RECORD OF DECISION
MIDDLESEX MUNICIPAL LANDFILL FUSRAP SITE
MIDDLESEX, NEW JERSEY

SEPTEMBER 2022

PREPARED BY:

U.S. ARMY CORPS OF ENGINEERS
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BCG	biota concentration guide
BHHRA	Baseline Human Health Risk Assessment
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
Church	Middlesex Presbyterian Church
cpm	counts per minute
CSM	conceptual site model
DCGL	derived concentration guideline level
EC	environmental covenant
EPC	exposure point concentration
FEMA	Federal Emergency Management Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
IC	institutional control
LUC	land use control
MCL	maximum contaminant level
MML	Middlesex Municipal Landfill
mrem/yr	millirem per year
MSP	Middlesex Sampling Plant
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
ORAU	Oak Ridge Associated Universities
pCi/g	picocuries per gram
pCi/L	picocuries per liter
RA	risk assessment
RAO	remedial action objective

RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RIA	radiologically impacted area
RG	remedial goal
ROC	radionuclides of concern
SARA	Superfund Amendments and Reauthorization Act
Site	Middlesex Municipal Landfill (MML) Formerly Utilized Sites Remedial Action Program (FUSRAP) Site
SF	slope factor
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Atomic Energy Commission
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency

1.0 DECLARATION

1.1 Site Name and Location

The Middlesex Municipal Landfill (MML) Formerly Utilized Sites Remedial Action Program (FUSRAP) Site is in the Borough of Middlesex, Middlesex County, New Jersey (see Figure 1), approximately 16 miles southwest of Newark, New Jersey. The MML FUSRAP Site (Site) is a 37-acre property that includes parcels located on the MML belonging to the Borough of Middlesex and the Middlesex Presbyterian Church (see Figure 2). The MML was operated by the Borough of Middlesex from 1940 through 1974 and is no longer in use.

The MML is bordered to the south and east by Pershing Avenue, to the south and west by Mountain Avenue, and to the north by Bound Brook (see Figure 2). The MML includes portions of the Middlesex Presbyterian Church, Middlesex Borough Hall, and the Borough's recycling center. The majority of the MML is owned by the Borough of Middlesex and zoned for municipal use while the Middlesex Presbyterian Church (Church) property is zoned single-family residential. The northwest portion of the MML, behind the Borough Hall, is used for parking. The remainder of the Borough's land is currently undeveloped and has a permanent fence located along Mountain Avenue and Pershing Avenue.

1.2 Statement of Basis and Purpose

This Decision Document presents the Selected Remedy for the MML FUSRAP Site, in Middlesex, New Jersey, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for the MML FUSRAP Site.

This is a continuation of actions completed at the MML FUSRAP Site, which is being addressed under the U.S. Army Corps of Engineers (USACE) FUSRAP. USACE, as lead agency, has made the final remedy selection decision for the MML FUSRAP Site with New Jersey Department of Environmental Protection (NJDEP) input as the support agency with oversight responsibilities, and is documenting that decision in this Record of Decision (ROD) (NCP §300.430(f)(4)(i)). The State of New Jersey concurred with the Selected Remedy by letter dated 15 December 2021.

Comments on the Proposed Plan (USACE 2021) for the MML FUSRAP Site, provided by the Borough of Middlesex and community members, were evaluated and considered in selecting the final remedy. Specific responses to comments are provided in Section 3.0 Responsiveness Summary. The Administrative Record file may be reviewed at the Middlesex Public Library, 1300 Mountain Avenue, Middlesex, NJ 07016.

1.3 Assessment of Site

The Selected Remedy described in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances and/or pollutants or contaminants from the MML FUSRAP Site. The media impacted at the MML FUSRAP Site include soils containing uranium ore intermixed with waste material, identified as "FUSRAP-related materials". FUSRAP wastes within the MML are limited to uranium ore radionuclides as no chemical wastes were identified as being subject to the FUSRAP. Based on the findings of the Remedial Investigation (RI) (USACE 2016) and the results of the risk assessments completed at the Site, certain areas of concern present radiological risks for the anticipated future development of the property; therefore, to accommodate the anticipated future use of the MML, remedial alternatives were evaluated, and a remedy selected for addressing FUSRAP-related material. The Selected Remedy is excavation of FUSRAP-related material, radiological soil sorting to segregate radioactive material that may present a risk to human health, removal of FUSRAP-related radioactive material to an extent that will allow unrestricted use of the land as it relates to FUSRAP-related contamination, and disposal in a licensed and/or permitted landfill. The Selected Remedy meets these objectives and provides the highest level of protectiveness to human health and the environment due to the removal of FUSRAP-related materials, resulting in unrestricted end use of the property as it relates to FUSRAP-related materials.

The RI and Risk Assessment (RA) completed for the MML FUSRAP Site detected parent and daughter isotopes of natural uranium (U) and uranium ore nuggets in areas of the Site related to Middlesex Sampling Plant (MSP) disposal activities. The MSP was an industrial operation that assayed uranium and thorium (Th) ores between 1943 and 1955 for the Manhattan Engineer District and the U.S. Atomic Energy Commission (USAEC), predecessor of the U.S. Department of Energy (USDOE). Additional information on the relationship between the MML FUSRAP Site and MSP is included in Section 2.2. There are three isotopes of uranium typically found in nature: uranium-238 (U-238), uranium-235 (U-235), and uranium-234 (U-234). All three of these isotopes are unstable, emitting radiation and decaying into other elements, called daughter products. Radium-226 (Ra-226) is an example of a daughter product of U-238. Ra-226 and its daughter products typically comprise the majority of the risk to human health and the environment at sites contaminated with natural uranium ores.

The RA found that radionuclides in the U-238 and U-235 decay chain are contributors to the radiological risk at MML (USACE 2016). Activities of the isotopes U-238 and U-235 and their respective decay chains must be satisfactorily reduced to meet the applicable or relevant and appropriate requirement (ARAR) for the annual dose limit of 15 millirem per year (mrem/yr) above background, as established in New Jersey Administrative Code (NJAC) 7:28-12.8(a)(1); therefore, the U-238 and U-235 decay chains have been identified as the radionuclides of concern

(ROCs) for the MML FUSRAP Site. The RA identified that the dominant human health risk at the MML FUSRAP Site resulted from concentrations of Ra-226 in soils which poses an unacceptable human health risk due to external exposure to current and future receptors. Additionally, the Ra-226 isotope serves as a good indicator of elevated concentrations for the U-238 and U-235 decay chains and is suitable as a surrogate to determine ROC concentrations.

Ecological risk was found to be negligible and not hazardous to the fish, birds, mammals, amphibians, reptiles, and invertebrates within the Site.

No ROCs were identified in groundwater beneath MML. Radionuclide activity in groundwater at MML was observed to fall within the range observed in off-site background potable wells and below the USEPA Maximum Contaminant Levels (MCLs); therefore, remedial actions for groundwater are not necessary.

The proposed remedial goal (RG) at the MML FUSRAP Site for the ROCs is based on NJAC 7:28-12.8(a)(1), which was selected as an ARAR. The proposed RG is identified as the Total Effective Dose Equivalent of 15 mrem/yr above background. The derived concentration guideline levels (DCGLs), which are based on exposure pathway modeling, were determined to be an average Ra-226 activity of approximately 5 picocuries per gram (pCi/g) above background for unrestricted release of the Site as it relates to FUSRAP-related materials. Dose modeling was used to determine that this DCGL is protective and would reduce potential dose below the proposed RG, inclusive of all ROCs.

1.4 Description of Selected Remedy

The Selected Remedy is excavation of FUSRAP-related material, radiological soil sorting to segregate radioactive material that may present a risk to human health, removal of FUSRAP-related radioactive material to an extent that will allow unrestricted use of the land as it relates to FUSRAP-related contamination, and disposal in a licensed and/or permitted landfill. The following key components characterize the Selected Remedy:

- Conduct a pre-construction radiological survey to establish baseline site conditions.
- Excavate soil and debris containing FUSRAP-related contaminants with average concentrations greater than 5 pCi/g above background to allow for release of the MML FUSRAP Site as unrestricted use as it relates to FUSRAP-related materials.
- Mechanically screen, scan, and sort oversized debris (material larger than 2 inches) to prepare smaller material for the radiological sorting and to separate oversized material greater than their respective unrestricted use DCGL from oversized material less than their respective unrestricted use DCGL.

- Radiologically sort soils and small debris (material smaller than 2 inches) to separate material greater than their respective unrestricted use DCGL from material less than their respective unrestricted use DCGL.
- Transport and dispose of FUSRAP soils and both small and oversized debris greater than the unrestricted use DCGL in a licensed or permitted facility.
- Place segregated and sorted soils and small and oversized debris sorted below the unrestricted use DCGL within the excavated areas.
- Backfill and re-grade remaining excavation areas with uncontaminated soils from a local borrow source.
- Conduct a post-construction radiological survey to confirm mass removal of radiation above unrestricted use DCGL.
- Perform site restoration.

1.5 Statutory Determination

The USACE is issuing this Record of Decision under the NCP and CERCLA. This is a continuation of actions completed at the MML FUSRAP Site, which is being addressed under the USACE's FUSRAP. The MML FUSRAP Site has been listed in the USEPA Superfund Enterprise Management System database under Identification No. NJD980505499 and is identified by the NJDEP as Site No. 5655 with Program Interest No. 024189. The USACE was delegated the authority to clean up FUSRAP related contamination at the MML FUSRAP Site under the FUSRAP by the Energy and Water Development Appropriations Act of 1998 and subsequent Appropriations Acts.

1.5.1 Statutory Requirements

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

1.5.2 Statutory Preference for Treatment

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

1.5.3 Five-Year Review Requirements

The Selected Remedy will not result in FUSRAP-related hazardous substances, pollutants, or contaminants in soil remaining on-site above levels that allow for unlimited use and unrestricted exposure; therefore, five-year reviews will not be required for this remedial action.

1.6 ROD Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information may be found in the Administrative Record file for this Site.

ROD Data Checklist
Middlesex Municipal Landfill

ROD Data Checklist Item	ROD Section, Number Reference
The radionuclides of concern (ROCs) and their respective concentrations (Sources, Types and Extent of Contamination)	Section 2.5.3
Baseline risk represented by the ROCs (Summary of Human Health Risk Assessment and Ecological Risk Assessment)	Section 2.7.1 and 2.7.2
The cleanup levels established for the ROCs and their basis	Section 2.8.1
The principal threat source materials (Principal Threat Waste)	Section 2.13
Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the baseline risk assessment and ROD.	Section 2.6 and 2.7.1
Potential land and groundwater use that will be available as a result of the Selected Remedy	Section 2.6
The estimated costs of the Selected Remedy	Section 2.12.7
The key factors that led to the selection of the Remedy	Sections 2.12, 2.13, 2.14, and 2.15

1.7 Authorizing Signature

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Signature and Date:
Reinhard W. Koenig, P.E. SES
Programs Director
North Atlantic Division

2.0 DECISION SUMMARY

2.1 Site Name, Location, and Description

The MML FUSRAP Site is located in the Borough of Middlesex, Middlesex County, New Jersey (see Figure 1), approximately 16 miles southwest of Newark, New Jersey. USACE is the lead agency for the MML FUSRAP Site with NJDEP as the support agency. The source of FUSRAP cleanup money is authorized through the United States Congress utilizing USACE for administration and execution of FUSRAP cleanup. The MML FUSRAP Site has been listed in the USEPA Superfund Enterprise Management System database under Identification No. NJD980505499 and is identified by the NJDEP as Site No. 5655 with Program Interest No. 024189.

The MML FUSRAP Site is located on the MML, a 37-acre landfill site that includes parcels belonging to the Borough of Middlesex and the Middlesex Presbyterian Church (see Figure 2). The MML was operated by the Borough of Middlesex from 1940 through 1974 and is no longer in use.

The MML is bordered to the south and east by Pershing Avenue, to the south and west by Mountain Avenue, and to the north by Bound Brook (see Figure 2). The MML includes portions of the Middlesex Presbyterian Church, Middlesex Borough Hall, and the Borough's recycling center. The majority of the MML is owned by the Borough of Middlesex and zoned for municipal use (Borough of Middlesex 2014). The northwest portion of the MML, behind the Borough Hall, is used for parking. The remainder of the Borough's land is currently undeveloped and has a permanent fence located along Mountain Avenue and Pershing Avenue. The Borough's plan for the area is to reserve it only for active and passive recreational uses and parking requirements associated therewith (Borough of Middlesex Code, General Legislation, Chapter 252, Paragraph 4).

The Middlesex Presbyterian Church property spans 5.95 acres and is zoned single-family residential (see Figure 2). The church is located in the western portion of the property and is not within the historic fill area. The eastern portion of the property extends into the historic fill. The church uses a portion of the historic fill area for parking, and the remainder to the east is not developed.

A topographic survey of the MML was conducted in 2002 and showed a relatively flat landfill top with several depressions, possibly associated with subsurface waste subsidence (Zenith NADIR 2002). The northern/northeastern edge of the MML slopes downward approximately 20 feet to the floodplain of Bound Brook. The streambank is flat and dominated by a mature forest and ground or low-level vegetation. Mature trees and other ground cover are present along the south (Mountain

Avenue), the southeast (Pershing Avenue) perimeter fence, and on the northern side of the MML along Bound Brook. Individual trees and large bushes are also dispersed throughout the property.

The MML FUSRAP Site was broken into sub-areas called radiologically impacted areas (RIAs) based on the nature and extent of radiological contamination documented in the RI. RIA-1 is a small area along the fence on the eastern side of MML. RIA-2 is located on the northern slope of the MML. RIA-3 is the largest of the three and located on the western portion of the MML. Portions of RIA-3 are owned by the Borough of Middlesex and the Middlesex Presbyterian Church. RIA-4 is the shallow groundwater beneath MML (see Figure 2 for RIA-1, RIA-2, and RIA-3 locations).

2.2 Site History and Enforcement Activities

The MML was operated by the Borough of Middlesex between 1940 and 1974, during which time the facility received unregulated municipal and industrial wastes. There is no available record of the amount or type of waste disposal that occurred at the MML over its operational history. Operations at the MML ended in 1974 prior to the enactment of the 1976 Resource Conservation and Recovery Act (RCRA). Because the Borough of Middlesex closed the landfill prior to January 1, 1982, the Borough is not required to have a Sanitary Landfill Closure Plan (according to NJAC 7:26-2A.9). Instead, landfill closure was conducted according to standard practices in place at the time, which included the placement of cover material and vegetation.

Although the MML FUSRAP Site and MSP are two separate sites designated under FUSRAP, their interrelationship dictates that the following brief history addresses both the MML FUSRAP Site and the MSP. The MSP is located approximately 0.5 mile south of the MML. It is no longer operational, and the property is owned by the federal government. During operation, the MSP stored uranium ore that was crushed/ground, dried, screened, weighed, assayed, and shipped by the government to private and public enterprises. Spillage occurred during handling and transfer of uranium ore at the MSP resulting in contamination of site soils.

In 1948, the USAEC decided that the pitchblende (uranium ore) storage area at the MSP should be paved. The area was graded smooth and covered with asphalt. The excess soil from the grading operation was transported to the MML. It is estimated that MML received approximately 6,000 cubic yards of soil contaminated with radiologic material generated at the MSP around 1948. The soil contained small quantities of uranium ore and was dispersed over approximately 3 to 5 acres of the MML as fill and cover material for sanitary landfill operations (USDOE 1984). At the time of MML's operation, waste management regulations did not exist; it was not until 1976 that RCRA was established to regulate the transport, management, and disposal of waste material. The current FUSRAP-related radioactivity at the MML has been determined to be related to the disposal of MSP soils, as waste materials from MSP show similar distributions of radioactive isotopes (USACE 2016).

USAEC Remediation

Environmental investigations related to the disposal of uranium ore at the MML date back to May 1960 when a local civil defense exercise identified elevated radiation levels 20 to 50 times above background levels at the landfill. In response, the USAEC removed approximately 650 cubic yards of radiologically contaminated surface soils from an area of less than 0.5 acre the following year (USDOE 1989).

Radioactive materials remained following completion of this remedial action; therefore, the USAEC placed approximately 24 inches of clean cover material over the remaining radioactive material to lower the external gamma radiation levels to less than 50 microroentgens per hour (USDOE 1989).

USDOE Remediation

In 1986, the USDOE completed a remedial action that consisted of excavating additional contaminated soils from the western portion (including the area remediated in 1960) of the MML (see Figure 2). The contaminated soils were transported to the MSP where they were placed in an interim storage waste pile. The USDOE guidelines at the time provided a clean-up standard for surface soils (top 6 inches) of an average of 5 pCi/g above background across an area of 100 square meters for each of the radiologic isotopes Ra-226, Ra-228, Th-230 and Th-232. For subsurface soils, the clean-up standard was 15 pCi/g above background across an area of 100 meters for each of these isotopes (USDOE 1989). The excavation covered approximately 4 acres and to depths of up to 18 feet. The remedial action included segregating contaminated materials from clean materials in 1-foot layers. Materials that were determined not to be contaminated were stockpiled and then used for backfilling after the excavation was complete. It is estimated that approximately 31,200 cubic yards of radioactive material were excavated from MML, placed in a stockpile at MSP, and then disposed of at a permitted facility by USACE in 1998 under the MSP FUSRAP remedial project (USACE 2010).

During the confirmation survey of the backfilled areas completed by Oak Ridge Associated Universities (ORAU), elevated gamma readings were reported across 10 percent of the excavated area and additional uranium ore nuggets were identified and removed at the surface (ORAU 1987). Following the remedial action, the 5-acre worksite at the MML was certified as compliant with the applicable radiological cleanup criteria and released for unrestricted use based on the criteria used at the time (USDOE 1989).

Borough of Middlesex Radiological Survey and Remedial Investigation

In 2001, the Borough of Middlesex conducted a radiological survey under the direction of the NJDEP as part of conditions set forth in the landfill remedial program. The survey identified elevated radiation levels at the southeast boundary of MML along Pershing Avenue, located

approximately 820 feet south of the 1984-1986 USDOE Remedial Action. This area is in the vicinity of a water line extension completed in October 1998 and did not have a radiological survey performed during prior investigations. Ambient dose rates (measured approximately 3 feet above ground) and contact dose rates (measured at ground level) were observed to be distinctly higher when compared to the remaining MML survey area. Analytical sampling was not conducted during the survey (Sadat 2007).

The Borough of Middlesex conducted a Remedial Investigation between 2002 and 2005 under the direction of NJDEP in order to meet the conditional requirements under an NJDEP 1993 Administrative Consent Order and resulting 1998 Memorandum of Agreement between the two entities as part of the landfill remedial program. Activities conducted as part of the Borough Remedial Investigation were performed in accordance with guidance provided under NJAC 7:26E-4.6, Remedial Investigation of Landfills. Additional data were collected in response to a notice of deficiency issued by NJDEP after review of the Remedial Investigation report and a revised report, combined with a conceptual remedial work plan, submitted in 2007. The Remedial Investigation included test pit excavation, soil borings, and installation of temporary wells, piezometers, and soil gas points. Both chemical and radiological data were evaluated during this investigation. The conceptual remedial work plan proposed excavation and offsite disposal of soils from two areas in RIA-3 within or adjacent to the USDOE excavation that was conducted between 1984 and 1986. This proposed remediation is in response to non-FUSRAP-related waste. It proposed removal of 500 cubic yards from one area and 5,000 cubic yards from a second area in order to remove soils contaminated with petroleum, polychlorinated biphenyls, and metals (Sadat 2007).

ATDSR Public Health Assessment and Health Consultations

The Agency for Toxic Substances and Disease Registry (ATSDR) performed an independent public health assessment to determine if contaminants associated with the MSP site located 0.5 miles south of the MML created a hazard to public health (ATSDR 2002). According to the Foreword in the ATSDR Public Health Assessment Guidance Manual, "The mission of the ATSDR is to serve the public by using the best science, taking responsive public health actions and providing trusted health information to prevent harmful exposures and disease related to toxic substances. The ATSDR public health assessment process serves as a mechanism to help ATSDR sort through the many hazardous waste sites in its jurisdiction and determine when, where, and for whom, public health actions should be taken. Through this process, ATSDR finds out whether people living near or at a hazardous waste site are being exposed to toxic substances, whether that exposure is harmful, and what must be done to stop or reduce any exposure." ATSDR collected groundwater samples from all MSP monitoring wells and 17 nearby private wells in February and April of 2000. Given the proximity of the MML to the MSP, the sampling of the 17 private wells is also pertinent to potential groundwater concerns from the MML. Based on its evaluation, the ATSDR determined that no exposures posing public health hazards occur now or are likely to occur in the future. Note that this assessment occurred prior to the USACE removal of

contaminated soils at the MSP site in 2008 which further reduces any potential hazard to the public (USACE 2010).

2008 USDOE Radiological Survey

Following the work performed by the Borough of Middlesex and at the request of the NJDEP, the USDOE performed an additional radiological survey. The survey was performed to determine whether observed elevated surface radiation levels near Pershing Avenue were indicative of residual deposits of radioactive material in the near-surface soil not remediated under the 1984-1986 USDOE Remedial Action. Locations of observed elevated gamma readings appeared to be consistent with the results of the 2001 radiological survey, primarily concentrated along the Pershing Avenue fence line. In addition, elevated levels of gamma radiation were detected in RIA-3. During the survey, surface and sub-surface soil samples were also collected from five discrete locations across the MML, including three samples within the extents of RIA-3 and two from the Pershing Avenue area (USDOE 2008). The survey findings resulted in a USDOE determination to refer the MML to USACE for further evaluation.

2010 USACE Preliminary Assessment and Site Inspection

Following the CERCLA process, the USACE first performed a CERCLA Preliminary Assessment. The Preliminary Assessment included a review of available literature to determine the potential for the presence of hazardous materials and the potential risk of impacts to human health or ecologic resources regarding radiologic contaminants at the MML. The Preliminary Assessment determined that potential radiological impacts related to FUSRAP material may be present and progressed to a Site Inspection. During the Site Inspection, data were collected to confirm the Preliminary Assessment findings and support the planning of a Remedial Investigation. The USACE completed the Site Inspection in 2010 with more thorough radiologic surveys, as well as collection of 103 surface and subsurface soil samples (USACE 2010).

2014-2016 USACE Remedial Investigation

The next step in the CERCLA process involved completing a RI to determine the full nature and extent of the FUSRAP contamination. The USACE completed this between 2014 and 2016. The sampling effort included three separate walkover gamma scan surveys to confirm and fill in data gaps identified from the 2010 Site Inspection. Surface and subsurface soil sampling and downhole gamma profiling were conducted at 154 locations across the MML FUSRAP Site. Fourteen additional test pits were also installed onsite in RIA-1 and RIA-3 to investigate elevated radiological levels. The test pits were minimal excavations conducted to understand subsurface conditions and were completed to determine if uranium ore nuggets were present at locations with higher radioactivity than at the surface. Additionally, background samples were collected offsite at Lake Nelson on Ambrose Brook in Piscataway to establish background radioactivity of the region (USACE 2016).

Groundwater sampling was also conducted during the RI field program. Thirteen onsite monitoring wells were sampled for radioactive contaminants. Additionally, 11 potable wells in the surrounding area were sampled for radiological data to confirm no elevated contaminants were present and to establish background conditions for the area. Sediment and surface water samples were collected at 10 locations along Bound Brook located upstream, adjacent to, and downstream of the study area. Five additional surface water and sediment samples were collected from remnant and oxbow pond areas on the northern part of the MML FUSRAP Site.

Based on an evaluation of the sample results, the RI recommended four RIAs be evaluated further in the Feasibility Study. The RIAs are shown on Figure 2. RIA-1 through RIA-3 are areas where uranium ore nuggets and impacted soils were identified, while RIA-4 is the groundwater below the MML FUSRAP Site.

The area identified along the Pershing Avenue right-of-way with elevated radioactivity was determined to be not related to FUSRAP activities (USACE 2016). The radioactive characteristics found in samples collected from this area were found to be different from uranium ore. Uranium ore has higher concentrations of uranium than are typically found naturally in soils and rock. The ratio of isotopes and daughter products found in uranium ore are relatively consistent with decay of the decay chain parent isotope (e.g., U-238 or U-235). The radioactive materials found in samples collected from the Pershing Avenue right-of-way were found to have daughter products of uranium in different ratios than would be seen from the decay of U-238 in uranium ore, thus indicating these radioactive materials were derived from some other material or process. Activities at the MSP did not include processing that would alter the isotopic ratio of the material. In addition, no uranium ore nuggets were found during investigations in this area, as typical of the waste from the MSP and the other soil RIAs. Materials that were found in the ground exhibiting radioactivity at the Pershing Avenue right-of-way were concrete debris and a radioluminescent dial (dial painted with radium). The USACE is authorized to remediate contamination related to early atomic energy program activities only; therefore, the radioactive contamination found along Pershing Avenue cannot be addressed by the USACE under FUSRAP. The RI report provides additional information. This area is to be addressed with the remainder of the MML (i.e., in the Borough's efforts).

2017-2018 Pilot Study

A pilot study was completed between 2017 and 2018 to evaluate a radiological soil sorting technology and determine its capabilities to support a remedial effort at the MML FUSRAP Site. Soils contaminated with FUSRAP materials found in RIA-2 were used in the pilot study. During excavation of contaminated soils, significant amounts of soils that are not contaminated inevitably were excavated along with the contaminated soils. This pilot study helped determine the soil sorter's ability, effectiveness, and efficiency for separating radiologically contaminated soil from uncontaminated soil. This resulted in reducing the amount of soil to be treated or shipped offsite

for disposal at a licensed/permitted landfill. The soils were sorted by detecting the radioactivity produced by Ra-226—a decay product of uranium that produces gamma rays (a form of radiation) that are readily detectable. The pilot study concluded that the sorter could reduce the volume of soil requiring offsite disposal by 78 percent and recommended the technology be evaluated in the Feasibility Study as a remedial option.

During pilot study activities, approximately 1,190 cubic yards of soil were excavated from RIA-2 for use in the pilot study. The excavation was guided using a radiological gamma detector and soils were removed until background levels were reached. Uranium ore nuggets and elevated radiological activity were discovered in soils across nearly the entirety of 0.5 acre of RIA-2. The contamination primarily occurred in the soils used for cover material for the MML, with waste intermixed throughout. Fifty-seven uranium ore nuggets of various sizes were removed from RIA-2 soils, and some were selected for use as radiological sources to test the soil sorter. The pilot study report is included as Appendix A of the Feasibility Study report (USACE 2019).

Following the pilot study, a final status survey, which includes a gamma walkover survey and soil sampling program, was conducted in accordance with the *Multi-Agency Radiation Survey and Site Investigation Manual* to evaluate the resulting conditions of RIA-2. The survey concluded that radioactivity in samples collected from this area after the excavation are indistinguishable from background radioactivity. Therefore, remedial action is not necessary in this area (USACE 2019).

2.3 Community Participation

Community participation activities provide the public with an opportunity to express its views on the preferred remedial action. USACE considered State and public input from the community participation activities conducted during the Remedial Investigation/Feasibility Study (RI/FS) in selecting the remedial alternative to be used for the MML FUSRAP Site. Community participation was provided in accordance with CERCLA, as amended by SARA.

The Proposed Plan for the MML FUSRAP Site in Middlesex, NJ, was made available to the public on 02 August 2021. This document, along with the RI and FS, is in the Administrative Record file maintained at the Middlesex Public Library in Middlesex, NJ. The notice of availability for the document was published in the Star Ledger and Home News Tribune as well as on the USACE New York District website. A notice of availability was also mailed to residents within a quarter mile of the MML FUSRAP Site. A public comment period was held from 02 August 2021 through 03 September 2021. In addition, a virtual public meeting was held on 18 August 2021. During the virtual public meeting, representatives from USACE provided information and answered questions about contamination at the MML FUSRAP Site and the remedial alternatives under consideration. A response to the comments received during this meeting is included in the Responsiveness

Summary (Section 3) of this ROD. A transcript of the public meeting has been provided as Attachment 2.

2.4 Scope and Role of Response Action

The USACE is responsible for addressing FUSRAP waste, which is defined at the MML FUSRAP Site as uranium ore related wastes. Uranium is an element that is commonly found in low levels in the soils and rock of the earth. Uranium ore contains minerals with higher concentrations of uranium than typically found in soils and rock. The three uranium isotopes are U-238, U-235, and U-234 which are found in consistent ratios in uranium ore. All three of these isotopes are unstable and emit radiation as they decay into other elements. These other elements are called daughter products and are also unstable, emitting radiation until they decay into a stable form of lead. The Feasibility Study identified U-238 and U-235 and daughter products as radionuclides of concern at the MML FUSRAP Site (U-234 is a daughter product of U-238). The types of radiation emitted by each element or daughter product can be different. There are three primary forms of radiation emitted from these unstable elements—alpha, beta, and gamma radiation. Gamma radiation has the highest penetrating power and therefore can travel much farther in the environment than alpha or beta radiation. Because of this, gamma radiation is easily detected. Ra-226 is a decay product of U-238 and an emitter of gamma radiation. In natural uranium ore the Ra-226 activity is equivalent to the U-238 activity. This is known as equilibrium. Ra-226 produces gamma radiation that is easier to measure than that of U-238. In addition, Ra-226 and its daughter products typically comprise the majority of the risk to human health and the environment at sites contaminated with natural uranium ores. Evaluation of the soil data has shown that Ra-226 activity is co-located with U-238 and U-235 and their decay products throughout the Site. The dominance of Ra-226 as a risk contributor and the co-location of elevated activity of the radionuclides show that Ra-226 can be used as a surrogate radionuclide during the remediation. As a result, the summary of the contaminated soils discussed below focuses on the location and extent of Ra-226, a known and readily quantifiable component of the uranium ore, as a surrogate for uranium and daughter products. Targeting Ra-226 for remediation will sufficiently remove the risk associated with radiation while also resulting in a significant reduction in the total activity associated with the uranium isotopes and other radioactive decay products.

The RI indicated that FUSRAP-related radioactive material was present above background levels in surface and subsurface soils at the MML FUSRAP Site. The following sections present a summary of the nature and extent of radionuclide activities for each of the four RIAs that were identified during the RI. It should be noted that surface water and sediment samples were collected from Bound Brook and the oxbow pond onsite as part of the RI. Analysis of these results in the RI report concluded that the samples were similar to background concentrations and do not present a risk to human health or the environment. Therefore, sediment and surface water were not included in RIAs.

Background Levels

Low-level radioactivity naturally occurs in the environment; therefore, to evaluate radioactivity at the MML FUSRAP Site it is important to understand the level of radioactivity naturally occurring at this location (i.e., the background levels of radioactivity). To determine background levels, 39 samples were collected from areas that would only contain natural levels of radioactivity. For this evaluation, soil samples were collected from the Borough of Middlesex in the following locations: (1) Mountain View Park, located approximately 0.5 mile from the MML FUSRAP Site; (2) Veteran's Park, located on Ambrose Brook south of the MML FUSRAP Site; and (3) the banks of Lake Nelson, also located on Ambrose Brook. The background concentration for Ra-226 was determined to be 1.00 pCi/g.

Soils RIA-1

RIA-1 has a footprint of approximately 0.22 acre and represents the soils and waste material in the vicinity of an area where a uranium ore nugget was found and elevated Ra-226 concentrations have been observed. Radionuclide contamination is limited to a small area within RIA-1 and at depths of up to 2.5 feet from the surface. The soil radionuclide activity and uranium ore nugget activity observed together in RIA-1 resulted in an exposure point concentration that was determined to pose a potential unacceptable cancer risk. Figure 3 presents the Ra-226 results from samples collected in this area. A summary of the results is presented below.

Summary of Radionuclide Activity in Soils in RIA-1

Parameter	Number of Samples	Background Concentration	Maximum Detection	Average Concentration
Radium-226	35	1.00 pCi/g	10.7 pCi/g	5.01 pCi/g

Maximum and average concentration are inclusive of background radium-226 concentration.

Soils RIA-2

RIA-2 is located on the northern slope of the MML where 11 uranium ore nuggets and diffuse radioactive soils were discovered during previous investigations. The contaminated soils were removed during the Pilot Study (USACE 2019) and used to study the capabilities of radiological soil sorting technology. A total of 1,190 cubic yards were removed from an area of about 0.34 acre and disposed of in an offsite landfill that is licensed/permitted to handle the waste.

As discussed in Section 2.3, a radiological survey, including a gamma walkover survey and soil sampling program, was conducted to document the conditions of soils remaining after the contaminated material was removed. The gamma walkover survey was performed over 100 percent of RIA-2 following the excavation. The maximum observed count rate during the gamma walkover survey was below the background levels established for the RI. The survey also included

the collection of 27 soil samples, which were analyzed for the presence of Ra-226. The average Ra-226 concentration for the soil samples was 1.00 pCi/g, which is equal to the background concentration of the MML, as determined during the RI (USACE 2016).

Two statistical tests were performed using the survey data in accordance with the *Multi-Agency Radiation Survey and Site Investigation Manual*, which is used to determine if a site is in compliance with a radiation dose or risk-based regulation. Both statistical tests indicated that the Ra-226 concentrations were indistinguishable from background concentrations. Additionally, the highest net sample result was 1.65 pCi/g Ra-226 which is well below the remedial action objective for unrestricted use presented in Section 2.8. Following the Pilot Study, the excavation area was backfilled with clean soil from offsite locations and then revegetated with grass. No additional remedial action is necessary in RIA-2.

Soils RIA-3

RIA-3 has a footprint of approximately 7.4 acres and includes the area that the USDOE excavated during 1984 to 1986. The soil radionuclide activity and uranium ore nugget activity observed together in RIA-3 resulted in an exposure point concentration that was determined to pose a potential unacceptable cancer risk. Further discussion of risk is presented in Section 2.7. Figure 4 presents the Ra-226 results from soil samples collected in this area. A uranium nugget collected from RIA-3 was sent for analysis, as well. A summary of the results is presented below:

Summary of Radionuclide Activity in RIA-3

Parameter	Number of Samples	Background Concentration	Maximum Detection	Average Concentration
Soil				
Radium-226	1,053	1.00 pCi/g	185 pCi/g	5.01 pCi/g
Uranium Nugget				
Radium-226	1	1.00 pCi/g	142,000 pCi/g	

Maximum and average concentration are inclusive of background radium-226 concentration.

The contaminated soils in RIA-3 are assumed to originate from historical disposal of contaminated soil wastes from MSP operations that had remained after the 1984-1986 USDOE Remedial Action effort. As discussed in Section 2.2 the previous remedial effort utilized a higher criterion than that in this remedial action (see Section 2.8). The RI data indicated that radioactive material above background levels was distributed across RIA-3, particularly in the footprint of the 1984-1986 USDOE Remedial Action. Radionuclide contamination was identified in samples at depths of up to 14 feet below ground surface (bgs).

Groundwater RIA-4

During the RI activities, 13 monitoring wells were sampled onsite. Nine of these wells are screened in the overburden and four of them are screened in bedrock (see Figure 5). In addition, 14 offsite potable wells were sampled to establish a background of naturally occurring radionuclide activity for the area. Groundwater samples were analyzed for the presence of radionuclides and compared to MCLs established in the National Primary Drinking Water Regulations as presented in the Code of Federal Regulations (CFR), 40 CFR 141. Relative to offsite potable wells and the MCLs, the nature and extent of radioactivity in onsite groundwater is comparable to that in background levels and indicated that radioactive contaminants in soils at the MML were not migrating to groundwater. No samples showed concentrations of radionuclides above MCLs. The results of the sampling event conducted in 2015 are summarized below:

Summary of Radionuclide Activity in RIA-4

Parameter	Number of Samples	USEPA MCL	Maximum Detection	Average Concentration
Onsite Monitoring Wells				
Ra-226+Ra-228	13	5 pCi/L	3.32 pCi/L	0.857 pCi/L
Total Uranium		30 µg/L	6.6 µg/L	1.5 µg/L
Gross Alpha		15 pCi/L	10.4 pCi/L	2.62 pCi/L
Gross Beta		50 pCi/L*	44.8 pCi/L	15.1 PCi/L
Offsite Potable Wells				
Ra-226+Ra-228	14	5 pCi/L	1.72 pCi/L	0.636 pCi/L
Total Uranium		30 µg/L	1.3 µg/L	1.0 µg/L
Gross Alpha		15 pCi/L	2.01 pCi/L	3.40 pCi/L
Gross Beta		50 pCi/L*	4.14 pCi/L	2.25 pCi/L

Note:

*Although not applicable to the MML FUSRAP Site, the concentration of 50 picocuries per liter (pCi/L) is used as a screening level or "trigger" concentration to determine if additional testing is necessary to determine if levels may be greater than the dose based USEPA man made beta emitters MCL of 4 mrem/yr (40 CFR 141.26(b)(1)(i)).

2.5 Site Characteristics

2.5.1 Overview

The Site characteristics summarized here are described in the RI Report, Middlesex Municipal Landfill FUSRAP Site (USACE 2016) and Final Feasibility Study Report, Middlesex Municipal Landfill FUSRAP Site (USACE 2019).

2.5.2 Site Geology/Hydrogeology

Prior to landfill operations, the MML consisted of a series of wetland depressions. These wetlands were systemically filled during MML activities from approximately 1940 to 1974. The MML is underlain by three main geological strata: overburden, weathered bedrock, and intact or "competent" bedrock. The overburden can be divided into two substrata: the landfill material (including the cover material) and the underlying Quaternary alluvium.

Overburden

Based on USDOE geologic records, within and near the 1984 to 1986 USDOE remedial action area, the overburden material was observed at depths between approximately 16.5 feet bgs and 34.2 feet bgs. This was on the northerly end of the landfill where soils from the MSP were deposited in RIA-3 (USDOE 1984). Native overburden material, or the Quaternary alluvium, lies beneath the landfill material and consists primarily of gray, red, and brown fine-grained to medium-grained sand and contains occasional clay and silty clay lenses. The alluvium primarily is comprised of sediments eroded from inland areas that have been deposited in floodplains of Bound Brook. Soil borings from the RI field program indicated that landfill material (or non-native material) is present at depths of up to 19.6 feet bgs. Municipal refuse was observed across the MML and within the footprint of the 1984-1986 USDOE Remedial Action area.

Competent and Weathered Bedrock

The Borough of Middlesex is located in the Piedmont physiographic province, which has been defined by the New Jersey Geological Survey as chiefly low rolling plains divided by a series of higher ridges. It is mainly underlain by slightly folded and faulted sedimentary rock of Triassic and Jurassic age and igneous rocks of Jurassic age (New Jersey Geological Survey 2006). The competent bedrock at the MML is the Brunswick Shale of the Passaic Formation. As part of the USDOE geological work at the MML, competent bedrock was encountered at depths between approximately 20 and 37.5 feet bgs (USDOE 1984).

Hydrogeology and Groundwater

Groundwater flows through the soil overlaying the bedrock, known as overburden, and bedrock at the MML. Groundwater flow through the overburden is generally not significant enough to be used as a potable source. The overburden aquifer observed at MML is relatively thin, on the order of feet, and flows north towards Bound Brook while also likely leaking into the bedrock aquifer. The bedrock aquifer, which is the regional aquifer in central and northeastern New Jersey, is contained within fractures of the formation called the Brunswick Shale and provides a water supply source to the area (Michalski and Britton 1997). A geologic formation is a series of bedrock layers with similar characteristics. The groundwater flow is through the fractures in the bedrock. Groundwater onsite at the MML is not used for any potable, commercial, or industrial purposes. Regionally, wells in the bedrock aquifer range from 30 to 1,500 feet bgs. Common well yield rates

of the formation are 10 to 500 gallons per minute, although well yields have exceeded 1,500 gallons per minute. The regional bedrock aquifer in the vicinity of MML contains naturally occurring radionuclides (U.S. Geological Survey 2014).

2.5.3 Conceptual Site Model

Three possible routes were identified at the MML FUSRAP Site with the potential to influence the transport of radionuclides from the landfill soils to other environmental media such as groundwater. These potential routes are dependent on the geochemical conditions of each radionuclide and include:

- Migration of radionuclides from surface soils to air via dust generation; migration of radioactive gas through soils via diffusion; or migration of radioactive gas from water via volatilization.
- Leaching of residual radionuclides from the soil vadose zone to groundwater during infiltration of precipitation through the non-native material.
- Transport of radionuclides to surface water and sediments during stormwater runoff, flooding of wetlands, or groundwater discharge.

The potential for radionuclides to migrate from soil to other media via these mechanisms were assessed through a geochemical conceptual site model (CSM) and supported with field data where appropriate. The geochemical CSM prepared for the MML FUSRAP Site and presented in the RI was based on the chronology of landfill activities, measured radionuclide activities in field samples, and identification of uranium ore nuggets and non-FUSRAP material observed during field and remedial activities.

The geochemical CSM described above was used to develop a conceptual site exposure model for the risk assessment to evaluate potential current and future exposure scenarios. A brief description of the human exposure scenarios is provided below:

- Trespassers and recreational users, both adult and adolescent, may come into contact with contaminated surface soil, surface water, and sediment while traversing or recreating at the Site;
- Outdoor maintenance workers may come into contact with contaminated surface soils while conducting maintenance activities at the Site;
- Future indoor workers may casually contact surface soils or use groundwater as a potable water supply while conducting indoor work at the Site;

- Construction or utility workers may come into contact with surface and subsurface soils or shallow groundwater while conducting construction or utility installation, maintenance, or repairs at the Site; and
- Future residents, both adult and child, may come into contact with surface and subsurface soils while performing yard work or use groundwater as a potable water supply while residing at the Site.

2.5.4 Contaminant Fate and Transport

The contaminant fate and transport of the ROCs at the MML FUSRAP Site are highly dependent on the chemical form, bioavailability, and mobility of the individual radionuclides, as well as potential routes of migration under the current site conditions. Several geochemical factors influence the environmental persistence and mobility of radionuclides, including oxidation-reduction potential, cation exchange capacity, and sorption of radionuclides onto fine-grained iron oxides. Radionuclide mobility is also affected by pH levels, total suspended solids, sulfur species and carbonate alkalinity. The specific geochemical conditions that encourage or mitigates mobility of parent uranium, thorium, and radium radionuclides and their daughter isotopes are detailed in the RI.

Migration to Air

The air migration pathway does not appear to be a dominant transport mechanism at the Site under the existing site conditions. Radionuclides released from soils typically result as airborne dust stemming from near-surface winds, disturbance from vehicular movement, or construction activities such as intrusive investigation or remedial work. Air monitoring conducted during intrusive investigation and remedial work within or near the RIAs did not result in conditions that posed a radiological hazard on-site or off-site (USACE 2016).

As noted in the RI, background soils within the Borough of Middlesex had an overall ranking of "moderate radon potential" (Tier 2), based on a statewide evaluation of the potential natural radon exposure from soils conducted by the NJDEP (NJDEP 2015). Radon is an inert radioactive gas resulting from the decay of radium that can migrate through soils via diffusion or volatilize from water. Exposure to radon is dependent on many factors, including the Ra-226 levels in soils and the ventilation rate in structures contacting soil. Radon may exist as an indoor air hazard when it can accumulate in building crawl spaces and interiors that have little to no air movement; however, no buildings are currently located within the RIAs.

Migration to Groundwater

Leaching of residual radionuclides from the soil vadose zone to groundwater during infiltration of precipitation is a potential route of migration at the Site. The extent of leaching depends on the

radionuclide's solubility, adsorption partitioning, amount of precipitation, and the acidity of the percolating water. Radium (in the form of Ra-226 and Ra-228) was the only ROC identified in the RI as potentially leachable based on the observations from groundwater sampling (USACE 2016).

Based on the RI groundwater samples, radionuclide activities reported in on-site overburden and bedrock groundwater samples were not significantly different from off-site potable wells for all examined parameters, except for gross beta screening. On-site overburden groundwater for gross beta was elevated when compared to both off-site potable well groundwater and on-site bedrock groundwater gross beta results; however, there does not appear to be any significant migration of FUSRAP contamination to groundwater at the Site.

Migration into Surface Water and Sediment

Transport of radionuclides to surface water and sediments during stormwater runoff (as well as flooding and drainage of wetlands) and groundwater discharge does not appear to be a significant migration mechanism at the Site. Based on the sediment data, radionuclide activity in Bound Brook sediments appeared to be only slightly elevated downstream (between RM 1.0 and RM 0.5) when compared to background levels; however, the uncertainty in the measurements suggests that the activities are generally similar. Therefore, the RI could not definitively identify sediment transport from surface water runoff as the migration mechanism. Similarly, the radionuclide activity in surface water collected in the vicinity of the Site was generally similar when compared to upstream surface water.

2.6 Current and Potential Future Land and Resource Uses

Current on-site land uses of MML include the Middlesex Presbyterian Church, Middlesex Borough Hall, and the Borough's recycling center. The majority of the MML is owned by the Borough of Middlesex and zoned for municipal use while the Church property is zoned single-family residential. The northwest portion of the MML, behind the Borough Hall, is used for parking. The remainder of the Borough's land is currently undeveloped and has a permanent fence located along Mountain Avenue and Pershing Avenue.

Land surrounding the MML consists of residential parcels to the northwest, south, and west and wooded floodplain northeast and east. Several ponds, wetlands, and drainage areas are present in the floodplain which is adjacent to Bound Brook.

Anticipated future land use at the MML FUSRAP Site is an important consideration when determining the appropriate extent of remediation and the RGs. Future land use affects the type and frequency of exposure that may occur from residual contamination remaining onsite, which in turn is a consideration in the selection of remedial actions. Conversely, the alternatives selected through the CERCLA remedy selection process may limit the future use of Site areas and resources

after remedial actions are completed. According to the Borough of Middlesex Code, General Legislation, Chapter 252, Paragraph 4, "the former landfill site [is to] be protected from being used as a residential or commercial property and that the site [is to] be reserved for and used only for both active and passive recreational uses and parking requirements associated therewith." Active recreation refers to uses that require special facilities, courses, fields, or equipment, while passive recreation does not require special facilities. Passive recreational uses result in minimal disturbance of a site and use more natural ecosystem-based designs, such as planted fields with walking trails. The future land use described in the Borough of Middlesex Code is in line with the natural resources observed at the MML, including the riparian areas, wetland areas, and vegetated open space, which comprise the majority of the MML. The Borough's plan for the area is to create a recreational park on top of the MML which is contingent on future actions of the Borough to appropriately close MML in accordance with state regulations. The portion of the church property that is within the extents of the MML FUSRAP Site and RIA-3 is currently used for parking. This is the anticipated future use of the Church property.

Currently at MML the groundwater is not used for any purpose, this is anticipated to remain the future condition for both the Borough and Church properties.

2.7 Summary of Site Risks

As part of the overall RI/FS activities at the MML FUSRAP Site, a Baseline Human Health Risk Assessment (BHHRA) and a Screening Level Ecological Risk Assessment (SLERA) were conducted. These RAs were prepared to better understand the potential current and future impacts of Site contamination on human health and the environment. The details of the RAs are found in *Risk Assessment Volume 2 of 2, Middlesex Municipal Landfill FUSRAP Site, Borough of Middlesex, New Jersey* (USACE 2016). This documents the potential risks to humans and ecological receptors that result from exposure to contaminated soils and groundwater at the MML FUSRAP Site.

The ROCs found at the MML FUSRAP Site were quantitatively characterized to understand the potential risks to human health from exposure to these contaminants. The results of the RA are used to:

- Document and evaluate potential risks to human health, i.e., potential indoor workers and/or future residents;
- Assess the need, if any, for remedial action; and
- Support the evaluation of remedial alternatives in the FS relative to the "no action" alternative.

Many of the radionuclides detected at MML occur naturally and are present at some concentration in almost all soils and groundwater. Human activities may increase the concentration of these natural materials or other chemicals not normally found at the Site. The MML RI identified the naturally occurring (background) concentrations of radionuclides in the vicinity of the MML FUSRAP Site. These background concentrations were compared to the site-measured concentrations to determine which contaminants needed to be addressed in the RA. The RI Report concluded that, based on potential health impacts, there are some radionuclides that needed further evaluation in the FS. The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Summaries of the results of these RAs are presented below.

2.7.1 Summary of Baseline Human Health Risk Assessment

The BHHRA estimates what risks the Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline RA for this Site.

2.7.1.1 Identification of Radionuclides of Concern

Table 1 lists those ROCs for which a determination was made that remediation was required, along with the range of concentrations detected and frequency of detection within RIA-1. Table 2 presents a summary of concentrations found within RIA-3.

2.7.1.2 Exposure and Toxicity Assessment

Section 2.5.3 discusses the conceptual site model of environmental transport media and principal exposure routes for contaminated soil at the MML FUSRAP Site.

Currently, the Site is not occupied and little to no exposure to Site contaminants is occurring. However, the USACE evaluated adverse health effects to human populations should use of the Site change in the future.

Based on current zoning and anticipated future use, the following scenarios were evaluated in the BHHRA:

- Trespassers and recreational users, both adult and adolescent, that may come in to contact with surface soil, surface water, and sediment;
- Outdoor maintenance workers that may come into contact with surface soils;
- Future indoor workers that may come into contact with surface soils as well as groundwater (for RIA-3 and limited recreational offices);

- Construction or utility workers that may come into contact with surface and subsurface soils as well as groundwater in the overburden; and
- Future residents, both adult and child, that may come into contact with surface and subsurface soils as well as groundwater (for RIA-3 only and for data to support an unlimited use and unrestricted exposure determination).

Along with the concentration ranges, Tables 1 and 2 present the exposure point concentration (EPC) for each of the ROCs detected in the site soils (i.e., EPC is the concentration that is used to estimate the exposure and risk from each ROC in the soil). Parameters used to quantify exposure for the receptors were developed based on a reasonable maximum exposure. The reasonable maximum exposure parameters are intended to represent the highest exposure that is reasonably expected to occur at the Site, and to ensure that risks incurred were not underestimated for any population. The BHHRA assumes that no remediation or institutional controls to mitigate or remove hazardous substance releases.

The slope factor is unique to each radionuclide based on its toxicology and exposure pathway. The slope factor is an estimate of an upper-bound probability of an individual developing cancer as the result of a lifetime exposure to a carcinogen and is generally expressed as the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used in the risk characterization step to estimate the likelihood of developing cancer. Table 3 summarizes the slope factors used to evaluate cancer risk for each pathway in the BHHRA.

2.7.1.3 Risk Characterization

USEPA classifies the ROCs at the MML FUSRAP Site as human carcinogens, which is presented as cancer risk in the BHHRA. For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

Where: risk = a unitless probability (e.g., 2×10^{-5}) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(\text{mg/kg-day})^{-1}$.

As defined by the NCP, a calculated cancer risk between 1 in 10,000 and 1 in 1,000,000 is recognized as an acceptable probability of an individual developing cancer. A cancer risk greater than 1 in 10,000 generally indicates an increased risk of an individual developing cancer and results in a risk management action.

Since USEPA classifies the radionuclides of concern as human carcinogens, non-cancer health effects, such as kidney toxicity, were not evaluated. The one exception is for total uranium, which has the potential to pose both radiotoxicity and chemical toxicity. For soil, a reasonable exposure concentration for total uranium was determined for each RIA. The concentrations were evaluated against the USEPA preliminary remediation goal for residential soil (USEPA 2016a), and the concentrations were determined to be less than this preliminary remediation goal. The RA concluded that non-cancer health effects from the chemical toxicity of uranium are not anticipated. For groundwater, the maximum total uranium concentrations were evaluated against the USEPA regional screening level for tap water (USEPA 2016b), and the concentrations were determined to be less than the screening level. As a result, non-cancer health effects from chemical toxicity of uranium are not anticipated.

The BHHRA evaluated the cancer risk for each receptor by first comparing the risk to the background risk value. If the risk for the receptor was found to be greater than the background, then the cancer risk was compared to the acceptable risk range noted above.

In addition to cancer risk, radionuclide exposure was evaluated as the annual radiation dose to an individual. The doses to each receptor were summed over all pathways to represent a total estimated dose of radiation. The BHHRA evaluated the dose by comparing the dose from the MML FUSRAP Site to the background dose value. Radiation dose is not completely applicable for estimating health risk to the general population as the methodology was primarily developed for regulation of occupational exposure. However, per the Risk Assessment Guidance for Superfund Sites, radiation dose should be computed and presented in the RA. As previously mentioned, radionuclides are naturally occurring in the environment; therefore, the calculated doses are presented as a comparison to background or natural levels.

2.7.1.4 Risk Characterization Conclusions

The RA addressed potential health impacts from radionuclides identified in the RI field investigation and toxicity screening process described above. A summary of risk conclusions associated with each RIA is provided below.

Soils RIA-1

The BHHRA evaluated risks to the future resident and indoor worker and current trespasser/recreational user, outdoor maintenance worker, and construction/utility worker exposed to soil within RIA-1. Although there are currently no residents or recreational facilities within the MML boundaries, the BHHRA evaluated risk for a future situation where a residence or recreational building was constructed onsite without remediation to evaluate potential adverse effects.

The future resident scenario was evaluated for both a child and adult. A cancer risk of 3 in 10,000 and a dose of 68 mrem/yr were calculated for the child future resident scenario. The cancer risk due to MML FUSRAP Site contamination is five-fold greater than from child background sources, which was 0.6 in 10,000. The dose from the MML FUSRAP Site contamination is four-fold greater than from background sources, which was 16 mrem/yr. For the future adult resident, an adult cancer risk of 10 in 10,000 and an adult dose of 82 mrem/yr were calculated. The cancer risk due to MML FUSRAP Site contamination is three-fold greater than from adult background sources, which was 3 in 10,000. The dose from the MML FUSRAP Site contamination is five-fold greater than from background sources, which was 17 mrem/yr. Table 4 provides a summary of the estimated cancer risk for the future adult resident.

For the future adult indoor worker scenario, a cancer risk of 5 in 10,000 and a dose of 26 mrem/yr were calculated. The cancer risk due to MML FUSRAP Site contamination is seven-fold greater than from indoor worker background sources, which was 0.7 in 10,000. The dose from MML FUSRAP Site contamination is seven-fold greater than from indoor worker background sources, which was 4 mrem/yr. Table 5 provides a summary of the estimated cancer risk for the future indoor worker.

The cancer risk and radiation doses presented above indicate that there is an unacceptable risk to the future indoor worker exposed to soil within RIA-1. The cancer risk and dose levels are primarily due to exposure of Ra-226 via external radiation.

The BHHRA concluded that risks to the current trespasser/recreational user, outdoor maintenance worker, and construction/utility worker were within an acceptable risk range and exhibited radiological doses equal to or less than background for soil exposure.

Soils RIA-2

RIA-2 was evaluated for soil exposure to the current trespasser/recreational user scenario only. The area is located on a slope of the MML and would not be a likely location for constructing a building, such as a residence or a recreational facility.

The soil radionuclide activity and uranium nugget activity together were determined to have an exposure point concentration that potentially posed a cancer risk greater than the risk range. The USACE conducted a pilot study in RIA-2 to test a radiological soil sorting technology to support the evaluation as a remedial alternative in the Feasibility Study. Contaminated soils were excavated from this area for use in the study. When the excavation was completed, the USACE performed a radiological final status survey of the soils remaining, in accordance with the *Multi-Agency Radiation Survey and Site Investigation Manual*. It concluded that Ra-226 in soils remaining were indistinguishable from background concentrations. The contaminated soils were disposed of offsite in a licensed/permitted facility and the excavation area was backfilled using

certified clean soils. There is no longer an increased cancer risk or the potential for an elevated radiation dose with respect to FUSRAP wastes in RIA-2 (see Section 2.4).

Soils RIA-3

RIA-3 was evaluated for risks to the future resident and indoor worker and current trespasser/recreational user, outdoor maintenance worker, and construction/utility worker. Although there are currently no residents or recreational facilities within the MML boundaries, the BHHRA evaluated risk for a future situation where a residence or recreational building was constructed onsite without remediation to evaluate potential adverse effects.

The future resident scenario was evaluated for both a child and adult in RIA-3. A cancer risk of 3 in 10,000 and a dose of 80 mrem/yr were calculated for the future child resident scenario. The cancer risk due to MML FUSRAP Site contamination is five-fold greater than from background sources, which was 0.6 in 10,000. The dose from MML FUSRAP Site contamination is five-fold greater than from background sources, which was 16 mrem/yr. A cancer risk of 10 in 10,000 and a dose of 97 mrem/yr were calculated for the future adult resident scenario. The cancer risk due to MML FUSRAP Site contamination is three-fold greater than from background sources, which was 3 in 10,000. The dose from MML FUSRAP Site contamination is six-fold greater than from background sources, which was 17 mrem/yr. Table 6 provides a summary of the estimated cancer risk for the future adult resident.

For the future adult indoor worker scenario, a cancer risk of 3 in 10,000 and a dose of 15 mrem/yr were calculated. The cancer risk due to MML FUSRAP Site contamination is four-fold greater than from background sources, which was 0.7 in 10,000. The dose from MML FUSRAP Site contamination is four-fold greater than from background sources, which was 4 mrem/yr. Table 7 provides a summary of the estimated cancer risk for the future indoor worker.

The cancer risk and radiation doses presented above indicate that there is an unacceptable risk to the future resident and future indoor worker exposed to soil within RIA-3. The cancer risk and dose levels primarily are from exposure of Ra-226 via external radiation.

The BHHRA concluded that risks to the current trespasser/recreational user, outdoor maintenance worker, and construction/utility worker were within an acceptable risk range and exhibited radiological doses equal to or less than background for soil exposure.

Groundwater RIA-4

RIA-4, which is Site-wide shallow groundwater, was evaluated as a future situation in which the future resident and future indoor worker would use shallow groundwater as a potable water source without treatment. Currently at MML the groundwater is not used for any purpose. Groundwater

was also evaluated for the construction worker exposure in which the worker would come in contact with shallow groundwater during excavation activities.

The future residential scenario was evaluated for both a child and adult. A cancer risk of 4 in 10,000 and a dose of 5 mrem/yr were calculated for the child future resident scenario. However, as explained in the RA Report this risk may be overestimated. The cancer risk due to MML contamination is four-fold greater than from background sources, which was 1 in 10,000. The dose from MML contamination is equivalent to the dose from background sources, which was 5 mrem/yr. A cancer risk of 30 in 10,000 and a dose of 15 mrem/yr were calculated for the future adult resident scenario. However, as explained in the RA Report this risk may be overestimated. The cancer risk due to MML contamination is three-fold greater than from background sources, which was 9 in 10,000. The dose from MML contamination is equivalent to the dose from background sources, which was 15 mrem/yr.

The cancer risk presented above indicates that there is an elevated probability of cancer to the future resident. The primary contributor to the cancer risk is from inhalation of Ra-226 during showering with untreated groundwater. However, as explained in the RA this risk may be overestimated. The radiological dose from exposure to MML groundwater was within the range of doses from the background sources, and less than USEPA MCLs.

Risk to the indoor worker and construction/utility worker were determined to be within an acceptable risk range and exhibited doses equal to or less than background.

Elimination of Groundwater as RIA

Currently, site groundwater at MML is classified by NJAC 7:9C as a Class II-A water, which has a designated primary use of potable water (with treatment). Although the groundwater at MML is not presently a source of drinking water for the Site or community, its classification as Class II groundwater means that State and National Primary Drinking Water Regulations may be pertinent. These regulations address criteria and standards for pollutants in drinking water and thus address levels that would be obtained from groundwater wells and contain MCLs for selected ROCs at the Site (e.g., radionuclides) in groundwater.

Maximum radionuclide results in groundwater do not exceed the MCLs. Additionally, radionuclide concentrations observed in groundwater have historically been shown to align with concentrations observed in off-site, background groundwater sources. No apparent groundwater migration trends or plume of radioactive FUSRAP contaminants could be identified during the RI. In addition, the USGS has determined that naturally occurring radioactivity in the local bedrock can be a source for elevated activity in groundwater (USGS 1997). Despite the findings of risk in the BHHRA, the contaminant levels are similar to background and they are below the federal

drinking water standards. Therefore, remedial actions were not developed for groundwater at the MML FUSRAP Site.

2.7.2 Summary of Screening Level Ecological Risk Assessment

The purpose of the SLERA was to evaluate whether valued ecological resources present at the MML FUSRAP Site are potentially exposed and adversely affected by the radiological contaminants in soil, sediment, and surface water. The SLERA included the following principal components in accordance with USDOE's graded approach: 1) Data Assembly, which involves assembling environmental media data and defining evaluation areas; 2) General Screening, which involves comparing radionuclide activities in environmental media to biota concentration guides; and 3) Analysis, which could include, with increasing rigor, site-specific screening, site-specific analysis, and site-specific biota dose assessment.

The SLERA evaluated the potential exposure and hazards to the following receptors:

- Aquatic plants, benthic invertebrates, freshwater fish, semi-aquatic birds and mammals, reptiles, and amphibians exposed to surface water and sediment;
- Terrestrial birds and mammals exposed to surface water; and
- Terrestrial plants, soil invertebrates, birds, mammals, reptiles, and amphibians exposed to surface soil.

In the general screening methodology, the maximum measured radionuclide activity for an environmental medium (i.e., surface water, sediment, and soil) was compared with a set of biota concentration guides (BCGs). Tables 8 and 9 provide a summary of the activities detected in surface soils within RIA-1 and RIA-3, respectively. Each radionuclide-specific BCG represents the limiting radionuclide activity in the environmental medium that would not result in the biota dose limit being exceeded. The comparison of the radionuclide activity to the BCG was quantified in an analogous manner to a hazard quotient, where the maximum soil concentration was divided by the BCG. The ratio of each radionuclide was summed for each medium and then the ratios for all media were summed to calculate a total ratio value analogous to a hazard index. If the total ratio exceeded a value of 1, then further analysis may be needed to determine the hazards posed by the radionuclides. If, however, the ratio fell below a value of 1, radionuclides may be eliminated from further study.

The aquatic system evaluation considered radionuclide activities in surface water and sediment. None of the radionuclide activities in surface water and sediment from Bound Book adjacent to the Study Area, Bound Brook downstream of the Study Area, and the oxbow pond were found to pose a potential for adverse health effects in these aquatic systems. All of the combined surface water and sediment ratios were less than 1, ranging from 0.01 (1.1E-02) for location 06 in Bound

Brook adjacent to the Study Area to 0.91 (9.1E-01) for location 02 in Bound Brook downstream of the Study Area.

The terrestrial system evaluation considered radionuclide activities in surface water (oxbow pond) and surface soil. None of the radionuclide activities in surface soil and surface water from RIA-1, and RIA-2 were found to pose a potential for adverse health effects in these terrestrial systems. Combined surface soil and surface water ratios were less than 1. However, at RIA-3 the combined surface soil and surface water ratios were 1.4 (1.4E+00), indicating a potential for adverse health effects in these terrestrial systems. Table 10 provides a summary of the general screening level assessment for RIA-1 and Table 11 provides the summary for RIA-3.

Based on the results of the general screening evaluation, a site-specific screening analysis was conducted for the terrestrial systems at the RIA-3 exposure units in accordance with the USDOE's graded approach (USDOE, 2002). A site-specific screening analysis was performed in a similar manner to the general screening methodology with the exception that the mean radionuclide activity value was used in place of maximum value for surface soil values. None of the radionuclide activities in surface soil and surface water from RIA-3 were found to pose a potential for adverse health effects in these terrestrial systems. The combined surface soil and surface water ratios were less than 1 (0.044 or 4.4E-02) at RIA-3. Table 12 provides a summary of the site-specific screening level assessment for RIA-3.

The screening-level ecological effects evaluation demonstrated that radionuclide activities in surface water, sediment, and surface soil within the MML FUSRAP Site do not pose a potential for adverse health effects in aquatic and terrestrial biota and, by extension, other biota that are less sensitive to radiation exposure. Therefore, there is no need for risk mitigation associated with ecological resources.

2.8 Remedial Action Objectives

Remedial action objectives (RAOs) are site-specific goals that are established based on the nature and extent of contamination, the resources that are potentially threatened, and the potential for human and environmental exposure. The primary general objectives for any remedial action considered at the Site are to: (1) prevent or mitigate release of FUSRAP waste to the surrounding environment; and (2) eliminate or minimize the risk or future risk to human health and the environment from radiological exposure. The NCP requires that RAOs be established by specifying contaminants and media of concern, potential exposure pathways, and remediation goals (40 CFR 300.430(e)(2)(i)).

The sources of contamination identified for FUSRAP-related radionuclide contamination at the MML FUSRAP Site include uranium ore wastes (i.e., nuggets) and contaminated soils associated

with the disposal of MSP soils within RIA-1 and RIA-3 of the MML. FUSRAP-related radionuclides of concern are U-238, U-235, and associated decay products, specifically Ra-226, which is the radionuclide of concern identified as the dominant contributor to risk and used as a surrogate for uranium in determining compliance with cleanup levels. The RA identified exposure to ionizing radiation from contaminated soils as the predominant pathway for future harmful effects to human health. Therefore, a RAO was established for soils contaminated with FUSRAP wastes within the MML.

Since the RA determined there was not a risk to terrestrial and aquatic health related to radioactive materials, no RAOs were developed in response to ecological receptors. The RA also determined no risk from FUSRAP wastes were present in surface water or sediments of Bound Brook and no RAOs were established for it. Additionally, although radioactivity in groundwater contributed to the risk to human health at MML, its radionuclide activity is at or near background levels and below the National Primary Drinking Water Regulation's MCLs. RAOs therefore are not necessary for groundwater.

Remedial actions that "clean up" hazardous substances at CERCLA sites must clean to levels set by risk or ARARs, which are federal environmental or state environmental or facility siting requirements that must be attained by a CERCLA remedial action. The radiologically specific ARAR for contaminated soil at the MML FUSRAP Site is the New Jersey Remediation Standard for Radioactive Materials, promulgated in NJAC 7:28-12 (USACE 2019). This regulation establishes standards for the remediation of real property (including soil, groundwater, surface water, and sediment) contaminated by radioactive materials at sites located within the state. For MML FUSRAP Site soil remediation, the substantive requirements found in NJAC 7:28-12.8(a)(1) have been identified as ARARs. NJAC 7:28-12.8(a)(1) requires that a maximum total annual effective dose of 15 mrem/yr above background (which includes the sum of annual external gamma radiation dose and intake dose, including groundwater) be met for an unrestricted use remedial action, a limited use remedial action, or a restricted use remedial action. This ARAR applies to all alternatives consisting of some action evaluated in the Feasibility Study and establishes the remediation goals, which are the basis for the cleanup goals. A full listing of identified ARARs is in Table 13.

The site-specific RAO identified for MML FUSRAP-related radionuclides of concern (Ra-226, U-238, and U-235 decay chains), exposure pathways, and receptors is to prevent human exposure to FUSRAP-related radionuclides of concern by reducing the potential for a future total effective dose to equal or less than the RG of 15 mrem/yr above background by eliminating exposure to soils with average radioactivity greater than the derived concentration guideline level (DCGL) proposed for the Site, as follows:

- The DCGL applied to unrestricted land use is an average of 5 pCi/g of Ra-226 in soil above background for FUSRAP contaminants within a final status survey unit. This criterion accounts for the risk contribution from all site radionuclides of concern identified.
- Alternatively, the DCGL for land used for recreational purposes (restricted use) is an average of 15 pCi/g of Ra-226 above background in soil for FUSRAP contaminants within a final status survey unit. This criterion accounts for the risk contribution from all site radionuclides of concern identified.

2.9 Description of Alternatives

The focus of the remedial action is to meet the RAOs associated with residual radionuclides (uranium and decay products, Ra-226 as a surrogate) in RIA-1 and RIA-3.

Seven alternatives were evaluated for soil remediation:

- Alternative 1 – No Action;
- Alternative 2 – Limited Action using Land Use Controls for Restricted Use;
- Alternative 3a – Excavation and Offsite Disposal for Unrestricted and Restricted Use;
- Alternative 3b – Excavation and Offsite Disposal for Unrestricted Use;
- Alternative 4a – Excavation, Radiological Soil Sorting, and Offsite Disposal for Unrestricted and Restricted Use;
- Alternative 4b – Excavation, Radiological Soil Sorting, and Offsite Disposal for Unrestricted Use; and
- Alternative 5 – Excavation and Onsite Containment.

The development of these alternatives considers the fact that the onsite contaminated soil within RIA-2 was removed during the pilot study.

Alternative 1 – No Action

Alternative 1 has been considered in accordance with the NCP (40 CFR 300.430(e)(6)) and is intended to provide a baseline comparison to the other alternatives. In this alternative, no remediation would be performed, and no land use controls (LUCs) would be used to prevent exposure to soils contaminated with FUSRAP materials. There is no capital or present-worth operation or maintenance costs involved with this alternative since there would be no action. This alternative has no timeframe associated with implementation and would result in continued restricted use.

Alternative 2 – Limited Action using Land Use Controls for Restricted Use
Alternative 2 addresses the soil contamination, along with LUCs and periodic inspections of the installed controls. Contaminated soil would be left in place in RIA-1 and RIA-3 and no active remediation would be performed. The LUCs would include restricting Site activities that would disturb the soil at the Borough of Middlesex property through deed notices associated with the titles of the properties and installation of fencing around the perimeter of the entire MML FUSRAP Site. Inspections of the site would occur periodically. These inspections would include visual observations and the recording of soil disturbance activities, erosion, or unauthorized use of the landfill property, which may indicate the potential for exposure of contaminants. A review of the MML FUSRAP Site would occur at least every 5 years to determine whether the remedy continues to be protective of human health and the environment, as required by CERCLA 121(c). The capital cost for this alternative is approximately $338,700. The periodic inspection cost was estimated to be $28,200 and the cost for each 5-year review and associated report was estimated to be $63,300. The 100-year present worth was estimated to be $1,749,200. With the cooperation of the landowners this alternative could be implemented within 6 months and would result in continued restricted use.

Alternative 3a – Excavation and Offsite Disposal for Unrestricted and Restricted Use
Alternative 3a involves excavation of the Middlesex Presbyterian Church property in areas where average Ra-226 concentrations are higher than 5 pCi/g above background and the Borough of Middlesex property where average Ra-226 concentrations are higher than 15 pCi/g above background. Removing FUSRAP-related materials at these concentrations would allow unrestricted use of the Middlesex Presbyterian Church but require restrictions on the use of the Borough property as it relates to FUSRAP-related materials.

As part of the excavation, larger debris material (greater than 2 inches in diameter) would be separated, scanned for radiation, and returned to the excavation area if below the concentrations listed above. Excavated contaminated soils would be transported to a licensed/permitted disposal facility, and excavated areas would be backfilled with clean soil, with topsoil placed on top to support planting after construction. In order to accomplish the excavation and backfill tasks, access roads and staging areas for material and equipment storage would be required.

Since contamination will remain on the Borough of Middlesex property with average concentrations greater than the unrestricted DCGL of 5 pCi/g above background, a LUC would be required for that area. The LUC would involve a deed notice and signage marking the area. The federal government would conduct periodic inspections to evaluate the effectiveness of the signage in preventing exposure of soil contaminants. These inspections would include visual observations and the recording of soil disturbance activities, erosion, or unauthorized use of the landfill property, which may indicate the potential for exposure of contaminants. CERCLA 5-year reviews would be conducted to determine whether the remedy continues to be protective of human health

and the environment. The capital cost for this alternative is approximately $10,748,800 and the periodic costs for inspections and 5-year reviews was estimated to be $91,500. The 100-year present worth was estimated to be $12,159,300. This alternative could be implemented within one year with the cooperation of the Borough of Middlesex and would result in unrestricted use of Church property as it relates to FUSRAP-related materials and continued restricted use of Borough property.

Alternative 3b – Excavation and Offsite Disposal for Unrestricted Use

Alternative 3b is similar to Alternative 3a except that it involves excavation of all areas where average Ra-226 concentrations are higher than 5 pCi/g above background. Large debris segregation, disposal of soil at a licensed/permitted disposal facility, and clean soil backfill would occur under this alternative.

For this alternative, no FUSRAP contamination will remain with average concentrations higher than the unrestricted DCGL of 5 pCi/g above background; this would allow unrestricted use as it relates to FUSRAP-related materials of both properties. As a result, LUCs and 5-year reviews would not be required. The capital cost for this alternative is approximately $17,671,400. Given that no periodic costs would be required, the 100-year present worth would be the same at $17,671,400. This alternative could reach ROD DCGLs within 2 years following implementation and would result in unrestricted use as it relates to FUSRAP-related materials of both the Church and Borough properties.

Alternative 4a – Excavation, Radiological Soil Sorting, and Offsite Disposal for Unrestricted and Restricted Use

Alternative 4a is the same as Alternative 3a, with the addition of radiological soil sorting of excavated soil. Excavated soils will be screened, with large debris and soil with Ra-226 concentrations below cleanup levels removed for replacement in excavation areas. Soil with concentrations higher than cleanup levels will be disposed of at a licensed/permitted disposal facility and clean soil will be used to backfill excavated areas. Radiological soil sorting is included to reduce the quantity of soil that will need to be disposed of while still achieving the RG of removing soils with concentrations higher than the concentrations listed above. The 2017 pilot study demonstrated that the volume of soil requiring offsite disposal could be reduced by 78 percent with radiological soil sorting.

Since soil with average concentrations greater than the unrestricted DCGL of 5 pCi/g above background contamination will remain on the Borough of Middlesex property, a LUC would be required for that area. The LUC would involve a deed notice and signage marking the area. The federal government would conduct periodic inspections to evaluate the effectiveness of the signage in preventing exposure of soil contaminants. These inspections would include visual observations and the recording of soil disturbance activities, erosion, or unauthorized use of the landfill

property, which may indicate the potential for exposure of contaminants. CERCLA 5-year reviews would be conducted to determine whether the remedy continues to be protective of human health and the environment in relation to FUSRAP-related materials. The capital cost for this alternative is approximately $7,337,300, and the periodic cost for inspections and 5-year reviews was estimated to be $91,500. The 100-year present worth was estimated to be $8,747,800. This alternative could be implemented within one year and would result in unrestricted use as it relates to FUSRAP-related materials of Church property and continued restricted use of Borough property.

Alternative 4b – Excavation, Radiological Soil Sorting, and Offsite Disposal for Unrestricted Use

Alternative 4b is the same as Alternative 3b with the addition of radiological soil sorting of excavated soil. Excavated soils will be screened, with large debris and soil with Ra-226 concentrations below cleanup levels removed for replacement in excavation areas. Soil with concentrations higher than cleanup levels will be disposed of at a licensed/permitted disposal facility and clean soil will be used to backfill excavated areas.

For this alternative, no contamination will remain on the property with average concentrations higher than the unrestricted DCGL of 5 pCi/g above background. As a result, LUCs and 5-year reviews would not be required. The capital cost for this alternative is approximately $11,942,700. Given that no periodic costs would be required, the 100-year present worth would be the same at $11,942,700. This alternative could reach ROD DCGLs within 2 years following implementation and would result in unrestricted use as it relates to FUSRAP-related materials of both the Church and Borough properties.

Alternative 5 – Excavation and Onsite Containment

Alternative 5 involves the excavation of contaminated material in the same areas that were designated in Alternatives 3a and 4a, but the material would remain onsite and consolidated under a cap. The excavated material would be placed on the surface of the landfill outside of the church property, capped with a clay liner, and planted. The excavated areas would be backfilled with clean material and planted, as well. The cap would be designed to be in compliance with the substantive design requirements of 40 CFR Part 258.60(a) of RCRA which was identified as an ARAR in the feasibility study. These requirements include a cover permeability of 1×10^{-5} cm/s or equal to natural subsoils present, whichever is less; an infiltration layer that contains a minimum of 18 inches of earthen material; and a minimum of 6 inches of earthen material that is capable of sustaining native plant growth.

Since contamination would remain on the property where consolidation occurred, LUCs would be required. The cap would need to be inspected regularly, and 5-year reviews would need to be conducted to determine whether the remedy continued to be protective of human health and the

environment. The capital cost for this alternative is approximately $10,104,800 and the periodic costs for inspections and 5-year reviews was estimated to be $119,200. The 100-year present worth was estimated to be $12,385,700. This alternative could be implemented within 6 months and would result in continued restricted use of the Site.

2.9.1 Common Elements of Alternatives

The following common components and activities may be required under the alternatives:

- Engineering design;
- Plans and submittals;
- Mobilization and site setup;
- Temporary site security and access controls;
- Road and haul route maintenance;
- Radiological Surveys;
- Air monitoring;
- Stormwater management, erosion control and maintenance; and
- Site restoration.

The costs for these activities are included in the estimated cost for each alternative.

2.9.2 Expected Outcomes of Alternatives

The remedial action alternatives for the MML FUSRAP Site were developed to focus specifically on the FUSRAP contaminated soil deposited during the landfill's operation and pose a potential future risk to human health. The alternatives were developed based on their abilities to achieve site-wide protectiveness, combining different remedial technology types with different volumes of media and/or areas of the Site.

2.10 Summary of Comparative Analysis of Alternatives

Each alternative was evaluated during the Feasibility Study against seven of the nine criteria established by the NCP (40 CFR 300.430(e)(9)(iii)) and the last two criteria (State Acceptance and Community Acceptance) were assessed during the public comment period following publishing of the Proposed Plan.

The nine evaluation criteria for Superfund Remedial Activities, consisting of Threshold Criteria, Primary Criteria, and Modifying Criteria, are as follows:

Threshold Criteria:

- Protection of Human Health and the Environment;
- Compliance with ARARs;

Primary Criteria:

- Long-Term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment;
- Short-term Effectiveness;
- Implementability;
- Cost;

Modifying Criteria:

- State Acceptance; and
- Community Acceptance.

A summary of the evaluation criteria followed by a comparative analysis is presented in the subsections below.

2.10.1 Protection of Human Health and the Environment

Protection of Human Health and the Environment addresses whether an alternative provides protection of human health and the environment and describes how exposure risks are eliminated, reduced, or controlled through treatment, engineering, or LUCs.

In addition to cancer risk, radionuclide exposure is evaluated as the annual radiation dose to an individual. The doses to each receptor are summed over all pathways to represent a total estimated dose of radiation. The BHHRA evaluated the dose by comparing the dose from the MML FUSRAP Site to the background dose value. These values were used in determining alternatives protective of human health and the environment. Table 14 presents the risk-based evaluation of alternatives used in the comparative analysis.

Except for Alternative 1, No Action, all proposed alternatives are protective of human health and the environment. Under Alternative 1 radiation exposures could result in the future from the contaminants remaining in place without additional LUCs such as engineering controls (ECs) or institutional controls (ICs) or restrictions. Under this scenario, potential risks at the Site would exceed the USEPA-specified CERCLA risk range of 10-4 to 10-6 and dose rates would exceed ARAR dose requirement of 15 mrem/yr above background.

Alternative 2, Limited Action, is considered protective. LUCs would be required for the Borough and church properties under Alternative 2 to ensure protectiveness.

Alternatives 3a, 3b, 4a, and 4b are protective of human health and the environment through the removal and off-site disposal of radionuclide activity that could result in a radiation dose above the proposed RG. Average residual radionuclide concentrations are expected to be below 15 pCi/g for Alternatives 3a and 4a, but portions of RIA-1 and RIA-3 could potentially be above the DCGL (5 pCi/g in excess of background for average Ra-226 concentrations) that allows for unrestricted release at the Site. Therefore, LUCs would be required for the Borough property under Alternatives 3a and 4a to ensure protectiveness. There would be short-term risks to the community and site-workers that could be temporarily exposed to contaminants during implementation of Alternatives 3a, 3b, 4a, 4b, and 5; however, health and safety and environmental measures would be implemented to mitigate these temporary risks.

Alternative 5, Consolidation and Capping, protectiveness is ensured by the placement of the clay cap and implementation of LUCs designed to restrict land use and site activities on Borough property. LUCs would be required for the Borough property under Alternative 5 to ensure protectiveness.

2.10.2 Compliance with ARARs

Compliance with ARARs evaluates whether the alternative meets the federal and state environmental statutes and regulations that have been determined to be applicable or relevant and appropriate to this remediation, or whether a waiver is justified under 40 CFR 300.430 (f)(1)(ii)(C).

Alternative 1 is not compliant with the ARARs. Alternative 2, Alternative 3a, Alternative 3b, Alternative 4a, Alternative 4b, and Alternative 5 would all comply with ARARs since they meet the ARAR-based performance standards.

2.10.3 Long-Term Effectiveness and Permanence

This evaluation criterion refers to the ability of the alternative to protect human health and the environment over time, once cleanup levels have been met for FUSRAP-related materials.

Alternative 1 does not provide for long-term effectiveness and/or permanence. Alternative 2 offers slightly more effectiveness and permanence when compared to no action, but not nearly as much as the other proposed alternatives. MML previously had instituted ECs for the landfill, but they have not been maintained, thus allowing trespassers to access contaminated areas.

Alternatives 3a and 4a offer similar levels of long-term effectiveness and permanence; however, residual risks would remain at the Borough property that would prevent MML from meeting

remedial goals, necessitating the need for LUCs and long-term periodic inspections of Site ICs. Alternatives 3b and 4b are ranked highest with respect to this criterion because these remedial actions would result in permanent off-site disposal of all soils that would result in a dose above the proposed RG without requiring the need for LUCs or long-term site performance inspection. The disposal of excavated contaminated material would be in a licensed or permitted disposal facility that is continuously monitored and maintained. The differences between Alternatives 3a and 4a and Alternatives 3b and 4b is that LUCs would be required under Alternatives 3a and 4a (in the form of deed notices) to limit site activities that would result in exposures to radioactivity that exceeds the RG.

Alternative 5 also offers long-term effectiveness and permanence. However, long-term O&M of the cap would be required to ensure the cap's integrity and LUCs in the form of ICs and ECs would be implemented to limit future exposures at the Site by restricting land uses to recreational and by prohibiting certain activities (such as construction of buildings on the proposed cap) that are not compatible with the residual risks that remain in the landfill or that may compromise the effectiveness or permanence of the proposed cap.

2.10.4 Reduction in Toxicity, Mobility, or Volume through Treatment

This evaluation criterion refers to anticipated ability of the remedy to reduce the toxicity, mobility, or volume of the FUSRAP-related materials present at the MML Site through treatment.

None of the alternatives meet this criterion as none of them involve treatment.

2.10.5 Short-Term Effectiveness

This evaluation criterion addresses the impacts to the community and Site workers during the time it takes to complete the action. This criterion also includes an assessment of the relative timeframe required for the remedial action to achieve protection.

Alternative 1 would not achieve RAOs, as contamination would remain on-site above the proposed RG. Risks to current and future receptors and the environment would persist at the MML FUSRAP Site; however, since there are no proposed disturbances under this alternative, there would be no increase in short-term worker and public exposure to contaminants.

Minimal short-term exposures to the trespassers and occupational workers would be anticipated under Alternative 2 through implementation of the proposed alternative.

Alternatives 3a, 3b, 4a, and 4b would result in effective removal of FUSRAP contaminated waste from the Site with no environmental impacts anticipated after completion of the cleanup. Transportation and disposal of FUSRAP-related material will lead to temporary increases in local

truck traffic. Alternative 3b will have the greatest anticipated amount of truck traffic due to the highest off-site disposal and backfill requirements, followed by Alternatives 3a, 4b, and 4a in order of truck traffic. Alternative 5 would not have FUSRAP-related material transported off site but would have the greatest short-term impacts from localized truck traffic compared to the other alternatives based on cap materials, backfill and other components of the cap, that require transport to the Site.

Of the remaining alternatives, Alternative 3b would generate the most adverse short-term risk due to the duration required to complete the remedial action and the total volume of FUSRAP contaminated material that would be transported and disposed of off-site. Under Alternatives 3a, 3b, 4a, 4b, and 5, excavation activities, hauling materials, and handling and placement of site soils could generate dust-containing radionuclides. However, these short-term impacts were identified as moderate, as dust suppression and personal protective equipment would be used to mitigate potential for exposure and worker health conditions would be monitored and regulated under a site-specific health and safety program. Continuous air monitoring would also be conducted for protection of the surrounding residential communities. Transport of materials off-site would occur in a manner that meets the requirements of USDOT for shipment of radioactive materials.

Additionally, under each of these alternatives, programmatic protections would be implemented to reduce the potential impacts to on-site and adjacent environmental resources. Proposed controls as part of the remedial action include: minimizing tree clearing; restricting wetland disturbances; installing stormwater runoff controls and initiating an erosion control program through implementation of an Soil Erosion and Sediment Control Plan to prevent contaminated sediments from entering Bound Brook or adjacent surface waters; developing a hazardous response program; encouraging use of native plants to re-establish habitats during post-construction restoration; and constructing a temporary berm to protect the work areas from flood hazards during construction.

2.10.6 Implementability

This evaluation criterion addresses the technical and administrative feasibility of an alternative, including the availability of material and services required for cleanup.

All of the action alternatives can be implemented from a technical, administrative, and supply vantage. Alternative 1 is rated the highest in implementability, as it involves no action, personnel, or equipment. Alternative 2, which includes the use of LUCs, is also rated among the easiest to implement; however, negotiations with both the church and Borough would be required to prevent land use that would result in exposure to radioactivity that exceeds the RG. LUCs proposed under Alternative 2 are common to site remediation and are considered easily implementable subject to the negotiations discussed above.

Alternatives 3a, 3b, 4a, and 4b utilize typical construction methods, equipment, and personnel to complete the activities and are proven methods for FUSRAP remediation. The duration and implementability of these alternatives would depend upon the volume of soil removed, depth of excavation and other factors such as presence and control of groundwater in the excavation areas. The use of the radiological soil sorting system for Alternatives 4a and 4b may require additional testing prior to use in order to refine the processing settings of the equipment based on the RIA-specific materials encountered in RIA-1 and RIA-3. Negotiations with the Borough to implement the LUCs (deed notices) under Alternatives 3a and 4a are not anticipated to be problematic but will require additional considerations and coordination during the planning stages of each of these remedial actions.

Alterative 5 also uses common construction methods, equipment, and personnel to perform the excavation, consolidation, and construction of the cap; however, this alternative may be difficult to implement if additional chemical analysis results in finding hazardous materials at the Site from historical non-FUSRAP-related waste disposal. The presence of any hazardous waste may require modifications to the proposed low-permeability cap design to ensure that it meets the State and Federal requirements as specified under RCRA. Additionally, this alternative may impede the Borough of Middlesex's ability to appropriately close MML in accordance with state regulations. Long-term O&M would also be required to maintain the integrity of the cap and ensure mitigation of risks from radionuclides. Therefore, Alternative 5 received a low rating for implementability.

2.10.7 Cost

This evaluation criterion addresses the estimated capital and operation and maintenance costs of each alternative. Due to the inclusion of remediation alternatives with extended lifetimes (e.g., landfill cap maintenance and LUCs), costs were evaluated over a 100-year period using present worth analysis. A longer period of time was not used because there was not a significant difference in cost beyond 100 years. As noted in A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-0022000) approximately 99.9% of present worth costs are usually represented within the first 100 years. Accordingly, the present worth for this project did not significantly change after 100 years. Using 100 years ensures that enough money is there in perpetuity for O&M costs for alternatives with extended lifetimes. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

Alternative 3b is the most expensive alternative, with a present worth cost of $17,671,400. Despite this alternative being the most expensive, the remedial action proposed would remove risks to public health and the environment to levels that would allow unrestricted release of the Site with regards to FUSRAP contamination. Alternative 4b also would remove risks from FUSRAP contamination to concentrations that would allow unrestricted release of the MML FUSRAP Site. The use of radiological sorting results in a significant cost reduction of remediation due to

minimizing the volume of material required for off-site transport and disposal, with the total present worth of Alternative 4b estimated at $11,942,700. Based on the estimated volume reduction that is anticipated to result under Alternatives 4a and 4b, sorting provides an approximate 30 percent savings when compared to Alternatives 3a and 3b, respectively.

Alternative 5 is the second most costly alternative, with a present-worth cost of $12,385,700 due to the long-term O&M of the cap, periodic inspections of LUCs, and CERCLA 5-year reviews of the remedial action. It should be noted that the cap designed under this FS only accounted for FUSRAP contamination and has been designed to meet the Subtitle D requirements under RCRA.

The present worth estimates for Alternatives 3a and 4a are $12,159,300 and $8,747,800, respectively, including costs for periodic inspections of the ECs and ICs and the CERCLA 5-year reviews of the remedial action.

The present worth cost associated with Alternative 2 is approximately $1,749,200 to implement LUCs to provide sufficient level of protection at the Site, while the No Action alternative does not have an associated cost.

2.10.8 State Acceptance

State Acceptance considers whether the State agrees with the USACE's analyses and recommendations, as described in the Remedial Investigation, Feasibility Study, and Proposed Plan.

The Draft Proposed Plan was provided to NJDEP on 03 September 2020. The NJDEP provided comments to the USACE on 20 November 2020 and requested consideration of Alternative 4b as the Preferred Alternative. On 15 December 2021, the State sent a letter concurring with selection of the Preferred Alternative as the Selected Remedy for the Site.

2.10.9 Community Acceptance

Community Acceptance considers whether the local community agrees with the Preferred Alternative. Comments received during the Public Comment Period are an important indicator of community acceptance. Community acceptance was evaluated formally after the public comment period. Comments were in favor of Alternative 4b. Comments received are included in Section 3, Responsiveness Summary.

2.11 Principal Threat Wastes

Per the NCP's definition of principal threat waste, there is no FUSRAP on-site contaminant at the Site that meets this definition.

2.12 Selected Remedy

A summary of the comparative analysis of alternatives in presented in Table 15. USACE identified the preferred alternative, Alternative 4b **(**Excavation, Radiological Soil Sorting, and Offsite Disposal for Unrestricted Use), as the Selected Remedy. The Selected Remedy will allow unrestricted use of the Site as it relates to FUSRAP-related materials.

2.12.1 Summary of the Rationale for the Selected Remedy

Based upon an evaluation of all alternatives, Alternative 4b (Excavation, Radiological Soil Sorting, and Offsite Disposal for Unrestricted Use) is recommended as the Selected Remedy for the following reasons:

- The alternative will meet the RAO and ARARs;
- The alternative will meet the threshold criteria of protection of human health and the environment and compliance with cleanup levels;
- The alternative will be effective in the long term because soils presenting a potential unacceptable risk from FUSRAP wastes will be removed from the Site; and
- The alternative has been proven to be highly implementable based on historical remediation projects and a successful pilot study demonstrating radiological soil sorting.
- This alternative was supported by both the state and community.

The Selected Remedy meets the threshold criteria and provides the best overall balance of tradeoff in terms of the five balancing criteria:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume;
- Short-term effectiveness;
- Implementability; and
- Cost.

The Selected Remedy addresses State and community concerns by removing contaminated materials from the MML FUSRAP Site.

2.12.2 Description of Selected Remedy

Figure 6 shows the excavation areas associated with this alternative as well as the locations of transportation routes, temporary storage areas, and work areas. Approximate depths of excavation

based on previous sampling are listed within each excavation area. The approximate area where the radiological soil sorting would take place is also noted on Figure 6.

Radiological soil sorting is a resource recovery technology involved in this alternative and will reduce the volume of offsite soils needed to backfill excavation areas as well as the volume of soils contaminated with FUSRAP wastes removed from the MML. This process is illustrated on Figure 7. The radiological soil sorting will occur after the material sorting process removes any items larger than 2-inches (e.g., municipal waste such as refrigerators and glass bottles) that do not contain radioactive contamination and will allow appropriately sized material (e.g., soil) to be passed through the radiological sorter. After mechanical removal of large items, soil will be passed through the radiological sorter and separated into distinct piles of material with average Ra-226 concentrations higher and lower than 5 pCi/g above background. Periodic sampling will be conducted to ensure RGs are being met.

The pilot study completed in RIA-2 resulted in a soil volume reduction efficiency rate of approximately 78 percent and had a maximum sorting rate of 300 cubic yards per day. A rate of 350 cubic yards per day is assumed for full-scale operation with the implementation of this alternative, as efficiencies are expected with the large debris sorting process that could be improved. Based on the efficiencies observed during the 2017 Soil Sorting Pilot Study, it is also anticipated that an efficiency rate of 82 percent would be achieved in full-scale operation for material radiologically sorted as clean material and would be determined to be acceptable to be placed back into the excavated area. The planned excavation volume for this alternative is 21,290 loose (or ex-situ) cubic yards. Based on the assumed segregation efficiency rate, approximately 3,790 cubic yards of the excavated soils would require transport and offsite disposal in a licensed/permitted facility. The remaining 17,500 ex-situ cubic yards would be removed through size segregation and radiological sorting and then placed back in the excavation areas. All large items that do not contain radioactive contamination will be placed back into the excavation. Large materials would not be placed in areas less than 2 feet deep to allow for a minimum 2-foot layer of clean backfill. The estimated cost for this remediation is $11,942,700.

Clean backfill would be required to replace the volume of soils removed for offsite disposal. Clean backfill brought onsite would be required to meet the NJDEP's requirements for uncontaminated surface soil, as specified in NJAC 7:28-12 and NJAC 7:26E-1.4, in accordance with NJDEP's Fill Material Guidance for SRP Sites.

During construction, there would be a potential for short-term health risks for construction workers and surrounding residents due to the excavation of the contaminated soils. These risks will be mitigated by monitoring the air for dust and using dust suppression techniques (e.g., wetting the soils) to reduce the amount of dust created during excavation.

Land use controls for FUSRAP contamination would not be necessary under this alternative due to the removal of FUSRAP-related contamination that allows for unlimited use and unrestricted exposure as it relates to FUSRAP-related materials. Additional actions post-remediation, such as site inspections and CERCLA 5-year reviews and reporting, would not be required for this alternative from a FUSRAP perspective. It should be noted that the use of the property is currently restricted by Borough of Middlesex Code, General Legislation, Chapter 252, Paragraph 4 which states "that the former landfill site [MML] be protected from being used as a residential or commercial property and that the site be reserved for and used only for both active and passive recreational uses and parking requirements associated therewith."

Based on information currently available, the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The USACE expects the preferred alternative to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

2.12.3 Summary of Estimated Remedy Costs

The total cost to complete the Selected Remedy in 2018 dollars is approximately $11,942,700. Costs are based on excavation of approximately 21,290 ex-situ cubic yards of soil from the RIA-1 and RIA-3 areas, of which only 3,790 ex-situ cubic yards are anticipated to be above cleanup criteria and disposed of off-site at a license or permitted landfill after screening and sorting as described in Section 2.12.2. No annual O&M cost or LUC-related costs have been provided since materials containing average contaminant concentrations above the proposed unrestricted land use DCGL would be removed from the MML FUSRAP Site, allowing for unlimited use and unrestricted exposure as it relates to FUSRAP-related materials. CERCLA 5-year reviews would not be required under this alternative. Therefore, the 100-year present-worth cost would remain at $11,942,700. Table 16 provides a more detailed summary of the costs associated with implementation of the Selected Remedy.

The estimated time to implement the Selected Remedy is approximately one year after completion of remedial design, which is estimated to require an additional year. The time to implement the Selected Remedy is dependent on USACE funding, which is appropriated by Congress for the USACE.

The information in the cost estimate summary (Table 16) is based on the best available information regarding the anticipated scope of the Selected Remedy. Changes in the cost elements are likely

to occur as a result of new information and data collected during the engineering design of the remedial alternative.

2.12.4 Expected Outcomes of Selected Remedy

The MML FUSRAP Site RAOs, as shown in Section 2.8, would be achieved for the contaminated soil medium. The Selected Remedy is protective of human health and the environment. It would allow for beneficial unrestricted future use of the Site as it relates to FUSRAP-related materials upon completion of the final remedy. A comprehensive sampling and analysis program will confirm that all contaminants have been removed to the required levels.

2.13 Statutory Determinations

The Selected Remedy satisfies the statutory requirements of CERCLA 121 and the NCP, as described below.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy would be protective of human health and the environment as it relates to FUSRAP-related materials removing FUSRAP-related material above unrestricted use for exposure pathways identified at the MML FUSRAP Site. Excavation and off-site disposal of FUSRAP contaminated soils and debris containing average concentrations of Ra-226 above the unrestricted use DCGL would be protective of human health and the environment by reducing the on-site radiological dose below the proposed RG of 15 mrem/yr. The radiological dose anticipated under the Selected Remedy is calculated as 13.9 mrem/yr for both the church property and the Borough property (Table 14). This dose value was derived under conditions modeled for an unrestricted land use scenario that could result in a residential exposure scenario. (USACE 2019)

Material sorted below set alarm criteria of the radiological soil sorting system is anticipated to meet the unrestricted DCGL and would be placed back into excavation areas. Supplemental clean backfill would be transported from an off-site borrow source site to achieve existing grades, as needed. Off-site backfill would be required to meet the requirements for uncontaminated fill as established under NJAC 7:28-12 and NJAC 7:26E. Post-cleanup sampling, analysis, and further removal of FUSRAP contaminated soils (as necessary) would provide a high level of confidence that residual radiation at the MML FUSRAP Site would be at an acceptable level.

Minor short-term impacts on human health and the environment are anticipated during the actual remedial activities such as excavation, waste handling and off-site transport of contaminated soil. However, exposures would be mitigated through implementation of safety measures such as designated truck routes, dust control, air monitoring, stormwater management, flood hazard mitigation, and proper collection and treatment/disposal of contact water. Because this alternative

would meet unlimited use and unrestricted exposure as it relates to FUSRAP-related materials, as such, 5-year reviews would not be required in accordance with CERCLA 121(c).

2.13.2 Compliance with ARARs

Achievement of the cleanup criteria will be identified throughout the remediation of the property. The Selected Remedy will comply with the ARARs listed here:

- New Jersey Remediation Standard for Radioactive Materials, NJAC 7:28-12.8(a)(1)
- Clean Water Act, 40 CFR Part 230.10(c)

Table 13 contains additional information on the ARARs.

2.13.3 Cost Effectiveness

In the lead agency's judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume though treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money to be spent.

The estimated present worth cost of the Selected Remedy is $11,942,700. Although Alternative 4a is $3,194,900 less expensive, unrestricted use in relation to FUSRAP-related contamination would not be achieved under that Alternative, and therefore that alternative is not deemed cost-effective since future use considerations would not be met.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The Selected Remedy represents the maximum extent to which permanent solutions and treatment are practicable at the Site. The Selected Remedy represents the best balance of tradeoffs between the alternatives because it provides a permanent solution, and cost-effectively remediates the property for unrestricted use as it relates to FUSRAP-related materials.

2.13.5 Preference for Treatment as a Principal Element

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

2.13.6 Five-Year Review Requirements

The Selected Remedy will not result in FUSRAP-related hazardous substances, pollutants, or contaminants in soil remaining on-site above levels that allow for unlimited use and unrestricted exposure; therefore, five-year reviews will not be required for this remedial action.

3.0 RESPONSIVENESS SUMMARY

The Responsiveness Summary serves the dual purpose of: (1) presenting stakeholder concerns about the Site and preferences regarding the remedial alternatives; and (2) explaining how those concerns were addressed and how stakeholder preferences were factored into the remedy selection process.

The following were received as either written comments or oral comments during the public comment period. Each comment is followed by a response to that comment. Environmental counsel to the Borough of Middlesex, and on behalf of Middlesex Borough, formally submitted concerns pertaining to the area known as "Pershing Avenue Right-of-Way Area of Interest ("Pershing Ave. AOI")." Written comments were received 03 September 2021. The full letter has been included as Attachment 1. A transcript of the public meeting that was held following publication of the Proposed Plan and public comment period has been included as Attachment 2.

Comment #1, Part 1:
This comment was received in letter format via email on 03 September 2021 during the public comment period for the Proposed Plan. The letter was sent to Ms. Helen Edge of USACE from Mr. Matt Moench on behalf of the Borough of Middlesex. Due to the length of the letter, the body of the letter is provided below (in italics) with USACE responses in inset text throughout.
I am environmental counsel to the Borough of Middlesex, and on behalf of Middlesex Borough I formally submit our concerns to the "Final Proposed Plan," dated July 2021, submitted under the Formerly Utilized Sites Remedial Action Plan ("FUSRAP") program for the Middlesex Municipal Landfill FUSRAP Site ("MML"). Specifically, Middlesex objects to the Government's refusal to remediate the area known as "Pershing Avenue Right-of-Way Area of Interest ("Pershing Ave. AOI")." This area has some of the highest gamma radiation on the site and poses a significant public health risk should the Government fail to properly take responsibility for this contamination and include this area in the Remedial Action Plan.

> **Response to Comment #1, Part 1:**
> The limits of the Corps' legal authority, the FUSRAP program, and the CERCLA process, preclude the cleanup of non-FUSRAP material.
>
> Under Article I, Section 9, Clause 7 of the United States Constitution, no money shall be drawn from the Treasury except as appropriated by Congress. No agency, including the Corps, has authority to spend public money for a purpose that for which Congress has not appropriated funds. The Anti-Deficiency Act, 31 U.S.C. 1341 et seq., prohibits federal employees from making or authorizing an expenditure from any appropriation or fund in excess of the amount available in the appropriation or fund.
>
> Congress authorized the Corps to carry out the Formerly Utilized Sites Remedial Action Program (FUSRAP) via Public Law 105-62 (Oct. 13, 1997), Public Law 105-245 (Oct. 7,

1998), and Public Law 106-60 (Sept. 29, 1999). Under these laws, Congress appropriated funds to be used to clean up contamination from sites throughout the United States resulting from work performed as part of the Nation's early atomic energy program pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. 9601 et seq.). The Corps has no authority to exceed the limits of Congress's directive by cleaning up contamination that has not been shown to be the result of the nation's early atomic energy program.

The Corps' FUSRAP regulation, ER 200-1-4, provides further guidance about the scope of the Corps' authority and duty to remediate contamination at sites formerly used by the nation's early atomic energy program. The portion of ER 200-1-4, paragraphs 6.b(2)(a)-(d) relevant to MML provides that the following hazardous substances will be considered within the scope of FUSRAP cleanup authority at FUSRAP sites and vicinity properties:

a) Radioactive contamination resulting from the nation's early atomic energy program activities, including hazardous substances associated with these activities
b) Other radioactive contamination or hazardous substances that are mixed or commingled with contamination from the early atomic energy program activities, and

Pursuant to ER 2001-4, paragraph 6.3, materials not listed in paragraphs 6.b.(2)(a)-(d) above are excluded from the scope of a FUSRAP cleanup.

As the federal government does not own the Middlesex Municipal Landfill, only contamination described in paragraphs 6.b.(2)(a) and (b) would be within the scope of FUSRAP cleanup activities. The Corps defined the nature and extent of the Middlesex Municipal Landfill's FUSRAP-eligible contamination (see RI published 2017 and FS published 2019, available at the Middlesex Public Library and *https://www.nan.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/563012/fact-sheet-middlesex-municipal-landfill/*), and the proposed plan is designed to clean up FUSRAP-eligible contamination in accordance with the authority accorded the Corps by Congress.

The Corps is bound by the appropriations bills passed by Congress, and cannot exceed its authority by expanding the scope of the cleanup effort to include non-FUSRAP contamination. Hazardous substances that are beyond the scope of FUSRAP are best addressed through other environmental programs.

The USACE believes the statement that the site poses a 'significant public health risk' is an incorrect statement. The USACE evaluated risk for the site and the detailed evaluation is presented in the "Risk Assessment, Middlesex Municipal Landfill FUSRAP Site, 2016." In its current state as a non-occupied property, risks to human health are within the acceptable range as defined in CERCLA.

Comment #1, Part 2:
The program objectives under FUSRAP "are to safely, effectively and efficiently: …Clean up or control FUSRAP sites to ensure protection of human health and environment" and to "dispose of or stabilize radioactive material in a way that is safe for the public and the environment."1 It is undisputed that the United States Government dumped contaminated radioactive soil that arose from the nation's early atomic programs at the MML. However, despite the clear presence of harmful, radioactive contaminants on the MML site, the Government's Proposed Remediation Plan carves out an exception for the radioactive waste in the Pershing Ave. AOI. This leaves the public health at risk and continues to render the property useless.

Response to Comment #1, Part 2:
The Program objectives as stated are correct, but the limitations explained above apply to the work the USACE conducts thru the FUSRAP. The known disposal of radioactive material at the MML by the Government is a small fraction of the overall disposal volume of the landfill. Disposal at the landfill included municipal and industrial wastes that were not regulated during operations and were not documented. A more detailed history of site operations is included in the "Remedial Investigation, Middlesex Municipal Landfill FUSRAP Site, 2016." The materials discovered along Pershing Avenue were determined to not be characteristic of wastes known to be handled at the MSP site.

Comment #1, Part 3:
The December 18, 2008 Radiological Survey Report prepared on behalf of the US Department of Energy contains a table of Surface Radiation Identified by Gamma Scans. That chart demonstrates that some of the highest areas of radioactive gamma identified on the site is in the area of the Pershing Ave. AOI. (See, e.g., Location 11, in the Pershing Avenue AOI with 120 x 1000 counts per minute (cpm); compared to Location 5, with 12 x 1000 cpm).

Despite a ten-fold increase in gamma radiation in some points of the Pershing Ave. AOI, the Final Proposed Plan seeks to distinguish that location under the guise that the type of radioactivity is different from the other areas on the site. Such a distinction fails and should not be utilized by the Government to avoid its responsibility to the public health and welfare of Middlesex's residents. First, no other entity has been identified to date which would have been responsible for dumping radioactive waste at the MML, and no alternative have been proffered by the Government. To the extent the Government is suggesting that some third party's waste containing "radioluminescent dial" is responsible, the Government ignores the fact that (a) no such party has been identified, (b) no facts have been proffered to show how much of such waste would need to be present to amount to such elevated contamination levels, (c) no explanation has been offered as to why such waste only appears on one location in the overall MML site.

Second, the Government claims, without any supporting reports or data, that the type of radioactivity is different because it appears in different ratios of parent to daughter products.

However, the Government makes this self-supporting statement with no ability for parties to challenge such an assertion. Additionally, there remain numerous unknowns about the waste or type of waste which may have been utilized in the early atomic program. For instance, how do we know that a different type of uranium product was not experimented with or attempted to be utilized before being disqualified as a functional product for the atomic program?

Response to Comment #1, Part 3:
The USACE "Remedial Investigation, Middlesex Municipal Landfill FUSRAP Site, 2016" fully documents all evaluations related to the contamination at the MML and provides the analysis and supporting data used to make the determination that waste discovered along Pershing Avenue were not considered FUSRAP wastes.

Comment #1, Part 4:
Given the Government's prolific contamination on the MML site, it should be incumbent on the Government to prove that the waste was not theirs, and if there is any question, the Government should find in favor of remediating the radioactivity. Any other process ignores the Government's own recognized goals of providing for the health and safety of the public by remediating dangerous radioactive waste.

Response to Comment #1, Part 4:
As discussed above, Congress gave USACE the authority to clean up contamination resulting from the nation's early atomic energy program via FUSRAP. The Remedial Investigation documented the nature and extent of the contamination attributable to the nation's early atomic energy program. Further, the Remedial Investigation clearly documented that non-FUSRAP materials such as radium dials and radium painted devices were dumped in the landfill. Such non-FUSRAP material is clearly ineligible for cleanup under the FUSRAP program. Exceeding the limits of USACE's authority under FUSRAP would be a violation of the Anti-Deficiency Act as well as a violation of the constitutional separation of powers.

Comment #2:
This comment was received during the public meeting from Commenter A; Daphne [last name not provided] asked who is responsible for paying for the cleanup.

Response: The remediation of the MML FUSRAP Site is being funded under the Formerly Utilized Site Remedial Action Program (FUSRAP). Funds under the program are appropriated by Congress and used to clean up FUSRAP-related material.

Comment #3:
This comment was received during the public meeting from Commenter A; Daphne [last name not provided] asked what determines the risk since it was stated that there would be less risk to recreational versus residential. They also asked the definition of risk and what was the margin that says there is risk.

Response: The risk assessment takes into account activities that would potentially expose people to the radioactive materials. For example, a resident would be on-site longer than a recreational user, so the risk to residential users of the Site would be higher. The risk assessment follows the State of New Jersey's regulations that determine acceptable exposure levels, which equate to risk. Typically, potential exposure to residents is the highest level of risk because they are onsite the longest.

For the MML FUSRAP site, risk to human health was evaluated as the probability of an individual developing cancer from radionuclide exposure. Cancer risk is evaluated as the likelihood of an individual developing cancer as a result of exposure to site contaminants under the use conditions, e.g., residential, on-site worker, trespasser. The result of the evaluation is expressed as a probability. As defined by the NCP, a calculated cancer risk between 1 in 10,000 and 1 in 1,000,000 is recognized as an acceptable probability of an individual developing cancer. A cancer risk greater than 1 in 10,000 generally results in a risk management action.

Comment #4:
This comment was received during the public meeting from Commenter A; Daphne [last name not provided] expressed that their biggest concern was that once the Site was cleaned up that there would be more of a strain on the current strained infrastructure, more taxes, more traffic and more people.

Response: The USACE will address FUSRAP contaminants at the landfill site. Other contaminants are present in the landfill and would need to be remediated by another party before the property could be developed for other uses. The Borough of Middlesex has an Ordinance that states the landfill is not to be redeveloped for residential use. The Borough's plan is for the property to be used for active and passive recreation. USACE will not have a say in the Borough's plans other than to advise on any land use related to the cleanup.

Comment #5:
This comment was received during the public meeting from Commenter A; Daphne [last name not provided] asked how long the excavation will take and who is responsible for cleaning up any damage such as disturbed grass, potholes, stones [in the roadway].

Response: The Preferred Alternative is expected to take two years to complete. During construction activities a traffic management plan, erosion and sediment control plan, and equipment inspections will be implemented so that impacts to the public from removal activities occurring on site and trucks entering and exiting the site are minimized to the extent practicable. Once remediation is complete any on- or off-property disturbances will be restored to their previous condition and revegetated.

Comment #6:
This comment was received during the public meeting from Commenter A; Daphne [last name not provided] asked how wildlife would be managed.

Response: The USACE completed a review of wildlife habitats at the site. No habitats for sensitive or special status species were identified. There is the potential for bald eagles and special status bat species to use wooded areas at the landfill, but these areas would not be disturbed by remediation activities under the Preferred Alternative.

Comment #7:
This comment was received during the public meeting from Commenter A; Daphne [last name not provided] expressed concern that after the cleanup is complete that there could be future development and construction on the property that ignores the impacts to wildlife, the current aesthetics and quiet enjoyment, and wanted to make sure that it was on the record that it is important and cannot be ignored.

Response: Comment noted. The Borough's plan is for the property to be used for active and passive recreation. USACE will not have a say in the Borough's plans other than to advise on any land use related to the cleanup.

Comment #8:
This comment was received during the public meeting from Commenter B; Matt Moench commented on the cleanup standard as currently proposed and the possibility if in the future these standards changed. He asked if the USACE would come back and do a further remedy of this or is this the one shot to make sure it is as clean as it can be.

Response: The proposed RG at the MML FUSRAP Site for the ROCs is based on NJAC 7:28-12.8(a)(1), which was selected as an ARAR. The proposed RG is identified as the Total Effective Dose Equivalent of 15 mrem/yr above background. Once adopted as an ARAR this standard will not change in the future, unless the site is no longer protective. Pursuant to CERCLA, there are procedures to change to a more protective standard or to take other actions to ensure protectiveness. Risk from each RIA was evaluated in the HHRA and the derived risk numbers show that the remedial action will remain protective even if the New Jersey standard changes in the future. This action is designed to address all FUSRAP contamination at this time, so no further remedial actions are anticipated to be necessary in the future.

Comment #9:
This comment was received during the public meeting from Commenter B; Matt Moench asked if there were any other sites that are contaminated, that are radioactive, that are not tied to the U.S. government's activities on the site [MML].

Response: The remedial investigation report and feasibility study for the Site discuss the extent of FUSRAP-related materials at the landfill site and additional radiological contamination along Pershing Avenue that is from other sources. USACE has not been given authority by the Federal Government to address non-FUSRAP waste.

Comment #10:
This comment was received during the public meeting from Commenter B; Matt Moench asked as a follow up to his previous question whether the data is publicly available and all made available to the Borough with regard to what is along Pershing Avenue, where it came from, and the reason why the USACE thinks that one area of radioactivity or radioactive material is not [FUSRAP related] and doesn't fall within USACE's responsibility to remediate.

Response: The remedial investigation report and feasibility study are available to the public on the USACE's website: *https://www.nan.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/563012/fact-sheet-middlesex-municipal-landfill/*, and at the Middlesex Public Library. In addition, the Administrative Record file including these documents is located at the Middlesex Public Library. Refer to the responses for Comment #1 for additional information.

Comment #11:
This comment was received during the public meeting from Commenter B; Matt Moench stated that the Borough's interest is to make sure that the site [the MML FUSRAP Site] is remediated to the highest standards possible and that they are not stuck in a situation where after the remedy the property remains contaminated [as it relates to FUSRAP-related materials].

Response: Comment noted.

Comment #12:
This comment was received during the public meeting from Commenter C; Marcia Karrow stated that communication between the former mayor and the USACE may have existed concerning the radioactive material found along Pershing Avenue but that they are not aware of any recent communications with the Borough.

Response: Comment noted. Recent communications between the Borough and USACE have been made in response to the letter sent to Ms. Helen Edge of USACE from Mr. Matt Moench on behalf of the Borough of Middlesex, refer to Comment #1.

Comment #13:
This comment was received during the public meeting from Commenter C; Marcia Karrow stated that nobody had expressed to the Borough that the radioactive material found along Pershing Avenue was going to be left, and that to the best of their knowledge, at no time could anybody obtain radioactive material without a government permit and going through the federal government quarry.

Response: Refer to the responses for Comment #1.

Comment #14:
This comment was received during the public meeting from Commenter C; Marcia Karrow stated that there is extreme concern that this expensive cleanup [of the radioactive material found along Pershing Avenue] can be done more efficiently and less expensively by the USACE and

Department of Energy than the Borough ever could and should consider expediting the entire cleanup now of any radioactive material and sort out who owes what to whom later.

Response: Refer to the responses for Comment #1

Comment #15:
This comment was received during the public meeting from Commenter D; Mike [last name not provided] asked that if during your excavation contamination is found going beyond the currently hatched areas [on the map] if the USACE will continue to excavate and clean up additional soil.

Response: Remediation work will begin in the areas identified. If FUSRAP-related materials are identified outside of the boundaries of those areas, the USACE will expand remediation activities to the full extent of the FUSRAP-related contamination.

Comment #16:
This comment was received during the public meeting from Commenter D; Mike [last name not provided] asked what type of cover would be placed after remediation was completed.

Response: Alternative 4b was selected as the Preferred Alternative in the Proposed Plan. Under this alternative, once excavation is complete, the USACE would place two feet of clean fill material on top of excavated areas. Additionally, all disturbed areas will be restored in-kind, such as seeding and mulching to reestablish vegetation.

Comment #17:
This comment was received during the public meeting from Commenter D; Mike [last name not provided] asked if there would be any restrictions on the remediated portion of the landfill following cleanup.

Response: Under the Preferred Alternative, there would be no land use controls for the MML FUSRAP Site once remediation is completed. The USACE would clean up the Site to unrestricted standards as it relates to FUSRAP-related materials, so land use restrictions related to FUSRAP-related materials would not be required for the property.

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TABLES

Table 1
RIA-1 Summary of Radionuclides of Concern and Medium-Specific Exposure Point Concentrations
Middlesex Municipal Landfill FUSRAP Site

Scenario Timeframe: Current/Future
Medium: Soil - RIA-1
Exposure Medium: All Soil

Exposure Point	Radionuclide of Concern	Activity Detected			Frequency of Detection	Exposure Point Activity		Statistical Measure
		Min	Max			Value	Units	
RIA-1	Uranium-238	0.473 ± 0.551	14.2 ± 2.5	pCi/g	30/41	4.64	pCi/g	95% KM (Chebyshev) UCL
	Uranium-234	0.62 ± 0.16	15.2 ± 2.7	pCi/g	19/19	7.41	pCi/g	95% Chebyshev (Mean, Sd) UCL
	Thorium-230	0.123 ± 0.098	15.5 ± 0.477	pCi/g	25/25	5.05	pCi/g	95% Chebyshev (Mean, Sd) UCL
	Radium-226	0.571 ± 0.066	47.6 ± 5.7 G	pCi/g	34/41	8.54	pCi/g	95% KM (Chebyshev) UCL
	Thorium-232	0.659 ± 0.121	1.61 ± 0.182	pCi/g	41/41	1.07	pCi/g	95% Student's-t UCL
	Thorium-228	0.565 ± 0.112	1.46 ± 0.176	pCi/g	25/25	1.01	pCi/g	95% Student's-t UCL
	Uranium-235	-0.004 ± 0.23 G	1.82 ± 0.76 G	pCi/g	19/19	0.78	pCi/g	95% Chebyshev (Mean, Sd) UCL

Key:
G = Sample density differs by more than 15% of LCS density; sample results may be biased.
pCi/g = picocuries/gram
UCL = upper confidence limit

Table 2
RIA-3 Summary of Radionuclides of Concern and Medium-Specific Exposure Point Concentrations
Middlesex Municipal Landfill FUSRAP Site

Scenario Timeframe: Current/Future
Medium: Soil - RIA-3
Exposure Medium: All Soil

Exposure Point	Radionuclide of Concern	Activity Detected			Frequency of Detection	Exposure Point Activity		Statistical Measure
		Min	Max			Value	Units	
RIA-3	Uranium-238	0.343 ± 0.421	176 ± 27	pCi/g	153/167	6.71	pCi/g	95% KM (BCA) UCL
	Uranium-234	0.304 ± 0.024	178 ± 28	pCi/g	68/68	20.85	pCi/g	95% Chebyshev (Mean, Sd) UCL
	Thorium-230	0.242 ± 0.109	178 ± 0.217	pCi/g	116/116	10.72	pCi/g	95% Chebyshev (Mean, Sd) UCL
	Radium-226	0.409 ± 0.048	185 ± 22 G	pCi/g	168/168	9.63	pCi/g	95% Chebyshev (Mean, Sd) UCL
	Thorium-232	0.422 ± 0.109	9 ± 1.2 G	pCi/g	168/168	1.22	pCi/g	95% Student's-t UCL
	Thorium-228	0.324 ± 0.101	3.72 ± 0.099	pCi/g	116/116	1.08	pCi/g	95% Student's-t UCL
	Uranium-235	0.009 ± 0.23	12.4 ± 2.6	pCi/g	68/68	1.35	pCi/g	95% Chebyshev (Mean, Sd) UCL

Key:
G = Sample density differs by more than 15% of LCS density; sample results may be biased
pCi/g = picocuries/gram
UCL = upper confidence limit

Table 3
Toxicity Data Summary
Middlesex Municipal Landfill FUSRAP Site

Radionuclide of Concern	Cancer Slope Factor					Weight of Evidence/Cancer Guideline Description
	External Radiation (Risk/yr per pCi/g)	Particulate Inhalation (Risk/pCi)	Food Ingestion (Risk/pCi)	Water Ingestion (Risk/pCi)	Soil Ingestion (Risk/pCi)	
Uranium-238	1.24E-10	2.36E-08	8.66E-11	6.40E-11	8.66E-11	A- Human Carcinogen
Uranium-234	2.53E-10	2.78E-08	9.55E-11	7.07E-11	9.55E-11	A- Human Carcinogen
Thorium-230	8.45E-10	3.41E-08	1.19E-10	9.14E-11	1.19E-10	A- Human Carcinogen
Radium-226	2.50E-08	2.82E-08	5.14E-10	3.85E-10	5.14E-10	A- Human Carcinogen
Thorium-232	3.58E-10	4.33E-08	1.33E-10	1.01E-10	1.33E-10	A- Human Carcinogen
Thorium-228	5.64E-09	1.32E-07	1.48E-10	1.08E-10	1.48E-10	A- Human Carcinogen
Uranium-235	5.51E-07	2.50E-08	9.43E-11	6.96E-11	9.43E-11	A- Human Carcinogen

Key:
Risk/yr per pCi/g = risk per year per picocurie per gram
Risk/pCi = risk per picocurie

Source:
RESRAD DCFPAK3.02 Morbidity Library, 02/2016

Table 4
RIA-1 Residential Risk Characterization Summary
Middlesex Municipal Landfill FUSRAP Site

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult
Medium: Soil
Exposure Meduium: All Soil
Exposure Point: RIA-1

Radionuclide of Concern	Carcinogenic Risk							
	External Radiation	Soil Ingestion	Particulate Inhalation	Ingestion of Produce[1]	Ingestion of Produce[2]	Outdoor Radon Inhalation[1]	Drinking Water Ingestion	Exposure Routes Total
Actinium-227	7.0E-06	2.0E-07	3.7E-08	1.6E-07	5.4E-08	--	9.0E-06	1.6E-05
Protactinium-231	3.2E-06	1.6E-07	3.1E-08	3.6E-07	2.9E-08	--	4.9E-06	8.7E-06
Lead-210	2.1E-07	1.2E-05	6.0E-08	3.8E-05	6.3E-07	--	1.1E-04	1.6E-04
Radium-226	5.3E-04	6.3E-06	9.4E-08	4.3E-05	4.0E-07	3.3E-07	6.8E-05	6.5E-04
Radium-228	3.3E-05	3.9E-07	2.2E-08	4.0E-06	2.4E-08	6.5E-08	3.9E-06	4.2E-05
Thorium-228	7.6E-06	3.1E-08	6.2E-09	1.0E-08	2.9E-12	8.8E-09	4.6E-10	7.7E-06
Thorium-230	1.4E-06	3.3E-07	5.3E-08	2.0E-07	8.9E-10	1.1E-09	1.5E-07	2.1E-06
Thorium-232	4.9E-05	7.0E-07	4.7E-08	6.6E-06	3.9E-08	1.3E-07	6.5E-06	6.3E-05
Uranium-234	1.5E-05	3.7E-07	6.3E-08	3.0E-07	4.1E-08	1.2E-13	6.8E-06	2.3E-05
Uranium-235	3.4E-06	4.0E-08	6.0E-09	3.3E-08	4.4E-09	--	7.3E-07	4.2E-06
Uranium-238	4.1E-06	3.0E-07	3.4E-08	2.4E-07	3.2E-08	1.2E-18	5.2E-06	1.0E-05
							Total Cancer Risk	1E-03

[1] Water Independent Pathway

[2] Water Dependent Pathway

Table 5
RIA-1 Indoor Site Worker Risk Characterization Summary
Middlesex Municipal Landfill FUSRAP Site

Scenario Timeframe: Future
Receptor Population: Indoor Site Worker
Receptor Age: Adult
Medium: Soil
Exposure Meduium: All Soil
Exposure Point: RIA-1

Radionuclide of Concern	Carcinogenic Risk				
	External Radiation	Soil Ingestion	Particulate Inhalation	Outdoor Radon Inhalation[1]	Exposure Routes Total
Actinium-227	2.6E-06	1.7E-08	4.9E-09	--	2.7E-06
Protactinium-231	1.5E-06	1.7E-08	5.0E-09	--	1.5E-06
Lead-210	1.8E-07	2.1E-06	1.7E-08	--	2.3E-06
Radium-226	3.9E-04	1.3E-06	2.8E-08	1.3E-08	3.9E-04
Radium-228	1.4E-05	4.2E-08	3.7E-09	1.1E-08	1.4E-05
Thorium-228	3.2E-06	3.6E-09	1.1E-09	4.2E-09	3.2E-06
Thorium-230	2.4E-06	1.3E-07	3.1E-08	7.8E-11	2.6E-06
Thorium-232	2.7E-05	9.5E-08	9.8E-09	2.2E-08	2.7E-05
Uranium-234	7.6E-09	3.9E-08	1.0E-08	2.6E-15	5.7E-08
Uranium-235	1.7E-06	4.2E-09	9.6E-10	--	1.7E-06
Uranium-238	2.2E-06	3.8E-08	6.5E-09	3.3E-20	2.3E-06
				Total Cancer Risk	5E-04

[1] Water Independent Pathway

Table 6
RIA-3 Residential Risk Characterization Summary
Middlesex Municipal Landfill FUSRAP Site

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult
Medium: Soil
Exposure Meduium: All Soil
Exposure Point: RIA-3

Radionuclide of Concern	Carcinogenic Risk							
	External Radiation	Soil Ingestion	Particulate Inhalation	Ingestion of Produce[1]	Ingestion of Produce[2]	Outdoor Radon Inhalation[1]	Drinking Water Ingestion	Exposure Routes Total
Actinium-227	1.2E-05	3.4E-07	6.5E-08	2.8E-07	9.3E-08	--	1.6E-05	2.8E-05
Protactinium-231	5.6E-06	2.8E-07	5.4E-08	6.2E-07	5.0E-08	--	8.5E-06	1.5E-05
Lead-210	2.4E-07	1.3E-05	6.8E-08	4.2E-05	7.2E-07	--	1.2E-04	1.8E-04
Radium-226	6.0E-04	7.1E-06	1.1E-07	4.9E-05	4.5E-07	3.8E-07	7.7E-05	7.3E-04
Radium-228	3.8E-05	4.5E-07	2.6E-08	4.5E-06	2.7E-08	7.4E-08	4.5E-06	4.7E-05
Thorium-228	8.2E-06	3.3E-08	6.6E-09	1.1E-08	3.1E-12	9.4E-09	4.9E-10	8.2E-06
Thorium-230	3.0E-06	7.1E-07	1.1E-07	4.3E-07	1.9E-09	2.4E-09	3.2E-07	4.5E-06
Thorium-232	5.6E-05	8.0E-07	5.4E-08	7.5E-06	4.5E-08	1.4E-07	7.4E-06	7.2E-05
Uranium-234	4.4E-08	1.1E-06	1.8E-07	8.5E-07	1.1E-07	3.3E-13	1.9E-05	2.1E-05
Uranium-235	5.9E-06	7.0E-08	1.0E-08	5.6E-08	7.6E-09	--	1.3E-06	7.3E-06
Uranium-238	6.0E-06	4.3E-07	4.9E-08	3.5E-07	4.7E-08	1.7E-18	7.6E-06	1.4E-05
							Total Cancer Risk	1E-03

[1] Water Independent Pathway

[2] Water Dependent Pathway

Table 7
RIA-3 Indoor Site Worker Risk Characterization Summary
Middlesex Municipal Landfill FUSRAP Site

Scenario Timeframe: Future
Receptor Population: Indoor Site Worker
Receptor Age: Adult
Medium: Soil
Exposure Meduium: All Soil
Exposure Point: RIA-3

Radionuclide of Concern	Carcinogenic Risk				
	External Radiation	Soil Ingestion	Particulate Inhalation	Outdoor Radon Inhalation[1]	Exposure Routes Total
Actinium-227	1.7E-06	1.1E-08	3.2E-09	--	1.8E-06
Protactinium-231	1.0E-06	1.1E-08	3.3E-09	--	1.0E-06
Lead-210	1.0E-07	1.2E-06	9.3E-09	--	1.3E-06
Radium-226	2.2E-04	7.1E-07	1.5E-08	7.2E-09	2.2E-04
Radium-228	1.4E-05	4.3E-08	3.8E-09	1.2E-08	1.4E-05
Thorium-228	3.2E-06	3.6E-09	1.1E-09	4.2E-09	3.2E-06
Thorium-230	5.7E-07	3.0E-08	7.2E-09	1.8E-11	6.0E-07
Thorium-232	2.8E-05	9.7E-08	1.0E-08	2.3E-08	2.8E-05
Uranium-234	3.3E-09	1.7E-08	4.3E-09	1.1E-15	2.4E-08
Uranium-235	1.1E-06	2.8E-09	6.4E-10	--	1.1E-06
Uranium-238	1.3E-06	2.2E-08	3.8E-09	1.9E-20	1.3E-06
				Total Cancer Risk	3E-04

[1] Water Independent Pathway

Table 8
RIA-1 Summary of Ecological Radionuclides of Concern
Middlesex Municipal Landfill FUSRAP Site

Medium: Soil - RIA-1
Exposure Medium: Surface Soil

Exposure Point	Radionuclide of Concern	Activity Detected			Frequency of Detection	Range of Minimum Detectable Activities	
		Min	Max			Value	Units
RIA-1	Uranium-238	0.77 ± 0.24	14.2 ± 2.5	pCi/g	11/15	0.04 - 0.13	pCi/g
	Uranium-234	0.9 ± 0.26	15.2 ± 2.7	pCi/g	11/11	0.04 - 0.2	pCi/g
	Thorium-230	0.372 ± 0.125	15.5 ± 0.477	pCi/g	7/7	0.13 - 0.19	pCi/g
	Radium-226	0.635 ± 0.104	47.6 ± 5.7 G	pCi/g	15/15	0.06 - 0.83	pCi/g
	Thorium-232	0.708 ± 0.136	1.55 ± 0.45 G	pCi/g	15/15	0.07- 0.96	pCi/g
	Thorium-228	0.633 ± 0.103	1.27 ± 0.135	pCi/g	7/7	0.06 - 0.1	pCi/g
	Uranium-235	0.04 ± 0.25 G	1.82 ± 0.76 G	pCi/g	11/11	0.02 - 1.25	pCi/g

Key:
G = Sample density differs by more than 15% of LCS density; sample results may be biased.
pCi/g = picocuries/gram

Table 9
RIA-3 Summary of Ecological Radionuclides of Concern
Middlesex Municipal Landfill FUSRAP Site

Medium: Soil - RIA-3
Exposure Medium: Surface Soil

Exposure Point	Radionuclide of Concern	Activity Detected			Frequency of Detection	Range of Minimum Detectable Activities	
		Min	Max			Value	Units
RIA-3	Uranium-238	0.481 ± 1.09	12.3 ± 1.79 J	pCi/g	48/59	0.02 - 2.88	pCi/g
	Uranium-234	0.568 ± 0.037	6.8 ± 1.3	pCi/g	26/26	0.02 - 0.26	pCi/g
	Thorium-230	0.278 ± 0.11	22.7 ± 0.537	pCi/g	47/47	0.13 - 0.27	pCi/g
	Radium-226	0.428 ± 0.048	69.7 ± 8.75	pCi/g	60/60	0.03 - 2.15	pCi/g
	Thorium-232	0.705 ± 0.117 J	3.05 ± 0.42 G	pCi/g	60/60	0.08 - 0.89	pCi/g
	Thorium-228	0.507 ± 0.106 J	1.64 ± 0.233	pCi/g	47/47	0.05 - 0.21	pCi/g
	Uranium-235	0.029 ± 0.031	1.97 ± 0.585	pCi/g	26/26	0.01 - 0.96	pCi/g

Key:
G = Sample density differs by more than 15% of LCS density; sample results may be biased.
J = The value is considered estimated.
pCi/g = picocuries/gram

Table 10
RIA-1 General Screening Level Ecological Effects Evaluation
Middlesex Municipal Landfill FUSRAP Site

	Water, Terrestrial Systems			Surface Soil			Water & Soil
Nuclide	Water Limit pCi/L	Water Data pCi/L	Partial Fraction	Soil Limit pCi/g	Soil Data pCi/g	Partial Fraction	Sum of Fractions
Ra-226	8E+03	1.37E-01	1.7E-05	5E+01	4.76E+01	9.4E-01	9.4E-01
Ra-228	7E+03	7.29E-01	1.1E-04	4E+01			1.1E-04
Th-232	5E+04	1.10E-02	2.1E-07	2E+03	1.55E+00	1.0E-03	1.0E-03
U-234	4E+05	NA		5E+03	1.52E+01	3.0E-03	3.0E-03
U-235	4E+05	NA		3E+03	1.82E+00	6.4E-04	6.4E-04
U-238	4E+05	3.75E+01	9.2E-05	2E+03	1.42E+01	9.0E-03	9.1E-03
Totals			**2.2E-04**			**9.6E-01**	**9.6E-01**

Table 11
RIA-3 General Screening Level Ecological Effects Evaluation
Middlesex Municipal Landfill FUSRAP Site

	Water, Terrestrial Systems			Surface Soil			Water & Soil
Nuclide	Water Limit pCi/L	Water Data pCi/L	Partial Fraction	Soil Limit pCi/g	Soil Data pCi/g	Partial Fraction	Sum of Fractions
Ra-226	8E+03	1.37E-01	1.7E-05	5E+01	6.97E+01	1.4E+00	1.4E+00
Ra-228	7E+03	7.29E-01	1.1E-04	4E+01			1.1E-04
Th-232	5E+04	1.10E-02	2.1E-07	2E+03	3.05E+00	2.0E-03	2.0E-03
U-234	4E+05	NA		5E+03	6.80E+00	1.3E-03	1.3E-03
U-235	4E+05	NA		3E+03	1.97E+00	6.9E-04	6.9E-04
U-238	4E+05	3.75E+01	9.2E-05	2E+03	1.23E+01	7.8E-03	7.9E-03
Totals			**2.2E-04**			**1.4E+00**	**1.4E+00**

Table 12
RIA-3 Site-Specific Screening Level Ecological Effects Evaluation
Middlesex Municipal Landfill FUSRAP Site

	Water, Terrestrial Systems			Surface Soil			Water & Soil
Nuclide	Water Limit pCi/L	Water Data pCi/L	Partial Fraction	Soil Limit pCi/g	Soil Data pCi/g	Partial Fraction	Sum of Fractions
Ra-226	8E+03	1.37E-01	1.7E-05	5E+01	2.06E+00	4.1E-02	4.1E-02
Ra-228	7E+03	7.29E-01	1.1E-04	4E+01			1.1E-04
Th-232	5E+04	1.10E-02	2.1E-07	2E+03	1.09E+00	7.2E-04	7.2E-04
U-234	4E+05	NA		5E+03	1.74E+00	3.4E-04	3.4E-04
U-235	4E+05	NA		3E+03	1.48E-01	5.2E-05	5.2E-05
U-238	4E+05	3.75E+01	9.2E-05	2E+03	2.40E+00	1.5E-03	1.6E-03
Totals			**2.2E-04**			**4.3E-02**	**4.4E-02**

Table 13
Applicable or Relevant and Appropriate Requirements
Middlesex Municipal Landfill FUSRAP Site

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
NJDEP	Soil	7:28-12.8(a)(1)	Relevant and Appropriate	New Jersey Remediation Standard for Radioactive Materials establishes minimum standards for the remediation of real property contaminated by radioactive materials. NJAC 7:28-12.8(a)(1) requires that a maximum total annual effective dose of 15 mrem/yr above background (which includes the aggregation of annual external gamma radiation dose and intake dose, including groundwater) be met for an unrestricted use remedial action, a limited use remedial action or a restricted use remedial action.	Implementation of the Selected Remedy will meet this requirement.
USACE	Soil	40 CFR Part 230.10(c)	Applicable	The dredge and fill standards of the Clean Water Act would pertain to remedial activities that may result in the excavation and fill of portions of the onsite wetland. The CWA § 404 regulates the discharge of dredged or fill materials into waters of the U.S., including freshwater wetlands. Discharge of dredged or fill material into wetlands without a permit is prohibited.	The Selected Remedy will prohibit the discharge of dredged or fill material into wetlands without a permit.

ARAR = Applicable or Relevant and Appropriate Requirement

mrem/yr = millirem per year

NJAC = New Jersey Administrative Code

NJDEP = New Jersey Department of Environmental Protection

USACE = U.S. Army Corps of Engineers

USEPA = U.S. Environmental Protection Agency

Table 14
Risk-Based Evaluation of Alternatives
Middlesex Municipal Landfill FUSRAP Site

		RIA-1	RIA-3
Alternatives	**Clean-up**	**Radiological Dose (mrem/yr)**	
Alterative 1 – No Action [1]	Restricted	26.0	15.5
	Unrestricted	81.6	96.5
Alternative 2 – Limited Action with LUCs [2]	N/A	1.5	0.9
Alternative 3 & 4 – Excavation and Off-site Disposal for Unrestricted and Restricted Use [3]	Restricted	11.9	
	Unrestricted	13.9	
Alternative 5 – Containment (capping) and Land Use Controls [4]	Restricted	11.9	11.2
	Unrestricted	--	13.9

Key:

1. Alternative 1 is the maximum dose for unrestriced use is from the residential scenario determined in the risk assessment, and the maximum dose for restriced use is from the indoor site worker scenario determined in the risk assessment.

2. Alternative 2 is the maximum dose for the adolescent trespasser/recreational visitor scenrio determined in the risk assessment.

3. Alternative 3 and 4 are the maximum dose associated with the potential land use after removal of soils exceeding the proposed RG has been completed.

4. Alternative 5 is the maximum dose associated with removal of contaminants from RIA-1 using a proposed RG of 15 pCi/g for the Borough property and a proposed RG of 5 pCi/g for church property, and the maximum dose for indoor site worker with the cap in place in RIA-3.

LUC = Land use control
mrem/yr = millirem per year
N/A = Not applicable
-- = Unrestricted release not considered

Table 15
Comparison of Remedial Alternatives
Middlesex Municipal Landfill FUSRAP Site

Remedial Alternative	Evaluation Criteria[1]						
	Protection of Human Health and the Environment	**Compliance with ARARs**	**Short-Term Effectiveness**	**Long-Term Effectiveness and Permanence**	**Reduction in Toxicity, Mobility, and Volume through Treatment**	**Implementability**	**Cost (Present Value of Total Capital and O&M Cost)**
Alternative 1 No Action	**Not Protective**	**Not Compliant**	**High.** Results in no short-term impacts.	**Low** Provides no long-term effectiveness.	**None**	**High** The site remains the same; therefore, is easily implementable.	$0
Alternative 2 Limited Action	**Protective**	**Compliant**	**High** Results in no short-term impacts.	**Moderate** Provides long-term effectiveness and permanence so long as LUCs are enforced and/or maintained.	**None** Treatment has not been proposed under this alternative. No reduction in toxicity, mobility, or volume.	**Moderate** Readily implementable but will require negotiation with Borough and church property owners regarding implementation of LUCs.	$1,749,200
Alternative 3a Excavation and Off-site Disposal for Unrestricted and Restricted Use	**Protective**	**Compliant**	**Moderate** Results in short-term impacts on human and ecological receptors; however, these impacts would be mitigated with programmatic controls.	**Moderate** Residual risks above unrestricted release RGs would remain at Borough property. LUCs must be maintained for soils that exceed RGs for unrestricted release.	**None** Treatment has not been proposed under this alternative. No reduction in toxicity or volume. Mobility is reduced through off-site disposal.	**Moderate** Readily implementable but will require negotiation with the Borough regarding implementation of LUCs	$12,159,300
Alternative 3b Excavation and Offsite Disposal for Unrestricted Use	**Protective**	**Compliant**	**Moderate** Results in more short term impacts when compared to Alternative 3a due to the volume and duration of material handling; however, these impacts would be mitigated with programmatic controls.	**High** Residual risks removed to allow for unrestricted release.	**None** Treatment has not been proposed under this alternative. No reduction in toxicity or volume. Mobility is reduced through off-site disposal.	**High** Readily implementable. No LUC negotiation with stakeholders required.	$17,671,400
Alternative 4a Excavation, Radiological Soil Sorting and Off-site Disposal for Unrestricted and Restricted Use	**Protective**	**Compliant**	**Moderate** Results in short-term impacts on human and ecological receptors; however, these impacts would be mitigated with programmatic controls.	**Moderate** Residual risks above unrestricted release RGs would remain at Borough property. LUCs must be maintained for soils that exceed RGs for unrestricted release	**None** Treatment has not been proposed under this alternative. No reduction in toxicity or volume of FUSRAP contamination. Mobility is reduced through off-site disposal.	**Moderate** Readily implementable but will require negotiation with stakeholders regarding implementation of LUCs.	$8,747,800
Alternative 4b[2] Excavation, Radiological Soil Sorting and Off-site Disposal for Unrestricted Use	**Protective**	**Compliant**	**Moderate** Results in the short-term impacts on human and ecological receptors for the duration and volume of material handling; these impacts would be further mitigated with programmatic controls.	**High** Residual risks removed to allow for unrestricted release.	**None** Treatment has not been proposed under this alternative. No reduction in toxicity. Volume is reduced through radiological sorting. Mobility is reduced through off-site disposal.	**Moderate** Readily implementable. No LUC negotiation with stakeholders required. Pre-construction testing of sorting equipment may be required to determine optimal operational parameters.	$11,942,700
Alternative 5 Containment through Capping and LUCs	**Protective**	**Compliant**	**Moderate** Results in short-term impacts on human and ecological receptors; however, these impacts would be mitigated with programmatic controls.	**Low** Residual risk would remain onsite. Long-term permanence and effectiveness is dependent upon O&M and LUCs.	**None** Treatment has not been proposed under this alternative. No reduction in toxicity or volume. Minor reductions in mobility result from containment and reduced infiltration.	**Low** Depending on the chemical characteristics of soils at the site, may be administratively difficult if hazardous waste materials are encountered. Will also require negotiation with stakeholders regarding implementation of LUCs	$12,385,700

[1] The Modifying Criteria of State Acceptance and Community Acceptance were solicited for Alternative 4b during the public comment period following publication of the Proposed Plan. Alternative 4b was supported by both the state and community.
[2] Alternative 4b, the Selected Alternative, is highlighted.

Key:
EC = engineering control
FUSRAP = Formerly Utilized Sites Remedial Action Program
IC = institutional control
LUC = land use control
LTM = long-term monitoring
O&M = operation and maintenance
RG = Remediation Goal

Table 16
Cost Estimate for the Selected Remedy - Excavation, Radiological Sorting, and Disposal for Unrestricted Use
Middlesex Municipal Landfill FUSRAP Site

Item	Description	Quantity	Unit	Unit Cost	Total Cost
Capital Costs					
Institutional Controls	No Institutional Controls Required for this alternative	0	LS	$17,500	$0
Subtotal					$0
Site Preparation					
Pre-Design Investigation	Includes sampling plan, sampling, and design report	1	LS	$313,310.00	$313,310
Mob/Demob	Inc. work plan, H&S plan, E&SC plan & install, access road, decon pad	1	LS	$89,000.00	$89,000
Clearing and Grubbing	Includes trees up to 12" diameter	1.21	Acre	$11,000.00	$13,351
Tree Removals	Assume 10 trees >12" to be removed; includes stump removal	10	Each	$193.96	$1,940
Temporary Fencing	Assume 2500 linear feet; cost scaled from Pilot Study	1	Each	$21,437.50	$21,438
Construct Staging Areas	Soil containment area, IDW staging area, soil sorting area	1	Each	$40,000.00	$40,000
Excavation / Soil Sorting / Replacement / Disposal					
Topographic Survey	Assume 3 surveys: pre-con, post-excavation, post-con	3	Each	$4,500.00	$13,500
Decommission Monitoring Wells	81-1; MW-4; 86-23; 81-16; 81-15; 81-9; MW-2	7	Each	$6,000.00	$42,000
Contact Water Management	Dewatering of excavation areas and offsite disposal	4	LS	$2,000.00	$8,000
Excavation	Excavate areas in RIA (church) > 6 pCi/g and RIA-3 (floodplain) and RIA-1 > 16 pCi/g	17,033	BCY	$16.42	$279,683
Stage Soils for Segregation	Stage excavated material at sorting area	17,033	BCY	$20.90	$355,991
Segregate Large Material	Filter, scan large debris in 0.5-foot lifts prior to replacement	17,033	BCY	$4.02	$68,473
Soil Sorting	Filter, scan soil via sorter	13,777	BCY	$139.00	$1,915,014
Stage Sorted Soils	Stage sorted clean and IDW material for fill or disposal	3,031	BCY	$4.02	$12,184
Load into Haul Trucks	Assume 25% swell after excavation; 22% of sorted soil is IDW	3,789	CY	$25.01	$94,755
Hauling	Assume 1.13 Ton/CYD and same hauling distance as Pilot Study	4,281	Ton	$127.73	$546,841
Disposal	Assume same disposal facility used for Pilot Study	4,281	Ton	$100.00	$428,123
Backfill	Purchase and transportation to site (includes 1.5 ft minimum cover at 90% compaction)	3,789	CY	$69.11	$261,837
Backfill	Placement and compaction (includes 1.5 ft minimum cover at 90% compaction)	3,789	CY	$13.35	$50,579
Topsoil	Purchase and transportation to site (includes 0.5 ft topsoil cover)	979	CY	$78.16	$76,524
Topsoil	Placement (includes 0.5 ft topsoil cover)	979	CY	$17.16	$16,801
Monitoring/Sampling/Analyses					
Rad tech support	Used Cabrera costs from Pilot Study; assume loadout 100 ton/day	257	Day	$1,011.20	$259,878
Dust Monitors	8 DustTrack II units for duration of project	52	Week	$1,600.00	$83,200
Chemical Properties Analyses	Backfill and topsoil material sampling, every 1,000 CY	5	Each	$3,579.82	$17,899
Radiological Analyses	Backfill and topsoil material sampling, every 1,000 CY	5	Each	$894.95	$4,475
Physical Properties Analyses	Backfill and topsoil material sampling, every 1,000 CY	5	Each	$538.48	$2,692
Excavated Soil Analyses	Gamma spec - standard TAT, assume every 100 CY + 10% field dups	42	Each	$60.00	$2,508
Construction Oversite	One person per day for mob/demob, 3/day for excavation, sorting, loadout	732	Day	$1,350.00	$988,200
Restoration					
Hydroseed	Install ground cover seed and hydromulch	5,874	SY	$6.42	$37,714
Planting	Riparian buffer area, approx. 2,000 sf; assume 10 maple trees	10	Each	$320.34	$3,203
Maintenance (1-yr)	Maintain and repair seeded and mulched areas	1	Each	$10,141.77	$10,142
Remove Staging/Access Areas	Removal of staging, decon pad, access road, soil containment areas	1	Each	$17,800.00	$17,800
Subtotal					$6,077,055
				Capital Cost Subtotal:	$6,077,055
				Location Factor Adjustment for New Brunswick, New Jersey (1.156, unit prices account for location):	$7,025,076
				15% Project Administration:	$1,053,761
				30% Contingency:	$2,107,523
				15% Legal and Engineering Costs:	$1,053,761
				10% Prime Contractor Profit:	$702,508
				Total Capital Cost:	**$11,942,700**

Key:

LS = Lump Sum

SF = Square Foot

BCY = Cubic Yard

CF = Cubic Foot

> = Greater Than

Notes/Assumptions:

1. Contingency assumed at: 30%
2. Project Administration assumed at: 15%
3. Legal and Engineering Costs assumed at: 15%
4. Prime Contractor costs assumed at: 10%
5. Present value costs assumes annual interest rate per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 July 2000) and the Office of Management and Budget Real Discount Rates for the year 2011 (http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html) at

   Annual interest rate: 2.0%
6. Institutional Controls include: Environmental Easements, Deed restrictions, etc.
7. Unit costs listed were obtained from 2018 RS Means Cost Data, vendor quotes, Pilot Study costs, and engineering judgement.

FIGURES

New York

Connecticut

Pennsylvania

Maryland

Delaware

New Jersey

Newark

Middlesex County

Atlantic Ocean

Delaware Bay

Source:
ESRI Map Web Service, accessed 2015.

0 5 10 15 20
Miles

Middlesex

Middlesex Municipal Landfill

Middlesex Sampling Plant

FUSRAP Site

0 250 500 750 1,000
Feet

S:\Projects\Task Order 0020 USACE Middlesex\MXD\RI 2016\1-1 MCL Regional Map.mxd

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New York District

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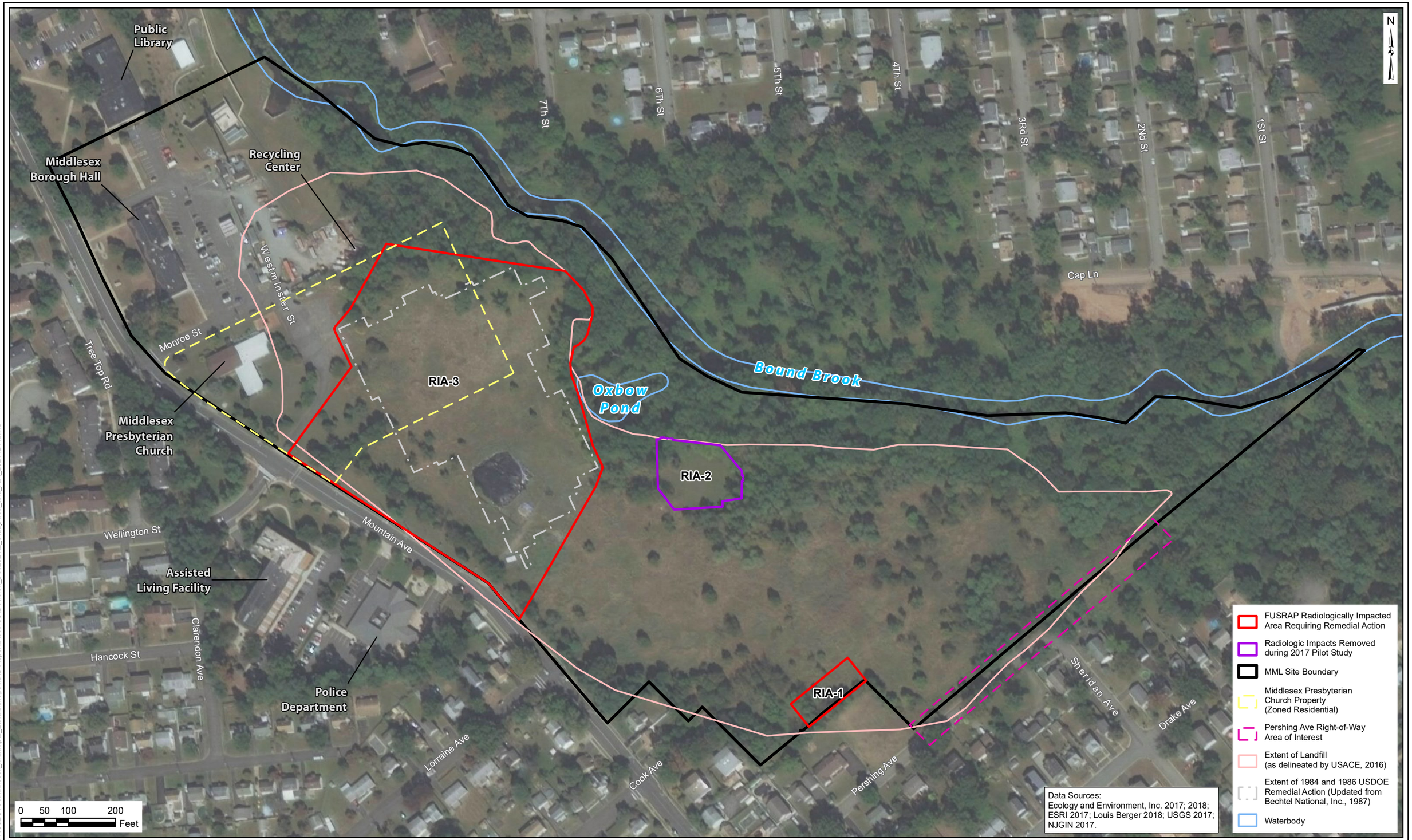
Kansas City District

Middlesex Municipal Landfill - Regional Map

Middlesex Municipal Landfill FUSRAP Site, Borough of Middlesex, New Jersey

Figure 1



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Radiologically Impacted Areas (RIAs) at MML

Middlesex Municipal Landfill FUSRAP Site, Borough of Middlesex, New Jersey

Figure 2

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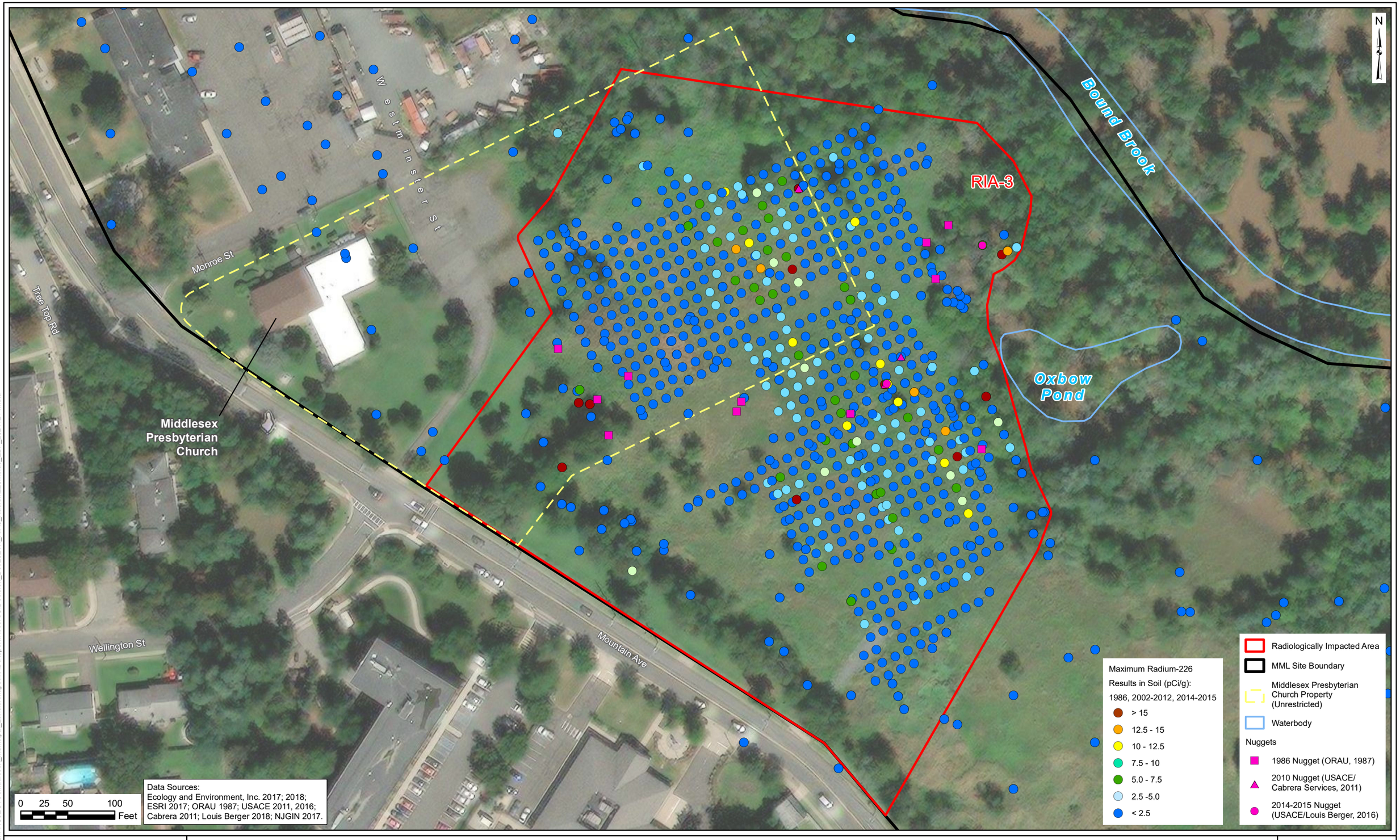
Radium-226 Sample Results for RIA-1

Middlesex Municipal Landfill FUSRAP Site, Borough of Middlesex, New Jersey

Figure 3



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Radium-226 Sample Results for RIA-3

Middlesex Municipal Landfill FUSRAP Site, Borough of Middlesex, New Jersey

Figure 4

MML-GW-BACK-01
MML-GW -BACK-03
MML -GW-BACK-02
MML-GW-BACK-06
MML-GW-BACK-07
MML-GW-BACK-08
MML-GW-BACK-09
Public Library
Middlesex Borough Hall
Recycling Center
81-11
86-23
MW-5
RIA-3
81-16
81-15
81-1
81-9
Oxbow Pond
Bound Brook
Middlesex Presbyterian Church
MML-GW-BACK-04
MW-4
RIA-2
MW-3
MW-9
MW-1
Assisted Living Facility
Police Department
MW-8
MW-2
RIA-1
MML-GW-BACK-05
MML-GW-BACK-11
MML-GW-BACK-10

Monitoring Well	Well Classification	Total Depth As–Built (below ground surface) METERS / FEET	Total Depth Measured on November 19, 2014 (below ground surface) METERS / FEET	Depth to Water Measured on November 19, 2014 (below ground surface) METERS / FEET	Remarks
81-1	Bedrock	14.0 / 46	14.0 / 45.8	5.07 / 16.6	Sampled in 2003, 2014, and 2015
81-15	Bedrock	10.4 / 34.2	10.3 / 33.7	0.84 / 2.76	Sampled in 2002, 2003, 2014, and 2015
MW-8	Bedrock	18.0 / 59	17.5 / 57.4	4.24 / 13.9	Sampled in 2002, 2003, 2014, and 2015
MW-9	Bedrock	24.1 / 79	21.9 / 72.0	4.72 / 15.5	Sampled in 2002, 2003, 2014, and 2015
81-9	Overburden	7.92 / 26	7.08 / 23.2	4.57 / 15.0	Sampled in 2003, 2014, and 2015
81-11	Overburden	4.42 / 14.5	4.30 / 14.0	2.71 / 8.88	Sampled in 2002, 2003, 2014, and 2015
81-16	Overburden	3.51 / 11.5	3.30 / 10.8	0.78 / 2.55	Sampled in 2002, 2003, 2014, and 2015
86-23	Overburden	Unknown	5.50 / 18.1	2.80 / 9.18	Sampled in 2014 and 2015
MW-1	Overburden	3.66 / 12	3.10 / 10.2	1.71 / 5.61	Sampled in 2002, 2003, 2014, and 2015
MW-2	Overburden	7.92 / 26	7.30 / 23.9	4.62 / 15.2	Sampled in 2002, 2003, 2014, and 2015
MW-3	Overburden	7.92 / 26	6.30 / 20.6	4.67 / 15.3	Sampled in 2002, 2003, 2014, and 2015
MW-4	Overburden	7.62 / 25	7.50 / 24.7	4.60 / 15.1	Sampled in 2002, 2003, 2014, and 2015
MW-5	Overburden	3.66 / 12	3.20 / 10.6	0.35 / 1.16	Sampled in 2002, 2003, 2014, and 2015
MML-GW-BACK-01	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-02	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-03	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-04	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-05	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-06	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-07	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-08	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-09	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-10	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015
MML-GW-BACK-11	Residential	Unknown	Not applicable	Not applicable	Sampled in 2015

0 250 500 1,000 Feet

N

Bedrock Monitoring Well
Overburden Monitoring Well
Residential Potable Well (USACE / Louis Berger)
FUSRAP Radiologically Impacted Area Requiring Remedial Action
Radiologic Impacts Removed during 2017 Pilot Study
MML Site Boundary
Middlesex Presbyterian Church Property (Zoned Residential)
Pershing Ave Right-of-Way Area of Interest
Extent of Landfill (as delineated by USACE, 2016)
Extent of 1984 and 1986 USDOE Remedial Action (Updated from Bechtel National, Inc., 1987)
Waterbody

Data Sources:
Ecology and Environment, Inc. 2017; 2018; ESRI 2017; Louis Berger 2018; USGS 2017; NJGIN 2017.

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Groundwater Monitoring Wells and Potable Wells Sampled for the RI

Middlesex Municipal Landfill FUSRAP Site, Borough of Middlesex, New Jersey

Figure 5

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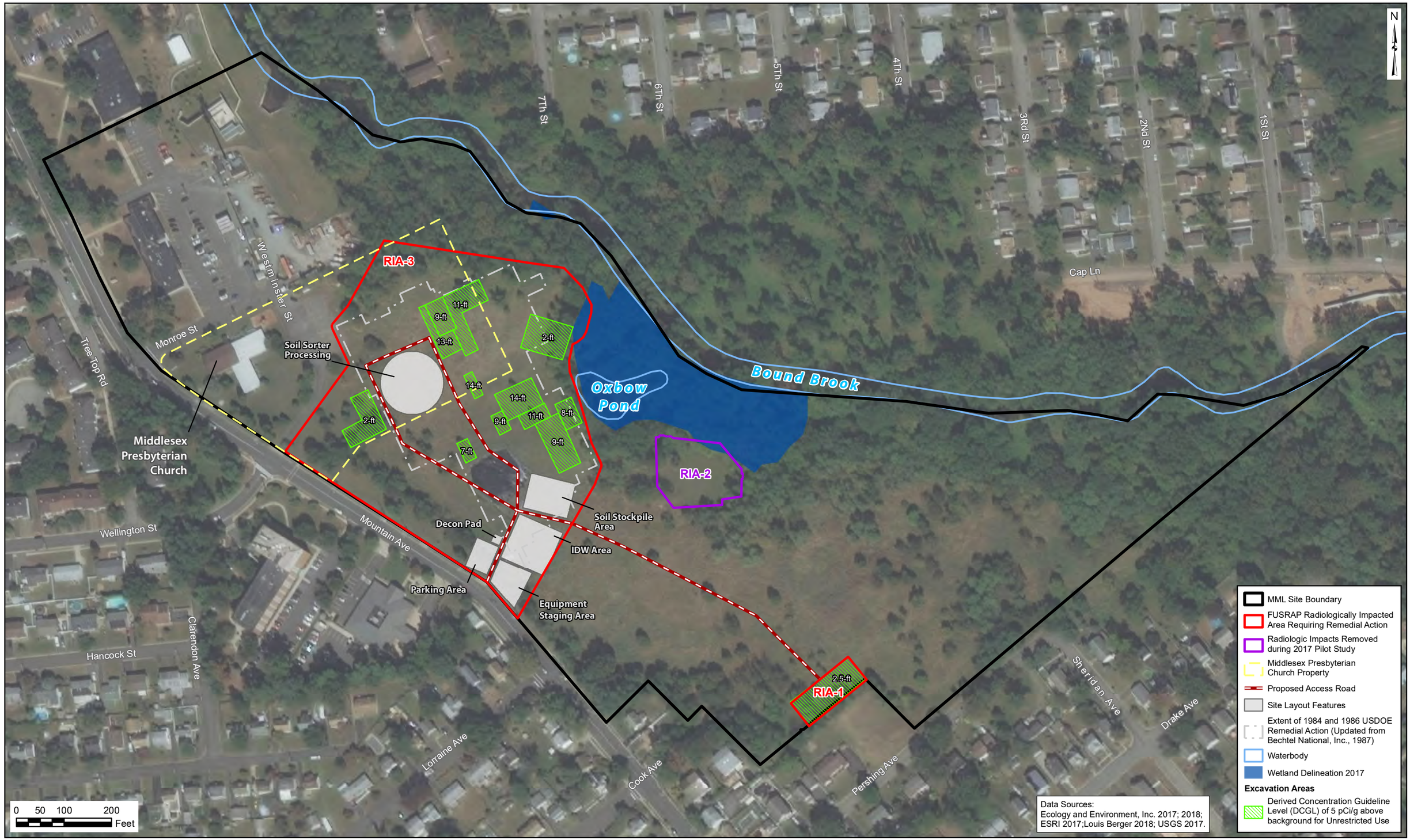

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Selected Remedy: Alternative 4b – Excavation with Soil Sorting for Unrestricted Use

Middlesex Municipal Landfill FUSRAP Site, Borough of Middlesex, New Jersey

Figure 6

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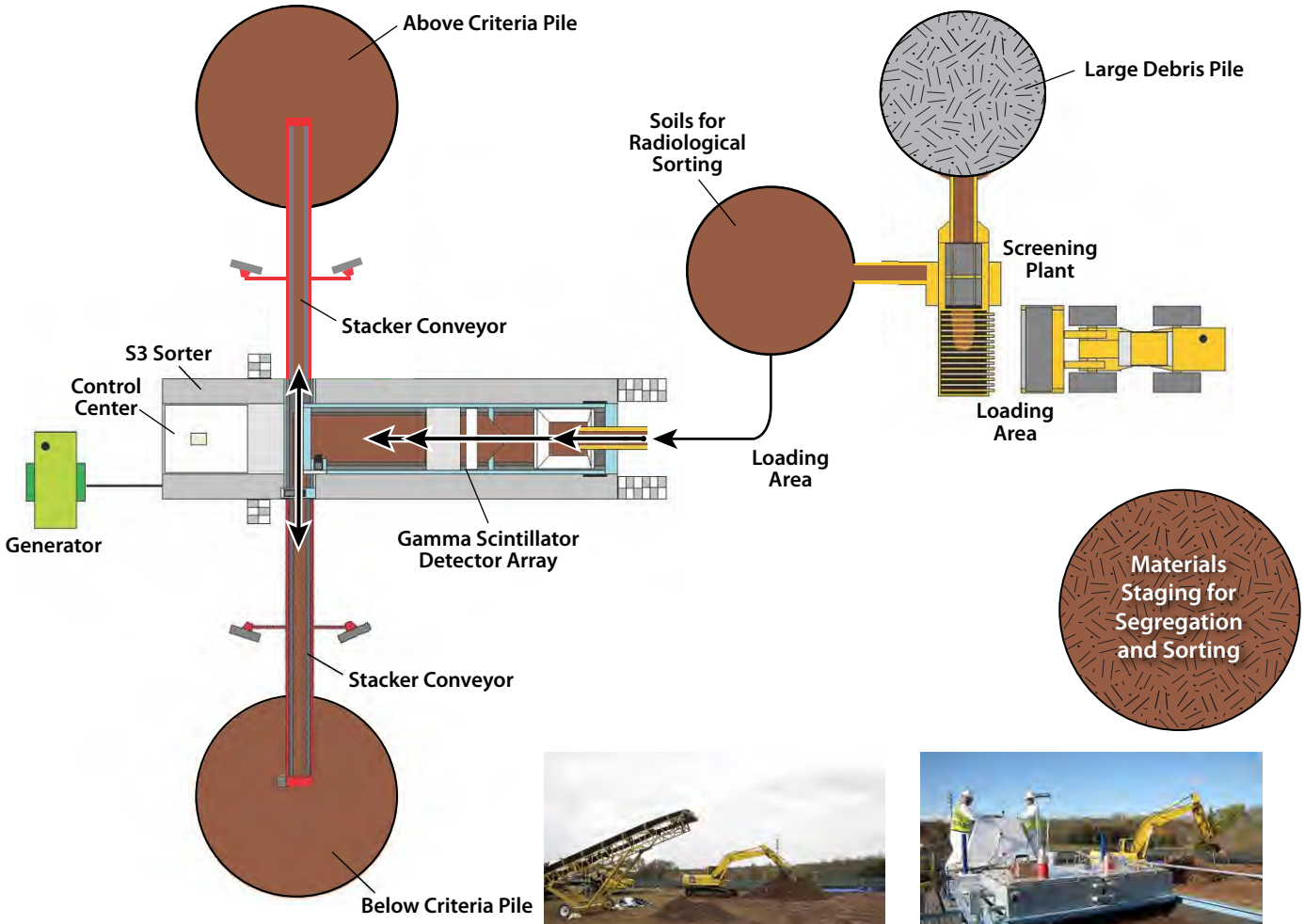

Photos shown were taken during the 2017 Soil Sorting Pilot Study

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Soil Sorter Process Layout
Middlesex Municipal Landfill FUSRAP Site, Borough of Middlesex, New Jersey

Figure 7

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ATTACHMENT 1 BOROUGH OF MIDDLESEX COMMENT LETTER

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September 3, 2021

VIA E-MAIL
USACE
c/o USEPA Region 2
Attention: Ms. Helen Edge
2890 Woodbridge Avenue
Edison, NJ 08837
Helen.K.Edge@usace.army.mil

Re: Middlesex Municipal Landfill

Dear Ms. Edge:

I am environmental counsel to the Borough of Middlesex, and on behalf of Middlesex Borough I formally submit our concerns to the "Final Proposed Plan," dated July 2021, submitted under the Formerly Utilized Sites Remedial Action Plan ("FUSRAP") program for the Middlesex Municipal Landfill FUSRAP Site ("MML"). Specifically, Middlesex objects to the Government's refusal to remediate the area known as "Pershing Avenue Right-of-Way Area of Interest ("Pershing Ave. AOI")." This area has some of the highest gamma radiation on the site and poses a significant public health risk should the Government fail to properly take responsibility for this contamination and include this area in the Remedial Action Plan.

The program objectives under FUSRAP "are to safely, effectively and efficiently: …Clean up or control FUSRAP sites ***to ensure protection of human health and environment***" and to "dispose of or stabilize radioactive material in a way that is ***safe for the public and the environment.***"[1] It is undisputed that the United States Government dumped contaminated radioactive soil that arose from the nation's early atomic programs at the MML. However, despite the clear presence of harmful, radioactive contaminants on the MML site, the Government's

[1] USACE's website, located at https://www.usace.army.mil/Missions/Environmental/FUSRAP/

Proposed Remediation Plan carves out an exception for the radioactive waste in the Pershing Ave. AOI. This leaves the public health at risk and continues to render the property useless.

The December 18, 2008 Radiological Survey Report prepared on behalf of the US Department of Energy contains a table of Surface Radiation Identified by Gamma Scans. That chart demonstrates that some of the highest areas of radioactive gamma identified on the site is in the area of the Pershing Ave. AOI. (See, e.g., Location 11, in the Pershing Avenue AOI with 120 x 1000 cpm; compared to Location 5, with 12 x 1000 cpm).

Despite a ten-fold increase in gamma radiation in some points of the Pershing Ave. AOI, the Final Proposed Plan seeks to distinguish that location under the guise that the type of radioactivity is different from the other areas on the site. Such a distinction fails and should not be utilized by the Government to avoid its responsibility to the public health and welfare of Middlesex's residents.

First, no other entity has been identified to date which would have been responsible for dumping radioactive waste at the MML, and no alternative have been proffered by the Government. To the extent the Government is suggesting that some third party's waste containing "radioluminescent dial" is responsible, the Government ignores the fact that (a) no such party has been identified, (b) no facts have been proffered to show how much of such waste would need to be present to amount to such elevated contamination levels, (c) no explanation has been offered as to why such waste only appears on one location in the overall MML site.

Second, the Government claims, without any supporting reports or data, that the type of radioactivity is different because it appears in different ratios of parent to daughter products. However, the Government makes this self-supporting statement with no ability for parties to challenge such an assertion. Additionally, there remain numerous unknowns about the waste or type of waste which may have been utilized in the early atomic program. For instance, how do we know that a different type of uranium product was not experimented with or attempted to be utilized before being disqualified as a functional product for the atomic program?

Given the Government's prolific contamination on the MML site, it should be incumbent on the Government to prove that the waste was not theirs, and if there is any question, the Government should find in favor of remediating the radioactivity. Any other process ignores the Government's own recognized goals of providing for the health and safety of the public by remediating dangerous radioactive waste.

We may have additional comments or information in the future which we will provide to USACE as our investigation continues into the Government's responsibility on this site. We are meeting with representatives from NJDEP on September 7, 2021, and may have additional information after that time. We will continue to advocate for the health and safety of our residents and we hope that USACE will reconsider its position and act to fully protect our citizens in the most cost-effective and expeditious manner possible.

Very truly yours,

/s/Matthew C. Moench
MATTHEW C. MOENCH

cc: Hon. Cory Booker
Hon. Robert Menendez
Hon. Bonnie Watson Coleman
Hon. John Madden
Hon. Marcia Karrow

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ATTACHMENT 2 PUBLIC MEETING TRANSCRIPT

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UNITED STATES ARMY CORPS OF ENGINEERS

----------X

MIDDLESEX MUNICIPAL LANDFILL MEETING

RE: Middlesex Municipal Landfill Proposed Plan

FUSRAP SITE IN Middlesex, New Jersey

----------X

Held Remote Via Webex

August 18, 2021

6:00 p.m. EST

APPEARANCES:

FOR THE USACE:

HELEN EDGE, Project Manager, New York District

ANN EWY, Technical Manager, Kansas City District

DAVID HAYS, Health Physicist, Kansas City District

FOR THE USDOE:

JILL BENNETT, Contractor to USDOE

FOR THE NJDEP:

SCOTT VONDY, Case Manager

FOR THE MIDDLESEX BOROUGH:

MARCIA KARROW, Borough Administrator

MATT MOENCH, Environmental Attorney

FOR THE WSP:

DAN KENNEDY, Project Manager/Geologist

JESSICA FORBES-GUERRERO, Public Involvement Specialist

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MS. EWY: This meeting is for the Middlesex Municipal Landfill for the FUSRAP site for the proposed plan. I'm going to do a few logistics and introductions before we get started, and then I'm going to turn it over to Helen Edge.

So thank you, in advance, for attending tonight, and thank you, in advance, for your patience with any technical issues.

As you guys know, we've been doing things remote for a while now, but there's just no telling when you're going to have IT issues. So if anything comes up, we'll get back on and keep things moving, so thanks in advance for that.

We are going to ask that once we get started with the presentation, cameras are off. Everybody is going to be muted automatically, except for the presenter, and we're going to be

utilizing the chat feature, if you want, on your screen.

If you have any questions, feel free to put those in the chat at any time throughout the presentation. What we're going to do is go through the actual presentation, and then at the end, we'll read through any comments that we've received, as well as any comments in the chat, and an open event for the public participants to ask questions.

So we do ask that if you ask a question, either in the chart or verbally, just please state your name and spell it. We have a stenographer that is capturing the entire meeting for the record, so everything in the chat and on the video will be part of the record.

Official responses to all of the questions, those are going to be captured in the response of this

summary for the next document, and we'll get into that a little bit later, but just lots of ways that we're capturing the information tonight.

So I wanted to go through a few introductions just so that you all know who is on the line. This meeting is open to any member of the public.

From the U.S. Army Corps of Engineers from the New York District, our project manager, Helen Edge, is on. You're going to be hearing from Helen next for the actual presentation.

Other Corps of Engineers team members, myself, Ann Ewy, I'm with the Kansas City District, and David Hays is on the line. Dave is our Health Physicist here in Kansas City and for the project.

From WSP, so that's the army corps' contractor for the project, we have Dan Kennedy, who is our Project Manager and Geologist, as well as

Jessica Forbes-Guerrero, she is helping us with logistics tonight.

And I don't know if they're on quite yet from the Department of Energy, Darina Castillo and Jill Bennett, who is one of the DOE contractors. So I know Jill is on the line, thanks for joining us.

From the New Jersey Department of Environmental Protection, Scott Vondy. Scott is our case manager for this project. We work closely with Scott.

And then from the borough, I am not sure if all of these folks are on, I think they might be coming on and off, Marcia Karrow, who is the Borough Administrator; Matt Moench, the environmental attorney; Rob Schwarzkoft, the Environmental Engineer; and Mayor Madden.

So welcome to everybody who has joined us, and with that, I'm going to turn it over, if we can turn off

videos. Again, I think everybody should be muted automatically, and we're going to turn it over to Helen for our presentation.

MS. HEDGE: Okay. Thanks, Ann. Good evening, everybody. Thank you for joining us at our virtual public meeting for the -- wait, hold on one second. I'm sorry. Okay.

Thank you for joining us for the Middlesex Municipal Landfill proposed plan.

As Ann went through briefly before, just for virtual meeting etiquette, please mute the volume on your computers or phones, and hold all questions and comments until the end of the presentation.

Tonight, we will go over the following topics, FUSRAP, site location, site history, risk assessments, proposed plan alternatives, preferred remedy, and

public comments.

FUSRAP stands for the Formerly Utilized Site Remedial Action Program. It was initiated in 1974 to identify, investigate, and clean up or control sites throughout the United States that became contaminated as a result of the nation's early atomic energy program during the 40's, 50's, and 60's.

FUSRAP was initially managed by the U.S. Department of Energy, abbreviated as USDOE, and transferred to USACE in 1997.

USACE conducted a remedial investigation and risk assessment of the Middlesex Municipal Landfill site located at 1200 Mountain Avenue in Middlesex, New Jersey. The investigation effort at the site was conducted to characterize the nature and expense of soil, surface water, sediment, and groundwater impacted by the disposal of radionuclides at the

MML, and evaluate the risk to human health and environment.

The MML is a 37-acre site, and consists of parcels belonging to the Borough of Middlesex and the Middlesex Presbyterian Church. It was operated by the Borough of Middlesex from 1940 to 1974, during which time the facility received unregulated municipal and industrial waste, and is no longer in use.

The Middlesex sampling plant was an industrial operation that assays uranium and thorium ore between 1943 and 1955 for the Manhattan Engineer District in the U.S. Atomic Energy Commission, or USAEC.

During operation, the MSP stored uranium ore that was processed and shipped by the government to private and public enterprises. So much occurred during handling and transfer of the uranium ore at the MSP,

resulting in contamination of site soil.

In 1948, the USAEC paved the uranium ore storage area and the excess soil from the grading operation was transported to MML. The current FUSRAP-related radioactivity at the MML has been determined to be related to the disposal of the MSP soil, as waste material from MSP show similar distribution of radioactive isotopes.

Environmental investigations related to the disposal of the uranium ore at the MML date back to May 1960 when a local civil defense exercise identified elevated radiation levels 20 to 50 times above background levels at the landfill.

In response, USAEC conducted a removal action. Radioactive materials remained following completion of this removal action. Therefore, the USAEC placed approximately two feet of clean

cover material over the remaining radioactive material.

In 1986, the USDOE completed a remedial action that consisted of excavating additional contaminated soils from the western portion of MML, including the area remediated back in 1960.

The remedial action included segregating contaminated material from clean materials in one-foot layers. Materials that were determined not to be contaminated were stockpiled, and then used for backfill after the excavation was complete.

In 2001, the Borough of Middlesex conducted a radiological survey under the direction of the New Jersey Department of Environmental Protection, or NJDEP, as part of the landfill remedial program.

The survey identified elevated radiation levels of the southeast

boundary of MML along Pershing Avenue. The Borough of Middlesex conducted a remedial investigation between 2002 and 2005, and additional data was collected, and all the data was included in a report submitted to NJDEP in 2007.

Both chemical and radiological data were evaluated during this investigation. Following the work performed by the Borough of Middlesex, and at the request of the NJDEP, the USDOE performed an additional radiological survey.

The survey findings resulted in a USDOE determination to refer the MML to USACE for further evaluation. MML was then added to the FUSRAP program in March of 2009.

Lost my place there. Give me one second, please. All right. Continuing, sorry about that. All right.

FUSRAP-related contaminants, they are radioactive contamination resulting from the nation's early atomic energy program, related to the Manhattan Engineer District or the Atomic Energy Commission activities and hazardous substances associated with these activities.

At the MML, FUSRAP contaminants are radioactive isotopes associated with uranium ore that includes radium-226, uranium-238, and uranium-235 decay chains.

USACE identified four areas where FUSRAP material may be present, and recommended further evaluation in the feasibility study. These areas were called radionuclide impacted area, or RIA.

RIA 1 is the small area along the fence on the eastern side of the MML near Pershing Avenue, and soil will be addressed in the remedy.

RIA 2 is located on the northern slope of the MML and soils were addressed, already addressed, during the radiological soil sorting pilot study. Therefore, no additional remedial action is necessary in RIA 2.

RIA 3 is the largest of the three, and located on the western portion of the MML, and on portions of the property owned by the Borough of Middlesex, and the Middlesex Presbyterian Church, and will be addressed in the remedy. These three areas contained FUSRAP contamination in the soils.

RIA 4 is shallow groundwater beneath the MML site and found not to pose unacceptable risk after further evaluation.

This map here depicts all the different RIA's. RIA 1 is all the way to the right here on the bottom, the little rectangle. Then we have RIA 2,

the purple little circle in the middle, and then towards the upper left, that big red area is RIA 3.

Okay. So RIA 1 represents the soils and waste materials in the vicinity of an area where uranium ore nugget was found, and elevated radium-226 concentrations were observed. Radionuclide contamination is limited to a small area within RIA 1, in excess of two and-a-half feet from the surface.

Summary of the results from the sample collected in this area presented on the RIA 1 table, and radium-226 background concentration of the MML site is one picocurie per gram. The average radium-226 concentration in RIA 1 is 5.01 picocurie per gram.

RIA 2 is located on the northern slope of the MML, as I mentioned before, the contaminated soils were removed during the USACE pilot study in

2019, and USACE studied the capabilities of radiological soil sorting technology.

The excavation area was backfilled with clean soil from the offsite location, and then revegetated with grass. A radiological survey, including a gamma walkover survey and soil sampling program, was conducted to document the conditions of soil remaining after the contaminated material was removed.

The average raidium-226 concentration for the soil sample was 1 picocurie per gram, which is equal to background of the MML site. Therefore, no additional remedial action is necessary in RIA 2.

RIA 3, as I mentioned before, is the area that DOE excavated during 1984 to 1986, and the radionuclide activity in soil background levels and uranium ore nugget activity was observed in RIA

3. The average concentration of radium-226 was 5.01 picocurie per gram in soil, and the concentration of the radium-226 and the uranium nugget was 142,000 picocurie per gram.

Groundwater samples in RIA 4 were analyzed for the presence of radionuclide and compared to the USEPA's the maximum contaminant level, or MCL, established in the national primary drinking water regulation.

The nature and extent of radioactivity in onsite groundwater is comparable to that in background levels. So that indicates that radioactive contaminants in soils have not migrated into the groundwater at MML. No samples show concentrations of radionuclide above the MCL.

A baseline human risk assessment was conducted for the MML site in 2016 as part of the remedial investigation. It was conducted in order to determine

the current and future cancer risk, and radiation doses from exposure to radioactivity detected at the MML site.

A screening level, ecological risk assessment, was also conducted to evaluate ecological hazards from the exposure to radioactivity detected in the surface water, sediment, and surface soil. Based on findings of the risk assessment completed for the MML site, the surface water and sediments do not pose unacceptable risk.

An unacceptable risk of cancer for future residents or recreational worker scenarios due to exposure of radionuclides in soil at RIA 1 and 3 were identified. Exposure to shallow groundwater at the site indicated a potential for elevated risk of cancer in the residential scenario, but not for the recreational scenario. Results were below the EPA MCL drinking water standard.

Seven alternatives were evaluated for soil remediation:

Alternative 1: No further action.

Alternative 2: Limited action using land use controls for restricted use.

Alternative 3a: Excavation and offsite disposal for unrestricted and restricted use.

Alternative 3b: Excavation and offsite disposal for unrestricted use.

Alternative 4a: Excavation, radiological soil sorting, and offsite disposal for unrestricted and restricted use.

Alternative 4b: Excavation, radiological soil sorting, and offsite disposal for unrestricted use.

And Alternative 5: Excavation and onsite containment.

The development of these alternatives considers the fact that the onsite contaminated soil within RIA

2 was remediated during the pilot study. Each alternative was evaluated during the feasibility study against seven of the nine evaluation criteria for Superfund Remedial Activities.

The last two criteria, referred to as modifying criteria, will be evaluated after the public comment period as part of the final remedy selection process.

The nine evaluation criteria are: Protection of human health and environment; compliance with applicable or relevant and appropriate requirements, or as we call, ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume of contaminants through treatment; short-term effectiveness; implementability; cost; state acceptance; and community acceptance.

Based upon an evaluation of all alternatives, Alternative 4b,

excavation, radiological soil sorting, and offsite disposal for unrestricted use is recommended as the preferred alternative. The alternative will meet the remedial activity objective and ARARs. It'll meet the threshold criteria of protection of human health and environment, and is in compliance with cleanup levels.

It will be effective in the long-term because the soil is presenting a potential unacceptable risk from FUSRAP wastes, will be removed from both properties. It will produce a significant reduction in volume of contamination through the removal of the soils contaminated with FUSRAP waste. And the alternative has been proven to be highly implementable based on historical remediation projects, and a successful pilot study demonstrating radiological soil sorting onsite.

Radiological soil sorting is a resource recovery technology involved in this alternative, and it will reduce the volume of offsite soil needed to backfill excavation areas, as well as volume of soil contaminated with FUSRAP wastes removed from the MML site.

The radiological soil sorting will occur after large items that are not anticipated to contain radiation are initially sorted out, allowing appropriately-sized material to be passed through the sorter.

Soil will be passed through the radiological sorter, and separated into distinct piles above and below unrestricted use criteria. FUSRAP contaminated materials that are above the unrestricted use criteria will be segregated for offsite disposal. Materials that are not contaminated or below the unrestricted use criteria will be returned to the excavation.

And this is just some photos of the radiological soil sorting process. So we have the initial excavation on the top left there, and then followed by some of the soil going through the sorter, and you can see that there's a scan while it's going through the sorter, and that big grey dot on top of the blue, I guess, area where the soil is going into is actually -- has all the scanners in it.

And then at the end on the bottom, right-hand corner, you see the piles after the soil is sorted. It's dumped out into this big pile.

The pilot study completed in RIA 2 resulted in soil volume reduction efficiency rate of about 78 percent. A rate of 350 cubic yards per day is assumed for a full-scale operation with implementation of this alternative.

The planned excavation volume for this alternative is 21,290 cubic yards.

Based on the assumed segregation efficiency rate, approximately 3,700 cubic yards of the excavated soil would require transport offsite, and disposal in a licensed facility.

The remaining 17,500 cubic yards will be removed through size segregation and radiological sorting, and then placed back into the excavation areas. The estimated cost for this remediation is $11,942,700.

The land use controls for FUSRAP contamination would not be necessary under this alternative, due to the removal of FUSRAP-related contamination that allows for unlimited use and unrestricted exposure.

USACE will evaluate comments submitted through the -- oh, wait. Before I go on, this is just a map of all the different RIA areas, and how everything would be staged up. So you see RIA, again, and RIA 1. On the

bottom right is that, that rectangle, and then RIA 2 in the middle, and then RIA 3 all the way on the big red area on the top left. So that's -- RIA 1 and 3 are going to be staged for the remediation.

Okay. And so the next steps in the CERCLA process, the USACE will evaluate comments submitted through the public comment period, and responses to significant public comments will be formally documented in the responses of this summary.

After considering all comments, the USACE, and in coordination with NJDEP, will make a final decision regarding the remediation for the MML site. The final decision will be detailed in a record of decision, which will include the response of this summary.

The preliminary assessment, site inspection, remedial investigation,

risk assessment, feasibility study, and proposed plan reports are all available online at this website. And if you have any questions, feel free to call me at the number listed on there as well.

Written comments must be postmarked or e-mailed by the close of the public comment period on September 3rd, and that wraps up our presentation. And I want to thank you for your participation.

We will now open the floor to questions and comments.

MS. EWY: Helen, thanks. I think a few people joined us after we did the initial introductions and logistics. So for those of you that joined us, if we had received any comments, so far, through the public comment period, we would read those now, but I don't believe we received any.

So if you do have a question,

please feel free to put it in the chat, or I think we can go off mute and ask questions.

We do ask that if you have questions, if you can please state and spell your name. We do have a stenographer who is capturing all of this for the record, and we're going to leave the line open for another hour.

So we will be on, probably have video turned off, but that way if people do join or have questions, we are available. Okay. And we will -- Jessica and Dan, if you can help me monitor the chat.

So Daphne and Barbara, I see that you have raised your hand, and I have no idea what to do with that.

Can they take themselves off mute, Jessica?

Ladies, are you out there.

MS. DAPHNE: I should be off mute right now, right?

MR. KENNEDY: Yes, we can hear you.

MS. DAPHNE: Who is responsible for paying for that clean up?

MS. EWY: Sorry, okay. I didn't know if they were connected.

MS. DAPHNE: I didn't want to ask them all in a row. I figured I'd ask them one at a time.

MS. EWY: We will give you any information we can. Now, I think Helen can answer this one, but we will have formal -- the official written responses will be in the next document, that way everything is official.

So, Helen, go ahead, sorry.

MS. HEDGE: No problem. So under the Formerly Utilized Site Remedial Action Program or FUSRAP, as I mentioned before, congress appropriates us a funding for cleanup of FUSRAP-related material at these project sites. So that's how we're

being funded for this work.

MS. DAPHNE: Okay. What determines the risk? Like, you say there wouldn't be any risk to recreational versus residential. Did I get that right? Because I want to know what is the definition, what is that margin that says where's the risk? Because once you clean it up, quite frankly, I'd rather it be cleaned up, but not trying to clean it up so some developer can come in there and make this more, more pregnant with more traffic and more people.

And that is, probably, one of my, of my biggest concerns, is that this just came up. I shouldn't say, "just came up." I mean, you've gone through the timeline, but now it's becoming more of an issue, and I just see it opening up to a whole lot of, just, more of a strain on our current strained infrastructure, more taxes,

more people, more traffic, and that is a complete concern for me, and I'm sure quite a few other residents around here.

MS. EWY: Understood. Dave, I don't know. I think the risk one, as far as how we calculate risk and all that, that one is so detailed and technical. I know we definitely want to answer that one in writing.

Is there anything, in general, that you think would help for now or that we can say? And if you're not comfortable, Dave, I don't want to put you on the spot. I don't know, in general, how we evaluate risk.

MR. HAYS: Yeah, that's another problem. Basically, the risk assessment takes into account activities that expose people to the radioactive materials.

So a resident is onsite a lot longer than, say, a recreational user.

So those type of things come into play. We utilize the State of New Jersey's regulation as to what is an acceptable exposure, which equates to risk.

Typically, the residential exposure ends up being your highest risk, again, because they're onsite the longest. I do think it's important to recognize that we're just addressing the FUSRAP contaminants, the radiological contaminants.

There are other contaminants in the landfill. So once our work is done, there's still a lot of work yet to be done at the landfill before anyone could develop it.

MS. DAPHNE: Okay. I only have a couple more questions because I see other hands raised. So let me not hold you up.

MS. EWY: That's what we're here for, so, please, don't hesitate.

MS. DAPHNE: How long will this

excavation take? And if there's any damage, and by that I mean even as far as aesthetically, being grass, potholes, stones, whatever, who is responsible for cleaning that up?

MS. EWY: So, Dan, I think you probably know the specifics of the remedy about as far timelines, if you can talk to that one. And that's, and can you also let us know, Dan, I think that's in the proposed plan as well, but I'm not -- if you can confirm that.

MR. KENNEDY: Yeah, that should be in the proposed plan. I was trying to toggle over to it to scan through to see if we have the timeline of it. I wasn't able to catch it, and I don't remember off the top of my head what we have planned for it in our costing estimate to complete on that, but I imagine, if I remember right, it is within a year timeframe, but don't quote me on that. We're going to have

to go back to the response on this. It's not a super long effort. It's not a very large-scale excavation and serving issue.

One thing that I did want to get back to is you were concerned about that property being redeveloped, and I wanted to mention that the borough has, I forget what you call it. It's not a statute.

MS. DAPHNE: An ordinance.

MR. KENNEDY: They have an ordinance that that is not to be redeveloped for residential use or anything other than that.

The plan for it is to be used as an active and passive recreation use. So there are not plans to redevelop that property or put residences at this time, even though our remedy is cleaning up to those standards.

MS. DAPHNE: I just want to, you know, I just blink and I turn around,

and there be some freaking high-rise over there, okay.

MR. KENNEDY: Well, I don't think that we have a lot of control over that. The borough owns the property and that ordinance.

MS. EWY: I wanted to circle back to the other part of your question about restoration and damage and things like that. The federal government, as a whole, when we do our work, and I'm going to use my very simple terms, we have to make sure that we fix, you know, leave things that's in, at least, a condition that we found them.

We're also very limited, and I think most people can appreciate this, is money from congress is taxpayer money that we're using for this. So we also can't go and make a bunch of improvements, but things like, you know, normally when we do a project, you know, we do re-vegetation, we do,

you know, planting grass, fixing anything, we'll leave it at least as good as when we found it.

MS. DAPHNE: What about the wildlife? How are you going to manage that? The wildlife here, that it should be --

MS. EWY: Yeah, I don't, yeah.

Dan, again, you probably know the most about that, all the different New Jersey, you know, or, Scott, if you're on, all of the different roles and regulations and guidelines, everything that we have to follow. I don't know if there's anything you can speak to on that.

MR. KENNEDY: Yeah, as far as the wildlife, we've done a review of the habitat onsite and the areas that are lined up for excavation are not areas that are being used by sensitive wildlife users.

Although, there is, on the

landfill, the potential for, I believe it was bald eagles and bats, the long-nosed bat and another bat that may use the wooded areas for habitat, but those areas shouldn't be disturbed as part of this remedy.

MS. EWY: And, Dan, I guess it's in the RI stage that we did all of those, I don't even know what you call it, those studies, I guess, the environmental studies to make sure before we even did our investigation, let alone remediation, we had to make sure we knew what was out there, and knew all the red.

Again, just even going out and punching holes for an investigation, we have a lot of restrictions there because of the wildlife or wetlands or whatever area you're working in.

MR. KENNEDY: Correct.

MS. DAPHNE: I'm going to let other folks get in, but I'm putting it

out there because we've seen this development and construction out there, and the wildlife is pushed out, and aesthetically and quiet enjoyment, all of the above is being ignored, and I just want to make sure I put it on record that that's important. It can't be ignored.

MR. KENNEDY: Understood. Yeah, that is always a consideration in these projects, and would be continued to be reevaluated in the design phase for the project when more specifics are developed.

MS. EWY: Okay. I don't even know how to use Webex. I think Matt Moench, it looks like, I think your hand is up. We actually introduced you in the beginning to let people know you might be on. So if I'm reading this right, and you want to unmute and chat with us.

MR. MOENCH: Thank you. And can

you hear me okay?

MS. EWY: Yep.

MR. MOENCH: Okay, hi. I did hear the presentation, just a few quick questions. Of course, I'm here as an environmental counsel for the Middlesex Borough.

A few questions, one, with regard to the standard that you're currently proposing, for anybody who's listening, we have today's standards, and with the proposed remedy, certainly there is going to be some areas that have, quote acceptable levels of, you know, contaminants still there, just below the levels that are of concern.

What happens if in the future, these standards change? Does the army corps come back and do a further remedy of this or is this our one shot to make sure it's as clean as it can be?

MS. EWY: I want to, I guess, give this a caveat. Our team is in Oklahoma

and Kansas City and Buffalo and New York, so we aren't all in the same room trying to figure out who is going to field the question. So I just know this one is not me.

So Helen or David, if you're comfortable with this one, if not, we can put this one in the response of this summary if we don't have an answer to it, but if either one of you does, I just know I don't.

MR. HAYS: I would like to expand a little bit on, you know, we have a level that we would clean to, which, through the risk assessments, would meet an unrestricted release, meaning it could become residential property or be used for any purpose.

That level, however, as we do the excavations and the testing, we would, we expect, and in all of our previous work on other sites, we're always well-below that level, and, in general,

when we cling to an unrestricted use, our residuals are much closer to background than they are the actual release limit that we have in our documents. And I fully expect that to be the case here as well.

MR. MOENCH: Okay. Because, certainly, I think, from our perspective, I think we want it cleaned, obviously, as close to nothing or background levels as possible, as, obviously, it's better to do it now when we have the funding and the army corps there as opposed to having to try to deal with future issues if things change.

The second question, are you aware of whether there's any -- you identified certain areas where there are contaminants that are tied to the activities that you went over. Are there any other sites that are contaminated that are radioactive that

are not tied to the U.S. government's activities on the site that you're aware of?

MS. EWY: So I'm going to let Dave take the majority of that one. I will say, just to keep in mind, again, a lot of this comes down to authorities.

We get our money from congress, and it's very specific between the authority and the appropriation. That said, you can spend this money on this, so that, that's why this question, I think, is so important.

Dave?

MR. HAYS: The short answer is, yes. And our public documents, the remediate investigation report, and I believe our feasibility study goes into great detail of not only where the contamination we're responsible for is and what levels, but also the investigations that we did, of the radiological contamination, which runs

along Pershing Avenue, that is not the responsibility of the federal government.

MR. MOENCH: Okay. My second question that was going to follow up on that is the data that you have is all made available to the borough with regard to what's there, where it came from in terms of, I assume, there's a reason why you think that one area of radioactivity or radioactive material is not yours, doesn't fall within your responsibility to remediate, that data is in the public report and available to the borough?

MS. EWY: Yes, absolutely. And not just to the borough, like you said, to the public either online, we do have a hard copy of everything still at the library and I think we sent reports at various times, but, yeah to the public as well.

MR. MOENCH: Okay.

MR. HAYS: I'm sorry. I just wanted to add, you know, that decision isn't made in a vacuum. It's not the Army Corps of Engineers alone making that. We have many discussions and talks with New Jersey Department of Environmental Protection staff as well.

MR. MOENCH: Understood. I just want to make sure, and I think we will submit formal written comments as well. Just, obviously, the borough's interest is to make sure that all the radioactive waste on the site is remediated to the highest standards possible, and, you know, I think we want to make sure we're not stuck in a situation where you go through your remedy, but at the end of the day, it still leaves us with, you know, property that is contaminated with, you know, serious concerns for the borough.

So, and not that we dispute that it's not your waste to remove, but, you

know, we certainly want to make sure that we're in agreement, and be able to look at that data to make sure that if we have a disagreement, we can raise that concern.

Those are all my comments. Thank you very much for the presentation and concerns, and if we have others we will submit formal written comments, and we know how to reach you. Thank you.

MS. EWY: Okay. And I think Marcia Karrow's hand is up.

MS. KARROW: I do. I have a question and a statement. I'm the Business Administrator in Middlesex Borough, and our esteemed attorney may get mad at me for saying what I'm going to stay, but, first of all, to Barbara and Daphne, I just want to let them know that under state statute, our master plan will be under review starting this fall, and you should, certainly, might want to try to make

some of the joint board meetings as they start announcing hearings for the master plan when the entire town and all of its zoning comes under review, if you have concerns.

We do not own the church property, which may or may not be up for sale since, you know, there doesn't seem to be a lot of activity there, and, but I can tell you that the town has abdicated to the federal government for the unrestricted use possible, which means the cleanest land possible on the landfill.

The town has put in writing that we want to put solar there as well as a potential future performing arts center or recreation center, as well as possible other public-use buildings, and active recreation like a soccer field, which we are in desperate need of more ball fields. So we want to, certainly, keep everybody safe.

Having said all of that, I have heard from constituents on Pershing Avenue. I know that they reached out to Ms. Edge, and have expressed to me that Ms. Edge has not returned phone calls. They are extremely concerned about this underlying radioactive contamination, and although FUSRAP may not have operated within a vacuum within the DEP, certainly, the vacuum of not talking to the borough about this is prevalent, and if you did, that gentleman is currently in jail, and nobody is aware of any conversations with him, the former mayor.

So having said that, I've been with the borough for two and-a-half years. Nobody has expressed to us that, except in this report, that there's going to be radioactive material left, and, certainly, although the borough accepted industrial waste that was unregulated at the time, to

the best of my knowledge, at no time could anybody ever obtain radioactive material without a government permit and going through the federal government quarry. If I'm wrong, correct me, but somebody was allowing these industries to obtain radioactive material that was then dumped in our landfill.

So there's an extreme concern that this expensive cleanup, which we know we have a responsibility to for some of this, I really hope that the DEP is going to help us clean it up because we are anxious to do so because we would like to put this very valuable piece of land back into public use, but, you know, the fact of the matter is, the army corps and congress and the Department of Energy are all mobilizing to do a cleanup. You can certainly do it more efficiently and less expensively than we ever could, and by

the time we get to it, it could be another year or two after you're done.

So, you know, personally speaking on behalf of the borough, the best thing to do is to expedite the entire cleanup now of any radioactive material and sort out who owes what to whom later.

That's all I have to say.

MS. EWY: I know those are all captured in the record. I know we'll have a formal response to all of those in response of the summary. I don't know if anyone else has anything, specifically, to respond to.

MS. HEDGE: Yes. This is Helen. I totally understand. Logistically, yeah, it makes sense. We do this all the time, and we're experts at this, and, of course, you know, why not, you know, if we're going to be doing some of the remediation, why not do all of it?

But, unfortunately, within the program that we're working in, it's very, very specific as to how we can use the funding that's provided, and in order for us to remediate any contamination, we have to prove that it is linked with activities from the early atomic energy and Manhattan Engineer District activities.

So because we were unable to do that for the particular contamination along Pershing Avenue there, we were -- it did not fall under classification as FUSRAP-related material.

So, therefore, we cannot, we cannot remediate it under this effort.

MS. EWY: Okay. Jessica, I don't know if you're monitoring anything, if you've seen anything else come through. I don't see any hands up. I don't see anything else in the chat.

MR. MIKE: Hi, can you hear me?

MS. EWY: Yes.

MR. MIKE: Sorry, I'm a caller, so I'm driving right now. I wasn't able to be in front of the Webex, but would I be able to ask some questions?

MS. EWY: Yeah --

MR. MIKE: I'm more than happy to wait my turn. I just didn't know if --

MS. EWY: No, no. This is perfect timing. Everything is being captured for the record, so if you wouldn't mind stating and spelling your name, and then the floor is yours.

MR. MIKE: My name is Mike, M I K E, and the question I have, and I don't want to beat a dead horse, but I apologize for this, is with respect to the remediation areas.

I understand that certain areas, you can only clean up the FUSRAP items. So I don't want to expand beyond that too much, but if -- when I was looking at your remediation areas, it kind of followed that bench line and the

property line.

If during your excavation, and I know you're going with a bucket, not with a shovel, so it's not as finite, but if you start to see that it goes beyond your currently hatched areas to excavate, will you continue to excavate and cleanup additional soil?

MS. EWY: That's a great question, Mike. Dave, I don't know, even if it isn't super specific to MML, just our general approach, I think, would probably, if you can talk about that a little bit, I think that might help in recognizing -- sorry, Dave, cut you off already.

So we'll have a record of decision, and then before we do this work, you know, we'll have work plans, we'll have a remedial design, we'll have all of the documents that, basically, spell out how we're going to do the field work, but, sorry, Dave.

MR. HAYS: Mike, I think the short answer is, yes. You know, we will begin digging in those areas that we've identified, and we will chase that contamination to its full extent.

And you are correct, we use, you know, big construction equipment, and that's one of the reasons why when we're done digging, we're usually closer to background.

You just, with a big excavator, you just can't cut that fine of a line, and our excavations tend to over excavate.

MR. MIKE: Thank you, thank you. Like I said, it's not what I expected, but I just wanted to put that out there.

The other item is, and if I read your detail correctly, you're planning on putting down a, as part of your remediation, an earthen barrier with a geotextile or a vapor barrier; is that

accurate, for your -- after you guys disturb the soil?

So you'll put in a, you know, an earthen cap on it with, like, two feet or something like that? That it looks like a geotextile or vapor barrier in between the dirty or formerly dirty soil and new soil.

Was that accurate or am I confusing the 4b option with one of your other options?

MS. EWY: Dan, you're probably the best to answer specifics about the remedy. Are you able to do that?

MR. KENNEDY: Yeah, I think you're right. I think you might be mixing the options together. I think what you might be thinking of is Alternative 5 where we're going, we're reevaluating the potential for excavating the material, and putting in an onsite repository, and that's where those would be in place.

For this particular plan, 4b, after the excavation is complete, we would place two feet of clingfilm material on top of it, and there isn't a plan for a vapor barrier or otherwise.

MR. MIKE: Okay. Thank you very much. I think that's all of my questions.

MS. EWY: Okay. Anyone else? Please, again, don't hesitate. Speak up, raise your hands, and again we will stay on the line for another, what, 36 minutes.

We'll leave the line open that way if people do join or if anybody else has questions, we will be here.

Okay. So I think with that, thank you guys, again, just for taking the time to be on tonight.

I don't know, Jessica or Helen, are we leaving this line up? Are we taking the slides down, what are we --

how shall we do this? I think we can just, maybe, all monitor and if anybody sees anybody join, just let them know that we're on, and besides that, then thank you guys, again, and I'm just going to go on mute, and we'll be here if anything else comes up. Thank you.

MR. MIKE: Hey, sorry about this. This is Mike speaking again. May I ask an additional question?

MS. EWY: Yeah, please, go ahead.

MR. MIKE: So I know in dealing with the army corps, let's say I was doing wetland disturbance, do you look for me to remediate my disturbed wetlands to restore to original, or -- and then also put in preservation, right?

So let's say I'm doing a normal development, and part of mine I'm, you know, army corps jurisdiction for wetlands disturbance. My question is, after this remediation, would there be

any potential restriction towards any future uses which might contribute to, you know, carcinogenic materials or anything happening?

I know you're not supposed to, but, you know, people do dumb things, and with wetlands, where we restrict that land to preserve these wetlands so they can, you know, cannot be disturbed further down the roadway.

Is that something you guys would also do with your environmental remediation? Just because I'm not as familiar with that side of what you guys do.

MS. EWY: I will open that up for anyone, Helen, Dave, Dan?

MR. HAYS: Under the preferred alternative, there would not be any land use controls for our work. There certainly are wetlands along the landfill, and those fall under, you know, all the same wetland regulations.

MR. MIKE: Right.

MR. KENNEDY: Right, but under the preferred alternative, we'll be cleaning up to residential standards, and so there won't be a need to put additional restriction on the property, as far as land use.

MR. MIKE: All right. Thank you. I apologize if that's mixing things up. I don't want to be rude.

MS. EWY: You're fine, and if anything comes up for the next 30 minutes just speak up. We'll all be on the line.

MR. HAYS: I'd rather have a conversation than just sit here and listen to silence.

MR. MIKE: If you can help me on the wetland property side, I'd appreciate it. I'm dealing with one of your other partners. Unfortunately, you're the wrong team. I'd be more than happy to. I read your report, and

I leave it at that, and then work with you guys on the wetland side for my development, but, you know, it's one of those.

You got an in-vote for me, and if you want to do a quick review of my proposed wetland restoration, I'm happy to have that conversation with you right now. I could speak to various steps, but, you know, environmental remediation, outside of my team.

MS. EWY: Okay. I'm going back on mute.

Hey, Helen or Jessica, I don't know, or whoever has access to what's on the screen, do we want to, I mean, we can all just be monitoring the participants, but do we want to put something up or just type in that, that we're, if people have any questions, please just speak up or, or just leave it as is?

MS. HEDGE: I'm working on it

right now, but I'm going to -- I'll post it up.

MS. EWY: Again, for anybody that is on, thank you for joining us. And, again, you know, the whole project is following the CERCLA process, so everything from tonight, questions, any additional questions that are received through the public comment period, everything will be documented in the response of this summary.

And with that, I, I am showing 6:30 or 7:30 Eastern. So, Jessica, if you don't mind just confirming that you are as well on your computer, make sure mine's not ahead or anything, and if so, I think we can go ahead and end this presentation.

MR. VONDY: Thank you, Ann, and thank you to the whole army corps team for hosting tonight.

MS. EWY: Yeah, no problem. Thanks for joining us. You guys take

care, bye-bye.

(The proceedings concluded at 7:30 p.m. EST)

C E R T I F I C A T E

STATE OF NEW YORK)
) :ss
COUNTY OF KINGS)

I, AMANDA VILA, a Shorthand Reporter (stenotype) and Notary Public within and for the State of New York, do hereby certify:

I reported the proceedings in the within-entitled matter and that the within transcript is a true record of such proceedings.

I further certify that I am not related to any of the parties to this action by blood or marriage; and that I am in no way interested in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 25th of August 2021.

Amanda Vila
AMANDA VILA