SIXTH FIVE-YEAR REVIEW REPORT FOR KIN-BUC LANDFILL SUPERFUND SITE MIDDLESEX COUNTY, NEW JERSEY

Prepared by

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

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Superfund and Emergency Management Division

Date

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BGS	Below Ground Surface
BMP	Biota Monitoring Plan
CEA	Classification Exception Area
CEC	Contaminants of Emerging Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
COC	Contaminant of Concern
ECMA	Edmonds Creek Marshland Area
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
GPD	Gallons Per Day
GWQS	Groundwater Quality Standard
HDPE	High-Density Polyethylene
ICs	Institutional Controls
ILR	Industrial Land Reclaiming
MCUA	Middlesex County Utilities Authority
µg/L	Microgram per Liter
MSL	Mean Sea Level
NAPs	Natural Attenuation Parameters
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/L	Nanogram per Liter
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
OSC	On-Scene Coordinator
OU	Operational Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PFAS	Per- and Polyfluoroalkyl Substances
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
POTW	Publicly Owned Treatment Works
PPM	Parts Per Million
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SVOC	Semi-volatile Organic Compound
SWQS	Surface Water Quality Standard

UAO	Unilateral Administrative Order
UU/UE	Unlimited Use/Unrestricted Exposure
VOC	Volatile Organic Compound
4,4'-DDD	4,4'-dichlorodiphenyldichloroethane

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 Kin-Buc Landfill Superfund 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 two Operable Units (OUs), and both will be addressed in this FYR. OU1 addresses the landfill wastes contained within the landfill cap. OU2 addresses areas of contamination outside of the landfill including sediment, groundwater, and surface water.

The Kin-Buc Landfill Superfund Site FYR was led by Jason M. Daggett, EPA Remedial Project Manager. Participants included Rich Puvogel, Section Supervisor, Dr. Lora Smith, Human Health Risk Assessor; Sabrina Gonzalez, Hydrogeologist; Pat Seppi, Community Involvement Coordinator, Leena Raut, Office of Regional Counsel; and Detbra Rosales, Ecological Risk Assessor. The Potentially Responsible Party (PRP) was notified of the initiation of the five-year review. The review began on 5/22/2023.

Site Background

The Kin-Buc Landfill Superfund Site (Site) is located at 383 Meadow Road in Edison Township, Middlesex County, New Jersey (Figure 1). The Site is bordered by the Edison Township Landfill, approximately 600 feet to the south, wetlands and the inactive Industrial Land Reclaiming (ILR) Landfill to the east, the Raritan River to the west, and a scrap metal salvage yard, the Edison Township boat launch, and a chemical manufacturing plant to the northwest. The Heller Industrial Park, a light-industrial and commercial complex, is located northeast of the Site. The Edgeboro Landfill is located across the river, approximately 0.5 miles southwest of the Kin-Buc and Edison landfills.

The Site includes three landfill mounds, the Low-Lying Area (situated in between Kin-Buc I and the Edison Township Landfill), and the Edmonds Creek Marsh Area (ECMA). Kin-Buc I is the largest of the landfill mounds, covering 30 acres, with a maximum elevation of 93 feet above mean sea level (msl). Kin-Buc II, immediately north of Kin-Buc I, covers 12 acres, with a maximum elevation of 51 feet above msl. Mound B is located west of Kin-Buc I, along the shoreline of the Raritan River, and covers approximately 9 acres, at an average elevation of 15 feet above msl. The 14-acre Low-Lying Area between Kin-Buc I and the Edison Landfill has an elevation ranging between 10 and 25 feet above msl, of which approximately 10 feet is fill material and refuse. Additional portions of the Site, including the Edmonds Creek Wetlands, the Pool C area, the eastern end of the Low-Lying Area, the mouth of

Millbrook/Martins Creek, and the southern end of Mound B, all fall within the 100- or 500-year floodplain.

The Edmonds Creek wetlands consist of approximately 50 acres of tidal wetlands, which border the Landfill mounds to the east. The wetlands are drained by Edmonds Creek, which discharges to the Raritan River southeast of the Edison Landfill. Edmonds Creek and the associated wetlands are tidally influenced, with a maximum elevation of 4 feet above msl, and sediments are regularly redistributed in response to tidal fluctuations and storm events. Edmonds Creek also receives drainage from the ditch between the Low-Lying area and the Edison Landfill. Millbrook/Martins Creek flows past the Site to the northwest of Kin-Buc I and II, and discharges to the Raritan River at Mound B. This stream system receives runoff from the Kin-Buc mounds, as well as upgradient sources, and is tidally influenced in the vicinity of Mound B.

The Site is located within an industrial and commercial area of Edison Township, which is zoned for light industrial use. Upstream of the Site, the City of New Brunswick withdraws drinking water from surface supplies including the Delaware and Raritan Canal and Weston's Mill Pond, and a dammed section of Lawrence Brook, a tributary of the Raritan River which enters the river from the west.

The closest residences are approximately 1.5 to 2 miles to the north of the Site, and no municipal or private drinking water supply wells are located within a two-mile radius of the Site. The OU2 Record of Decision (ROD) concluded that local land use factors would prevent the use of the groundwater, and the conditions identified at the time of the ROD are still valid.

Site Geology/Hydrogeology

There are four stratigraphic units present at the Site (top to bottom): refuse fill, meadow mat, sand-and-gravel, and bedrock.

The Site is underlain by sedimentary rocks of Triassic Age, including the Brunswick Formation and the Lockatong formation, which consist chiefly of siltstone, mudstone, and shale, and occur at depths ranging between 25 and 46 feet below ground surface (bgs). A sand-and-gravel unit, representing recent Raritan River channel fill, overlies the bedrock locally at an average thickness of 16 feet. Within Mound B and the Low-Lying Area, a layer of organic-rich clay and silt known as "meadow mat" overlies the sand-and-gravel deposit, with an average thickness of seven feet. A refuse layer of varying thickness, between seven and 24 feet outside of the landfill mounds, overlies the meadow mat deposit. The refuse contains relatively old waste materials, such as household and municipal solid waste, debris, household appliances, industrial wastes, and fill material. The refuse layer is overlain by clay and a layer of cover soil on Mound B, and a layer of cover soil over the Low-Lying Area.

All four stratigraphic units are water bearing, although only the bedrock unit is regionally extensive and used as a water supply. In the refuse layer, the groundwater flows radially from the Kin-Buc I mound toward Pool C, the Edison Landfill, and the Raritan River, and is not tidally influenced by the river. The underlying meadow mat layer acts as a semi-confining layer, as its fine-grained organic-rich matrix exhibits very low permeability, indicating that groundwater does not readily flow vertically or horizontally in this unit. The sand-and-gravel unit is in direct hydraulic contact with the river and is therefore affected by tidal influence. At low tide, the groundwater in this unit flows across the Site from southeast to northwest. At high tide, this flow is reversed, and groundwater flows from Mound B towards the Low-Lying Area. However, net flow is west, towards the river. Regional flow in the

bedrock unit is towards the south. Vertical gradients within the four units indicate the net discharge from these units is either directly or indirectly to the Raritan River. The refuse and sand-and-gravel units discharge directly into the Raritan River at high and low tides, while the bedrock unit discharges upward into the sand-and-gravel unit, from which groundwater then discharges into the river.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Kin-Buc Landfill Superfund Site		
EPA ID: NJD049860836		
Region: 2	**State:** NJ	**City/County:** Edison Twp., Middlesex County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Jason M. Daggett		
Author affiliation: U.S. Environmental Protection Agency		
Review period: 5/22/2023 - 12/29/2023		
Date of site inspection: 7/24/2023		
Type of review: Statutory		
Review number: 6		
Triggering action date: 4/3/2019		
Due date *(five years after triggering action date)*: 1/15/2024		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Landfilling at the Site began around 1947, with private operators accepting municipal, industrial, and hazardous waste. Kin-Buc, Inc., began operating the Site in 1968. Between 1971 and 1976, Kin-Buc, Inc., operated the Site as a state-approved landfill for solid and liquid industrial wastes and municipal wastes. EPA estimates, on the basis of owner-operator records, that approximately 70 million gallons of liquid waste, and at least one million tons of solid waste, were disposed at Kin-Buc between 1973 and 1976. Hazardous wastes were disposed in the main landfill mound, Kin-Buc I, as well as in Kin-Buc II. Limited information is known about the waste disposal history of Mound B, other than it was primarily used for municipal wastes.

In 1976, the New Jersey Department of Environmental Protection (NJDEP) revoked Kin-Buc's permit to operate due to violations of both state and federal environmental statutes. EPA's involvement with the Site began that same year during an investigation of an oil spill at the Site, which revealed that hazardous substances had been discharged from the facility. In 1979, EPA filed initial charges against the owners/operators under the Water Pollution Control Act and the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA). Under a partial settlement in 1980, the owners/operators, Kin-Buc, Inc., agreed to install a landfill cap and initiate a long-term monitoring program at the Site, but did not agree to remediate the Site, or control further migration of contaminants in the area. Therefore, that same year, EPA began collecting aqueous and oily leachate from the Pool C area for treatment and disposal as part of an emergency response action, with funds provided initially under Section 311(k) of the Clean Water Act (and later under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)). In 1982, as part of the settlement negotiations, the owners/operators assumed responsibility for all cleanup activities.

In September 1983, the Site was added to the National Priorities List (NPL). That same year, failed negotiations with a small group of owner/operator potentially responsible parties (PRPs) led to the issuance of the first of several unilateral administrative orders (UAOs) for the Site. The first UAO directed the PRPs to assume ongoing maintenance of EPA's emergency response actions around Pool C and performance of a remedial investigation and feasibility study (RI/FS) for the Site. From 1983 to 1988, EPA directed and provided oversight for the PRP OU1 RI/FS activities at the Site. As part of the initial actions in 1984, 4,000 drums containing oily and aqueous phases of leachate and contaminated solids were shipped off-site for incineration. From 1984 to 1994, approximately 5,000,000 gallons of aqueous phase leachate were shipped off-site for treatment and disposal. The RI indicated high levels of Polychlorinated Biphenyls (PCBs), volatile and semi-volatile organic compounds, and inorganic contaminants in soils, groundwater, and surface water. The RI also identified the portions of the waste disposal areas, in particular the Kin-Buc I and Kin-Buc II mounds, and the Pool C area, as continuing sources of discharge of contaminants into the environment.

Contaminants were found in the refuse unit leachate, as well as in groundwater from the sand-and-gravel unit, and at lower levels in the bedrock aquifer. Leachate in the refuse unit contained volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, pesticides, and PCBs. Contamination originated within the Kin-Buc I and II mounds and migrated towards Mound B and the Raritan River to the west, and towards the ECMA to the east. The sand-and-gravel unit contained VOCs and SVOCs similar to those found in the refuse unit, although at lower concentrations. The bedrock unit contained even lower concentrations of VOCs. EPA performed a risk assessment, which identified eight indicator contaminants from over 100 compounds within various media at the Site, including benzene, chloroform, 1,1-dichloroethylene, PCBs, vinyl chloride, arsenic, cadmium, and lead. The risks associated with exposure scenarios identified in the risk assessment included: potential future ingestion of groundwater; potential exposure of on-site workers to volatilization of PCBs from Pool C; direct contact of on-site workers to oily-phase (non-aqueous phase liquid) leachate; consumption of aquatic life with elevated PCB levels; exposure of aquatic populations adjacent to the Site to elevated PCB and heavy metal concentrations; and, exposure of terrestrial populations (especially birds) to direct contact with oily-phase leachate.

Between 1989 through 1992, EPA directed a group of PRPs to perform an RI/FS at the Site for OU2, which involved evaluating migration pathways of contaminants into groundwater, surface water, and sediments. The PRPs also conducted a supplemental sediment sampling program which further refined

the extent of PCB contamination in the Edmonds Creek wetland sediment. The report confirmed the findings of the RI – that sediments in the ECMA contained PCBs, polyaromatic hydrocarbons (PAHs) and metals. PCBs were found at concentrations less than 10 parts per million (ppm) in most parts of the marsh, although portions of the Edmonds Creek channel contained concentrations which ranged up to 81 ppm. Areas immediately adjacent to Pool C exhibited concentrations between 100 and 290 ppm. PCBs identified were predominantly Aroclors 1248 and 1254. Distribution of these contaminants indicated that PCBs were attributable to Pool C via the connecting channel to Edmonds Creek. PAHs and metals were found throughout the marsh. Distribution patterns were less clear regarding PAHs and metals in the sediments; other man-made sources of PAHs and metals in the vicinity of the Site have most likely contributed to the distribution of these constituents in the study area. However, certain metals and PAHs were highest in areas also characterized by high levels of PCBs.

The OU2 RI identified elevated levels of PCBs in Edmonds Creek, a tidal tributary to the Raritan River, as posing unacceptable risks to human health and the environment. EPA estimated that total risks for both carcinogens and noncarcinogens were derived primarily from ingestion of fish exposed to Site contaminants and secondarily to the ingestion of contaminated groundwater by potential future residents. The OU2 ROD concluded that the locations and characteristics of the Site preclude any current exposure to contaminated groundwater, and future residential use was not plausible based upon historic and current land use. Surface waters in Edmonds Creek did not appear to be affected by Site-derived contamination; thus, in OU2, only ingestion of fish exposed to sediment contaminants constituted a risk to human health.

Response Actions

OU1

EPA issued the first of two RODs for the Site on September 30, 1988. The first ROD divided the Site into two operable units: OU1, which consisted of the Kin-Buc I and II mounds, as well as portions of the Low-Lying Area (between Kin-Buc I and the Edison Landfill) and Pool C, and OU2, which addressed the other off-site areas of contamination. The selected remedy for OU1, intended to provide source control for the landfill mounds, consisted of the following components:

- Installation of a circumferential slurry wall to bedrock on all sides of the Site;
- Maintenance, and upgrading if necessary, of the Kin-Buc I cap and installation of a cap in accordance with RCRA Subtitle C and state requirements on Kin-Buc II, portions of the Low-Lying area between Kin-Buc I and the Edison Landfill and Pool C;
- Collection and off-site incineration of oily phase leachate;
- Collection and on-site treatment of aqueous phase leachate and contaminated groundwater with disposal via direct surface water discharge;
- Periodic monitoring; and
- Operation and maintenance.

These remedial activities were necessary in order to attain the remedial action objectives (RAOs) of controlling the lateral movement of contaminants within the refuse layer, controlling subsurface flow manifesting as surface seeps, controlling surface contamination, and controlling the migration of contaminants into the underlying aquifers with evaluation of the effectiveness of natural barriers. EPA did not develop remedial action objectives for groundwater or surface water in the OU1 ROD because

the implementation of source control provided for in the OU1 remedial action, including a slurry wall and cap, was expected to be sufficient to prevent further migration of contaminants.

OU2

The OU1 ROD required that an RI/FS be conducted for adjacent areas affected by contaminant migration from the landfill. The OU2 RI/FS focused on evaluating the nature and extent of groundwater contamination in the Low-Lying Area and Mound B, wetland area contamination in Edmonds Creek and the neighboring marsh system, and surface water contamination in Edmonds Creek and Mill Brook/Martins Creek.

On September 28, 1992, EPA issued the ROD for OU2. The major components of the remedy selected under the 1992 ROD for OU2 were:

- The excavation of an estimated 2,200 cubic yards of sediment containing PCBs at levels greater than 5 ppm from within the Edmonds Creek channel;
- Consolidation of the excavated sediments within the OU1 containment system;
- Restoration of wetland areas affected by the excavation of contaminated sediments; and
- Long-term monitoring of groundwater and surface water to ensure the effectiveness of the remedy.

These remedial activities were necessary in order to attain the RAOs of removing sediments containing PCBs at concentrations greater than 5 ppm, by consolidating them within the OU1 containment system and restoring wetland areas impacted by the excavation of contaminated sediments.

Status of Implementation

Construction for OU1 was initiated in June 1993. The slurry wall and landfill cap, as well as the leachate collection and groundwater treatment system, were completed in May 1995. During the construction of the OU1 remedy, buried drums were detected in Mound B, an area not previously thought to be used for hazardous waste disposal. EPA conducted further investigations in the form of geophysical testing and dug a series of test pits in Mound B. Investigations led to the excavation and removal of drums containing suspected hazardous materials. The details of this investigation and subsequent response action are memorialized in an Explanation of Significant Differences (ESD), issued in 2001.

A group of PRPs commenced work on the remedial design for OU2 in 1992 and the remedial action for OU2 was initiated in June 1994. PCB-contaminated sediments were excavated from five separate zones located within Edmonds Creek and the neighboring marsh system, where PCB concentrations exceeded the cleanup goal of 5 ppm. While the OU2 ROD estimated that approximately 2,200 cubic yards of sediments exceeded the remediation goal, confirmatory sampling conducted during the remedial action led to the expansion of the excavation area, with a final volume totaling 9,400 cubic yards. The excavated sediments were placed within the OU1 slurry wall, and the wetland areas were restored.

Groundwater Collection and Treatment

As of May 2022, groundwater and leachate at the Site are extracted from four deep sand-and-gravel unit pumping wells and four shallow pumping wells, at an average rate of 19,151 gallons per day (gpd) for deep wells, and 1,214 gpd for shallow wells. Approximately 7.43 million gallons of groundwater were collected by the system in 2022. Collected groundwater is discharged to the Middlesex County Utilities Authority (MCUA) Millbrook Siphon chamber on the northern bank of the Raritan River for treatment

at the MCUA publicly owned treatment works (POTW). A double containment (four-inch inner diameter, eight-inch outer diameter), double-wall high-density polyethylene (HDPE) pipe conveys fluids from the Site to the metering station, and from the metering station to the Millbrook Siphon. Previously, groundwater and leachate were collected and treated on Site, and discharged to surface water in the nearby Raritan River. Groundwater elevation is measured monthly at monitoring wells to evaluate the gradient between wells inside and outside the slurry wall and the vertical gradient within the landfill.

Groundwater Sampling Plan

In July 2012, EPA approved a groundwater sampling program modification that included large-scope years (sampling for VOCs, PCBs, specific metals, specific natural attenuation parameters (NAPs)) and small-scope years (PCB sampling only). The approved plan allowed for three large-scope years and two small-scope years within a FYR period. Further modifications to the sampling program were approved by EPA in July 2013, which included the elimination of PCB sampling from monitoring wells screened in the bedrock unit. The current monitoring plan includes monthly elevation measurements, annual surface water sampling, and groundwater sampling every other year from the monitoring well network.

Biota Monitoring Plan

After completion of the OU2 sediment removal in 1996, a Biota Monitoring Plan (BMP) was developed to evaluate post-remedial conditions in Edmonds Creek. The assessment goals of the BMP included:

- An evaluation of the recolonizing of invertebrates and fish to the remediated areas;
- Measurement of downward PCB concentration trends in the tissues of targeted species;
- Long-term assessment of achieving the remediation goal of 5 ppm in sediment; and
- Commensurate reductions in biological uptake in targeted species.

Biota monitoring data collected under the BMP was suspended in 2008. In 2010, EPA began another investigation to assist in the characterization of PCBs present in the soil/sediment in and around Edmonds Creek within approximately 50 acres of marshland. In 2018, based on the results of post remedial sampling and eleven years of biota monitoring, EPA determined that no additional sampling of sediment or biota in Edmonds Creek or the ECMA was necessary.

IC 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	No	Sitewide	Restrict groundwater use in the vicinity of the Site.	Classification Exception Area (CEA) 2006

Institutional Controls Verification

In 2006, the NJDEP approved a Classification Exception Area (CEA) for a portion of the Site. The CEA was established by NJDEP in accordance with N.J.A.C. 7:9-1.6, because groundwater quality standards are not being met at this Site due to pollution caused by human activity.

Systems Operations/Operation & Maintenance

Under an existing UAO, Waste Management, a PRP for the Site, continues to operate the groundwater and leachate collection system, manages the appropriate disposal of landfill gas, performs maintenance of the cap and other aspects of the remedy, and conducts groundwater and surface water monitoring, all in accordance with an approved Operations and Maintenance plan for the Site.

Landfill Gas Migration System and Flare

A gas extraction system monitors the combustible gas levels in the landfill to ensure they remain at acceptable levels, and no off-site gas migration occurs. Combustible and lower explosive limit measurements are obtained from six gas migration monitoring wells located outside the slurry wall, along the northern edge of the landfill boundary. In December 2017, flare upgrades were conducted at the Site, due to the decreasing gas quality and difficulty of keeping the gas flare operational 24 hours a day. The flare is typically operated seven days a week depending on gas quality and can be operated intermittently if needed. The O&M plan does not stipulate how often the gas flare must operate, provided that gas migration through the subsurface does not occur, as measured by the gas migration monitoring probes.

Summer 2022 Brush Fire and Landfill Membrane Cap Repair

On July 5, 2022, the EPA was notified by the New Jersey Department of Environmental Protection (NJDEP) of a 60-acre brush fire at the landfill caused by abnormally dry conditions. During this time, the active gas collection system was turned off, effectively creating a passive system allowing any accumulated gases to bypass the blower and vent through the flare stack un-combusted. Brush fire response actions were conducted by the NJDEP Forest Fire Service, with assistance from the local fire department, resulting in the fire being extinguished by July 6, 2022.

Initial response actions included perimeter air monitoring performed by EPA On-scene Coordinators (OSCs) through three fixed locations for sulfur dioxide, hydrogen cyanide, chlorine, and VOCs, which had been requested by the NJDEP and Middlesex County Office of Emergency Management (OEM). Two air monitoring locations were placed downwind, and one location was placed upwind of a smoldering caved-in section in the northeast portion of the landfill cap, which was believed to have been damaged during the course of the brush fire. Throughout the duration of monitoring activities, air monitoring results produced no detectable amounts of sulfur dioxide, hydrogen cyanide, or chlorine and only low-level detection results for VOCs. OSC air monitoring activities concluded on July 8, 2022. Additional emergency response monitoring was performed by the PRP with perimeter ambient air monitoring, wellfield gas readings, carbon monoxide readings within the affected area, gas readings at perimeter probes, and visual inspection of the landfill surface. The additional subsurface monitoring was performed in order to evaluate the potential of a subsurface fire within the landfill cap.

At the conclusion of emergency response activities and once the brush fire was extinguished, the Site was canvassed by the PRP to determine the extent of damage and also to continue monitoring activities at the Site. According to the September 15, 2022 Kin-Buc Landfill, Determination of Extinguished Fire Memorandum prepared by SCS Engineers, initial observations indicated that the brush fire

compromised gas well EW-27, along with the membrane cap material in the immediate vicinity, and also gas well EW-29. A caved-in section of the landfill cap was also observed in the area of EW-27. Subsequently, EW-27 and EW-29 were abandoned on July 7th and 8th, respectively. Immediate repairs included replacing damaged and dislocated sections of the gas header and lateral piping to allow the flare to be operated intermittently as gas quality improved. Additionally, approximately 150 cubic yards of soil were brought in on-site to repair the caved-in portion of the landfill cap. Charred areas were eventually reseeded to allow the natural growth of grassy vegetation in order to protect the landfill cap.

Monitoring of the gas system by the PRP and visual observations of the landfill post-fire concluded that:

- Gas wells WE-28, EW-30, and EW-31initially had elevated levels of carbon monoxide after the fire was discovered, but those levels returned to typical conditions soon after;
- No gas temperatures exceeding 145°F were measured in the vicinity of the fire;
- No signs of subsidence around EW-27 were observed after cap repairs; and
- No smoke, flames, melting, or charred conditions have been observed since the days following discovery of the fire.

The EPA was provided the Membrane Cap Repair Plan dated October 4, 2022, by the PRP, which details the proposed plan to restore the landfill cap to its original condition. The EPA approved the Membrane Cap Repair Plan for the Site on October 20, 2022, which has since been completed.

A reference list of documentation regarding the brush fire incident is provided in Appendix A.

Groundwater and Surface Water Monitoring

The OU1 hydraulic monitoring network is composed of 29 monitoring wells located along the slurry wall, including 11 wells screened in the bedrock, most of which are located in five clusters or transects (Figure 2). Monitoring wells at each transect were installed in pairs, within the same hydrogeologic unit, with one well located inside the slurry wall, and the other well located outside the slurry wall. Groundwater elevation data is collected on both sides of the slurry wall to assess the performance of the slurry wall as a hydraulic barrier and containment system.

The OU2 monitoring network is composed of 16 monitoring wells, including one background bedrock monitoring well, located in the Low-Lying area and Mound B. Groundwater and surface water monitoring are conducted as part of the OU2 remedy to ensure that the OU1 remedy is functioning as anticipated. The objective of the annual groundwater monitoring program for OU1 and OU2 is to monitor groundwater quality including parameters which assess the natural attenuation potential within the various water-bearing units.

Surface water samples are obtained from four locations in the Raritan River and are utilized to monitor surface water quality in the Raritan River downstream, upstream, and adjacent to the Site. A surface water monitoring program was implemented to confirm there is no gross contamination migrating from the landfill to surface water.

Climate Change

Potential Site impacts from climate change have been assessed, and the performance of the remedy may be impacted by the following expected effects of climate change in the region and near the Site: remedy impairment due to water level rise, flooding, storms and/or winds; sea level rise; increasing frequency of heavy precipitation events; increasing intensity of storms (winds/precipitation/storm surge); and increasing risk of floods. Also, increased probability of hotter days and drought conditions indicate a

potential elevated risk for wildfires. However, the O&M Plan addresses these impacts through inspection and maintenance of the landfill cap, vegetated areas, the surface water drainage system, and the treatment plant, following heavy rains or flooding. A detailed summary of the results and monitoring tools utilized as part of the climate change assessment is provided in Appendix D.

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 2019 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The OU1 remedy is protective of human health and the environment.
2	Protective	The OU2 remedy is protective of human health and the environment.
Sitewide	Protective	The sitewide remedies are protective of human health and the environment.

There were no issues and no recommendations made in the 2019 FYR that are required to be addressed in this report.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On August 7, 2023, 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, Puerto Rico, and the U.S. Virgin Islands, including the Kin-Buc 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 www.epa.gov/superfund/kin-buc and provided the notice to Edison Township by email on December 21, 2023 with a request that the notice be posted in municipal offices and on the village/town webpages. This notice indicated that a Five-Year Review (FYR) would be conducted at the Kin-Buc Landfill 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 results will be made available at the following repositories: Region 2, 290 Broadway, 18th Floor, New York, New York, 10007 and at the Edison Township Public Library, 340 Plainfield Avenue, Edison, New Jersey, 08817. In addition, the final report will be posted on the following website: www.epa.gov/superfund/kin-buc. Efforts will be made to reach out to local public officials to inform them of the results.

Data Review

The data assessed in this review period includes the Annual Monitoring Reports from 2018 – 2022. An additional groundwater sampling event was conducted in 2020 in order to evaluate Contaminants of Emerging Concern (CECs) within select monitoring wells at the Site. These CECs are identified as perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorooctanesulfonic acid (PFOS),

1,2,3-trichloropropane, 1,4-dioxane, and perchlorate. A summary of available information from the groundwater and surface water sampling events is provided below. A reference list of the Annual Monitoring Reports and groundwater analytical results is provided in Appendix A.

Hydraulic Monitoring

Groundwater elevation data is collected monthly from 23 monitoring wells in OU1 and 15 monitoring wells in OU2 in order to assess the performance of the slurry wall in isolating the landfill wastes from the groundwater. Groundwater elevation data and leachate collection system data from 2018 to 2022 indicates the Site has an inward gradient towards the landfill, sufficient to prevent off-site migration of contaminated groundwater within the landfill. Although there are some occurrences where a vertical gradient is shown between the sand-and-gravel layer to the bedrock, the horizontal gradient at these bedrock locations is directed inward and toward the landfill (Figure 3).

Groundwater Sampling and Analysis

Groundwater samples are collected biannually from 21 monitoring wells in OU1 and 16 monitoring wells in OU2. Monitoring well locations vary and are located within the slurry wall, just outside the slurry wall, Mound B, in the Low-Lying Area south-southeast of Kin-Buc 1 and II, and upgradient of the landfill (Table 3 and Table 4). Monitoring wells are analyzed for VOCs, semi-volatile organic contaminants (SVOCs) (select wells), PCBs, and metals.

The primary pollutants and groundwater and leachate Contaminants of Concern (COCs) identified in the OU1 and OU2 RODs include benzene, chlorobenzene, 1,2-dichloroethene, 1,1-dichloroethene, vinyl chloride, xylene, naphthalene, toluene, chloroform, phenol, antimony, arsenic, barium, beryllium, cadmium, lead, manganese, nickel, vanadium, zinc, and PCBs. The predominant contaminants that remain in the groundwater above the NJDEP Groundwater Quality Standards (GWQS) outside of the slurry wall are benzene, chlorobenzene, vinyl chloride, PCBs, arsenic, manganese, and lead. The predominant contaminants identified within groundwater inside the slurry wall that remain above the NJDEP GWQS are 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, benzene, chlorobenzene, chloroform, cis-1,2-dichloroethene, methylene chloride, tetrachloroethene, toluene, trichloroethene, phenol, PCBs, arsenic, manganese, lead, and zinc.

VOCs

Refuse Layer

According to available analytical data, concentrations of benzene within the refuse layer monitoring wells exceeded the NJDEP GWQS of 1 microgram per liter (µg/L) both within and outside of the slurry walls, during each sampling year. Concentrations of benzene outside of the slurry wall were generally observed between 1.3J µg/L (estimated value) to 430 µg/L in Site monitoring wells. Concentrations of benzene within the slurry wall were generally observed between 160 µg/L to 210 µg/L. It should be noted that the highest concentration of benzene overall was reported within Mound B at well GEI-5G in 2018 at 430 µg/L, but was reported as non-detect in 2020 and at 150 µg/L in 2022, indicating variable concentrations of more than an order of magnitude. Additional benzene fluctuations were observed within well W-4G, where benzene was reported at 110 µg/L, 170 µg/L, and 0.28J µg/L in 2018, 2020, and 2022, respectively. Concentrations of benzene within W-13G were reported within a relatively consistent range of between 190 µg/L to 210 µg/L during sampling periods. The nearest monitoring well within the slurry wall, W-15G, was also observed to have benzene concentrations reported from 160 µg/L to 210 µg/L during this period.

The monitoring well with the lowest reported concentrations of benzene in the refuse layer is W-6G, which is situated outside the slurry wall, across from W-5G in Transect #3, with a detected range of 1.3J µg/L to 1.6J µg/L.

Chlorobenzene was also reported above the NJDEP GWQS of 50 µg/L within select monitoring wells. Concentrations of chlorobenzene outside of the slurry wall ranged from 15 µg/L to 430 µg/L, with the most elevated concentrations detected consistently within monitoring wells W-4G and W-13G, and the lowest values observed at well GEI-3G, located near the Kin-Buc treatment plant. Concentrations of chlorobenzene within the slurry wall at W-15G were the most elevated with a reported range of 840 µg/L to 1,300 µg/L.

Sand and Gravel Layer

According to available analytical data, benzene was reported in Site monitoring wells located outside of the slurry wall in concentrations ranging from non-detect to 350 µg/L. The most elevated benzene concentrations within this group of monitoring wells is consistently identified within well WE-5S, located within Mound B. Benzene concentrations within this monitoring well were reported from 290 µg/L to 350 µg/L. Considerably lower concentrations of benzene were reported in wells W-4S and WE-3S between 42 µg/L to 47 µg/L and 53 µg/L to 82 µg/L, respectively. The only sand-and-gravel well that is currently monitored and situated within the slurry wall is W3-S, which is also reported to have elevated concentrations of benzene ranging from 210 µg/L to 280 µg/L during the monitoring period.

Chlorobenzene was reported in three monitoring wells as part of this evaluation: W-4S and W-6S, located outside of the slurry wall, and W-3S located within the slurry wall. The most elevated concentrations of chlorobenzene were reported within W-3S with a concentration range of 2,400 µg/L to 3,200 µg/L. Elevated chlorobenzene concentrations above the NJDEP GWQS were also reported within wells W-6S with a range of 150 µg/L to 240 µg/L and W-4S with a range of 440 µg/L to 500 µg/L. Well W-3S and W-4S are part of Transect #1, while W-6S is part of Transect #3. No VOC exceedances were reported during this monitoring period for wells WE-7S, WE-10S, and W-13S. The locations of the transects are provided in Figure 2.

Bedrock

Based on available analytical data, benzene was reported in Site bedrock monitoring wells outside of the slurry wall in concentrations ranging from non-detect to 50 µg/L during the review period. The most elevated benzene concentrations outside of the slurry wall were observed in wells W-2R and W-6R, where benzene was detected in the range of 45 µg/L to 47 µg/L and 40 µg/L to 50 µg/L, respectively. Concentrations of benzene in samples collected from within the slurry wall range from 1.3J µg/L to 490J µg/L. The most elevated concentrations from these monitoring wells were observed in well W-1R, with a concentration range of 410 µg/L to 860 µg/L (Note: these values were reported as non-detect due to elevated reporting limits caused by multiple dilutions due to the presence of other contaminants). It should be noted that W-1R and W-2R are adjacent to one another, although separated by the slurry wall. The lowest concentrations of benzene detected within the slurry wall were observed within well W-7R, with a concentration range of 1.3J µg/L to 1.7J µg/L.

The COC vinyl chloride was reported within well W-2R from non-detect to 1.4J ug/L and at well W-5R from 1.6J ug/L to 2.7J ug/L. At MW-1R, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, chlorobenzene, chloroform, cis-1,2-dichloroethene, methylene chloride, tetrachloroethene, toluene, trichloroethene, and phenol were reported to have exceeded the NJDEP GWQS at least 10 times their respective standard and in some cases nearly 100 times higher than the standard. No VOC or SVOC

exceedances were reported within monitoring wells W-2R, W-4R, W-3RR, WE-7R, WE-3R, WE-6R, WE-5R, WE-10R, W-8RR, W-10R, and WE-114DR.

SVOCs

In general, SVOCs have not been detected in OU1 or OU2, although their presence is still noted with some exceptions. Phenol has consistently been reported above the GWQS of 2,000 µg/L in monitoring well W-1R in the range of 47,000 µg/L to 97,000 µg/L, where the most elevated concentration was reported in 2018 with a decreasing trend observed through 2022. Phenol was reported as non-detect in the adjacent well W-2R, located outside of the slurry wall, and no other exceedances were observed.

PCBs

Analytical detections of PCBs are generally limited to the refuse and sand and gravel stratigraphic units within the Low Lying Area and within the slurry wall. The GWQS for total PCBs is 0.5 µg/L. Concentrations of PCBs within wells W-6G and GEI-10G, both located outside of the slurry wall, with GEI-10G located in the Low Lying Area, ranged from 1.4 µg/L to 1.5 µg/L and 1.1 µg/L to 1.9 µg/L, respectively. Another well outside of the slurry wall, W-6S, was reported with concentrations of PCBs ranging from 0.96 µg/L to 1 µg/L. The highest reported concentration of PCBs was observed within well W-15G, located within the slurry wall. PCBs at this location ranged from 3.3 µg/L to 6.6 µg/L, with the most elevated value being reported in 2018. No other PCB exceedances were reported at the remaining monitoring wells.

Metals

Arsenic and manganese are two metals that are commonly detected in groundwater at the Site above the GWQS in each stratigraphic unit both within and outside of the slurry wall. During the review period, four wells within the refuse layer, seven wells within the sand and gravel layer, and six wells within the bedrock unit were identified with arsenic above the GWQS. Also, 10 wells within the refuse layer, 10 wells within the sand and gravel layer, and 15 wells within the bedrock unit were identified with manganese above the GWQS. The highest reported concentration of arsenic was located at well WE-3S within the Low Lying Area with a concentration of 90 µg/L. The highest reported concentration of manganese was located at well W-1R, within the slurry wall, with a concentration of 58,300 µg/L. Additionally, lead and zinc were reported in exceedance of the GWQS within well W-1R with concentrations ranging from 18 µg/L to 150 µg/L and 1,700 µg/L to 7,000 µg/L, respectively. No other exceedances were observed.

Overall, groundwater concentrations of contaminants have remained relatively stable during this review period, and elevation data collected from inside and outside the slurry wall indicates that hydraulic source control is being maintained and functioning as intended. Although there are some occurrences where a vertical gradient is shown inside the slurry wall, between the sand-and-gravel layer to the bedrock layer, the horizontal gradient at these bedrock locations is directed inward and toward the landfill. Concentrations of contaminants in groundwater outside of the slurry wall are an order of magnitude less than they were during the RI sampling and continue to remain below those levels, demonstrating that groundwater concentrations have improved over time. Monitoring wells located within the slurry wall continue to exhibit the most elevated concentrations of contaminants, while generally, monitoring wells located outside of the slurry wall, and away from Mound B, were reported with much lower concentrations for the same or similar contaminants. While some variability of contaminant concentrations are noted from well to well, these concentrations are significantly lower than historic groundwater analytical results. The Meadow Mat layer that overlies the sand-and-gravel layer at Mound B and the Low-Lying Area also restricts movement of the contaminated groundwater that is

present outside the slurry wall by acting as a semi-confining layer. The fine-grained, organic-rich matrix of the Meadow Mat layer exhibits very low permeability, indicating that groundwater does not readily flow vertically or horizontally in this unit.

Contaminants of Emerging Concern Groundwater Sampling and Analysis

In October 2020, based on a request from the NJDEP, the responsible party for Kin-Buc Landfill conducted groundwater sampling for CECs including PFOA, PFOS, PFNA, 1,2,3-trichloropropane, 1,4-dioxane, and perchlorate. A total of seven groundwater sampling locations were selected including monitoring wells inside and outside the slurry well, in Mound B, and in the Low-Lying Area. The monitoring wells included as part of this evaluation are identified as W-15G, W-13G, GEI-10G, WE-5S, WE-114DR, W-2G, and W-1R. Groundwater sampling activities were performed in accordance with the QAPP approved by EPA on September 21, 2020. The purpose of the groundwater sampling event was to evaluate the potential presence of CECs in groundwater at the Site.

Per- and Polyfluoroalkyl Substances (PFAS)

According to analytical data, at least one type of PFAS was reported in each well sampled. Specifically, PFOA, PFNA, and PFOS were all detected in one or more wells above the applicable NJDEP GWQS. Concentrations of PFAS ranged from non-detect to 5,000 nanograms per liter (ng/L), contingent on the types of PFAS present (i.e., PFOA, PFNA, or PFOS). Of the PFAS compounds analyzed, MCLs and NJGWQS exist for perfluorooctanoic acid (PFOA) at 14 ng/L, perfluorooctanesulfonic acid (PFOS) at 13 ng/L, and perfluorononanoic acid (PFNA) at 13 ng/L. The single highest PFAS value was identified within monitoring well W-2G with a PFOS concentration of 5,000 ng/L, while the next highest concentration of PFOS was identified in well W-15G at a concentration of 550 ng/L. It should also be noted that the single highest value of PFOA was also detected within well W-2G at a concentration of 750 ng/L, followed closely by well W-15G at 730 ng/L. The most elevated concentration of PFNA was identified within well W-2G at 76 ng/L, followed by well GEI-10G at 9.6 ng/L. Monitoring well W-2G is located outside the slurry wall within the refuse layer, which has historically been regarded as the most impacted stratigraphic unit, while well W-15G is located within the slurry wall in the refuse layer.

1,2,3-Trichloropropane

According to available analytical data, detectable concentrations of 1,2,3-trichloropropane were reported in monitoring wells W-1R and W-13G at concentrations of 2.3 µg/L and 0.032 µg/L, respectively. The NJDEP GWQS for this compound is identified as 0.03 µg/L. Monitoring well W-1R is identified as a bedrock well within the slurry wall and well W-13G is identified as located within the refuse layer outside of the slurry wall.

1,4-Dioxane

The NJDEP GWQS for 1,4-dioxane is 0.4 µg/L. 1,4-Dioxane was detected in every well above the GWQS with the exception of W-2G, with a concentration of 0.23J µg/L. The most elevated concentrations of 1,4-dioxane were identified within W-15G at 800 µg/L, WE-5S at 600 µg/L, and W-1R at 530 µg/L. The next lowest concentration of 1,4-dioxane was identified within well WE-114DR at 6.6 µg/L. The most impacted wells were located within the slurry wall and within Mound B, within all three stratigraphic units.

Perchlorate

According to analytical data, detectable concentrations of perchlorate were observed within five wells including W-15G at 0.015J µg/L, W-1R at 13 µg/L, W-13G at 0.0080J µg/L, W-2G at 0.043J µg/L, and WE-5S at 0.0050J µg/L. The GWQS for perchlorate is 5 µg/L.

Based on an evaluation of analytical data, each CEC was identified in at least one or more monitoring wells at the Site. As indicated by both the PFAS and 1,4-dioxane data, contaminants were identified inside and outside the slurry walls, within the refuse layer, the sand and gravel layer, and within bedrock. Further, PFOA, PFNA, PFOS and 1,4-dioxane were identified within WE-114DR, which was designated as the bedrock and only upgradient well location. As a result, at least some of the source of these contaminants appears to be originating off-site; however further evaluation is needed, including potentially the collection of additional samples within other hydrogeologic units upgradient from the Site. During this sampling event, wells in which higher concentrations of emerging contaminants were found seem to correlate with wells that have historically shown higher concentrations of other contaminants. According to a March 2021 memorandum prepared by EPA titled *Emerging Contaminant Sampling at the Kin-Buc Landfill Site*, additional action to address CECs at the Site is needed. In particular, the memorandum states it is EPA's intention to expand the CEA to cover the entirety of the Kin-Buc Landfill Site, expand the groundwater and surface water monitoring to include analysis of emerging contaminants, and to include the analysis of emerging contaminant data collected during groundwater and surface water monitoring events in subsequent five-year review reports.

Surface Water

Surface water quality samples are collected annually from four locations in the Raritan River near Mound B, based upon the predominant direction of groundwater flow away from the Site. These surface water samples are collected downstream, upstream, and adjacent to the Site during an outgoing tide, from downstream sampling locations to upstream sampling locations. The surface water analytes are VOCs, SVOCs, PCBs, pesticides, and metals. There were no VOC, SVOC, or PCB exceedances reported for any of the surface water samples collected between 2018 through 2022. Additionally, there were no pesticide exceedances reported in 2018 or 2021 and no metals exceedances observed in 2018.

In 2019, the pesticide delta-BHC was detected in samples SW-01, SW-02, SW-03, and SW-04, while 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD) was detected over the NJDEP Surface Water Quality Standard (SWQS) for saline water in samples SW-01, SW-02, SW-03, and SW-04. Additionally, arsenic was reported in exceedance of the SWQS in each of the four samples. In 2020, the pesticide 4,4'-DDD was reported over the SWQS in SW-01, SW-03, and SW-04, while delta-BHC was detected in SW-01, SW-03, and SW-04. Arsenic was reported in excess of the SWQS in each of the four samples, while manganese was reported in exceedance of the SWQS in SW-01 and SW-02 for the first time. In 2021, the only pesticide that was detected was Endosulfan II, which was reported below the applicable standard. Arsenic was reported in excess of the SWQS in each of the four samples. In 2022, the pesticide delta-BHC was detected in three of the four samples and lindane was detected in each of the four samples. The pesticides 4,4'-DDD, aldrin, and alpha-BHC were reported in excess of the SWQS in each of the four samples. Arsenic was also reported in excess of the SWQS in each of the four samples. The arsenic and pesticide detections are consistent with historic sampling results. Surface water sampling showed a continued presence of metals, specifically arsenic, and manganese concentrations appeared to decrease after 2020. The levels detected over the past five years are consistent with previous surface water analyses, and do not suggest new sources to the river.

Laboratory detection limits for PCBs and some pesticides exceeded NJDEP SWQSs; however, the OU2 ROD did not develop RAOs or chemical-specific ARARs for surface water, and there is currently no exposure scenario for surface water that would adversely affect human health. Future surface water monitoring results will be compared to the NJDEP SWQS for screening purposes only, as the surface

water monitoring program was implemented to evaluate migration of contaminants from Kin-Buc into the Raritan River.

Site Inspection

The inspection of the Site was conducted on 7/24/2023. In attendance were Jason M. Daggett of the EPA, Detbra Rosales, an ecological risk assessor at the EPA, and Sabrina Gonzalez, a hydrogeologist at the EPA. The purpose of the inspection was to assess the protectiveness of the remedy. EPA personnel noted that the vegetative cap on Kin-Buc I and II was restored and had largely grown back to its previous condition following the fire in July 2022. No significant disturbances to the landfill cap such as depressions or erosion were observed during the Site inspection. Based on the areas accessed, monitoring well conditions appeared to be satisfactory. The venting flare was not operating at the time of the inspection.

V. TECHNICAL ASSESSMENT

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

Groundwater elevation data indicates that the implementation of hydraulic source control in OU1 is being maintained and the leachate collection system is functioning as intended. Overall, an inward gradient has been established, and where there are vertical gradients from the sand-and-gravel layer to the bedrock, the horizontal gradient at the bedrock locations is directed inward and toward the landfill.

Monitoring of the groundwater and surface water ensures the protectiveness of the OU1 remedy. There has been no indication of increasing contamination or sudden concentration spikes which supports the determination that the hydraulic control system is functioning as intended. In addition, concentrations of contaminants in groundwater outside of the slurry wall continue to remain considerably less than they were during the RI sampling, demonstrating that groundwater concentrations have improved over time.

Based on an evaluation of analytical data, both the PFAS and 1,4-dioxane were identified inside and outside the slurry walls, within the refuse layer, the sand and gravel layer, and within bedrock. Further, PFOA, PFNA, PFOS and 1,4-dioxane were identified in the upgradient well. As a result, there seems to be both off-site and on-site contributions of CECs to groundwater at the Site. To fully evaluate if the Site is the source of the emerging contaminants and determine the extent of Site related impacts and if the current remedy can address them, the groundwater and surface water monitoring for emerging contaminants should be expanded.

Implementation of Institutional Controls and Other Measures

In accordance with N.J.A.C. 7:9-1.6, a groundwater CEA has been established for the Site as of October 29, 2006. The CEA is an institutional control utilized when groundwater quality standards are not being met and establishes restrictions on well use within the area. Based on the data provided within this FYR, the CEA is functioning as intended; however, available groundwater analytical data indicates several newly identified CECs such as PFOA, PFOS, PFNA, 1,2,3-trichloropropane, and 1,4-dioxane that will require further evaluation and may be added to the CEA at a later date.

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?

Changes in Risk Assessment Methods
The OU1 and OU2 RODs were signed prior to the implementation of a majority of the Risk Assessment Guidance for Superfund used currently by EPA. However, the process that was used remains valid.

Changes in Exposure Pathways
The exposed populations and exposure pathways evaluated as part of the 1988 OU1 and 1992 OU2 RODs for the Site remain appropriate and are expected to be appropriate for the next five years. These include: landfill worker dermal contact with groundwater and/or leachate, and dermal contact with/inhalation of vapors from Pool C, recreational contact via consumption of fish and/or dermal contact with/ingestion of surface water and sediment, dermal contact with/ingestion of surface water and sediment while swimming, and residential consumption of/dermal contact with groundwater for potable purposes. These pathways were evaluated separately for children and adults, when appropriate.

Since the landfill was capped, the dermal contact with leachate and the dermal contact with/inhalation of vapors from Pool C pathways have been interrupted. Residential dermal contact and inhalation of vapors from contaminated groundwater are not currently a concern since groundwater is not used for potable purposes below or downgradient of the landfill, and the slurry wall provides a steady inward gradient. While there remain some exceedances of NJDEP GWQS inside the slurry wall (predominantly benzene, chlorobenzene, PCBs, and arsenic), landfill worker contact with groundwater is not a concern since the area inside the slurry wall is capped. Furthermore, the inward gradient prevents groundwater outside the slurry wall from posing an unacceptable risk, and extracted groundwater is discharged directly to the MCUA. Continued groundwater and surface water monitoring will ensure that impacts are monitored on a routine basis.

Though the ROD for OU2 did not develop RAOs or chemical-specific ARARs for groundwater and surface water, it stated that "implementation of source control provided in the OU1 remedial action will be sufficient to prevent further migration of contaminants into the environment." For data evaluation purposes, OU2 groundwater and surface water sampling results are compared to the current federal and state groundwater quality standards and surface water quality standards. While detection limits for several surface water contaminants remain above their respective NJDEP SWQS, concentrations appear to be consistent with previous sampling rounds. These contaminants could not be solely attributed to the Kin-Buc Landfill due to tidal influences and several other contamination sources. Further, the OU2 ROD determined no current or plausible future exposure scenarios for surface water would pose a risk to human and ecological health.

Soil vapor intrusion is evaluated when soils and/or groundwater are known or suspected to contain VOCs. One or more exceedances of benzene, chlorobenzene, chloroform, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, tetrachloroethene, toluene, trichloroethene, and vinyl chloride have been reported in groundwater in the last five years; however, Kin-Buc is located in an industrial/commercial area bordered by a number of landfills, wetlands, and the Raritan River, and the nearest residences are between one and a half and two miles north of the Site. It is unlikely that the Site will be re-developed in the next five years, and the current potential for the vapor intrusion pathway remains incomplete.

Contaminants of Concern (COCs)
In the OU1 ROD, eight indicator contaminants were chosen from over one hundred contaminants identified in the various media at the Site (groundwater, surface water, sediment and air). These included: benzene, chloroform, 1,1-dichloroethene, PCBs, vinyl chloride, arsenic, cadmium, and lead. In the OU2 ROD, benzene, chlorobenzene, 1,2-dichloroethene, vinyl chloride, xylene, naphthalene, PCBs,

antimony, arsenic, barium, beryllium, cadmium, manganese, nickel, and vanadium were identified as the primary COCs.

PCBs are present in the Edmonds Creek marshland sediments adjacent to the Site. The landfill appears to maintain an inward gradient (except during strong storm events); therefore, the contamination present is either residual as a result of the Site or originating from another source outside of the Site. Additional sediment sampling presented in the 2019 FYR showed that the Site is not a continuing source of PCBs to Edmonds Creek or the associated wetland area.

As detailed previously, the predominant COCs that remain in groundwater above the GWQS varies between monitoring wells located within the slurry wall and outside of the slurry wall, as well as which geologic unit the samples are collected from (i.e., bedrock, sand and gravel unit, refuse layer). In summary, the following contaminants were identified at the Site in excess of the GWQS from wells located both within and outside of the slurry wall regardless of geologic unit: 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, benzene, cis-1,2-dichloroethene, methylene chloride, tetrachloroethene, toluene, trichloroethene, vinyl chloride, chlorobenzene, phenol, PCBs, arsenic, lead, manganese, and zinc. Additionally, the emerging contaminants PFOA, PFNA, PFOS, 1,2,3-trichloropropane, 1,4-dioxane, and perchlorate were detected above the applicable GWQS in one or more Site monitoring wells.

In this five-year review, monitoring of emerging contaminants such as PFOA, PFNA, PFOS, 1,2,3-trichloropropane, 1,4-dioxane, and perchlorate were limited to groundwater analysis. It is recommended that CEC groundwater sampling be expanded to other areas at Kin-Buc Landfill including surface water. Analysis of CECs in both groundwater and surface water will be helpful in assessing the impacts of these contaminants to human health and the environment and wildlife. Currently, groundwater is not utilized for potable purposes.

Expected Progress Towards Meeting RAOs

The OU1 RAOs included controlling the lateral movement of contaminants within the refuse layer, controlling subsurface flow manifesting as surface seeps, controlling surface contamination, and controlling the migration of contaminants into the underlying aquifers with evaluation of the effectiveness of natural barriers. EPA did not develop remedial action objectives for groundwater or surface water in the OU1 ROD because the implementation of source control provided for in the OU1 remedial action, including a slurry wall and cap, was expected to be sufficient to prevent further migration of contaminants. The RAOs selected remain valid and the remedial actions outlined in the OU1 ROD have been effective at achieving them.

The 1992 OU2 ROD addressed Mound B, the Low-lying area, Edmonds Creek, Mill Brook/Martins Creek, and associated wetland portions of the Kin-Buc Landfill, and called for the excavation of approximately 2,200 cubic yards of sediments with total PCB levels above 5 ppm, disposal and containment of excavated sediment within the OU1 slurry wall and cap, active restoration of wetlands affected by the excavation of contaminated sediments, long-term monitoring of groundwater and surface water, and maintenance of the Mound B cover. These remedial activities were necessary in order to attain the RAOs of removing sediments containing PCBs at concentrations greater than 5 ppm, by consolidating them within the OU1 containment system and restoring wetland areas impacted by the excavation of contaminated sediments.

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

protectiveness of the remedy?

No other information is available that could call into question the protectiveness of the remedy at this time.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU2	**Issue Category: Monitoring**			
	Issue: One or more Contaminants of Emerging Concern have been identified at elevated concentrations in Site groundwater.			
	Recommendation(s): Further evaluation as to the extent and source of the CECs is required to determine if they are site-related and whether the existing remedy will address them. Evaluate if the Site is the source of the emerging contaminants and determine the extent of Site related impacts by expanding the groundwater and surface water monitoring to include analyses for the identified emerging contaminants.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	1/15/2029

VII. PROTECTIVENESS STATEMENT

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

Protectiveness Statement(s)	
Operable Unit: OU2	*Protectiveness Determination:* Short-term Protective

Protectiveness Statement: The remedy at OU2 currently protects human health and the environment because the slurry wall, landfill cap, hydraulic source control pumping systems, institutional control (i.e., CEA), and long-term monitoring program for groundwater and surface water are functioning as intended. In order for the remedy to be protective in the long-term, additional investigations need to be completed to evaluate the source and extent of emerging contaminants and, if they are site-related, whether the existing remedy will address them.

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The sitewide remedies for Kin-Buc Landfill Superfund Site are protective of human health and the environment in the short-term because the slurry wall, landfill cap, hydraulic source control pumping systems, CEA and long-term monitoring program for groundwater and surface water are functioning as intended. In order for the remedy to be protective in the long-term, additional investigations need to be completed to evaluate the source and extent of emerging contaminants and, if they are site-related, whether the existing remedy will address them.

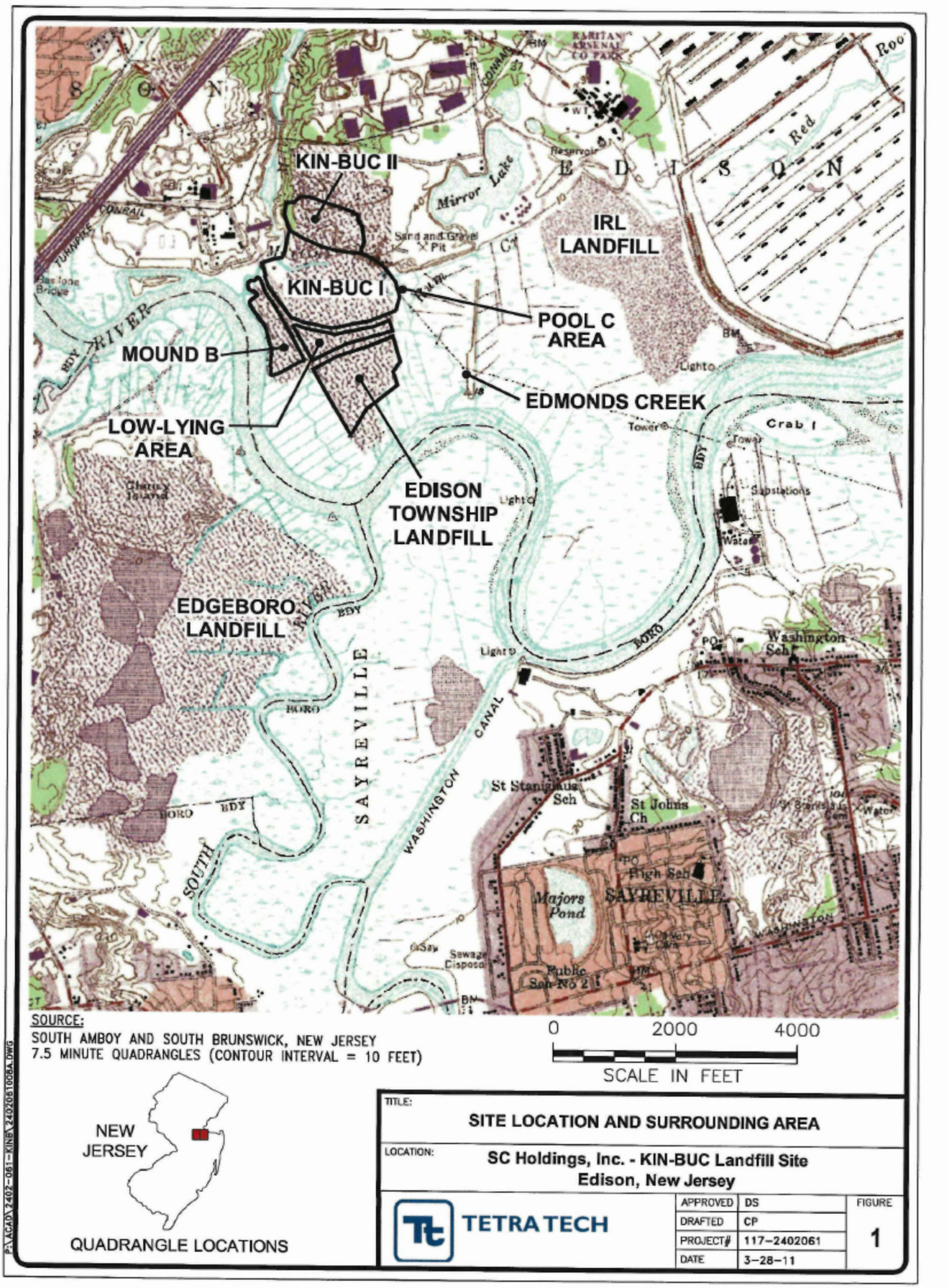
VIII. NEXT REVIEW

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

APPENDIX A – REFERENCE LIST

Document Title, Author	Date
Five-Year Review Report, EPA	February 1999
Explanation of Significant Differences, EPA	August 2001
Five-Year Review Report, EPA	September 2004
Five-Year Review Report, EPA	September 2009
Five-Year Review Report, EPA	July 2014
Five-Year Review Report, EPA	April 2019
Record of Decision, EPA	September 1988
Record of Decision, EPA	September 1992
2018 Annual Monitoring Report, Waste Management	March 2019
2019 Annual Monitoring Report, Waste Management	March 2020
2020 Annual Monitoring Report, Waste Management	March 2021
2021 Annual Monitoring Report, Waste Management	March 2022
2022 Annual Monitoring Report, Waste Management	March 2023
Final Close-Out Report for Kin-Buc Landfill Superfund Site, EPA	September 2019
Summary Report Emerging Contaminants in Groundwater, EPA	December 2020
Memorandum – Emerging Contaminant Sampling at the Kin-Buc Landfill Site, EPA	March 2021
Memorandum – Kin-Buc Landfill – Determination of Extinguished Fire, Waste Management	September 2022
Memorandum – Kin-Buc Landfill – Membrane Cap Repairs, Waste Management	October 2022

APPENDIX B - Figures



SOURCE:
SOUTH AMBOY AND SOUTH BRUNSWICK, NEW JERSEY
7.5 MINUTE QUADRANGLES (CONTOUR INTERVAL = 10 FEET)

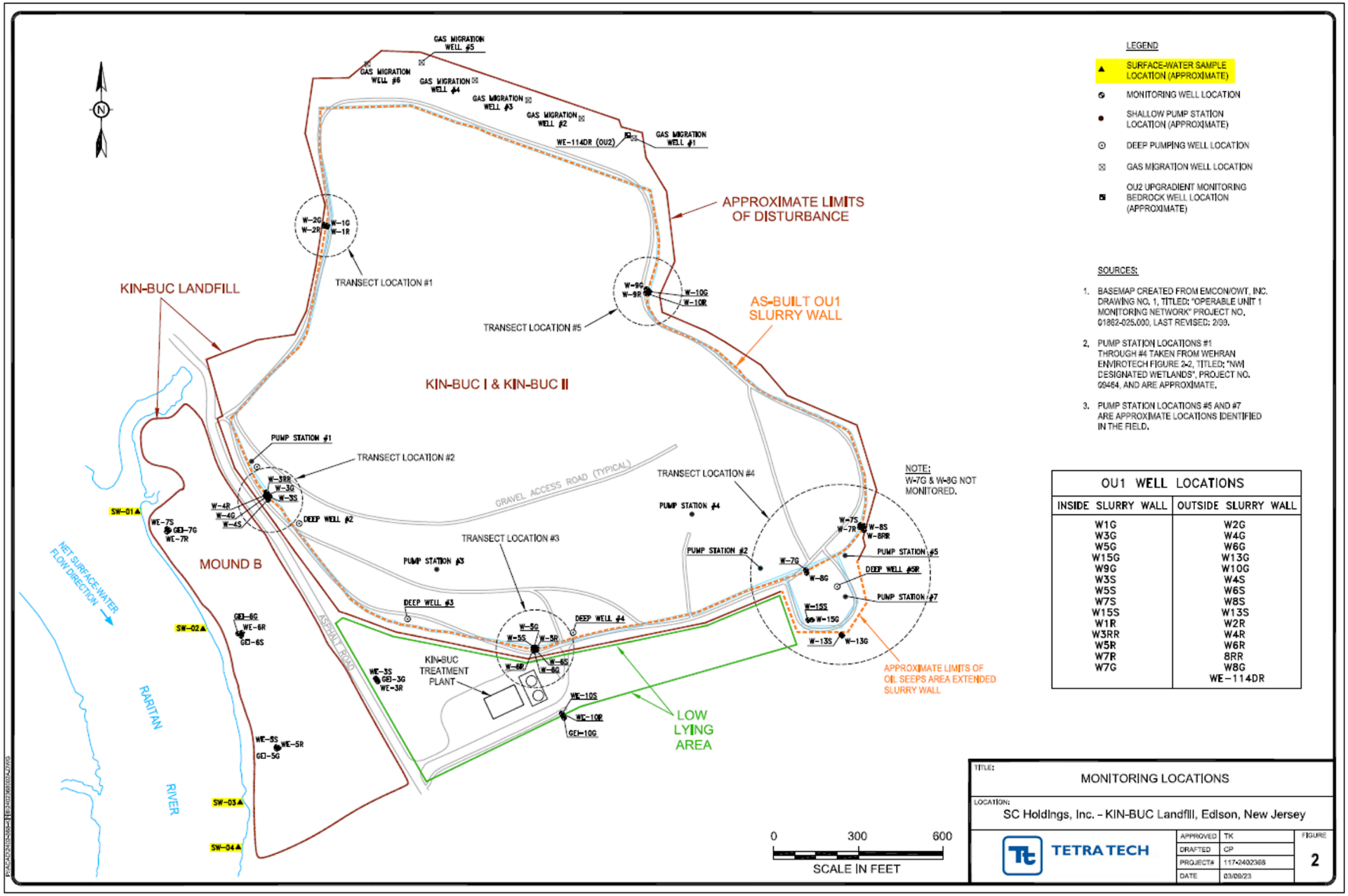
QUADRANGLE LOCATIONS

P:\AGADV 7407-051 - KIN\V 2402061T006A.DWG

TITLE:	SITE LOCATION AND SURROUNDING AREA
LOCATION:	SC Holdings, Inc. - KIN-BUC Landfill Site Edison, New Jersey

TETRA TECH

APPROVED	DS	FIGURE
DRAFTED	CP	1
PROJECT#	117-2402061	
DATE	3-28-11	



OU1 WELL LOCATIONS	
INSIDE SLURRY WALL	OUTSIDE SLURRY WALL
W1G	W2G
W3G	W4G
W5G	W6G
W15G	W13G
W9G	W10G
W3S	W4S
W5S	W6S
W7S	W8S
W15S	W13S
W1R	W2R
W3RR	W4R
W5R	W6R
W7R	8RR
W7G	W8G
	WE-114DR

TITLE: MONITORING LOCATIONS

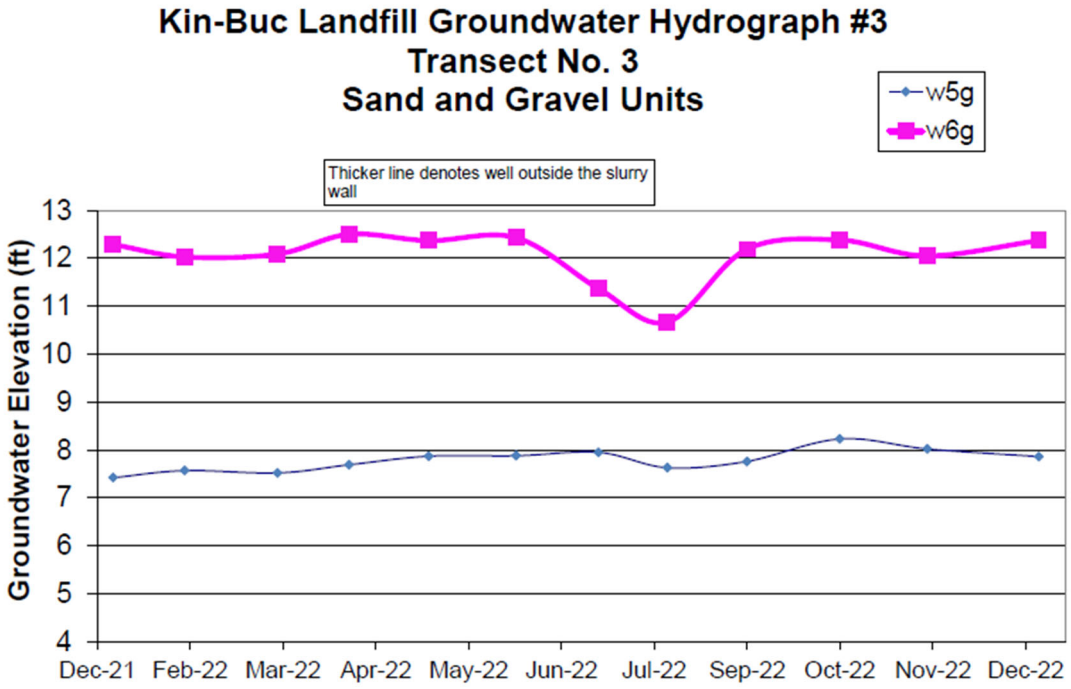
LOCATION: SC Holdings, Inc. - KIN-BUC Landfill, Edison, New Jersey

TETRA TECH

APPROVED	TK
DRAFTED	CP
PROJECT#	117-2402388
DATE	03/09/23

FIGURE 2

Figure 3
Hydrograph depicting a typical scenario where the water table outside the slurry wall is higher than the groundwater table within the slurry wall, indicating an inward hydraulic gradient.



APPENDIX C - Tables

Table 3: Distribution of OU1 Wells Across the Site

Transect Location No.	Screened Hydrogeologic Unit	Well ID Inside Slurry Wall	Well ID Outside Slurry Wall
1	Refuse/Fill Bedrock	 W-1R	W-2G W-2R
2	Refuse/Fill Sand and Gravel Bedrock	 W-3S W-3RR	W-4G W-4S W-4R
3	Refuse/Fill Sand and Gravel Bedrock	 W-5R	W-6G W-6S W-6R
4	Refuse/Fill Sand and Gravel Bedrock	W-15G W-7R	W-13G W-13S W-8S W-8RR
5	Refuse/Fill Bedrock	 W-9R	W-10G W-10R

Table 4: Distribution of OU2 Wells Across the Site

Well ID	Screened Hydrogeologic Unit
Low-Lying Area	
GEI-3G	Refuse/Fill
WE-3S	Sand and Gravel
WE-3R	Bedrock
GEI-10G	Refuse/Fill
WE-10S	Sand and Gravel
WE-10R	Bedrock
Mound B	
GEI-5G	Refuse/Fill
WE-5S	Sand and Gravel
WE-5R	Bedrock
GEI-6G	Refuse/Fill
GEI-6S	Sand and Gravel
WE-6R	Bedrock
GEI-7G	Refuse/Fill
WE-7S	Sand and Gravel
WE-7R	Bedrock
Upgradient	
WE-114DR	Bedrock
Surface Water	
SW-01	Raritan River
SW-02	Raritan River
SW-03	Raritan River
SW-04	Raritan River

APPENDIX D – Climate Change Analysis

According to the Region 2 Guidance for Incorporating Climate Change Considerations in Five Year Reviews, three climate change tools were utilized to assess the Kin-Buc Landfill Superfund Site. Screenshots from each of the tools assess are included below.

The first tool used to assess Edison Township was *The Climate Explorer*. According to this tool, coastal flooding may increase as global sea level rises 0.5-2 feet. Annual counts of intense rainstorms are projected to have between a 1% decrease and a 6% increase. As can be seen from Figure D-1, there is a projected increase of days per year with maximum temperatures > 100 °F. As can be seen on Figure D-2 there is a slight increase in potential drought conditions. Increased probability of hotter days and drought conditions indicate a potential elevated risk for wildfires. A summary of the Top Climate Concerns from the tool can be seen as Figure D-3.

The second tool utilized is called the *Flood Factor*. According to this assessment tool, Middlesex County is designated as an overall "Minor" risk for flooding. However, due to the location of Kin-Buc Landfill along the Raritan River and adjacent to wetlands, there are several locations prone to flood risk. North of the landfill cap there is a "Severe" risk of flooding; in the vicinity of Mound B there is a "Major" risk from flooding; south of the landfill within the Low-Lying Area there is a "Severe" risk from flooding; and within the adjacent wetlands there is an "Extreme" risk of flooding. Due to the surface elevation of the Site landfills, they are not as likely to be impacted from major flooding events as the surrounding area.

The final tool utilized is called *Sea Level Rise*. While the municipality of Edison as a whole is only slightly vulnerable to sea level rise, the area surrounding the landfill is particularly susceptible due to its proximity to the Raritan River, Atlantic Ocean, and location with a flood plain. Figure D-4 shows the Site, southeast of the "Greensand" label, at current conditions, with low-lying areas already susceptible to sea level rise. Figure D-5 depicts the Site at low sea level rise, with limited change due to proximity to wetlands. Projections forecast sea level rise from 2.69 ft. to 6.86 ft. by 2100. Note that because of the increased elevation of the landfill mounds, they are likely to remain less affected than the surrounding area. This is demonstrated in Figure D-6 which depicts flood prone locations due to tidal influences.

Potential Site impacts from climate change have been assessed, and the performance of the remedy may be impacted by the following expected effects of climate change in the region and near the Site: remedy impairment due to sea level rise, increasing frequency of heavy precipitation events, increasing intensity of storms, and increasing risk of floods. Currently, there are portable generators which can be utilized in the event of a power outage. Based on available information, there has been no flooding issues at the Site to date. The O&M plan addresses these impacts through inspection and maintenance of the landfill cap, vegetated areas, the surface water drainage system, and the wastewater treatment plant, especially following storms and flooding events. Climate change impacts will continue to be monitored over time.

Figure D-1

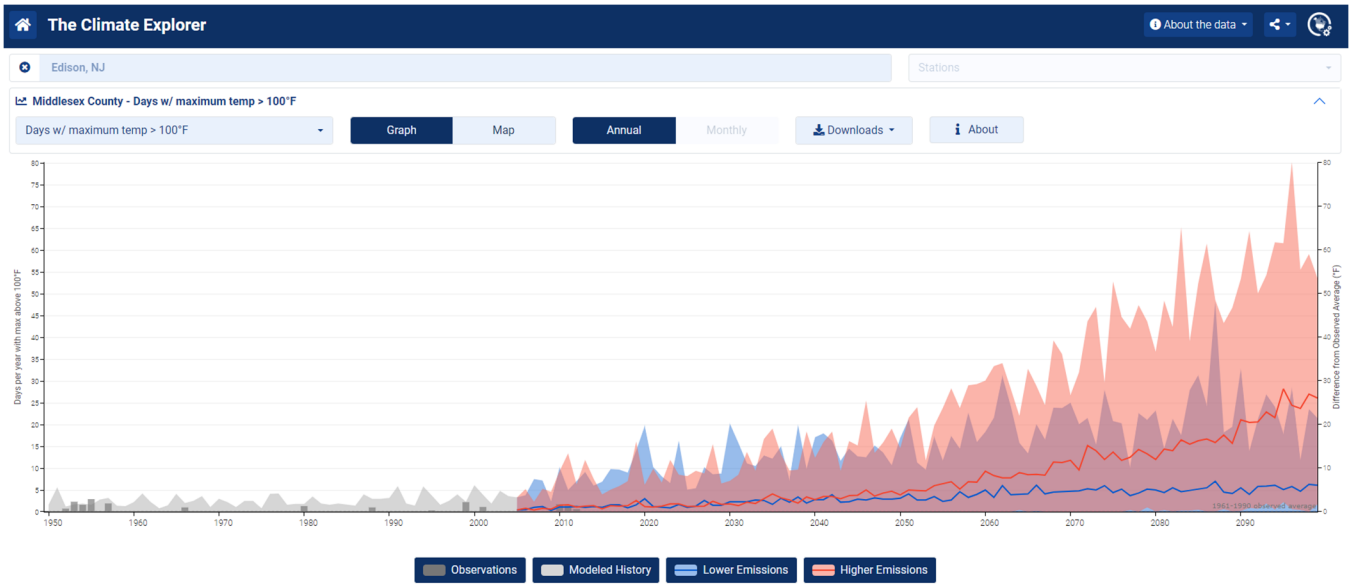


Figure D-2

Figure D-3

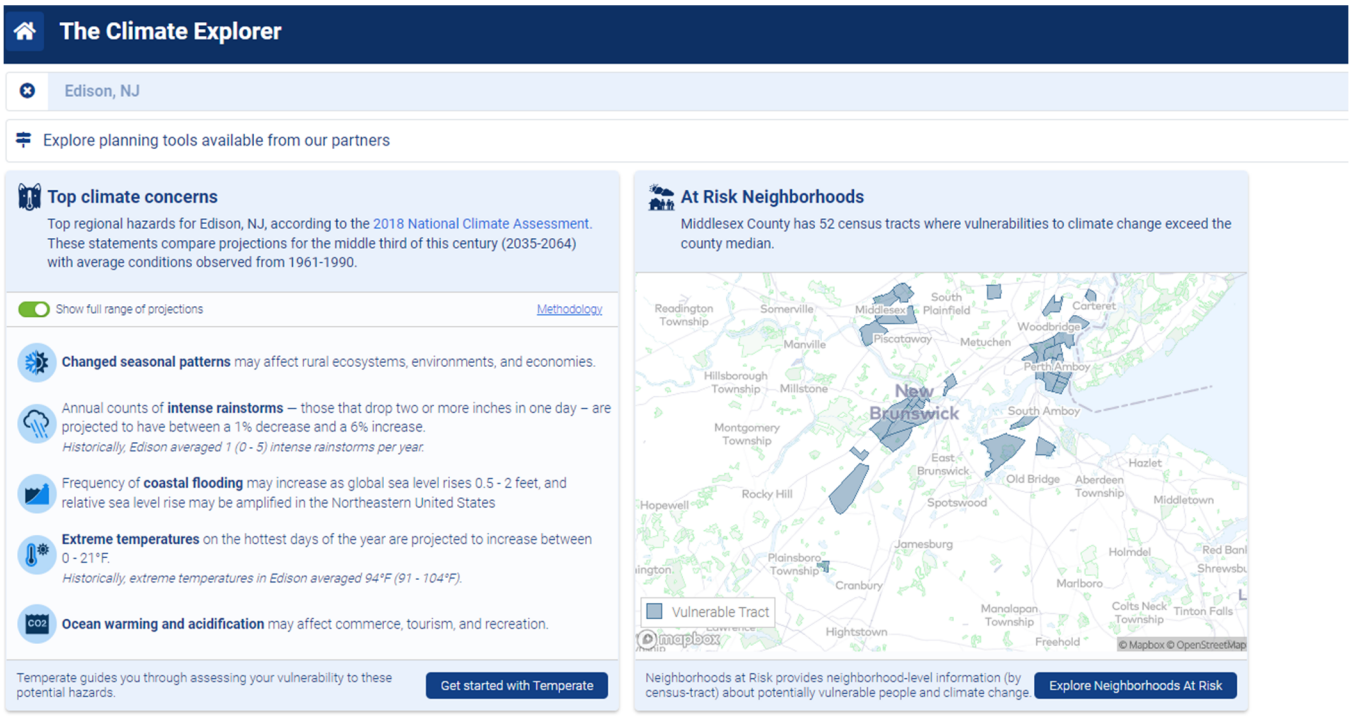


Figure D-4

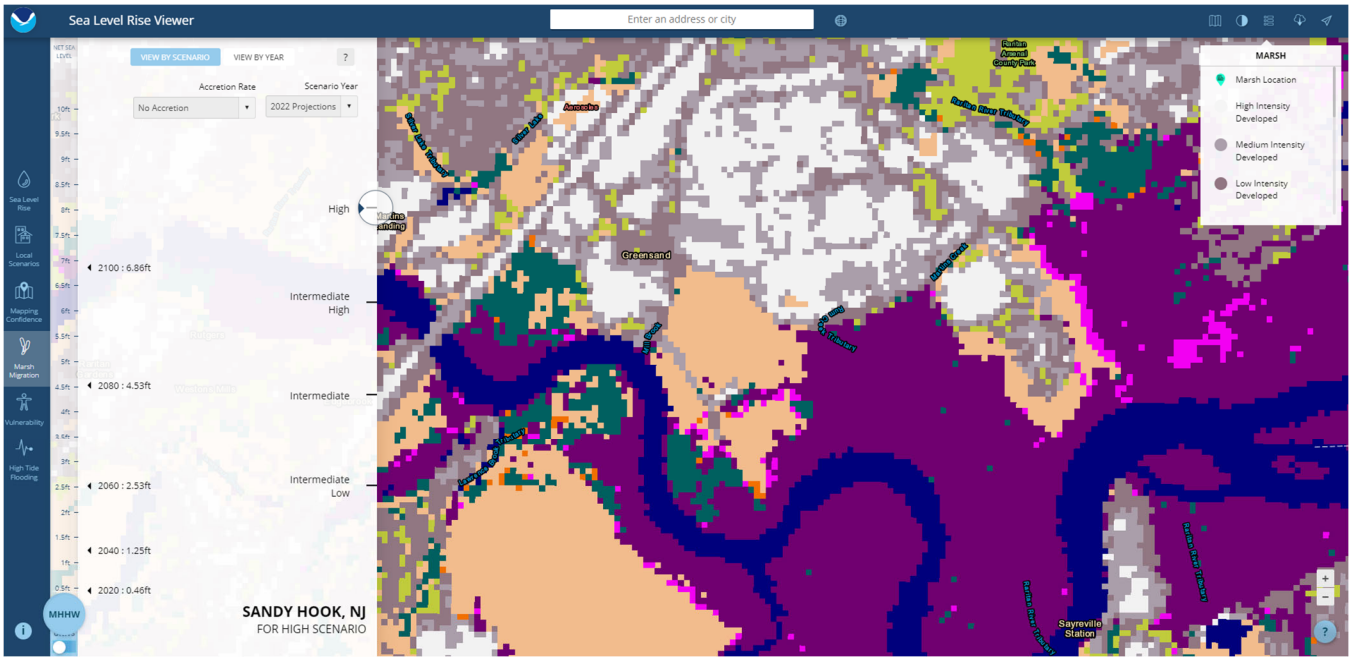


Figure D-5

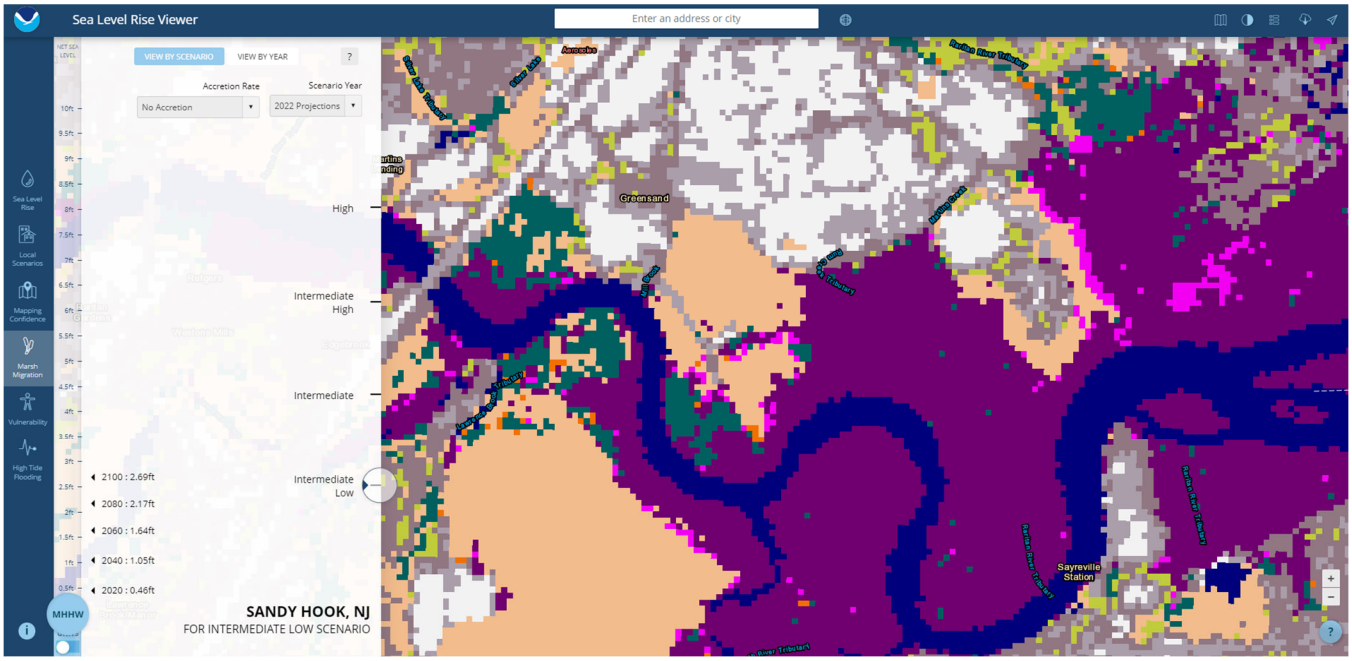


Figure D-6