SIXTH FIVE-YEAR REVIEW REPORT FOR HERTEL LANDFILL SUPERFUND SITE ULSTER COUNTY, NEW YORK

Prepared by

U.S. Environmental Protection Agency
Region 2
New York, New York

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BERA	Baseline Ecological Risk Assessment
BHHRA	Baseline Human Health Risk Assessment
BOD	Biochemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
COD	Chemical Oxygen Demand
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
ICs	Institutional Controls
LEL	Lowest Effects Level
MCLs	Maximum Contaminant Levels
µg/L	microgram per liter
mg/kg	milligrams/kilogram
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operation and Maintenance
OU	Operable Unit
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated biphenyls
PRP	Potentially Responsible Party
RD/RA	Remedial Design/Remedial Action
RAO	Remedial Action Objectives
RL	Reporting Limit
RSLs	Regional Screening Levels
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UCDOH	Ulster County Department of Health
VOC	Volatile Organic Compound
WQS	Water Quality Standards

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment and is functioning as intended by the decision documents. The methods, findings, and conclusions of reviews are documented in the FYR. 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 review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the sixth FYR for the Hertel Landfill Superfund site (Site), located in the Town of Plattekill, Ulster County, New York. The triggering action for this statutory review is the signature date of the previous FYR, which was February 21, 2020. A FYR is required at this Site because the remedial actions selected at the Site will leave hazardous substances, pollutants, or contaminants on Site above levels that allow for unlimited use and unrestricted exposure.

The Site is being addressed in one operable unit (OU). This OU is the subject of this FYR.

The Site FYR was led by EPA: Lorenzo Thantu, Remedial Project Manager (RPM). Participants included Damian Duda (Supervisor), Sabrina Gonzalez (Hydrogeologist), Julie McPherson (Human Health and Ecological Risk Assessor), and Shereen Kandil (Community Involvement Coordinator). The Town of Plattekill and the Potentially Responsible Parties (PRPs) were notified of the initiation of the FYR. The FYR began on July 29, 2024.

Site Background

The Hertel Landfill Superfund site is in the Town of Plattekill, Ulster County, New York, just south of U.S. Route 44/NY Route 55 and approximately midway between Bedell Avenue and Tuckers Corner Road (**Figure 1**). An approximate 15-acre portion of the 80-acre Site property was a waste disposal area that was established in 1963 as a private landfill accepting municipal and industrial waste (**Figure 2**). In 1976, the Ulster County Department of Health (UCDOH) revoked the landfill permit for numerous violations, including allegations of illegal industrial dumping. This UCDOH action and a Town of Plattekill ordinance prohibiting the dumping of out-of-town garbage resulted in the permanent closing of the Hertel Landfill in March 1977.

Wetlands border the Site property to the north, south, and east, and a small unnamed stream crosses the southern and eastern portion of the Site and flows adjacent to the landfill. The unnamed stream flows into Pancake Hollow Creek and then Black Creek and then the Hudson River. There are two aquifers beneath the Site, an overburden glacial till aquifer and a bedrock aquifer, the Austin Glen formation.

The Site and the surrounding area are zoned residential. Approximately 1,350 people live within three miles of the landfill, and approximately 500 people live within a mile of the Site. Residents in the area obtain their drinking water from individual drinking water wells. No permanent structures are currently located on the Site.

The Site was placed on EPA's National Priorities List (NPL) in June 1986. Please refer to 1) **Appendix C** for a list of Site documents utilized to perform this FYR and 2) **Appendix D** for a chronology of Site events.

SIXTH FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Hertel Landfill Site		
EPA ID: NYD0980780779		
Region: 2	**State:** NY	**City/County:** Town of Plattekill/Ulster County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Lorenzo Thantu		
Author affiliation: EPA		
Review period: 7/29/2024 - 12/31/2024		
Date of site inspection: 9/5/2024		
Type of review: Statutory		
Review number: 6		
Triggering action date: 2/21/2020		
Due date *(five years after triggering action date)*: 2/21/2025		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

During the initial Remedial Investigation/Feasibility Study (RI/FS), which was released to the public in July 1991, a Baseline Human Health Risk Assessment (BHHRA) was performed. Both current and future land use scenarios were considered. The primary cancer and noncancer risks were associated with the future use of the Site as a residential area. The routes of exposure of most concern included dermal contact with soil, ingestion of groundwater and ingestion of soil. The contaminants of concern (COCs) included polynuclear aromatic hydrocarbons (PAHs), arsenic, chromium in soil and groundwater, and manganese in groundwater. An ecological assessment was also conducted, as part of the RI/FS, and

determined that a general trend of elevated concentrations of organic and inorganic contaminants, which included arsenic, iron, lead, manganese, chromium, thallium and benzene, existed in one or more environmental media at the Site and presented potential ecological effects and risks.

Based upon the results of the RI, BHHRA, and ecological risk assessment, EPA determined that active remediation was necessary to protect human health and the environment from actual and threatened releases of hazardous substances into the environment.

Response Actions

A Record of Decision (ROD) for the Site was signed in September 1991. The remedy selected in the 1991 ROD included:

- Construction of a multi-layer cap consistent with New York State Part 360 solid waste landfill closure requirements;
- Additional soil sampling along the western portion of the disposal area;
- Regrading and compaction of the landfill mound to provide a stable foundation for the placement of the cap prior to its construction;
- Construction of a gas venting system;
- Performance of air monitoring prior to, during, and following construction at the Site, to ensure that air emissions resulting from the cap construction meet applicable or relevant and appropriate requirement (ARARs);
- Quarterly groundwater monitoring using existing groundwater monitoring wells, and six additional wells to be installed beyond the capped area (the monitoring program will include sampling of selected residential wells with subsequent follow-up actions as necessary);
- Construction of fencing around the perimeter of the capped area;
- Establishment of ordinances or restrictions imposed on the deed to ensure that future use of the Site property will maintain the integrity of the cap;
- Installation of a groundwater extraction and treatment system to control leachate migration utilizing innovative groundwater treatment technology to be evaluated with a treatability study;
- Delineation and evaluation of the wetlands and drainage channels flowing through the wetlands adjacent to the landfill;
- Full evaluation of the wetlands prior to remediation activities to determine measures necessary to mitigate potential negative impacts to the wetlands;
- Performance of a treatability study to demonstrate the effectiveness of the innovative technology for groundwater treatment;
- Disposition of treatment residuals in accordance with Resource Conservation and Recovery Act requirements, including its Land Disposal Restrictions; and
- Implementation of precipitation, filtration, and carbon adsorption for groundwater treatment as a contingency remedy should the treatability study indicate the innovative groundwater treatment technology is not effective.

The landfill cap was constructed in 1998. The remedial action objective (RAO) of the OU 1 remedy was to control the source of contamination. Given the improvements in Site groundwater quality over the ensuing several years following capping, EPA re-evaluated whether the active groundwater extraction and treatment remedy specified in the 1991 ROD was necessary. The re-evaluation included an updated

assessment of human health and ecological risks. In November 2003, an updated BHHRA was conducted to evaluate potential human health risks from exposure to the contaminated groundwater at the Site. In addition, in August 2004, the updated Baseline Ecological Risk Assessment (BERA) evaluated the extent to which current conditions posed a risk to ecological receptors at the Site, including any risk associated with residual sediment contamination and provided information necessary for evaluating and addressing groundwater impacts at the Site. Ecological receptors of concern at the Site included sediment-dwelling (benthic) invertebrates, zooplankton, amphibians, and aquatic-feeding insectivorous birds based on exposure potential and sensitivity.

Based upon the results of the updated BHHRA and the BERA, Site-related human and ecological exposures were found to be at acceptable levels following capping of the landfill. In addition, groundwater modeling performed during early remedial design work predicted that a groundwater pump and treat system, if implemented, would have a negative impact on the wetlands immediately adjacent to the landfill, without achieving the goal of remediating groundwater contamination in the saturated zone.

As a result of these evaluations, in 2005, EPA approved a ROD Amendment for the Site. The ROD Amendment, signed on January 21, 2005, clarified the RAOs for the Site. The two Site-specific RAOs are:

(1) Protect human health by ensuring that future residents are not exposed to contaminated groundwater; and

(2) Reduce further contamination of the wetlands in the area, and the migration of contaminants in groundwater.

The major components of the modification to the selected remedy include:

- Elimination of the groundwater extraction and treatment system requirement of the 1991 selected remedy;
- Implementation of a long-term monitoring program where groundwater, surface water, sediment samples, and residential well water will be collected and analyzed on an annual basis to ensure that the remedy remains protective of human health and the environment; and
- Maintenance of Site access restrictions, and implementation of institutional controls (ICs) to prohibit any use of the Site that would impair the effectiveness of the landfill cap and leachate collection system and to prohibit any digging of wells or extraction of groundwater in or immediately adjacent to the landfill cap.

The selected remedies in both the 1991 ROD and the 2005 ROD Amendment would enable EPA maximum contaminant levels (MCLs) and NYSDEC Ambient Water Quality Standards (WQS) for drinking water to be met.

Status of Implementation

In September 1992, EPA issued a Unilateral Administrative Order (UAO) to six PRPs, directing them to perform the remedial design/remedial action (RD/RA) for the Site. Ford Motor Company (Ford) was the only PRP at the time to comply with the UAO. Subsequently, EPA entered into an RD/RA with 11 PRPs (the Hertel Steering Committee), including Ford, as well as cost recovery settlements with additional PRPs.

In 1994, Ford completed a pre-design investigation for the Site, which defined the extent of the landfill mass, modeled Site groundwater dynamics and characterized soil, groundwater, surface water, and sediment contamination.

In September 1996, EPA approved the remedial pre-design investigation, which formed the basis of the landfill cap design. The PRPs completed the construction of the approximately 13.5-acre multi-layer landfill cap in December 1998. In May 1999, EPA approved a Remedial Action Report, which determined that the landfill cap and leachate collection system had been completed, in accordance with the approved Remedial Design Report and New York State Part 360 solid waste landfill closure requirements. In addition to the cap, a fence was installed around the landfill at the Site. The gas venting system and leachate collection systems were also constructed in 1998.

IC Summary Table

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Soil	Yes	Yes	Landfill Cap and Leachate Collection System	Prohibit any use of the Site that would impair the effectiveness of the landfill cap and leachate collection system	Town of Plattekill Code, Chapter 110-53 (Aquifer Protection Zone)
Groundwater	Yes	Yes	Aquifer Protection Zone for the Hertel Landfill Site	Designated as Environmental Impact Assessment Area (EIAA) (**Figure 2**) - Properties within EIAA subject to multiple water supply development requirements, which include Site-specific drilling, testing, and water quality studies	Town of Plattekill Code, Chapter 110-53 (Aquifer Protection Zone)
Groundwater	Yes	Yes	Block Parcels: 4-l1.001 4-36.001 4-13.001 4-12.001 4-37.000 4-38.000	Deed Restrictions/Environ-mental Easements to prohibit the development of potable water wells within the potential limits of the Site-impacted groundwater plume	Recorded Dates 4-l1.001 – 10-12-11 4-36.001 – 8-22-11 4-13.001 – 6-24-11 4-12.001 – 6-24-11 4-37.000 – 9-20-11 4-38.000 – 7-12-11

The 2005 ROD Amendment specified that ICs would be put in place to prohibit any use of the Site that would impair the effectiveness of the landfill cap and leachate collection system, and to prohibit any digging of wells or extraction of groundwater in or immediately adjacent to the landfill cap. ICs would also be put in place to ensure continued access to the Site by EPA and the State of New York.

Appropriate ICs have been put in place at the Site. The Town of Plattekill Code, Chapter 110-53 (Aquifer Protection Zone) was enacted into law solely for the Site and established the EIAA. Properties within EIAA are subject to multiple water supply development requirements, which include Site-

specific drilling, testing, and water quality studies. These studies are required to be completed by a qualified hydrogeologist or engineer representing the applicant/property owner. The application may also be referred to an independent hydrogeologist or engineer selected by the Town at the applicant's expense.

EPA worked with the PRPs to develop and implement deed restrictions/environmental easements on several properties. On November 26, 2013, the PRPs submitted a letter to EPA documenting that all ICs as required by the 2005 ROD Amendment were met. The November 26, 2013 letter stated that ICs in the form of deed restrictions/environmental easements were implemented/recorded for all parcels except parcel 4-14.000 where EPA determined that a deed restriction/environmental easement was not required because the parcel was not within the potential limits of the Site-impacted groundwater plume.

Systems Operations/Operation & Maintenance

The landfill cap and leachate collection system are being monitored and maintained by the PRPs as set forth in the RD/RA Consent Decree and the EPA-approved Post-Closure Operation and Maintenance (O&M) Manual (January 1999). In accordance with the EPA-approved monitoring plan of the Post-Closure O&M Manual, long-term post-closure compliance monitoring has consisted of sampling groundwater monitoring wells, sediment and surface water, residential wells (*i.e.*, potable wells), and landfill gas vents.

Prior to October 2017, the EPA-approved Site monitoring plan consisted of sampling the Site monitoring wells on a semi-annual frequency, sediment and surface water locations on an annual frequency, residential wells in the Site vicinity on an annual frequency; and passive gas vents (*i.e.*, landfill gas vents) on an annual frequency (via field measurement equipment). In the landfill gas monitoring program, a sample would be collected from the location exhibiting the highest landfill gas field screening readings for laboratory analysis. The details on the locations of the eleven residential wells and the media-specific monitoring locations, analytes, and frequencies are presented in **Appendices A and B**.

In May 2017, Ford submitted a written request to the EPA to secure approval for a reduction in the monitoring frequency and a reduction in the list of media-specific parameters for the Site. On October 27, 2017, EPA, in consultation with the NYSDEC and the NYSDOH, approved the revised compliance monitoring and sampling plan. The revised compliance monitoring and sampling plan consists of sampling of the Site monitoring wells biennially (once every 2 years) for metals and quinquennially (once every 5 years) for benzene, toluene, ethylbenzene and xylene (BTEX); sediment and surface water locations biennially for metals and quinquennially for pesticides, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs); residential wells in the Site vicinity annually for metals and VOCs; and, passive gas vents (*i.e.*, landfill gas vents) biennially (via landfill gas field screening equipment) for TO-14 VOCs, carbon dioxide, and methane. The details of the post-October 2017 long-term post-closure compliance monitoring program are presented in **Table 2.**

Remedy Resilience Assessment

Potential Site impacts from severe weather have been assessed, and the performance of the remedy is currently not at risk as a result of expected weather-related effects in the region and near the Site. Refer to **Appendix E** for additional information.

III. PROGRESS SINCE THE LAST REVIEW

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

The fifth FYR was completed in February 2020 and concluded that the remedy for the Hertel Landfill Superfund site protects human health and the environment. There were no specific recommendations included in the last FYR.

Protectiveness Determinations/Statements from the 2020 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The implemented remedies for the Hertel Landfill Superfund Site are protective of human health and the environment.
Sitewide	Protective	The implemented remedies for the Hertel Landfill Superfund Site are protective of human health and the environment.

Although there were no formal issues and recommendations included in the last FYR, the following suggestion was included as an Other Finding:

During the October 2, 2019 Site inspection, a breach with the 1,800-gallon capacity concrete collection sump in the form of a hole atop the structure was discovered. Further inspection of standing water within the interior of the structure showed what appeared to be stormwater. The Site contractor has scheduled a pump-out for the concrete collection sump for Spring 2020, at which time the breach will be repaired to put back the leachate collection system in working order as designed.

During the FYR Site Inspection, the PRPs and their contractor reported that the damage to the collection sump had been fixed and standing water removed.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On August 7, 2024, the EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at Superfund sites in New York, New Jersey, and Puerto Rico, including the Hertel Landfill Superfund site. The announcement can be found at the following web address: https://www.epa.gov/superfund/R2-fiveyearreviews.

In addition to this notification, in December 2024, a public notice was distributed via email to local Town officials and other interested parties and copies were also mailed to interested parties. The announcement indicated that EPA is conducting a FYR of the remedy for the Site to ensure that the implemented remedy remains protective of human health and the environment and is functioning as designed. It also indicated that once the FYR is completed, the results will be made available in the local Site repository at the Plattekill Town Hall, P.O. Box 45, Modena, New York 12548, as well as the

website: https://www.epa.gov/superfund/hertel-landfill. In addition, the notice included contact information, including addresses and telephone numbers, for questions related to the FYR process or the Hertel Landfill site.

No interviews were conducted as part of this FYR.

Data Review

Since the completion of the landfill cap at the Site in 1998, the groundwater, sediment and surface water, residential wells, and landfill gas vents have been monitored and sampled by the PRPs pursuant to the RD/RA Consent Decree, O&M Plan and the amended long-term post-closure compliance monitoring program, approved by EPA on October 27, 2017. However, with the exception of limited discussion of historical data to evaluate trends for various COCs, *e.g.*, arsenic, this data review specifically covers analytical results for groundwater, sediment and surface water, residential wells, and landfill gas vents that were collected during the monitoring period from September 2019 through December 2023.

Groundwater Monitoring Wells

The groundwater monitoring program includes sampling the 20 monitoring wells located adjacent to or nearby the landfill that were sampled on a biennial basis for inorganic compounds (*i.e.*, metals and water quality parameters) and a quinquennial basis for BTEX compounds; the sampling results are summarized in **Tables 3 and 4**.

The groundwater sampling results were compared to EPA MCLs or NYSDEC WQS, whichever is more stringent. The only VOCs that exceeded the WQS during this monitoring period were benzene and toluene during the 2019 sampling event (**Table 3**). Benzene was detected at a concentration of 1 microgram per liter (µg/L), equal to the WQS (1 µg/L) in well MW-W1SA. Toluene was detected at a concentration of 8 µg/L in well MW-W2D, which exceeds the WQS of 5 µg/L.

Historically, these groundwater monitoring wells were sampled for metals and VOCs on a quarterly basis from December 1996 to January 2001, on a semi-annual basis until October 2017, and finally on a biennial basis for metals and quinquennial basis for BTEX compounds. VOCs, which were present in monitoring wells during the remedial investigation, had not been detected since 1999 until benzene was detected in well MW-W1SA in 2015.

Analytical results identified the inorganic compounds (arsenic, iron, magnesium, manganese, and sodium) at concentrations exceeding their drinking water standards and criteria (**Table 4**). Arsenic was detected above the EPA MCL (10 µg/L) for each sampling event (September 2019, November 2021, and November 2023) in wells MW-W1SA, MW-W2SA, MW-11D, and MW-W2D. The maximum concentration of arsenic was 65.9 µg/L in well MW-W1SA. Monitoring wells MW-W1SA, MW-W2SA, MW-11D, and MW-W2D, which are located along the eastern boundary of the landfill, are adjacent to the wetland and near the unnamed creek. Historically, arsenic was either not detected or detected at lower concentrations than 65.9 µg/L. Monitoring well sampling data that were considered in the 2005 ROD Amendment showed 111 detections out of 322 samples collected and analyzed with the highest detection at 45.7 µg/L.

Landfill leachate is characterized by anaerobic and reducing geochemistry which can reduce and mobilize metals that may be naturally-occurring in the aquifer. Groundwater impacted by leachate will contain several leachate indicator parameters, including elevated concentrations of dissolved iron and manganese which have been mobilized by the leachate geochemistry. The discussion of inorganic results for wells based on their downgradient versus upgradient locations are provided in more detail below.

The upgradient wells MW-W3S and MW-16DS are located along the southwest end of the landfill and are assumed to represent the background geochemical conditions for the overburden and bedrock aquifers, respectively. Neither iron, manganese nor sodium concentrations exceeded the NYSDEC WQS in MW-W3S (overburden aquifer) during the monitoring period. However, the analytical results for MW-16DS (bedrock aquifer) exceeded the WQS for iron (59,000 to 99,000 µg/L) and manganese (290 to 371 µg/L) as listed in **Table 4**.

Analytical results from monitoring wells MW-14S/I installed along the western boundary of the landfill cap, and topographically upgradient, did not exceed the NYSDEC WQS for arsenic or sodium. MW-14S exceeded the WQS for iron and manganese (WQS for the summed concentration of iron and manganese is 300 µg/L). MW-14I also exceeded the WQS for manganese. However, analytical results from the downgradient monitoring wells located along the eastern boundary of the landfill cap, adjacent to the unnamed creek and wetlands, exceeded the WQS for iron (up to 32,000 µg/L), manganese (up to 19,400 µg/L), and sodium (45,000 µg/L). Sodium is a major ion commonly present in landfill leachate and the WQS is 20,000 µg/L. The iron concentrations along the eastern boundary are elevated, but within the range of background concentrations assumed from the upgradient well MW-16DS. The highest concentrations of manganese and sodium for this monitoring period were observed downgradient at the northeast toe of the landfill cap near wells MW-W1SA and MW-W1D. The average concentrations of manganese and sodium for this location are 8,287 µg/L and 36,200 µg/L, respectively. Wells MW-W1SA, MW-W1D, MW-W2D, MW-11D are also the only wells in the monitoring network that exhibit arsenic concentrations that exceed the EPA MCL for drinking water (10 µg/L). These constituents are present in the regional aquifer and are likely being mobilized due to the typically reducing and acidic geochemistry of landfills. The elevated arsenic concentrations trends in wells along the eastern boundary will be monitored in the future as precautionary measure. Iron, manganese, and sodium in wells located near the northeast toe of the landfill are not considered to be either a human health or environmental risk but will continue to be monitored in the next five-year period.

Emerging contaminant sampling was conducted at the Site in August 2020. Five wells in total were sampled, one upgradient (MW-W3S), two landfill area wells (MW-W1SA and MW-2WSA), and two downgradient wells (MW-K1D and MW-K3D). All groundwater samples were analyzed for PFAS, and a select sample from well MW-W2SA was also sampled for 1,4-dioxane. PFOA and/or PFOS were detected in each of the wells, with exception of the upgradient well (MW-W3S). There were three wells that exceeded the EPA MCL of 4.0 nanograms per liter (ηg/L) for PFOA with concentrations of 7.96 ηg/L (MW-W2SA), 4.47 ηg/L (MW-K3D), and 34.8 ηg/L (MW-W1SA). There were two wells that exceeded the MCL of 4.0 ηg/L for PFOS with concentrations of 6.28 ηg/L (MW-W2SA) and 61.4 ηg/L (MW-W1SA). 1,4-Dioxane was detected in the sample from well MW-W2SA at a concentration of 0.602 µg/L which does not exceed the NYSDEC MCL of 1.0 µg/L.

In December 2023, additional PFAS sampling was conducted at the Site. Groundwater samples were collected from three wells, previously sampled MW-W1SA (landfill area well with highest exceedances) and MW-17I and MW-P1 (side gradient and downgradient). All three groundwater samples were

analyzed for PFAS compounds. PFOS and PFOA were detected at each well location. There were two wells that exceeded the MCL of 4.0 ηg/L for PFOA with concentrations of 37.6 ηg/L (MW-W1SA) and 6.13 ηg/L (MW-P1). There was only one well that exceeded the MCL of 4.0 ηg/L for PFOS at a concentration of 27.9 ηg/L (MW-W1SA). The groundwater results suggest that PFAS is Site-related and has migrated downgradient of the landfill. Based on review of the PFAS sampling results, EPA determined that additional PFAS sampling needs to be conducted to confirm this conclusion and has directed the Hertel Steering Committee to conduct the sampling at upgradient well MW-W3S; on-Site (landfill area) wells MW-W1SA and MW-W2SA; and downgradient wells MW-K1S, MW-K1D, MW-P1, MW-K2S, KW-K2D, MW-K3S, and MW-2S. The sampling event is expected to be conducted in 2025.

Potable Wells in Residential Area

It should be noted that the private wells are screened around 250 feet in the bedrock aquifer, which has shown little impact from site-related contamination in the past. The maximum detected concentrations of inorganics in the private wells are compared to their respective residential groundwater EPA MCLs (National Primary Drinking Water Standards) and NYSDEC WQS. As part of the Site monitoring program, 11 residential wells along Route 44/55 are sampled annually and analyzed for VOCs and inorganics (**Figure 4**).

Analytical results for VOCs were non-detect in all private wells for all sampling events during this FYR period, with the exception of acetone. There was a single occurrence of acetone being detected above the WQS of 50 µg/L in well PW-8 at a concentration of 160 µg/L. This exceedance of acetone was detected in the 2019 sampling round but then was non-detect in the 2020 - 2023 sampling rounds and was detected at a low level of 1.7 µg/L in PW-11 in 2024. Acetone is often a lab contaminant. Four inorganic compounds exceeded their WQS: sodium, copper, lead, and iron. Sodium exceedances (WQS = 20,000 µg/L) were reported for wells PW-3, PW-5, PW-8, PW-10, and PW-11 for at least three consecutive sampling events during this monitoring period. Sodium is commonly associated with landfill leachate, but it is also associated with waters subjected to enhanced evaporation, such as wetlands, water softening treatment systems to replace calcium, and/or wellhead impact by road salt. It is unlikely that the sodium in private wells is from the landfill since no other Site COCs were detected. Iron and manganese were below the combined WQS (300 µg/L) in all potable wells and all other sampling events, except for two events in potable wells PW-8 and PW-13 when iron was detected at concentrations of 710 µg/L and 630 µg/L, respectively (**Table 3**); but these concentrations are well below the EPA Regional Screening Levels for iron (14,000 µg/L) and manganese (430 µg/L).

Copper exceeded the WQS (200 µg/L) in residential wells PW-2, PW-8, PW-12 and PW-13 in four isolated sampling events between 2019 and 2022 (**Table 5**). Copper exceedances ranged from 260 to 2,200 µg/L and was not detected in groundwater samples collected from the landfill. Lead was detected above the EPA MCL (15 µg/L) in residential wells PW-9 (28 µg/L) and PW-12 (55 µg/L) in 2022 (**Table 5**). Lead was not detected above the MCL in any of the residential wells during the 2023 and 2024 sampling events. Lead was also not detected above the MCL in any of the monitoring wells near the landfill. This suggests that the presence of copper and lead in the private wells is not site-related and most likely from a secondary source, such as copper plumbing, lead soldering, or brass water fixtures. The two residences where the MCLs for copper and lead were exceeded do not appear to be occupied on a full-time basis based on the fact that samplers often found the water to the residence turned off. As a result, standing water in the plumbing system may indeed be influencing the sample. EPA will work

with the PRP to ensure that samples from the private residential wells are collected using appropriate EPA methods for drinking water sampling and that results are promptly conveyed to the homeowners with suggestions of running the water prior to use. Arsenic was either not detected or detected at low levels (highest concentration of 4.6 µg/L) well below its EPA MCL of 10 µg/L.

The private wells will continue to be monitored annually for VOCs and inorganics.

Surface Water and Sediments

The monitoring program includes collection of sediment and surface-water samples from six locations on the eastern edge of the landfill. The samples are collected from the upstream area of the unnamed creek to the toe of the landfill cap, and from one location northeast of the landfill in the wetland area. Samples were analyzed for VOCs, SVOCs, pesticides, and inorganics in 2019. Sediment and surface water samples were analyzed for metals only in 2021 and 2023.

Analytical results for VOCs, and SVOCs were non-detect for sediments at the SSW-2 location in 2019 except for acetone, 2-butanone and DDE. No toxicity screening values are available for these constituents. Analytical results for inorganics are similar to previous years, with persistent occurrences of iron and manganese, and isolated and discontinuous occurrences of arsenic, cadmium, copper, lead, nickel and zinc that exceeded the NYSDEC Lowest Effects Level (LEL) standard for sediments and/or NYSDEC Sediment Screening Criteria.[1] Iron and manganese exceeded the LEL at all seven locations for all sediment sampling events. There is no systematic pattern of either iron or manganese concentrations from upstream to downstream. In addition, manganese concentrations downgradient are similar or below the soil concentrations analyzed for the BERA completed in 2003. This BERA was performed prior to the ROD Amendment of 2005 and concluded that the concentrations identified from sediment sampling events performed in 2002 and 2003 do not pose a threat/impact to the wetlands. It is noted that the manganese concentrations in the upgradient location (SSW-4) were significantly higher than in the BERA as well as when compared to the other sampled locations downgradient, which suggests that the manganese impacts at this location are associated with off-Site sources.

Surface-water samples (SW-1A, -2, -3, -4, 5 and -6) were analyzed for VOCs, SVOCs, pesticides and inorganics in 2019. Analytical results for VOCs and SVOCs were non-detect for all sampling events, except for bis(2-ethyl hexyl phthalate). Iron and manganese exceeded the WQS at all surface water sample locations and for all sampling events. Lead occurred in isolated events and are temporally inconsistent. Copper, vanadium and zinc were found only at surface water locations SW-5 and SW-6. Consistent with the sediment results, the concentrations in surface water do not indicate concerns related to human health or ecological exposure.

In addition, several geological and groundwater reports published by the U.S. Geological Survey, U.S. Department of the Interior, and New York Rural Water Association suggest that iron and manganese are both naturally occurring constituents in the regional geologic formation. These reports, coupled with the iron and manganese concentration trends at the Site, indicate that the Site geology is a natural contributor to elevated levels of these metals historically observed regionally and at the Site.

[1] DEC Sediment Screening Criteria: https://extapps.dec.ny.gov/docs/fish_marine_pdf/screenasssedfin.pdf

Air (Gas Vent) Quality

All landfill gas vents are field sampled on an annual basis using a landfill gas meter. Samples are analyzed for TO-14 VOCS, carbon dioxide, and methane. No combustible gas levels have been reported in off-site gas probes screened in non-landfill material. No standard exceedances for these compounds have been recorded for the period.

Site Inspection

The inspection of the Site was conducted on September 5, 2024. The purpose of the inspection was to assess the protectiveness of the remedy. The following parties were in attendance:

Lorenzo Thantu, EPA RPM
Sabrina Gonzalez, EPA Hydrogeologist
Tara Bhat, EPA Risk Assessor
Ryan Richard, NYSDEC Project Manager
Steven McCague, NYSDEC Section Chief
Mohamed Zakkar, Ford Motor Company
Brian Henning, Mott MacDonald (consultant to the Hertel Steering Committee)
Robert Starcher, Mott MacDonald
Joseph Kane, City of Poughkeepsie
Joseph Chenier, City of Poughkeepsie

During the Site visit, the Site contractor stated that the gas venting system has had no gas recovery for years. No combustible gas levels have been recorded in the off-Site gas probes screened in the non-landfill material, indicating that there is no migration of gas away from the main landfill. This is likely the result of the age of the material in the landfill, which, for the most part, had already generated its peak gas quantity. In addition, the waste is relatively shallow, in terms of typical solid waste landfills, and consequently would not be expected to generate extensive quantities of gas. No exceedances of the standards for these compounds (*i.e.*, TO-14 VOCS, carbon dioxide, and methane) have been recorded over the evaluation period.

For the leachate collection system, the previous FYRs documented that the moisture content of the waste had continued to decrease as a result of cap construction, which was evidenced by the decrease of the leachate volume generated and discharged into the sump. Immediately after capping, the Site contractor periodically pumped and removed collected leachate from the sump. However, as the cap became more effective, the amount of leachate produced was reduced to the point where it has not been necessary to empty the sump. The leachate drain has not collected any leachate for close to fifteen years. The fact that the leachate collection system had not collected leachate in the past fifteen years indicates that the landfill cap is performing as designed and is not allowing rainwater to enter the landfill waste to produce additional leachate.

In general, the landfill cover system and slopes appear to be well maintained. No breaches or depressions were noted during the Site inspection. Runoff control features appear to be in good repair.

V. TECHNICAL ASSESSMENT

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

According to the 1991 ROD, the remedy calls for a multi-layered cap, a drainage system, a gas venting system, leachate collection system, groundwater monitoring program and access restrictions. The cap continues to comply with Title 6 NYCRR Part 360 and covers approximately 13.5 acres. A perimeter fence surrounds the capped area and prevents unauthorized personnel from entering the Site. As stated above, the cover system and slopes appear to be well maintained. No breaches or depressions were noted during the September 5, 2024 Site inspection. Runoff control features appear to be in good repair. The gas venting systems appear to function as designed as well.

Performance of the remedy is evaluated with groundwater-quality data collected in monitoring wells that circumscribe the cap area, sentinel wells located to the northwest of the landfill near the wetland, and residential wells. Monitoring wells were sampled semi-annually for organic and inorganic compounds until October 2017, after which all wells have been sampled biennially for inorganic compounds. Groundwater quality data for the previous five years show no exceedances of the NYSDEC WQS for organic compounds, with the exception of toluene in one isolated location. The analyses do show elevated levels of iron, manganese, sodium, and, to a lesser extent, arsenic and magnesium in on-Site monitoring wells. Iron and manganese are found in most wells at elevated levels in excess of NYSDEC WQS in and adjacent to the landfill. It is important to note that these constituents are present in the regional aquifer and are likely being mobilized due to the typically reducing and acidic geochemistry of landfills. Additionally, iron and manganese are regulated as secondary MCLs under EPA's Secondary Drinking Water Regulations, which are not based on human health but rather are based on cosmetic or aesthetic effects. Arsenic exceedances are localized to the eastern parameter of the landfill cover. Results of groundwater analysis from residential wells along Route 44/55 indicate that the iron, manganese, sodium and, to a lesser extent, copper have occasionally been detected above their respective NYSDEC WQS and/or EPA's secondary MCLs. Consistent with the on-Site wells, the maximum detected concentrations of iron and manganese did not exceed their respective human health risk-based criteria (RSLs) of 14,000 µg/L and 403 µg/L. Copper and lead was detected in four private wells above NYSDEC standards but was not detected in the on-site monitoring wells above the criteria, suggesting that the exceedances of copper in the private wells are not Site-related and may be related to secondary sources (e.g., copper plumbing or brass water fixtures). The presence of PFAS at the site is discussed further under Question C.

ICs have been implemented, as stated above, to prohibit any land use that would impair the effectiveness of the cap and to prohibit installation of wells immediately adjacent to cap.

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

Some chemical specific toxicity values have changed since the Site was originally assessed. To account for changes in toxicity values since the baseline human health risk assessment was performed, the maximum detected concentrations of the COCs identified during the 2019 through 2023 sampling period in Site monitoring wells were compared to EPA MCLs and NYSDEC WQS, which are the chemical-specific ARARs established in the ROD, in addition to EPA RSLs. The results indicate that the concentrations of several contaminants continue to be elevated and exceed their respective standards. In

addition, several private potable wells were sampled in 2024. Several metals were detected and were compared to their respective EPA RSLs, MCLs and NYSDEC WQS. The concentrations did not exceed their respective criteria/standards.

The RAOs are established in the ROD in order to minimize further contamination of the wetland area and the downgradient migration of contaminants in groundwater and to protect human health by ensuring that future residents are not exposed to contaminated groundwater. The RAOs are still valid.

Soil vapor intrusion was evaluated in previous FYRs. Over the past ten years, there are no organic contaminants that exceed vapor intrusion screening criteria. Therefore, it has been concluded that this exposure pathway is not a concern at this Site.

A BERA was conducted in 2003 to evaluate the ecological risks for aquatic and wetlands areas adjacent to and downstream of the Hertel Landfill. The exposure assumptions, toxicity data, and screening levels used to complete the August 2004 BERA are still valid. The evaluation concluded that the majority of the aquatic and benthic organisms were not at risk due to COCs and were limited to two seeps. Although ecological risk assessment methodologies have changed since 2003, the results of the 2003 BERA are still valid. Sediment and surface water quality data are compared to NSYDEC Sediment Screening Criteria and WQS. Iron and manganese in surface water and sediment continue to be elevated; however, the highest levels of manganese were identified at an upstream location indicating an off-site source and iron concentrations are within the range of concentrations or lower than those detected at the time of the original ROD. In addition, previous reports indicate that the Site geology is a natural contributor to elevated levels of iron and manganese historically observed at the Site and regionally. Therefore, ecological receptors are not considered to be impacted by site-related contamination. Nevertheless, monitoring of the wetland will continue.

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

Sampling for emerging contaminants (PFAS and 1,4-dioxane) has occurred in several monitoring wells within the last five years. The concentrations of PFAS were found to exceed their respective EPA MCLs in several wells. The highest concentrations were found in wells closest to the landfill boundary. Downgradient monitoring wells contained PFOA marginally exceeding the EPA MCL. PFOA was identified at 6.13 ηg/L at MW-P1 in 2023, approximately 400 feet northeast of the landfill, while the furthest downgradient well sampled (MW-K3D) contained 4.47 ηg/L in 2020, just slightly above the MCL of 4.0 ηg/L. In order to determine the nature and extent of PFAS contamination and to evaluate if groundwater contamination is migrating further downgradient in the direction of residential wells, EPA has directed the Hertel Steering Committee to conduct the sampling at upgradient well MW-W3S; on-Site (landfill area) wells MW-W1SA and MW-W2SA; and downgradient wells MW-K1S, MW-K1D, MW-P1, MW-K2S, KW-K2D, MW-K3S, and MW-2S. The sampling event is expected to be conducted in late 2025. As discussed above, the residential wells are screened in the bedrock aquifer which has very limited connection to the overburden aquifer. While it is unlikely that the residential wells would be impacted by site-related contamination (they have not been in the past and concentrations in the sampled wells are only marginally above the MCLs), the nature and extent of PFAS contamination is necessary to verify this assumption.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
none				
OU(s): 1	**Issue Category:** Monitoring			
	Issue: Groundwater results suggest PFAS is site-related.			
	Recommendation: Additional groundwater sampling is needed to confirm the nature and extent of PFAS contamination. The following wells should be sampled upgradient MW-W3S; on-Site (landfill area) MW-W1SA and MW-W2SA; and downgradient MW-K1S, MW-K1D, MW-P1, MW-K2S, KW-K2D, MW-K3S, and MW-2S.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/31/2025

OTHER FINDINGS

In addition, the following suggestion was identified during the FYR and may improve management of O&M, but do not affect current and/or future protectiveness:

The two residences where the MCLs for copper and lead were exceeded do not appear to be occupied on a full-time basis based on the fact that samplers often found the water to the residence turned off. As a result, standing water in the plumbing system may indeed be influencing the sample. EPA will work with the PRP to ensure that samples from the private residential wells are collected using appropriate EPA methods for drinking water sampling and that results are promptly conveyed to the homeowners with suggestions of running the water prior to use.

VII. PROTECTIVENESS STATEMENT

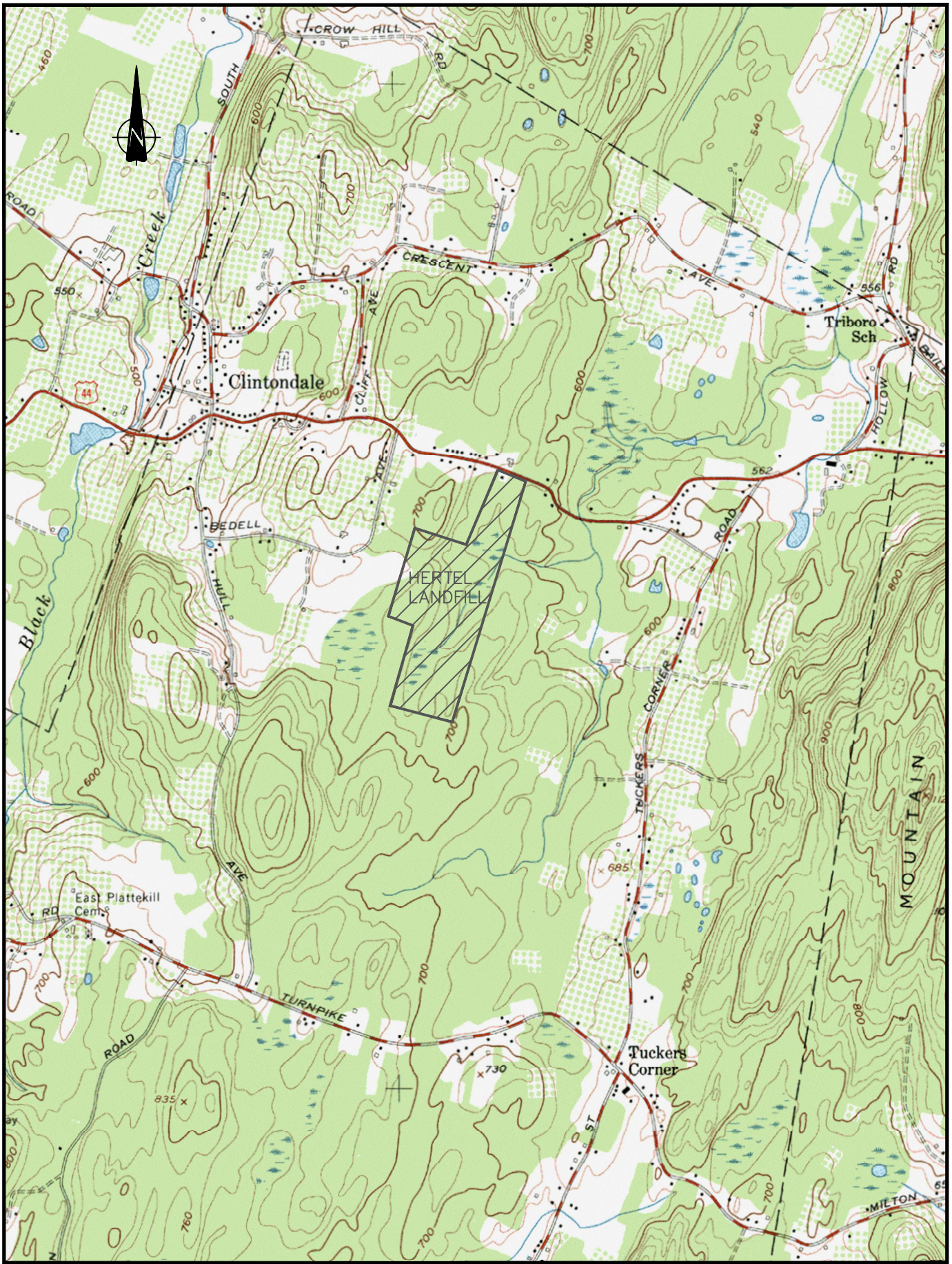
Protectiveness Statement(s)	
Operable Unit: 1	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The implemented remedies for the Hertel Landfill Superfund Site are protective of human health and the environment in the short term. In order for the remedy to be protective in the long term, additional groundwater sampling is needed to confirm the nature and extent of PFAS contamination.	

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The implemented remedies for the Hertel Landfill Superfund Site are protective of human health and the environment in the short term. In order for the remedy to be protective in the long term, additional groundwater sampling is needed to confirm the nature and extent of PFAS contamination.

VIII. NEXT REVIEW

The next FYR report for the Hertel Landfill Superfund site is required five years from the completion date of this review.

APPENDIX A – Figures



P:\219626\VII - Site Reviews\2020 Five Year Review\Figures 1-3\Figure 1 - Site Location Map.dwg

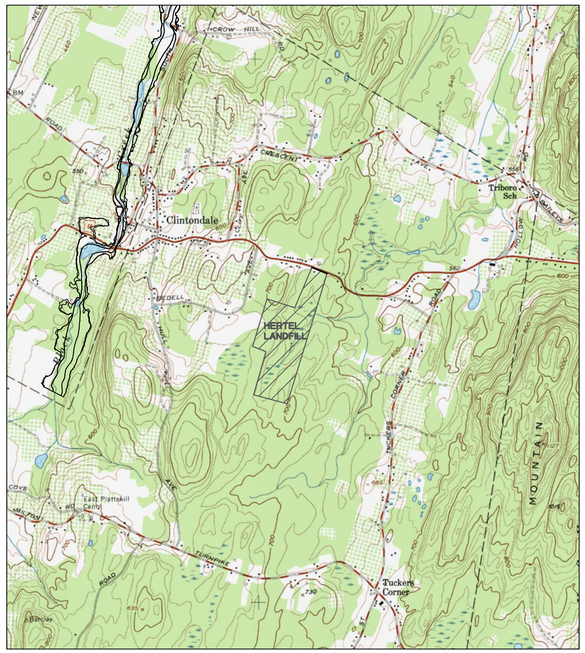
MOTT MACDONALD

111 Wood Avenue South
Iselin, NJ 08330

HERTEL STEERING COMMITTEE
PLATTEKILL, NEW YORK

HERTEL LANDFILL SITE
FIGURE 1
SITE LOCATION MAP

Designed	Drawn	Checked	Approved	Date
	CN	MBM		



SITE LOCATION MAP

2000 0 2000 4000
SCALE IN FEET

LEGEND

- BUFFER BOUNDARY
- PARCEL BOUNDARY
- STREAM/WATER BODY
- FORMER LANDFILL LIMIT
- APPROXIMATE LIMITS OF LANDFILL CAP
- PARCEL WITH A DOMESTIC SUPPLY WELL
- NYSDEC FRESH WATER WETLANDS
- 100-FT WETLANDS BUFFER
- TOWN OF PLATTEKILL EIAA DISTRICT BOUNDARY

N

NOTES:

1. THE WETLANDS INFORMATION PRESENTED IN THIS FIGURE WAS OBTAINED FROM THE ULSTER COUNTY INFORMATION SERVICES. THIS DATA SET REPRESENTS THE EXTENT AND APPROXIMATE LOCATION OF THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION FRESH WATER WETLANDS.

2. THE PARCELS INFORMATION PRESENTED IN THIS FIGURE WAS OBTAINED FROM THE ULSTER COUNTY INFORMATION SERVICES,.

3. 100-FT WETLANDS BUFFER IN ACCORDANCE WITH THE THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, FRESH WATER WETLANDS ACT.

PARCELS MAP

200 0 200 400
SCALE IN FEET

P:\219626\EPA Well Protection Buffer Request\Meetings\Buffer Line_rev4.dwg 3/11/11 1:58 pm

Revision	Date

M. BRENDAN MULLEN
Professional Engineer - N.J. Lic. No. 38346

Date

Designed	Drawn	Checked	Approved	Date
R.W.S	CEN	MBM		

Hatch Mott MacDonald
Certificate No. 24GA28016600

27 Bleeker Street
Millburn, New Jersey 07041

FORMER HERTEL LANDFILL SITE
PLATTEKILL, NY

FIGURE 2

WELL EXCLUSION BUFFER

Job	No.	
219626	1	
	B/O 1	Total 1

Contract No.

MW-K3S MW-K3D

MW-K2D MW-K2S

MW-K1D

SW/SSW-2

MW-K1S

MW-17I

MW-2S MW-2D

MW-P1

SW/SSW-5

Water

MW-W1SA

MW-W1D

SW/SSW-6

V-3 V-1

MW-11D

MW-W2SA

V-2

SW/SSW-3

MW-W2D

V-4

PV-1

MW-14S

MW-14I

MW-14D

MW-10D

V-5

SW/SSW-1A

V-8

MW-9S

V-6

SW/SSW-4A

PV-2

V-15

V-9

PV-6

MW-P3

V-7

SW/SSW-4

MW-P2

MW-3D

V-12

V-10

V-16

MW-3S

V-13

V-11

PV-3

MW-P4

PV-5

PV-4

V-14

MW-1D

MW-1S

MW-16DN

MW-16DS

MW-16S

MW-W3S

LEGEND

LIMIT OF FINAL COVER	
FORMER LANDFILL LIMIT	
MONITORING WELL	MW-14D
SURFACE WATER	SW-6
SEDIMENT SURFACE WATER	SSW-1A
VENTPOINT	V-10
PERIMETER	PV-3

NOTES

1. MAP (& PROPERTY BOUNDARY) SOURCE: BASED ON KILLAM ASSOCIATES PROPERTY SURVEY PERFORMED IN 1994 AND 2001 AND TOWN OF PLATTEKILL TAX MAPS
2. COORDINATE SOURCE: NEW YORK STATE GRID COORDINATE SYSTEM

200 0 200 400

SCALE IN FEET

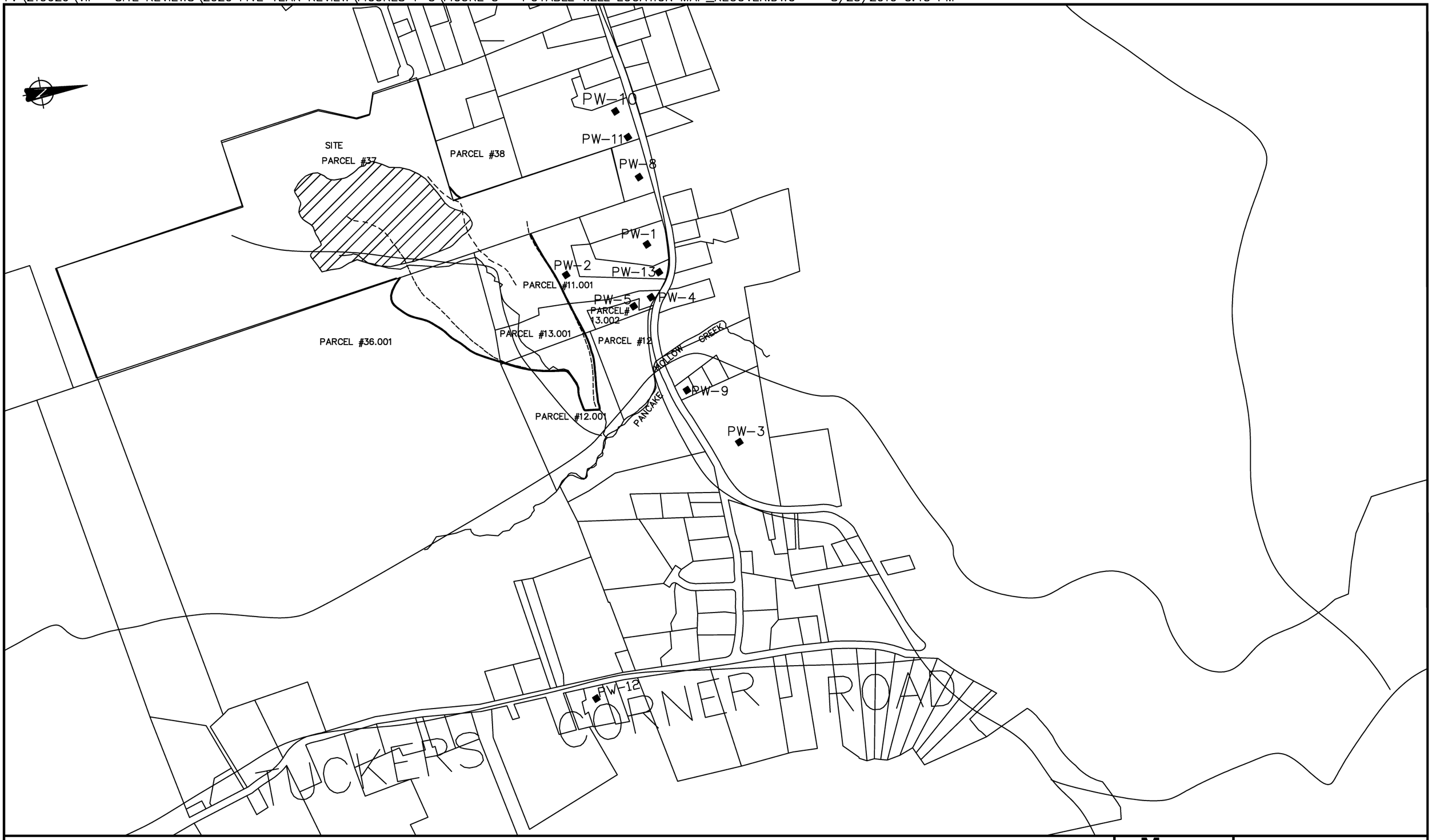
MOTT MACDONALD

111 Wood Avenue South
Iselin, NJ 08830

HERTEL MONITORING WELL & SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS MAP
FIGURE 3
AUGUST 2019

P:\219626\VII - Site Reviews\2020 Five Year Review\Figures 1-3\Figure 2 - Sampling Locations.dwg

P:\219626\VII – SITE REVIEWS\2020 FIVE YEAR REVIEW\FIGURES 1–3\FIGURE 3 – POTABLE WELL LOCATION MAP_RECOVER.DWG 8/25/2019 5:13 PM



600 0 600 1200

SCALE IN FEET

MOTT MACDONALD

111 Wood Avenue South
Iselin, New Jersey 08830–4112

HERTEL LANDFILL
FIGURE 4

POTABLE WELL LOCATION MAP

Designed	Drawn	Checked	Approved	Date

APPENDIX B – Tables

TABLE 1
Pre-October 2017 Long-Term Post-Closure Compliance Monitoring Program
Winter/Spring Event and Summer/Fall Sampling Event
HERTEL LANDFILL

Pre-October 2017 Long-Term Post-Closure Compliance Monitoring Program Winter/Spring Event		
Medium	**No. of Samples**	**Analyses and Sample Location IDs**
Groundwater	6	Target Analyte List (TAL) Metals, Cyanide, Ammonia Nitrogen, Total Kjeldahl Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, Total Organic Carbon (TOC), Total Phosphorus as PO_4, Alkalinity to pH 4.5 and 8.3, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Chloride, Sulfate, Sulfide, Total Dissolved Solids (TDS), Total Suspended Solids (TSS) **Sample Locations:** MW-P1, -14I, -14S, 16DS, -W3S, -9S
Groundwater	14 (plus 2 duplicates)	Same as above plus benzene, toluene, ethylbenzene and total xylenes (BTEX) **Sample Locations:** MW-2S, -2D, -K2D, -K2S, -K3D, -K3S, -K1D, -K1S, -W1D, -W1SA, -11D, -W2D, -W2SA, -10D, and 2 duplicates
Surface Water	7	Target Compound List (TCL) Volatile Organic Compounds (VOCs), TCL Semivolatile Organic Compounds (SVOCs), TAL Metals, Cyanide, TCL pesticides, total hardness **Sample Locations:** SW-1A, -2, -3, -4, -4A, -5, and -6
Sediment	7	TCL VOCs, TCL SVOCs, TAL Metals, Cyanide, TCL Pesticides, percent moisture, TOC **Sample Locations:** SSW-1A, -2, -3, -4, -4A, -5, and -6
Landfill Gas	22 (Field Screened) 1 (For Lab Analysis	Field test with 4-gas detector and (TO-14 VOCs, CO_2, methane) **Gas Reading Locations:** V-1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16 and PV-1, -2, -3, -4, -5, and -6 **Sample Location:** Vent with highest Lower Explosive Limit reading on a multi-gas meter or highest methane reading on a landfill gas meter

Pre-October 2017 Long-Term Post-Closure Compliance Monitoring Program Summer/Fall Sampling Event		
Medium	**No. of Samples**	**Analyses and Sample Location IDs**
Groundwater	6	TAL Metals, Cyanide, Ammonia Nitrogen, Total Kjeldahl Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, TOC, Total Phosphorus as PO_4, Alkalinity to pH 4.5 and 8.3, BOD, COD, Chloride, Sulfate, Sulfide, TDS, TSS **Sample Locations:** MW-P1, -14I, -14S, 16DS, -W3S, and -9S
Groundwater	14 (plus 2 duplicates)	Same as above plus BTEX **Sample Locations:** MW-2S, -2D, -K2D, -K2S, -K3D, -K3S, -K1D, -K1S, -W1D, -W1SA, -11D, -W2D, -W2SA, -10D, and 2 duplicates
Residential Wells	11	TAL Metals, TCL VOCs, Nitrate Nitrogen, Nitrite Nitrogen, Alkalinity to pH 4.5 and 8.3, Chloride, Sulfate **Sample Locations:** PW-1, -2, -3, -4, -5, -8, -9, -10, -11, -12, -13

TABLE 2
Post-October 2017 Long-Term Post-Closure Compliance Monitoring Program
HERTEL LANDFILL

Post-October 2017 Long-Term Post-Closure Compliance Monitoring Program			
Medium	**Sampling Frequency**	**Number of Samples**	**Analyses and Sample Location IDs**
Groundwater Monitoring Wells	Biennially (once every 2 years)	20 (Plus 2 Duplicates)	TAL Metals, Cyanide, Ammonia-Nitrogen, Total Kjedahl Nitrogen, Nitrate-Nitrogen, Nitrite-Nitrogen, TOC, Total Phosphorus as PO_4, Alkalinity to pH 4.5 and to pH 8.3, BOD, COD, Chloride, Sulfate, Sulfide, TDS, TSS **Sample Locations:** MW-P1, -14I, -14S, 16DS, -W3S, -9S, MW-2S, -2D, -K2D, -K2S, -K3D, -K3S, -K1D, -K1S, -W1D, -W1SA, -11D, -W2D, -W2SA, -10D, and 2 duplicates
	Quinquennially (once every 5 years)	20 (Plus 2 Duplicates)	BTEX **Sample Locations:** MW-P1, -14I, -14S, 16DS, -W3S, -9S, MW-2S, -2D, -K2D, -K2S, -K3D, -K3S, -K1D, -K1S, -W1D, -W1SA, -11D, -W2D, -W2SA, -10D, and 2 duplicates
Surface Water and Sediment	Biennially (once every 2 years)	7	TAL Metals, Total Hardness **Sample Locations:** SW-1A, -2, -3, -4, -4A, -5, and -6
	Quinquennially (once every 5 years)	7	Pesticides, PCBs, VOCs, SVOCs, Cyanide, % Moisture, TOC **Sample Locations:** SW-1A, -2, -3, -4, -4A, -5, and -6

Post-October 2017 Long-Term Post-Closure Compliance Monitoring Program			
Landfill Gas	Biennially (once every 2 years)	22 (Field Screened) 1 (For Lab Analysis)	Field screening (via GEM 2000 Meter) for %CO, %O_2, % Lower Explosive Limit, %H_2S at all locations followed by summa-canister analysis for TO-14 VOCS, CO_2, and Methane at the one location with the most elevated field screening values. **Gas Reading Locations:** V-1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16 and PV-1, -2, -3, -4, -5, and -6
Potable Residential Wells	Annually (once per year)	11 (Plus 1 Duplicate)	TAL Metals, Nitrate-Nitrogen, Nitrite-Nitrogen, Alkalinity to pH 4.5 and to pH 8.3, Chloride, Sulfate, and VOCs **Sample Locations:** PW-1, -2, -3, -4, -5, -8, -9, -10, -11, -12, -13

TABLE 3
Summary Analytical Results For VOCs in Monitoring Wells (2019 to 2023)
Hertel Landfill

Well	VOC	MCL	Sep-19
MW-9S	Benzene	1	0.2U
MW-9S	Toluene	5	0.2U
MW-10D	Benzene	1	0.2U
MW-10D	Toluene	5	0.2U
MW-11D	Benzene	1	0.8J
MW-11D	Toluene	5	0.2U
MW-14I	Benzene	1	0.2U
MW-14I	Toluene	5	0.2U
MW-14S	Benzene	1	0.2U
MW-14S	Toluene	5	0.2U
MW-16DS	Benzene	1	0.2U
MW-16DS	Toluene	5	0.2U
MW-17I	Benzene	1	0.2U
MW-17I	Toluene	5	0.2U
MW-2D	Benzene	1	0.2U
MW-2D	Toluene	5	0.2U
MW-K1D	Benzene	1	0.2U
MW-K1D	Toluene	5	0.2U
MW-K1S	Benzene	1	0.2U
MW-K1S	Toluene	5	0.2U
MW-K2D	Benzene	1	0.2U
MW-K2D	Toluene	5	0.2U
MW-K2S	Benzene	1	0.2U
MW-K2S	Toluene	5	0.2U
MW-K3D	Benzene	1	0.2U
MW-K3D	Toluene	5	0.2U
MW-K3S	Benzene	1	0.2U
MW-K3S	Toluene	5	0.2U
MW-P1	Benzene	1	0.2U
MW-P1	Toluene	5	0.2U
MW-W1SA	Benzene	1	1
MW-W1SA	Toluene	5	0.2U
MW-W1D	Benzene	1	0.2U
MW-W1D	Toluene	5	0.2U
MW-W2D	Benzene	1	0.8J
MW-W2D	Toluene	5	**8**
MW-W2SA	Benzene	1	0.6J
MW-W2SA	Toluene	5	0.2U
MW-W3S	Benzene	1	0.2U
MW-W3S	Toluene	5	0.2U

Notes:
U = non-detect, J = estimated below the reporting limit
B = detected in the sampling blank
GWQS = New York State Groundwater Quality Standard
---= Not Sampled

Table 4
Summary Analytical Results for Inorganics in Monitoring Wells (2019 to 2023)
Hertel Landfill

WELL	ANALYTE	GWQS	Dec-98	Sep-19	Nov-21	Nov-23
MW-10D	Arsenic	10*	8.1B	0.86J	0.68U	1.0J
MW-10D	Iron	300***	1,040	**319**	230	**460**
MW-10D	Magnesium	35,000	7,450	9,920	8,900	8,800
MW-10D	Manganese	300***	260	280	250	260
MW-10D	Selenium	10	2U	0.65U	0.28U	0.28U
MW-10D	Sodium	20,000	5,300	4,860	3,600	6,200
MW-11D	Arsenic	10*	36	**30.7**	**28**	**32**
MW-11D	Iron	300***	18,800	**21,300**	**19,000**	**20,000**
MW-11D	Magnesium	35,000	30,900	24,600	25,000	24,000
MW-11D	Manganese	300***	7,880	**4,540**	**4,000**	**3,800**
MW-11D	Selenium	10	3.1B	0.65U	0.28U	0.28U
MW-11D	Sodium	20,000	47,700	**21,800**	**22,000**	19,000
MW-14I	Arsenic	10*	7.5B	0.68U	0.68U	0.68U
MW-14I	Iron	300***	84.5B	112	180	95
MW-14I	Magnesium	35,000	3,270B	2,620	2,100	3,000
MW-14I	Manganese	300***	3,430	**1,950**	**1,300**	**2,500**
MW-14I	Selenium	10	2.4B	0.65U	0.28U	0.28U
MW-14I	Sodium	20,000	3430B	2,320	2,400	2,400
MW-14S	Arsenic	10*	8.3B	6.9	2.4	8.2
MW-14S	Iron	300***	3,220	**3,550**	**930**	**3,600**
MW-14S	Magnesium	35,000	3520B	4,870	3,700	5,900
MW-14S	Manganese	300***	4,020	**9,400**	**6,500**	**10,000**
MW-14S	Selenium	10	2U	0.65U	0.28U	0.28U
MW-14S	Sodium	20,000	3,600B	2,360	2,400	2,500
MW-16DS	Arsenic	10*	7.4B	2.3	4	2.9
MW-16DS	Iron	300***	600	**62,100**	**99,000**	**59,000**
MW-16DS	Magnesium	35,000	2,400B	1,700	2,100	2,300
MW-16DS	Manganese	300***	1,190	**371**	290	**340**
MW-16DS	Selenium	10	2U	0.65U	0.28U	0.28U
MW-16DS	Sodium	20,000	2,090B	2,020	2,200	4,300
MW-17I	Arsenic	10*	9.1B	0.68U	0.68U	0.68U
MW-17I	Iron	300***	72.4B	22.8U	23U	20U
MW-17I	Magnesium	35,000	3730B	3,960	4,400	4,300
MW-17I	Manganese	300***	10.4B	25	3.5	260
MW-17I	Selenium	10	2U	0.65U	0.28U	0.28U
MW-17I	Sodium	20,000	23,000	**39,300**	11,000	11,000
MW-2D	Arsenic	10*	9.5B	0.68U	0.68U	0.68U
MW-2D	Iron	300***	228	22.8U	23U	36J
MW-2D	Magnesium	35,000	3880B	3,630	5,100	3,500
MW-2D	Manganese	300***	11B	4.9U	2.1	**1,200**
MW-2D	Selenium	10	2U	0.65U	0.28U	0.28U
MW-2D	Sodium	20,000	23,600	**42,700**	**26,000**	**36,000**
MW-9S	Arsenic	10*	16	0.98J	3.7	0.80J
MW-9S	Iron	300***	18,300	**2,520**	**13,000**	**2,000**

Table 4
Summary Analytical Results for Inorganics in Monitoring Wells (2019 to 2023)
Hertel Landfill

WELL	ANALYTE	GWQS	Dec-98	Sep-19	Nov-21	Nov-23
MW-9S	Magnesium	35,000	6,460	3,410	5,000	3,300
MW-9S	Manganese	300***	671	74	**1,200**	56
MW-9S	Selenium	10	2U	0.65U	0.28U	0.28U
MW-9S	Sodium	20,000	6,740	2,910	3,000	2,700
MW-K1D	Arsenic	10*	9.9B	1.2J	0.86J	1.2J
MW-K1D	Iron	300***	1,790	**18,500**	**12,000**	**41,000**
MW-K1D	Magnesium	35,000	4370B	17,700	22,000	23,000
MW-K1D	Manganese	300***	53	**757**	**1,000**	**1,200**
MW-K1D	Selenium	10	2U	0.65U	0.28U	0.28U
MW-K1D	Sodium	20,000	13,900	15,300	19,000	**21,000**
MW-K1S	Arsenic	10*	9.5B	0.68U	0.68U	0.68U
MW-K1S	Iron	300***	56.2B	**607**	**680**	**760**
MW-K1S	Magnesium	35,000	3160B	2,700	1,900	2,000
MW-K1S	Manganese	300***	383	300	100	120
MW-K1S	Selenium	10	2U	0.65U	0.285U	0.28U
MW-K1S	Sodium	20,000	6,010	6,940	3,600	3,500
MW-K2D	Arsenic	10*	10	1.2J	2.4	1.6J
MW-K2D	Iron	300***	4,560	**22,700**	**41,000**	**26,000**
MW-K2D	Magnesium	35,000	6,770	7,510	8,100	8,600
MW-K2D	Manganese	300***	96	241	**460**	**340**
MW-K2D	Selenium	10	2U	0.65U	0.28U	0.28U
MW-K2D	Sodium	20,000	5,660	7,180	7,100	8,200
MW-K2S	Arsenic	10*	9.4B	0.68U	0.68U	0.68U
MW-K2S	Iron	300***	1,720	233	170	**760**
MW-K2S	Magnesium	35,000	4540B	5,180	1,600	1,500
MW-K2S	Manganese	300***	116	**351**	300	**440**
MW-K2S	Selenium	10	2U	0.65U	0.28U	0.28U
MW-K2S	Sodium	20,000	16,100	**25,700**	6,300	6,800
MW-K3D	Arsenic	10*	9.5B	0.68U	0.77J	0.68U
MW-K3D	Iron	300***	6,580	**6,130**	**13,000**	**1,600**
MW-K3D	Magnesium	35,000	14,300	17,300	17,000	17,000
MW-K3D	Manganese	300***	314	61.9	240	130
MW-K3D	Selenium	10	2U	0.65U	0.28U	0.28U
MW-K3D	Sodium	20,000	22,400	14,800	15,000	16,000
MW-K3S	Arsenic	10*	11	2.0J	2.5	0.68U
MW-K3S	Iron	300***	178	**6,460**	**3,100**	**1,400**
MW-K3S	Magnesium	35,000	7,140	12,400	10,000	3,300
MW-K3S	Manganese	300***	685	**1,730**	**1,300**	**1,900**
MW-K3S	Selenium	10	2U	0.65U	0.28U	0.28U
MW-K3S	Sodium	20,000	11,900	14,000	12,000	**23,000**
MW-P1	Arsenic	10*	9.7B	3	4	2.4
MW-P1	Iron	300***	5,990	**2,280**	**3,500**	**3,800**
MW-P1	Magnesium	35,000	5,170	4,280	4,200	4,000
MW-P1	Manganese	300***	2,110	**1,490**	**1,500**	**1,200**

Table 4
Summary Analytical Results for Inorganics in Monitoring Wells (2019 to 2023)
Hertel Landfill

WELL	ANALYTE	GWQS	Dec-98	Sep-19	Nov-21	Nov-23
MW-P1	Selenium	10	2U	0.65U	0.28U	0.28U
MW-P1	Sodium	20,000	24,200	**35,300**	31,000	31,000
MW-W1D	Arsenic	10*	12	5.9	2.4	1.7J
MW-W1D	Iron	300***	2,330	**3,070**	**1,600**	**1,000**
MW-W1D	Magnesium	35,000	44,100	**41,900**	**43,000**	**42,000**
MW-W1D	Manganese	300***	3,760	**5,670**	**4,000**	**3,600**
MW-W1D	Selenium	10	2U	0.65U	0.28U	0.28U
MW-W1D	Sodium	20,000	94,200	**41,100**	**45,000**	**43,000**
MW-W1SA	Arsenic	10*	8.7B	**65.9**	**52**	**62**
MW-W1SA	Iron	300***	3,700	**18,700**	**20,000**	**26,000**
MW-W1SA	Magnesium	35,000	24,950	30,200	28,000	28,000
MW-W1SA	Manganese	300***	21,000	**19,400**	**17,000**	53
MW-W1SA	Selenium	10	12	0.65U	0.28U	0.28U
MW-W1SA	Sodium	20,000	13,400	**41,100**	**23,000**	**24,000**
MW-W2D	Arsenic	10*	25	**25.8**	**22**	**27**
MW-W2D	Iron	300***	8,760	**22,400**	**20,000**	**23,000**
MW-W2D	Magnesium	35,000	20,800	14,500	12,000	13,000
MW-W2D	Manganese	300***	10,600	**8,830**	**9,600**	**8,400**
MW-W2D	Selenium	10	3.2B	0.65U	0.28U	0.28U
MW-W2D	Sodium	20,000	27,000	7,320	5,800	6,200
MW-W2SA	Arsenic	10*	35	**26.7**	**35**	**34**
MW-W2SA	Iron	300***	25,200	**25,300**	**32,000**	**30,000**
MW-W2SA	Magnesium	35,000	29,000	16,200	15,000	14,000
MW-W2SA	Manganese	300***	12,400	**10,000**	**14,000**	**10,000**
MW-W2SA	Selenium	10	4.6B	0.65U	0.28U	0.28U
MW-W2SA	Sodium	20,000	31,700	9,420	7,300	7,500
MW-W3S	Arsenic	10*	6.4B	0.68U	0.68U	0.68U
MW-W3S	Iron	300***	1,380	199	30J	83
MW-W3S	Magnesium	35,000	1430B	1,020	910	920
MW-W3S	Manganese	300***	55.8	4.9U	7.2	2.8
MW-W3S	Selenium	10	2U	0.65U	0.28U	0.28U
MW-W3S	Sodium	20,000	1920B	2,030	2,700	2,100

Notes:

U = non-detect, J = estimated below the reporting limit, B = detected in the sampling blank

GWQS = New York State Groundwater Quality Standard

*= EPA Maximum Contaminant Level (MCL)

*** = GWQS for iron and manganesium is summmed value of 300 micrograms per liter

Table 5
Summary Analytical Results for Inorganics in Private Wells (2019 to 2023)
Hertel Landfill

Well	Element	GWQS	Jun-01	Sep-19	Jun-20	Nov-21	Sep-22	Nov-23	Oct-24
PW-1	Copper	200	27	12.7	---	19	39	18	9.3J
PW-1	Iron	300***	49.8B	46U	---	130J	110U	60U	70U
PW-1	Lead	15**	1.6U	0.67U	---	2.7	11	0.67U	0.67U
PW-1	Manganese	300***	1.2B	5.5	---	9.4	3.4	6.1	5U
PW-1	Sodium	20000	9,980	13,800	---	14,000	13,000	14,000	13,000
PW-2	Copper	200	20	**260**	18	9.8U	25	11	16
PW-2	Iron	300***	33.4U	46U	16U	120J	110U	60U	70U
PW-2	Lead	15**	1.6U	3.9	0.67U	0.67U	0.98J	0.67U	0.67U
PW-2	Manganese	300***	0.83U	7.4	4.2J	23	1U	2U	5U
PW-2	Sodium	20000	153,000	15,300	14,000	15,000	**200,000**	**200,000**	**190,000**
PW-3	Copper	200	5.8B	12.2	9.8J	9.8U	11	88	---
PW-3	Iron	300***	47B	46U	**430**	110U	110U	60U	---
PW-3	Lead	15**	1.6U	0.67U	0.78J	0.67U	0.89J	0.97J	---
PW-3	Manganese	300***	7.4B	1.1U	8.9J	1U	1.6J	2U	---
PW-3	Sodium	20000	15,700	18,900	**20,000**	**21,000**	**24,000**	**22,000**	---
PW-4	Copper	200	20.9B	---	37	180	50	---	23
PW-4	Iron	300***	58.9B	---	65	110U	110U	---	70U
PW-4	Lead	15**	1.9	---	1.2	1.8	9.7	---	0.67U
PW-4	Manganese	300***	2.7B	---	3J	2.6J	1U	---	5U
PW-4	Sodium	20000	11,700	---	11,000	18,000	**33,000**	---	19,000
PW-5	Copper	200	10.3B	13.5	9.8U	9.8U	8.6	8.2	5.1
PW-5	Iron	300***	29.8B	46U	16U	110U	110U	60U	70U
PW-5	Lead	15**	1.6U	0.67U	0.67U	0.67U	0.67U	0.67U	0.67U
PW-5	Manganese	300***	0.7B	1.1U	0.65J	1U	1U	2U	5U
PW-5	Sodium	20000	18,000	**132,000**	**140,000**	**130,000**	**140,000**	**140,000**	**140,000**
PW-8	Copper	200	118	76.6	**430**	**830**	**920**	78	42
PW-8	Iron	300***	189	75.1	**710**	110U	110U	60U	70U
PW-8	Lead	15**	1.9	0.67U	1.4	0.67U	0.67U	0.91J	0.79J
PW-8	Manganese	300***	2B	25.7	11	1U	1U	2U	5U
PW-8	Sodium	20000	39,700	**41,400**	**25,000**	**46,000**	**43,000**	**82,000**	**100,000**
PW-9	Copper	200	8.4B	9.8U	9.8U	47	49	11	4.2J
PW-9	Iron	300***	74.1B	46U	16U	110U	110U	100J	210
PW-9	Lead	15**	1.6U	0.67U	2	0.67U	**28**	3.5	0.9J
PW-9	Manganese	300***	88	127	130	160	130	150	150
PW-9	Sodium	20000	3,760B	4,370	4,200	4,300	4,300	4,500	4,300
PW-10	Copper	200	30	10.4	59	9.8U	22	11	12
PW-10	Iron	300***	23.7U	46U	16U	110U	110U	60U	70U
PW-10	Lead	15**	2.3	0.67U	0.67U	0.67U	0.67U	0.67U	1.5
PW-10	Manganese	300***	1.7B	1.1U	0.65U	1U	1U	2U	5U
PW-10	Sodium	20000	8,610	**100,000**	**96,000**	**100,000**	**99,000**	**100,000**	**94,000**
PW-11	Copper	200	50.8	41.8	13	24	14	16	11
PW-11	Iron	300***	60.8B	100	16U	110U	110U	60U	70U

Table 5
Summary Analytical Results for Inorganics in Private Wells (2019 to 2023)
Hertel Landfill

Well	Element	GWQS	Jun-01	Sep-19	Jun-20	Nov-21	Sep-22	Nov-23	Oct-24
PW-11	Lead	15**	50.5	12	1.1	1.8	12	0.67U	0.67U
PW-11	Manganese	300***	61	15.9	4.5	1.9	1.1J	2U	5U
PW-11	Sodium	20000	34,100	**43,600**	**40,000**	**46,000**	**47,000**	**44,000**	**31,000**
PW-12	Copper	200	14.1	---	---	---	**2,200**	---	---
PW-12	Iron	300***	27.7	---	---	---	110U	---	---
PW-12	Lead	15**	2.4U	---	---	---	**55**	---	---
PW-12	Manganese	300***	3.4	---	---	---	14	---	---
PW-12	Sodium	20000	22,100	---	---	---	14,000	---	---
PW-13	Copper	200	---	33.1	150	**700**	**530**	140	48
PW-13	Iron	300***	---	46J	16J	110U	110U	**630**	78J
PW-13	Lead	15**	---	1.6	2.1	5.5	9.7	5	2.5
PW-13	Manganese	300***	---	49.7	0.95J	8.9J	9.6J	70	28
PW-13	Sodium	20000	---	15,100	14,000	12,000	16,000	15,000	16,000

Notes:

U = non-detect, J = estimated below the reporting limit, B = detected in the sampling blank GWQS = New York State Groundwater Quality Standard

**= USEPA Drinking Water MCL

*** = GWQS for iron and manganese is summmed value of 300 micrograms per liter

APPENDIX C – Reference List

Document Title, Author	Submittal Date
Remedial Investigation/Feasibility Study	July 1991
Former Hertel Landfill Site Remedial Action Report, Killam Associates	April 1999
Record of Decision, EPA	September 1991
First Five-Year Review, EPA	September 2001
Former Hertel Landfill Site, Groundwater Technical Report, Hatch Mott MacDonald	October 2002
Baseline Human Health Risk Assessment (BHHRA) Update	November 2003
Final Baseline Ecological Risk Assessment, Arcadis G & M	August 2004
ROD Amendment, EPA	January 2005
Second Five-Year Review, EPA	June 2005
Third Five-Year Review, EPA	April 2010
Environmental Protection Easements Letter, Hatch Mott MacDonald	November 26, 2013
Groundwater, Residential, Surface water and Sediment Sampling Data Reports, Hatch Mott MacDonald	2010-2014
2014 Hertel Landfill - Evaluation of Site Monitoring Data Report, Hatch Mott MacDonald	October 10, 2014
Fourth Five-Year Review, EPA	September 2015
2019 Hertel Landfill - Evaluation of Site Monitoring Data Report, Hatch Mott MacDonald	August 30, 2019
Fifth Five-Year Review, EPA	February 21, 2020
August 2020 Emerging Contaminants in Groundwater Sampling Event Report, Mott MacDonald	June 4, 2021
Quarterly Inspection Reports, City of Poughkeepsie	April 17, 2024 July 3, 2024 September 5, 2024
December 2023 PFAS in Groundwater Sampling Event Report, Mott MacDonald	April 17, 2024
2023 Compliance Monitoring Results Report, Mott MacDonald	August 30, 2024
August 2024 Five-Year Site Monitoring Data Report (September 2019 to December 2023), Mott MacDonald	August 30, 2024

APPENDIX D – Chronology of Site Events

Chronology of Events	
Date	**Event**
June 1986	Site placed on NPL
July 1991	Remedial Investigation/Feasibility Study (RI/FS) released
September 1991	ROD issued
September 1996	Remedial Pre-Design Investigation approved
November 1996	Preliminary clearing and grubbing of the landfill area
June 1997	Beginning of construction activities
December 1998	Construction of landfill cap completed
December 1998	Site Inspection of landfill cap
May 1999	Remedial Action Report Approved
September 2001	First Five-Year Review completed
October 2002	Groundwater Technical Report completed
July 2004	Post-Decision Proposed Plan issued
July 2004	Upgradient Residential Sampling performed
September 2004	Final Site Inspection conducted
February 2005	Preliminary Close-Out Report documenting completion of Site construction activities approved
January 2005	ROD Amendment
June 2005	Second Five-Year Review completed
April 2010	Third Five-Year Review completed
2005 – to present	Long-term monitoring program
September 2015	Fourth Five-Year Review completed
February 2020	Fifth Five-Year Review completed

APPENDIX E – REMEDY RESILIENCE ASSESSMENT

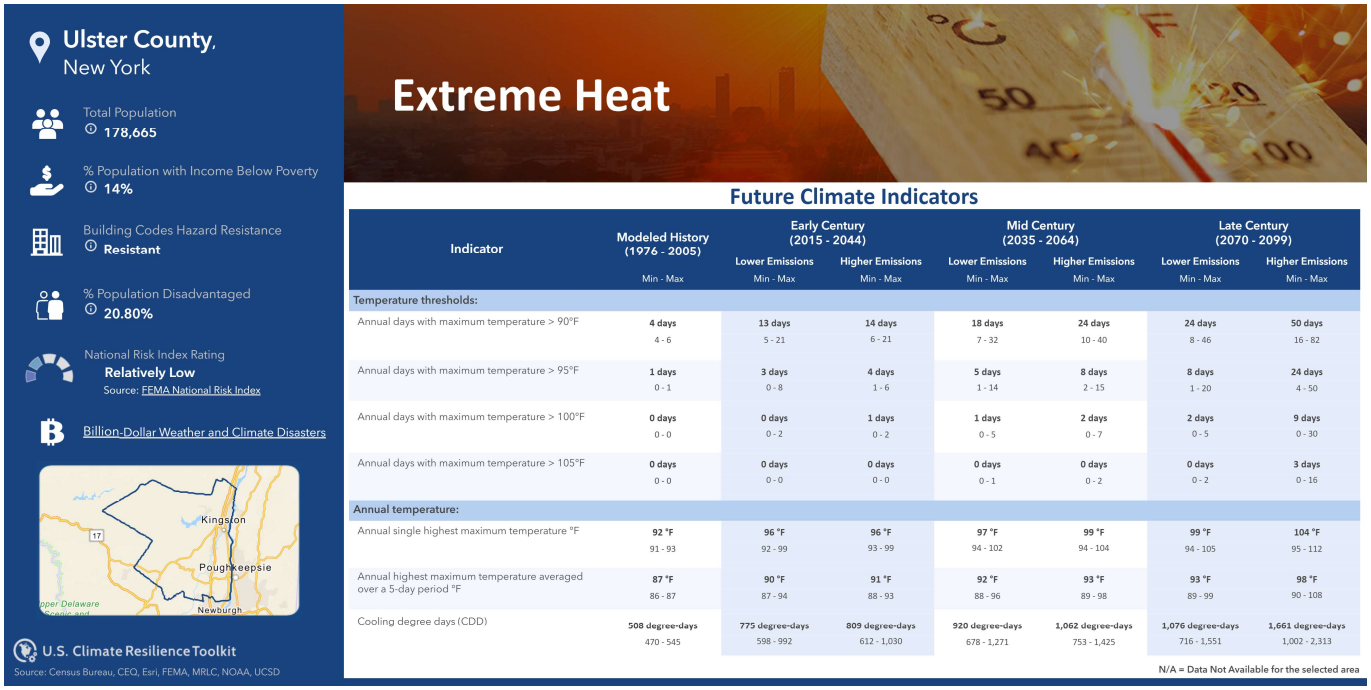
In accordance with Region 2 practice, two tools were utilized to assess the Hertel Landfill Superfund Site. Screenshots from each of the tools assessed are shown below.

The first tool used to assess the site was the CMRA Assessment Tool. The tool examined five hazards for the county the Site falls within. According to this tool, the National Risk Index Rating for extreme heat is "Relatively Low." There is a projected increase of days per year with maximum temperatures >100°F, as show in **Figure E-1**. The four other hazards evaluated by this tool, drought, flooding, wildfire, and coastal flooding, have National Risk Index Ratings of "Relatively Low," "Relatively Moderate," "Very Low," and "Relatively Moderate," respectively. Despite the relatively moderate risk rating for flooding, **Figures E-2 and E-3** only show a slight increase in average annual total precipitation and an increase in days per year with precipitation. **Figure E-4** also shows a slight increase in annual days with precipitation over one inch. Furthermore, flooding has not been identified as a site-specific risk factor in the past. Although coastal flooding is associated with a "Relatively Moderate," as shown in **Figure E-5**, the percent of the county impacted by global sea level rise is 0.0%.

The second tool utilized is called the *USGS U.S. Landslide Inventory*. Results indicate that although there is some limited landslide susceptibility near the site, there have not been any landslides recorded in the immediate vicinity(**Figure E-6**).

Based on this information, potential site impacts from severe weather have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of weather-related events in the region and near the site.

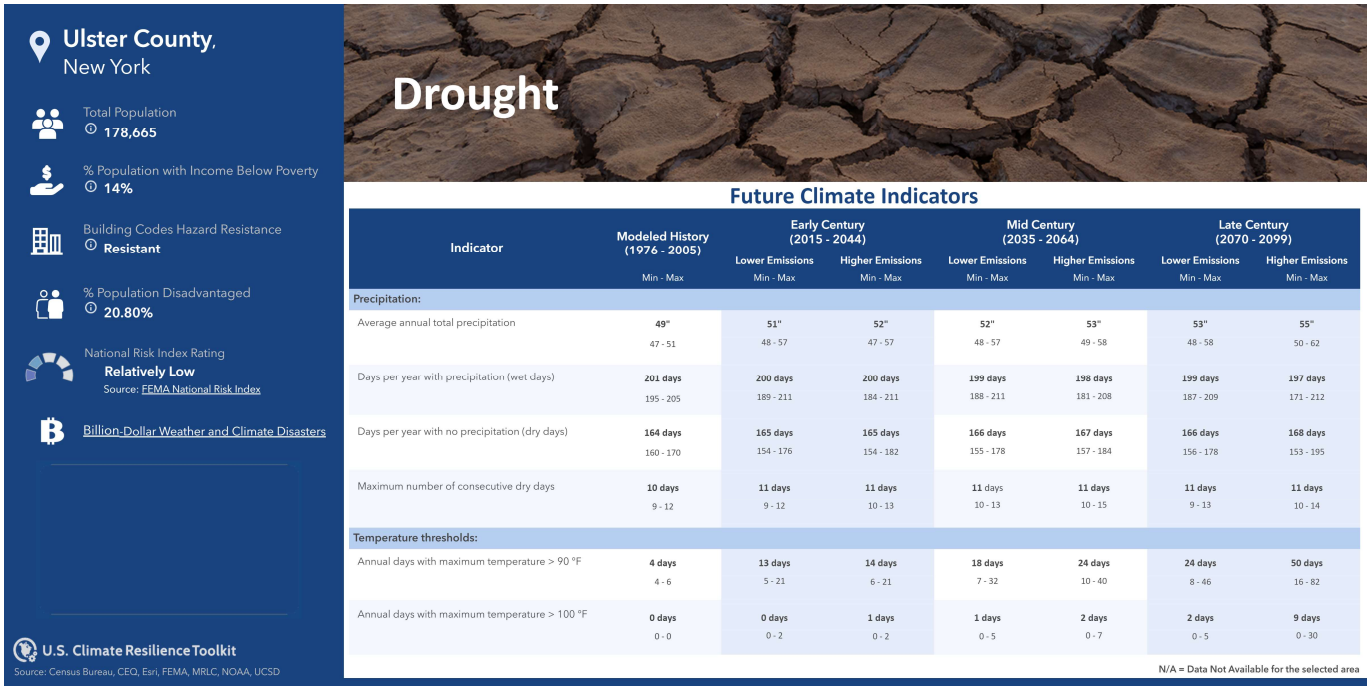
Figure E-1 - Extreme Heat



Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Temperature thresholds:							
Annual days with maximum temperature > 90°F	4 days 4 - 6	13 days 5 - 21	14 days 6 - 21	18 days 7 - 32	24 days 10 - 40	24 days 8 - 46	50 days 16 - 82
Annual days with maximum temperature > 95°F	1 days 0 - 1	3 days 0 - 8	4 days 1 - 6	5 days 1 - 14	8 days 2 - 15	8 days 1 - 20	24 days 4 - 50
Annual days with maximum temperature > 100°F	0 days 0 - 0	0 days 0 - 2	1 days 0 - 2	1 days 0 - 5	2 days 0 - 7	2 days 0 - 5	9 days 0 - 30
Annual days with maximum temperature > 105°F	0 days 0 - 0	0 days 0 - 0	0 days 0 - 0	0 days 0 - 1	0 days 0 - 2	0 days 0 - 2	3 days 0 - 16
Annual temperature:							
Annual single highest maximum temperature °F	92 °F 91 - 93	96 °F 92 - 99	96 °F 93 - 99	97 °F 94 - 102	99 °F 94 - 104	99 °F 94 - 105	104 °F 95 - 112
Annual highest maximum temperature averaged over a 5-day period °F	87 °F 86 - 87	90 °F 87 - 94	91 °F 88 - 93	92 °F 88 - 96	93 °F 89 - 98	93 °F 89 - 99	98 °F 90 - 108
Cooling degree days (CDD)	508 degree-days 470 - 545	775 degree-days 598 - 992	809 degree-days 612 - 1,030	920 degree-days 678 - 1,271	1,062 degree-days 753 - 1,425	1,076 degree-days 716 - 1,551	1,661 degree-days 1,002 - 2,313

N/A = Data Not Available for the selected area

Figure E-2 - Drought



Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Precipitation:							
Average annual total precipitation	49" 47 - 51	51" 48 - 57	52" 47 - 57	52" 48 - 57	53" 49 - 58	53" 48 - 58	55" 50 - 62
Days per year with precipitation (wet days)	201 days 195 - 205	200 days 189 - 211	200 days 184 - 211	199 days 188 - 211	198 days 181 - 208	199 days 187 - 209	197 days 171 - 212
Days per year with no precipitation (dry days)	164 days 160 - 170	165 days 154 - 176	165 days 154 - 182	166 days 155 - 178	167 days 157 - 184	166 days 156 - 178	168 days 153 - 195
Maximum number of consecutive dry days	10 days 9 - 12	11 days 9 - 12	11 days 10 - 13	11 days 10 - 13	11 days 10 - 15	11 days 9 - 13	11 days 10 - 14
Temperature thresholds:							
Annual days with maximum temperature > 90 °F	4 days 4 - 6	13 days 5 - 21	14 days 6 - 21	18 days 7 - 32	24 days 10 - 40	24 days 8 - 46	50 days 16 - 82
Annual days with maximum temperature > 100 °F	0 days 0 - 0	0 days 0 - 2	1 days 0 - 2	1 days 0 - 5	2 days 0 - 7	2 days 0 - 5	9 days 0 - 30

N/A = Data Not Available for the selected area

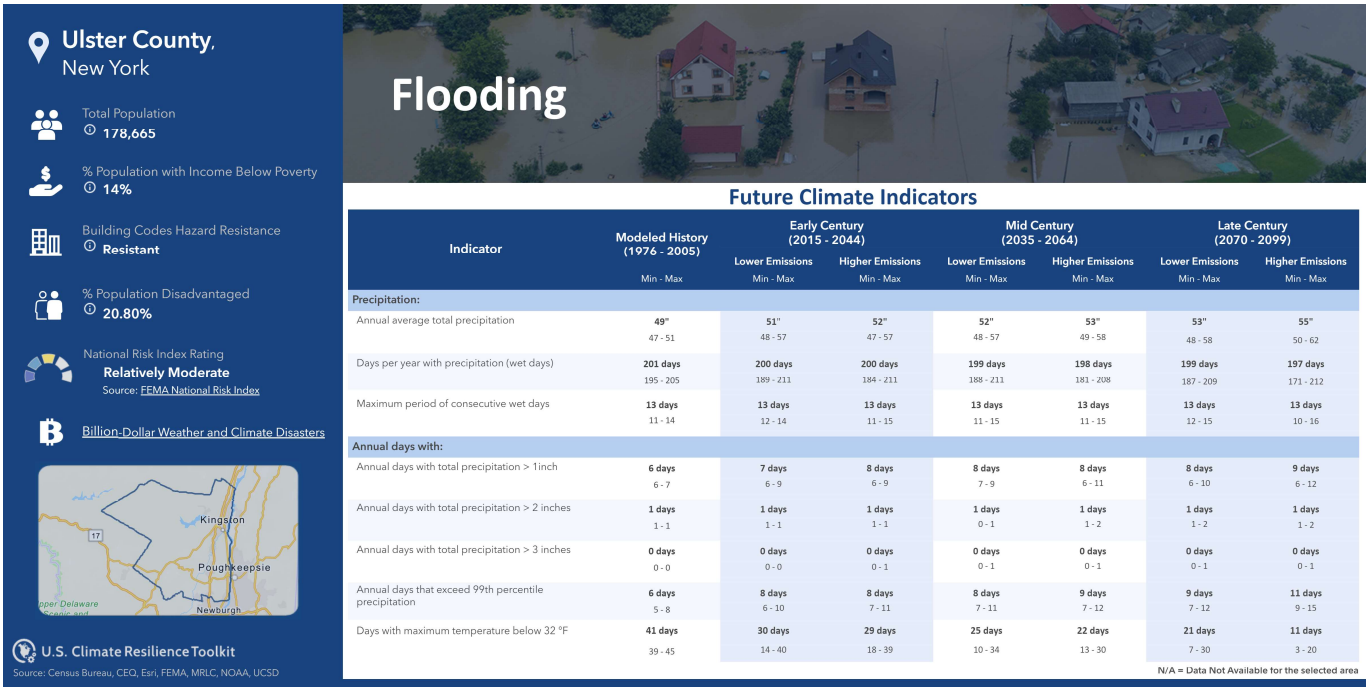
Figure E-3 - Wildfire

Future Climate Indicators

Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Precipitation:							
Days per year with no precipitation (dry days)	164 days 160 - 170	165 days 154 - 176	165 days 154 - 182	166 days 155 - 178	167 days 157 - 184	166 days 156 - 178	168 days 153 - 195
Maximum number of consecutive dry days	10 days 9 - 12	11 days 9 - 12	11 days 10 - 13	11 days 10 - 13	11 days 10 - 15	11 days 9 - 13	11 days 10 - 14
Days per year with precipitation (wet days)	201 days 195 - 205	200 days 189 - 211	200 days 184 - 211	199 days 188 - 211	198 days 181 - 208	199 days 187 - 209	197 days 171 - 212
Temperature thresholds:							
Annual days with maximum temperature > 90°F	4 days 4 - 6	13 days 5 - 21	14 days 6 - 21	18 days 7 - 32	24 days 10 - 40	24 days 8 - 46	50 days 16 - 82
Annual days with maximum temperature > 100°F	0 days 0 - 0	0 days 0 - 2	1 days 0 - 2	1 days 0 - 5	2 days 0 - 7	2 days 0 - 5	9 days 0 - 30

N/A = Data Not Available for the selected area

Figure E-4 - Flooding



Future Climate Indicators

Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Precipitation:							
Annual average total precipitation	49" 47 - 51	51" 48 - 57	52" 47 - 57	52" 48 - 57	53" 49 - 58	53" 48 - 58	55" 50 - 62
Days per year with precipitation (wet days)	201 days 195 - 205	200 days 189 - 211	200 days 184 - 211	199 days 188 - 211	198 days 181 - 208	199 days 187 - 209	197 days 171 - 212
Maximum period of consecutive wet days	13 days 11 - 14	13 days 12 - 14	13 days 11 - 15	13 days 11 - 15	13 days 11 - 15	13 days 12 - 15	13 days 10 - 16
Annual days with:							
Annual days with total precipitation > 1inch	6 days 6 - 7	7 days 6 - 9	8 days 6 - 9	8 days 7 - 9	8 days 6 - 11	8 days 6 - 10	9 days 6 - 12
Annual days with total precipitation > 2 inches	1 days 1 - 1	1 days 1 - 1	1 days 1 - 1	1 days 0 - 1	1 days 1 - 2	1 days 1 - 2	1 days 1 - 2
Annual days with total precipitation > 3 inches	0 days 0 - 0	0 days 0 - 0	0 days 0 - 1	0 days 0 - 1	0 days 0 - 1	0 days 0 - 1	0 days 0 - 1
Annual days that exceed 99th percentile precipitation	6 days 5 - 8	8 days 6 - 10	8 days 7 - 11	8 days 7 - 11	9 days 7 - 12	9 days 7 - 12	11 days 9 - 15
Days with maximum temperature below 32 °F	41 days 39 - 45	30 days 14 - 40	29 days 18 - 39	25 days 10 - 34	22 days 13 - 30	21 days 7 - 30	11 days 3 - 20

N/A = Data Not Available for the selected area

Figure E-5 - Coastal Flooding

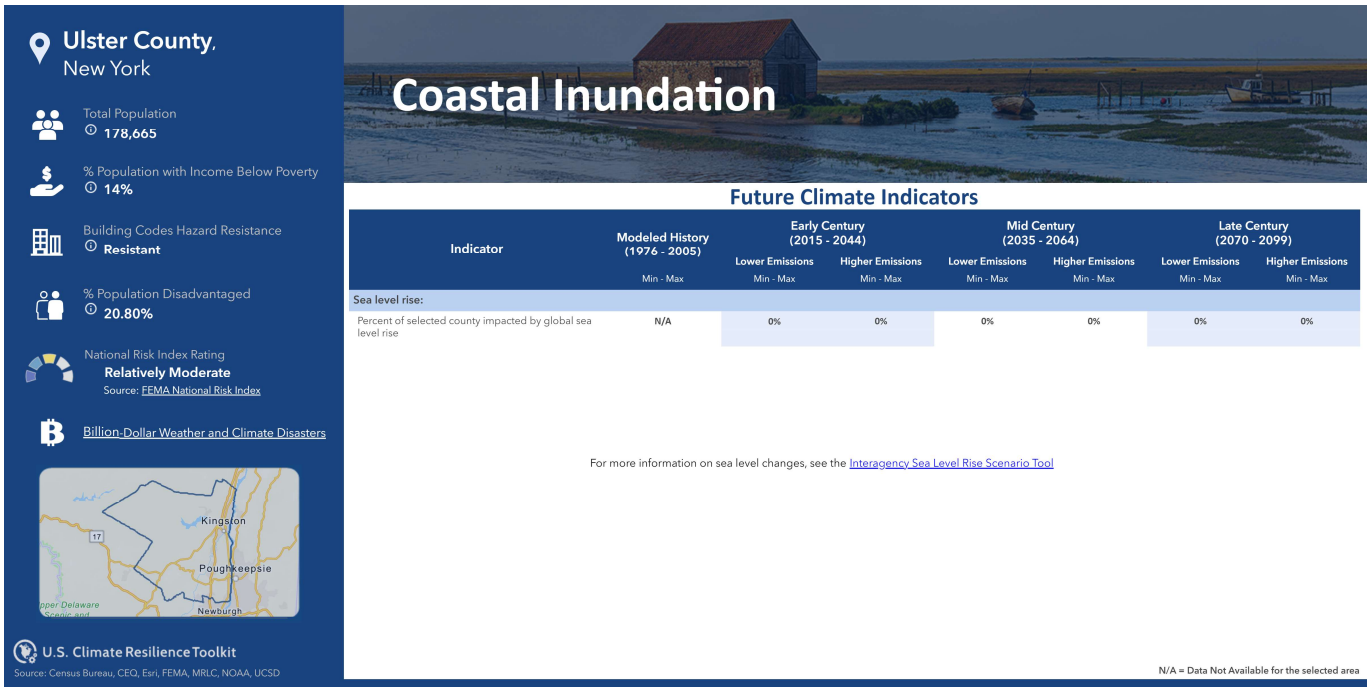


Figure E-6 – Landslides