FIFTH FIVE-YEAR REVIEW REPORT FOR HELEN KRAMER LANDFILL SUPERFUND SITE GLOUCESTER COUNTY, NEW JERSEY

Prepared by

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Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
MCL	Maximum Contaminant Limit
MW	Monitoring Well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
ROD	Record of Decision
RPM	Remedial Project Manager
VOC	Volatile Organic Compound

INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of remedies in order to determine if the remedies are 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 identify 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 fifth FYR for the Helen Kramer Landfill Superfund site. The triggering action for this statutory review is the previous FYR report, completed on September 29, 2015. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The site consists of one operable unit (OU), which is addressed in this FYR.

The Helen Kramer Landfill Superfund site FYR was led by Lawrence Granite, the EPA Remedial Project Manager (RPM). Participants included Kathryn Flynn (Geologist), Cecilia Echols (Community Involvement Coordinator (CIC)), Michael Clemetson (Ecological Risk Assessor) and Julie McPherson (Human Health Risk Assessor) of EPA. EPA notified the Settling Parties (PRPs) of the initiation of the FYR on May 31, 2019. This is a PRP-lead site.

Site Background

The Helen Kramer Landfill site, located in Mantua Township, Gloucester County, New Jersey, encompassed a 66-acre refuse area, and an 11-acre area between the eastern limit of the refuse and Edwards Run that had contained stressed vegetation prior to EPA's remedial action. Edwards Run is a surface water tributary to Mantua Creek and the Delaware River (see Figure 1). The site is near Mantua's border with East Greenwich Township.

The landfill was originally a sand and gravel excavation operation; however, in the early 1960s, landfilling occurred simultaneously with sand excavation. During the 1970s, the landfill was estimated to have received several million gallons of chemical wastes, including waste solvents and paints. In addition, over two million cubic yards of solid waste were estimated to have been disposed of at the landfill. The waste is believed to be more than 50 feet deep in most areas. The wastes disposed of included hazardous, industrial, septic, municipal, and hospital wastes.

The landfill ceased operation in March 1981 as a result of a court-ordered closure because the landfill had exceeded its permitted elevations and capacity. During the summer and fall of 1981, several fires occurred at the site. The New Jersey Department of Environmental Protection (NJDEP), with the assistance of the local fire department, extinguished all fires by November 1981. The site was listed on EPA's National Priorities List (NPL) in September 1983.

There are no residences on the site. Two private residences were permanently relocated prior to the remedial construction. All residents in the area, with limited exceptions, are connected to the public water supply. Access to the site is limited by a chain-link fence. The site is bordered by woods, farmland, Edwards Run and private residences.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: HELEN KRAMER LANDFILL Superfund Site		
EPA ID: NJD980505366		
Region: 2	**State:** NJ	**City/County:** Mantua/Gloucester County

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

REVIEW STATUS
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**
Author name (Federal or State Project Manager): Lawrence A. Granite
Author affiliation: EPA
Review period: 9/30/2015 - 7/15/2020
Date of site inspection: 11/21/2019
Type of review: Statutory
Review number: 5
Triggering action date: 9/29/2015
Due date *(five years after triggering action date)*: 9/29/2020

I. RESPONSE ACTION SUMMARY

Basis for Taking Action

Following the NPL listing of the site, EPA began a remedial investigation/feasibility study (RI/FS) in 1984 to delineate the nature, extent and impact of contamination at the site, and to develop and evaluate remedial alternatives. The RI indicated that the landfill was not contained. The landfill was characterized by randomly placed, uncompacted, and uncovered refuse, with numerous settlement cracks which vented methane and water vapor into the atmosphere.

To assist in determining the impact of the landfill on public health and the environment, a risk assessment was performed during the RI/FS for the conditions at the site. Where possible, relevant standards were used to assess the impact of the site. In most cases, no applicable standards existed, therefore, relevant or appropriate criteria and guidance were used.

Relevant criteria for airborne contaminants were based on the Occupational Safety and Health Administration's (OSHA) standards developed for workplace exposures. The ambient measured or calculated concentration of air contaminants at the landfill did not exceed the workplace standards. For some compounds, the workplace Threshold Limit Value (TLV) was used to develop a guidance level for non-workplace exposure. The concentrations of 1,1-dichloroethene and toluene at the site exceeded these guidance levels. The potential increased cancer risk due to airborne contaminants from the site, prior to implementation of the remedy, was estimated to be in excess of 1×10^{-6} up to a distance of five miles from the site.

The RI/FS indicated that several of the maximum observed concentrations of contaminants in Edwards Run exceeded the water quality criteria for surface water that were developed pursuant to the Clean Water Act. For the inorganic contaminants, only nickel exceeded the criteria, and for the organic contaminants, seven compounds exceeded the criteria. The seven organic contaminants included chloroform, benzene, and several chlorinated ethenes. The potential increased cancer risk for ingestion of water from Edwards Run was estimated in the RI/FS to be 3.5×10^{-3}.

The RI/FS concluded that, in general, the leachate entering Edwards Run was considered to have rendered the stream unusable for its designated uses as an FW-2 non-trout surface water.

The RI determined that the underlying groundwater, Mount Laurel aquifer, was heavily contaminated with organic compounds including benzene, toluene, xylenes and phenols. Inorganic chemicals found in high levels in the groundwater included arsenic, cobalt, magnesium and sodium. It was also determined that the groundwater was discharging to

Edwards Run.

An evaluation of ecological risks was not conducted as part of the RI/FS process.

Response Actions

Based upon the results of the RI/FS, a Record of Decision (ROD) was issued on September 27, 1985, which selected a containment remedy for the site. The remedial action objective (RAO) for the site was to prevent or mitigate the migration of hazardous substances. The selected remedy included:

- Construction of a clay cap over the site;
- Dewatering, excavation, and filling of the leachate ponds and lagoons;
- Construction of an upgradient slurry wall;
- Construction of a groundwater/leachate collection trench;
- Collection and treatment of groundwater/leachate from the trench. (The treatment preference for collected leachate was pretreatment and discharge to the publicly owned treatment works (POTW). Implementation was contingent upon approval of the State of New Jersey and the local POTW. If such approval was not provided, the ROD called for on-site treatment followed by discharge to local surface waters.);
- Construction of an active gas collection and treatment system;
- Implementation of surface water controls;
- Construction of a security fence surrounding the site and work areas;
- Implementation of a monitoring program to assess the effectiveness and reliability of the remedial action (RA); and
- Operation and maintenance (O&M), as required, to ensure the continued effectiveness of the remedy.

During design activities, it was determined that the leachate from the collection trench could be pretreated and discharged to the Gloucester County Utilities Authority (GCUA) POTW as preferred in the ROD. During a Value Engineering evaluation, the slurry wall was expanded from only upgradient of the landfill to completely encircling it. The Value Engineering

assessment showed that the extension of the slurry wall would allow for a decrease in the capacity of the leachate pretreatment facility (PTF) and an overall reduction in the volume of leachate requiring treatment and discharge to the POTW.

Status of Implementation

Remedial Action (RA) activities, which began on February 20, 1990 and were considered construction-complete on June 30, 1993, are described below.

Lagoons

Three lagoons were located at the site between the landfill and Edwards Run. NJDEP interim action levels for soil which were in effect at the time of the cleanup of the lagoons in 1990 and 1991 were used as the basis for the excavation of sediments from lagoons identified as numbers 1 and 2. A third lagoon, lagoon number 3, had been lined with plastic, and, therefore, no excavation was deemed necessary prior to backfilling the lagoon to existing grade.

Contaminated water in Lagoon 1 was transferred to the PTF and the contaminated lagoon sediments were excavated in 1991 to a depth of five feet, in addition to excavation of all visibly contaminated sediments. No post-excavation samples were collected prior to backfilling. The excavated lagoon sediments were deposited in the landfill and were subsequently capped.

Contaminated water in Lagoon 2 was transferred to the PTF for treatment. Sampling of the sediments in Lagoon 2 showed that concentrations of contaminants in sediments below 2.5 feet did not exceed the NJDEP's interim action levels for soil. Accordingly, Lagoon 2 was excavated to a depth of 2.5 feet and the excavated sediments were deposited in the landfill for subsequent capping. Based on sampling results, EPA determined that the water in Lagoon 3 was not contaminated and did not require treatment prior to discharge to the landfill.

A total of 34,325 tons of clean soil were used to backfill the three lagoons. This work was completed in 1991.

Landfill Containment and Leachate Collection Activities

A six-layer cap was installed on an area of approximately 81.5 acres at the site. The cap was constructed of stone, a fabric filter layer, a clay layer, followed by sand and topsoil. The subgrade of the cap required the placement of approximately 774,000 tons of common fill. A 8,350-foot slurry wall was installed to surround the entire landfill. The wall is three feet wide and varies in depth from 20 to 70 feet.

Landfill leachate is collected via a trench system utilizing perforated polyethylene drainage pipe. Three pumping stations are used to convey the collected leachate through a forcemain to the PTF. A 120-gallon per minute (gpm) capacity leachate PTF was constructed at the site. The first discharge of pretreated leachate to the GCUA POTW occurred on April 1, 1992. The pretreatment process included chemical precipitation, air stripping and carbon adsorption to remove contaminants. During EPA's RA, the effluent from the PTF was stored and tested prior to disposal at the GCUA POTW. Presently, the effluent from the PTF is directly discharged to the POTW. The leachate pumping rate currently averages approximately 40 gpm. The current capacity of the leachate PTF is 120 gpm.

A landfill gas collection system was installed circa 1991 and includes 73 gas collection wells. The gas treatment facility, which consists of a carbon adsorption system and a methane gas flare, has a designed capacity to treat 1,000 cubic feet per minute. The landfill gas generation rate has diminished. Currently, the gas collection system operates at approximately 100 cubic feet per minute for seven to fourteen hours per week.

The site's storm water management features include two drainage basins. The site is surrounded by chain-link security fencing. A perimeter road, located within the security fence, was built to provide access to the entire site. Thirteen groundwater monitoring wells were installed around the perimeter of the site.

In June 1993, EPA approved a Preliminary Close-Out Report (PCOR) for the site, documenting that all construction activities had been completed. After the RA was completed, EPA transferred O&M responsibilities to the NJDEP. EPA and the NJDEP coordinated the effective transfer of site responsibilities. On September 27, 1995, EPA issued a Remedial Action Report for the remedy.

Institutional Controls

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	The capped landfill and the area between the slurry wall and the West Branch of Edwards Run	Minimize the potential for exposure to contaminated groundwater until the aquifer meets cleanup goals	EPA's remedy does not call for a Classification Exception Area (CEA); however; NJDEP established a CEA in 1996

II. SYSTEM OPERATIONS/OPERATION AND MAINTENANCE

Construction of the remedy was completed in 1993. The project has been in the O&M phase since 1994. O&M activities include operation of the leachate and gas collection systems and the two associated treatment plants, maintenance of the cap and the surface water controls, and environmental monitoring.

From May 1994 to May 1997, the O&M was performed by an NJDEP contractor. Under an agreement with NJDEP, the PRPs began performing the O&M in May 1997 and continue to perform the O&M activities.

Previously, the PRPs' long-term groundwater sampling network included eight wells, of which three were sampled semi-annually and five were sampled annually. The sampling also included collection of surface water and sediment samples from Edwards Run. In March 2020, NJDEP approved an application to modify the O&M Plan to include changes to the frequency and parameters of

the groundwater monitoring plan. The modification to the O&M Plan provides for water quality monitoring at a total of 36 locations; 15 of which are sampled annually and 21 sampled biennially. The revised monitoring plan was developed to monitor the Englishtown aquifer; monitor the shallow groundwater; and monitor background conditions of upgradient groundwater flowing towards the site.

Climate Change

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

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determination and statement from the last FYR as well as the recommendations from the **last** FYR and the current status of those recommendations.

Table 1: Protectiveness Determination/Statement from the 2015 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-term Protective	The remedy currently protects human health and the environment because levels of site-related contaminants in the surface water of Edwards Run are low and do not cause unacceptable exposures for ecological or human receptors. In order for the remedy to be protective in the long-term, an evaluation of the effectiveness of the slurry wall/leachate collection system should be conducted to ensure groundwater migrating towards Edwards Run is effectively contained.

Table 2: Status of Recommendation from the 2015 FYR

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	Groundwater contaminant concentrations outside the slurry wall exceed standards	Perform an evaluation of the slurry wall/leachate collection to determine its effectiveness	Ongoing	• Cleanout of the leachate collection system was attempted in May and July of 2015. • An updated groundwater model was developed to	December 31, 2021

				assess site conditions and determine the best approach to improve the performance of the remedy. This included installation of additional monitoring wells, and performance of pump tests. This effort is ongoing. • The groundwater model determined that contamination had reached the underlying Englishtown formation. • Pump tests were performed in the Englishtown formation to determine if the contamination can be contained. Pump tests and delineation of groundwater contamination are ongoing. • A remedy optimization study has been ongoing since March 2018 to evaluate approaches to improve the performance of the remedy including: o Additional off-Site Englishtown Aquifer Wells o Enhanced Leachate Recovery Pilot Test	

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 1, 2019, 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 Helen Kramer Landfill site. The announcement can be found at the following web address: https://www.epa.gov/aboutepa/fiscal-year-2020-five-year-reviews.

In addition to this notification, EPA provided a public notice to Mantua Township on December 3, 2019 with a request that the notice be posted to their web site. The purpose of the public notice was to inform the community that EPA is conducting a FYR to ensure that the remedy implemented at the site remains protective of human health and the environment and is functioning as intended by the decision documents and inviting the public to submit any comments to EPA. In addition, the notice included the RPM and CIC email addresses and telephone numbers. Mantua Township posted the notice to their web site in December 2019. The EPA RPM has not been contacted by any members of the community regarding the remedy or site conditions. An NJDEP representative participated in the site inspection for this FYR. NJDEP agrees with EPA's concerns and conclusions regarding the site and is supportive of the PRPs' efforts to address the concerns.

EPA has made site-related documents available to the public in the record repositories maintained at the West Deptford Free Public Library and EPA Region 2 office (290 Broadway, New York, New York 10007). Furthermore, when this FYR is completed, copies will be sent to the repositories, as well as posted on the website for the site: https://www.epa.gov/superfund/helen-kramer-landfill.

Data Review

Leachate System Performance

Since the start-up of the leachate PTF in 1992, monitoring has been performed, as required by GCUA, to ensure that the PTF's effluent meets the discharge criteria. PTP effluent over the past five years has met the discharge criteria. The PRPs will continue to evaluate leachate volume and system performance. Approximately 21 million gallons of leachate are treated per year.

Groundwater

The 2015 FYR documented increasing VOC concentrations at shallow monitoring wells MW-11S and MW-13S. These wells are located downgradient of the landfill, between the slurry wall and Edwards Run (see Figure 2). Total VOC concentrations did not increase at MW-11S and MW-13S in this FYR period. At MW-11S, benzene and chlorobenzene are the highest concentration VOCs. The maximum benzene concentration in this period, at MW-11S, was 1,600 µg/l in 2016. 1,1-dichloroethene, cis-1,2-DCE, vinyl chloride, and benzene have been detected at MW-13S with the maximum concentration of cis-1,2-DCE at 770 micrograms per liter (µg/l) in 2016. These two shallow wells also showed elevated concentrations of 1,4-dioxane (up to 230 µg/l) and arsenic (up to 86.8 µg/l) in this review period.

In 2018, 14 new shallow groundwater monitoring wells were installed along three transects located between the landfill and Edwards Run. The shallow aquifer is in fill material or the Mount Laurel and alluvial units. The goal was to delineate groundwater contamination in the areas near MW-11S and MW-13S. Around MW-11S, the new shallow wells show high concentrations of 1,2-dichloroethane (DCA), benzene, chlorobenzene, bis(2-chloroethyl)ether and arsenic. The new wells close to MW-13S show elevated 1,2-DCA, benzene, TCE, vinyl chloride, bis(2-chloroethyl)ether, arsenic, and heptachlor epoxide. These shallow monitoring wells also showed elevated concentrations of 1,4-dioxane, up to 180 µg/l at MW-21S in 2019. The maximum 1,4-dioxane concentration within the slurry wall in 2019 was 210 µg/l at PZ-12.

The 2015 FYR documented an outward gradient on the eastern side of the landfill. In 2018, the shallow groundwater elevation measurements outside the slurry wall were found to be significantly lower than the elevations inside, indicating an outward groundwater gradient towards Edwards Run. No shallow wells on the east side of Edwards Run were installed and sampled in this period due to access problems. It is unknown if the contamination from the landfill is flowing beyond Edwards Run or if the site groundwater is completely discharged into the creek. Shallow wells are required on the eastern side of Edwards Run as soon as property access issues are resolved to fully delineate the extent of the plume outside the slurry wall. Water level measurements on the western and the southern sides of the landfill indicate an inward gradient in these areas.

To investigate the shallow groundwater discharge into Edwards Run, seven temporary well points were installed in January 2019, between MW-9S and MW-17S. VOCs were detected at four of the temporary well points (TWP-04, TWP-05, TWP-06, and TWP-07). TWP-4 had the highest concentration of 1,2-DCA, 11 µg/l, located between surface water locations SW-2 and SW-6. This location also had 840 µg/l cis-1,2-DCE, 1000 µg/l vinyl chloride, and 32 µg/l benzene. 1,4-dioxane was detected above the Ground Water Quality Standards (GWQS) at all points except TWP-06. Multiple per and poly fluorinated akyl substances (PFAS) were detected at each sample location, and the range of perfluorooctanoic acid (PFOA) was 7.6 ng/l to 65.5 ng/l.

Three deep groundwater wells (see Figure 3) were sampled annually during the previous review period, one upgradient and two east of Edwards Run. Those wells did not show detections of VOCs or SVOCs in the previous review or in this review period. However, the off-site deep monitoring well X-7D had 1,2-DCA impacts when sampled in 2016 (2,100 to 3,600 µg/l). Four new deep wells were installed in 2016 in order to delineate contamination downgradient of the landfill in the northeast and north directions, and existing wells were redeveloped. In 2017, four additional deep wells were installed, followed by seven new deep wells in 2018. Two additional wells, MW-31D and MW-32D, were installed in 2019 to determine if the extent of the deep groundwater contaminant plume was delineated.

The March 2019 data from the deep monitoring wells show the current extent of deep groundwater contamination. Deep wells within the landfill (that were not sampled in the previous review period) had high concentrations of 1,2-DCA and 1,1-dichlorothene, vinyl chloride, and benzene, plus high levels of 1,4-dioxane and arsenic (see attached table). The maximum concentration of 1,2-DCA in the interior wells was 1,800 µg/l at MW-23D and the maximum concentration of 1,4-Dioxane in the interior wells was 42 µg/l at MW-16D. Outside the landfill, the deep wells show that the 1,2-DCA plume extends east of Edwards Run to MW-30D and X-7D. In 2019, the 1,2-DCA concentrations at MW-30D and X-7D were 790 and 1,800 µg/l respectively. The highest concentration of 1,4-dioxane in a deep well east of the landfill was 82 µg/l at MW-19D. In the deep wells on the east side of Edwards Run, 1,4-dioxane was only detected at X-7D, at 0.93 µg/l. Two additional wells were installed in 2019 to determine if the extent of the deep groundwater contaminant plume was delineated. Specifically, the deep groundwater plume extent was defined by monitoring wells MW-31D and MW-32D, which were installed in October 2019, and did not show detections of VOCs or 1,4-dioxane. Arsenic concentrations inside and outside the landfill also exceeded the NJ GWQS standard of 3 µg/l. The highest arsenic concentration in 2019 was 150 µg/l at MW-20D.The groundwater monitoring data from the shallow and deep aquifers indicates that the slurry wall and leachate collection system are not containing contaminated groundwater within the landfill. Additional investigation is needed to evaluate the flow direction and plume extent in the shallow aquifer.

Surface Water and Sediment

The 2015 five-year review documented increasing 1,2-DCA concentrations at downgradient surface water location SW-1, starting in 2011. In that review period, the maximum concentration of 1,2-DCA at SW-1 was 10 µg/l in 2014. In this review period, surface water was sampled in January, February, March, and April 2018, as well as for the semi-annual monitoring events. Three new surface water locations were added in 2018, located between SW-1 and SW-3.

The 1,2-DCA concentrations at SW-1 did not further increase in this period, but the concentrations ranged from undetected to 8.5 µg/l, above the NJ SWQS of 0.29 µg/l. SW-4 consistently had 1,2-DCA concentrations above the NJ SWQS standard, ranging from 0.84 µg/l to 2.9 µg/l. Vinyl chloride was detected above the surface water quality standard at SW-1, SW-2, SW-4, and SW-5 in this period, and benzene was found at SW-2, SW-4, and SW-5 in 2018. Arsenic concentrations consistently exceeded the standard at least once at every surface water location in this period.

Sediments are sampled annually in the fall at the three original surface water locations. The previous FYR found all three locations had exceedances of NJDEP's lower effects level (LEL) for arsenic, cadmium, chromium, and iron. Sediment results from this period continue to show concentrations of these analytes above the LEL at all three locations.

V. SITE INSPECTION

The site fencing and grass cover are in good condition. The landfill cover system (i.e. grass, riprap apron and access roads) is inspected for erosion, burrowing animals, and sparse vegetation by a PRP contractor several times per year.

A site inspection was performed on November 21, 2019. The following parties were in attendance: Lawrence Granite and Kathryn Flynn, EPA; Gwen Zervas, NJDEP; Daniel Sirkis, U.S. Army Corps of Engineers; and Bill Lee, de maximis. During the inspection, the site appeared to be in satisfactory condition.

A licensed treatment plant operator maintains an ongoing presence on the site as noted in monthly reports that the PRPs' consultant submits to GCUA.

VI. TECHNICAL ASSESSMENT

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

Presently, the remedy is not functioning as intended by the decision documents. In November 2014, EPA informed the PRPs that insufficient operation and maintenance activities related to the leachate collection system were likely causing contaminated leachate to escape the slurry wall.

The 1985 ROD is the only decision document for the site. It called for groundwater/leachate collection and treatment; a clay cap; an upgradient slurry wall; active gas collection and treatment; dewatering, excavating, and backfilling lagoons; security fencing; and monitoring. While the landfill containment portion of the remedy called for a slurry wall on the upgradient side of the landfill, a decision was made during remedial design, based on value engineering, to extend the slurry wall to completely surround the landfill. The ROD indicated that the slurry wall and cap would lower the water table such that the vertical hydraulic gradient would reverse direction from the Englishtown aquifer up to the Mount Laurel aquifer. This is not currently generally occurring.

Lagoons have been drained and backfilled. As appropriate, any contaminated soils were excavated and placed on the landfill prior to capping. The landfill area is covered by a clay cap. The site is fenced, which has prevented trespassing. A leachate collection system has also been constructed at the site. Leachate is collected and treated at the on-site PTF and is then discharged for further treatment at the GCUA wastewater treatment plant. It appears that the leachate collection system, as currently configured, cannot keep the landfill leachate hydraulic head at an optimal level. The PRPs are investigating methods to lower the landfill head, some of which include upgrading portions of the system. There is a need for increased pumping from the leachate collection system

to reduce any outward gradient from the landfill and protect the Englishtown aquifer and the surface water of Edwards Run.

Data from the shallow monitoring wells located between the slurry wall and Edwards Run (the area of the former lagoons) indicates persistent high concentrations of VOCs. In August 2013, EPA collected 36 subsurface soil samples from 12 locations near former lagoons 1 and 2, and adjacent to monitoring wells MW-11S and MW-13S to try to determine if soil could be a residual groundwater contaminant source. EPA concluded in the 2015 FYR that although there were some sporadic detections of chemicals in soils above the water table, the unsaturated soils at these locations did not show concentrations that would indicate they act as a source of groundwater contamination. EPA reviewed the results and concluded in the 2015 FYR that insufficient operation and maintenance activities related to the leachate collection system were likely causing groundwater impacts between the slurry wall and Edwards Run.

Water levels in the wells around the downgradient slurry wall indicate an outward gradient. This information indicates that the leachate collection system has not been operating as intended. Additional groundwater monitoring wells have been installed by the PRPs to delineate the shallow and deep groundwater contamination. Further remedial work is needed to fully delineate groundwater contamination outside of the slurry wall.

Samples from Edwards Run frequently show VOC concentrations that exceed standards for surface water. Temporary well points installed in January 2019 identified areas of shallow groundwater discharge into Edwards Run.

Since EPA notified the PRPs of concerns about insufficient containment of contaminated leachate, the PRPs are delineating the groundwater plume that is reaching Edwards Run. Also, the PRPs have been actively investigating additional measures to improve pumping from the leachate collection system. As part of ongoing remedy optimization efforts, the PRPs are investigating if there would be any value in converting additional leachate collection system clean-out manholes to pumping stations. This effort is ongoing and no conclusions have been reached at this time. The PRPs are also pilot testing installation of individual leachate extraction wells as a potential addition or replacement to the existing leachate collection system. EPA and NJDEP will review the results of these tests to make a determination on how best to address groundwater contamination.

Currently, land use downgradient of the site is primarily agricultural/rural. All residents in the area are connected to the public water supply, except for one known property owner who refused connection in 2005. This resident has a private well which is located in the deeper Magothy Aquifer that is not impacted by site-related contamination. Since all other residents in the area are connected to the public water supply, the exposure pathway via ingestion of the groundwater has been interrupted. Groundwater use is not expected to change in this area

within the next five years, the period of time considered in this review. According to the NJDEP, all water is considered a potential drinking water source regardless of whether it is currently used for drinking water or not. Therefore, the aquifer is considered Class IIA.

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

The baseline risk assessment evaluated the health effects which could potentially result from ingestion of leachate and surface water, and inhalation of airborne contaminants. The exposure assumptions and the toxicity values that were used to estimate the potential risk and hazards to human health followed the general risk assessment practice at the time the risk assessment was performed. Although the risk assessment process has been updated since then and specific parameters and toxicity values may have changed, the risk assessment process that was used is still consistent with current practice and the need to implement a remedial action remains valid.

Groundwater and Surface Water

In order to account for changes in toxicity values and the risk assessment process since the original risk assessment was performed in 1985, the maximum detected concentrations of the contaminants of concern (COCs) identified during the sampling period from 2015 to 2019 were compared to EPA's residential Regional Screening Levels (RSLs), National Primary Drinking Water Standard Maximum Contaminant Levels (MCLs) and their respective NJDEP groundwater and surface water quality standards.

Sampling results indicate that multiple site-related COCs such as benzene, vinyl chloride, 1,1-dichloroethene, cis-1,2-dichloroethene, chlorobenzene, bis(2-chloroethyl)ether and arsenic, have consistently exceeded their respective NJDEP GWQS and MCLs in groundwater monitoring wells within the past five years. The most recent groundwater sampling event (2019) detected benzene at 6,600 µg/l, cis-1,2-DCE at 25,000 µg/l, chlorobenzene at 410 µg/l, vinyl chloride at 6,700 µg/l, 1,2-DCA at 8,400 µg/l and bis (2-chloroethyl) ether at 600 µg/l. These levels were detected outside of the landfill in the shallow aquifer.

In 2017, leachate from the site was sampled and analyzed for PFAS compounds. The results indicated that total PFOA and PFOS were detected in the influent leachate at 430 ng/l. The concentration of PFAS exceeded EPA's Health Advisory (HA) for PFOA+PFOS (70 ng/l) and NJDEP's groundwater quality standards and MCL for PFOA of 14 ng/l and PFOS of 13 ng/l. In June 2018, sampling was conducted in two off-site deep wells (MW-15D and X-7D). Neither PFOA nor PFOS were detected in these wells. In 2018, shallow monitoring wells were also sampled by the PRPs for PFAS constituents. The maximum detected concentration in groundwater (MW-11S) of PFOA and PFOS combined was 1,385 ng/l. Surface water was also analyzed for PFAS constituents. The concentrations of PFOA and PFOS did not exceed EPA's

HA or NJDEP MCLs.

1,4-dioxane has been sampled and analyzed in several wells at the site. The maximum detected concentration in 2019 was 210 µg/l in PZ-12 (inside the landfill) and 180 µg/l in MW-21S (outside of landfill). The concentrations detected in wells exceed the NJ groundwater quality standard (0.4 µg/l).

Although groundwater outside the slurry wall does not currently meet drinking water quality standards, a groundwater restriction or CEA prohibits the installation of wells in this area and nearby residents are either connected to the public supply or have not been impacted. Therefore, this exposure pathway is currently interrupted.

Surface water samples indicate that several site-related COCs exceed or are at the NJDEP surface water quality standards and MCL. Although the concentrations of these constituents exceed their respective screening criteria, Edwards Run is not used for potable water or recreation and these uses are not anticipated in the near-term.

Sediment

Sediment sampling results from this period continue to show concentrations of arsenic (25 mg/kg), cadmium (1.6 mg/kg), chromium (66 mg/kg) and iron (67,000 mg/kg) above the LEL at all three sampling locations.

Soil

In August 2013, EPA collected 36 subsurface soil samples from 12 locations near former lagoons 1 and 2, and adjacent to monitoring wells MW-11S and MW-13S to try to determine whether soil could be a residual groundwater contaminant source. EPA concluded in the 2015 FYR that although there were some sporadic detections of chemicals in soils above the water table, the unsaturated soils at these locations did not show concentrations that would indicate they are the source of groundwater contamination. EPA reviewed the results and concluded in the 2015 FYR that insufficient operation and maintenance activities related to the leachate collection system were likely causing groundwater impacts between the slurry wall and Edwards Run.

The clay landfill cap, which was constructed as part of the remedial action, continues to eliminate direct exposure with site-related contamination and is considered protective.

Vapor Intrusion

The 2005 and 2010 FYRs evaluated soil vapor intrusion and indicated that further investigation would be necessary if a building were to be constructed over the contaminant plume. As of 2020, there are no buildings overlying the plume (i.e., between the slurry wall and Edwards Run); therefore, the exposure pathway is incomplete.

Ecological Risk

The remedy selected in the ROD called for a landfill cap which addressed the terrestrial exposure pathway by eliminating the direct contact pathway to ecological receptors. The leachate collection system was designed to protect Edwards Run by intercepting contaminated groundwater/leachate. Surface water and sediment monitoring data from Edwards Run were reviewed. The recent (June 2018) surface water sampling results indicated that one location (SW-2) had a concentration (0.039 µg/L) of benzo(a)anthracene which exceeded the chronic New Jersey Surface Water Criteria (0.025 µg/L). However, since this concentration was detected at only one location, the ecological risk may not be significant. The results of the October 2018 sediment sampling indicate that some contaminant concentrations (arsenic, cadmium, chromium and iron) exceeded the lower effect levels of the NJDEP ecological screening levels. However, with the exception of iron, these concentrations in sediment did not exceed the NJDEP severe effect levels and are consistent with the historical data. Monitoring of Edwards Run should be continued.

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

As previously discussed in this report, additional groundwater and surface water contamination has been identified since the last FYR. Delineation of the contaminant plume should be conducted to fully define the extent of deep groundwater contamination. Additional pumping of the leachate should be conducted to address the outward gradient in the eastern section of the slurry wall that impacts Edwards Run. In 2017, leachate from the site was sampled and analyzed for PFAS and results in groundwater and leachate exceeded standards. Considering the limited information collected thus far and the expected behavior of PFAS in the environment, it is recommended that a more extensive investigation and delineation of PFAS be conducted in downgradient wells (including all of the shallow monitoring wells). The groundwater is currently not being treated to address PFAS.

1,4-dioxane has been sampled and analyzed in several wells at the site. The concentrations detected in wells exceeded NJ groundwater quality criteria. Groundwater is not currently being treated to address 1,4-dioxane. Further delineation of 1,4-dioxane is recommended farther downgradient (on the other side of Edwards Run) as a data gap exists in the shallow aquifer on the east side.

VII. ISSUES/RECOMMENDATIONS

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU 1	**Issue Category: Remedy Performance**			
	Issue: Groundwater and surface water contaminant concentrations outside the slurry wall exceed standards.			
	Recommendation: Additional leachate pumping/system optimization is needed to maintain an inward gradient inside the slurry wall. Sampling for 1,4-dioxane and PFAS and other site COCs should be conducted by the PRPs to define the contaminant plumes in the shallow and deep aquifers. Monitoring of surface water and sediments should continue.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	12/31/2021

VIII. PROTECTIVENESS STATEMENT

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Planned Addendum Completion Date:* N/A Click here to enter a date
Protectiveness Statement: The remedies at the site protect human health and the environment in the short-term because all exposure pathways have been addressed. In order for the remedy to be protective in the long-term, additional leachate pumping/system optimization is needed to maintain an inward gradient inside the slurry wall; sampling for 1,4-dioxane and PFAS and other site COCs to define the contaminant plumes in the shallow and deep aquifers needs to occur; and monitoring of surface water and sediments should continue.	

IX. NEXT REVIEW

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

LEGEND:

- PROPERTY LINE
- SCOUR PROTECTION
- SHEET PILE
- GAS LINE
- WATER MAIN
- DIRT ROAD
- ROAD (ASPHALT)
- MW-22D RECOVERY WELL LOCATION
- MW-10D MONITOR WELL LOCATION
- SW-1 SURFACE WATER SAMPLE LOCATION
- PZRC-2A OTHER MONITORING LOCATION
- MW-15S 2018 INSTALLED SHALLOW MONITORING POINT
- MW-30D 2018 INSTALLED DEEP MONITORING POINT
- CLEANOUT / PUMP STATION
- LANDFILL BORING / MONITORING POINT
- RIP-RAP
- WATER (SWAMP / POND)
- HOUSE

NJSPCS NAD 1983

BLOCK 6 - LOT 1

BLOCK 6 - LOT 4

BLOCK 6 - LOT 12.01

BLOCK 6 - LOT 19,01

BLOCK 7 - LOT 17 MANTUA TOWNSHIP (VACANT)

BLOCK 7 - LOT 16 MANTUA UTILITY AUTHORITY

TOMARCHIO BLOCK 6 - LOT 5.02 (FARM QUALIFIED)

BLOCK 6 - LOT 5.29 (VACANT)

BLOCK 6 - LOT 5.32 (VACANT)

BLOCK 52 - LOT 2.03 (VACANT)

BLOCK 52.01 - LOT 39 (VACANT)

BLOCK 6 - LOT 5.17 (VACANT)

BLOCK 6 - LOT 5.19 (VACANT)

BLOCK 6 - LOT 5.06 (VACANT)

BLOCK 46 - LOT 1.09

BLOCK 46 - LOT 1.08

BLOCK 46 LOT 1,10

BLOCK 46 LOT 1,11

BLOCK 46 LOT 1,07

EAST GREENWICH TOWNSHIP MUNICIPAL LINE

MANTUA TOWNSHIP

BROOKS MILL ROAD

JESSUPS MILL ROAD

SCHAUB ROAD

EDWARDS RUN

TRIBUTARY OF EDWARDS RUN

SACRAMENTO DRIVE

SACRAMENTO CT.

LARAMIE WAY

PHOENIX AVENUE

DENVER AVENUE

SANTA FE DRIVE

OLYMPIA STREET

PALOMINO CIRCLE

FRIESIAN COURT

LEGENDS LANE

TROTTERS LANE

PALOMINO CIRCLE

SUNCREST COMMUNITIES

KRAMER BLOCK 1304 - LOT 10

KRAMER BLOCK 6 - LOT 1

KRAMER BLOCK 6 - LOT 1

MW-1S MW-1D MW-2S MW-2D MW-3S MW-3D MW-4S MW-4D MW-5S MW-5D MW-6S MW-6D MW-7S MW-7D MW-8S MW-8D MW-9S MW-9D MW-10S MW-10D MW-11S MW-11D MW-12S MW-12D MW-13S MW-13D MW-14S MW-14D MW-15S MW-15D MW-16S MW-16D MW-17S MW-17D MW-18S MW-18D MW-19S MW-19D MW-20S MW-20D MW-21S MW-21D MW-22S MW-22D MW-23[RW] MW-24S MW-24D MW-25D MW-26D MW-27D MW-28D MW-29S MW-29D MW-30D MW-31D MW-32D MW-75 MW-85 MW-22D[RW]

PZ-12 PZ-14 PZ-17 PZ-40 PZ-41 PZ-42 PZ-43 PZ-60 PZ-61 PZ-62 PZ-63 PZ-64 PZ-65 PZ-66 PZ-67 PZ-68 PZ-69 PZ-70

PZRC-2A PZRC-3A PZRC-4A

LFPZ-1 LFPZ-2 LFPZ-3 LFPZ-4 LFPZ-5 LFPZ-6 LFPZ-7

TP-1 TP-2 TP-3 TP-4 TP-5 TP-6 TP-7 TP-8 TP-9 TP-10 TP-11 TP-12

CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8 CO 9 CO 10 CO 11 CO 12

PS 1 PS 2 PS 3

SW-1 SW-2 SW-3 SW-4 SW-5 SW-6

TWP-1 TWP-2 TWP-3 TWP-4 TWP-5 TWP-6 TWP-7 TWP-8

IW-PC1 IW-PC2 IW-PC3 IW-PC4 IW-PC5 IW-PC6 IW-PC7 IW-PC8 IW-PC9 IW-PC10 IW-PC11 IW-PC12 IW-PC13 IW-PC14 IW-PC15 IW-PC16 IW-PC17 IW-PC18 IW-PC19 IW-PC20 IW-PC21 IW-PC22 IW-FC28 IW-FC30 IW-FC32 IW-FC34 IW-LL3

X-7D X-7S

GROUND OBSCURED

SHADOWS

WET AREA

(SWAMP/BASIN)

OBS

PILE

ANTENNA

MANHOLE

DRAINAGE EASEMENT

SURVEY NOTES

1. MAPPED BY GEOD CORPORATION (LATEST REVISION 4/6/2020) USING PHOTOGRAMMETRIC METHODS FROM 5.0cm DIGITAL AERIAL PHOTOGRAPHY DATED 23 MARCH 2017. THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS. HORIZONTAL DATUM: NJSPCS NAD 1983, US FEET. VERTICAL DATUM: NAVD 88.

2. CONVERSION FROM NAVD88 TO NGVD29 FOR THIS SITE IS + 1.22 FEET.

GRAPHIC SCALE 120 0 60 120 240

REV.	DATE	DESCRIPTION	BY

FREY ENGINEERING, LLC
1117 STATE HWY 31
LEBANON, NEW JERSEY 08833
Phone 908-238-0502
www.freyengineering.com
No. 24GA2807300

No. 24GA2807300
Frey Engineering, LLC

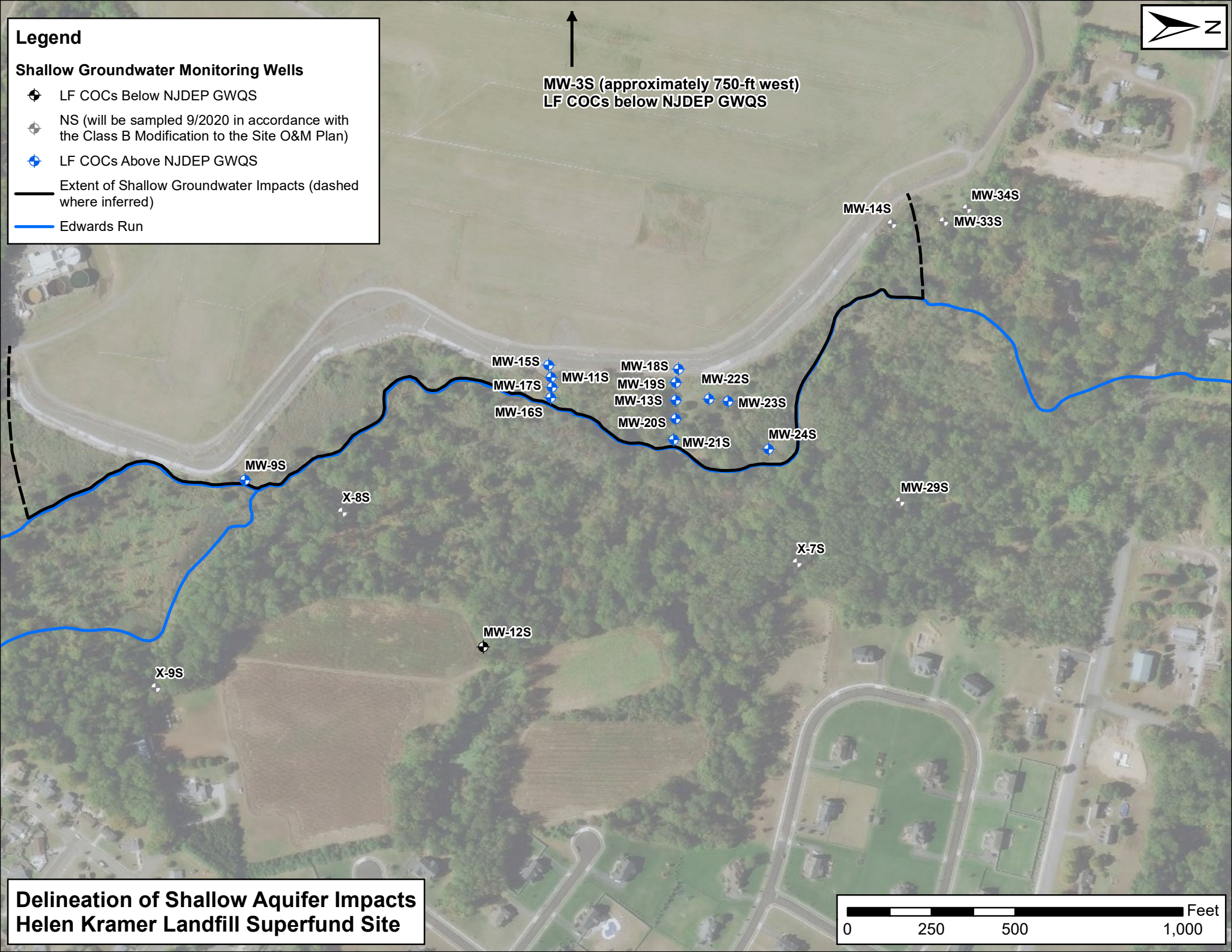
LJF
NJ Professional Engineer
License No. GE34723

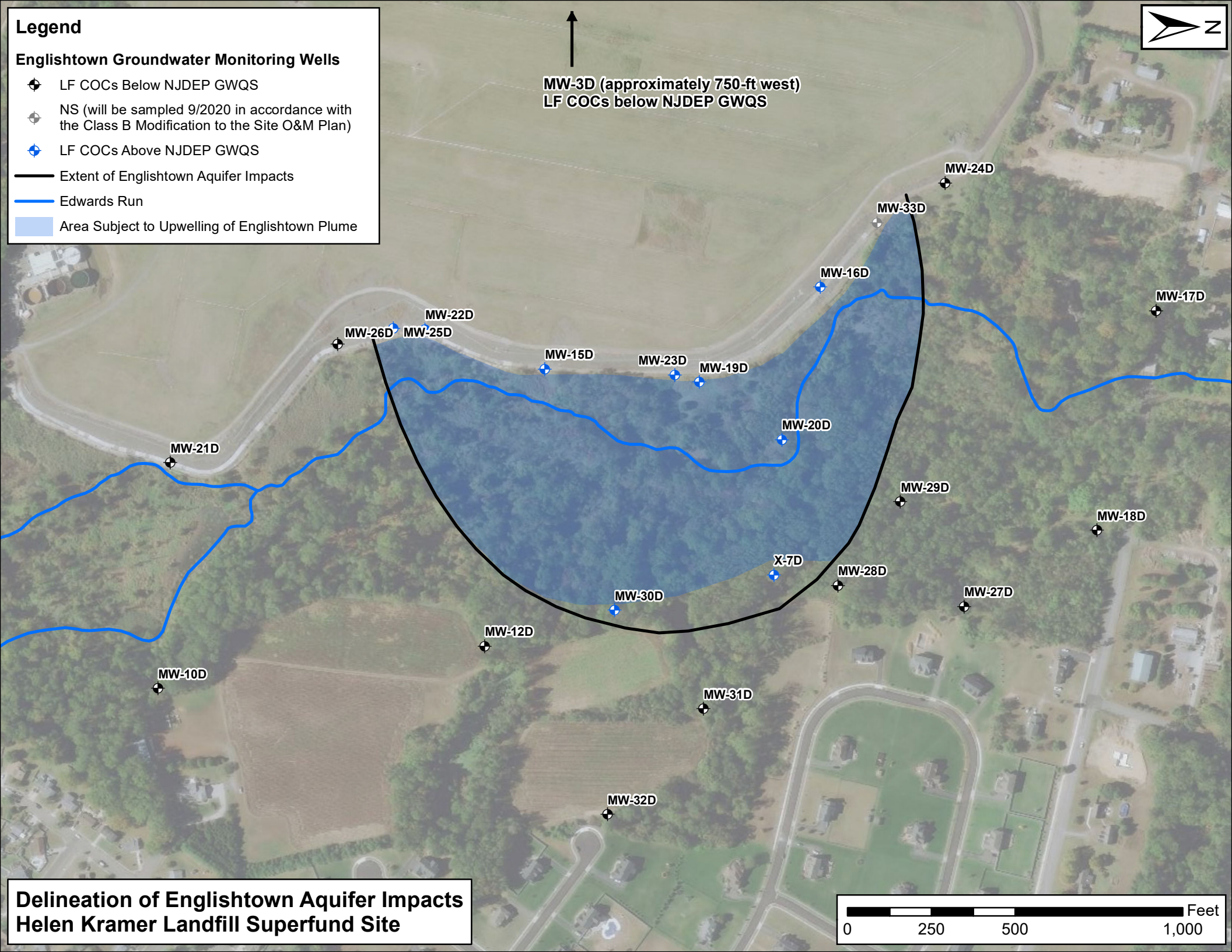
2020 SITE MAP EXPANDED

PREPARED FOR:
KRAMER LANDFILL SUPERFUND SITE
MANTUA TOWNSHIP, GLOUCESTER COUNTY, NJ

CHK:	LJF	SCALE:	1"=120'	DRAWING NO. REV. NO.
ENG.	LJF	CAD FILE NO. 2020 BaseMap		0
DATE:	MAY 2020	SHEET		

S:\FE Projects\Kramer Landfill\Drawings\2020 Drawings\2020 BaseMap.dwg, FIFE-E, 5/5/2020 12:18:52 PM, jsmith


Legend
Shallow Groundwater Monitoring Wells
LF COCs Below NJDEP GWQS
NS (will be sampled 9/2020 in accordance with the Class B Modification to the Site O&M Plan)
LF COCs Above NJDEP GWQS
Extent of Shallow Groundwater Impacts (dashed where inferred)
Edwards Run
MW-3S (approximately 750-ft west)
LF COCs below NJDEP GWQS
N
MW-14S
MW-34S
MW-33S
MW-15S
MW-11S
MW-17S
MW-16S
MW-18S
MW-19S
MW-13S
MW-20S
MW-21S
MW-22S
MW-23S
MW-24S
MW-9S
X-8S
MW-29S
X-7S
MW-12S
X-9S
Delineation of Shallow Aquifer Impacts
Helen Kramer Landfill Superfund Site
Feet
0
250
500
1,000


Legend
Englishtown Groundwater Monitoring Wells
LF COCs Below NJDEP GWQS
NS (will be sampled 9/2020 in accordance with the Class B Modification to the Site O&M Plan)
LF COCs Above NJDEP GWQS
Extent of Englishtown Aquifer Impacts
Edwards Run
Area Subject to Upwelling of Englishtown Plume
MW-3D (approximately 750-ft west)
LF COCs below NJDEP GWQS
N
MW-24D
MW-33D
MW-16D
MW-17D
MW-22D
MW-26D
MW-25D
MW-15D
MW-23D
MW-19D
MW-20D
MW-21D
MW-29D
MW-18D
X-7D
MW-28D
MW-27D
MW-30D
MW-12D
MW-10D
MW-31D
MW-32D
Delineation of Englishtown Aquifer Impacts
Helen Kramer Landfill Superfund Site
Feet
0
250
500
1,000