SIXTH FIVE-YEAR REVIEW REPORT FOR MONROE TOWNSHIP LANDFILL SUPERFUND SITE MIDDLESEX COUNTY, NEW JERSEY

Prepared by

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

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November 15, 2024

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Date

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LIST OF ABBREVIATIONS & ACRONYMS

ACO	Administrative Consent Order
BFISJ	Browning Ferris Industries of South Jersey
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
GMP	Gas Monitoring Probe
ICs	Institutional Controls
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/L	Nanograms per Liter
NJDEP	The New Jersey Department of Environmental Protection
NJGWQS	New Jersey Ground Water Quality Standards
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
POTW	Publicly Owned Treatment Works
PFAS	Per- and Polyfluoroalkyl Substances
RAO	Remedial Action Objectives
Republic	Republic Services
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
SVOC	Semi Volatile Organic Compound
UU/UE	Unlimited Use and Unrestricted Exposure
µg/L	Micrograms per Liter
VOC	Volatile Organic Compound

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. 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 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 Monroe Township Landfill Superfund Site (site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared due to the fact that 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 one Operable Unit (OU) which will be addressed in this FYR. OU1 addresses the source control measures and groundwater.

The Monroe Township Landfill Superfund Site FYR was led by Brennan Woodall, the Remedial Project Manager for EPA. Participants included Rachel Griffiths, EPA's Hydrogeologist; Urszula Kinahan, EPA's Human Health Risk Assessor; Detbra Rosales, EPA's Ecological Risk Assessor; and Pat Seppi, EPA's Community Involvement Coordinator. The New Jersey Department of Environmental Protection (NJDEP), Monroe Township, and Republic Services were notified of the initiation of the FYR. The review began on 5/30/2024.

Site Background

The Monroe Township Landfill Site is located on an 86-acre property in Middlesex County, New Jersey. The landfill mound covers the majority of the property, with the leachate collection facilities in the northeast corner covering most of the remaining area. Although at the time of the Record of Decision (ROD) the landfill was only bordered on two sides by residential housing, with wooded areas adjacent to the other sides, it is now completely surrounded by low to mid-density residential development. There are no current uses for the closed landfill.

Monroe Township was the original owner and operator of the landfill and continues to own the property. The township operated the landfill from the mid-1950s to 1968, when it was leased to Princeton Disposal Service for operation under a service contract with Monroe Township. Browning Ferris Industries of South Jersey (BFISJ) acquired Princeton Disposal Service in 1972 and operated the landfill until 1978. NJDEP ordered the site operations to cease in 1978 when leachate seeped onto Lani Street adjacent to the northeast corner of the property. Based on NJDEP documentation, only municipal and household waste was placed in the landfill. BFISJ was acquired by Republic Services (Republic) in 2008.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Monroe Township Landfill Superfund Site		
EPA ID: NJD980505671		
Region: 2	**State:** NJ	**City/County:** Monroe Township, Middlesex County

SITE STATUS	
NPL Status: Deleted	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: State
Author name (Federal or State Project Manager): Brennan Woodall
Author affiliation: USEPA
Review period: 5/30/2024 – 8/30/2024
Date of site inspection: 8/6/2024
Type of review: Statutory
Review number: 6
Triggering action date: 11/18/2019
Due date *(five years after triggering action date)*: 11/18/2024

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

When the site was placed on the NPL in September 1983, NJDEP was designated the lead agency, and EPA was designated the support agency. Pursuant to a 1986 Administrative Consent Order (ACO) with NJDEP, BFISJ was required to perform a remedial investigation and feasibility study (RI/FS) to determine the effectiveness of the remedial measures already in place and determine if any additional measures were required to address site contamination (a list of site contaminants can be found in Appendix B, Table 1). During the RI/FS, a site-specific risk assessment considered several potentially exposed populations including off-site residents, site trespassers, site workers, and future recreational site users. Each of these populations was evaluated for potential exposure to contaminated groundwater, soil, sediments and air. The risk assessment determined that the remedial measures already in place were effective, and none of the exposure pathways posed an unacceptable risk.

The RI/FS also evaluated ecological risks. Based on the off-site chemical data, information on the source of contaminants, and remedial measures taken pursuant to the 1986 ACO, it was concluded that it was

unlikely that there would be adverse impacts on the flora and fauna of the area, on the wetland communities as a whole, or on potential threatened and endangered species in the vicinity of the site. The RI/FS was completed in 1993 and formed the basis for the selection of a remedy for the site, discussed below.

Response Actions

Following cessation of operations, an ACO was signed by BFISJ and NJDEP on October 19, 1979. This ACO established methods and schedules for designing and implementing a landfill closure plan. The remedial measures required under the closure plan were completed in 1984. In accordance with the 1979 ACO the following remedial measures were implemented:

- Installation of a 7,000-foot-long compacted clay cutoff wall circumscribing most of the site.
- Construction and operation of a leachate collection and storage system that discharges to a Publicly Owned Treatment Works (POTW) under a New Jersey Pollutant Discharge Elimination System (NJPDES) permit.
- Construction of a protective clay cap covering the northern portion of the landfill and a soil cap covering the remainder of the landfill.

The clay cutoff wall could not be installed on the northern portion of the landfill due to the absence of an underlying clay layer to key the wall into. On this portion of the landfill, a low permeability clay cap was installed (maximum permeability of 10^{-7} centimeters per second) to minimize infiltration of precipitation. The clay cap was installed in accordance with the New Jersey State Solid Waste Management Act and meets current state and federal standards for solid waste.

The soil cap covering the remainder of the landfill was also installed in accordance with the New Jersey State Solid Waste Management Act and meets current state and federal standards (two feet of clean topsoil and vegetation). The soil cap prevents erosion from occurring and allows the percolation of rainwater through the landfill. Leachate generated from this percolation is collected in the leachate collection system and discharged to a dedicated sewer line before discharging to the main sewer line on Spotswood Gravel Hill Road. The leachate is ultimately treated at a POTW facility. Appendix B, Figure 1 identifies areas of the landfill with the clay cap, cutoff wall, leachate collection system and the soil cap. BFISJ and the NJDEP entered into a second ACO effective December 29, 1986, to determine the effectiveness of the closure and remedial measures implemented, and to address upgrades required by NJDEP.

The following additional remedial measures were completed between 1987 and 1991 in accordance with the 1986 ACO:

- Upgrading the soil erosion and sediment control systems by replacing the former channels with rip-rap lined channels and upgrading the sediment basin.
- Installation of a seven-foot-high chain-link fence surrounding the landfill to limit unauthorized access.
- Closure of the previous leachate storage lagoon and construction of an underground leachate storage tank.
- Installation of an emergency power generator as a contingency for the leachate collection system in case of power failure.
- Installation of 13 landfill gas vents for gas ventilation under a New Jersey Air Pollution Control Permit.

In addition to these response actions, the leachate discharge system was modified in 2023 as described in the Systems Operations/Operation & Maintenance section below.

These remedial systems have proven to be effective as source control measures.

Status of Implementation

The ROD for the Monroe Township Landfill was issued by NJDEP on April 23, 1993. The ROD called for No Further Action with Maintenance and Monitoring. A summarized description of the selected remedy as contained in the ROD is presented below.

- The source control measures which are currently in place at the site, including the landfill cover systems, site security fencing, leachate collection and management system, emergency power supply, landfill gas vent system, and surface water, sediment and erosion control are maintained under the post-closure operation and maintenance plan.
- A groundwater monitoring program, which includes a sentinel well system, is to be instituted to assess the continued effectiveness of the existing source control measures. The sentinel well system is to be sampled on a quarterly basis to monitor groundwater quality. The groundwater at the site is determined to be in compliance if: 1) contaminant concentrations have not been increasing in site monitor wells; 2) contaminant concentrations have been steadily decreasing in source control monitor wells; and 3) no contamination above the applicable groundwater quality standard is detected in the sentinel well system, which indicates no significant migration of contaminants has occurred. If contaminants are confirmed to be present in the sentinel well system at concentrations above the New Jersey Ground Water Quality Standards (NJGWQS), the need for additional remedial action(s) will be reevaluated.
- Landfill gas emissions are to be monitored in accordance with the existing air pollution control permit.
- Surface water discharge from the sedimentation pond is to be monitored in accordance with the NJPDES/Discharge to Surface Water permit for the first five years.
- The leachate collection and discharge to the POTW is to be monitored in accordance with the current NJPDES permit.

No remedial action objectives were identified in the ROD. The Operation and Maintenance (O&M) Plan and the requirements for the source control measures are specified in the Post-Closure Monitoring and Maintenance Plan. The Post-Closure Monitoring and Maintenance Plan also included monitoring of selected perimeter monitor wells using target compound list/target analyte list parameters.

IC Summary Table

Table 1: Summary of Planned and/or Implemented 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	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	No	Landfill Property	Restrict installation of groundwater wells and groundwater use.	Classification Exception Area (CEA) October 2000

Although a CEA has been established, the ROD acknowledges that future use of the Magothy formation, the results from which are discussed under Data Review, is unlikely due to a township ordinance that requires all dwellings to be connected to the public water supply. The ordinance also precludes any future homes from using private wells.

Systems Operations/Operation & Maintenance

Since 1991, BFISJ (now Republic) has been operating the leachate collection system under State oversight and has conducted long-term monitoring and maintenance activities according to the State approved Post-Closure Monitoring and Maintenance Plan. The primary activities associated with O&M, which are currently ongoing, include the following:

- Operate, monitor, and maintain the leachate collection system.
- Collect and analyze groundwater samples to ensure effectiveness of the containment system.
- Monitor the landfill gas emissions.
- Monitor and maintain integrity of the perimeter fence, cap and slurry wall.

As approved per the site closure, leachate collected at the landfill was managed by direct discharge to the public sanitary sewage system for disposal. A number of community members contacted Republic, Monroe Township, NJDEP and EPA concerning odors in the area of the landfill leachate discharge. In September 2020, Monroe Township directed Republic to cease discharge of leachate to the Monroe Township sanitary sewer system due to potential capacity limitations of the sewer main located northeast of the landfill. Starting in September 2020, Republic temporarily trucked leachate off site to permitted wastewater treatment plants and worked with NJDEP and Monroe Township to assess the management of leachate at the site. During this temporary work, several leachate spills occurred at the landfill. Under the direction of NJDEP, Republic addressed the spills, increased the leachate handling capacity at the landfill and implemented additional monitoring controls to prevent further releases of leachate. In 2021, Republic also made several upgrades to the leachate pump stations on site and constructed a lined leachate storage tank containment area on the landfill to manage leachate. There is additional leachate storage capacity in this area designed for intermittent use to provide temporary storage of leachate in extreme rain events to ensure the quantity of leachate discharged to the sewer system remains below its permitted limit.

Construction of a separate leachate force main from the landfill to a main sewage trunk line located on Spotswood Gravel Hill Road was initiated in 2021 by Monroe Township. Construction was completed in

2023 and Republic began discharging leachate to the new force main in July 2023, ceasing the trucking of leachate off site.

In 2024, Republic placed heavy matting over manholes at the landfill to cover gaps where odors may emanate and installed carbon filters on the sumps at Pump Station A and Pump Station AB, as well as on the underground storage tank at the base of the landfill to address potential odor sources at the landfill (Appendix B, Figure 1).

Potential site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the site (Appendix C).

A new monitoring well, MW-100, was installed in 2021 per NJDEP request to evaluate groundwater quality in the northeast portion of the site. Consistent with the approved work plan for installation and sampling, MW-100 was sampled for 4 consecutive quarters (October 2021-October 2022) followed by semiannual sampling. As discussed below in the data review, no volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCs) exceeded their NJGWQS in any of the seven sampling events at this well. Sampling of MW-100 was discontinued in 2023 after 7 rounds of data with no VOC or SVOC exceedances, and metals data consistent with background concentrations.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the **last** FYR. There were no issues or recommendations from the last FYR.

Table 2: Protectiveness Determinations/Statements from the 2019 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The remedy at the Monroe Township Landfill site is protective of human health and the environment.
Sitewide	Protective	The remedy at the Monroe Township Landfill site is protective of human health and the environment.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On August 7, 2024, 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 Monroe Township 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, the EPA Community Involvement Coordinator (CIC) for the site, Pat Seppi, posted a public notice on the EPA site webpage [http://www.epa.gov/superfund/monroe-township] and provided the notice to Monroe Township by email on October 11, 2024 with a request that the notice be posted in municipal offices and on the township webpages. This notice indicated that a FYR would be

conducted at the Monroe Township Landfill Superfund Site to ensure that the cleanup at the site continues to be protective of people's health and the environment. Once the FYR is completed, the results will be made available at the following repository: EPA Region 2, Superfund Records Center, 290 Broadway, 18th Floor, New York, NY 10007-1866, Phone: (212) 637-4308. In addition, the final report will be posted on the following website: http://www.epa.gov/superfund/monroe-township. Efforts will be made to reach out to local public officials to inform them of the results.

Data Review

In accordance with the 1993 ROD, a landfill gas and groundwater monitoring program was implemented. The monitoring program, which includes perimeter and off-site sentinel monitoring wells, was developed by BFISJ and approved by NJDEP. The monitoring program is meant to assess the continued effectiveness of the existing source control measures.

The perimeter and sentinel monitoring well networks include wells that are screened in the Merchantville and Magothy Formations. The Merchantville Formation (thickness 30 to 50 feet) is predominantly a silty clay and directly underlies a majority of the landfill. Groundwater flow in the Merchantville is somewhat radial, with flow to the north-northwest and south-southeast from the center of the landfill. The Magothy Formation consists of sands and silty sands interbedded with lignite seams and lies directly below the Merchantville in the north and southeast. At the northeast corner of the site, where the Merchantville is absent, a perched zone lies twenty feet above the Magothy Formation. Groundwater flow in the Magothy Formation is generally toward the northeast.

Perimeter Well Monitoring

The perimeter monitoring well network was installed around the landfill outside of the leachate collection system. The objective of these wells is to evaluate performance of the remedial system and to track groundwater quality adjacent to the site. The perimeter wells include B-41R, B-43R, and B-44, screened in the Merchantville Formation, and B-7R, B-21R, B-46SS, B-53R, and B-51SS (background well), screened in the Magothy Formation (Appendix B, Figure 2). Perimeter wells are sampled annually and analyzed for VOCs and metals. In 2021, new monitoring well MW-100 was installed and sampled to evaluate groundwater quality in the northeast portion of the site. MW-100 was sampled for four consecutive quarters (October 2021-October 2022) followed by semiannual sampling. Sampling of MW-100 was discontinued in 2023 after 7 rounds of data with no VOC or SVOC exceedances, and metals data consistent with background concentrations.

During this review period, VOCs were either not detected or did not exceed NJGWQS in perimeter wells except for well B-7R which had a tetrachloroethene (PCE) concentration of 1.1 micrograms per liter (µg/L) in April 2021, marginally exceeding its NJGWQS of 1 µg/L.

Results from metals analysis indicate that iron, aluminum, and manganese were consistently detected in all perimeter wells at concentrations above NJGWQS. Arsenic was detected above its NJGWQS of 3 µg/L in wells B-41R (maximum 7.8 µg/L), B-43R (maximum 35 µg/L), and B-7R (maximum 3.5 µg/L) throughout the review period, including background well B-51SS (maximum 15 µg/L). Beryllium was only detected above its 1 µg/L NJGWQS in background well B-51SS (maximum 31 µg/L). Lead was detected above its NJGWQS of 5 µg/L in well B-7R once during the review period (maximum 9.2 µg/L). Sporadic exceedances of other metals, such as cobalt, nickel, and sodium were also detected in perimeter wells.

Metal concentrations in perimeter wells showed no discernable trend over this review period and have remained consistent with past concentrations. Iron, manganese, and aluminum occur naturally in the Merchantville and Magothy Formations and were found at concentrations above NJGWQS in background monitoring well B-51SS. Nickel, beryllium, and arsenic were also present in the background monitoring well at concentrations exceeding NJGWQS. Since the metals that were detected above NJGWQS in perimeter wells are also present at similar concentrations above NJGWQS in the background well B-51SS, these constituents are determined to be naturally occurring and consistent with background. The concentration trends for these metals have been relatively stable compared to historic data, and migration of contaminants from the site is not occurring.

Sentinel Well Monitoring

The sentinel monitoring well network was installed between impacted groundwater beneath the landfill and the off-property area to serve as early warning should groundwater impacts extend beyond the landfill. Sentinel wells consist of B-52R, located on the southern landfill boundary (screened in the Merchantville Formation), well B-48, located on the northern boundary (in the Magothy Formation), and wells B-1RSS and B-46P, also on the north side and screened in the perched zone within the Magothy (Appendix B, Figure 2). Sentinel wells are sampled semiannually and analyzed for VOCs and metals.

VOCs were detected above the NJGWQS in sentinel wells once during this five-year review period. Methylene chloride was detected marginally above its NJGWQS of 3.0 µg/L in well B-1RSS at 3.4 µg/L (April 2021).

The metals aluminum, iron, and manganese were consistently detected above their respective NJGWQS in all sentinel wells. Arsenic was detected above the 3 µg/L NJGWQS several times during this review period in wells B-1RSS, B-48, and B-46P. The maximum arsenic concentration of the sentinel wells during the review period was 29 µg/L in well B-1RSS. Beryllium was detected just above the 1 µg/L NJGWQS for several sampling events throughout the period in wells B-1RSS and B-46P (maximum 1.3 µg/L and 1.8 µg/L, respectively). Other metals were detected sporadically above NJGWQS and include nickel, detected above the 100 µg/L NJGWQS in well B-46P (maximum concentration of 140 µg/L); lead, detected above the 5 µg/L NJGWQS in wells B-1RSS and B-46P (maximum respective concentrations of 6.2 µg/L and 64 µg/L); and sodium, detected above the 50,000 µg/L NJGWQS in well B-46P (maximum concentrations of 64,100 µg/L). Total chromium was detected above the 70 µg/L NJGWQS in wells B-46P (maximum 2,400 µg/L in October 2020) and B-48 (maximum 140 µg/L in April 2021), however, the concentrations in both wells have been below the NJGWQS since 2021.

Generally, metal concentrations in sentinel wells have fluctuated, but showed no discernable trend over this review period and have remained consistent with past data. As presented in the perimeter well data discussion, most metals that were detected above NJGWQS in groundwater are naturally occurring as indicated by their presence at similar concentrations in background well B-51SS. Data collected during this review period show that contaminant concentrations in downgradient sentinel wells are consistent with data from previous years and are considered background. Groundwater impacts are not extending beyond the landfill.

Water Level Data

Hydraulic gradients in the Merchantville Formation along the clay cut-off wall on the southern perimeter

of the site are monitored quarterly at three transects to ensure that inward gradients are maintained (Appendix B, Figure 2). Based on water-level data from this five-year review period, water level gradients were generally either flat or inward throughout the review period. Transect 2 exhibited slight outward gradients in October 2019, January 2021, and July 2022. Transect 3 exhibited slight outward gradients in October 2019, October 2020, and July 2021. It is suspected that the outward gradients are related to higher groundwater levels. The periods of observed outward gradients do not appear to result in migration of contaminants. Overall, the inward gradients have been consistently achieved.

Landfill Gas Data

Passive gas vents were originally installed through the clay cap to dissipate potential gas pressure build-up. Over the years, the vents were modified to an active landfill gas extraction well and a gas monitoring probe (GMP) system. There are currently 29 extraction wells connected to a candlestick flare and 20 GMPs. GMPs are monitored quarterly to ensure that methane gas levels remain below 25% of the Lower Explosive Limit (LEL). Readings taken during the review period indicate that methane levels in GMP-7, GMP-9, GMP 16, GMP-17, GMP 18, and GMP-20 were sporadically recorded at levels in excess of 25% of the LEL. Using a barhole punch, samples were taken on the adjacent property in each case of exceedance, and no methane was detected, indicating no off-site migration.

In February 2024, on behalf of Republic, SCS Field Services conducted surface emissions monitoring (SEM) at the landfill to test for emissions of methane. Over 400 monitoring points across the landfill were surveyed. The highest recorded emission level was 34 parts per million (ppm), and none of the monitoring points surveyed had an emission level above the threshold for reporting an exceedance, which is 500 ppm.

NJDEP Vapor Intrusion Investigation

In July 2021, NJDEP conducted a vapor intrusion investigation to evaluate indoor air, sub-slab vapors, and ambient (outdoor) air at a residential property on Lori Street. No contaminants were detected in the indoor air above EPA's risk-based vapor intrusion screening levels (VISLs) for the residential scenario or NJDEP's applicable Indoor Air Remediation Standards or Sub-slab Screening Levels, indicating that vapor intrusion was not occurring at the residence. Trichloroethene (TCE) was detected in one ambient air sample but was not found in sub-slab soil gas or indoor air samples. Anomalous detections of TCE in air samples can often be attributed to background sources, as it is a chemical commonly found in glues/adhesives, paint and paint removers, cleaners, and other household products. The results of the ambient air sampling also showed detections of a suite of chemicals known as BTEX (benzene, toluene, ethylbenzene, and xylenes) in low concentrations. These chemicals are often found at low levels in ambient air in New Jersey and other states and are typically associated with the operation of gasoline powered equipment and vehicle emissions.

Monroe Township Limited Landfill Perimeter Air Monitoring

In May 2022, on behalf of Monroe Township, CME Associates performed limited air monitoring outside of the northeast perimeter of the landfill to investigate if landfill gas emissions were the source of odor complaints in the area. During this event, one upwind (relative to the landfill) monitoring point was sampled, and four downwind monitoring points were sampled. The air quality parameters monitored for included hydrogen sulfide, ammonia, methane, and VOCs. The analytical results of the air monitoring showed low concentrations of VOCs and two sulfide compounds. EPA compared the monitoring results to the residential indoor air VISLs and found no exceedances of the VISLs. Additionally, the sampling

results from the downwind monitoring points were generally similar to the results from the upwind monitoring point.

Emerging Contaminants Sampling

In April 2022, six monitoring wells were sampled and analyzed for emerging contaminants, including per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. The monitoring wells sampled included B-41R and B-43R in the shallow Merchantville Formation, and B-21R, MW-100, B-7R, and upgradient well B-51SS in the deeper Magothy Formation.

Perfluorooctanoic acid (PFOA) was detected in 5 of the 6 wells. PFOA was below the NJGWQS of 14 nanograms per liter (ng/L) but exceeded its EPA Maximum Contaminant Level (MCL) of 4 ng/L in wells B-21R (11 ng/L), B-41R (11 ng/L), and B-7R (12 ng/L). Perfluorooctanesulfonic acid (PFOS) was detected in 4 of the 6 wells. PFOS exceeded its NJGWQS of 13 ng/L and EPA MCL of 4 ng/L in monitoring well B-21R at a concentration of 25 ng/L. Perfluorononanoic acid (PFNA) was detected in 2 of the 6 wells, but was below the NJGWQS of 13 ng/L and EPA MCL of 10 ng/L. Concentrations of 1,4-dioxane were detected in 4 of the 6 wells, and exceeded the NJGWQS of 0.4 µg/L in the samples collected from B-21R and B-43R at concentrations of 13 µg/L and 2.1 µg/L, respectively. EPA will continue to work with NJDEP to determine future sampling needs.

Site Inspection

The inspection of the site was conducted on August 6, 2024, by EPA. Representatives of Republic, Taylor Geosciences and SCS Engineers were present at the inspection. The purpose of the inspection was to assess the protectiveness of the remedy, including the operation of the leachate collection system and the gas collection system, as well as the integrity of the landfill cap, and fencing. At the time of inspection, the leachate collection and gas collection systems were operational. The fence surrounding the landfill was in good condition and the landfill cap was properly maintained. No bare spots, evidence of erosion, or low-lying areas susceptible to ponding were observed on the cap. All engineering controls appeared intact and in good condition and no significant issues were identified during the inspection.

V. TECHNICAL ASSESSMENT

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

According to the ROD of April 1993, the remedy specified for Monroe Township Landfill is No Further Action with Maintenance and Monitoring. The major components of the remedy include the maintenance of source control remedial measures already in place (completed in 1984); groundwater monitoring of sentinel and perimeter monitoring wells; monitoring of landfill gas, leachate, and surface water; and an upgrade to the passive landfill gas system. The source control remedial measures that have been in place include a protective clay cap covering the northern portion of the landfill and a protective soil cap covering the remainder of the landfill, a 7,000-foot-long compacted clay cutoff wall circumscribing the area of the soil cap and keyed into a clay layer base, a leachate extraction system installed parallel to the cut-off wall, passive landfill gas venting systems, and a security fence.

The combination of protective caps, the cutoff wall, and leachate collection system function to contain contaminated groundwater. Groundwater monitoring well networks (both sentinel and perimeter) are used

to evaluate performance of the remedy and monitor potential migration of contaminants from the site. Groundwater quality data reported for the last five years indicate that there were no discernable trends in metals concentrations, and that concentrations have remained consistent with those reported for the wells in the past. While the concentrations of several metals (such as iron, manganese, and aluminum) were detected in excess of NJGWQS, the metals occur naturally in the formations beneath the landfill and are present in the background monitoring well. The concentrations of VOCs detected during the review period were low and sporadic, with only methylene chloride exceeding NJGWQS during one sampling event. Water-level data from wells along the cut-off wall show that inward gradients have been consistently achieved over the period. Thus, contaminated groundwater appears to be contained and does not extend beyond the landfill.

An enhanced surface-water drainage control system was put in place at the site. Surface drainage runs north and south away from height of the landfill. The system appears to be functioning as designed. No obstructions to drainage were noted. A 7-foot-high chain-link security fence surrounds the site. The fence is in good repair. The caps appear to be in good repair and are regularly maintained. Discharge is sent to a POTW under NJDES permit. Analytical results for leachate indicate that all parameters are within the permit limits.

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

There have been no physical changes to the site that would adversely affect the protectiveness of the remedy. Land use assumptions, exposure assumptions and pathways, and clean up levels considered in the decision document followed the Risk Assessment Guidance for Superfund used by the Agency and remain valid. Although specific parameters may have changed since the time the risk assessment was completed, the process that was used remains valid. The site-specific risk assessment conducted for the site determined that the remedial measures already in place were effective, and none of the exposure pathways posed an unacceptable risk to human health. Based on these considerations, no remedial action objectives were identified in the ROD; therefore, they cannot be evaluated in this review.

As indicated in the ROD, the 1992 Baseline Risk Assessment (BRA) evaluated populations potentially exposed to surface water, surface soil, sediment, and air under current site conditions (these included off-site residents, trespassers and site workers). For future conditions, in addition to the exposure scenarios outlined above, hypothetical recreational use of the site as a play area or park and subsequent exposure to surface water, surface soil, sediment and air were evaluated. Additionally, direct human exposure to chemicals of concern in groundwater via ingestion and bathing was also assessed. The result of the BRA indicated that the current and potential future risks associated with the chemicals of concern at the site fell within or below acceptable limits (i.e., do not exceed the carcinogenic risk range of 10^{-4} to 10^{-6} or a non-carcinogenic hazard index greater than 1) and therefore, there is no unacceptable risk to public health.

As a result of the protective clay and soil covering system, the clay cutoff wall and the security fencing, direct contact to contaminated soils is interrupted. Direct contact with contaminated groundwater beneath the site also continues to be an incomplete exposure pathway due to a township ordinance requiring all dwellings in the vicinity of the site be connected to the public water supply. In addition, a Classification Exception Area was established for the site in October 2000 and remains in place. These two restrictions preclude any future homes from using private wells in the area of the site. It should also be noted that the

Merchantville formation has been identified by NJDEP as a Class III-A aquitard and is naturally unsuitable as a source of potable water.

The potential for subsurface soil vapor intrusion (VI) is evaluated when site soils and/or groundwater are known or suspected to contain VOCs. Ten VOCs were detected in groundwater samples collected during the time of this five-year review period (2019 to 2024). These detections were predominantly found in Magothy perimeter well MWB-21R located on the northwestern portion of the site. With some minor sporadic exceptions, discussed in the data review section, none of the VOC detections were found above applicable federal and state drinking water standards. Continual monitoring will ensure state and federal standards will be met in the future. As for the potential of subsurface VI into indoor air in buildings at/near the site, since there are currently no occupied buildings at the site, the VI pathway remains incomplete. To ensure protectiveness of the nearby residential structures surrounding the site, maximum detected VOC concentrations were compared with EPA's current risk-based groundwater vapor intrusion screening level for the residential scenario. Results indicate these detections continue to fall below threshold values for cancer and noncancer effects. Based on this evaluation, the VI pathway remains incomplete and additional vapor intrusion investigations are not necessary at this time.

Based on the ecological risk assessment performed in the RI/FS it was concluded that potential risk from contaminants on-site and off-site data were unlikely to impact wildlife and the environment within the site and areas near the site. As noted in the ROD, sediment and surface water samples collected from an off-site intermittent stream did not exceed ecological screening/background values. Additionally, the landfill cap eliminated any potential risk from surface soil contaminates to terrestrial receptors. The slurry wall helps prevent any groundwater contaminant migration to sediment and surface water. Consequently, the exposure assumptions remain appropriate and thus the remedy remains protective of ecological resources.

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 Five-Year Review:
OU1 – (Site-wide remedy)

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit: OU1	*Protectiveness Determination:* Protective
Protectiveness Statement: The remedy at the Monroe Township Landfill site is protective of human health and the environment.	

Sitewide Protectiveness Statement
Protectiveness Determination: Protective
Protectiveness Statement: The remedy at the Monroe Township Landfill site is protective of human health and the environment.

VIII. NEXT REVIEW

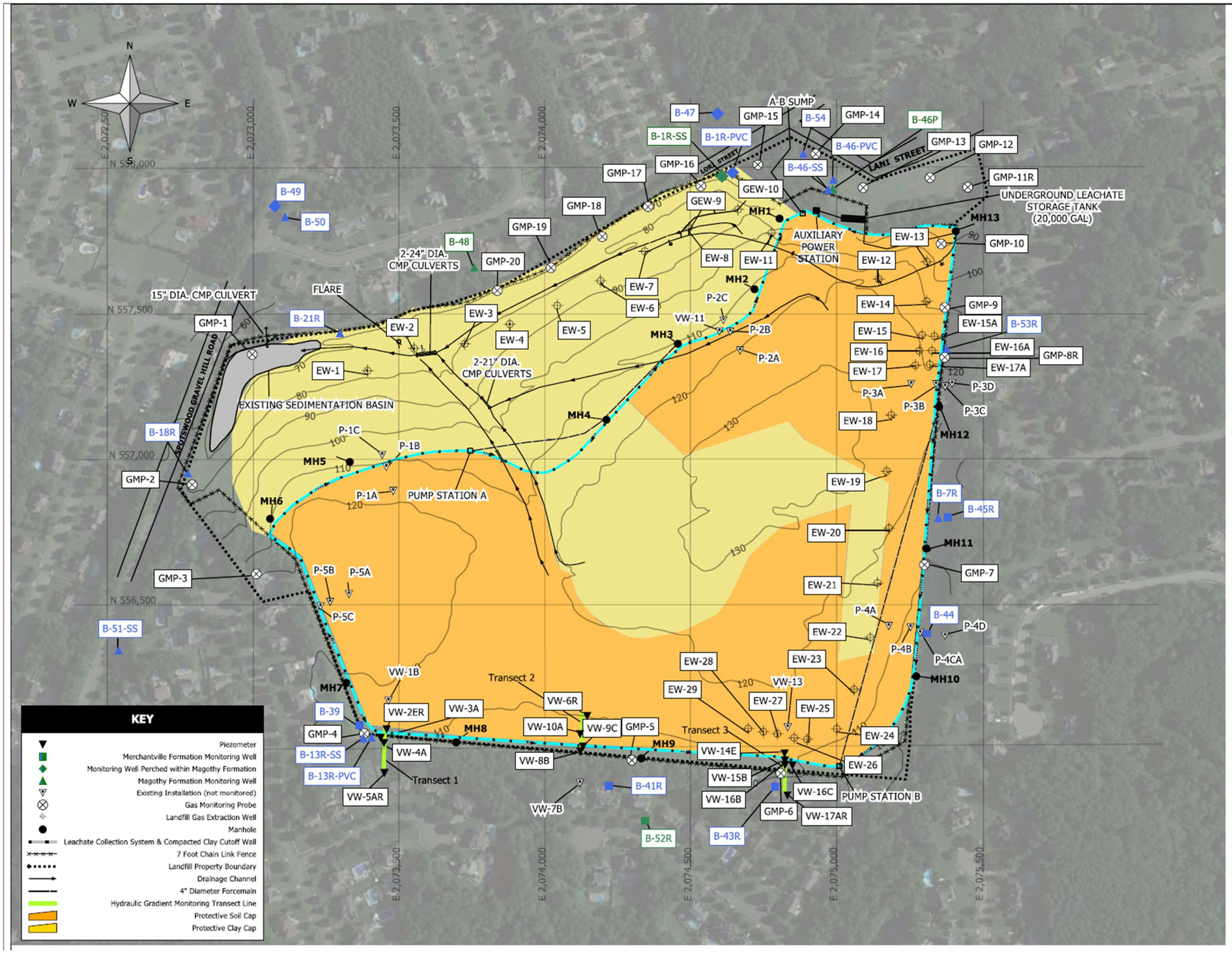
The next FYR report for the Monroe Township Landfill Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

- Administrative Consent Order, for the Monroe Township Landfill, NJDEP – **December 1986**
- Baseline Risk Assessment for the Monroe Township Landfill, Monroe Township, New Jersey, Industrial Compliance, Inc. and Golder Associates, Inc. – **July 1992**
- Record of Decision, Monroe Township Landfill Site, Monroe Township, Middlesex County, New Jersey, NJDEP – **April 1993**
- Post-Closure Monitoring and Maintenance Plan, Monroe Township Landfill, Monroe Township, New Jersey – **September 1993**
- Amendment to Administrative Consent Order, NJDEP – **November 1993**
- Fifth Five-Year Review Report, Monroe Township Landfill Superfund Site, Monroe Township, Middlesex County, New Jersey, USEPA – **November 2019**
- 27th Annual Post Closure Environmental Monitoring Report , Monroe Township Landfill, 2019 – 2020, Monroe Township, New Jersey, Taylor Geoservices – **March 2021**
- Residential Ambient Air Sampling July 2021 Results and Memo, Monroe Township, Middlesex County, NJDEP – **August 2021**
- Comprehensive Groundwater Evaluation October 2021, Monroe Township Landfill, Monroe Township, New Jersey, Taylor Geoservices – **December 2021**
- 28th Annual Post Closure Environmental Monitoring Report , Monroe Township Landfill, 2020 – 2021, Monroe Township, New Jersey, Taylor Geoservices – **March 2022**
- Limited Landfill Gas Monitoring – May 2022 Monitoring Event, Former BFI Landfill, Spotswood Gravel Hill Road, Monroe Township, New Jersey, CME Associates – **August 2022**
- 29th Annual Post Closure Environmental Monitoring Report , Monroe Township Landfill, 2021 – 2022, Monroe Township, New Jersey, Taylor Geoservices – **March 2023**
- 30th Annual Post Closure Environmental Monitoring Report , Monroe Township Landfill, 2022 – 2023, Monroe Township, New Jersey, Taylor Geoservices – **March 2024**
- Surface Emission Monitoring (SEM) at the Monroe Township Landfill Memo, Monroe Township, New Jersey, SCS Field Services – **April 2024**

APPENDIX B – TABLES AND FIGURES

Table 1: Groundwater Standards for Contaminants of Concern	
Contaminants of Concern	**New Jersey Groundwater Quality Standards μg/L**
Arsenic	3
Cadmium	4
Lead	5
Nickel	100
Benzene	1
Chlorobenzene	50
1,2-Dichloroethane	2
1,1-Dichloroethene	1
Vinyl chloride	1



NOTES

1.Locations of features and monitoring points are approximate
2.Base map provided by Paul C. Rizzo Assoc. Inc. 12/91, from the Supplemental Environmental Investigation Report, Monroe Township Landfill, Monroe, New Jersey
3.Green color indicates sentinel well, blue color indicates perimeter monitoring well
4.Sampling of sentinel wells B-48, B-1RSS, B-46P and B-52R occurs semi-annually for VOCs and metals
5.Sampling of perimeter monitoring wells B-21R, B-41R, B-43R, B-7R, B-44, B-46SS, VB-51SS and B-53R are sampled annually for VOCs and metals
6.VW-1B was removed from monitoring system in 2013

Prepared for: REPUBLIC SERVICES

by: Taylor GEOSERVICES
Earth, Water & Resource Consultants
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www.taylorgeoservices.com

Figure 2

Checked by: AJS

Drawn by:MI

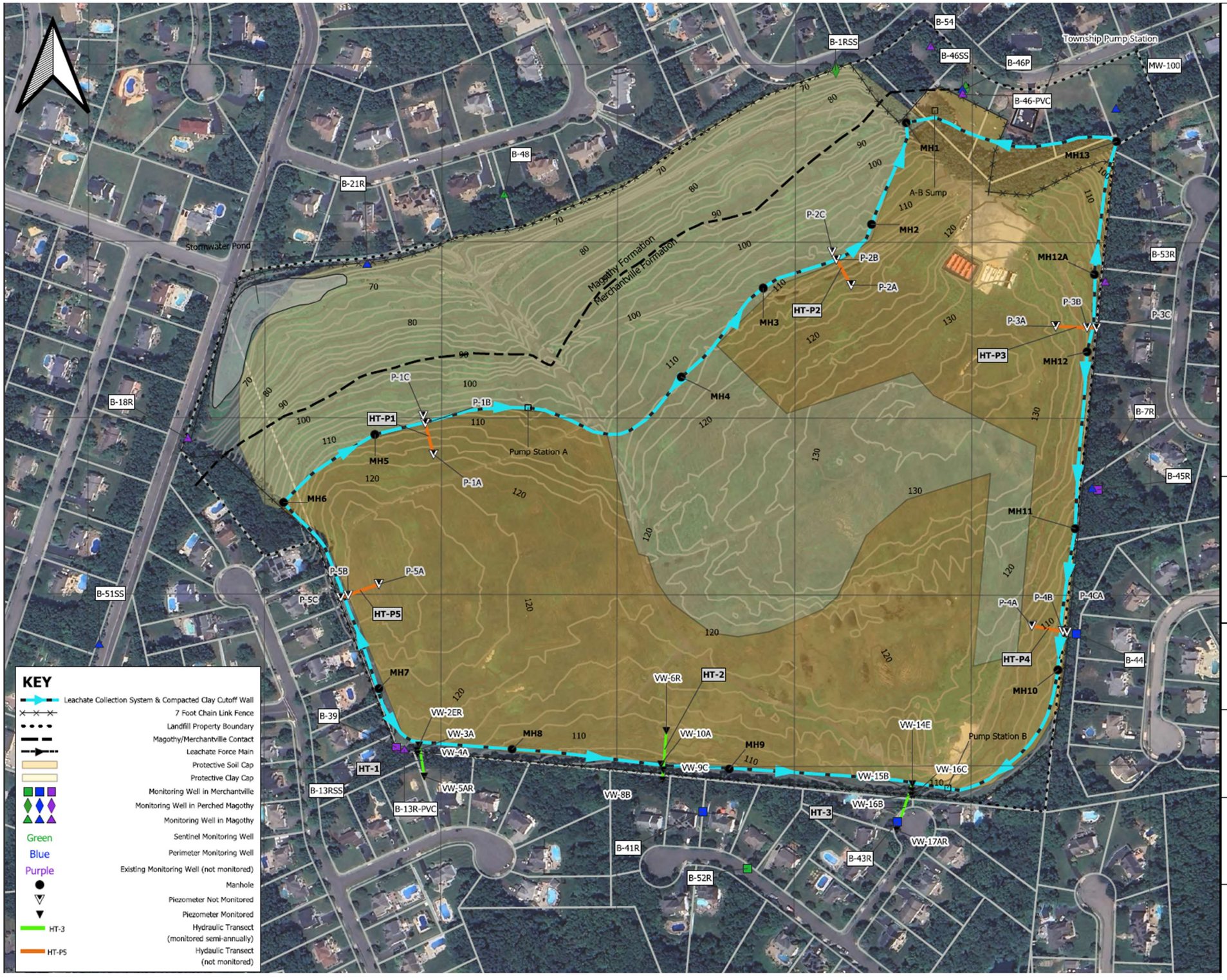
9/24/2020

BFI WASTE SYSTEMS OF NEW JERSEY, INC.
MONROE TOWNSHIP LANDFILL

Site Plan
Monroe Township, Middlesex County
New Jersey

0 300 ft US

Figure 1: Site Plan



NOTES

1. Base Map Topographic contours provided by Cooper Aerial Surveys, Co. from aerial photography taken July 28, 2021: vertical datum is NAVD88.
2. Horizontal Coordinate System: New Jersey State Plane Feet NAD8. Locations of features and monitoring points are approximate.
3. Aerial Photo is from Google Earth Satellite, July 2023.
4. Tax Parcel boundaries are from Middlesex County Open Data Portal
5. Perimeter Monitoring Wells are sampled annually and are designed to assess the performance of the remedial systems and to track groundwater quality adjacent to the landfill
6. Sentinel Monitoring Wells are sampled annually and are designed to provide an early warning system for the migration of contaminants from the site.

Prepared for: REPUBLIC SERVICES

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3/27/2024	
Drawn By: MD	
Checked By: AJS	
Figure 3	

BFI WASTE SYSTEMS OF NEW JERSEY, INC.
MONROE TOWNSHIP LANDFILL

Existing Groundwater Monitoring Installation
Location Map

Monroe Township, Middlesex County
New Jersey

0 150 300 ft

Figure 2: Monitoring Well Locations

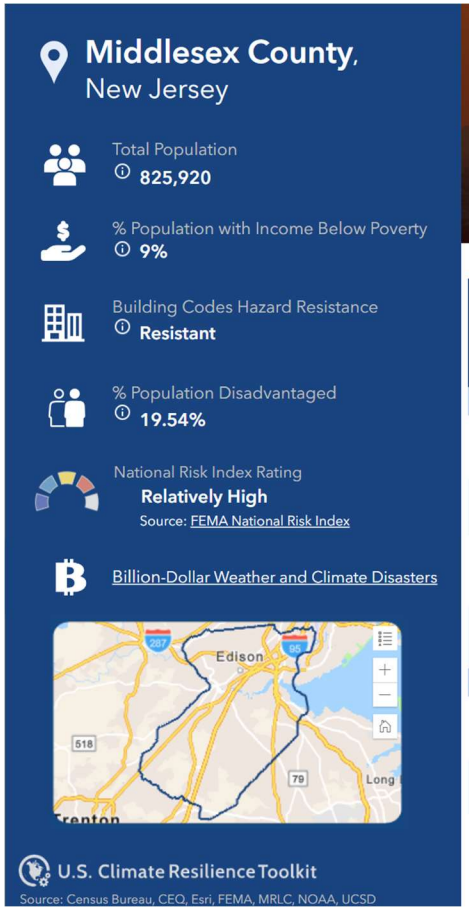
APPENDIX C – CLIMATE CHANGE ASSESSMENT

In line with regional practice, two climate change tools were utilized to assess the Monroe Township Landfill Superfund Site. Screenshots from each of the tools assessed are included here.

The first tool used to assess the site was the *Climate Mapping for Resilience and Adaptation (CMRA) Assessment Tool*. The tool examined five climate hazards for the county the site falls within. According to this tool, the National Risk Index Rating for extreme heat is "Relatively High." Figure C-1 shows the projected increase in days per year with maximum temperatures > 100°F throughout the century. The National Risk Index Rating is "Relatively High" for both flooding and coastal inundation in Middlesex County, however, the same Index Ratings are both "Relatively Low" for the census tract the site is located in. This is likely because Monroe Township is located farther from the coast and the Raritan River than other areas of Middlesex County. The two other climate hazards evaluated by this tool – drought and wildfire – each have a National Risk Index Rating of "Very Low" for the county. Figure C-2 shows a projected increase in annual average total precipitation while Figure C-3 shows a projected decrease in days per year with precipitation. Additionally, Figure C-4 shows a projected increase in annual days with total precipitation > 1 inch. These projections suggest future precipitation events may decrease in frequency but increase in intensity.

The second tool utilized is called the *USGS U.S. Landslide Inventory*. As shown by Figure C-5, there have been no landslides recorded in the vicinity of the site.

Potential site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the site.

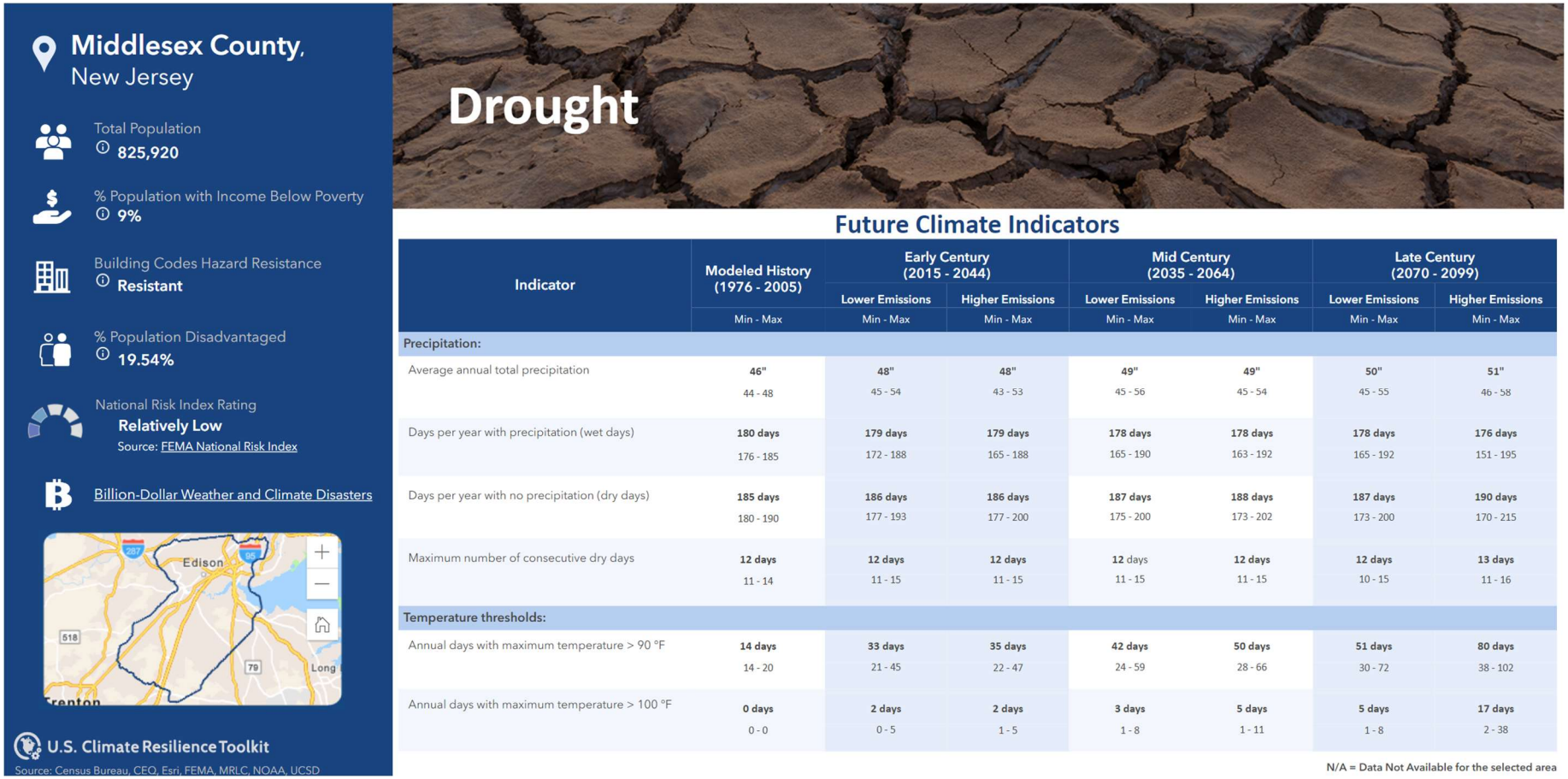


Future Climate Indicators

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
Temperature thresholds:							
Annual days with maximum temperature > 90°F	**14 days** 14 - 20	**33 days** 21 - 45	**35 days** 22 - 47	**42 days** 24 - 59	**50 days** 28 - 66	**51 days** 30 - 72	**80 days** 38 - 102
Annual days with maximum temperature > 95°F	**4 days** 3 - 5	**10 days** 5 - 16	**11 days** 5 - 16	**14 days** 7 - 23	**19 days** 8 - 30	**19 days** 8 - 35	**44 days** 12 - 69
Annual days with maximum temperature > 100°F	**0 days** 0 - 0	**2 days** 0 - 5	**2 days** 1 - 5	**3 days** 1 - 8	**5 days** 1 - 11	**5 days** 1 - 8	**17 days** 2 - 38
Annual days with maximum temperature > 105°F	**0 days** 0 - 0	**0 days** 0 - 1	**0 days** 0 - 1	**0 days** 0 - 2	**1 days** 0 - 4	**1 days** 0 - 4	**5 days** 0 - 18
Annual temperature:							
Annual single highest maximum temperature °F	**97 °F** 96 - 98	**101 °F** 99 - 103	**101 °F** 98 - 103	**102 °F** 99 - 106	**103 °F** 100 - 107	**103 °F** 100 - 108	**108 °F** 100 - 113
Annual highest maximum temperature averaged over a 5-day period °F	**92 °F** 91 - 93	**95 °F** 93 - 98	**96 °F** 93 - 98	**97 °F** 94 - 100	**98 °F** 95 - 101	**98 °F** 94 - 103	**102 °F** 95 - 108
Cooling degree days (CDD)	**970 degree-days** 910 - 1039	**1,289 degree-days** 1,089 - 1,621	**1,321 degree-days** 1,109 - 1,547	**1,454 degree-days** 1,161 - 1,845	**1,600 degree-days** 1,254 - 1,908	**1,624 degree-days** 1,241 - 2,035	**2,226 degree-days** 1,525 - 2,814

N/A = Data Not Available for the selected area

Figure C-1: Extreme Heat

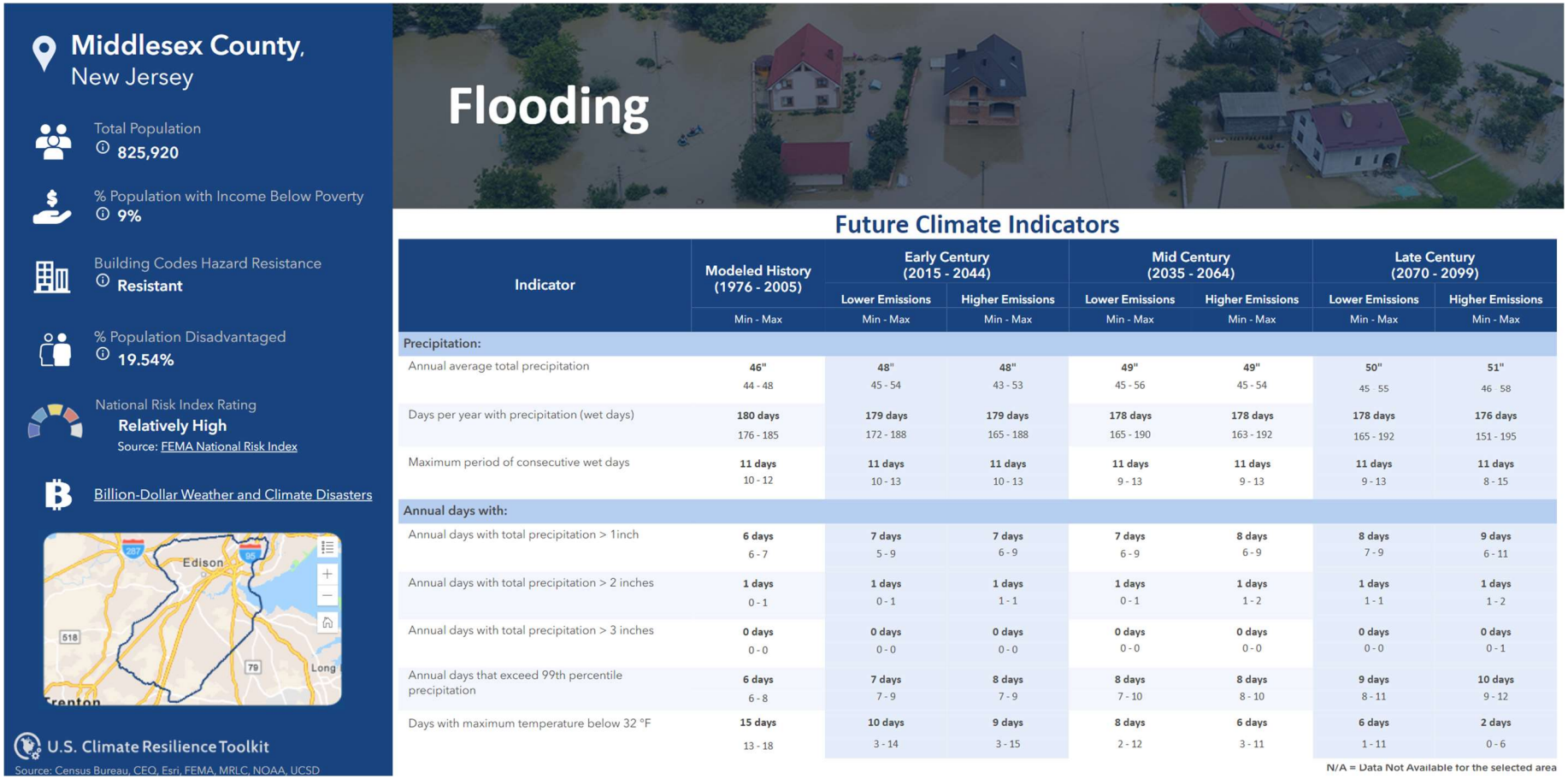


Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Precipitation:							
Average annual total precipitation	**46"** 44 - 48	**48"** 45 - 54	**48"** 43 - 53	**49"** 45 - 56	**49"** 45 - 54	**50"** 45 - 55	**51"** 46 - 58
Days per year with precipitation (wet days)	**180 days** 176 - 185	**179 days** 172 - 188	**179 days** 165 - 188	**178 days** 165 - 190	**178 days** 163 - 192	**178 days** 165 - 192	**176 days** 151 - 195
Days per year with no precipitation (dry days)	**185 days** 180 - 190	**186 days** 177 - 193	**186 days** 177 - 200	**187 days** 175 - 200	**188 days** 173 - 202	**187 days** 173 - 200	**190 days** 170 - 215
Maximum number of consecutive dry days	**12 days** 11 - 14	**12 days** 11 - 15	**12 days** 11 - 15	**12** days 11 - 15	**12 days** 11 - 15	**12 days** 10 - 15	**13 days** 11 - 16
Temperature thresholds:							
Annual days with maximum temperature > 90 °F	**14 days** 14 - 20	**33 days** 21 - 45	**35 days** 22 - 47	**42 days** 24 - 59	**50 days** 28 - 66	**51 days** 30 - 72	**80 days** 38 - 102
Annual days with maximum temperature > 100 °F	**0 days** 0 - 0	**2 days** 0 - 5	**2 days** 1 - 5	**3 days** 1 - 8	**5 days** 1 - 11	**5 days** 1 - 8	**17 days** 2 - 38

N/A = Data Not Available for the selected area

Figure C-2: Drought

Figure C-3: Wildfire



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	**46"** 44 - 48	**48"** 45 - 54	**48"** 43 - 53	**49"** 45 - 56	**49"** 45 - 54	**50"** 45 - 55	**51"** 46 - 58
Days per year with precipitation (wet days)	**180 days** 176 - 185	**179 days** 172 - 188	**179 days** 165 - 188	**178 days** 165 - 190	**178 days** 163 - 192	**178 days** 165 - 192	**176 days** 151 - 195
Maximum period of consecutive wet days	**11 days** 10 - 12	**11 days** 10 - 13	**11 days** 10 - 13	**11 days** 9 - 13	**11 days** 9 - 13	**11 days** 9 - 13	**11 days** 8 - 15
Annual days with:							
Annual days with total precipitation > 1inch	**6 days** 6 - 7	**7 days** 5 - 9	**7 days** 6 - 9	**7 days** 6 - 9	**8 days** 6 - 9	**8 days** 7 - 9	**9 days** 6 - 11
Annual days with total precipitation > 2 inches	**1 days** 0 - 1	**1 days** 0 - 1	**1 days** 1 - 1	**1 days** 0 - 1	**1 days** 1 - 2	**1 days** 1 - 1	**1 days** 1 - 2
Annual days with total precipitation > 3 inches	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 1
Annual days that exceed 99th percentile precipitation	**6 days** 6 - 8	**7 days** 7 - 9	**8 days** 7 - 9	**8 days** 7 - 10	**8 days** 8 - 10	**9 days** 8 - 11	**10 days** 9 - 12
Days with maximum temperature below 32 °F	**15 days** 13 - 18	**10 days** 3 - 14	**9 days** 3 - 15	**8 days** 2 - 12	**6 days** 3 - 11	**6 days** 1 - 11	**2 days** 0 - 6

N/A = Data Not Available for the selected area

Figure C-4: Flooding

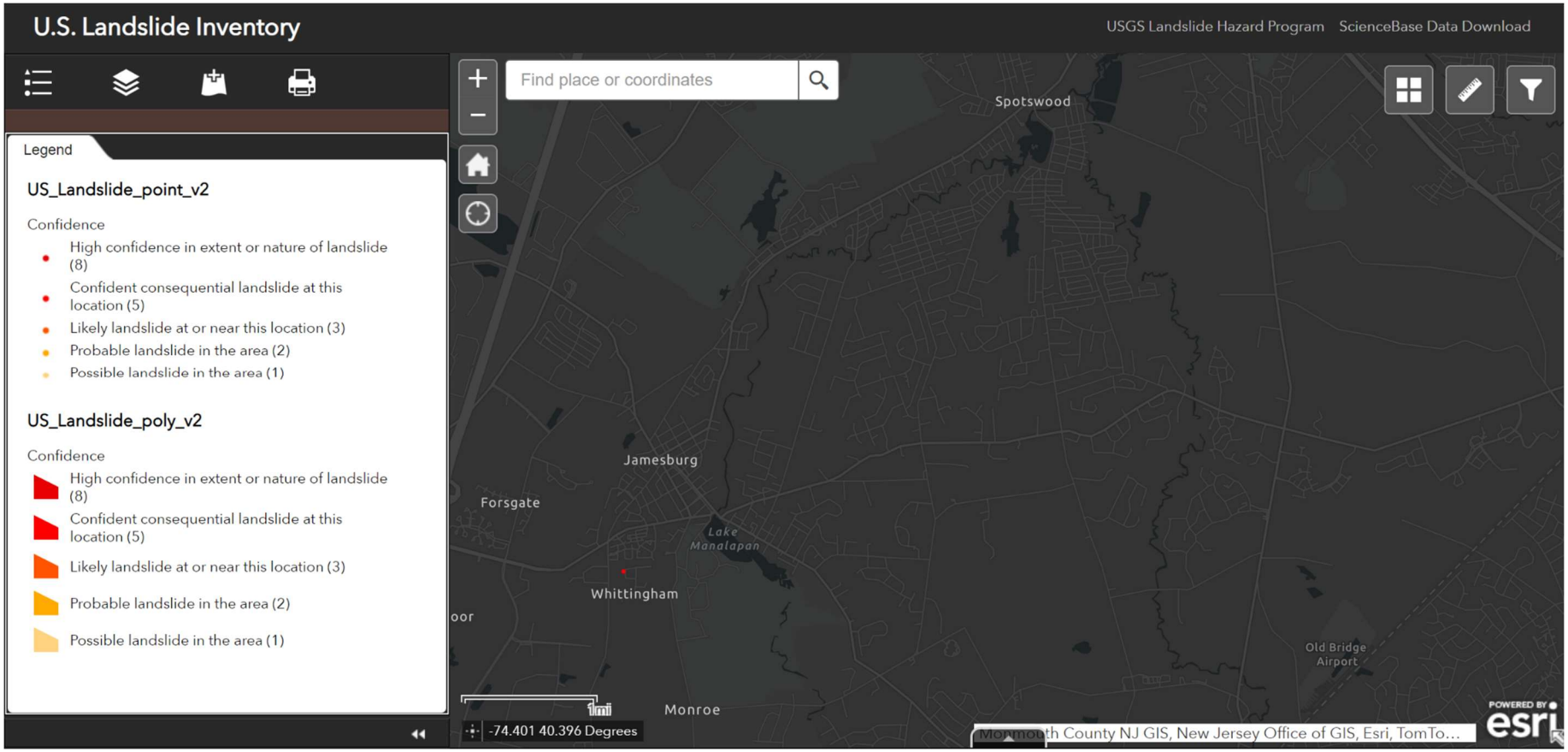


Figure C-5: Landslides