FOURTH FIVE-YEAR REVIEW REPORT FOR LANDFILL AND DEVELOPMENT SUPERFUND SITE BURLINGTON COUNTY, NEW JERSEY

Prepared by

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

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Date

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LIST OF ABBREVIATIONS & ACRONYMS

1,2-DCA	1,2-dichloroethene
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
ICs	Institutional Controls
L&D	Landfill & Development
MCLs	Maximum Contaminant Levels
MLCMS	Mount Laurel/Cape May Sand aquifer
mV	Millivolt
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NJDEP	New Jersey Department of Environmental Protection
NJGWQS	New Jersey Ground Water Quality Standards
OU	Operable Unit
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
RAO	Remedial Action Objectives
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
TCE	Trichloroethene
UU/UE	Unlimited use and unrestricted exposure
VOC	Volatile Organic Compounds

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 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 fourth FYR for the Landfill and Development Superfund Site (L&D site or 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 (OU1) and OU1 will be addressed in this FYR. OU1 addresses landfill contents and groundwater.

The site FYR was led by Alice Yeh, EPA Remedial Project Manager. Participants included Liana Agrios and Joseph Hayes, hydrogeologists; Abbey States and Tara Bhat, Human Health Risk Assessors; Detbra Rosales, Ecological Risk Assessor; and Shereen Kandil and Steven Petrucelli, Community Involvement Coordinators (CICs). The review began on 3/17/2025.

Site Background

The L&D site is a closed landfill located in Burlington County, New Jersey. It occupies portions of the Townships of Mount Holly, Eastampton, and Lumberton. The site is located on the north side of Route 38 and is approximately 200 acres in size. The closed landfill consists of two sections, the Mount Holly section on the west and the Eastampton section on the east. Landfill operations in the Eastampton section were discontinued in 1981. From 1982 until 1986, waste disposal in the Mount Holly section was conducted using cellular landfilling methods. A series of cells were constructed from east to west that were approximately 150 feet wide, 1,100 feet long, and filled in 8-to-10-foot lifts. Cell 9, in particular, was approximately 214,380 square feet and had an estimated waste volume of 277,900 cubic yards.

In addition to the two landfill sections, the site includes five sedimentation ponds, a perimeter road, a leachate collection system, and a landfill gas management system.

The North Branch of Rancocas Creek (hereafter referred to as Rancocas Creek) is located approximately 700 feet north of the landfill boundary (see Appendix B - Figure 1). In 2015, a solar power farm was built on approximately 50 acres of the eastern portion of the landfill. Approximately 42,000 solar panels were erected on the surface of the cap.

The groundwater beneath the L&D Site is divided into five hydrogeologic units based on similar hydrologic properties. The units, in descending order from the ground surface, are as follows (see Appendix B - Figure 2):

- Mount Laurel/Cape May Sand (MLCMS) aquifer
- Upper Wenonah confining unit
- Middle Wenonah aquifer
- Marshalltown/Lower Wenonah confining unit, and
- Englishtown aquifer.

Groundwater flow in all three aquifers is northward, towards Rancocas Creek. The Middle Wenonah and MLCMS aquifers discharge into Rancocas Creek. At times, the MLCMS aquifer north of the Eastampton section of the landfill may also discharge into Smithville Canal. Groundwater also discharges seasonally as groundwater seeps. During wet periods, numerous groundwater seeps have been observed between the landfill and Rancocas Creek. Vertical hydraulic gradients are downward to the Englishtown aquifer south of the landfill, and upward from the Englishtown aquifer north of the landfill (with an increasing upward gradient towards Rancocas Creek). Portions of the MLCMS aquifer and Middle Wenonah aquifer have been impacted by the landfill. Groundwater in the underlying Englishtown aquifer has not been impacted by the landfill. The greatest concentrations of contaminants in groundwater are found in the Middle Wenonah aquifer in a relatively narrow band downgradient of the eastern portion of the Mount Holly section. This relatively narrow band of higher concentrations is referred to as the "Central Area". Areas of much lower groundwater concentrations (historically) on either side of the Central Area are referred to as the "Flank Areas". Only the Central Area of the Middle Wenonah aquifer is associated with unacceptable levels of risk. Based on a comparison of historical groundwater levels versus the bottom elevation of landfill contents, groundwater is likely in contact with the refuse in the northwestern portion of the Mount Holly section. There are several other areas with the potential for groundwater to be periodically in contact with the refuse. Groundwater use in the vicinity of the L&D Site is restricted through a Classification Exception Area (CEA) that was established by the New Jersey Department of Environmental Protection (NJDEP) on May 23, 2008. The CEA restricts use of the upper aquifers under the site, extending to Rancocas Creek, but does allow use of the uncontaminated Englishtown aquifer.

There are also several surface water features in the vicinity of the site. Rancocas Creek is located north of the landfill and flows in a westerly direction. A man-made canal, known locally as the Smithville Canal, originates at Smithville Lake, and flows (when not stagnant or dry) to the west/northwest. Surface drainage at the landfill is controlled by the topography and a surface water runoff collection system that includes five sedimentation ponds.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Landfill and Development Superfund Site		
EPA ID: NJD048044325		
Region: 2	**State:** NJ	**City/County:** Mt. Holly, Eastampton, and Lumberton/Burlington County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: State		
Author name (Federal or State Project Manager): Alice Yeh		
Author affiliation: EPA		
Review period: 3/17/2025 - 12/1/2025		
Date of site inspection: 7/15/2025		
Type of review: Statutory		
Review number: 4		
Triggering action date: 12/22/2020		
Due date *(five years after triggering action date)*: 12/22/2025		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The site was included on the National Priorities List (NPL) in 1983. A Remedial Investigation and Feasibility Study (RI/FS) was initiated by NJDEP in 1986. In 1988, the Landfill & Development Company (L&D Company or L&D) signed an Administrative Order on Consent which included, among other things, completion of the RI/FS.

The groundwater investigations at the site found that the shallow aquifers (the Mount Laurel/Cape May Sands, and the Middle Wenonah) were contaminated with volatile organic compounds (VOCs) from the site. VOCs found at the site included: 1,2-dichloroethene (1,2-DCA), 2-butanone, 4-methyl-2-pentanone, acetone, benzene, cis-1,2-dichloroethene, methylene chloride, toluene, and vinyl chloride.

Elevated metals concentrations were found in groundwater at background wells, and in some cases background groundwater quality exceeded groundwater quality criteria for total and/or dissolved metals

(e.g., aluminum, arsenic, cadmium, chromium, iron, lead, manganese and thallium). However, sampling results indicated that for some inorganic parameters (including metals) the landfill was causing impacts to groundwater quality, while for other inorganic parameters it was difficult to determine if the landfill was causing impacts to groundwater. Inorganic parameters impacted by the landfill at one or more wells included chloride, hardness, ammonia, total dissolved solids, iron, lead, manganese and sodium. Inorganic parameters that may or may not be impacted by the landfill included aluminum, arsenic, cadmium and thallium.

The cumulative carcinogenic risk from exposure to groundwater in the Central Area of the Middle Wenonah aquifer was 1.7×10^{-2} for the potential future adult/child resident. For this population, the following chemicals were identified as risk drivers: arsenic, l,2-dichloroethane, benzene, methylene chloride, and vinyl chloride. The risk from exposure to these chemicals through all evaluated pathways exceeded the upper bound of EPA's risk range of 1×10^{-4}.

The noncarcinogenic hazard index from exposure to contaminants in the groundwater of the Central Area of the Middle Wenonah aquifer through ingestion, inhalation, and dermal contact was 230 for the potential future adult/child resident. The risk drivers for this population were: arsenic, 1,2-DCA, 2-butanone, 4-methyl-2-pentanone, acetone, benzene, methylene chloride, toluene, and vinyl chloride.

An ecological risk assessment was conducted and indicated potential risk to some ecological receptors (e.g., potential impacts to avian piscivores from selenium in surface water and potential impacts to benthic organisms from silver in sediments). However, the data strongly suggested that the L&D landfill was not causing or adding to any ecological risks. The stressors to ecology of the site vicinity were most likely: 1) naturally occurring high levels of heavy metals; and 2) anthropogenic activities not associated with the landfill (i.e., residential development and activity) that would lead to increased non-point source loadings into surface water bodies. Therefore, no action for surface water or sediment was warranted at the site.

Response Actions

The site operated as a sand and gravel pit from the early 1940s until approximately 1968. The first waste disposal activities at the site are believed to have been initiated in 1962, when the property owner began disposing of demolition debris in the Mount Holly section of the landfill. The disposal of demolition debris occurred from 1962 until the late 1960s. During this time period, a 10-foot-thick layer of refuse was deposited on what is believed to have been the excavated base of the sand and gravel pit. In 1968, the owner leased the Mount Holly section on the west to Mount Holly Township for use as a landfill, and the landfill began accepting industrial and commercial solid waste and sewage sludge. The L&D Company, currently owned by Waste Management of New Jersey, Inc., acquired the property in 1971, and began landfilling operations in the Eastampton section on the east of the site in 1976. These operations continued until 1981. The L&D Company operated the landfill until December 31, 1986, when it ceased accepting waste materials after reaching its permitted capacity.

In 1988, the L&D Company entered into the first of several Administrative Consent Orders with the NJDEP to conduct a RI/FS for the site. The landfill sections were closed in accordance with an approved closure plan, and the constructed closure systems for the entire landfill were approved by NJDEP on May 24, 1995.

The engineering controls that were constructed and are maintained as part of the landfill post-closure requirements include:

- A leachate collection system in the Mount Holly section and in a limited area of the Eastampton section;
- A methane gas collection system; and
- A cap, also known as a clay cover system.

The studies conducted for the RI/FS, along with the existing closure system provided the technical basis for the Record of Decision (ROD), which was issued by NJDEP with EPA concurrence on September 30, 2004.

The major components of the Selected Remedy in the 2004 ROD included:

- Construction and operation of a groundwater extraction system in the Middle Wenonah aquifer in the Central Area to provide hydraulic containment.
- Construction and operation of Enhanced Aerobic Treatment (Cell 9), whereby leachate and groundwater would be re-circulated into the landfill along with appropriate air injection to enhance contaminant degradation. Excess water would be discharged to the publicly owned treatment works for treatment if necessary.
- Long-term monitoring for groundwater exceeding the remediation goals, including in the Flank Areas not targeted for active extraction and treatment.
- Continued maintenance of the existing final cover system on the landfill.
- Continued landfill leachate and gas monitoring, collection, and disposal.
- Decommissioning of residential water-supply wells downgradient of the landfill.
- Continued maintenance of the site security.
- Institutional controls to prevent consumption of groundwater downgradient of both the Central Area and the Flank Areas, between the landfill and Rancocas Creek.

For the landfill contents, the primary remedial action objective was to maintain the existing engineering controls that accomplish the following:

- Prevent direct contact with landfill contents.
- Reduce leaching of constituents to groundwater over time.
- Control surface water runoff and erosion.
- Control landfill gas migration.

A secondary remedial action objective for landfill contents was to reduce the mass, toxicity, or mobility of potentially hazardous constituents in Cell 9, if feasible.

For groundwater, remedial action objectives were the following:

- Prevent human consumption of groundwater from the MLCMS and Middle Wenonah aquifers between the landfill and Rancocas Creek.
- Achieve remediation goals established for groundwater in the MLCMS and Middle Wenonah aquifers.

- Avoid and/or minimize negative impacts to human health or the environment (e.g., the wetlands) caused by active remedial measures.

The cleanup levels for groundwater are in Appendix C - Tables 1, 2 and 3.

The ROD identified that residential properties were to have their threatened shallow water supply wells decommissioned and water supplied to the properties by a water line extension from a public supply. A 2009 Explanation of Significant Differences (ESD) modified the selected remedy to allow for the installation of deep-water supply wells in lieu of a water line extension.

Status of Implementation

The Enhanced Aerobic Treatment had two components: groundwater extraction and air recirculation. Construction of the groundwater extraction system in the Middle Wenonah aquifer in the Central Area started in 2006. The groundwater component began operation in February 2007, while the air recirculation component began operation in November 2007.

After tests carried out in the in fall 2010, it was determined that continuing operation of the air recirculation portion of the Enhanced Aerobic System would provide limited additional benefit when compared with the cost of system operation; therefore, no further air recirculation was conducted. In addition, the injection of extracted groundwater in Cell 9 (groundwater recirculation into the landfill) ceased in July 2011.

In the ROD, groundwater extraction was anticipated to continue for three years after the aerobic treatment was discontinued to achieve the Remediation Goals in the Middle Wenonah aquifer.

Based on process performance data, the extraction system performed as designed, effectively containing dissolved phase VOCs and preventing downgradient migration. Due to persistently low VOC concentrations, extraction well (also termed "recovery well") RW-2 was shut down in March 2009. Similarly, extraction wells RW-4, RW-3, and RW-1 were shut down in February 2012, August 2012 and September 2015, respectively. The wells remain in stand-by/shut-down mode unless trigger concentrations (described below in Section IV, Five-Year Review Process, Data Review) are observed either in these extraction wells or in nearby monitoring wells, in which case NJDEP will be notified of the specific concentrations that were exceeded.

The ROD called for decommissioning water supply wells on a number of residential properties on the western portion of Rabbit Run, downgradient of the L&D Landfill, and the installation of a water line extension to these properties. At the time of the ROD and unrelated to the L&D site, Burlington County was in the process of acquiring properties along Rabbit Run and Hand Lane, including the properties that were to have residential water supply wells decommissioned. The ROD acknowledged that these property acquisitions would satisfy the well decommissioning component of the remedy, but the ROD also identified an action to be taken if Burlington County's independent effort to acquire the properties was not successful. That action was to extend a water line to Hand Lane and along the western portion of Rabbit Run. Since the county was unable to complete the purchase of all of the properties in a timely manner, in 2009, EPA and NJDEP documented a change to the selected remedy in an ESD. The ESD modified the selected remedy to allow for the installation of a new water supply via installation of new deeper private wells, in lieu of a water line extension for those properties not acquired by Burlington

County. The ESD allowed for the new water supply wells to be screened in the Englishtown aquifer which is unaffected by landfill contamination. The new residential wells were completed in 2010.

The active remediation activities, which ran from 2007 to 2015, as well as the residential well components of the remedy, are complete.

ICs Summary Table

Table 1: Summary of Planned and/or Implemented 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	Yes	Groundwater	Restrict installation of groundwater wells and groundwater use	Classification Exception Area May 23, 2008

In accordance with the ROD, a CEA was established for impacted aquifers underlying the landfill and downgradient of the landfill, extending to Rancocas Creek. The CEA ensures that the uses of the aquifer are restricted until groundwater standards are achieved. The CEA restricts the use of the MLCMS aquifer, but not the Englishtown aquifer. The Englishtown aquifer, which underlies the impacted MLCMS and Middle Wenonah aquifers, has not been impacted by Site related contamination.

Systems Operations/Operation & Maintenance

The landfill closure permit requirements continue to be implemented. Site fencing is maintained, landfill gas is collected and flared, the cap inspected and mowed, and the collected leachate is sent to the local sewage treatment plant for disposal.

On October 29, 2019, NJDEP approved a modification of the monitoring plan. The modification maintained semi-annual frequency of groundwater sampling at key wells in the Central Area for five years and reduced the groundwater monitoring frequency at other wells, since there is no longer active remedy pumping and groundwater contaminant concentrations have been generally consistent in successive sampling events site-wide. In addition, the monitoring plan modification merged the process monitoring program [which includes quarterly samples at 8 locations for VOCs, total metals, and other field/laboratory parameters] with the long-term monitoring program [which consists of semi-annual sampling, with large events in May (28 wells in even years and 23 wells in odd years) and small events in November (10 wells) for VOCs, total metals, dissolved metals, and other field/laboratory parameters]. The large monitoring events were to be performed starting in 2020, and once every five years thereafter, in the year prior to the FYR. A summary of the previous monitoring program compared to the approved modified monitoring program is provided in Appendix D. In addition, under the monitoring program modifications, a distinction between Process Monitoring and Long-Term Groundwater Monitoring will no longer be made beginning in 2020.

Potential site impacts from severe weather events have been assessed, and the performance of the remedy is currently not at risk due to these expected effects, as documented in Appendix E.

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.

Table 2: Protectiveness Determinations/Statements from the 2020 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The L&D remedy is protective of human health and the environment.
Sitewide	Protective	The L&D remedy is protective of human health and the environment.

The previous FYR report did not identify any issues or recommend any action at this site needed to protect public health and/or the environment. However, the following suggestions were included as Other Findings:

- In the past, 1,4-dioxane has been sporadically detected as a tentatively identified compound (TIC). Analysis of groundwater samples for 1,4-dioxane should be conducted using an approved analytical method.
- A determination should be made on whether the landfill is the source of metals or they are attributed to background.

Because 1,4-dioxane was reported as a tentatively identified compound in several samples at the site, the past two FYRs recommended that this parameter be added to the list of VOCs that are monitored for at the site. Following a request from NJDEP after the previous FYR, non-routine sampling for 1,4-dioxane was included in the May 2021 and November 2021 sampling events. Results and future monitoring plans are discussed below in Section IV Five-Year Review Process, Data Review. The May 2022 CEA Biennial Submittal included 1,4-dioxane as a potential contaminant of concern.

It was also suggested in the last FYR that the long-term monitoring plan be reviewed to ensure that the data being collected are sufficient to determine whether aquifer restoration (i.e., contaminant concentrations at or below NJGWQS or Maximum Contaminant Levels (MCLs)) can be achieved with respect to metals, which are also present in the background wells. As discussed in more detail below, the process monitoring plan has been combined with the long-term monitoring plan. Metals data is further detailed under Section IV.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On July 21, 2025, 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 the U.S. Virgin Islands, including the Landfill and Development 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 CIC for the site, Shereen Kandil, posted a public notice on the EPA site webpage www.epa.gov/superfund/landfill-and-development on October 10, 2025, and

provided the notice to the Townships of Mount Holly, Eastampton and Lumberton by email on October 9, 2025 with a request that the notice be posted in municipal offices and on the town webpages. This notice indicated that a FYR would be conducted at the Landfill and Development Superfund site to ensure that the cleanup at the site continues to be protective of human health and the environment. Once the FYR is completed, the EPA will make the results available at the repositories at the Burlington County Library in Westampton, NJ, and EPA Region 2's Superfund Records Center in New York, NY. In addition, the EPA will post the final report on the following website: www.epa.gov/superfund/landfill-and-development. The CIC will make efforts to reach out to local public officials to inform them of the results.

Data Review

The major components of the selected groundwater remedy include: (1) hydraulic containment in the Middle Wenonah aquifer in the Central Area; (2) Enhanced Aerobic Treatment in Cell 9; (3) long term monitoring for groundwater exceeding the remediation goals; (4) maintenance of the existing final cover system on the landfill; (5) monitoring, collection and disposal of landfill leachate and gas; (6) decommissioning of residential water-supply wells downgradient of the landfill; and (7) maintenance of the site security. The chemicals of concern identified in the shallow aquifers (the Mount Laurel/Cape May Sands, and the Middle Wenonah) include VOCs and inorganics.

Groundwater data has been collected regularly at the site for process monitoring of the groundwater extraction system and as part of the long-term monitoring plan. Sampling was performed annually, biennially or once every five years depending on the well in accordance with the revised monitoring plan shown in Appendix D. Monitoring wells are screened in the Mount Laurel/Cape May Sands (MLCMS), Middle Wenonah, and Englishtown aquifers and are sampled at different frequencies, according to the aquifer.

All groundwater data have been reported in Remedial Action Progress Reports and the last round of data submitted was included in the Remedial Action Progress Report #34 dated January 31, 2025. This five-year review covers groundwater sampling data from January 1, 2020 to December 31, 2024.

Recovery Wells and Associated Nearby Monitoring Wells

Historically, the centrally-located recovery wells RW-2 and RW-4 have had the highest VOC concentrations whereas recovery wells at the edges, RW-1 and RW-3, have had much lower VOC concentrations. VOC concentrations have significantly declined at all four recovery wells over the course of the remedy and have generally decreased or remained stable at each well after the well was shut down.

Recovery wells will remain on stand-by unless trigger concentrations are exceeded for a number of compounds in multiple wells for an extended period of time. NJDEP is notified if concentrations exceed the following trigger levels:

- If 1,2-DCA reaches 20 micrograms per liter (µg/L) or benzene reaches 50 µg/L or vinyl chloride reaches 20 µg/L or methylene chloride reaches 30 µg/L at RW-1 or monitoring wells 22M, LDM-210, LDM-306 or LDM-307;
- If 1,2-DCA reaches 20 µg/L or benzene reaches 35 µg/L at RW-2 or LDM-306;

- If 1,2-DCA reaches 20 µg/L or benzene reaches 50 µg/L or vinyl chloride reaches 20 µg/L at RW-3 or LDM-307 or LDM-308;
- If 1,2-DCA reaches 20 µg/L or benzene reaches 50 µg/L at RW-4 or LDM-308;
- If 1,2-DCA reaches 10 µg/L or benzene reaches 25 µg/L or vinyl chloride reaches 10 µg/L or methylene chloride reaches 15 µg/L at monitoring well LDM-206 (close to Rancocas Creek)

During this five-year review period, none of the trigger concentrations were exceeded in RW-1 or monitoring wells 22M, LDM-210, LDM-306 or LDM-307, although benzene concentrations in LDM-210 appear to be increasing from approximately 10 µg/l to 33 µg/l (below the trigger concentration of 50 µg/l). None of the trigger concentrations were exceeded in RW-2 or LDM-306; in RW-3 or LDM-307 or LDM-308; in RW-4 or LDM-308.

In LDM-206, the monitoring well close to Rancocas Creek, 1,2-DCA concentrations reached but did not exceed the trigger concentration of 10 µg/l on 11/16/2023 and decreased below the trigger concentration in 5/23/2024. Vinyl chloride and methylene chloride trigger concentrations were not exceeded. Benzene concentrations exceeded the trigger concentration of 25 µg/l in four consecutive sampling events (53 µg/l on 5/7/2020, 29 µg/l on 11/11/2020, 33 µg/l on 5/12/2021 and 47 µg/l on 11/17/2021) then declined to single digits from 2022 through 2024 (see Appendix B – Figure 3). The elevated benzene concentrations were the remnants of a short-term pulse of groundwater that escaped the landfill during a down period of pumping at RW-1 in 2014 (reported in the last FYR). NJDEP did not require pumping to be restarted at the recovery wells.

Mount Laurel/Cape May Sands (MLCMS) Aquifer

In the MLCMS aquifer (shallow), concentrations exceeding the New Jersey Ground Water Quality Standard (NJGWQS) are limited to benzene and chlorobenzene in the immediate vicinity of the landfill boundary (LDS-205 in the Mount Holly Section and 12S in the Eastampton Section).

- During this five-year review period, LDS-205 was scheduled to be sampled once. In that 2020 sampling event, the benzene concentration of 2.6 µg/l exceeded the standard of 1 µg/l, which was the first exceedance since 2017, and the chlorobenzene concentration of 17 µg/l did not exceed the standard of 50 µg/l, consistent with a decreasing trend in chlorobenzene concentrations that have not exceeded the standard since 2017 (see Appendix B – Figure 4).
- During this five-year review period, 12S was sampled once a year. Benzene concentrations ranged from non-detect to 5 µg/l, exceeding the standard of 1 µg/l every year except 2020. Chlorobenzene concentrations ranged from 22 µg/l to 90 µg/l, exceeding the standard of 50 µg/l in 2024 (see Appendix B – Figure 5).

The MLCMS aquifer remains impacted above criteria for metals. Concentrations of iron, manganese, aluminum, and arsenic (both total and dissolved) have been reported at levels above standards. As stated in the ROD, there are background concentrations for some metals which exceed criteria, and the landfill may add to these impacts. The presence of elevated metals and other inorganics is addressed by the remedy, via groundwater use restrictions in the CEA.

Middle Wenonah Aquifer

The greatest impacts to groundwater have historically been observed in the Middle Wenonah aquifer in a relatively narrow band downgradient of the eastern portion of the Mount Holly section. This narrow

band of historically higher concentrations is referred to as the "Central Area." Areas of much lower groundwater concentrations (historically) on either side of the Central Area are referred to as the "Flank Areas." During this review period, VOC concentrations in the Middle Wenonah aquifer were much lower within the Central Area than existed during pre-remedy conditions. In Flank Area monitoring wells 2M, LDM-8, LDM-302, LDM-304 and LDM-305, all VOCs were non-detect or below NJGWQS. In well 1M(R), trichloroethene (TCE) ranged from 1 µg/l to 1.8 µg/l, slightly exceeding the standard of 1 µg/l.

At Central well LDM-210, located less than 400 feet downgradient of RW-1, there have been significant reductions of most VOCs, such as methyl ethyl ketone, acetone, methyl isobutyl ketone, toluene and 1,2-DCA. During the five-year review period, benzene concentrations ranged from 9.8 µg/L to 33 µg/L, exceeding the NJGWQS of 1 µg/L, and vinyl chloride concentrations ranged from non-detect to 5.1 µg/L, exceeding the NJGWQS of 1 µg/L.

Central well LDM-206 was historically the most impacted well at the site. VOC concentrations are notably lower for this well since the remedy began. These declines are very likely due to hydraulic capture (during active remedy pumping from 2007 to 2015) and reduction in source area concentrations resulting from the remedy. During this five-year review period, 1,2-DCA concentrations ranged from 2.1 µg/L to 10 µg/L, exceeding the NJGWQS of 2 µg/L, and benzene concentrations ranged from 2.2 µg/L to 53 µg/L, exceeding the NJGWQS of 1 µg/L, with a decreasing benzene concentration trend from 2020 to 2024. This is the only monitoring well where a trigger concentration was exceeded: benzene concentrations were 53 µg/l on 5/7/2020, 29 µg/l on 11/11/2020, 33 µg/l on 5/12/2021 and 47 µg/l on 11/17/2021, all exceeding the trigger concentration of 25 µg/l. Benzene concentrations since then (2022-2024) have all been in the low single digits.

Concentration reductions have also been noted at LDM-7: 1,2-DCA has not exceeded the NJGWQS of 2 µg/L since 2021, benzene ranged from the NJGWQS of 1 µg/L to 2.3 µg/L in 2020 to 2024, and vinyl chloride has not exceeded the NJGWQS of 1 µg/L since 2018, except for a concentration of 1.1 µg/L in 2024.

At Central well 22M, located just upgradient of extraction well RW-1, there has also been a very substantial decline in VOC concentrations for many constituents such as methyl ethyl ketone, methylene chloride and 1,2-DCA. Because this is upgradient of the extraction well, these concentration declines indicate reduced source strength beneath the landfill. This is likely due to the remedy but is also due to declining source strength over time from natural degradation within the landfill that was already occurring prior to the implementation of the remedy. During this five-year review period, only benzene concentrations, which ranged from 6.3 µg/L to 19 µg/L, exceeded the NJGWQS of 1 µg/L.

In the Eastampton Section, VOC concentrations are all non-detect, except for vinyl chloride concentrations in monitoring well DEP-3(R) which ranged from 5 µg/L to 12 µg/L, exceeding the NJGWQS of 1 µg/L, but with a decreasing trend from 2020 to 2024.

The Middle Wenonah aquifer remains impacted above criteria for metals. Concentrations of iron, manganese, sodium, aluminum, and arsenic (both total and dissolved) have been reported at levels above standards. As stated in the ROD, there are background concentrations for some metals which exceed criteria, and the landfill may add to these impacts. The presence of elevated metals and other inorganics is addressed by the remedy, via groundwater use restrictions in the CEA.

Englishtown Aquifer

In the Englishtown aquifer, no VOCs exceeded criteria during this five-year review period. VOCs have not been detected over the course of the remedy, which is similar to historic results. In addition, total iron and total manganese continue to exceed criteria. Under the modified monitoring program, Englishtown wells were sampled in 2020 and will be sampled every 5 years thereafter.

Metals Exceedances and Groundwater Quality Evaluation

The MLCMS, Middle Wenonah, and Englishtown aquifers continue to exhibit concentrations of metals above applicable criteria. Based on review of VOC and metals concentrations, as well as landfill indicator parameters and groundwater quality parameters, metals exceedances are likely attributable to a combination of background conditions and potential landfill-related influences.

In the Englishtown aquifer, background well (LDE-202) and downgradient wells (22E and LDE-206) did not exhibit exceedances of landfill indicator parameters or VOCs. Sodium, chloride, ammonia, total dissolved solids and chemical oxygen demand are commonly used as landfill indicator parameters because they are typically enriched in landfill leachate and can serve as indirect indicators of potential landfill influence when present at elevated concentrations in groundwater. The absence of exceedances in these parameters as well as VOC detections indicates that the landfill is not impacting the Englishtown aquifer, and that persistent metals exceedances – particularly total iron and total manganese – likely reflect naturally occurring background groundwater conditions.

In the Middle Wenonah and MLCMS aquifers, VOCs, landfill indicator parameters, and metals exceedances – particularly total iron and total manganese – are consistently elevated in downgradient wells, indicating potential influence from the landfill. In contrast, VOCs and landfill indicator parameters were not detected in background wells (LDM-2 and LDS-202), although total iron and total manganese exceeded criteria. The elevated concentrations of landfill indicator parameters in downgradient wells 10S, 12S, LDS-205, 22M, LDM-7, LDM-206, LDM-210, LDM-301, LDM-302, LDM-304, and LDM-305 through LDM-308, along with exceedances of VOCs in many of these wells, suggest that the landfill is contributing to the development of reducing conditions. Although there is evidence that the landfill is enhancing metals mobility, the impacts appear to be localized to the general vicinity of the landfill and do not suggest migration of metals in groundwater.

Concentrations of metals in the Central Area have fluctuated over time. In the Middle Wenonah aquifer, concentrations of total iron in LDM-7 were reported at a maximum of 804,000 µg/L in 2000 before the remedy was operational but then decreased to 84,000 µg/L in 2024. Similarly, total iron concentrations in a monitoring well slightly upgradient of LDM-7 and closer to the edge of the landfill (LDM-301) were detected at 93,300 µg/L in 2024, suggesting that total iron concentrations in the Central Area are relatively stable and are not increasing as groundwater flows downgradient of the landfill. In the Middle Wenonah aquifer outside of the Central Area and MLCMS aquifer, the wells that are installed along the edge of the landfill (ex: 12S) have higher concentrations of total iron than wells downgradient of the landfill edge (ex: LDS-208), indicating that contamination is likely not migrating.

Although total iron and total manganese exceed criteria in Middle Wenonah and MLCMS background wells, concentrations are substantially higher in downgradient wells, consistent with landfill-related enhancement of reducing conditions. For example, total iron and total manganese concentrations ranged from 166 to 61,800 µg/L and nondetect to 477 µg/L in background well LDM-2, compared to 40,000 to

337,00 µg/L and 361 to 2,580 µg/L, respectively, in downgradient well 22M. Furthermore, oxidation-reduction potential values in these downgradient wells range from -150 millivolts (mV) to +150mV, indicating mildly to strongly reducing conditions that promote the dissolution and mobilization of iron and manganese oxides. Collectively, these results indicate that the Middle Wenonah aquifer appears to be the most impacted by landfill-related influences, with the MLCMS aquifer showing similar, though less pronounced, geochemical evidence of landfill impact.

1,4-Dioxane and PFAS

Following a request from NJDEP after the previous FYR, non-routine sampling of 1,4-dioxane was included in the May 2021 sampling event. The results indicated 1,4-dioxane was present above the current NJDEP standard of 0.4 µg/L at 16 of the 18 samples taken from monitoring wells screened in the MLCMS and Middle Wenonah aquifers. The highest 1,4-dioxane concentrations (e.g., 66 E[1] µg/L at LDM-308, 78 E µg/L at DEP-3R, and 82 E µg/L at LDM-301) do not correlate with locations where the highest VOC concentrations have been historically observed. However, 1,4-dioxane was not detected in the two Englishtown aquifer wells. These results are consistent with previous findings that the Englishtown aquifer has not been impacted by the landfill due to the thick overlying confining unit. Exceedances in the MLCMS and Middle Wenonah aquifers and lack of detection in the Englishtown aquifer suggests that 1,4-dioxane may be site-related and associated with contributions from the landfill. Additional sampling is warranted to support the absence of 1,4-dioxane in the Englishtown aquifer. In addition, the report detection limit ranged from 0.2 to 10 µg/L. It is suggested that 1,4-dioxane be included in the contaminant list for future groundwater sampling and that the analytical method used have the ability to detect levels down to the NJGWQS of 0.4 µg/L.

The May 2022 CEA Biennial Submittal included 1,4-dioxane as a potential contaminant of concern. L&D intends to include analysis for 1,4-dioxane at each well in the comprehensive sampling events conducted prior to Five-Year Reviews. Additionally, per NJDEP's October 2024 request for recurring 1,4-dioxane sampling at L&D, analysis of 1,4-dioxane will occur in 2027 and every other year thereafter. 1,4-Dioxane will also be included in the comprehensive sampling event in 2030.

Following a request from NJDEP in July 2020 regarding per- and polyfluoroalkyl substances (PFAS), a one-time sampling event was conducted in November 2020 at two Middle Wenonah wells (LDM-307 and LDM-308) for the following three PFAS regulated by NJDEP: perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), and perfluorononanoic acid (PFNA). PFOA was detected at both wells (12 nanograms per liter [ng/L] in LDM-307 and 5.6 ng/L in LDM-308) below the NJDEP limit of 14 ng/L, and PFOS and PFNA were both non-detect. In April 2024, EPA established MCLs for PFOA and PFOS of 4 ng/L. Although the results from 2020 slightly exceed the EPA MCLs, the data does not indicate the L&D Site is a significant source of these contaminants. EPA will continue to work with NJDEP to determine future sampling needs.

Site Inspection

The inspection of the Site was conducted on 7/15/2025. In attendance were Alice Yeh (EPA Remedial Project Manager); Carly DeLucca (NJDEP); Liana Agrios and Joseph Hayes (EPA Hydrogeologists);

[1] The lab report notes that some of the results were assigned an "E" qualifier because actual amounts are within the calibration range, but bias corrected concentrations (based on the recovery of the 1,4-dioxane-d8 isotope) are outside the calibration range

Abbey States, Tara Bhat and Detbra Rosales (EPA Risk Assessors); and Haley Burke and Dallas Mellott (Waste Management Landfill Operations Managers). The purpose of the inspection was to assess the protectiveness of the remedy.

Conditions observed indicate that the site is being properly maintained. Some gaps in the fencing on the north side of the landfill are expected to be repaired by the landfill operator.

V. TECHNICAL ASSESSMENT

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

The remedy selected in the 2004 ROD, and modified in the 2009 ESD, has been effective in controlling exposure to contaminants and has reduced the contaminant levels remaining on site. All components of the groundwater remedy for the site are operating and functioning as intended by the decision documents.

According to the 2004 ROD, the major components of the remedy include construction of a groundwater extraction system, construction of enhanced aerobic treatment, long-term monitoring in the central and flank areas of the landfill, maintenance of existing cover, continued landfill leachate and gas monitoring, collection and disposal, maintenance of site security, and decommissioning of residential water-supply wells (and public water line extension) downgradient of the landfill.

The groundwater extraction and enhanced aerobic treatment components of the remedy, intended to provide hydraulic containment of dissolved phase VOCs, were constructed in July of 2006 and put into operation by late February 2007. Between March 2009 and September 2015, wells RW-2, RW-4, RW-3 and RW-1 were progressively shut down due to persistently low VOC concentrations. These recovery wells remain on stand-by unless trigger concentrations are exceeded for a number of compounds in multiple wells for an extended period of time. These specific compounds are 1,2-DCA, benzene, vinyl chloride and methylene chloride in extraction wells RW-1 through RW-4, or monitoring wells 22M, LDM 206, LDM 210, LDM 306, LDM 307 and LDM 308.

The Enhanced Aerobic Treatment component of the remedy included air injection and groundwater/ leachate recirculation to stimulate biodegradation of waste in the source area and enhance contaminant mass reduction in the landfill. The construction of the air-recirculation system began July 2006 and was operated between December 2007 and April 2008. Based on an analysis showing limited additional benefit from the system, the air injection was terminated. Leachate collection continues to operate.

The Long-Term Groundwater Monitoring Program was initiated in May 2006. In the MLCMS aquifer (shallow), concentrations exceeding NJGWQS are limited to benzene and chlorobenzene in the immediate vicinity of the landfill boundary (LDS-205 and 12S). In the Middle Wenonah aquifer, VOC concentrations are much lower within the Central Area than existed during pre-remedy conditions. The benzene trigger concentration was exceeded in monitoring wells LDM-206 (near the Rancocas) in 2020 and 2021 only. Although the selected groundwater remedy continues to be protective, it has not yet resulted in restoration of groundwater to meet MCLs or NJGWQS outside of the landfill boundaries in the MLCMS and Middle Wenonah aquifers.

Additionally, groundwater remains impacted above standards for metals and other inorganics. Based on review of metals and VOC concentration data, landfill indicator parameters, and groundwater quality parameters, the landfill is likely promoting reducing conditions in groundwater and contributing to the mobilization of metals in the Middle Wenonah and MLCMS aquifers. However, data collected during this FYR period generally indicate that the metals are not migrating. Metals exceedances observed in the Englishtown aquifer are likely attributable to naturally occurring background groundwater conditions.

NJDEP issued a CEA in 2008 to restrict groundwater use in the vicinity of the site between the landfill and Rancocas Creek until groundwater standards are achieved. Groundwater remains impacted above NJGWQS for metals and limited VOCs in this area. The CEA applies vertically to the shallowest aquifers (the MLCMS and the Wenonah), ensuring that uses of the aquifer are restricted until groundwater standards are achieved. A well survey was performed for other wells between the landfill and Rancocas Creek. All properties in the CEA area are either connected to public supply or have wells screened in the uncontaminated Englishtown aquifer for potable supply; any existing wells screened in shallower aquifers are not used for potable purposes. A CEA Biennial Certification was completed and submitted every other May from May 2010 to May 2024. Based on detections of 1,4-dioxane in 16 of the 18 samples taken in May and November 2021, the May 2022 CEA Biennial Submittal included 1,4-dioxane as a potential contaminant of concern and sampling will be expanded in the next FYR period.

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?

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, cleanup levels and remedial action objectives (RAOs) considered in the decision documents remain valid. Although specific parameters have changed since the time the risk assessment was completed, the process that was used remains valid.

The landfill cover, fence, and continued maintenance of these barriers prevent direct contact with landfill contents and control surface water runoff and erosion. A solar farm was installed on the landfill in 2015, which does not disturb the landfill cover or impact protectiveness. All residential wells in the affected aquifers have been decommissioned, and the installation of new wells is restricted through a CEA that NJDEP established in 2008. These institutional controls prevent human consumption of groundwater from contaminated aquifers in the area. The groundwater and leachate monitoring systems reduce leaching of constituents to groundwater and control landfill gas migration.

While some standards have been updated since the time of the human health risk assessment and the ROD, the selected remedy continues to prevent exposures. Maximum groundwater concentrations detected during the FYR period were compared to NJGWQS and MCLs, which remains valid. Concentrations of several contaminants, including arsenic, benzene, 1,2-DCA, 1,4-dioxane, vinyl chloride, and TCE continue to exceed groundwater and drinking water standards, however, the remedy effectively prevents residents in the vicinity of the site from drinking groundwater affected by site-related contaminants. Additionally, 1,4-dioxane was not identified as a COC at the time of the ROD but has been detected and added to the monitoring program for further evaluation.

Monitoring well results from the shallow MLCMS aquifer were compared to EPA's residential vapor intrusion screening levels (VISLs) for groundwater set at a cancer risk of 10^{-4} and hazard of 1 and no exceedances were found. Since there is currently no development planned for the area, the vapor

intrusion pathway is likely to remain incomplete, and no specific monitoring for soil vapor intrusion is necessary at this time.

Ecological – As part of the remedial investigation, a four-step process was used for assessing site-related ecological risks for a reasonable maximum exposure scenario. The process consisted of problem formulation, exposure assessment, ecological effects assessment and risk characterization. The primary assessment endpoints evaluated in the ecological risk assessment were:

- Survival, growth and reproduction of benthic communities in Rancocas Creek and Smithville Canal
- Survival, growth, and reproduction of fish communities in Rancocas Creek and Smithville Canal.
- Survival, growth, and reproduction of avian piscivores (i.e., birds that eat fish) foraging in Rancocas Creek and Smithville Canal.

Surface water and sediment concentrations in the ponds/outfalls and groundwater seeps were compared to appropriate criteria/standards and background results. Sediment and surface water data, supplemented by exposure modeling for avian piscivores, were used to evaluate ecological effects. Sediment monitoring data were used to evaluate exposures to benthic organisms, while surface water monitoring data were used to evaluate exposures to fish. In addition, surface water monitoring data and bioaccumulation models were used to estimate dietary intakes to avian piscivores. Available toxicity criteria, standards, and toxicity data from the literature were used to characterize ecological effects. The exposure pathways and toxicity information that were used to estimate ecological risk remain valid. The quantitative ecological risk assessment indicated potential risk to some ecological receptors (e.g., potential impacts to avian piscivores from selenium in surface water and potential impacts to benthic organisms from silver in sediments). However, it was concluded that the L&D Landfill was not causing or adding to any ecological risks and that the risk associated with heavy metals was related to naturally occuring sources. Given that the exposure pathways from the L&D Landfill to the nearby waterbodies were determined to be incomplete (i.e., no site-related compounds related to ecological risk), the previous conclusion that there are no ecological impacts remains valid.

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

OTHER FINDINGS

The following are suggestions that were identified during the FYR and may improve performance of the remedy, but do not affect current and/or future protectiveness:

- Future groundwater sampling for 1,4-dioxane should use analytical methods that have the ability to detect levels down to the NJGWQS of 0.4 µg/L.

VII. PROTECTIVENESS STATEMENT

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

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

VIII. NEXT REVIEW

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

APPENDIX A – REFERENCE LIST

1. 2004 Record of Decision - https://semspub.epa.gov/work/02/90569.pdf
2. 2009 Explanation of Significant Differences - https://semspub.epa.gov/work/02/105388.pdf
3. 2011 (First) Five-Year Review - https://semspub.epa.gov/work/02/109609.pdf
4. 2016 (Second) Five-Year Review - https://semspub.epa.gov/work/02/437434.pdf
5. 2020 (Third) Five-Year Review - https://semspub.epa.gov/work/02/616052.pdf
6. Remedial Action Progress Report #30, Jan-December 2020
7. Remedial Action Progress Report #31, Jan-December 2021
8. Remedial Action Progress Report #32, Jan-December 2022
9. Remedial Action Progress Report #33, Jan-December 2023
10. Remedial Action Progress Report #34, Jan-December 2024

APPENDIX B - FIGURES

FIGURE 1 – SITE MAP

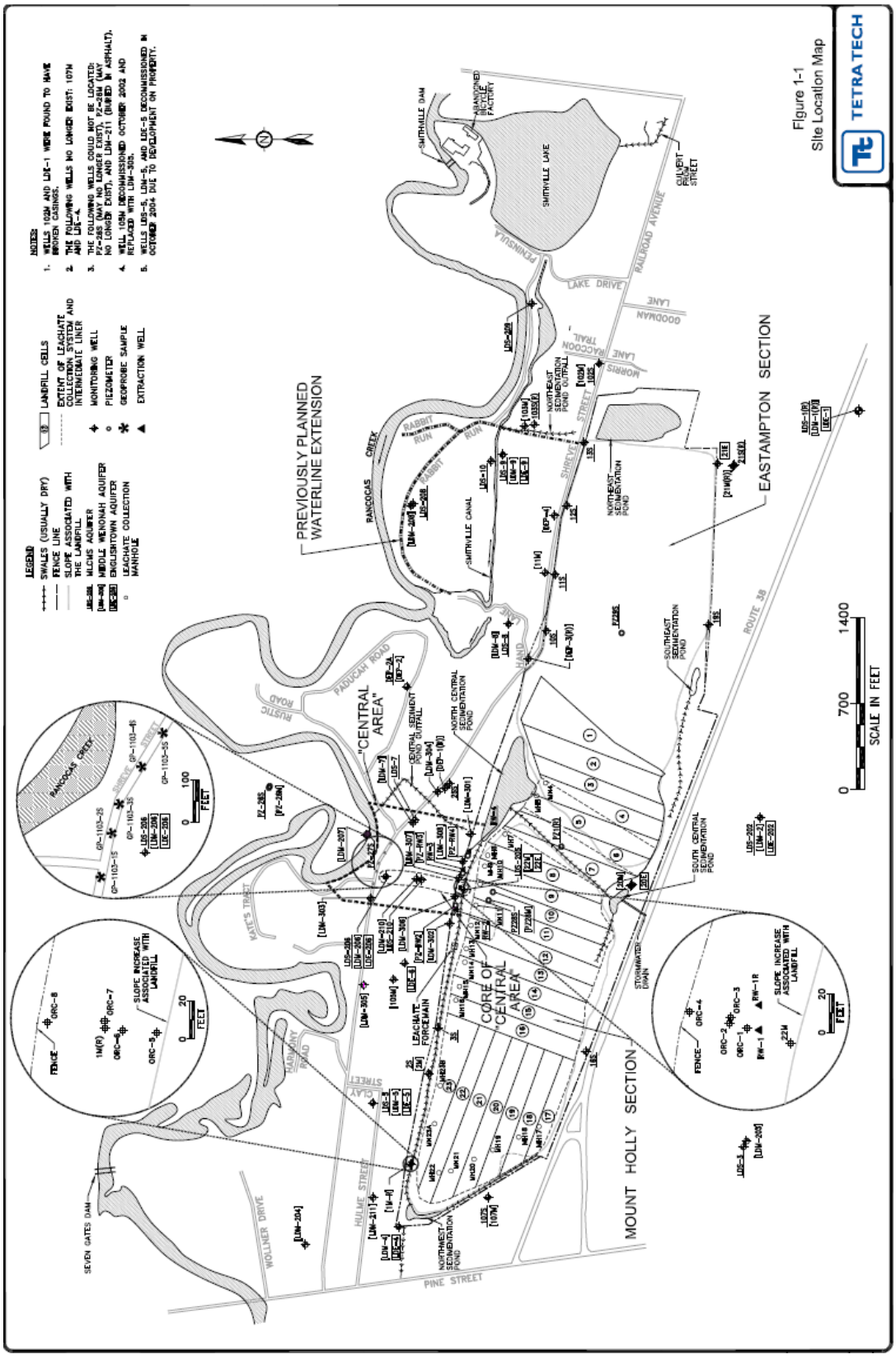


FIGURE 2 – HYDROGEOLOGIC UNITS

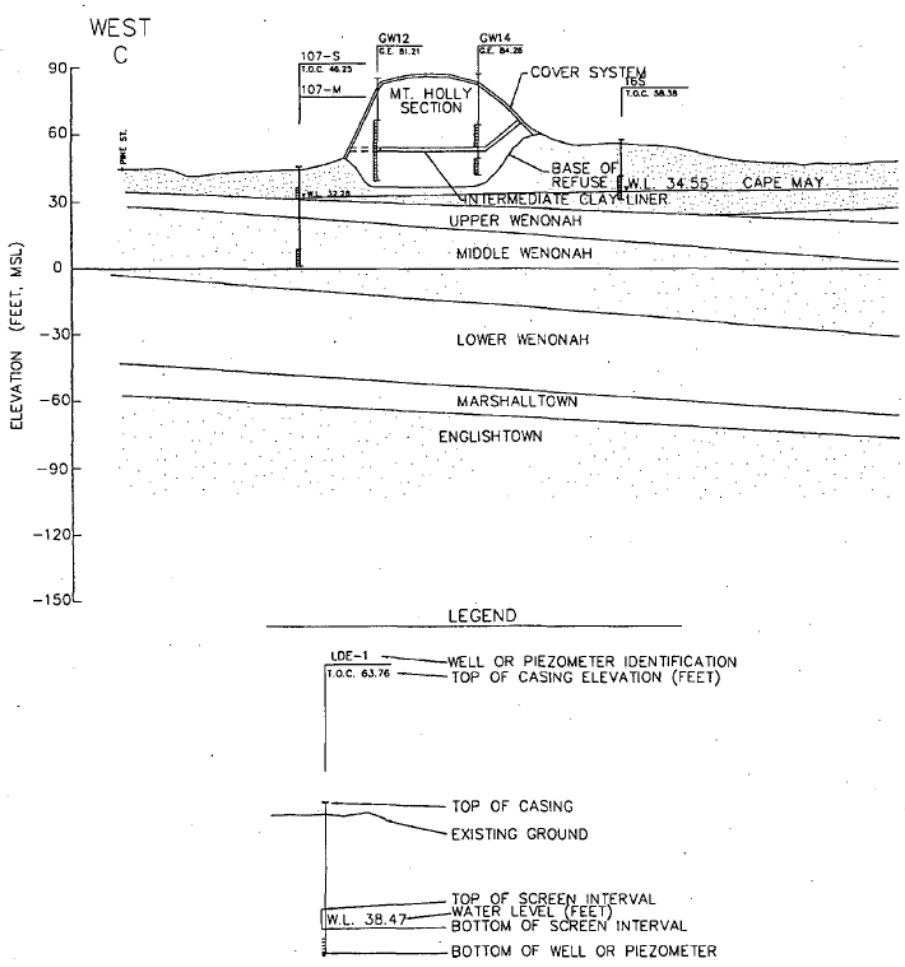


FIGURE 3

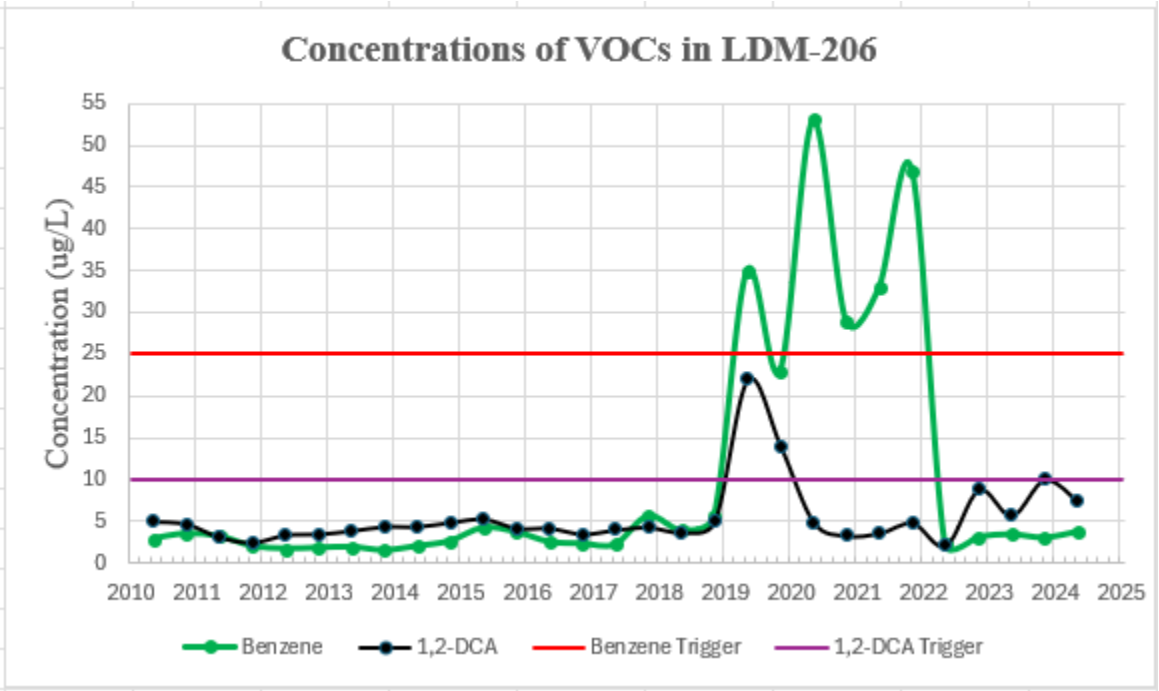


FIGURE 4

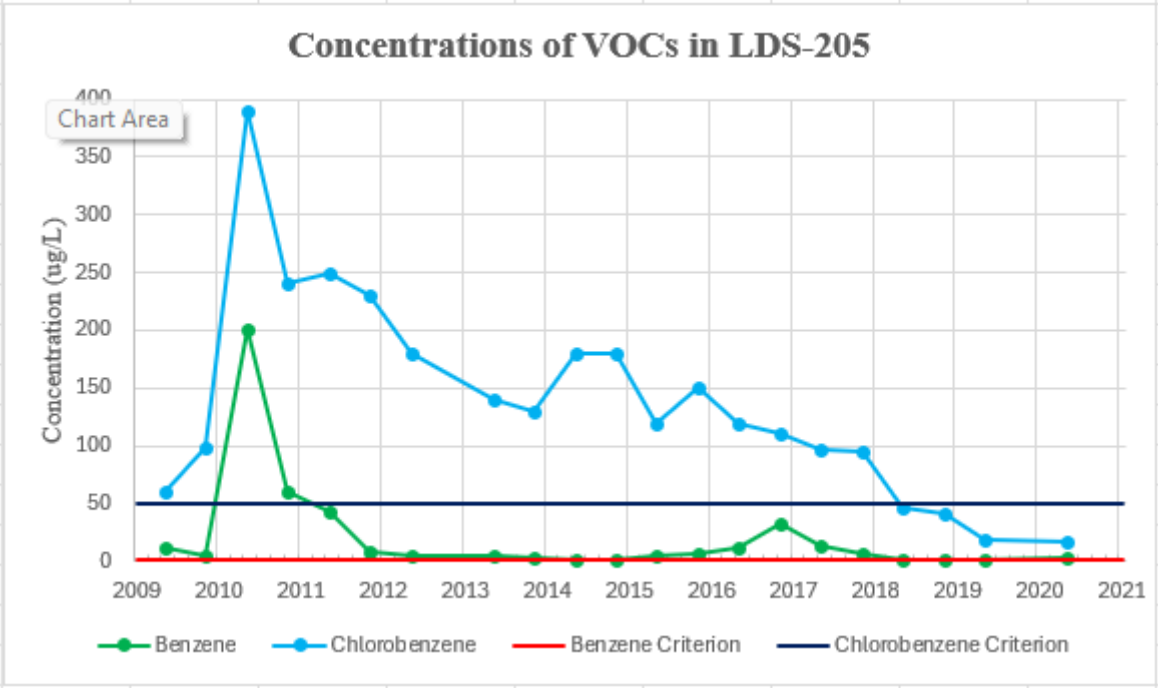
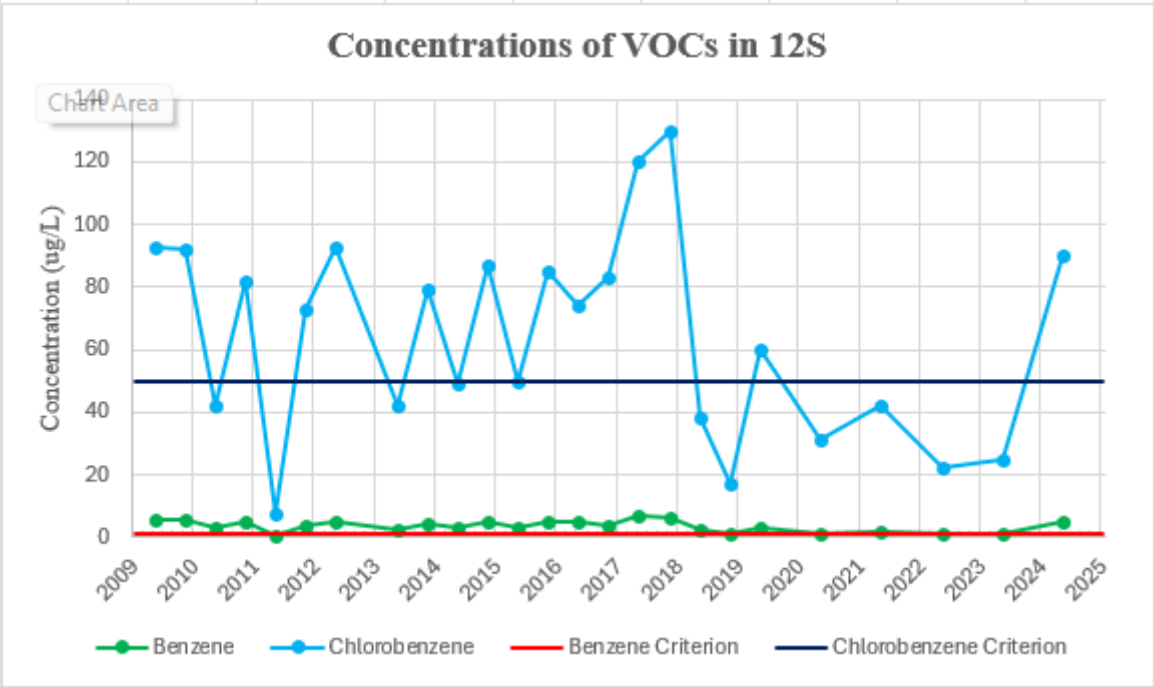


FIGURE 5


Concentrations of VOCs in 12S
Chart Area
Concentration (ug/L)
140
120
100
80
60
40
20
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Benzene
Chlorobenzene
Benzene Criterion
Chlorobenzene Criterion

APPENDIX C - TABLES

TABLE 1 – GROUNDWATER CRITERIA FOR VOCs

Parameter	NJ GWQS (ug/l)	Federal MCL (ug/l)	Data Evaluation Criterion (ug/l)
1,1,1-Trichloroethane	30	200	30
1,1,2,2-Tetrachloroethane	2	-	2
1,1,2-Trichloroethane	3	5	3
1,1-Dichloroethane	70	-	70
1,1-Dichloroethene	2	7	2
1,2-Dibromo-3-chloropropane	NA	0.2	0.2
1,2-Dibromoethane	0.05	0.05	0.05
1,2-Dichlorobenzene	600	600	600
1,2-Dichloroethane	2	5	2
1,2-Dichloropropane	1	5	1
1,3-Dichlorobenzene	600	-	600
1,4-Dichlorobenzene	75	75	75
2-Butanone	300	-	300
2-Hexanone	-	-	-
4-Methyl-2-pentanone	400	-	400
Acetone	700	-	700
Benzene	1	5	1
Bromochloromethane	-	10 (1)	10
Bromodichloromethane	1	100 (2)	1
Bromoform	4	100 (2)	4
Bromomethane	10	10 (1)	10
Carbon disulfide	-	-	-
Carbon tetrachloride	2	5	2
Chlorobenzene	4	100	4
Chloroethane	-	-	-
Chloroform	6	100 (2)	6
Chloromethane	30	3 (1)	3
cis-1,2-Dichloroethene	10	70	10
cis-1,3-Dichloropropene	NA	10 (3)	10
Dibromochloromethane	10	100 (2)	10
Ethylbenzene	700	700	700
Methylene chloride	2	5	2
Styrene	100	100	100
Tetrachloroethene	1	5	1
Toluene	1000	1000	1000
trans-1,2-Dichloroethene	100	100	100
trans-1,3-Dichloropropene	NA	10 (3)	10
Trichloroethene	1	5	1
Vinyl chloride	5	2	2
Xylene (total)	40	10000	40

Notes:
- NJ GWQS - New Jersey Groundwater Quality Standards (N.J.A.C. 7:9-6) listed value represents higher of the practical quantitation level and groundwater quality criterion.
- Federal MCL - Maximum contaminant levels as set forth in 40 CFR 141 and 143).
- Data Evaluation Criterion represents the more stringent of the state and Federal standards.

(1) Represents the Lifetime Health Advisory.
(2) Represents the MCL for total trihalomethanes.
(3) Represents the Drinking Water Equivalent Level.

TABLE 2 – GROUNDWATER CRITERIA FOR METALS

Parameter	NJ GWQS (ug/l)	Federal MCL (ug/l)	Background Groundwater Quality (ug/l)					Data Evaluation Criterion (ug/l)
			MLCMS Aquifer		Middle Wenonah Aquifer		Englishtown Aquifer	
			low	high	low	high		
Aluminum	200	200 (1)	1320	28200	136J	392	U	200 (*)
Antimony	20	6	U	2.7J	U	4.7J	U	6
Arsenic	8	50	U	154	U	U	U	8 (*)
Barium	2000	2000	81.5J	93J	58.8J	250	94.3J	2000
Beryllium	20	4	1.4J	4J	0.7J	1.1J	U	4
Cadmium	4	5	0.79J	6.9	0.36J	1J	U	4 (*)
Calcium	-	-	3960J	25900	8500	33800	19000	-
Chromium	100	100	12.5	338	1.6J	2J	1.4J	100 (*)
Cobalt	-	-	8.7J	18.9J	U	1.2J	0.7R	-
Copper	1000	1300	4.6J	25.2	U	U	U	1000
Iron	300	300 (1)	5210	135000	20100	49300	8560	300 (*)
Lead	10	15	3.3	35.6	U	5	U	10 (*)
Magnesium	-	-	5500	9430	1230J	5890	1750J	-
Manganese	50	50 (1)	60.6	354	166	477	94.7	50 (*)
Mercury	2	2	U	U	U	U	0.13J	2
Nickel	100	-	17.1J	69.5	U	2J	U	100
Potassium	-	-	2000J	14700	2490	13700	7870	-
Selenium	50	50	U	10.7R	U	3.2R	U	50
Silver	NA	100 (1)	U	U	U	U	U	100
Sodium	50000	-	1490J	8260J	4700	7680	5160	50000
Thallium	10	2	U	U	U	3.5J	U	2 (*)
Vanadium	-	-	4.2J	287	U	1.7J	2.1J	-
Zinc	5000	5000 (1)	87	309	6.5J	17J	20J	5000

Notes:
- NJ GWQS - New Jersey Groundwater Quality Standards (N.J.A.C. 7:9-6) listed value represents higher of the practical quantitation level and groundwater quality criterion.
- Federal MCL - Maximum contaminant levels as set forth in 40 CFR 141 and 143).
- Data Evaluation Criterion represents the more stringent of the state and Federal standards.

(1) Represents Secondary Drinking Water Standards, which are unenforceable guidelines regarding taste, odor and color of drinking water.
(*) Data evaluation criterion is less than background concentrations, data will be assessed on a case by case basis.
U = Not detected above the reported quantitation limit
J = analyte positively identified, concentration is approximate
R = data rejected by data validator

Background Wells:

MLCMS aquifer:	LDS-1(R), LDS-202, LDS-3
Middle Wenonah aquifer:	LDM-1(R), LDM-2, LDM-203
Englishtown aquifer:	LDE-202 (LDE-1 could not be sampled due to broken casing)

TABLE 3 – GROUNDWATER CRITERIA FOR GENERAL PARAMETERS

Parameter	Units	NJ GWQS (mg/l)	Federal MCL (mg/l)	Background Groundwater Quality (mg/l)					Data Evaluation Criterion (mg/l)
				MLCMS Aquifer		Middle Wenonah Aquifer		Englishtown Aquifer	
				low	high	low	high		
Alkalinity, Total	mg/l	-	-	U	7.2	14.8	57	53	-
BOD, 5 Day	mg/l	-	-	U	U	U	5.3	6.1	-
Chemical Oxygen Demand	mg/l	-	-	U	U	U	U	U	-
Chloride	mg/l	250	250 (1)	U	49	U	41	U	250
DO (Hach)	mg/l	-	-	4.5	10.7	0	0.8	0	-
FE+2 (Hach)	mg/l	-	-	0	11	2.6	4.6	2.6	-
Hardness, Total	mg/l	250	-	57.7	74.5	36.5	119	93.6	250
Nitrogen, Ammonia	mg/l	0.5	-	U	U	U	U	U	0.5
Nitrogen, Nitrate	mg/l	10	10	U	7.3	U	480	U	10 (*)
Nitrogen, Nitrate + Nitrite	mg/l	10	10	U	7.3	U	823	U	10 (*)
Nitrogen, Nitrite	mg/l	1	1	U	U	U	0.01	0.01	1
ORP	mV	-	-	197	342	-103	26	-101	-
pH	standard	-	-	4.29	4.69	5.69	6.9	7.66	-
Phenols	mg/l	4000	-	U	U	U	0.057	U	4000
Solids, Total Dissolved	mg/l	500	500 (1)	63	199	153	293	95	500
Specific Conductance	mS/m	-	-	16	22	24	59	21	-
Sulfate	mg/l	250	250 (1)	U	37.9	34.6	103	16.1	250
Temperature	deg. C	-	-	14.5	22.6	16.4	19.4	14.7	-
Total Organic Carbon	mg/l	-	-	U	7.9	U	1.3	1.1	-

Notes:
- NJ GWQS - New Jersey Groundwater Quality Standards (N.J.A.C. 7:9-6) listed value represents higher of the practical quantitation level and groundwater quality criterion.
- Federal MCL - Maximum contaminant levels as set forth in 40 CFR 141 and 143).
- Data Evaluation Criterion represents the more stringent of the state and Federal standards.

(1) Represents Secondary Drinking Water Standards, which are unenforceable guidelines regarding taste, odor and color.
(*) Data evaluation criterion is less than background concentrations, data will be assessed on a case by case basis.
U = not detected above the reported sample quantitation limit

Background Wells:
MLCMS aquifer: LDS-1(R), LDS-202, LDS-3
Middle Wenonah aquifer: LDM-1(R), LDM-2, LDM-203
Englishtown aquifer: LDE-202 (LDE-1 could not be sampled due to broken casing)

APPENDIX D – SUMMARY OF MONITORING PROGRAM CHANGES

Type of Monitoring	Previous Program	Revised Program
Process Monitoring	-Quarterly samples at 8 locations ○ RW-1/2/3/4 ○ LDM-306/307/308 ○ MH-9 -VOCs, total metals, and other field/lab parameters	Includes all the locations of the previous process monitoring and long-term monitoring except it eliminates sampling at MH-9 Change frequency as follows: ○ Annual sampling, plus extra events twice per year (with annual reporting) for the next five years (through 2023), at the following key Central Areas wells: RW-1/2/3/4, LDM-210, and LDM-206
Long-Term Monitoring	-Semi-annual sampling ○ Large events in May ▪ 28 wells in even years ▪ 23 wells in odd years when Englishtown wells and background wells are not sampled ○ Small Events in November ▪ 10 wells -VOCs, total metals, dissolved metals, and other field/lab parameters	○ Annual sampling at the following 9 wells: 12S, 22M, DEP-3R, LDM-301, LDM-303, LDM-306, LDM-307, LDM-308, and LDM-7 ○ Biennial sampling (once every two years) at the following 4 wells: 1M(R), LDM-302, LDM-304, and LDM-8 ○ Sampling every five years at remaining wells in the monitoring program (2020, 2025, and 2030) which is the year prior to Five-Year Reviews: 3S, 10S, 25S, LDS-8, LDS-202, LDS-205, LDS-206, LDS-208, 2M, DEP-4, LDM-2, LDM-208, LDM-305, 22E, LDE-202, LDE-206 Analysis for all parameters of previous sampling (including depth to water measured during sampling) except eliminate dissolved metals included in previous long-term monitoring
Water Levels for Capture Zone Evaluation	Once per year collection of water levels, and preparation of a groundwater contour map to illustrate capture zone of extraction wells	Continue with these measurements and maps on an annual basis although there is no longer a capture zone (because remedy extraction wells are no longer operating); these maps will confirm that groundwater flow patterns have not changed. Depth to water is also measured during every sampling event at sampling locations on their respective schedules, and those measurements are provided on field sampling forms included in monitoring reports.
Background Water Levels at 1M(R)	Monthly measurement of water level at background well 1M(R) to document periods of high and low water levels and evaluate water level trends	Continue with these manual water levels measurements at 1M(R) with minimum frequency of twice per year

APPENDIX E – REMEDY RESILIENCE

Three tools were used to assess the Landfill and Development Superfund Site in Burlington County, New Jersey. Screenshots from each of the tools used in the assessment are included below.

The first tool used to assess the site was the CMRA tool. The tool examined five hazards for Burlington County in which the site is located. According to this tool, the National Risk Index Ratings for the five hazards are as follows:

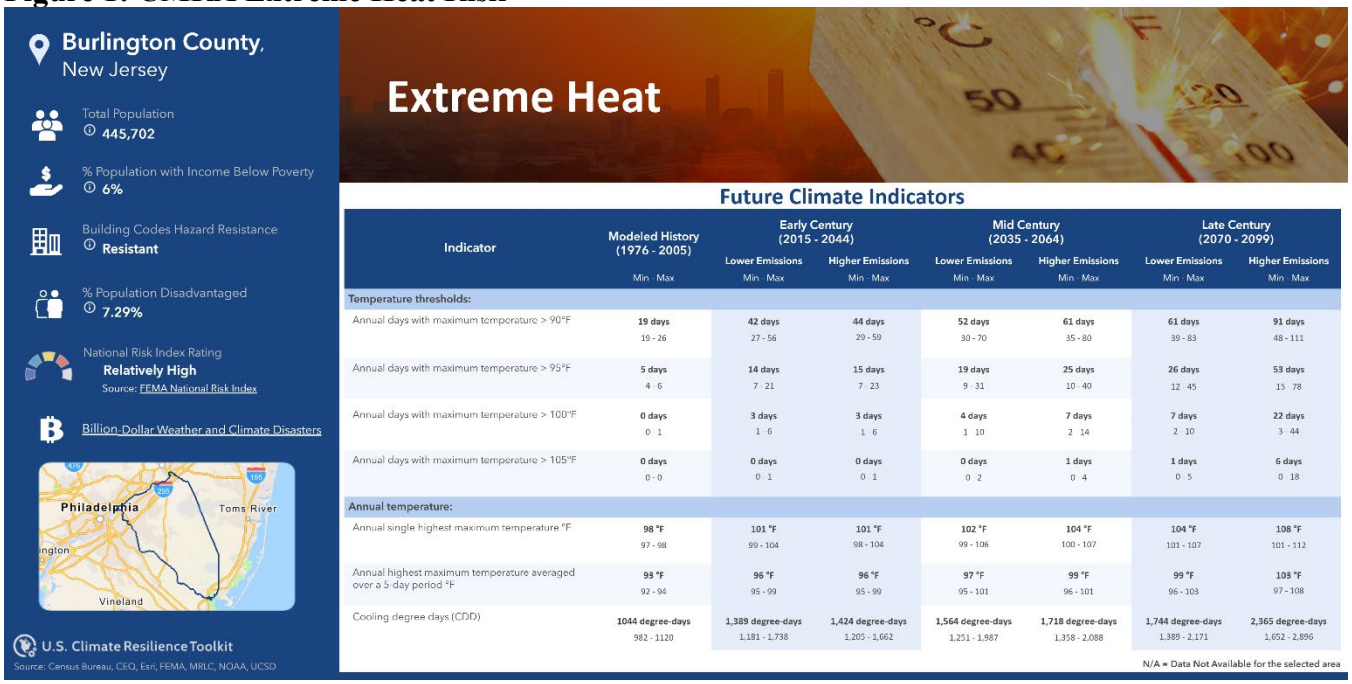
- Extreme heat is "Relatively High": There is a projected increase of days per year with maximum temperatures over 100°F, as shown in Figure 1.
- Flooding is "Relatively High" and Coastal Inundation is "Relatively Moderate": These ratings are applied to Burlington County as a whole rather than the site, which is in an inland location (see Figures 2 and 3). The second tool, NOAA's Sea Level Rise Viewer, provides a more site-specific assessment (see next paragraph below).
- Wildfire is "Relatively Moderate": There is a projected increase in days per year with no precipitation (dry days), as shown in Figure 4
- Drought risk is "Relatively Low" as shown in Figure 5.

The second tool used was the National Oceanic and Atmospheric Administration's (NOAA's) Sea Level Rise Viewer. The site is located south of Rancocas Creek. According to a 2019 Rutgers University report, it is likely (meaning at least a 66% chance) that New Jersey will experience sea level rise of 0.5 to 1.1 feet between 2000 and 2030, and 0.9 to 2.1 feet between 2000 and 2050. However, as shown in Figure 6, NOAA's Sea Level Rise Viewer, a rise in sea level up to 3 feet is unlikely to significantly affect the Landfill and Development Site. Figure 7 shows that high tide flooding also is unlikely to significantly affect the site.

The final tool used is called the U.S. Geological Survey (USGS) U.S. Landslide Inventory and Susceptibility Map. As shown by Figures 8 and 9, there have been no landslides recorded in the vicinity of the site, and the site's susceptibility to landslide activity in the future is relatively low.

Potential site impacts from severe weather events have been assessed, and the performance of the remedy is currently not at risk due to these expected effects.

Figure 1: CMRA Extreme Heat Risk

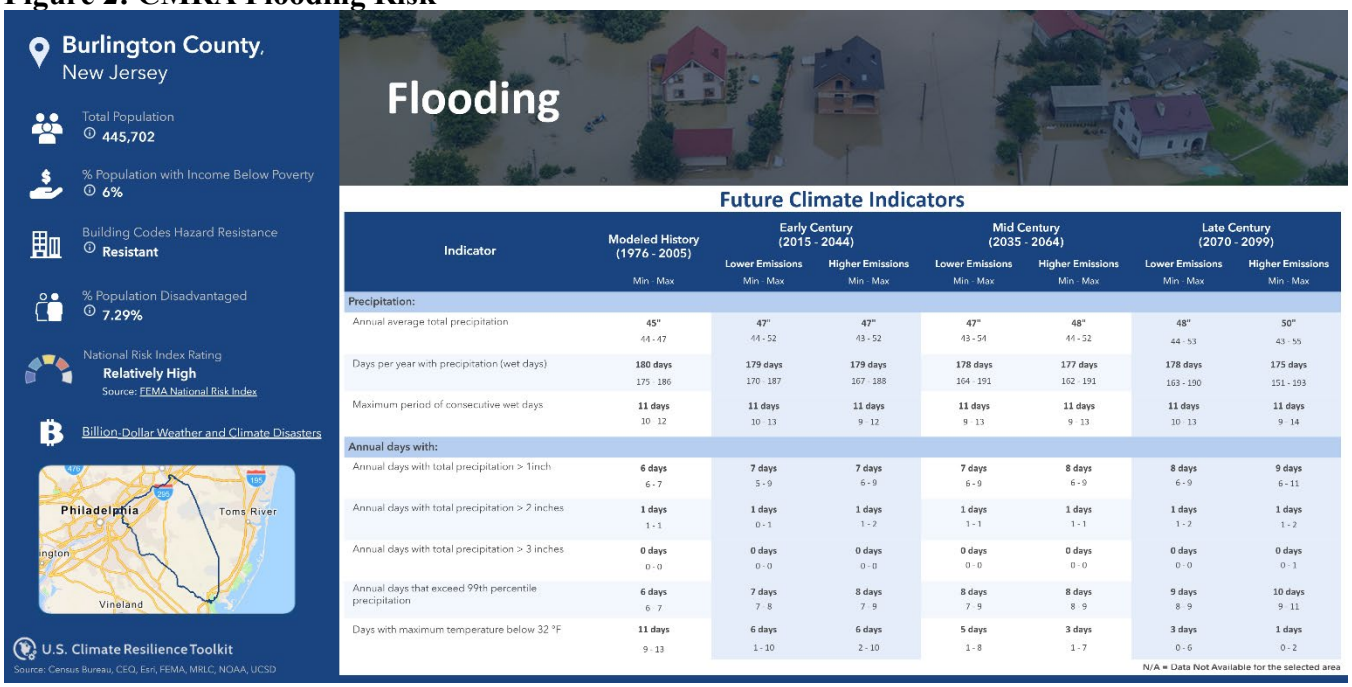


Future Climate Indicators

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	19 days 19 - 26	42 days 27 - 56	44 days 29 - 59	52 days 30 - 70	61 days 35 - 80	61 days 39 - 83	91 days 48 - 111
Annual days with maximum temperature > 95°F	5 days 4 - 6	14 days 7 - 21	15 days 7 - 23	19 days 9 - 31	25 days 10 - 40	26 days 12 - 45	53 days 15 - 78
Annual days with maximum temperature > 100°F	0 days 0 - 1	3 days 1 - 6	3 days 1 - 6	4 days 1 - 10	7 days 2 - 14	7 days 2 - 10	22 days 3 - 44
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 - 5	6 days 0 - 18
Annual temperature:							
Annual single highest maximum temperature °F	98 °F 97 - 98	101 °F 99 - 104	101 °F 98 - 104	102 °F 99 - 106	104 °F 100 - 107	104 °F 101 - 107	108 °F 101 - 112
Annual highest maximum temperature averaged over a 5-day period °F	93 °F 92 - 94	96 °F 95 - 99	96 °F 95 - 99	97 °F 95 - 101	99 °F 96 - 101	99 °F 96 - 103	103 °F 97 - 108
Cooling degree days (CDD)	1044 degree-days 982 - 1120	1,389 degree-days 1,181 - 1,738	1,424 degree-days 1,205 - 1,662	1,564 degree-days 1,251 - 1,987	1,718 degree-days 1,358 - 2,088	1,744 degree-days 1,389 - 2,171	2,365 degree-days 1,652 - 2,896

N/A = Data Not Available for the selected area

Figure 2: CMRA Flooding Risk

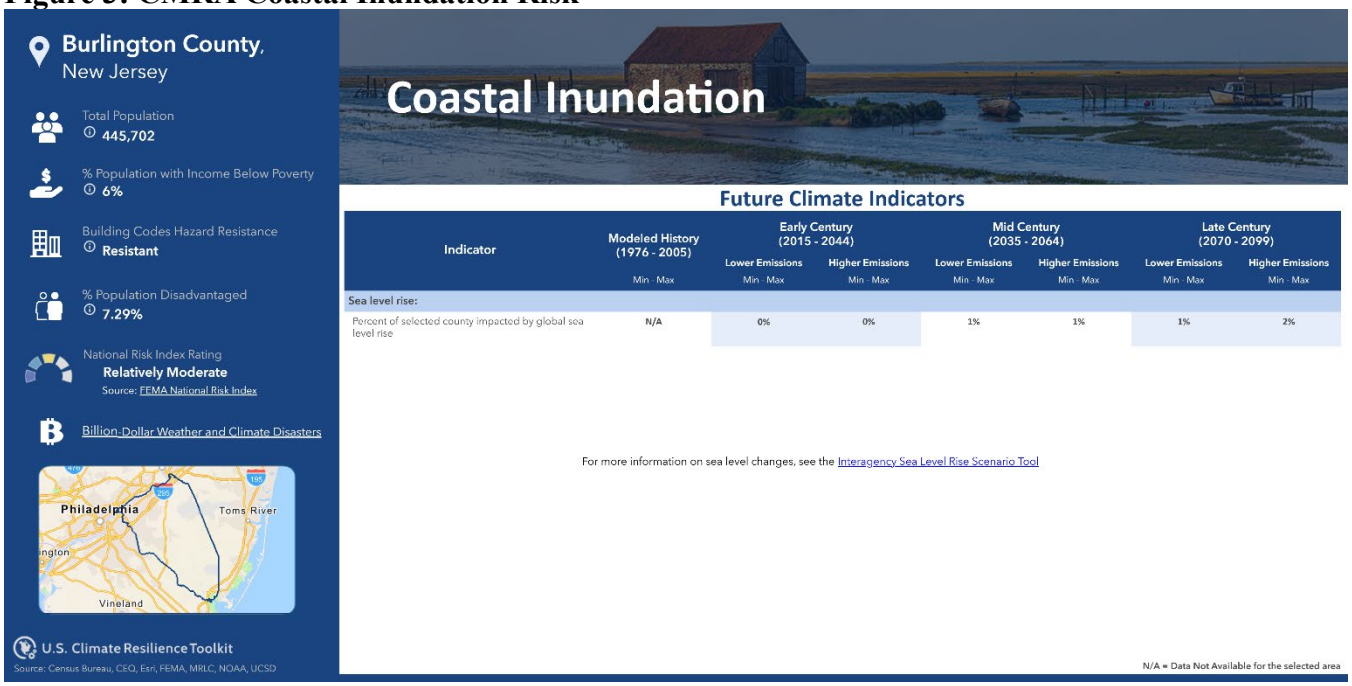


Future Climate Indicators

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	45" 44 - 47	47" 44 - 52	47" 43 - 52	47" 43 - 54	48" 44 - 52	48" 44 - 53	50" 43 - 55
Days per year with precipitation (wet days)	180 days 175 - 186	179 days 170 - 187	179 days 167 - 188	178 days 164 - 191	177 days 162 - 191	178 days 163 - 190	175 days 151 - 193
Maximum period of consecutive wet days	11 days 10 - 12	11 days 10 - 13	11 days 9 - 12	11 days 9 - 13	11 days 9 - 13	11 days 10 - 13	11 days 9 - 14
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 6 - 9	9 days 6 - 11
Annual days with total precipitation > 2 inches	1 days 1 - 1	1 days 0 - 1	1 days 1 - 2	1 days 1 - 1	1 days 1 - 1	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 - 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 - 7	7 days 7 - 8	8 days 7 - 9	8 days 7 - 9	8 days 8 - 9	9 days 8 - 9	10 days 9 - 11
Days with maximum temperature below 32 °F	11 days 9 - 13	6 days 1 - 10	6 days 2 - 10	5 days 1 - 8	3 days 1 - 7	3 days 0 - 6	1 days 0 - 2

N/A = Data Not Available for the selected area

Figure 3: CMRA Coastal Inundation Risk



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
Sea level rise:							
Percent of selected county impacted by global sea level rise	N/A	0%	0%	1%	1%	1%	2%

Figure 4: CMRA Wildfire Risk

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)	**185 days** 179 - 191	**186 days** 178 - 195	**186 days** 177 - 199	**187 days** 174 - 201	**188 days** 174 - 203	**187 days** 176 - 202	**190 days** 172 - 215
Maximum number of consecutive dry days	**12 days** 11 - 13	**12 days** 10 - 14	**12 days** 11 - 15	**12 days** 11 - 15	**12 days** 11 - 15	**12 days** 11 - 15	**13 days** 11 - 16
Days per year with precipitation (wet days)	**180 days** 175 - 186	**179 days** 170 - 187	**179 days** 167 - 188	**178 days** 164 - 191	**177 days** 162 - 191	**178 days** 163 - 190	**175 days** 151 - 193
Temperature thresholds:							
Annual days with maximum temperature > 90°F	**19 days** 19 - 26	**42 days** 27 - 56	**44 days** 29 - 59	**52 days** 30 - 70	**61 days** 35 - 80	**61 days** 39 - 83	**91 days** 48 - 111
Annual days with maximum temperature > 100°F	**0 days** 0 - 1	**3 days** 1 - 6	**3 days** 1 - 6	**4 days** 1 - 10	**7 days** 2 - 14	**7 days** 2 - 10	**22 days** 3 - 44

Figure 5: CMRA Drought Risk

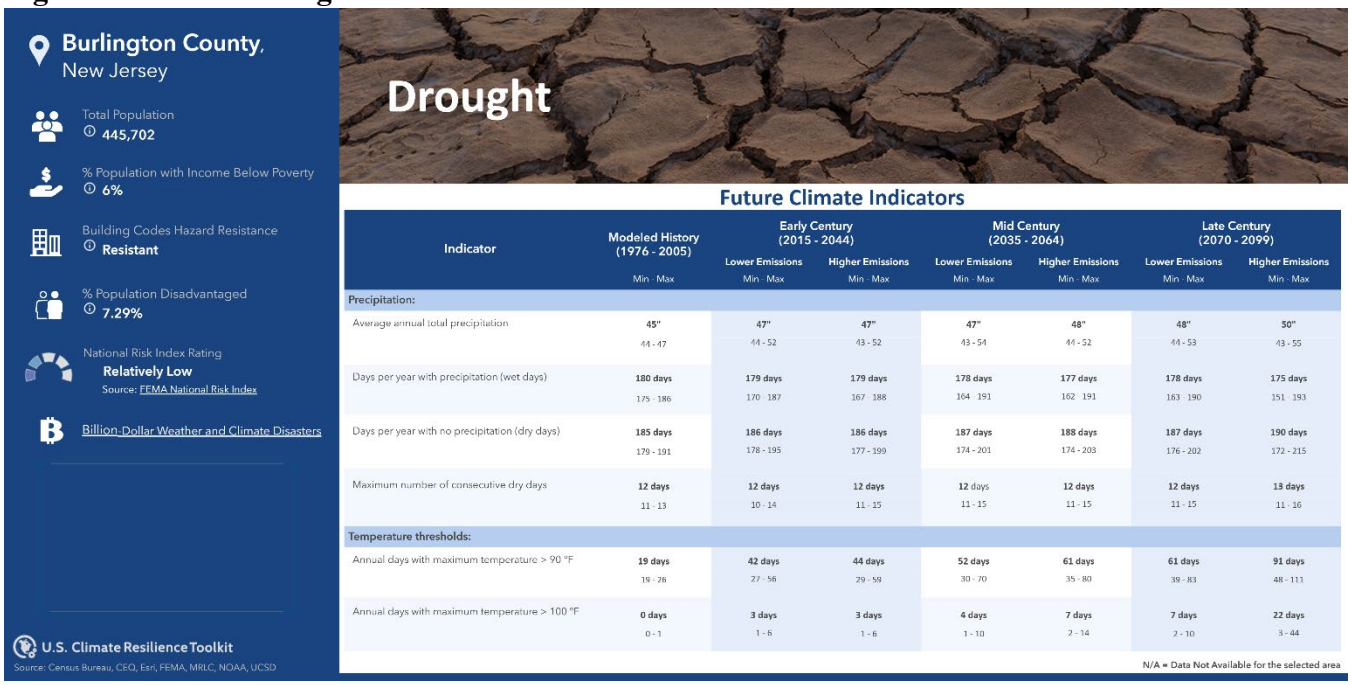


Figure 6: NOAA Sea Level Rise Viewer – Sea Level Rise
(Red star = Landfill and Development Site)

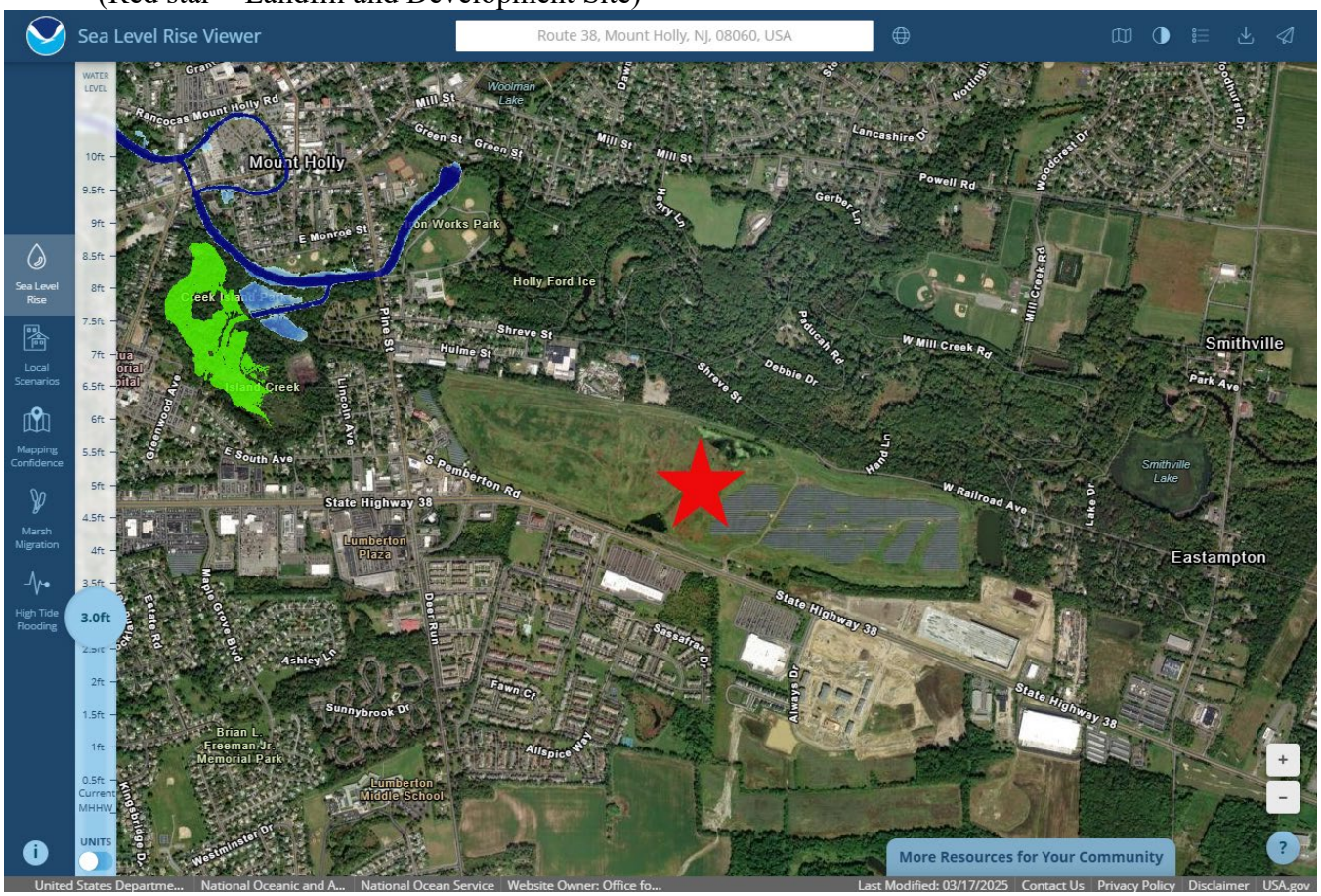


Figure 7: NOAA Sea Level Rise Viewer – High Tide Flooding
(Red star = Landfill and Development Site)

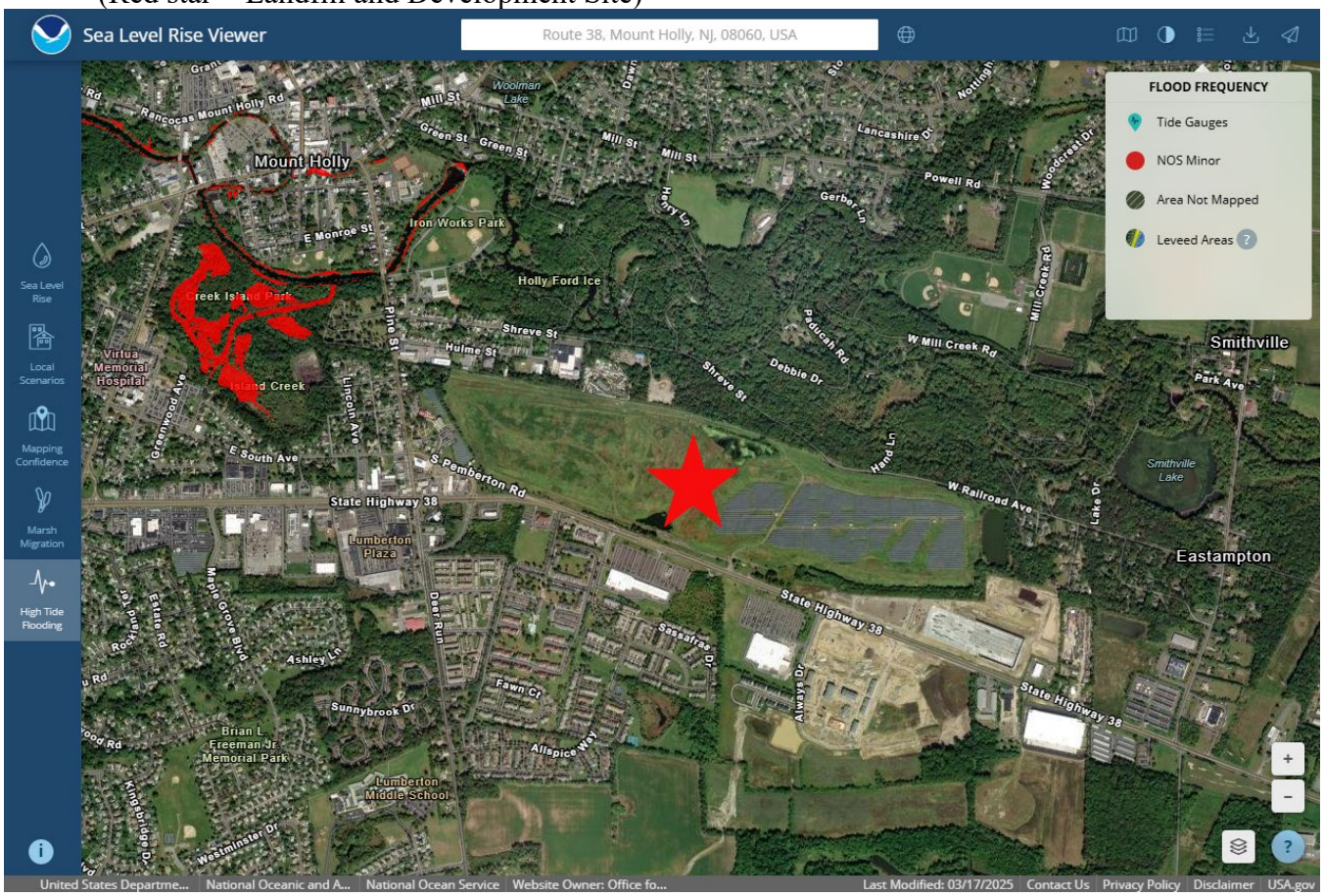


Figure 8: USGS U.S. Landslide Inventory and Susceptibility Map – Landslide History
(Red star = Landfill and Development Site)

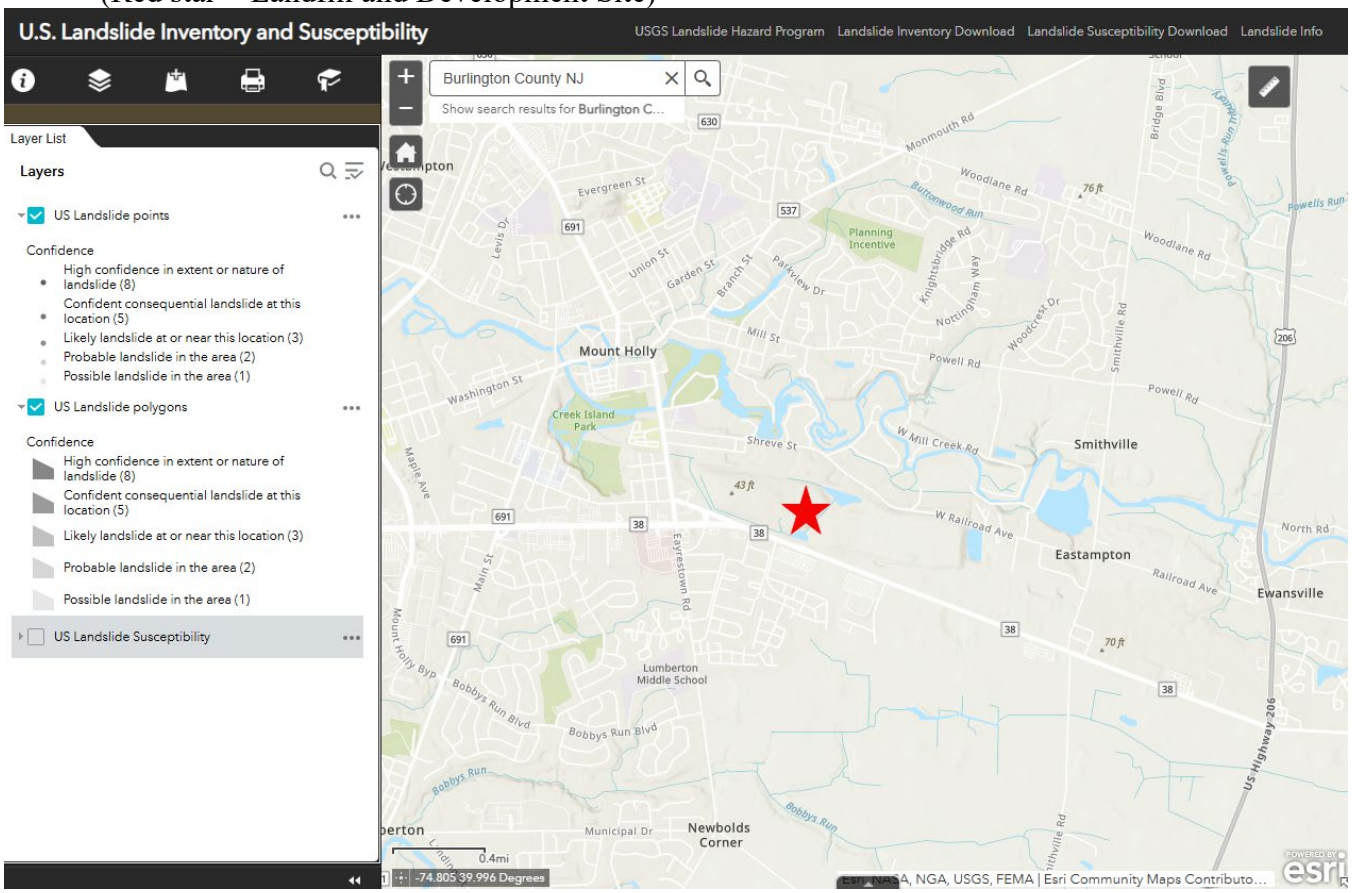


Figure 9: USGS U.S. Landslide Inventory and Susceptibility Map – Landslide Susceptibility
(Red star = Landfill and Development Site)