Inert Area and Grantham South Area. The amended remedy is currently in the remedial design phase for OU6.	12/12/2017
1, 3, 4, 5	The Respondent to the 2004 UAO has not complied with the provisions of the UAO requiring the owner to record a Notice of Institutional Controls, Access and Obligations Regarding Successors-in-Title in the land records of New Castle County.	Continue attempts to secure compliance with the 2004 UAO. Evaluate enforcement options.	Completed	In 2017, the United States filed a complaint seeking to enforce the 2004 UAO issued to Respondent. The complaint was resolved through entry of a Consent Decree in 2019 under which the site property owner agreed to comply with various land use restrictions and access and reporting requirements, and to record a notice of obligations to successors-in-interest in the land records. The property owner recorded a Notice of Institutional Controls with New Castle County in February 2020.	2/12/2020

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date
3	The Respondent to the 2004 UAO has not complied with the provisions of the UAO requiring the owner to ensure safe use of the Surface Barrier Area at the Inert Area.	Continue attempts to secure compliance with 2004 UAO. Evaluate enforcement options.	Ongoing	EPA conducted an inspection of the SBA. Ongoing issues were noted in the 2017 SBA inspection as well as the 2020 FYR site inspection. EPA is evaluating enforcement options.	Not applicable
1	Surface water that accumulates adjacent to the Grantham South Area has the potential to encroach on the landfill cap.	Continue to document this issue in the Quarterly Operating, Maintenance and Monitoring Reports. Photo-documentation of the extent of the ponded area should be included in the reports. Propose corrective measures if encroachment of surface water on the Grantham South Area continues or has the potential to interfere with the remedial action.	Ongoing	Encroachment of surface water on the toe of the Grantham South Area continues to be monitored as documented in the Quarterly O&M Reports; no corrective measures have been undertaken or recommended. During this FYR site inspection, surface water was several feet deep at one section of the south toe fence.	Not applicable
1, 3	Groundwater monitoring data suggests that releases from the Inert Area and the Grantham South Area may be impacting groundwater quality in the Columbia Aquifer and the Upper Potomac Aquifer.	Additional investigations are needed to evaluate potential releases of contaminants of concern from the Inert Area and the Grantham South Area.	Completed	Groundwater monitoring data indicate there is a potential that one or both of these landfills may contribute contaminant mass to the Columbia Aquifer and/or the UPCUTZ and Upper Potomac Aquifer upper sand. The groundwater remedy as modified by the 2017 AROD includes the ongoing Preliminary Design Investigation, which will develop supplemental information regarding source and extent of contamination in the Upper Potomac Aquifer.	12/12/2017

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date
1, 3	Institutional controls are required to prevent potential exposure to landfill gas constituents in any new buildings constructed beyond the perimeters of the Inert Area and Grantham South Area where landfill gas may be migrating.	The selected remedy should be modified to include institutional controls for new construction for those areas near the Inert Area and Grantham South Area where landfill gas may be migrating.	Completed	The selected remedy in the 2017 AROD requires institutional controls to prevent potential future exposure to site contaminants in soil vapor or landfill gas capable of migrating into the indoor air of any new habitable buildings constructed near those sections of the Inert Area and the Grantham South Area where the migration of landfill gas has not been mitigated. Barhole probe survey results indicate institutional controls are not needed at this time to address potential future soil vapor intrusion.	12/12/2017
1, 3	Operation and maintenance of the SSDS voluntarily installed by the DS&G Remedial Trust at an office building on Grantham Lane is not a requirement of the existing decision and enforcement documents.	The selected remedy should be modified to include the requirement for continued operation and maintenance of the SSDS.	Considered But Not Implemented	The SSDS is being operated in accordance with an Addendum to the 2012 Revised O&M Plan for the Grantham South and Inert Areas, and this additional response action is enforceable under the 1995 Consent Decree. The DS&G Remedial Trust will continue to monitor indoor air at the building in accordance with the O&M plan for the Inert Area.	Not applicable

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Community Involvement and Site Interviews

A public notice was made available by a newspaper posting in *The New Castle Weekly* on March 25, 2020 (Appendix D). It stated that the FYR was underway and invited the public to submit any comments to EPA. The results of the review and the report will be made available at the Site's information repository (the offices of DNREC's Site Investigation and Restoration Section located at 391 Lukens Drive, New Castle, Delaware 19720).

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The interviews are summarized below and included in Appendix E.

The CICs interviewed a representative from local water supplier Artesian, President of the Llangollen Estates Civic Association, Chairman of the Delaware Sand & Gravel Remedial Trust, and a state official concerning their knowledge and perceptions of EPA's activities at the Site.

All interview respondents except the local resident reported high awareness of activities at the Site. The resident generally knew of the Superfund Site (and adjacent site Army Creek Landfill) but was unfamiliar with its specific cleanup history. All respondents also reported that they were well-informed about site activities. The Llangollen estates resident indicated a positive view of recent communication about the Site, noting that the factsheet sent to area residents in September of 2019 was beneficial for the community. Artesian reported that communication had improved in recent years.

While the state and PRP respondents indicated no knowledge of resident issues or complaints, the resident reported some community concern about the site. Specifically, the resident noted community concerns about drinking water safety and the site's impact on property values in the Llangollen Estates neighborhood. Artesian noted heightened community concern about drinking water contamination resulting from the site. As noted in the Data Review section, below, Artesian's annual Water Quality Reports show compliance with all state and federal drinking water standards. In addition, Artesian routinely tests treated water at the Llangollen well field to ensure that concentrations of those Site-related COCs for which federal and state drinking water standards have not been promulgated are below acceptable risk- and health-based levels.

Overall, respondents indicated a generally positive impression towards the project's cleanup, maintenance, and reuse activities. The resident expressed interest in EPA communicating positive successes about the site cleanup, in order to share stories of progress with the Llangollen Estates community. The PRP and state representatives were satisfied with the performance of the remedy. Artesian reported a negative impression of the time required for decisions and action within the Superfund process and detailed the financial impacts of the additional treatment required for the contaminated drinking water source.

Data Review

During this FYR period, groundwater and soil data were collected as part of the ongoing Preliminary Design Investigation. At the time of this FYR, the Preliminary Design Investigation activities have not been completed; these results will be discussed in the next FYR.

Routine groundwater monitoring downgradient of the DDA and PW-1 and performance monitoring of the LFExS and PW-1 have been conducted semi-annually. In addition, effluent discharge is monitored semi-annually. This FYR also reviewed the Artesian's annual Water Quality Reports. Landfill gas and indoor air data have been collected to assess the performance of the LFG mitigation system. The data associated with these activities are discussed in more detail in Appendix I. A brief summary is provided in this section.

Overall, groundwater monitoring continues to show exceedances of the PRGs in the Columbia Aquifer, UPCUTZ and the Upper Potomac Aquifer (Upper and Lower Sand) in the DDA area and downgradient of the DDA, PW-1 and Grantham South and cross-gradient of the Inert Area. Groundwater monitoring results also show PRG exceedances in the Upper Potomac Aquifer downgradient of the eastern lobe of the Army Creek Landfill. The primary COCs that exceed PRGs at the Site are BCEE, 1,4-dioxane and manganese. The highest BCEE, 1,4-dioxane and manganese concentrations continue to occur in the UPCUTZ downgradient of the DDA (Figures J-4 through J-6 in Appendix J). In 2019, BCEE concentrations ranged from less than detection limit to 300 µg/L (PRG = 0.14 µg/L); 1,4-dioxane concentrations ranged from less than detection limit to 1,400 µg/L (PRG = 4.6 µg/L); and manganese concentrations ranged from 23.4 to 30,400 µg/L (PRG = 260 µg/L). Contamination within the Upper Potomac Aquifer extends to the Artesian production wells. Groundwater monitoring will continue while the remedial design for the amended remedy is ongoing.

The LFExS is providing hydraulic containment of contaminated groundwater within the DDA by inducing inward gradients across the slurry wall within the Columbia Aquifer and upward gradients between the Upper Potomac Aquifer and the Columbia Aquifer. Downgradient of the DDA, PW-1 is capturing contaminant mass in the Upper Potomac Aquifer, although contamination in some areas is migrating beyond PW-1. PW-1 is also providing some capture of contaminants in the UPCUTZ between the DDA and PW-1. The semi-annual effluent discharge from the LFExS and PW-1 was in compliance with the permit discharge limits during this FYR period. The Artesian annual Water Quality reports, which summarize the drinking water quality, indicate compliance with all state and federal standards.

The LFG mitigation system monitoring shows significant declines in methane levels at the perimeter of the Grantham South Area and the Inert Area since the system was installed in 2014. Methane levels still exceed the performance goal (less than 25% of the lower explosive limit) at certain perimeter gas monitoring wells. Based on these results, indoor air is monitored at the adjacent office building (which houses the SSDS) and at the DS&G

treatment building, as necessary. No methane was measured in indoor air in either of these buildings and no additional action was required. The DS&G Remedial Trust collected indoor air samples from the office building on January 28, 2020 and analyzed the samples for VOCs. EPA reviewed the analytical results and found that the VOCs detected in the indoor air were within EPA's acceptable risk range.

Site Inspection

The site inspection took place on February 13, 2020. Participants included the EPA RPM, EPA CICs, EPA human health and ecological risk assessors, EPA hydrogeologist and EPA air quality specialist. DNREC, Skeo (EPA contractor support), and PRP contractors also participated in the site inspection. The purpose of the inspection was to assess the protectiveness of the remedy.

Site inspection participants observed the DDA, Grantham South Area and the Inert Area including the SBA. All areas are surrounded by locked fences. The landfill caps were generally in good condition and grass is established. Site inspection participants observed the DDA LFExS system and the treatment building, which was in good condition. Several animal burrows were observed on the Grantham South Area cap and trees were observed resting against and growing through the fence in some areas. The south toe fence line of the Grantham South Area was partially submerged by a large pond. A large animal burrow was also observed on the northwest slope of the landfill. Site inspection participants toured the SBA with the owner and observed several puddles mostly along roads. Several large junk vehicles were noted resting on the ground and penetrating the gravel. Ponding was observed on the Inert Area (Grass Area) and a gap in the fence was also noted where a gate had been ripped from the fence. A damaged settlement monument was also observed on the Grass Area. On February 20, PRP contractors repaired the Inert Area fence.

Most monitoring wells were secured, but a few monitoring wells were unlocked and some were left unsecured to allow for water level monitoring. The PRP contractors confirmed that the wells with broken or missing locks were secured following the site inspection. Several wells contain transducers for monitoring purposes and cannot be secured. The PRP contractors indicated the wells will be secured once the transducers are removed. The site inspection checklist and photos are included as Appendices F and G, respectively.

EPA's FYR contractor visited the site repository at the DNREC Lukens Drive office and found that the repository was inaccessible to the public. EPA will establish a new local repository at the New Castle Public Library.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

The remedies selected for the Grantham South Area, Inert Area and the Ridge Area are functioning as intended by the decision documents. Landfill caps, fencing and institutional controls are preventing direct contact with contaminated soil and wastes at the Grantham South Area, Inert Area and DDA. Contaminated soil at the Ridge Area was excavated and consolidated at the DDA for treatment using bioventing. The remedies selected for groundwater and for soil in the DDA did not perform as expected. The bioventing systems were replaced with the LFExS in 2008 to provide hydraulic containment within the slurry wall. EPA issued an AROD in 2017 for soil and groundwater in the DDA as well as modified remedy components for other areas. The amended remedy, which is in the remedial design phase, will address contaminated groundwater in the Upper Potomac Aquifer including groundwater in the UPCUTZ and at the Llangollen well field, contaminated groundwater and soil in the DDA, and potential vapor intrusion in new construction adjacent to Grantham South Area and the Inert Area.

While the updated remedy is in the remedial design phase, a low-flow groundwater extraction system (the LFExS) continues to operate at the DDA to mitigate the release of contaminants from the DDA into the Upper Potomac Aquifer and a recovery well (PW-1) is being operated in the Upper Potomac Aquifer downgradient of the DDA as an interim measure. In the meantime, the treatment provided by Artesian at the Llangollen well field is preventing exposure to site-related contaminants in groundwater.

While ongoing maintenance of the caps and fencing in the Grantham South Area and the Inert Area (Grass Area) appears to be effective, there is an ongoing issue with surface water accumulating adjacent to the Grantham South Area. During the site inspection for this FYR, the surface water level was about 3 feet up the surrounding fence. This encroaching surface water body has the potential to intrude on the landfill cap. Additional investigations are needed to evaluate if additional actions are necessary to protect the cap. Ponding was also observed on the Inert Area (Grass Area). Excessive vegetation was observed growing through and around fencing on the Grantham South Area. A gap in the fence was noted where a gate had been hit; however, this was repaired immediately after the site inspection.

The DS&G Remedial Trust installed and is operating an LFG mitigation system and SSDS at an adjacent office building. The LFG mitigation system and tiered monitoring program ensure that receptors are not being exposed to landfill gases. During this FYR period, there were no additional response actions needed to address exposure and sampling results indicated that methane was not detected. The SSDS is being operated pursuant to the 1995 Consent Decree. Institutional controls are required in the 2017 AROD to prevent potential exposure to site contaminants in indoor air for any new construction in areas adjacent to the Grantham South Area and Inert Area where landfill gas may be migrating. Screening results in 2018-2019 showed no evidence of landfill gas migration outside the influence of the LFG mitigation system. Based on this finding, EPA determined that institutional controls to prevent potential exposure to landfill gas constituents in indoor air are not needed at this time.

All required soil and groundwater institutional controls have been implemented via deed notices and the GMZs. Respondents to EPA's 2006 and 2008 UAOs are complying with use restrictions at the Grantham South Area to ensure the continued effectiveness of the response actions. The settling defendant in the 2019 Consent Decree (former respondent to EPA's now terminated 2004 UAO) is providing the DS&G Remedial Trust access to his property to implement response actions and is complying in part with restrictions on the use of his site property, which includes the Inert Area, the DDA and a small portion of the Grantham South Area. The 2019 Consent Decree settling defendant recorded a notice of institutional controls with New Castle County's land records in 2020, as required by the Consent Decree. However, EPA has documented the 2019 Consent Decree settling defendant's noncompliance with provisions of the Consent Decree to ensure safe use of the SBA. During the 2017 inspection and the site inspection for this FYR, EPA noted several violations of the UAO and the 2019 Consent Decree, respectively, including automotive fluids that were not adequately contained and spills and ruts that had not been properly addressed. EPA will work with the owner to implement better cap maintenance techniques.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection still valid?

Although toxicity data has changed for some contaminants, the exposure assumptions, cleanup levels and RAOs used at the time of remedy selection remain valid. Any changes in toxicity or risk assessment methods do not affect the protectiveness of the remedy.

Risk-based groundwater PRGs were updated for the Upper Potomac Aquifer in the 2017 AROD to include all COCs including 1,4-dioxane based on current toxicity and risk assessment methods. These PRGs remain valid. Soil cleanup goals were specified for the DDA and Ridge Area. The DS&G Remedial Trust removed contaminated soil from the Ridge Area in 1995, meeting the soil cleanup levels specified in the 1993 AROD. These cleanup levels, developed for the protection of groundwater, continue to be protective for residential and industrial direct contact exposure to contaminated soil (Appendix K, Table K-1). However, the cleanup levels are less stringent than EPA's current soil screening levels for protection of groundwater (see Table K-1). As indicated in the previous FYR, EPA reviewed site-specific groundwater data and concluded that any remaining soil contamination at the Ridge Area is not affecting groundwater quality in the Upper Potomac Aquifer.

The RAOs for the Site were updated in the 2017 AROD to include the vapor intrusion pathway. All existing buildings within the area of the Site are monitored as part of the LFG mitigation O&M. RAOs for DDA soil and site groundwater were updated in the 2017 AROD. After the updated remedy is implemented, EPA expects the RAOs will be met in a reasonable timeframe.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the FYR:
OU4, OU5

Issues and Recommendations Identified in the FYR:

OU(s): 1	**Issue Category:** Changed Site Conditions			
	Issue: Surface water that accumulates adjacent to the Grantham South Area has the potential to encroach on the landfill cap. The level of the surface water has increased during this FYR period and is now above the fence line.			
	Recommendation: Evaluate if the current surface water level is impacting the integrity of the cap and propose corrective measures in order to prevent the surface water body from encroaching on the cap.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	8/28/2022

OU(s): 1, 3	**Issue Category:** Operations and Maintenance			
	Issue: The fences of the Grantham South Area and the Inert Area have excessive vegetation growing against and through them.			
	Recommendation: Remove excess vegetation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	8/28/2021

OU(s): 3	Issue Category: Operations and Maintenance			
	Issue: Several ongoing maintenance issues were noted at the SBA during the site inspection including ponding on roadways and heavy equipment sinking down into the gravel cap.			
	Recommendation: EPA will work with the property owner to identify and implement better cap maintenance techniques for the SBA, including: preventing and repairing ruts or gouges caused by erosion or use of the SBA, preventing objects stored on the SBA from penetrating the gravel and preventing or promptly cleaning up spills on the SBA. If unsuccessful, EPA will pursue enforcement of the 2019 Consent Decree.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	8/28/2021

OU(s): 6	Issue Category: Monitoring			
	Issue: Artesian has informed EPA that it routinely analyzes treated groundwater at the Llangollen well field for site-related COCs that are not regulated under the Safe Drinking Water Act. However, Artesian is not required to regularly report or make these results available to EPA.			
	Recommendation: EPA will work with the PRPs and Artesian to establish water quality reporting requirements for groundwater treated by Artesian at the Llangollen well field.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	8/28/2021

OTHER FINDINGS

Several additional recommendations were identified during the FYR. These recommendations do not affect current and/or future protectiveness.

- Ensure that the information repository is up to date and accessible to the public.
- Animal burrows observed on the Grantham South Area cap should be filled.
- Secure well DGC-8D.
- Conduct necessary maintenance to address ponding and low areas of the Grass Area cap and continue monitoring.

VII. PROTECTIVENESS STATEMENTS

Protectiveness Statement	
Operable Unit: 1	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at the Grantham South Area (OU1) currently protects human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled through a landfill cap and a perimeter fence. Institutional controls are in place to restrict the current and future use of the Grantham South Area. For the remedy to be protective over the long term, the following actions are needed: evaluate if the current surface water level is impacting the integrity of the cap, propose corrective measures in order to prevent the surface water body from encroaching on the cap and remove excess vegetation from fence.	

Protectiveness Statement	
Operable Unit: 3	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at the Inert Area (OU3) currently protects human health and the environment. Exposure pathways that could result in unacceptable risks are being controlled through a landfill cap and a perimeter fence. Institutional controls are in place to restrict the current and future use of the Inert Area. For the remedy to be protective over the long term, the following actions are needed: remove excess vegetation from fence and work with the property owner to identify and implement better cap maintenance techniques for the SBA, including preventing and repairing ruts or gouges caused by erosion or use of the SBA, preventing objects stored on the SBA from penetrating the gravel and preventing or promptly cleaning up spills on the SBA.	

Protectiveness Statement	
Operable Unit: 4 and 5	*Protectiveness Determination:* Protective
Protectiveness Statement: The remedy at the Ridge Area (part of OUs 4 and 5) is protective of human health and the environment. Soil with contaminant concentrations exceeding the cleanup standards was excavated and placed at the DDA. Unacceptable exposure pathways have been eliminated at the Ridge Area. The remedy at the DDA (part of OUs 4 and 5) currently protects human health and the environment. The potential for direct contact with contaminated soil is being controlled by containment and security measures. The LFExS is operating to maintain an inward and upward hydraulic gradient to prevent contaminant migration from the containment area. The updated remedy from the 2017 AROD is in the remedial design phase and will address contaminated soil and groundwater in the DDA under OU6.	

Protectiveness Statement	
Operable Unit: 6	*Protectiveness Determination:* Short-term Protective

Protectiveness Statement:
The remedy for the DDA source area and groundwater will be protective of human health and the environment when the updated remedy has been implemented. While the updated remedy is in the remedial design phase, a low-flow groundwater extraction system is being operated at the DDA and a recovery well (PW-1) is being operated in the Upper Potomac Aquifer downgradient of the DDA as an interim measure. In the meantime, the treatment provided by Artesian at the Llangollen well field is preventing exposure to site-related contaminants in groundwater, and institutional controls are in place to restrict installation of new public or domestic water supply wells and non-potable wells throughout the groundwater plume. In order to ensure long-term protectiveness, EPA will work with the PRPs and Artesian to establish water quality reporting requirements for groundwater treated by Artesian at the Llangollen well field.

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective

Protectiveness Statement:
The remedial actions at OU1 and OU3 are short-term protective. The remedial actions at OU4 and OU5 are protective. The remedial actions at OU6 will be protective upon completion and in the meantime, there is no exposure to site-related contamination. Therefore, the site is currently protective of human health and the environment. In order for the site to be protective in the long-term, the following actions need to be taken: evaluate if the current surface water level is impacting the integrity of the Grantham South Area cap, propose corrective measures in order to prevent the surface water body from encroaching on the Grantham South Area cap, remove excess vegetation from the fences of the Grantham South Area and the Inert Area, work with the property owner to identify and implement better cap maintenance techniques for the SBA and work with the PRPs and Artesian to establish water quality reporting requirements for groundwater treated by Artesian at the Llangollen well field.

VIII. NEXT REVIEW

The next FYR Report for the Delaware Sand & Gravel Landfill Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Addendum to 2012 Revised O&M Plan – Revision 2, Grantham South and Inert Area, Delaware Sand & Gravel Landfill Superfund Site, New Castle, Delaware. Prepared by Golder Associates. May 26, 2017.

Amended Memorandum of Agreement. DNREC, between Division of Air and Waste Management and Division of Water Resources. June 2006.

Analytical Data Summary – April – May 2019 Groundwater Monitoring Event, Delaware Sand & Gravel Landfill Superfund Site, New Castle, Delaware. Prepared by Golder Associates, July 31, 2019.

Artesian Water Company Water Quality Reports 2015 – 2019, PWSID #DE0000552.

Explanation of Significant Differences: Delaware Sand and Gravel Site, New Castle, Delaware. EPA Region 3. July 8, 2003.

Final Surface Barrier Area Inspection Memorandum, Delaware Sand & Gravel Landfill Superfund Site, New Castle, Delaware. March 24, 2017.

Fourth Five-Year Review Report: Delaware Sand & Gravel Landfill Superfund Site. EPA Region 3. September 16, 2010.

Fifth Five-Year Review Report: Delaware Sand & Gravel Landfill Superfund Site. EPA Region 3. August 28, 2015.

Indoor Air Sampling Report, Cirillo Brothers' Office Building – 761 Grantham Lane, Delaware Sand & Gravel Landfill Superfund Site, New Castle County, Delaware. Prepared by Golder Associates Inc. April 2020.

Notice of Institutional Controls, Access, and Obligations Regarding Successors-In-Interest, Parcel Number 1003500006. February 12, 2020.

Notice of Institutional Controls, Access, and Obligations Regarding Successors-In-Interest, Parcel Number 1003500056. June 26, 2008.

Notice of Institutional Controls, Access, and Obligations Regarding Successors-In-Interest, Parcel Number 1003500005. October 25, 2006.

Operations, Monitoring & Maintenance Plan, Landfill Gas Mitigation System, Delaware Sand & Gravel Superfund Site, New Castle County, Delaware. Prepared by Golder Associates Inc. April 2019.

Preliminary Close Out Report, Delaware Sand & Gravel Landfill Superfund Site, New Castle, Delaware. EPA Region 3. August 12, 1997.

Quarterly Operating, Maintenance and Monitoring Report for the Delaware Sand & Gravel Superfund Site, 2016 – 2020. Prepared by DS&G Remedial Trust Steering Committee.

Record of Decision, Delaware Sand & Gravel Superfund Site, New Castle, Delaware. EPA Region 3. April 22, 1988.

Record of Decision Amendment: Delaware Sand and Gravel Site, New Castle, Delaware. EPA Region 3. September 30, 1993.

Record of Decision Amendment No. 2, Delaware Sand and Gravel Landfill Superfund Site, New Castle, Delaware. EPA Region 3. December 2017.

Semi-Annual Monitoring Reports, 2015 – 2019, Delaware Sand & Gravel Superfund Site, New Castle, Delaware. Prepared by Golder Associates, Inc.

Surface Barrier Area Semi-Annual Operation and Maintenance Report, Delaware Sand and Gravel Superfund Site, New Castle Delaware. Prepared by CDM Smith. March 23, 2017.

APPENDIX B – SITE CHRONOLOGY

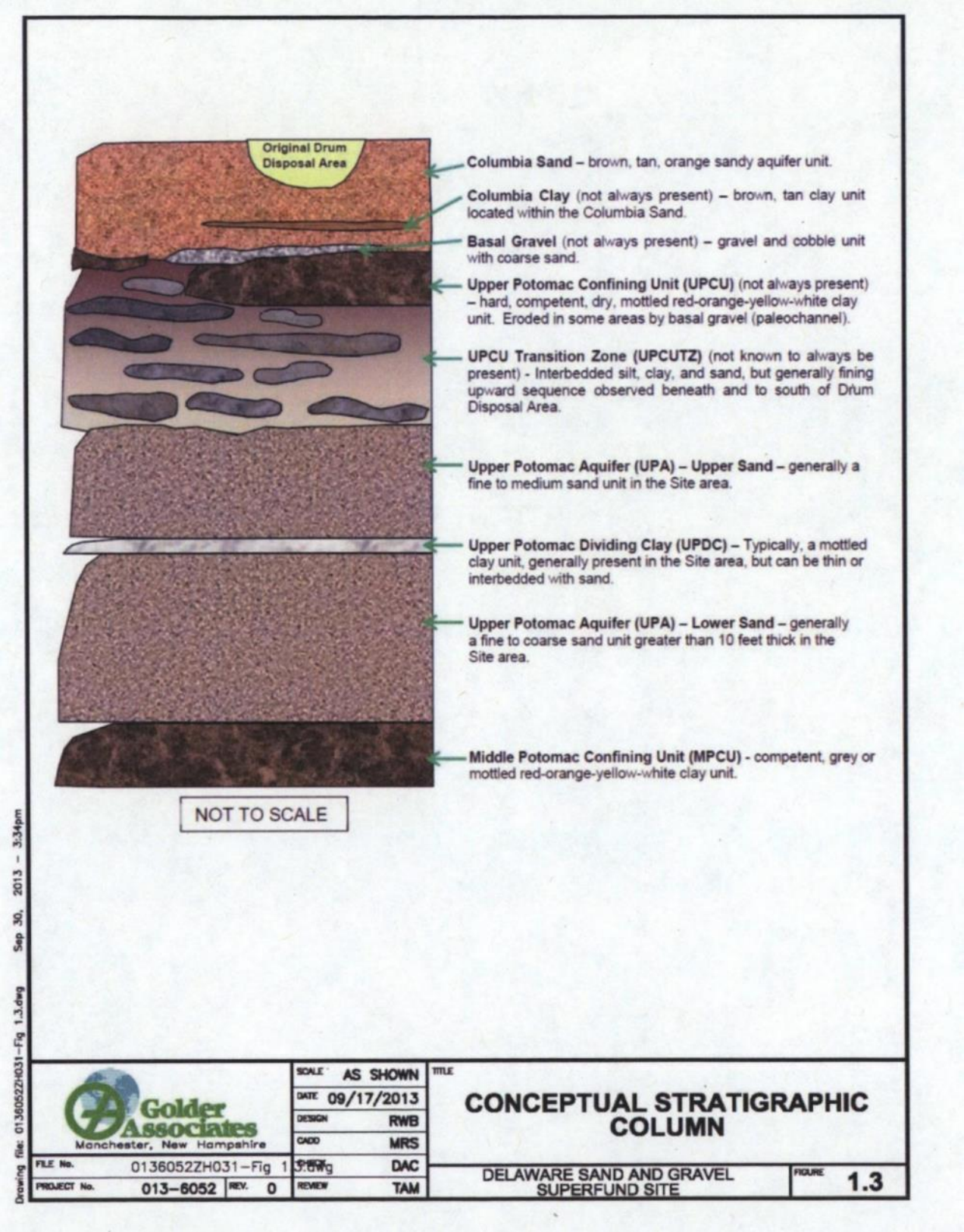
Table B-1: Site Chronology

Event	Date
DS&G operated permitted landfill	1968 - 1976
Contaminants found in residential well water located downgradient from Army Creek Landfill and DS&G Landfill	1971
New Castle County installed groundwater recovery wells to prevent contaminated groundwater beneath Army Creek Landfill and DS&G Landfill from reaching Artesian Water Company's Llangollen well field	1973
EPA placed Site on NPL	September 8, 1983
EPA and the state performed emergency removal of more than 1,600 drums from surface of DDA and Ridge Area	March-May 1984
DNREC conducted RI/FS	1984-1987
EPA issued ROD documenting selection of cleanup plan	April 1988
EPA began remedial design for Grantham South Area	August 26, 1988
EPA approved final remedial design for Grantham South Area	June 30, 1989
U.S. Army Corps of Engineers' contractor, on behalf of EPA, began construction of Grantham South Area landfill cap	September 1989
EPA conducted final inspection of Grantham South Area landfill cap and signed Remedial Action Completion Report for Grantham South Area (OU1 remedial action completed)	September 30, 1991
On behalf of EPA, U.S. Army Corps of Engineers conducted pre-design studies at DDA and Ridge Area. Findings led to 1993 ROD Amendment.	1991-1993
EPA determined that buried drums in DDA posed an imminent threat	March 23, 1992
EPA entered into Administrative Order on Consent (AOC) with 22 PRPs, who agreed to design and construct slurry wall around DDA as an interim action and to design multi-layer cap for Inert Area	June 12, 1992
PRPs initiated remedial design for Inert Area	June 26, 1992
State of Delaware assumed responsibility for O&M activities at Grantham South Area	October 1992
PRPs initiated remedial design for slurry wall	November 1992
EPA approved remedial design for Inert Area (OU3)	July 28, 1993
EPA issued AROD to revise remedy selected for buried materials and soil in DDA, Ridge Area and Inert Area	September 30, 1993
EPA approved slurry wall design	November 1993
PRPs initiated slurry wall construction	May 1994
EPA completed Site's first FYR	September 30, 1994
EPA conducted final inspection of slurry wall	October 12, 1994
Thirty-one PRPs entered into AOC with EPA, agreeing to begin remedial design for modified response actions selected in AROD for DDA and Ridge Area	December 5, 1994
PRPs initiated remedial design for OU4 and OU5	December 15, 1994
EPA accepted PRPs' certification of completion of slurry wall construction	February 23, 1995
Thirty-one PRPs entered into a Consent Decree with EPA, agreeing to implement remedial design and remedial action for modified response actions selected in ROD Amendment for DDA, Ridge Area and Inert Area, and to perform O&M activities at Grantham South Area	June 14, 1995
PRP contractor mobilized to begin drum and soil excavation activities at DDA and Ridge Area	June 26, 1995
PRPs completed OU4 remedial design	June 29, 1995
PRPs completed OU5 remedial design	July 24, 1996
PRPs began OU5 on-site construction	August 26, 1996
PRPs' contractor mobilized to begin construction of Inert Area cap	September 9, 1996

Event	Date
EPA accepted Remedial Action Report documenting completion of: 1) excavation and off-site disposal of drum carcasses and certain contaminated soils and waste materials from DDA and Ridge Area; 2) amendment of contaminated soil with sand, wood chips and fertilizer in preparation for on-site bioremediation; and 3) excavation of on-site bio-cell (OU4 remedial action complete)	September 27, 1996
EPA conducted final inspection of Inert Area cap and bioremediation area at DDA	August 8, 1997
EPA issued Preliminary Close-out Report (OU5 remedial action complete)	August 12, 1997
EPA accepted Remedial Action Report documenting completion of Inert Area cap construction (OU3 remedial action complete)	September 30, 1997
EPA completed Site's second FYR	September 30, 1999
EPA issued an ESD that clarified and expanded institutional controls needed for Site	July 8, 2003
EPA issued Administrative Order for Remedial Action to owner of most of site property calling for site access and implementation of institutional controls	September 27, 2004
EPA completed Site's third FYR	September 21, 2005
DNREC established a Groundwater Management Zone at Site and adjacent Army Creek Landfill site	June 2006
EPA issued Administrative Order for Remedial Action to Grantham Lane Associates LLC calling for site access and implementation of institutional controls	September 29, 2006
Grantham Lane Associates LLC recorded Notice of Institutional Controls, Access, and Obligations Regarding Successors-in-Interest, implementing institutional controls for portion of site property owned by Grantham Lane Associates LLC	October 20, 2006
EPA issued Administrative Order for Remedial Action to New Castle County calling for site access and implementation of institutional controls	March 30, 2007
EPA issued revised Administrative Order for Remedial Action to New Castle County	May 12, 2008
New Castle County recorded Notice of Institutional Controls, Access, and Obligations Regarding Successors-in-Interest implementing institutional controls for portion of site property owned by New Castle County	June 23, 2008
PRPs initiated low-flow groundwater extraction at DDA as an interim response action	May 2009
EPA completed Site's fourth FYR	September 16, 2010
PRPs started feasibility study for OU6 (DDA source and groundwater)	September 28, 2011
EPA completed Site's fifth FYR	August 28, 2015
PRPs completed the feasibility study for OU6 and the AROD for OU6	December 12, 2017
PRPs initiated remedial design for OU6	May 22, 2018
EPA and property owner entered into consent decree	August 13, 2019
Respondent filed Notice of Institutional Controls with New Castle County	February 12, 2020

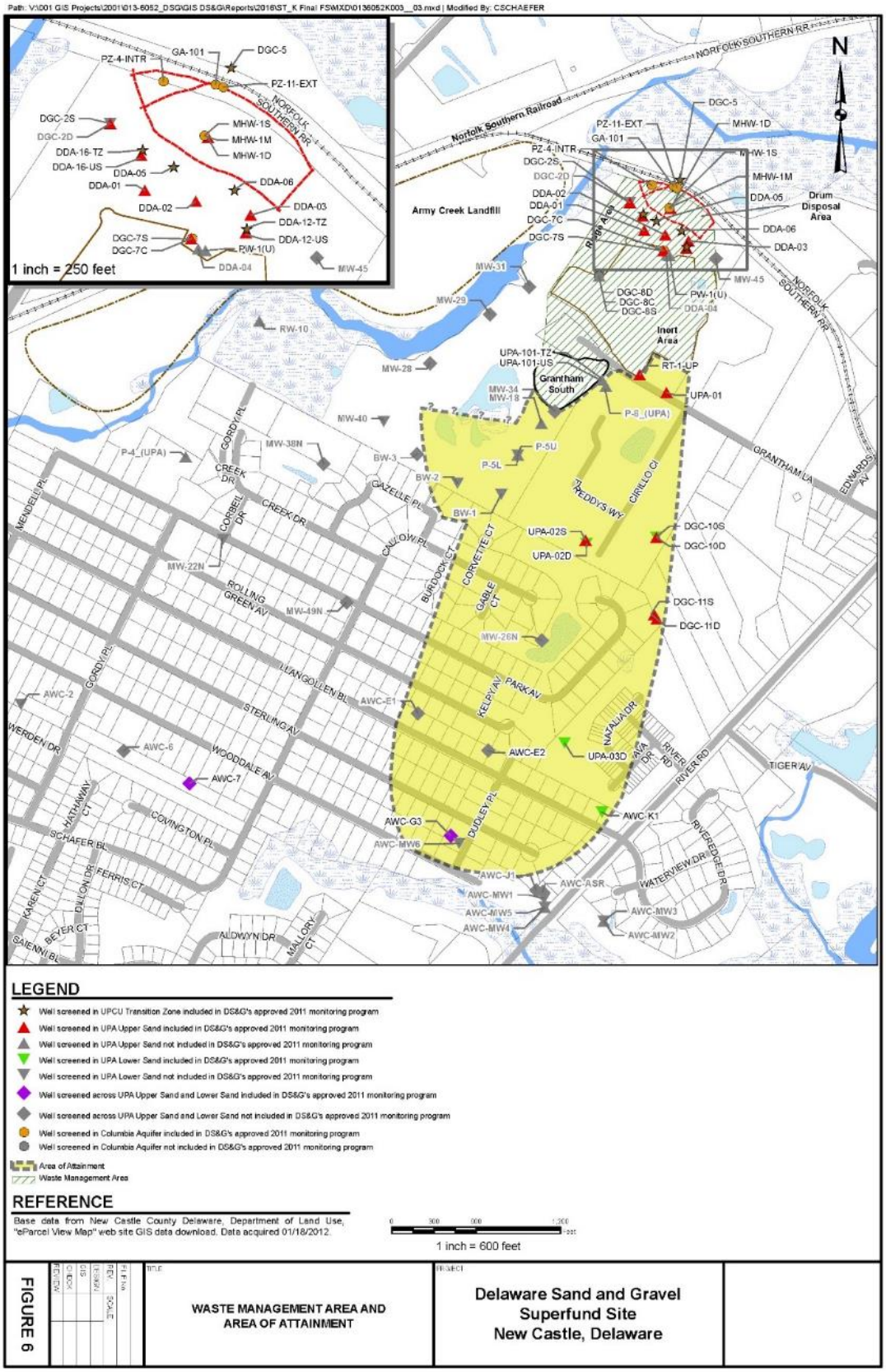
APPENDIX C – SITE MAPS

Figure C-1: Geologic Cross Section[2]



[2] Source: 2014 Supplemental Site Characterization

Figure C-2: Area of Attainment[3]



[3] Source: 2017 ROD Amendment

APPENDIX D – PRESS NOTICE

EPA PUBLIC NOTICE

EPA REVIEWS CLEANUP

DELAWARE SAND & GRAVEL LANDFILL SUPERFUND SITE

The U.S. Environmental Protection Agency (EPA) is reviewing the cleanup that was conducted at the Delaware Sand & Gravel Superfund Site located in New Castle, Delaware. EPA inspects sites every five years to ensure that cleanups conducted protect public health and the environment. EPA's 2015 review of the site concluded that the remedy was working as designed and is protective. Findings from the current five-year review will be available in August 2020.

To access detailed site information, including the five-year review report once finalized, visit: https://www.epa.gov/superfund/delawaresandgravel

For questions or to provide site-related information for the review, contact:
Meg Broughton, EPA Community Involvement Coordinator
215-814-5494 or keegan.megan@epa.gov

APPENDIX E – INTERVIEW FORMS

Delaware Sand & Gravel Landfill SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Delaware Sand & Gravel Landfill	
EPA ID: DED000605972	
Interviewer name: Meg Broughton	**Interviewer affiliation:** EPA
Subject name: Dee Morris	**Subject affiliation:** Llangollen Estates Civic Association
Subject contact information:	
Interview date: 2/13/2020	**Interview time:** 1:00 PM
Interview location: 201 S Dupont Hwy, New Castle, DE 19720	
Interview format (circle one): In Person Phone Mail Email Other:	
Interview category: Resident	

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date? *Somewhat aware of the two sites (Army Creek Landfill and Delaware Sand & Gravel), but not specifically familiar with the cleanup.*

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)? *My impression is that the sites are being cleaned up, and there are some good stories to tell. I want to know about the site, the issues and the progress so far, so that I can share with my constituents.*

3. What have been the effects of this Site on the surrounding community, if any? *People are always concerned about living near a Superfund Site. They are concerned about property values going down and issues with our drinking water or our environment. I have also received questions about whether it is safe to go to Llangollen Park, and I don't know how to answer.*

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing? *Our neighborhood is generally safe, but sometimes there are kids that hang around the fenced area.*

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future? *Recently yes. It's been good to be in touch with the EPA so that I can communicate news about the sites to our community. The factsheet that was mailed last year was a good way to keep people informed—most people read their mail around here. We have an upcoming annual meeting, too, if you wanted to give a presentation to update the residents about what is happening at the two sites.*

6. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used? *No.*
7. Do you have any comments, suggestions or recommendations regarding any aspects of the project? *As I said before, I want to be able to share the good news with our community members. I write a newsletter, and a story of progress would be a great segment in the newsletter.*

8. Do you consent to have your name included along with your responses to this questionnaire in the FYR report? *Yes.*

Delaware Sand & Gravel Landfill SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Delaware Sand & Gravel Landfill	
EPA ID: DED000605972	
Interviewer name: Meg Broughton	**Interviewer affiliation:** EPA
Subject name: Doug Sutton	**Subject affiliation:** Delaware Sand & Gravel Remedial Trust
Subject contact information: 732-233-1161; dsutton@hgl.com	
Interview date: 2/28/2020	**Interview time:** 10:22 AM
Interview location:	
Interview format (circle one): In Person Phone Mail Email Other:	
Interview category: Potentially Responsible Party (PRP)	

1. What is your overall impression of the remedial activities at the Site? *The remedial activities at the site have been appropriate based on the information available at the time they were designed and implemented. Operating the remedies has provided valuable information for further improving the overall site-wide remedy.*

2. What have been the effects of this Site on the surrounding community, if any? *I am not aware of the Site affecting the surrounding community. The activities conducted at the Site require work to be conducted within the community and on neighboring business properties. The cooperation of these neighboring businesses has been very helpful. The Trust particularly appreciates our positive working relationships with the Artesian Water Company, Cirillo Brothers, Inc., and Marini Brothers, Inc*

3. What is your assessment of the current performance of the remedy in place at the Site? *The current remedies are well-maintained, performing as expected, and providing important information for making further improvements in accordance with the ROD Amendment #2 pursuant to the May 2018 Administrative Order on Consent for Remedial Design ("RD AOC").*

4. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since implementation of the cleanup? *I am not aware of any complaints or inquiries from residents other than the inquiries made during the public comment period for the September 2017 PRAP that led to ROD Amendment #2.*

5. Do you feel well-informed regarding the Site's activities and remedial progress? If not, how might EPA convey site-related information in the future? *As the Chairman of the DS&G Remedial Trust, I feel well-informed and appreciate the open communication that we have with EPA.*

6. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy? *I am pleased with how the remedy is managed and operated. I am also pleased with the amount of work achieved over the past several years under the RD AOC associated with ROD Amendment #2.*

7. Do you consent to have your name included along with your responses to this questionnaire in the FYR report? *Yes.*

Delaware Sand & Gravel Landfill SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM					
Site Name: Delaware Sand & Gravel Landfill					
EPA ID: DED000605972					
Interviewer name: Meg Broughton		**Interviewer affiliation:** EPA			
Subject name: Joe DiNunzio		**Subject affiliation:** Artesian Water			
Subject contact information: (302) 453-6973; JDiNunzio@artesianwater.com					
Interview date: 5/22/2020		**Interview time:** 11:45 AM			
Interview location:					
Interview format (circle one): In Person	Phone	Mail	Email	Other:	
Interview category: Public Water Supplier					

1. Are you familiar with the Five-Year Review process? *Yes.*

2. Do you think that the site's contamination impacts public perception of water safety in this local area? If yes, how? *Yes. There is continued heightened community and media concern with regard to what might be present in the raw water, the effectiveness of the treatment before water is delivered to residents, the need for reassurance that raw and finished water quality is effectively monitored, and that all involved (EPA, DNREC, the identified responsible parties and Artesian) are fully engaged and working cooperatively. For its part, Artesian attempts to address these matters by educating its customers and the general public about water quality and treatment as part of its customer information and community relations programs.*

3. How does the contamination affect Artesian's profitability and ability to serve its customers? *The additional capital and operating costs to ensure proper treatment of contaminants before water is delivered to customers is currently being borne by all Artesian customers in Delaware without any recovery of those costs from the responsible parties. Because of the need for several types of treatment (iron and manganese filtration, ultraviolet light advanced oxidation process, and granular activated carbon), the cost of water from Artesian's Llangollen wellfield is now the highest among Artesian's sources.*

   In accordance with the way the Delaware Public Service Commission sets utility rates, these capital and operating costs are incorporated into the rates that Artesian's customers must pay. If the Delaware Public Service Commission refused to include any of these costs in customer rates, there would be a dollar for dollar reduction in revenues and profitability for Artesian. Also, a protracted loss of the use of the Llangollen wellfield could result in other costs, such as increased purchased water expense.

   From an operational perspective, Artesian's New Castle County, Delaware water system fortunately has multiple sources of supply and several interconnections with neighboring utilities that allow for temporary periods during which the Llangollen wellfield is out of service. However, the Llangollen wellfield is critical to the long-term water supply for Artesian's customers, providing as much as 15% of total supply to our northern New Castle County, Delaware system and including an aquifer storage and recover well.

4. What mechanism(s) exist to compensate Artesian for its losses associated with the site? *In the most recent Record of Decision, Artesian was recognized as due compensation for the capital and operating costs incurred for treatment of BCEE, 1,4-dioxane, and manganese contaminants. Artesian has completed construction and placed in service treatment for manganese within the past year. This additional treatment was necessary because levels of manganese in Artesian's Llangollen wellfield continue to rise to levels that would exceed the secondary drinking water standard. The levels rose in accordance to what both Artesian's and Delaware Sand and Gravel Trust's (DS&G Trust) hydrogeologists anticipated.*

It is critical that the responsible parties be held accountable for making Artesian's customers financially whole. To date, Artesian's customers have borne the capital and operating costs for the treatment required at the Llangollen wellfield even though the responsible parties created the need for treatment. Because of the way Artesian is required to account for contributions, all financial recovery Artesian that receives from the DS&G Trust would function as a reduction of Artesian's rate base upon which its water rates are determined. At this time, Artesian and the DS&G Trust are in discussions with respect to compensation to Artesian that would make our customers whole.

5. How has EPA's communication about the Site been? *Communication has improved compared to five and more years ago. EPA Staff has responded to inquiries and concerns as they have been raised. Most notable has been the active on-going communication provided by the DS&G Trust. Regular communication with the DS&G Trust provides Artesian much greater comfort that we will be aware of potential matters of concern sufficiently in advance to take appropriate actions, rather than being forced to shut down the wellfield until treatment can be installed for a newly detected contaminant that has reached our wellfield.*

6. Do you have any comments, suggestions or recommendations regarding the project? *Artesian remains frustrated by the length of time required for decisions and actions within the Superfund process. For instance, upon the parties recognizing that high levels of manganese and iron were migrating towards Artesian's Llangollen wellfield, Artesian requested timely installation of interceptor wells between the landfill sites and Artesian's wellfield. If installed expeditiously, the concentrations of manganese and iron reaching Artesian's wellfield may have been mitigated or the length of time that treatment will be required at the Llangollen wellfield may have been shortened. Over three years has passed from Artesian's request before the installation of interceptor wells was accomplished. Meanwhile, Artesian had to move forward with installing new treatment for manganese and iron as the higher concentrations began reaching its wellfield.*

7. What have been the positive impacts of EPA's actions over the past 15 years? *There has been improved communication among the parties (EPA, DNREC, DS&G Trust and Artesian) since the last five year review, particularly between the DS&G Trust and Artesian, which provides greater assurance that matters are detected, discussed and addressed before any threat to drinking water quality results; and there has been recognition of the importance of including Artesian in the process. Prior to then, Artesian too often learned of matters of concern as a result of the detection of a contaminant that had migrated to its wellfield. The full protection of our customers is our primary concern, and it is critical that Artesian is included in all discussions with regard to matters arising at the Superfund sites and any proposed actions to be taken.*

8. Do you consent to have your name included along with your responses to this questionnaire in the FYR report? *Yes.*

Delaware Sand & Gravel Landfill SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Delaware Sand & Gravel Landfill	
EPA ID: DED000605972	
Interviewer name: Meg Broughton	**Interviewer affiliation:** EPA
Subject name: Patrick Boettcher	**Subject affiliation:** DNREC
Subject contact information: 302-395-2600; Patrick.Boettcher@delaware.gov	
Interview date: 3/11/2020	**Interview time:** 1:15 PM
Interview location:	
Interview format (circle one): In Person Phone Mail Email Other:	
Interview category: State Agency	

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)? *Having only been involved with this project for less than a year, I am impressed by the continued action and movement on a project with such a long history.*

2. What is your assessment of the current performance of the remedy in place at the Site? *I feel that the current remedy is proper for our current understanding of the problems.*

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years? *I am not aware of any complaints or inquiries from the residents.*

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities. *Christina Wirtz and Paul Will with DNREC's Site Investigation and Restoration Section (now Remediation Section) met with Mike Cirillo, owner of the Cirillo Brothers, Inc. property located adjacent to the DS&G Superfund Site, to resolve potable water sampling discrepancies encountered by the PRPs' environmental contractor, Golder Associates. The discrepancies were first identified at a fire hydrant on the Cirillo Brothers Inc. property. The water samples were collected from the fire hydrant prior to initiating drilling activities for a Preliminary Design Investigation associated with the Record of Decision-Amendment 2 at the site. Paul Will and Christina Wirtz, accompanied by representatives from Artesian Water Company, met with Mike Cirillo to conduct a site visit at the Cirillo property to confirm that the former domestic well at the property had been properly abandoned. Mike Cirillo provided a tour of the property and pointed out where the domestic well had been abandoned and capped. No other evidence of a domestic well was observed.*

   EPA, DHSS-Division of Public Health and Artesian Water Company were made aware of the situation, and Artesian identified and corrected a malfunctioning pump at the nearby Llangollen public supply wellfield. Artesian initiated confirmatory water sampling activities in the area. The Artesian results indicated contaminant levels were below state and federal drinking water standards. Additional sampling was completed by Artesian over the next several weeks, which confirmed that contaminant levels continued to remain below the drinking water standards.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy? *I am not aware of any changes to state law that affect the protectiveness of the Site's remedy.*

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues? *I am comfortable with the status of the institutional controls.*

7. Are you aware of any changes in projected land use(s) at the Site? *I am not aware of changes in land use.*

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy? *I do not have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy.*

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report? *Yes.*

APPENDIX F – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Delaware Sand & Gravel Landfill	**Date of Inspection:** 2/13/2020
Location and Region: New Castle, DE; Region 3	**EPA ID:** DED000605972
Agency, Office or Company Leading the Five-Year Review: EPA Region 3	**Weather/Temperature:** ~45°F, rain

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☒ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** Doug Sutton (Name) | DS&G Remedial Trust project manager (Title) | 2/28/2020 (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems, suggestions ☐ Report attached: _____

2. **O&M Staff** _____ (Name) | _____ (Title) | _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency DNREC
   Contact Patrick Boettcher (Name) | Project officer (Title) | 3/11/2020 (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: see Appendix E

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____

Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached:_____

4. **Other Interviews** (optional) ☐ Report attached: see Appendix E

Resident

PRP

Public Water Supplier

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan**	☒ Readily available	☒ Up to date	☐ N/A
☒ Contingency plan/emergency response plan	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

3. **O&M and OSHA Training Records**	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☒ Effluent discharge	☒ Readily available	☒ Up to date	☐ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits: _____	☐ Readily available	☐ Up to date	☐ N/A

Remarks: _____

5. **Gas Generation Records**	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

6. **Settlement Monument Records**	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

7. **Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

8. **Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

9. **Discharge Compliance Records**

☒ Air	☒ Readily available	☒ Up to date	☐ N/A
☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

10. **Daily Access/Security Logs** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place ☒ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: Large opening in fence bordering the Inert Area, will be repaired when gate is repaired that accesses the bordering county property.

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: Signs in place near gates.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): _____

Frequency: _____

Responsible party/agency: _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☒ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☒ No ☐ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: _____

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: _____

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: Roadways on SBA exhibit rutted areas where water is accumulating.

B. Other Site Conditions

Remarks: _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☒ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident

Lengths: _____ Widths: _____ Depths: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident

Area extent: A single large animal burrow noted on northwest slope of Grantham South landfill. Depth: Unknown

Remarks: _____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established

☒ No signs of stress ☐ Trees/shrubs (indicate size and locations on a diagram)

Remarks: _____

6. **Alternative Cover** (e.g., armored rock, concrete) ☐ N/A

Remarks: Some puddles were observed on the gravel cap on the SBA

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident

Area extent: _____ Height: _____

Remarks: _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident

☒ Wet areas	☐ Location shown on site map	Area extent: Wet area on Inert Area grass cap, wet areas also noted on areas of the SBA
☒ Ponding	☐ Location shown on site map	Area extent: Large pond encroaching on toe of Grantham South and ponding noted on the Inert Area (Grass Area)
☐ Seeps	☐ Location shown on site map	Area extent: _____
☐ Soft subgrade	☐ Location shown on site map	Area extent: _____

Remarks: _____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map

☒ No evidence of slope instability

Area extent: _____

Remarks: _____

B. Benches ☒ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☒ N/A or okay

Remarks: _____

2. **Bench Breached** ☐ Location shown on site map ☒ N/A or okay

Remarks: _____

3. **Bench Overtopped** ☐ Location shown on site map ☒ N/A or okay

Remarks: _____

C. Letdown Channels ☒ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ No evidence of settlement

Area extent: _____ Depth: _____

Remarks: _____

2. **Material Degradation** ☐ Location shown on site map ☒ No evidence of degradation

Material type:_____ Area extent: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☒ No evidence of erosion

Area extent: _____ Depth: _____

Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☒ No evidence of undercutting

Area extent: _____ Depth: _____

Remarks: _____

5. **Obstructions** Type: _____ ☒ No obstructions

☐ Location shown on site map Area extent: _____

Size: _____

Remarks: _____

6. **Excessive Vegetative Growth** Type: _____

☐ No evidence of excessive growth

☒ Vegetation in channels does not obstruct flow

☐ Location shown on site map Area extent: _____

Remarks: _____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☒ Passive

☐ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☒ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Gas Monitoring Probes**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)

☐ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: Most wells were locked/secured; however, several wells were unsecured including MW-29, UPA-109 and DGC 8D.

4. **Extraction Wells Leachate**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

5. **Settlement Monuments** ☒ Located ☒ Routinely surveyed ☐ N/A

Remarks: One damaged settlement monument was observed.

E. Gas Collection and Treatment ☒ Applicable ☐ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ☐ Needs maintenance

Remarks: Direct venting

2. **Gas Collection Wells, Manifolds and Piping**

☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)

☒ Good condition ☐ Needs maintenance ☐ N/A

Remarks: _____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A

Remarks: _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A

Remarks: _____

G. Detention/Sedimentation Ponds ☒ Applicable ☐ N/A

1. **Siltation** Area extent: _____ Depth: _____ ☐ N/A

☒ Siltation not evident

Remarks: _____

2. **Erosion** Area extent: _____ Depth: _____

☒ Erosion not evident

Remarks: _____

3. **Outlet Works** ☒ Functioning ☐ N/A

Remarks: _____

4. **Dam** ☐ Functioning ☒ N/A

Remarks: _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement: _____ Vertical displacement: _____

Rotational displacement: _____

Remarks: _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident

Remarks: _____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A

☐ Vegetation does not impede flow

Area extent: _____ Type: _____

Remarks: Vegetation was observed along the drainage channel of the Inert Area that may impede flow.

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Discharge Structure** ☐ Functioning ☒ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☒ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☒ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Performance Monitoring** Type of monitoring: Water level measurements and LFExS

☐ Performance not monitored

Frequency: _____ ☐ Evidence of breaching

Head differential: _____

Remarks: _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing and Electrical**

   ☒ Good condition ☒ All required wells properly operating ☐ Needs maintenance ☐ N/A

   Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

   ☒ Good condition ☐ Needs maintenance

   Remarks: _____

3. **Spare Parts and Equipment**

   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

   Remarks: _____

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps and Electrical**

   ☐ Good condition ☐ Needs maintenance

   Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

   ☐ Good condition ☐ Needs maintenance

   Remarks: _____

3. **Spare Parts and Equipment**

   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

   Remarks: _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (check components that apply)

   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

   ☐ Air stripping ☐ Carbon adsorbers

   ☐ Filters: _____

   ☐ Additive (e.g., chelation agent, flocculent): _____

   ☐ Others: _____

   ☒ Good condition ☐ Needs maintenance

   ☒ Sampling ports properly marked and functional

   ☒ Sampling/maintenance log displayed and up to date

   ☒ Equipment properly identified

   ☐ Quantity of groundwater treated annually: _____

   ☐ Quantity of surface water treated annually: _____

   Remarks: Extracted groundwater is discharged to Wilmington Wastewater Treatment Plant

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair

☒ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

☐ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition

☐ All required wells located ☒ Needs maintenance ☐ N/A

Remarks: Some wells were unlocked with broken lids and some were left open to weather.

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The remedies selected for the Grantham South Area, Inert Area and the Ridge Area are functioning as intended by the decision documents. Landfill caps, fencing and institutional controls are preventing direct contact with contaminated soil and wastes at the Grantham South Area, Inert Area and DDA. Remedial measures at the Ridge Area were implemented in accordance with the 1993 AROD. The remedies selected for groundwater and for soil in the DDA did not perform as expected. The bioventing systems were replaced with the LFExS in 2008 to provide hydraulic containment within the slurry wall. EPA issued an AROD in 2017 for soil and groundwater in the DDA as well as modified remedy components for other

	areas. The amended remedy, which is in the remedial design phase, will address contaminated groundwater in the Upper Potomac Aquifer including groundwater in the UPCUTZ and groundwater pumped in the Llangollen well field, contaminated groundwater and soil in the DDA, and potential vapor intrusion in new construction adjacent to Grantham South Area and the Inert Area.
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Generally, O&M is adequate. Several wells were unsecured and a gap noted in the fence of the Inert Area. Landfills are mowed annually.
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. None identified.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None identified.

Inspection Roster:

Debra Rossi, EPA
Katie Matta, EPA
Kathy Davis, EPA
Linda R. Watson, EPA
Patricia Flores-Brown, EPA
Patrick Boettcher, DNREC
Doug Sutton, DS&G
Beth Klotzback, DS&G
Hagai Nassau, Skeo
Alison Cattani, Skeo

APPENDIX G – SITE INSPECTION PHOTOS

Site fence and sign

Treatment building, which contains 10,000-gallon effluent tank

DDA

Trailer housing landfill gas extraction system blower and direct venting stack

Landfill gas extraction well near the toe of Grantham South Area

Landfill gas extraction system condensate sump

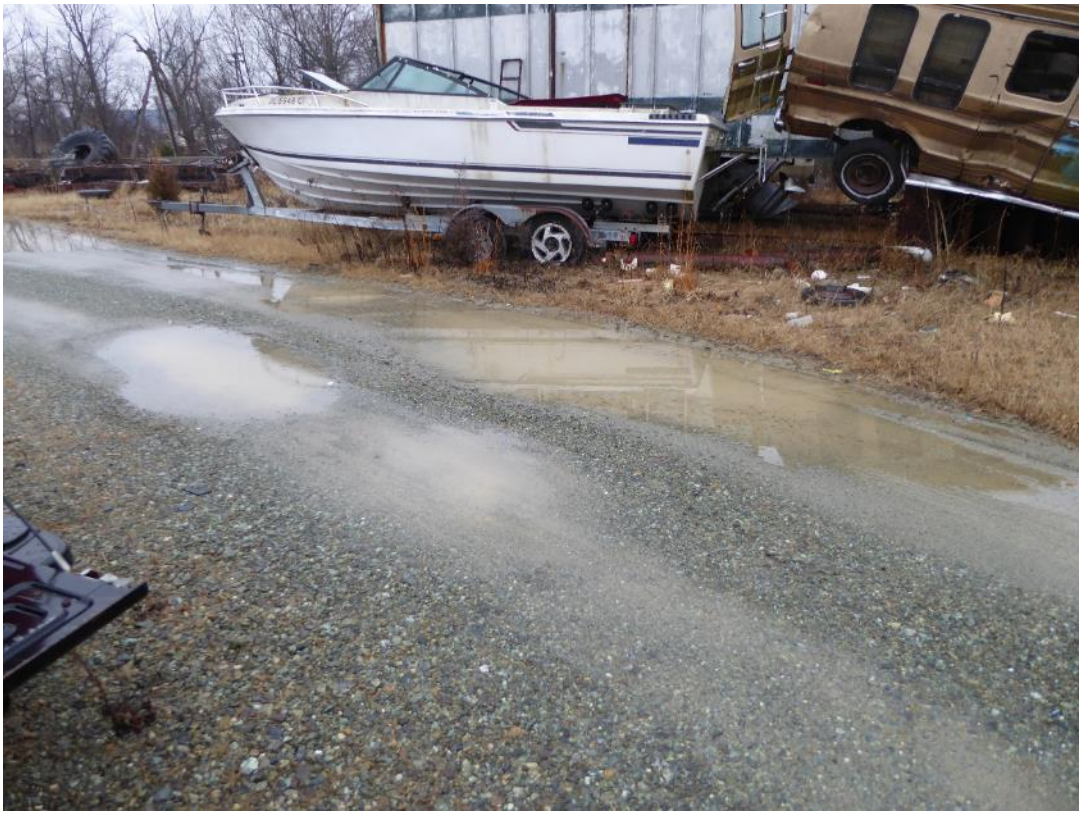
Scrapyard operating on SBA

Trailer post sinking into cap at SBA

Scrap vehicle stored on SBA, sinking into cap

Scrap vehicle stored on SBA, sinking into cap

Scrap vehicle stored on SBA with proper use of wood to prevent cap damage



Puddles on SBA

Asphalt chunks placed in rivulet on SBA to mitigate erosion

Pond at toe of Grantham South Area

Pond at toe of Grantham South Area

Beaver activity near pond at toe of Grantham South Area

Animal burrow at Grantham South Area

Vegetated cap on Inert Area

Ponding on Inert Area vegetated cap

Damaged settlement monument on Inert Area, resurveyed in 2010

Toe of Inert Area cap

Vegetation in drainage ditch next to Inert Area

Unsecured monitoring well DGC-8D

Unsecured monitoring well UPA-109. A lock was added after the inspection.

Monitoring well UPA-103-US left unsecured for water level monitoring, with rainwater collecting

Partially secured monitoring well UPA-102

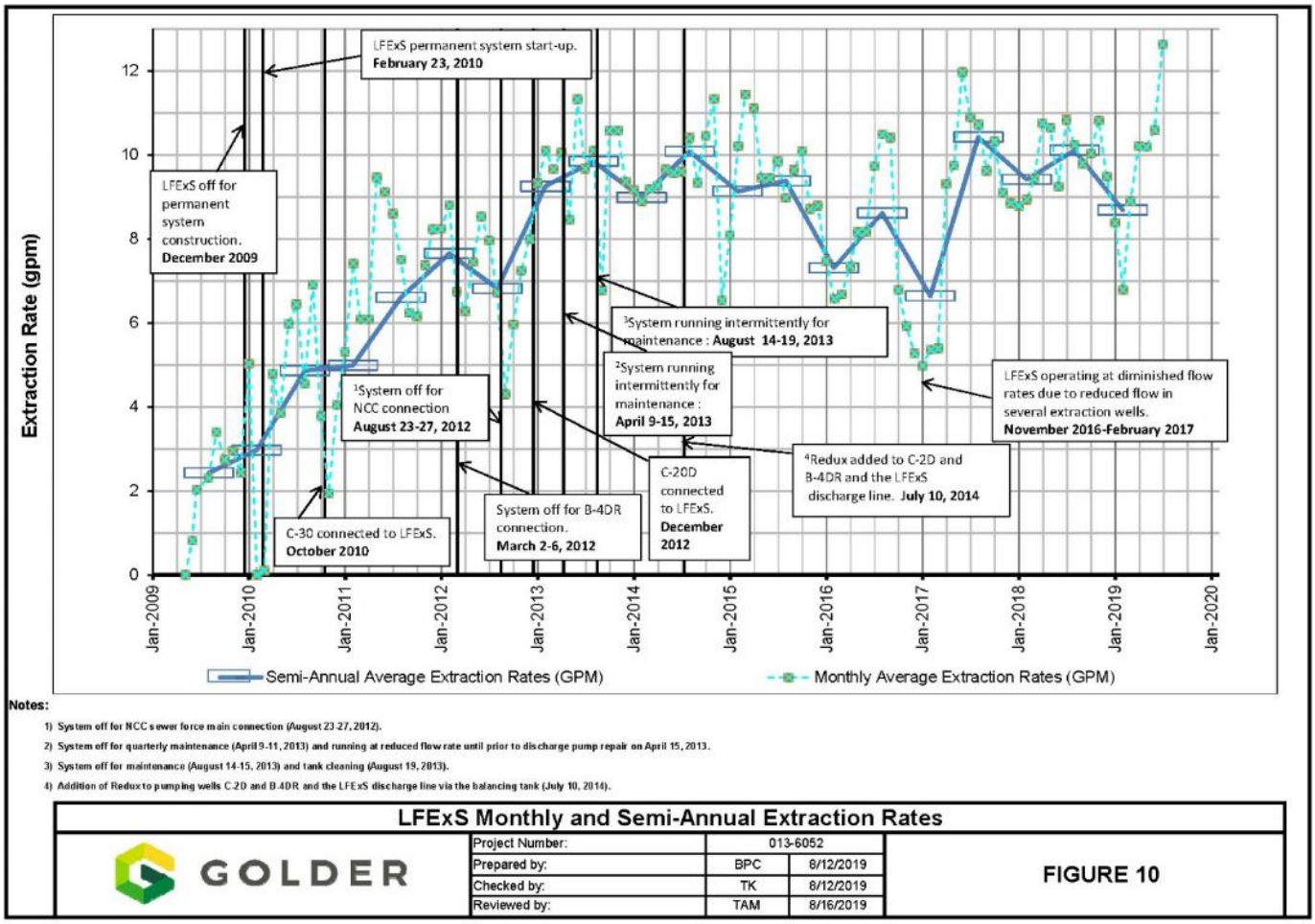
Tree growing around barbed wire on fence next to Inert Area

Vegetation growing on site fence

Gap in site fence due to removal of destroyed sliding gate

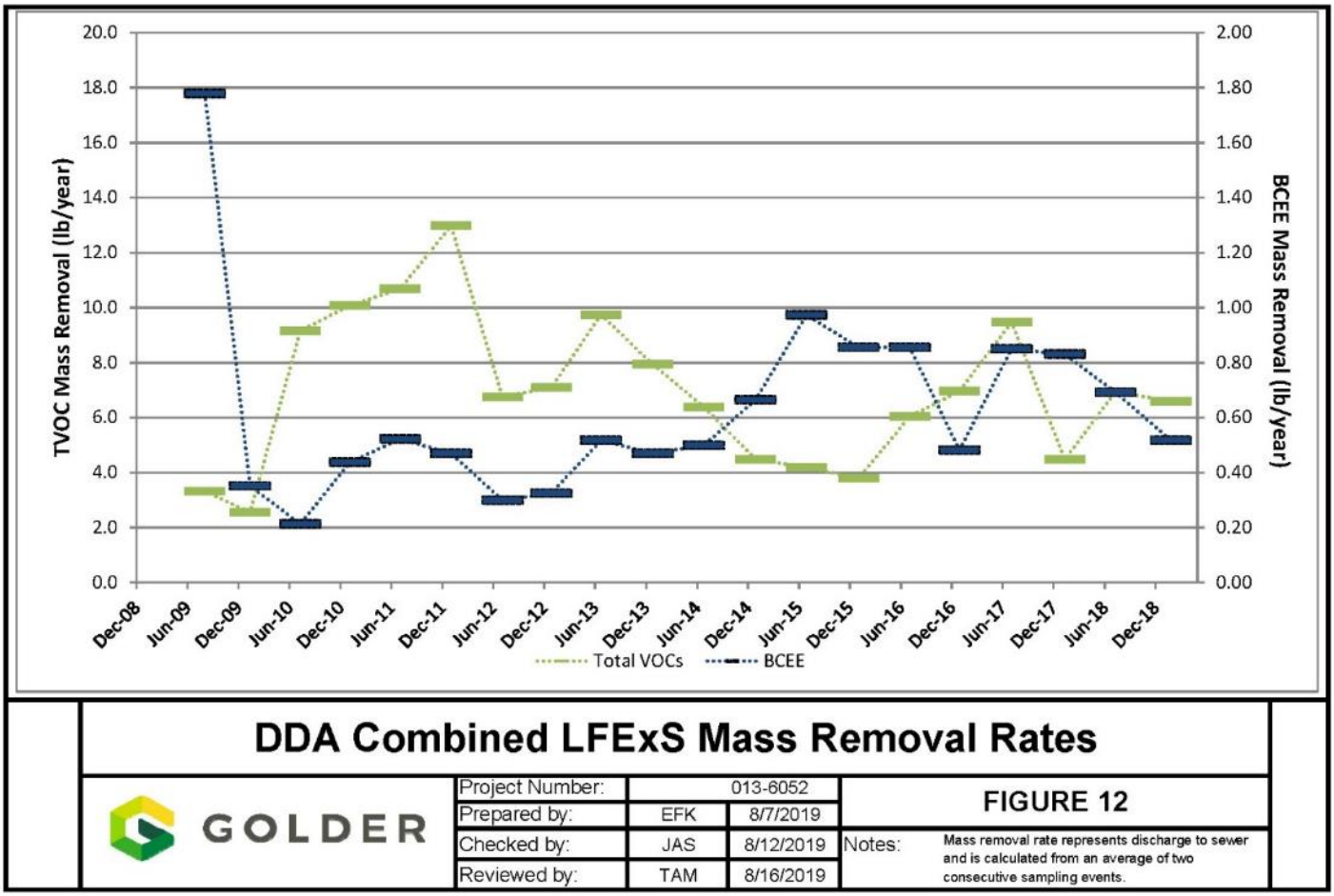
APPENDIX H – O&M CHARTS[4]

Figure H-1: LFExS Monthly and Semi-Annual Extraction Rates



[4] Source: August 2019 Semi-Annual Monitoring Report

Figure H-2: DDA Combined Mass Removal Rates



DDA Combined LFExS Mass Removal Rates

GOLDER

Project Number:	013-6052		FIGURE 12
Prepared by:	EFK	8/7/2019	
Checked by:	JAS	8/12/2019	Notes: Mass removal rate represents discharge to sewer and is calculated from an average of two consecutive sampling events.
Reviewed by:	TAM	8/16/2019	

Note: TVOC mass removal does not include 1,4, dioxane in calculation since it is not analyzed for in the TTO sample.

Figure H-3: Individual Extraction Well Mass Removal Rates

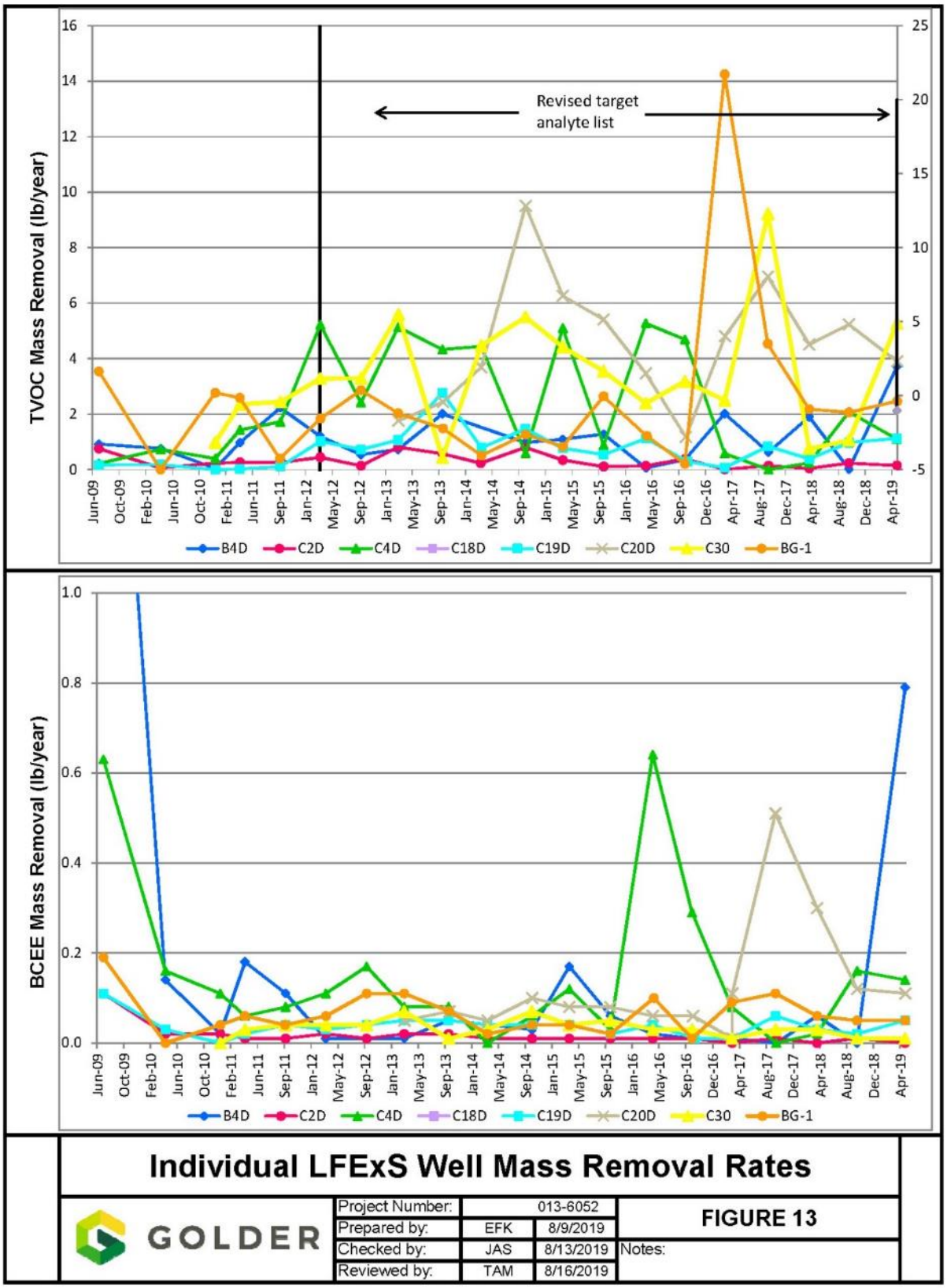
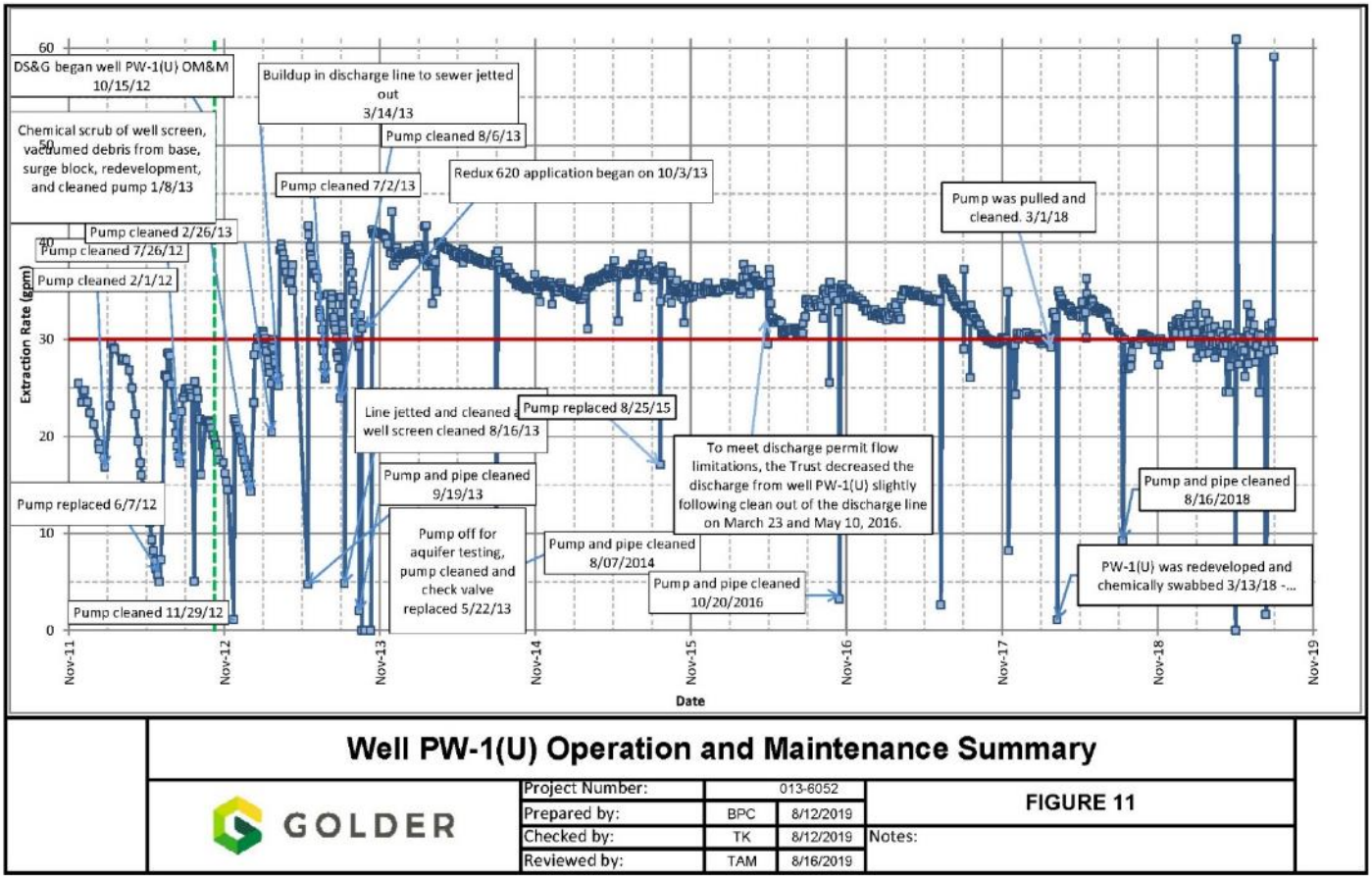


Figure H-4: PW-1 O&M Summary

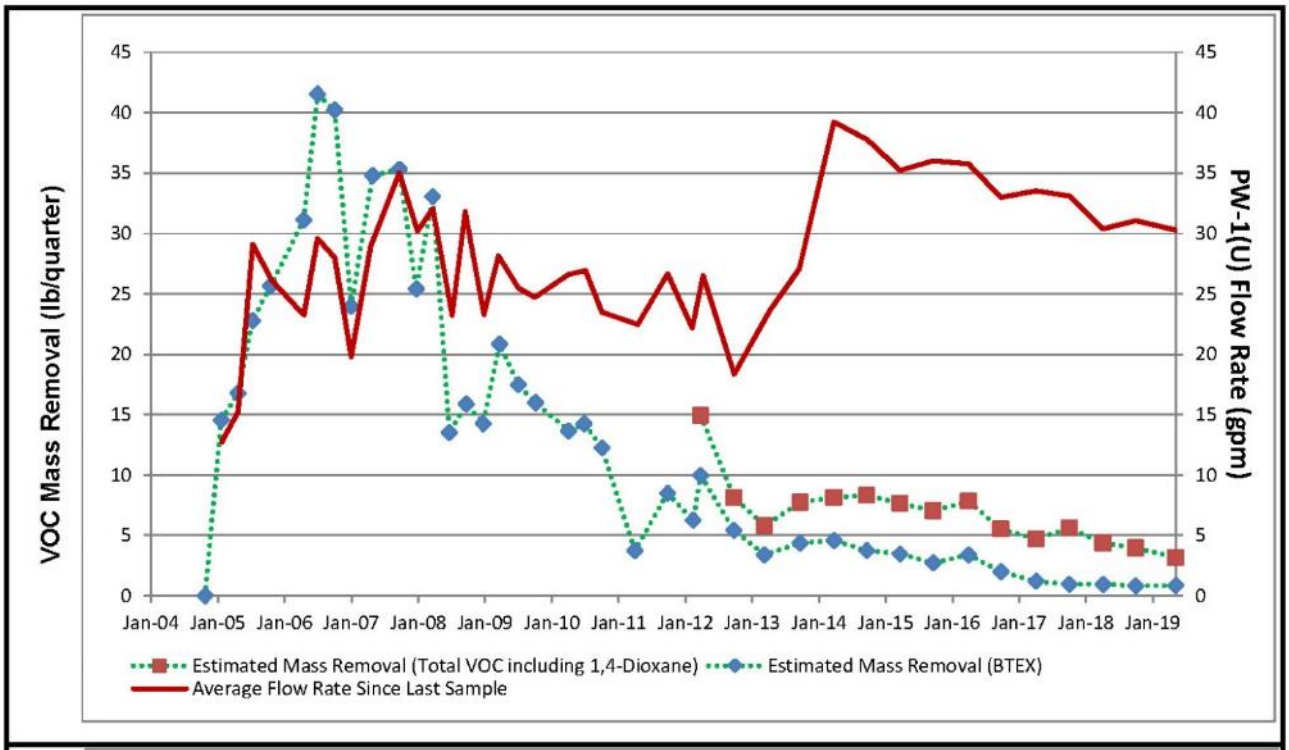


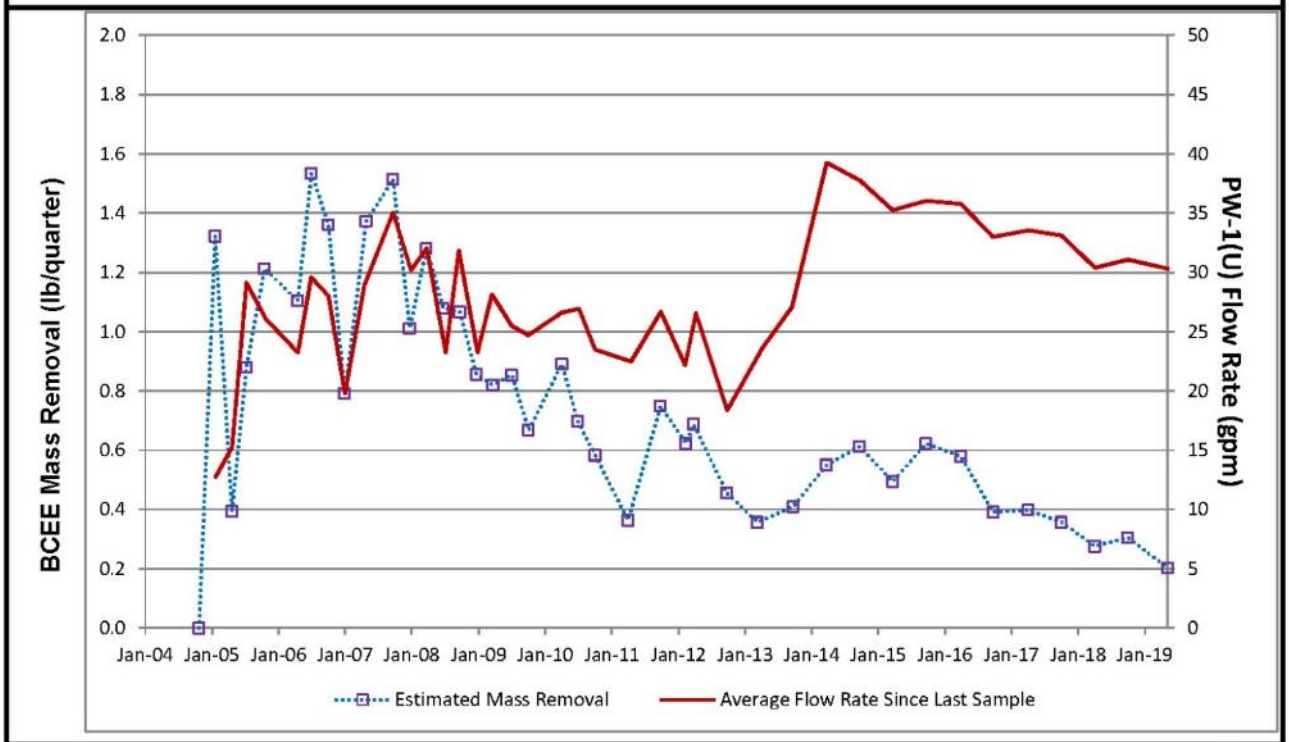
Well PW-1(U) Operation and Maintenance Summary

GOLDER

Project Number:	013-6052		FIGURE 11
Prepared by:	BPC	8/12/2019	
Checked by:	TK	8/12/2019	Notes:
Reviewed by:	TAM	8/16/2019	

Figure H-5: Well PW-1 Mass Removal Rates





Well PW-1(U) Mass Removal Rates

GOLDER

Project Number:	013-6052		FIGURE 14
Prepared by:	EFK	8/9/2019	
Checked by:	BPC	8/16/2019	Notes:
Reviewed by:	TAM	8/16/2019	

APPENDIX I – DETAILED DATA ANALYSIS

Data collected during this FYR period include groundwater monitoring data, performance monitoring for the extraction systems (LFExS and PW-1), effluent discharge monitoring, public water supply data, LFG and indoor air.

Groundwater Monitoring

The DS&G Remedial Trust conducted groundwater monitoring in accordance with the 2011 Feasibility Study Work Plan Sampling and Analysis Plan as well as sampling of additional monitoring wells in support of the ongoing pre-design activities. The groundwater monitoring spans four water-bearing units as follows:

- Columbia Aquifer
- UPCUTZ
- UPA Upper Sand
- UPA Lower Sand

The DS&G Remedial Trust conducts performance monitoring of the LFExS (Columbia Aquifer) and the PW-1 system (Columbia Aquifer, UPCUTZ and UPA Upper Sand) as well as routine monitoring downgradient of PW-1 in the UPA. Since the groundwater remedy was not functioning as intended and a new remedy was selected in the 2017 AROD, this data review focuses on the most recent data collected. Some historical context is provided as appropriate.

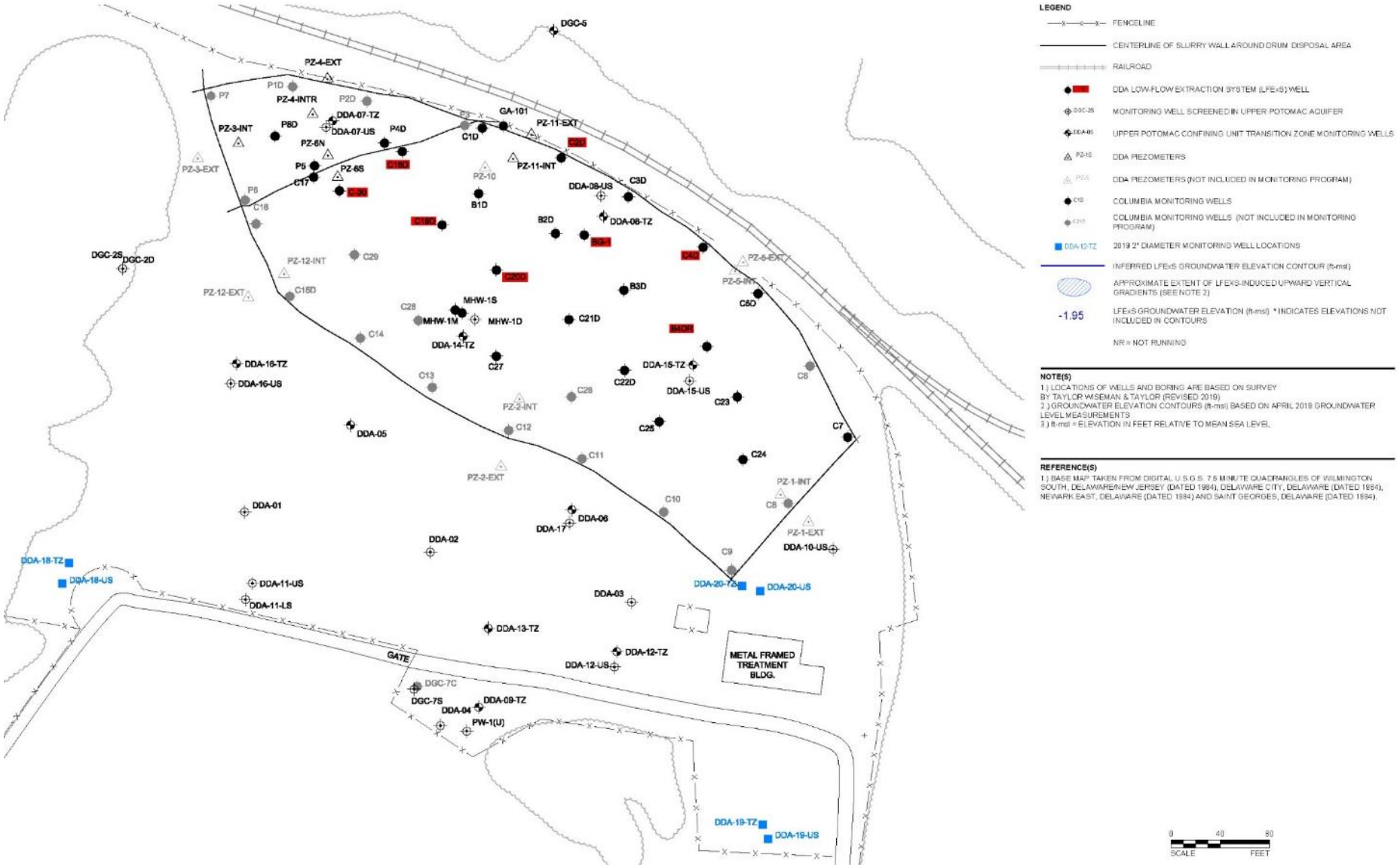
The most recent groundwater sampling event reviewed for this FYR was conducted in April and May 2019; results were reported in the *Semi-Annual Monitoring Report, January – June 2019.* Starting in 2016, in addition to the routine monitoring events, bimonthly monitoring events were voluntarily performed for four wells (MW-26N, UPA-03D, AWC-E1 and AWC-E2) located upgradient of AWC well AWC-G3R. The sampling frequency for these wells was increased to evaluate the migration of manganese and the leachate plume from the area between the DS&G and Army Creek Landfill Sites toward Artesian Water Company's Llangollen Wellfield.

The groundwater COCs include VOCs, SVOCs and metals. The primary COCs at the Site are BCEE, 1,4-dioxane and manganese. Groundwater samples are collected from DDA extraction wells, DDA monitoring wells, PW-1 monitoring wells (including UPCUTZ wells and upper sand wells), downgradient UPA wells (including Site wells and Artesian supply wells) and Army Creek Landfill UPA wells.

The groundwater monitoring locations are shown in Figures I-1 and I-2 (DDA and downgradient locations). In Appendix J, isocontour maps from the spring 2019 sampling event are provided for BCEE, 1,4-dioxane and manganese concentrations in the Columbia Aquifer (Figures J-1 through J-3), the UPCUTZ (Figures J-4 through J-6), the UPA Upper Sand (Figures J-7 through J-9) and the UPA Lower Sand (Figures J-10 through J-12). The isocontour maps for the DDA area are provided in the semi-annual monitoring report but are not included in this FYR due to low image resolution.

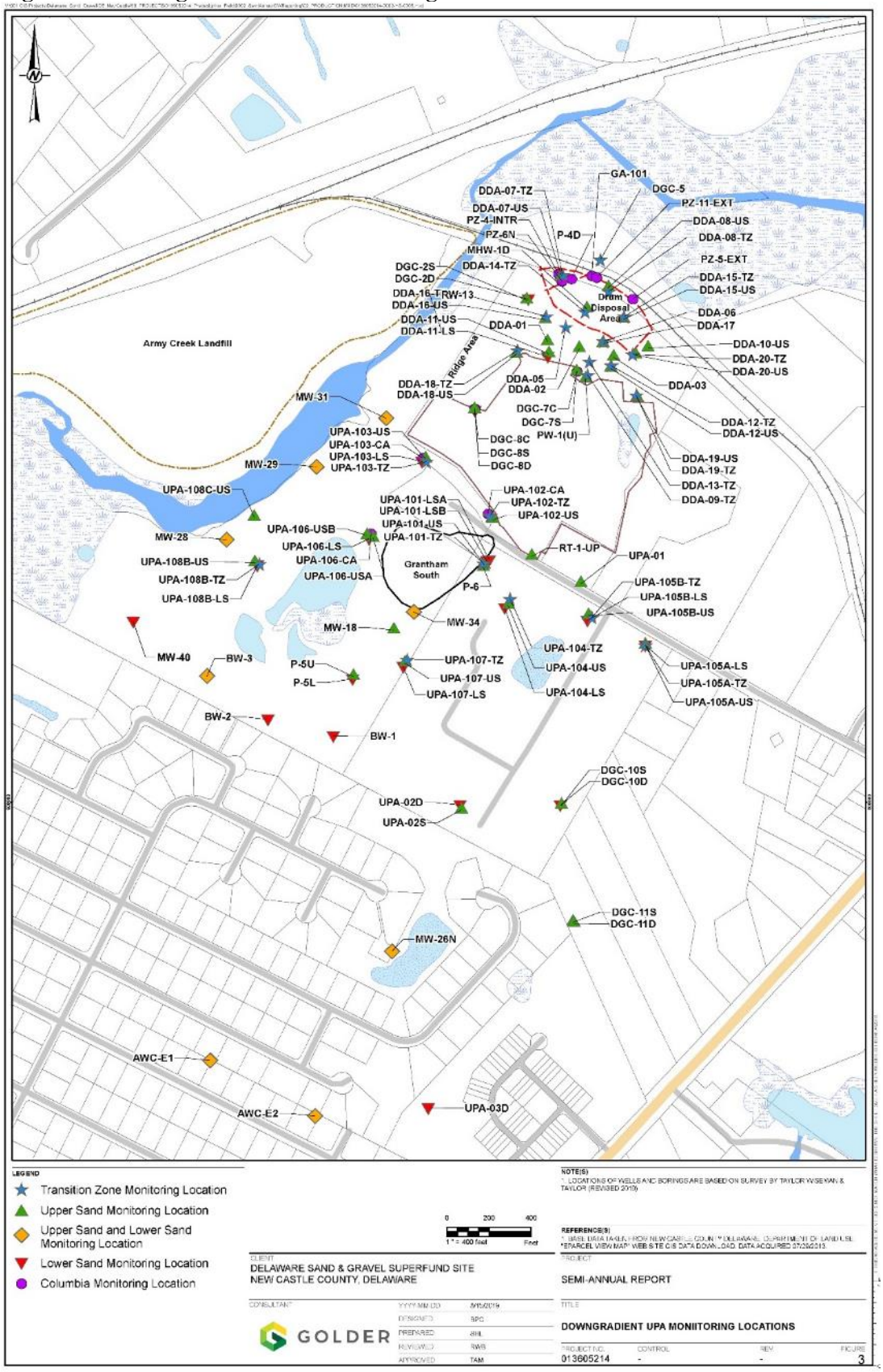
Within the Columbia Aquifer, with the exception of manganese, COC concentrations are highest within the containment area of the DDA, indicating that the LFExS is operating as intended to contain contamination (Figures J-1 and J-2 in Appendix J). Manganese concentrations cross-gradient of the Inert Area are higher than concentrations within the containment area. The highest manganese concentration in 2019 was observed in well UPA-106-CA located next to Grantham South (Figure J-3 in Appendix J).

Figure I-1: LFExS Wells, DDA and PW-1 Vicinity Monitoring Locations[5]



[5] Source: Semi-Annual Monitoring Report January - June 2019

Figure I-2: Downgradient UPA Monitoring Locations[6]



[6] Source: Semi-Annual Monitoring Report January - June 2019

The highest BCEE, 1,4-dioxane and manganese concentrations continue to occur in the UPCUTZ downgradient of the DDA (Figures J-4 through J-6). In 2019, BCEE concentrations ranged from less than detection limit to 300 µg/L (PRG = 0.14 µg/L); 1,4-dioxane concentrations ranged from less than detection limit to 1,400 µg/L (PRG = 4.6 µg/L); and manganese concentrations ranged from 23.4 to 30,400 µg/L (PRG = 260 µg/L). Within the UPA (Upper and Lower Sand), the highest concentrations of BCEE occur in the P-6 area (located east of Grantham South). Just south of Army Creek, downgradient of the Army Creek Landfill, the highest concentration of 1,4-dioxane within the UPA was detected at 660 µg/L in well UPA-108C-US (Figure J-8, Appendix J). The BCEE and 1,4-dioxane plumes extend south in the UPA to Artesian Water Company wells (Figure J-7, J-8, J-10 and J-11 in Appendix J). Manganese concentrations within the UPA remain elevated across the Site and exceedances of the PRGs extend to the Artesian Water Company public water supply wells (Figure J-9 and J-12). The Preliminary Design Investigation is ongoing and semi-annual monitoring will continue.

LFExS

Groundwater elevations both within and outside the containment area are measured to ensure the LFExS is maintaining both an upward (vertical) and an inward (horizontal) gradient. The LFExS currently has eight operational extraction wells (wells C2D, C19D, C18D, BG-1, C4D, B4DR, C-30 and C20D as shown on Figure I-1) that provide hydraulic containment within the DDA by inducing inward (horizontal) gradients in the Columbia Aquifer across the slurry wall, and upward (vertical) gradients between the Upper Potomac Aquifer upper sand and the Columbia Aquifer (i.e., maintaining a lower potentiometric head within the DDA).

The positive vertical head differences observed since initiation of LFExS extraction in May 2009 indicate that the LFExS generally induces an upward (vertical) gradient across the most impacted portions of the DDA containment area (which coincide with the DDA extraction wells). During times when the extraction wells are not operating due to routine maintenance, the vertical head difference is closer to zero. A neutral or slightly negative vertical head difference is apparent at two locations within the DDA containment area (C-6 and C-16). Well C-6 is located in an area of low VOC and SVOC concentrations and is considered outside the target capture zone. The negative head difference at well C-16 in 2015 was considered anomalous.

The positive horizontal head differences indicate the LFExS maintains an inward gradient (the Columbia Aquifer groundwater elevations outside the slurry wall are higher than inside the slurry wall). Some reduced horizontal head differences have been observed during extraction system maintenance.

PW-1

The operational effectiveness of pumping well PW-1 was evaluated in 2012 and 2016. Groundwater data (water quality and groundwater elevation) indicate that pumping well PW-1 captures some contaminant mass within the UPA upper sand and contaminant mass migrating from the UPCUTZ groundwater to the UPA upper sand groundwater to the north and northwest of well PW-1. Based on aquifer testing conducted in 2013, the areas to the east and northeast of well PW-1, and to the northwest in the area of well DDA-16-US, appear to be outside the capture zone for well PW-1.

During this FYR period, the DS&G Remedial Trust measured groundwater elevation and collected groundwater samples from 34 monitoring wells (32 wells screened in the UPCUTZ and two wells screened in the Upper Potomac Aquifer) (Figure I-1). In the UPCUTZ and the upper sand of the UPA between the DDA and pumping well PW-1, groundwater flow is from north-northwest to south-southeast toward well PW-1.

Discharge Monitoring

The LFExS and PW-1 system discharges are monitored on a semi-annual basis in accordance with the New Castle County Wastewater Discharge Permit requirements. Effluent monitoring results during this FYR period indicate there have not been any exceedances of the wastewater discharge permit limits.

Artesian Drinking Water

This FYR reviewed the annual Artesian Water Quality Reports for New Castle County. The Water Quality Reports for drinking water sources in northern New Castle County show that the water meets state and federal drinking water standards for regulated inorganic and organic contaminants.

LFG Monitoring

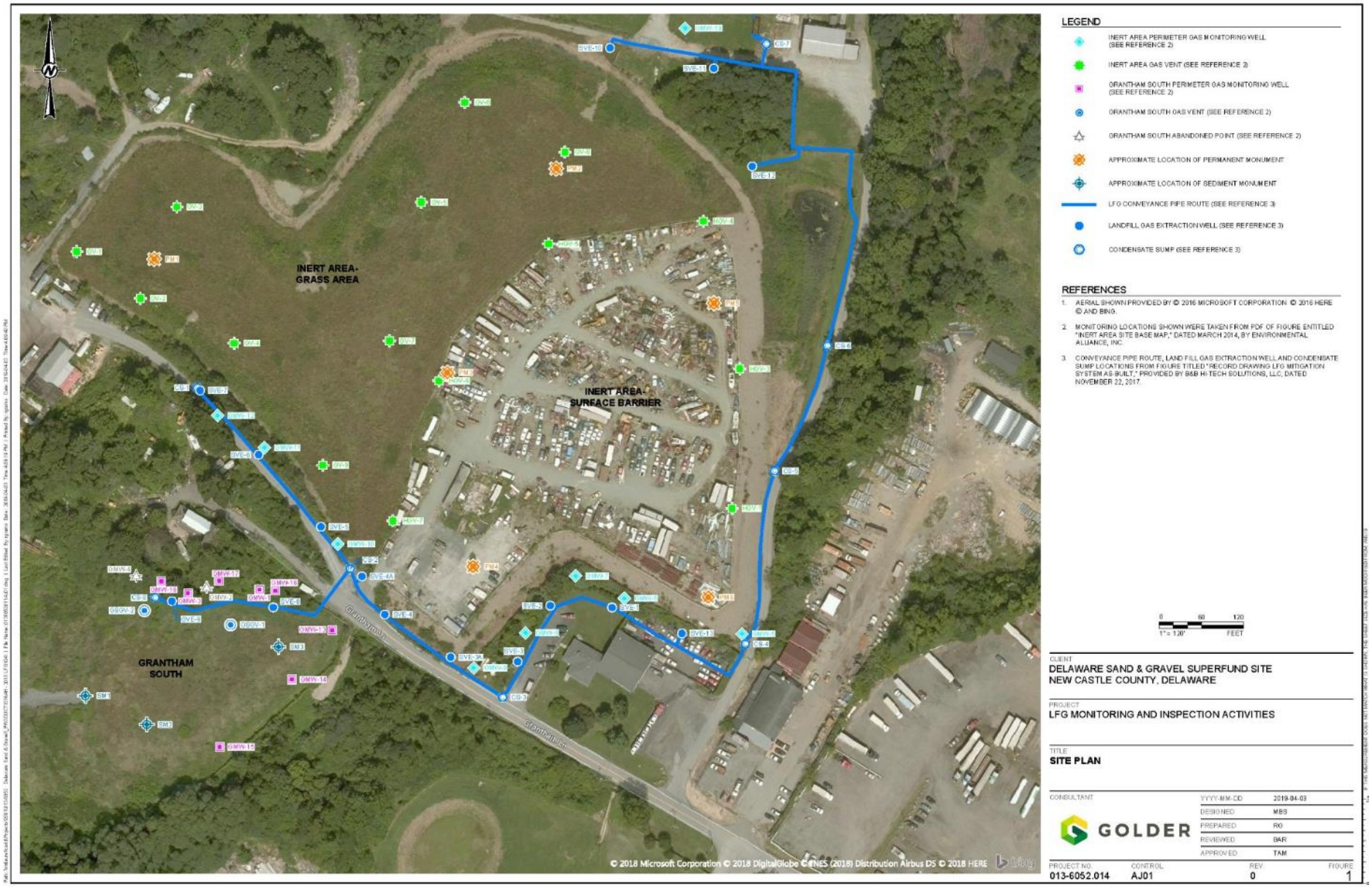
In accordance with the 2019 Operations, Monitoring and Maintenance Plan, the DS&G Remedial Trust collects gas samples four times per year from gas monitoring wells located near the edges of the Inert Area and the Grantham South Area. See Figure I-3 for a map of gas monitoring well locations. The gas monitoring consists of three steps, or tiers, for each well. In Tier 1, the level of combustible gas is measured. If the level is greater than 25% of the lower explosive limit, then Tier 2 monitoring is conducted, which entails measuring the combustible gas levels while purging the well. If the combustible gas levels are still greater than 25% of the lower explosive limit, then Tier 3 monitoring is conducted, which entails measuring combustible gas levels in nearby occupied buildings. Over the past five years, combustible gas levels have been consistently greater than 25% of the lower explosive limit in most of the Inert Area and the Grantham South Area perimeter gas monitoring wells during both Tier 1 and Tier 2 monitoring. Consequently, gas levels have been measured in nearby occupied buildings as discussed in the section on Indoor Air, below.

Indoor Air

During this FYR period, methane concentrations were monitored in the air of the office building associated with the SSDS including the exterior and basement. Although not required by the Tier III monitoring, the DS&G Treatment building, offices, storage room, treatment, containment and sump areas associated with the interior of the DS&G treatment building were also monitored. The methane concentrations in these areas were 0% of the lower explosive limit and no additional action was required. Since the initiation of the monitoring program, the results of the Tier III monitoring have not triggered additional response actions outlined in the Revised O&M Plan.

Intermittently, Tier III monitoring is triggered for the residence located adjacent to Grantham South. Historically, when results of the Tier II monitoring have triggered Tier III monitoring in the residence, the DS&G Remedial Trust has monitored the basement when access is granted. Access has not been granted by the owner since June 2014. Due to concerns about the structural integrity of the eastern portion of the residence (unoccupied portion with a basement), the Trust has determined that it would be unsafe to enter and monitor the basement area. In September 2015, the DS&G Remedial Trust purchased a plug-in methane alarm, provided the methane alarm to the owner and requested that he install the alarm in the western (occupied) portion of the residence. The residence has been unoccupied since late 2019.

Figure I-3: Gas Monitoring Locations[7]



[7] Source: July 1 – September 30, 2019 Summary of Site Maintenance Activities and Operating Highlights, Attachment 3

APPENDIX J – DATA ANALYSIS ISOCONTOUR MAPS

Figure J-1: 2019 Downgradient, BCEE Concentrations – Columbia Aquifer

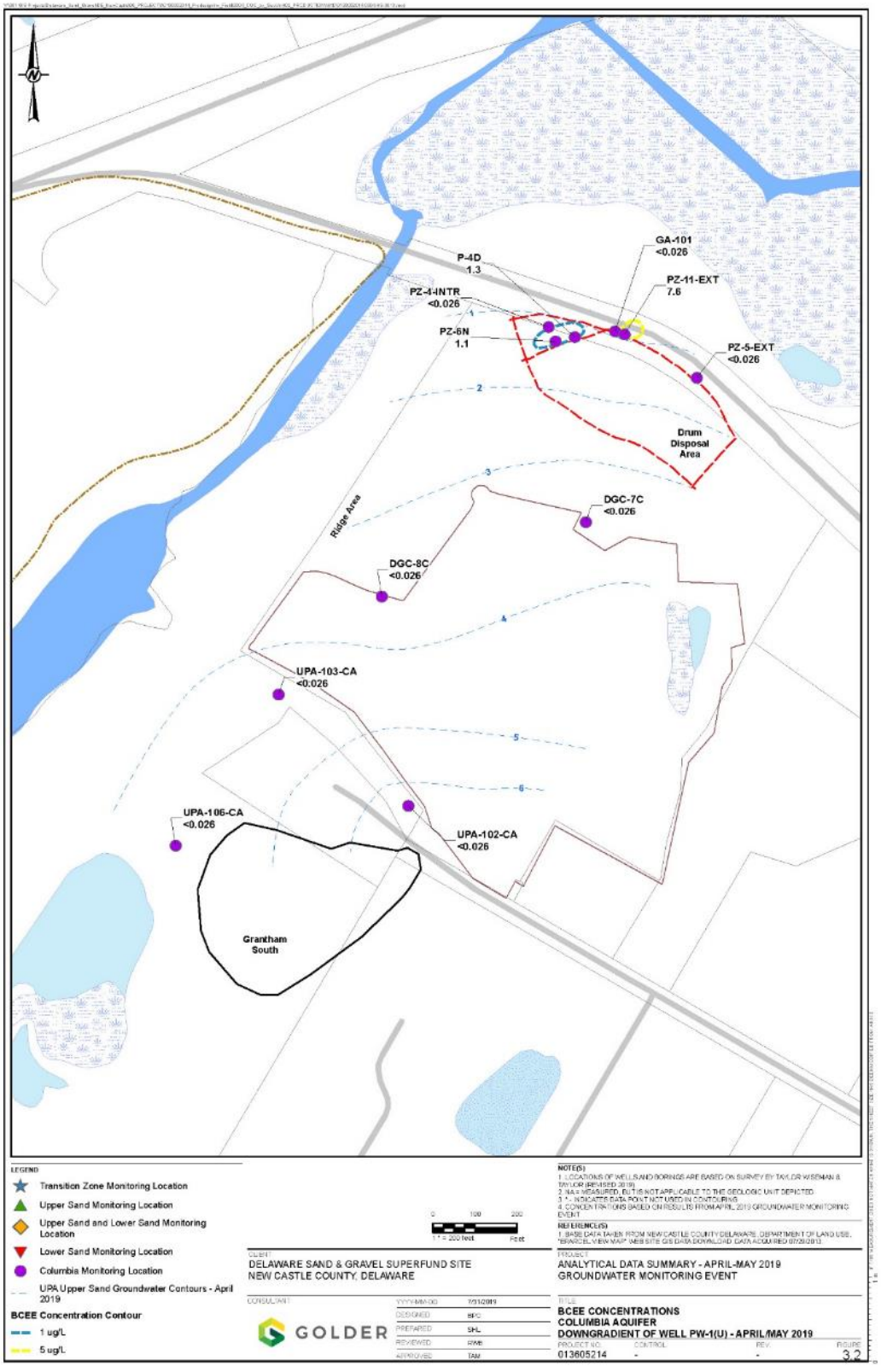


Figure J-2: 2019 Downgradient, 1,4-Dioxane Concentrations – Columbia Aquifer

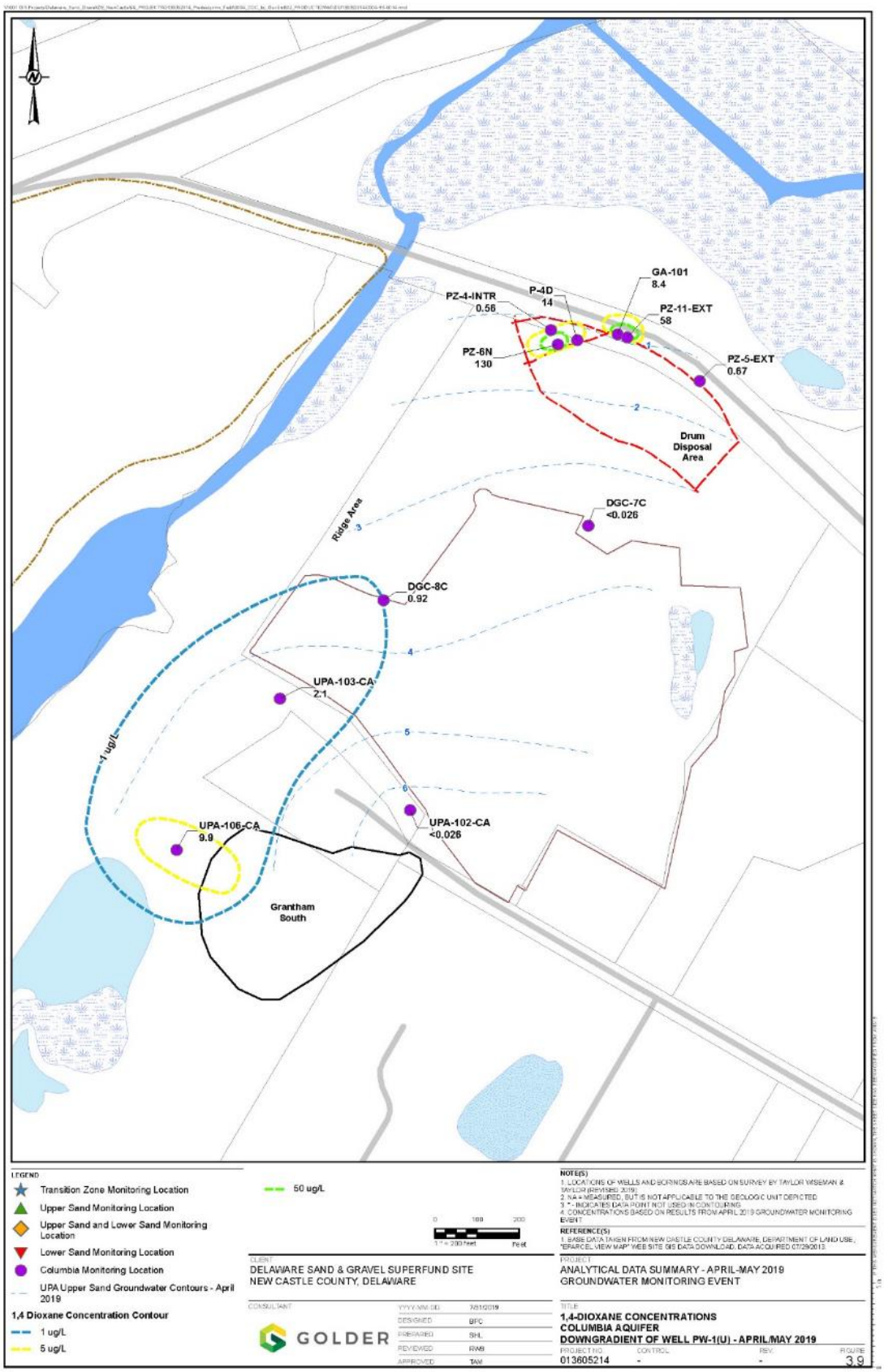


Figure J-3: 2019 Downgradient, Manganese Concentrations – Columbia Aquifer

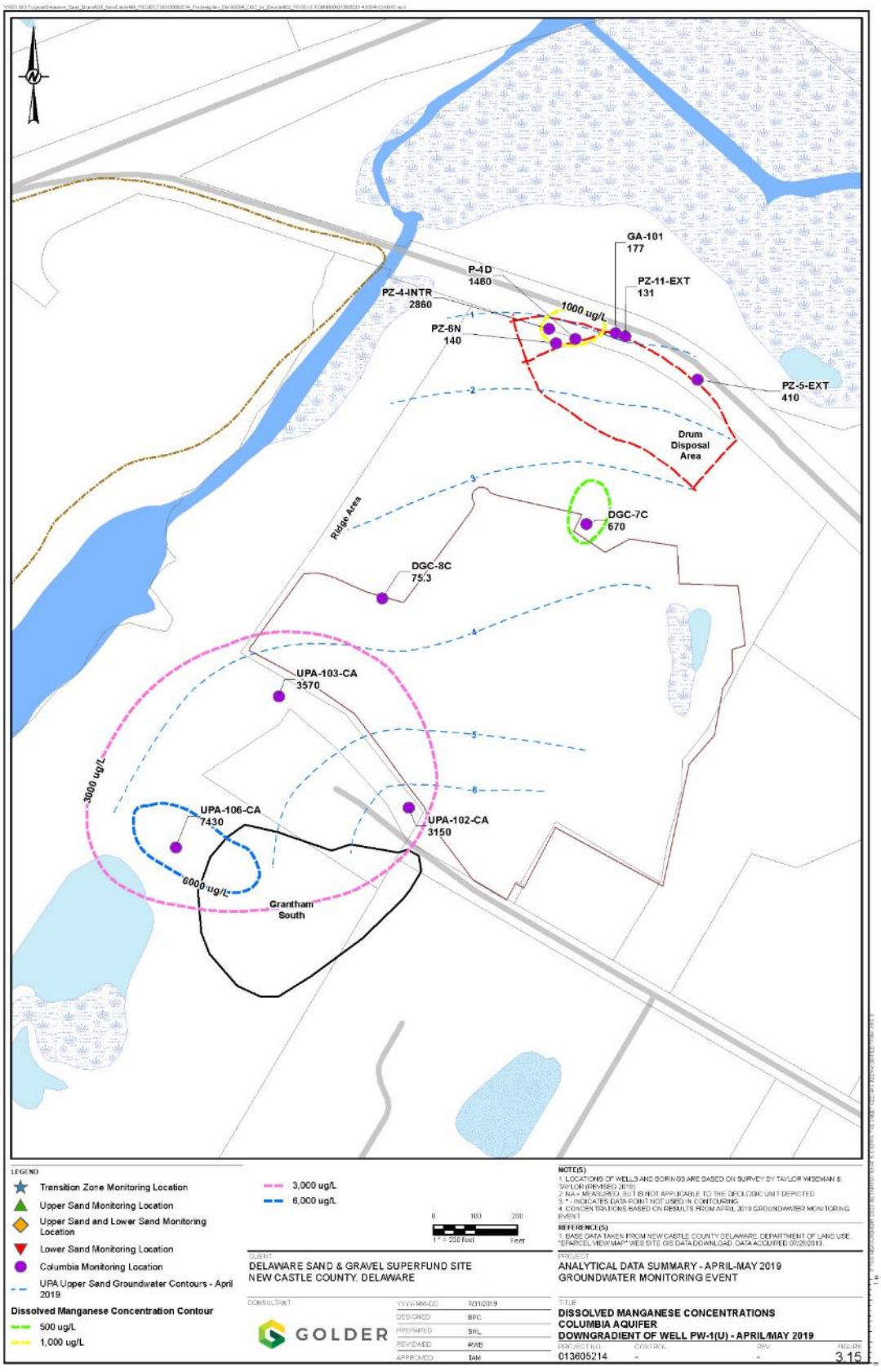


Figure J-4: 2019 Downgradient, BCEE Concentrations - UPCUTZ

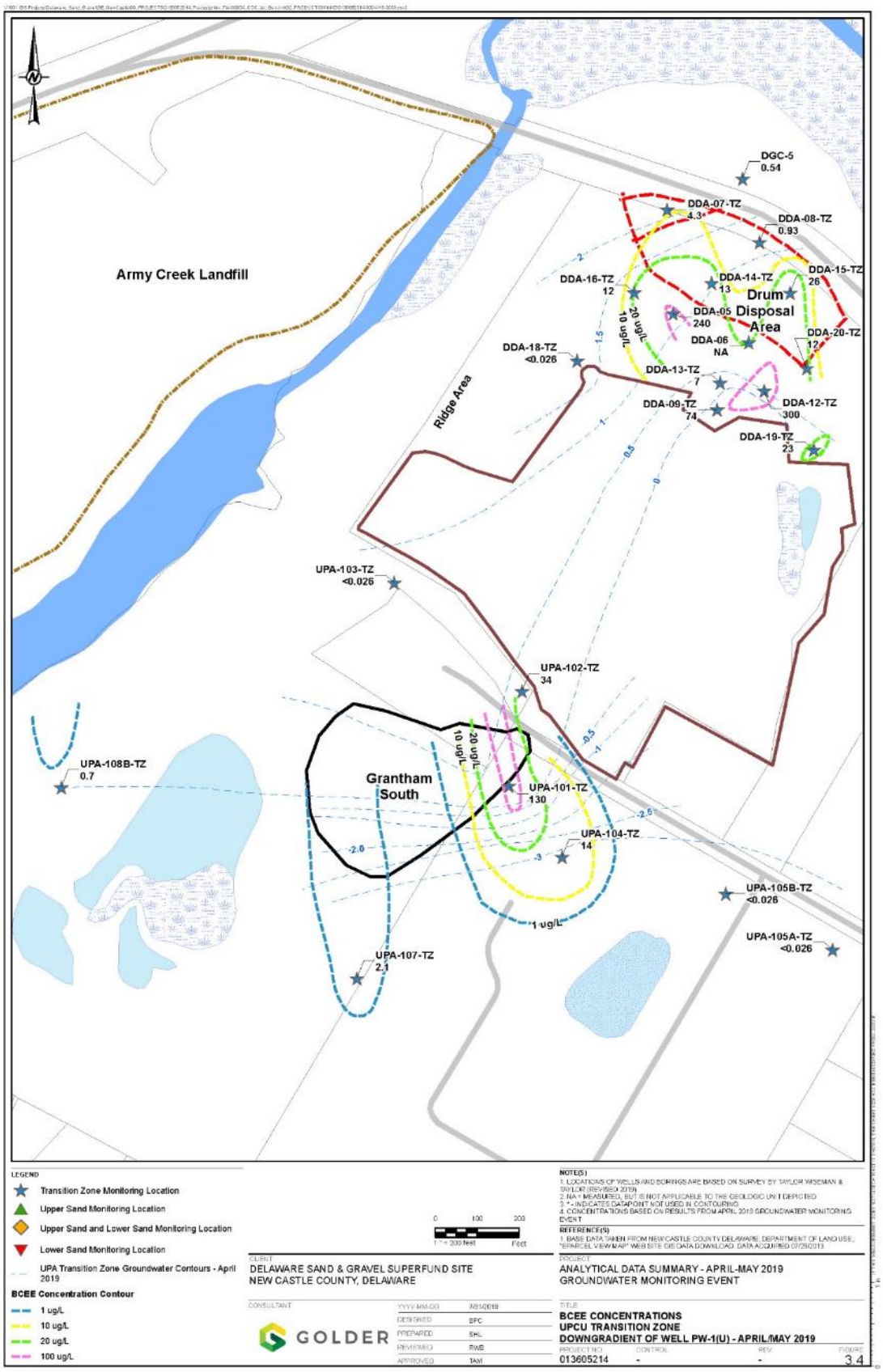


Figure J-5: 2019 Downgradient, 1,4-Dioxane Concentrations - UPCUTZ

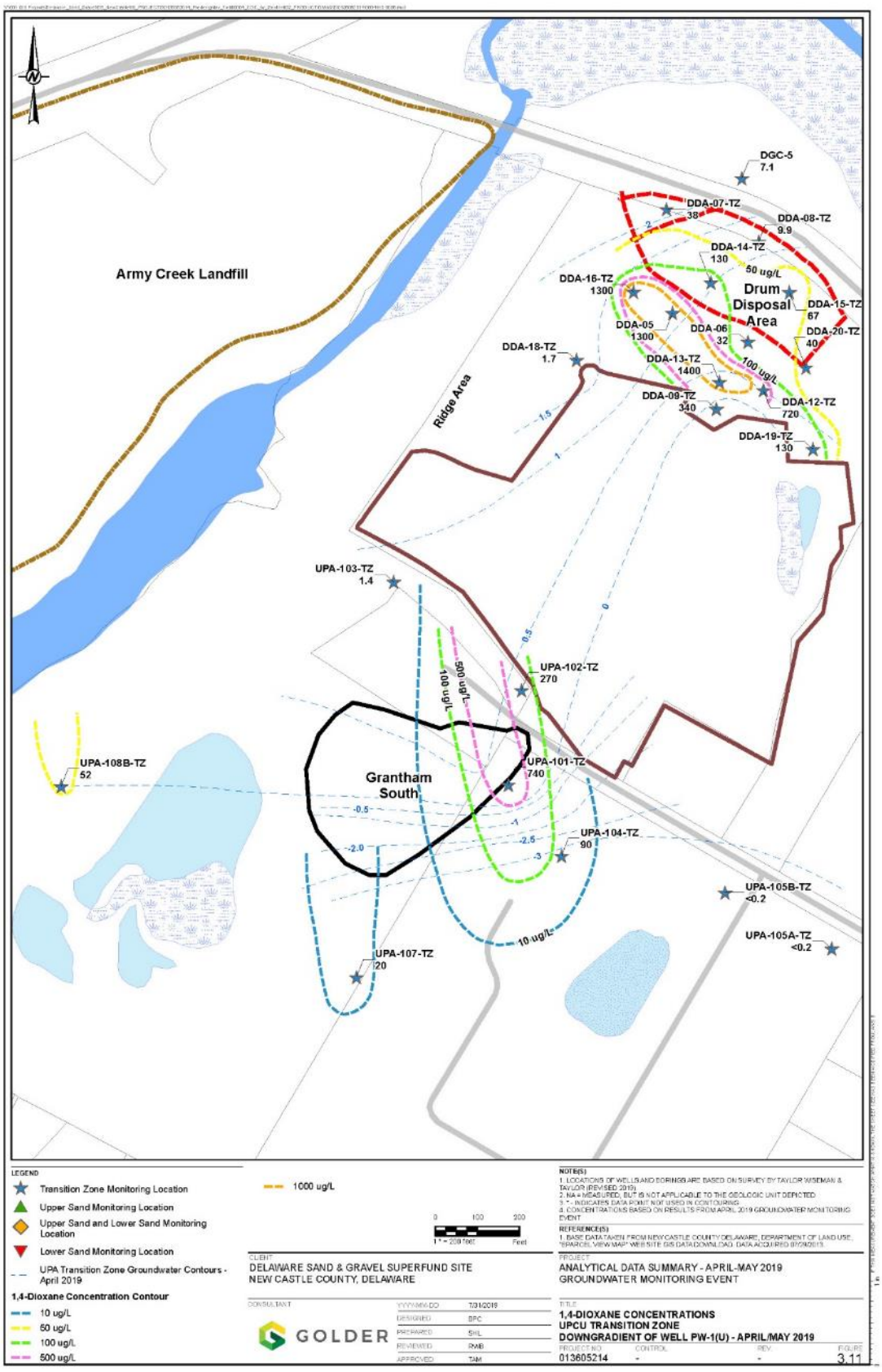


Figure J-6: 2019 Downgradient, Manganese Concentrations – UPCUTZ

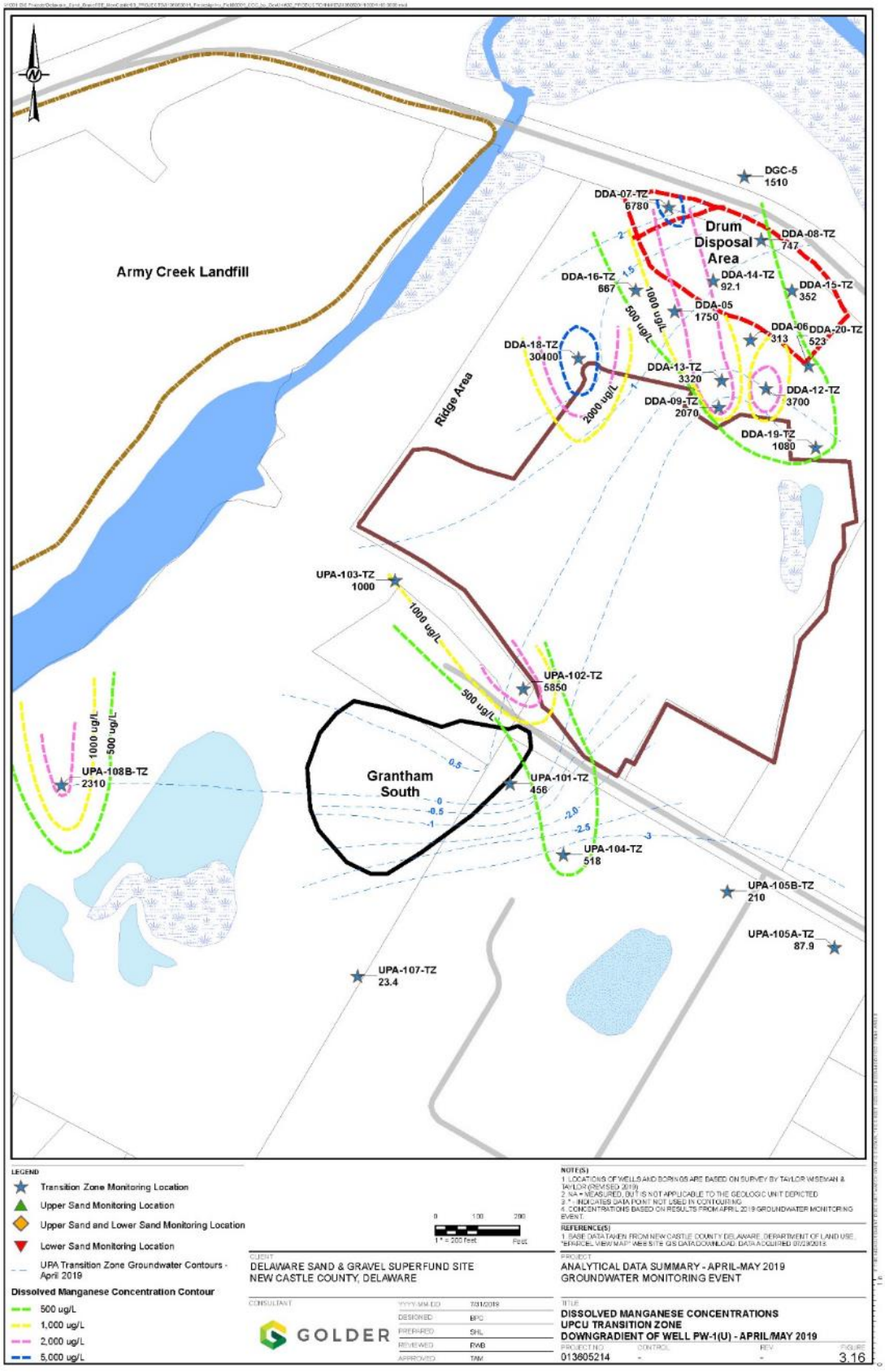


Figure J-7: 2019 Downgradient, BCEE Concentrations – UPA Upper Sand

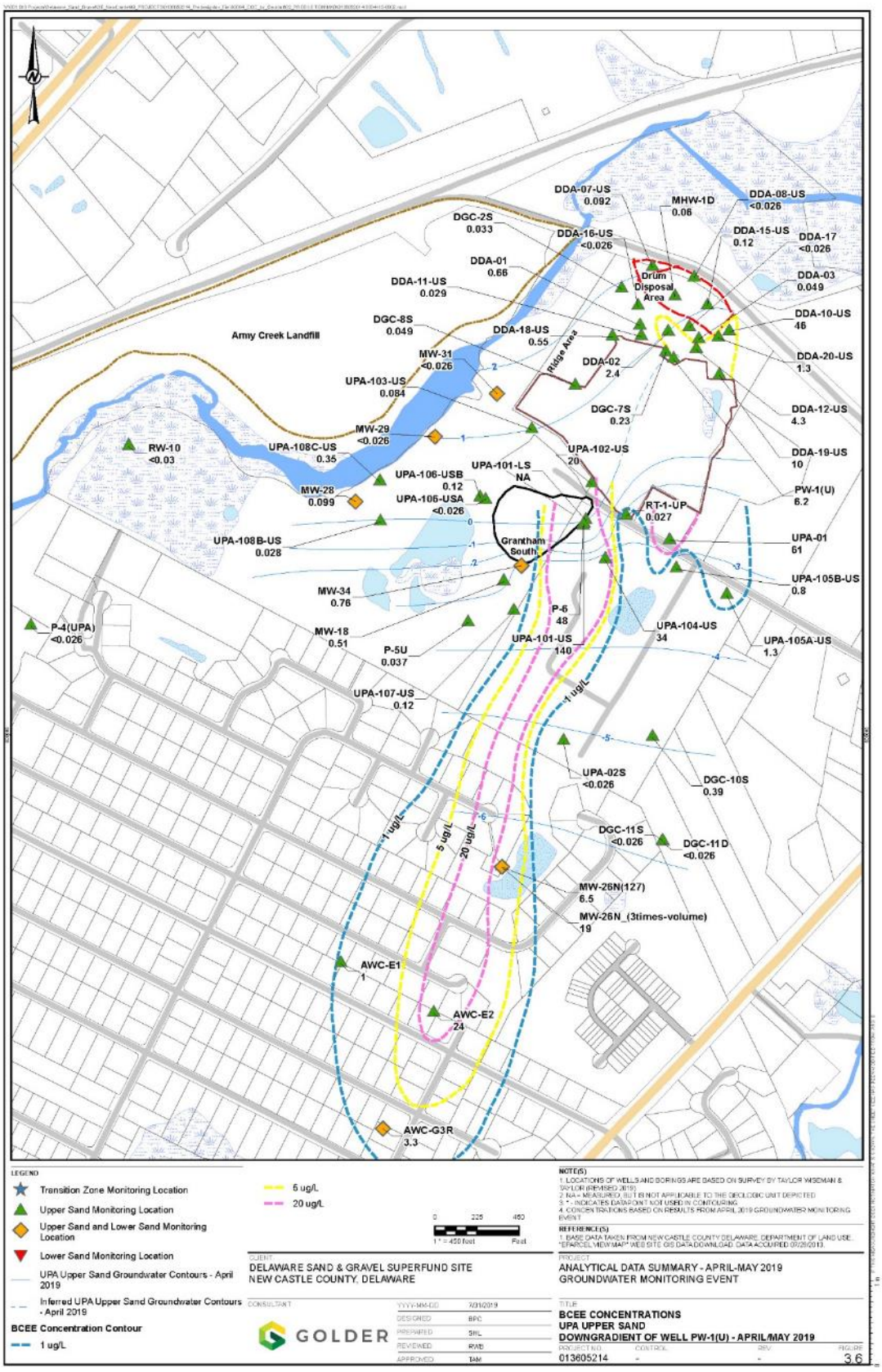


Figure J-8: 2019 Downgradient, 1,4-Dioxane Concentrations – UPA Upper Sand

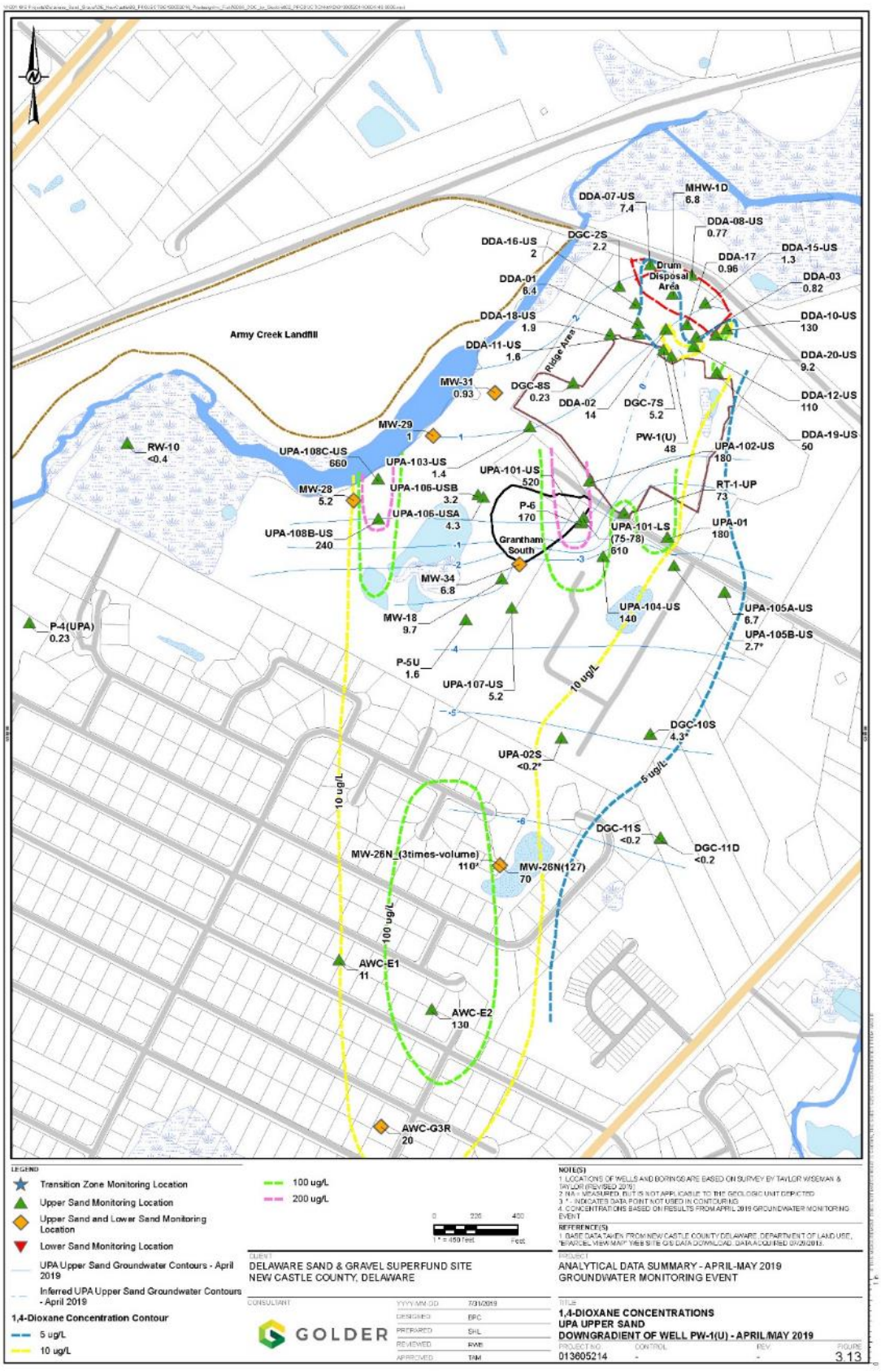


Figure J-9: 2019 Downgradient, Manganese Concentrations – UPA Upper Sand

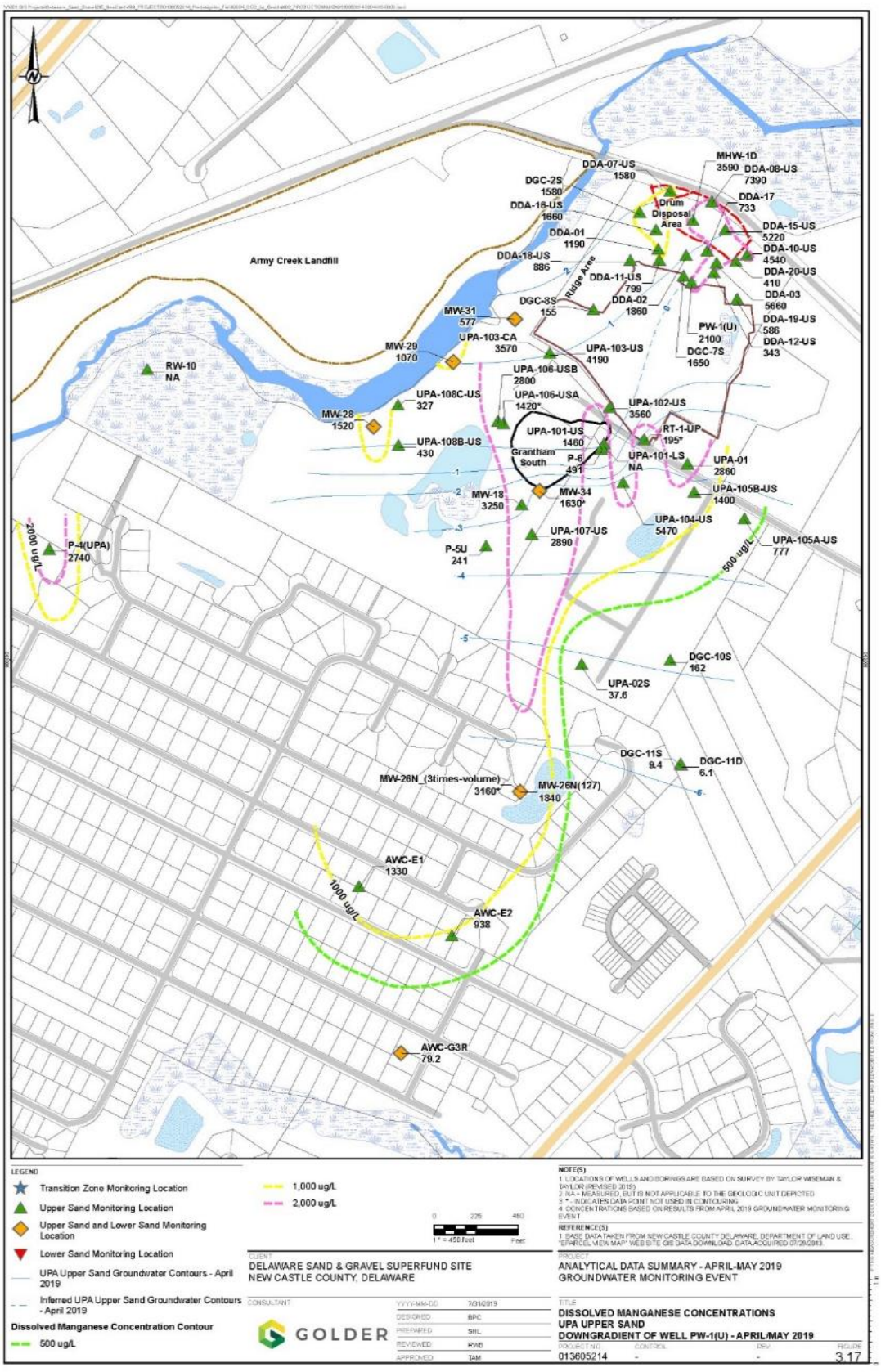


Figure J-10: 2019 Downgradient, BCEE Concentrations – UPA Lower Sand

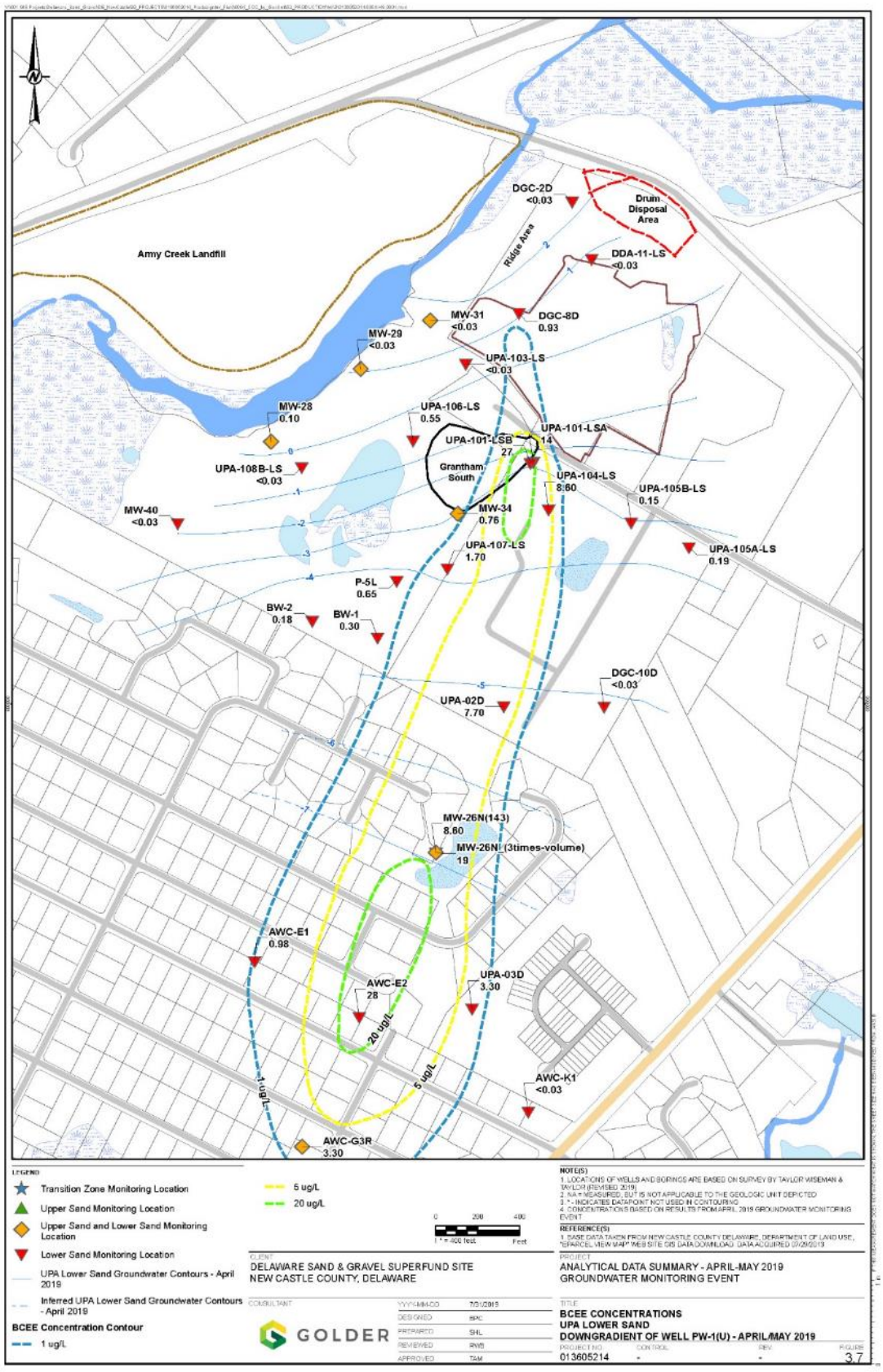


Figure J-11: 2019 Downgradient, 1,4-Dioxane Concentrations – UPA Lower Sand

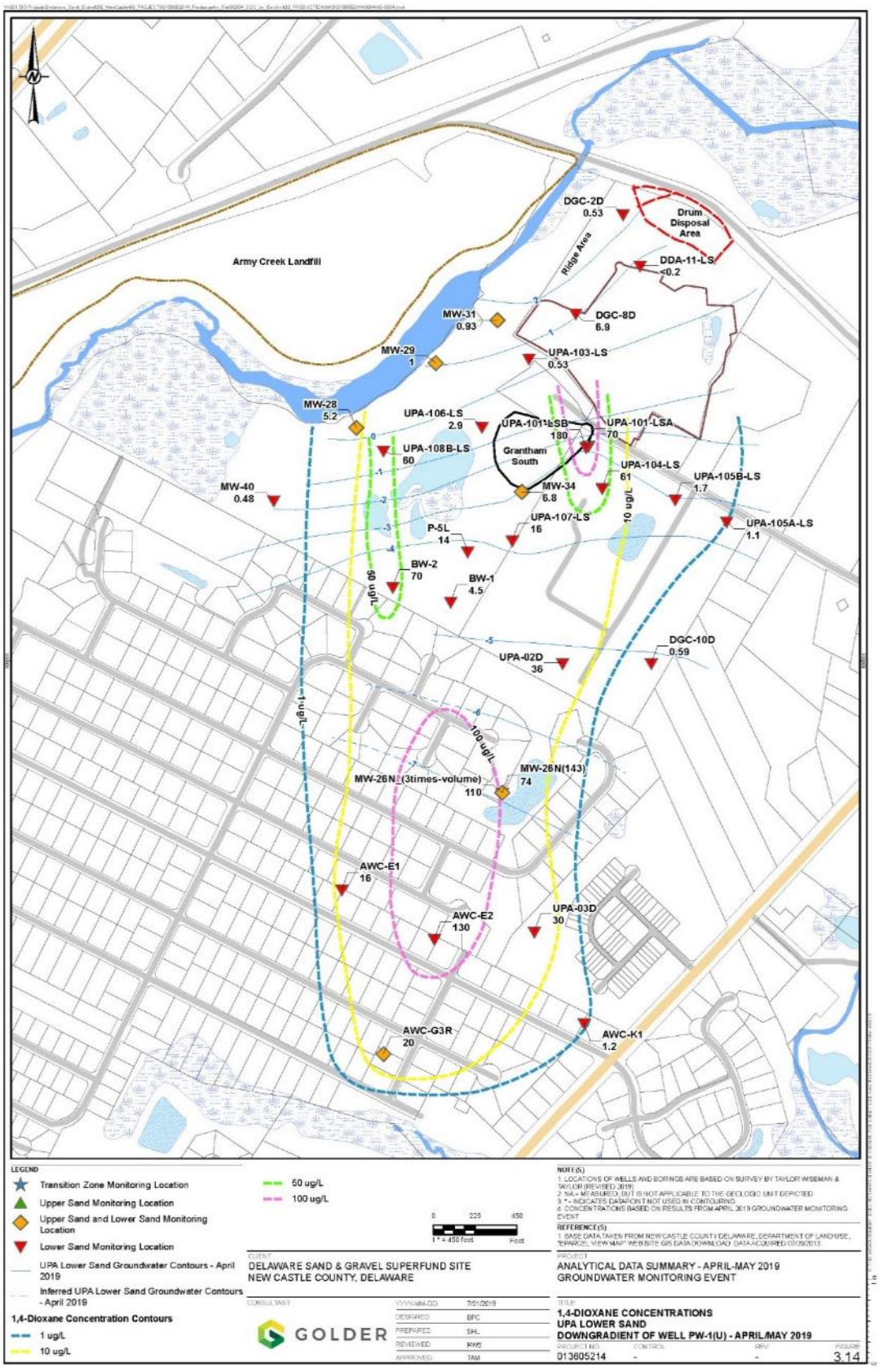
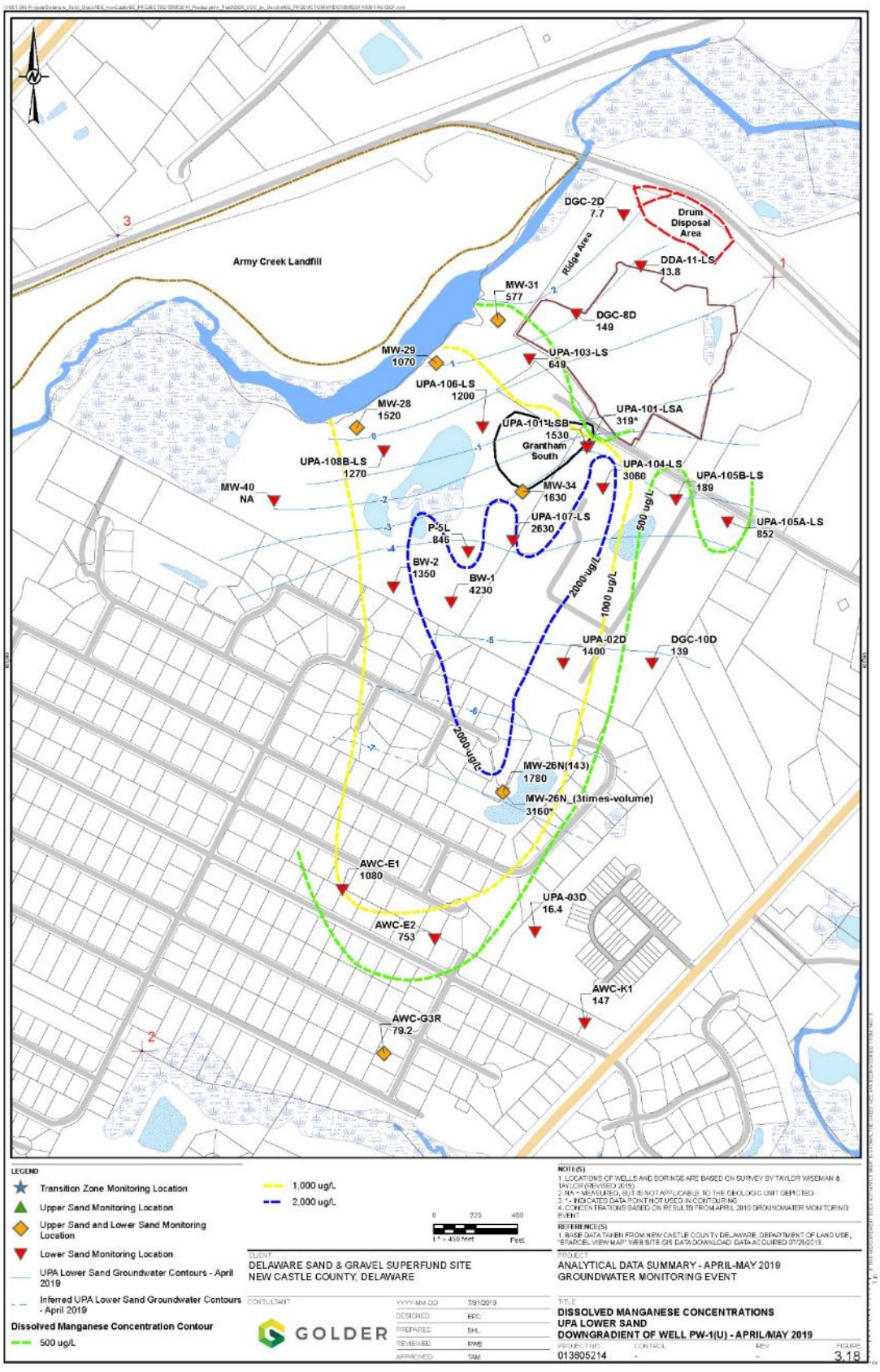


Figure J-12: 2019 Downgradient, Manganese Concentrations – UPA Lower Sand



APPENDIX K – SOIL CLEANUP GOALS REVIEW

The 1993 AROD specified site-specific soil cleanup goals for the DDA and the Ridge Area based on protection of groundwater. Soil cleanup standards for the DDA assume the existence of the slurry wall and the multi-layer cap, whereas the model-developed cleanup standards for the Ridge Area did not include the engineering controls. Therefore, the soil cleanup standards for the Ridge Area are more stringent than those calculated for the DDA. The DS&G Remedial Trust removed contaminated soil from the Ridge Area in 1995, meeting the soil cleanup levels specified in the 1993 AROD. These cleanup levels, developed for the protection of groundwater, continue to be protective for residential and industrial exposure to contaminated soil based on EPA's current screening levels. However, the cleanup levels are less stringent than EPA's current default soil screening levels for protection of groundwater based on a dilution attenuation factor of 1 (see Table K-1). As indicated in the previous FYR, EPA reviewed contaminated groundwater data and concluded that any remaining soil contamination at the Ridge Area is not affecting groundwater quality in the Upper Potomac Aquifer. Therefore, EPA does not plan to update the cleanup levels for Ridge Area soil.

Table K-1: Soil Cleanup Goals Review – Ridge Area

Soil Contaminant	Cleanup Goal from 1993 ROD Amendment (mg/kg)	Current Regional Screening Level (mg/kg)[a]				
		Residential Cancer	Residential Non-cancer	Industrial Cancer	Industrial Non-cancer	Protection of Groundwater
BCEE	0.00077	0.23	NA	1	NA	0.00000361
Bis(2-chloroisopropyl)ether	0.093	NA	NA	NA	NA	NA
Methylene chloride	0.812	57	350	1,000	3,200	0.00291

Notes:
mg/kg = milligrams per kilogram
NA = Regional screening level not available
a = Current Regional screening levels located here: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables (accessed on 4/1/2020)