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Region 2 RAC2
Remedial Action Contract

Final Focused Feasibility Study

Mansfield Trail Dump – OU1

Focused Feasibility Study

Byram Township, New Jersey

February 21, 2017

CDM Smith

Table of Contents

List of Tables

List of Figures

Appendices

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Acronyms

µg/L	micrograms per liter
ARAR	applicable or relevant and appropriate requirement
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
DESR	Data Evaluation Summary Report
EBEPOA	East Brookwood Estates Property Owners Association
EES JV	Engineering & Environmental Solutions
EPA	U.S. Environmental Protection Agency
FFS	focused feasibility study
FS	feasibility study
GAC	granular activated carbon
gpd	gallons per day
gpm	gallons per minute
GRA	general response action
HGL	hydraulic grade line
IEC	Immediate Environmental Concern
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
O&M	operation and maintenance
OM&M	operation, maintenance, and monitoring
OSWER	Office of Solid Waste and Emergency Response
OU1	Operable Unit 1
OU2	Operable Unit 2
POET	point-of-entry treatment
POU	point-of-use
PPE	personal protective equipment
PRG	preliminary remediation goal
RAC	Remedial Action Contract
RAO	remedial action objective
RI/FS	remedial investigation/feasibility study
SCHD	Sussex County Health Department
SSDS	sub-slab depressurization system
T/M/V	toxicity, mobility, or volume
TBC	to be considered
TCE	trichloroethene
VOC	volatile organic compound

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Section 1
Introduction

CDM Federal Programs Corporation (CDM Smith) received Work Assignment 069-RICO-A238 under the Remedial Action Contract (RAC) 2 (Contract No. EP-W-09-002) to prepare a focused feasibility study (FFS) for the U.S. Environmental Protection Agency (EPA), Region 2, at the Mansfield Trail Dump Site, Operable Unit 1 ([OU1] the site), located in Byram Township, New Jersey. The purpose of the FFS is to evaluate alternate drinking water supply sources for the impacted residences within the area of the identified groundwater plume. This FFS presents the development of the remedial action objectives (RAOs) and preliminary remediation goals (PRGs), the identification and evaluation of technologies, and the development and detailed evaluation of remedial alternatives.

The only current source of drinking water for the residences located near the site within the identified groundwater plume is groundwater withdrawn from private wells. Since groundwater contamination from volatile organic compounds (VOCs) exceed New Jersey drinking water standards, EPA deemed it appropriate to expedite the evaluation of alternate water supplies for the area within the groundwater plume. A separate feasibility study will be conducted to evaluate remedial alternatives for the contaminated groundwater plume and the contamination source at the site.

1.1 Purpose and Report Organization

The purpose of this FFS is to develop and evaluate the remedial alternatives for alternate water supplies. This FFS was prepared in accordance with following documents and policies:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended
- Guidance Document for Providing Alternate Water Supplies, EPA/540/G-87/006, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-03 (EPA 1988a)
- Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, EPA/540/G-89/004, OSWER Directive 9355.3-01 (EPA 1988b)
- Memorandum Concerning Update on Providing Alternative Water Supply as Part of Superfund Response Actions – Memorandum, OSWER Directive 9355.3-22 (EPA 2010)

This FFS is comprised of five sections as described below.

Section 1 – **Introduction** provides a brief summary of the site background and site history and a summary of the identified groundwater contamination.

Section 2 – **Development of Remedial Action Objectives and General Response Actions** develops the RAOs and general response actions (GRAs) for the FFS, including an evaluation of applicable or relevant and appropriate requirements (ARARs).

Section 3 – Development of Remedial Action Alternatives presents the remedial alternatives.

Section 4 – Detailed Analysis of Remedial Action Alternatives provides a detailed description and evaluation of each alternative developed in Section 3.

Section 5 – References provides a list of documents used to prepare the FFS.

1.2 Site Description

The site consists of former waste disposal trenches located on wooded, undeveloped properties, and associated groundwater contamination extending into an adjacent residential neighborhood in Byram Township, Sussex County (Figure 1-1). Trichloroethene (TCE) and cis-1,2-dichloroethene (cis-1,2-DCE) have migrated in groundwater from the former dump area to nearby residential supply wells at concentrations exceeding New Jersey Drinking Water Quality Standards.

1.3 Site History

The Sussex County Department of Health and Human Services and the New Jersey Department of Environmental Protection (NJDEP) first became aware of contamination in 2004 when potable water within a home along Brookwood Road was tested and TCE was detected. This led Sussex County Health Department (SCHD) and NJDEP to sample approximately 75 private wells in the area from 2005 through 2006. Concentrations were identified above EPA and New Jersey drinking water standards in residential wells serving homes on Brookwood Road and Ross Road. Results indicated that TCE concentrations ranged from 3.9 to 70 micrograms per liter (µg/L). Based on these results, point-of-entry treatment (POET) systems were installed in 18 homes to treat groundwater, 17 of which were installed by NJDEP and one installed by a home owner. Results from sub-slab probes and sub-slab soil gas samples also led to the installation of sub-slab depressurization systems (SSDS) inside five affected residences (Engineering & Environmental Solutions [EES JV] 2016).

After the discovery of the residential well contamination, site investigations and remediation efforts were conducted of the surrounding areas and onsite dump areas. In March 2011, the Mansfield Trail Dump site was added to the National Priorities List, based on the affected residential areas and the Hazard Ranking System results (EES JV 2016).

From August 2013 to December 2015, EPA's contractor EES JV performed remedial investigation activities at this site. EES JV performed site reconnaissance activities and collected environmental data, including overburden soil samples, subsurface soil samples, rock core samples, and groundwater samples. EES JV also collected untreated water samples from 16 targeted residential wells that were equipped with POET systems and an additional 8 residential wells without POET systems. These results are described in the Revised Data Evaluation Summary Report (DESR) for the Mansfield Trail Dump Site (EES JV 2016).

Site investigations mainly focused on two locations: the residential area in the northern portion of the Site with groundwater impacted by TCE and the dump areas. This FFS addresses the impact to receptors in the residential area. The dump areas and groundwater will be addressed in the Mansfield Trail Dump Site Operable Unit 2 (OU2) feasibility study (FS).

1.4 Area for Water Supply

The results of the groundwater investigation conducted by EES JV were utilized to determine the area to be considered for alternate water supply. Figure 1-2 shows the outline of the area that will be used throughout this FFS for water supply evaluation and shows the impacted area.

- *Impacted area:* The 18 impacted residential parcels shown on the figure are those that warranted the installation of POET systems as a result of the VOCs contamination from the Mansfield Trail Dump Superfund site. This area is considered the impacted area. Developing alternatives to provide a water supply to the impacted area will be the central focus of this FFS.

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Section 2

Development of Remedial Action Objectives and General Response Actions

RAOs are media-specific goals for protecting human health and the environment. Remedial alternatives are developed to meet the RAOs, which are based on regulatory requirements that may apply to the various remedial activities being considered. This section of the FFS presents the RAOs and identifies federal, state, and local regulations that may affect the remedial action.

PRGs are cleanup goals that are developed based on federal or state promulgated ARARs and risk-based levels, with consideration also given to background concentrations and other guidelines. They are benchmarks used in technology screening and alternative development and screening.

2.1 Identification of Remedial Action Objectives

Based on previous investigations in the residential community, risks associated with site-related contaminants remain mainly in the form of contaminated groundwater used as drinking water. A quantitative assessment of residential receptors under the current/future potable groundwater use exposure scenario indicated that contaminated groundwater beneath the Site poses an unacceptable carcinogenic risk (9×10^{-3}) and non-carcinogenic hazard (110) to human health due primarily to the presence of VOCs and inorganics in groundwater above state and federal maximum contaminant levels (MCLs) for drinking water. The RAO in this FFS has been developed to focus on reducing the impact from the contaminated drinking water supply. The RAO for the Mansfield Trail Dump OU1 is:

- Prevent or minimize current and future human exposures from ingestion, inhalation and dermal contact of contaminants in potable water attributable to contaminated groundwater at the site.

2.2 Potential ARARs, Guidelines, and Other Criteria

As required under Section 121 of CERCLA, remedial actions performed under Section 104 or secured under Section 106 must be protective of human health and the environment and attain the levels or standards of control for hazardous substances, pollutants, or contaminants specified by the ARARs of federal environmental laws and state environmental and facility siting laws unless waivers are obtained. According to EPA guidance, remedial actions also must take into account non-promulgated to-be-considered (TBC) criteria or guidelines if the ARARs do not address a particular situation (EPA 1988b).

The degree to which these environmental and health and safety requirements must be met varies, depending on the applicability of the requirements. Applicable requirements must be met to the full extent required by law. CERCLA provides that permits are not required when a response action is taken on site. Although permits are not required, the substantive requirements of the applicable permits must be met. Second, only the relevant and appropriate portions of non-

applicable requirements must be achieved and only to the degree that they are substantive rather than administrative in nature.

Potential ARARs are broken down into three groups:

- Chemical-specific ARARs
- Action-specific ARARs
- Location-specific ARARs

Additionally, TBC criteria are also evaluated. TBC criteria are not enforceable standards but may be technically or otherwise appropriate to consider in developing site- or media-specific RAOs or cleanup goals. Each of these groups of ARARs and TBCs is described below. A summary of the potential ARARs and TBC criteria is provided in Tables 2-1, 2-2 and 2-3.

Chemical-specific ARARs are defined as those that specify achievement of a particular cleanup level for specific chemicals or classes of chemicals as shown in Table 2-1. These standards usually take the form of health- or risk-based numerical limits that restrict concentrations of various chemical substances to a specified level.

Action-specific ARARs are those that are applicable or relevant and appropriate to particular remedial actions, technologies, or process options as shown in Table 2-3. These regulations do not define site cleanup levels but do affect the implementation of specific types of remediation. These action-specific ARARs are considered in the screening and evaluation of various technologies and process options in subsequent sections of this report.

Location-specific ARARs are those that are applicable or relevant and appropriate due to the location of the site or area to be remediated as shown in Table 2-2. Possible applicable regulations at the site are relevant to wetlands, floodplains, historical places, archaeological significance, endangered species, and wildlife habitats.

2.3 Preliminary Remediation Goals (PRGs)

Both federal and state chemical-specific ARARs were identified for drinking water and are considered to be applicable for the alternate water supplies since the water is used as a source of potable water. NJDEP Drinking Water Standards have both federal and state chemical-specific Maximum Contaminant Levels (MCLs) (Appendix A). These standards will be considered PRGs and evaluated when determining whether residences should be supplied with an alternative water supply.

Remediation of the groundwater plume will be considered in the FS for Mansfield Trail Dump OU2.

2.4 Identification of General Response Actions

GRAs are broad categories of actions that might satisfy the RAO and that characterize the range of remedial responses appropriate to prevent human exposure to contaminated drinking water. GRAs were developed using EPA's Guidance Document for Providing Alternate Water Supplies

(EPA 1988a) in conjunction with Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA 1988b). GRAs applicable to providing clean drinking water are described below.

2.4.1 No Action

The National Contingency Plan (NCP) and CERCLA require the evaluation of a No Action alternative as a basis for comparison with other remedial alternatives. Under the No Action alternative, no remedial actions are implemented.

2.4.2 Removal of Contaminants via Treatment

Treatment systems include community treatment facilities that would treat all the water within a water system prior to distribution. Typical steps in a community treatment facility include activated carbon adsorption and air stripping, which are both effective at removing site contaminants if systems are operated and maintained correctly.

On a smaller scale, POET systems can be used for individual homes. POET systems remove contaminants in the water at or near the point where the water pipes enter the home or building. Several treatment systems are available for POET systems, but the most commonly used is granular activated carbon (GAC). GAC is highly porous and has a large surface area due to its high porosity. Many organic compounds, such as chlorinated and non-chlorinated solvents, naturally occurring organic matter, some gasoline components, and trihalomethanes, can be adsorbed onto the GAC surface. In addition, GAC is moderately effective for removal of some heavy metals and metals that are bound to organic molecules. Other treatment systems include solid block activated carbon, reverse osmosis, ultraviolet light, microfiltration, ultrafiltration, and nanofiltration, all of which can effectively remove site contaminants if systems are properly operated and maintained.

2.4.3 Connection to Existing Water Supply

Alternate water supplies would include connecting residences within the impacted area to a water system through service connections. The alternate water supply would include installation of water mains to the impacted area as well as service connections from the main to each impacted home. Water for the alternate supply could be from different sources such as a publicly (local government or municipality) owned water supply system or a privately owned water supply system.

The nearest privately owned water supply is operated by East Brookwood Estates Property Owners Association, Inc. (EBEPOA), located less than half a mile to the west of the site. An evaluation of EBEPOA's water supply system capacity has been summarized in Appendix B. Other private water suppliers in the vicinity include Brookwood Musconetcong River Property Owners Association (West Brookwood), Strawberry Point Property Owners Association, North Shore Water Association, Frenches Grove Water Association, and Forest Lakes Water Company.

The nearest public water supply is operated by the Borough of Stanhope, less than half a mile to the northeast of the site across undeveloped land but much farther via streets. Other public water suppliers in the vicinity include Hopatcong Water Department and Sparta Water.

2.4.4 Development of New Water Resource

New groundwater sources include supply wells drilled upgradient of the contamination source, so groundwater is unaffected by pollutants from the source. This may also serve to retard movement of the contaminant plume downgradient. However, it would be difficult to ensure a completely unaffected water source free from hydraulic connections to the contaminated aquifer. Further groundwater investigations would need to be conducted to ensure that the supply wells would be drilled into a clean groundwater aquifer.

New surface water sources that may be available include streams, rivers, ponds, lakes, and reservoirs not impacted by contamination. At a minimum, treatment facilities would need to be constructed to treat surface water prior to distribution into a drinking water system.

2.5 Screening of General Response Actions

Table 2-4 presents the results of the qualitative screening of GRAs against three criteria: effectiveness, implementability, and relative cost, in accordance with EPA guidance document EPA/540/G-89/004, Section 4.2.5 (EPA 1988b). A brief description of these criteria is provided below.

Effectiveness – The evaluation focuses on the ability of each GRA to effectively protect human health by mitigating threats to public health presented by the contaminated water supply. Each alternative will be analyzed for potential environmental risk. This criterion also examines how proven and reliable the process is with respect to meeting regulatory guidelines for drinking water.

Implementability – The evaluation encompasses technical feasibility, administrative feasibility, timeliness, availability of necessary materials, installation requirements, work force, and relative ease or difficulty in achieving the operation and maintenance requirements.

Cost – The cost criterion includes relative capital costs for materials, land, construction, and operations and maintenance rather than detailed cost estimates. The cost analysis is based on engineering judgment, and each GRA is evaluated as to whether costs are high, moderate, or low as compared to costs of other GRAs.

As shown on Table 2-4, retained GRAs that will be used to construct remedial action alternatives include the following:

- No Action
- Removal of Contaminants via Treatment
- Connection to Existing Water Supply

Section 3

Development of Remedial Action Alternatives

In Section 2, potentially applicable GRAs and related technologies and process options were identified. In this section, the technologies and process options are combined to form remedial action alternatives. Assumptions used to develop the alternatives are discussed in Section 3.1, and the alternatives are described briefly in Section 3.2.

3.1 Development of Remedial Action Alternatives

Remedial action alternatives were developed from the list of GRAs to address drinking water at residential properties that have exhibited the presence of site-related contaminants in groundwater samples collected from their private wells. A total of 18 residential properties is assumed for the alternatives discussed in this FFS due to known impact from TCE. These properties are referred to throughout the FFS as the "impacted area" (see Figure 1-2).

3.2 Descriptions of Remedial Action Alternatives

In this section, remedial alternatives for the study area are briefly described. Existing water supply data from the EBEPOA water system were used to calculate water supply needs for the impacted properties. Based on calculated estimates, an average daily supply need of 250 gallons per day (gpd) per home and peak daily supply need of 2x average supply were assumed. See the Mansfield Trail Area Water Supply Need Evaluation Summary memorandum in Appendix B for more details.

3.2.1 Alternative 1: No Action

The No Action alternative was retained for comparison purposes as required by the NCP. No remedial actions would be implemented under the No Action alternative. Although there are already existing POET systems and SSDS within the impacted area, it is assumed for the No Action alternative that no additional remedial measures would be taken, and no monitoring would be conducted.

3.2.2 Alternative 2: Treatment via POET Systems

For Alternative 2, the RAO would be met by continued operation of existing POET systems. Individual POET systems are currently installed at each of 18 properties where prior sampling detected contamination above PRGs. Under this alternative, an assessment of the existing 18 systems for compliance with ARARs, including NJDEP minimum specifications for granular activated carbon POET systems (NJDEP 2015b), would be conducted. Potential upgrades, including water softeners, pH adjustments, post-GAC disinfection units, and additional GAC tanks, would be evaluated for increasing reliability and performance of existing POET systems. For costing purposes, it is assumed that five of the 18 POET systems would be upgraded, and that all 18 systems would be operated, monitored, and maintained in accordance with current practice.

Although previous investigations do not support the spread of groundwater contamination beyond the area that has been impacted, monitoring of drinking water wells in the vicinity of the

impacted homes will be conducted to assure that they meet drinking water standards. It is assumed that if additional properties become impacted, POET systems would be installed, operated, monitored, and maintained in these homes in accordance with NJDEP POET specifications.

3.2.3 Alternative 3: Connection to an Existing Water Supply System

The objective of this alternative is to meet the RAO by connecting each impacted property in the study area to a nearby existing water supply system. The closest privately owned water supplier to the study area is EBEPOA. The closest publicly owned water supplier is Stanhope Water.

Water mains would be constructed to expand the existing water supply system and deliver water to the impacted area. (Service connection from a new water main would be extended to each impacted house, in accordance with Byram Township, Sussex County, and New Jersey regulations). The delivery route of the water mains would be determined when an existing water supplier is selected. Additional storage capacity would be constructed, if needed, to maintain continuous supply and provide redundancy during system operation and maintenance. After installation of the new water main payment of the water bills will be the responsibility of the homeowners which would begin as soon as the connections are completed.

For costing and evaluation purposes, the alternative assumes that EBEPOA is the water supplier. Other water suppliers would be evaluated during the design phase. See Appendix B for further assumptions.

3.2.3.1 System Upgrades

In order to add the impacted area to the EBEPOA service area, the EBEPOA supply capacity would need to be increased and maintained. To accomplish this, the following changes to EBEPOA would be made:

- Increased well pump flow rate in Well 2 from approximately 18 gallons per minute (gpm) to approximately 30 gpm, which is the well's allocated capacity.
- Construction of a nitrate ion exchange treatment facility at Well 1 area. This would be used to reduce the levels of nitrate in well water from both Well 1 and Well 2.
- Construction of a wastewater holding tank with a submersible wastewater pump system to pump the regeneration brine waste from the ion exchange treatment process at the treatment facility to the public sewer system on Route 206 via an approximately 1,000-foot force main. There would be costs associated with this discharge (See Appendix C).
- Installation of a water booster pump system to pump water from the EBEPOA water system to the higher-elevation impacted area. Due to a lack of available land, it is assumed that this pump system would also be located at the new well treatment facility at Well 1.
- Installation of an 8-inch water main with a maximum of two fire hydrants for flushing and sampling. This level of fire protection would be consistent with the existing fire protection provided by EBEPOA. However, local fire department approval would be required prior to installation.

- The final water system configuration for Alternative 3 will be confirmed during design should this alternative be selected. A summary of the potentially required infrastructure and associated cost is shown in Figure 3-1 and Appendix C.

Discussions with NJDEP indicated they do not regulate fire flow or fire flow storage requirements beyond a flow requirement of 20psi at street level under all flow conditions. This requirement has been incorporated into the design of this alternative.

In addition, it is assumed that existing domestic wells and POET systems would be decommissioned following connection to the existing water supply.

For adjacent and nearby properties that do not have existing POET systems, monitoring would be conducted as described in Alternative 2. If any of these monitored homes become impacted, the capacity of the upgraded system would be reassessed.

3.3 Screening of Remedial Action Alternatives

Since only a limited number of remedial alternatives were developed, all alternatives will be carried forward for detailed analysis. Screening of remedial alternatives will not be performed.

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Section 4

Detailed Analysis of Remedial Action Alternatives

This section provides a detailed description and evaluation of each alternative developed in Section 3. The alternative descriptions are on the conceptual level and outline how the representative technologies and processes could be implemented to achieve the RAOs. The three remedial action alternatives developed in Section 3 are listed below.

- Alternative 1 – No Action
- Alternative 2 – Treatment via POET Systems
- Alternative 3 – Connection to an Existing Water Supply System

4.1 Evaluation Criteria

In the NCP, EPA has outlined nine evaluation criteria to assess remedial alternatives. These criteria take into consideration the statutory requirements specified in Section 121 of CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986. In addition, EPA has issued guidance on the evaluation criteria in "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (EPA 1988b). The criteria are classified in the following three groups:

Threshold Criteria: Threshold criteria are requirements that each alternative must meet in order to be eligible for selection.

- Overall protection of human health and the environment
- Compliance with ARARs

Primary Balancing Criteria: These criteria are used to distinguish the relative effectiveness of each alternative so that decision makers can evaluate the strengths and weaknesses of each alternative.

- Long-term effectiveness
- Reduction of toxicity through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria: These factors are typically considered following review of this document and the proposed plan by the supporting regulatory agencies and the public. These criteria are not evaluated in this FFS.

- Support agency (state) acceptance
- Community acceptance

Brief discussions of each of the above criteria based on the CERCLA FS guidance (EPA 1988b) with relevant and appropriate modifications/additions from the Guidance Document for Providing Alternate Water Supplies (EPA 1988a) are provided below.

Overall Protection of Human Health and the Environment: Each alternative is assessed to determine whether it can adequately protect human health and the environment, in both the short and long term, from unacceptable risks posed by contaminants present at the site. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. For alternatives which connect to an existing water supply, MCLs would be required to be met in order to ensure overall protectiveness. For all alternatives involving POETs, MCLs would be met in order to ensure overall protectiveness and are a chemical-specific ARAR.

Compliance with ARARs: Each alternative is assessed to determine whether it would meet the ARARs identified in Section 2.2. The detailed evaluation considers which ARARs are applicable to each of the specific alternatives and describes how the alternative meets the ARARs, which include chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence: Each alternative is assessed for the long-term effectiveness and permanence it presents along with the degree of certainty that the alternative would prove successful. Factors considered appropriate include magnitude of residual risk remaining from untreated waste or treatment residuals and adequacy and reliability of controls, if any, that are used to manage treatment residuals and untreated waste.

Reduction of Toxicity, Mobility, or Volume through Treatment: This criterion only applies to alternatives that involve treatment of the existing contaminated groundwater. The degree to which each alternative employs treatment that reduces toxicity, mobility, or volume (T/M/V) is assessed. For the applicable alternatives, factors considered appropriate include treatment processes employed; amount of contaminants destroyed, reduced, or recycled; and the degree to which the treatment is irreversible.

Short-Term Effectiveness: The short-term effectiveness of each alternative is assessed considering the following:

- Short-term risks and impacts that might be posed to the community during implementation of an alternative
- Potential impacts on workers during installation and the effectiveness and reliability of protective measures
- Potential environmental impacts of the remedial action resulting from construction and implementation

- Time until protection is achieved

Implementability: The ease or difficulty of implementing each alternative is assessed by considering the following types of factors, as appropriate:

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions (if necessary), and the ability to monitor the effectiveness of the remedy
- Administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required in obtaining any necessary permit equivalencies from other agencies
- Availability of services and materials, necessary equipment and specialists, and provisions to ensure any necessary additional resources and availability of prospective technologies

Cost: The types of costs that are assessed include the following:

- Capital costs, including both direct and indirect costs
- Annual operation and maintenance (O&M) costs, including long-term monitoring cost and periodic review cost
- Net present worth of capital and O&M costs

The cost estimates are developed based on EPA's "A Guide to Developing and Documenting Cost Estimates during the Feasibility Study" (EPA 2000). The present worth of each alternative provides the basis for the cost comparison.

The present worth cost with a discount rate represents the amount of money that, if invested in the initial year of the remedial action at a given rate, would provide the funds required to make future payments to cover all costs associated with the remedial action over its planned life. EPA specified that the discount rate of 7 percent shall be used for cost estimates over the life-cycle of each remedial alternative (EPA 2000). Pursuant to the EPA remedial investigation/feasibility study (RI/FS) guidance document (EPA 1988b), the costs are expected to be within -30 to +50 percent accuracy.

Supporting Agency (State) Acceptance: This criterion addresses technical and administrative preferences and issues that the State of New Jersey may have regarding each alternative. State acceptance will be addressed in the proposed plan.

Community Acceptance: The preferred alternative will be presented to the public in the proposed plan. Community input will be solicited and considered during the public comment period. Community acceptance of the preferred alternative will be evaluated after the public comment period. A responsiveness summary will be prepared to address comments received during the public comment period, and a summary will be included in the Record of Decision.

4.2 Detailed Analysis of Remedial Alternatives

The analysis of remedial alternatives is discussed in detail below and is also summarized in Table 4-1

4.2.1 Alternative 1: No Action

The No Action alternative was retained for comparison purposes as required by the NCP. No remedial actions would be implemented under the No Action alternative. Groundwater within the study area would continue to be used as the source of drinking water for private wells. This alternative does not include institutional controls.

4.2.1.1 Overall Protection of Human Health and the Environment

The No Action alternative would not provide overall protection of human health. Currently, there is risk to human health since the groundwater is used as a source of potable water at multiple private properties. Because no remedial action would be implemented under this alternative, there would be no means available to prevent current and future exposure to the contaminated groundwater.

This alternative would not provide protection to human health since potentially contaminated groundwater would continue to be used as a source of potable water. The alternative would not achieve the RAOs.

4.2.1.2 Compliance with ARARs

Due to the continued presence of site-related contaminants above drinking water standards, this alternative would not comply with the chemical-specific ARARs for drinking water. Location- and action-specific ARARs are not applicable to this alternative.

4.2.1.3 Long-Term Effectiveness and Permanence

Magnitude of Residual Risk – This alternative would not be considered a permanent remedy. The existing risk to human health due to consumption of potentially contaminated groundwater would remain.

Adequacy and Reliability of Controls – This alternative would not provide adequate or reliable control of risks to human health or the environment because there are no mechanisms to prevent exposure.

4.2.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would not affect the toxicity, mobility, or volume of the contaminants.

4.2.1.5 Short-Term Effectiveness

This alternative would not require any construction or installation; therefore, it would have no short-term impacts to the community, workers, or the environment.

4.2.1.6 Implementability

This alternative includes no technical components and would require no administrative action. It could be implemented immediately since no services would be required.

4.2.1.7 Cost

There would be no capital or O&M costs associated with this alternative.

4.2.2 Alternative 2: Treatment via POET System

See Section 3.2.2 for a detailed description of Alternative 2.

4.2.2.1 Overall Protection of Human Health and the Environment

This alternative would be protective of human health because contaminated groundwater would be treated prior to use by residents within the impacted area.

Risk to human health include risk of equipment malfunction or contaminant breakthrough. Monitoring and sampling of the POET systems would also need to occur to determine if any system changes or upgrades need to be made and to ensure all POET systems are in working order. The overall protectiveness of this alternative therefore relies upon consistent and effective monitoring and maintenance of each POET system.

This alternative would have no impact to the environment. This alternative would achieve the RAO.

4.2.2.2 Compliance with ARARs

This alternative would meet chemical-specific ARARs by treating contaminated groundwater to below PRGs at the point-of-entry to residences in the study area.

This alternative would not impact wetlands or floodplains as construction would be limited to plumbing installation within developed properties, which would be outside the limits of wetlands and floodplains. In addition, no wetlands or floodplains were identified adjacent to (within 150 feet) the areas of work for this alternative. There are also no known endangered species in the area. A Phase I Archeological Site Survey is not necessary as minimal disturbance to existing structures and the landscape is expected. This alternative would be designed to comply with action-specific ARARs. Tables 2-2 and 2-3 summarize the requirements of the location- and action-specific ARARs and their FFS considerations.

4.2.2.3 Long-Term Effectiveness and Permanence

Magnitude of Residual Risk – This alternative would have long-term effectiveness and permanence as long as the POET systems are properly maintained and monitored. The treated water would be below the PRG levels. The residents and workers would not be exposed to contaminated groundwater as the impacted area is equipped with functioning POET systems. However, some potential for exposure to contaminated water remains if the POET systems are not properly maintained and monitored. For example, if the GAC in the POET systems became saturated with contaminants, breakthrough might occur.

Adequacy and Reliability of Controls – This alternative would provide adequate control of risk to human health through long-term system monitoring and maintenance to ensure effectiveness. Careful coordination would be necessary to respond quickly to any potential alarms or detected malfunctions. As POET systems are susceptible to operational issues such as breakthrough, fouling, and breakdown over the long term, significant maintenance is required to ensure reliable

systems. Based on sampling results, additional POET systems could be easily added to any properties impacted by contaminated groundwater.

4.2.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The treatment of extracted groundwater under Alternative 2 would reduce the T/M/V of the contaminants through the operation of the POET system at its point-of-use such that the residents would not be exposed to contaminant concentrations above the PRGs. Note that the contaminated groundwater plume will be addressed under OU2.

4.2.2.5 Short-Term Effectiveness

This alternative would include very limited site work and would have minimal short-term impact to the communities and workers. There would be no adverse environmental impacts to habitats or vegetation due to the implementation of this alternative. It is estimated that each POET system installation would take 4 hours, and each POET system upgrade would take 2 hours. Periodic changeout of GAC tanks and quarterly sampling, would be necessary. This may lead to minor short-term disruptions to residents of the homes with POET system installations.

This alternative would not require any major construction efforts; therefore, it would have very little short-term impacts to the community, workers, or the environment.

4.2.2.6 Implementability

This alternative would be easily implemented as the properties in the impacted area already have POET systems that continue to operate as designed, providing clean, potable water. Adjacent or nearby homes would be monitored for impacts to their drinking water. Any new installations or upgrades required can be implemented relatively easily as long as proper access agreements are established.

4.2.2.7 Cost

Detailed cost estimates are presented in Appendix C. The total present worth for this alternative is $3.2 million over the 30-year life of the alternative.

4.2.3 Alternative 3: Alternative Water Supply for Impacted Area

See Section 3.2.3.1 for a detailed description of Alternative 3.

4.2.3.1 Overall Protection of Human Health and the Environment

This alternative would be protective of human health in providing a clean drinking water source to residents within the impacted area. The extracted water would be treated to meet all PRGs (see Appendix A) prior to distribution and use. The water supply would be operated, maintained, and monitored by a single entity such as EBEPOA. This alternative would meet the RAO. Note that this alternative would not address the contaminated groundwater, which would be evaluated during OU2. This alternative would have minimal impact to the environment.

4.2.3.2 Compliance with ARARs

This alternative would meet action-specific ARARs by providing a clean drinking water source that meets PRGs to residences in the impacted area. Residents would not be exposed to the contaminated groundwater.

A Phase I Archeological Site Survey would be conducted during the design phase. This alternative would not impact wetlands or floodplains as construction would be limited to roadways and developed properties, which would be outside the limits of wetlands and floodplains. In addition, no wetlands or floodplains were identified adjacent to (within 150 feet) the areas of work for this alternative. There are also no known endangered species in the area. However, the area is within the Highlands Region and is governed with restrictions set by the Highlands Council and NJDEP. These organizations would be contacted to obtain the appropriate approvals and/or exemptions before the alternative is implemented. This alternative would be designed to comply with action-specific ARARs. Tables 2-2 and 2-3 summarize the requirements of the location- and action-specific ARARs and their FFS considerations.

4.2.3.3 Long-Term Effectiveness and Permanence

Magnitude of Residual Risk – This alternative would have long-term effectiveness and permanence. The residents would not be exposed to contaminated groundwater once the properties in the impacted area are connected to the alternate water supply and existing private wells are abandoned.

Adequacy and Reliability of Controls – This alternative would provide adequate and reliable control of risk to human health as residences would be connected to a water supply regulated by NJDEP. Controls associated with groundwater use restrictions within the impacted area will be addressed under OU2.

4.2.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would provide potable drinking water that meets drinking water standards. This alternative would reduce T/M/V of contaminants in the potable water provided to the residents by the water supplier. Any effects to T/M/V of the contaminated groundwater will be addressed under OU2.

4.2.3.5 Short-Term Effectiveness

The site work associated with this alternative includes the installation of a water main, associated piping, booster pump, and a treatment facility. These construction activities would be performed without significant health risk to the community. Site workers would wear appropriate personal protective equipment (PPE) and follow the appropriate construction health and safety procedures. With an estimated timeframe of several months, the implementation of this alternative would have limited short-term impact to the residential community. There would be no adverse environmental impacts to habitats or vegetation as implementation would only affect already developed areas such as roads and private properties.

4.2.3.6 Implementability

This alternative would be technically implementable with conventional construction methods and equipment. Materials and services for implementation are readily available. Due to construction on main roads, there would be local traffic disruptions for a limited period of time. Obtaining permits and right-of-way access for installation of piping and construction of the treatment facility would be needed. However, depending on the water supplier ultimately selected, distance from the impacted area and capacity of the existing system would affect implementability. Other administrative challenges include obtaining approval or permit

exemptions from the Highlands Council and NJDEP for development in the Highlands Region where the site is located (under the Highlands Act).

Operation, maintenance, and monitoring (OM&M) of the expanded water supply would be performed by the water supplier.

4.2.3.7 Cost

Detailed cost estimates are presented in Appendix C. The total present worth for this alternative is $8.7 million, assuming 1-year oversight of operation and 30 years of monitoring homes adjacent or nearby impacted properties.

4.3 Comparative Analysis of Remedial Action Alternatives

Alternatives 1, 2, and 3 are compared below using the evaluation criteria described in Section 4.1.

4.3.1 Overall Protection of Human Health and the Environment

With the exception of Alternative 1, the other alternatives provide protection to human health. Under Alternative 1, human health would not be protected because contaminated groundwater has already reached private drinking water wells in the impacted area. Alternatives 2 and 3 would protect homes in the impacted area while monitoring would be used as a safeguard for adjacent or nearby properties that may be impacted in the future. When needed, additional POET systems or connections to the water supply system could be provided to those properties impacted by the contaminated groundwater.

4.3.2 Compliance with ARARs

Alternative 1 would not meet drinking water PRGs. Alternative 2 would meet chemical-specific ARARs by treating contaminated groundwater to below drinking water PRGs before consumption. Alternative 3 would meet action-specific ARARs by providing alternate drinking water that would meet PRGs before distribution.

4.3.3 Long-Term Effectiveness and Permanence

Alternative 3 would have the greatest degree of long-term effectiveness and permanence. By connecting all impacted properties to a centralized water supply system, OM&M would be conducted by an established and regulated central water supplier, which would provide high adequacy and reliability of controls. Alternative 2 would have less certainty around long-term effectiveness because it would rely on consistent and complete OM&M at individual homes to ensure long-term protection. Adequacy and reliability would depend on proper upkeep and consistent monitoring. Since Alternative 2 demands regular equipment replacement, maintenance, and monitoring, it would not be considered a permanent solution. As such, Alternative 2 would need to be in place until the contaminated groundwater has been addressed under OU2. Alternative 1 would not provide long term effectiveness or permanence.

4.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 would not provide any treatment to reduce T/M/V of drinking water contamination. Alternative 2 would provide treatment to reduce T/M/V of contaminants in drinking water

provided to properties. Alternative 3 would use an alternate groundwater source that would meet the PRGs prior to distribution to the residents.

4.3.5 Short-Term Effectiveness

Alternative 1 would have no short-term impacts to workers, the community, or the environment since no remedial action would be conducted. Alternative 2 would have minimal short-term impacts to workers, the community, and the environment since POET systems have already been installed in homes and only a small number of upgrades and new installations are expected. Alternative 3 would have the greatest short-term impacts due to construction activities associated with expansion of the existing water supply into the impacted area.

4.3.6 Implementability

Alternative 1 would be the easiest to implement since no action would be taken. Alternative 2 would be the second easiest to implement since the homes in the impacted area already have operating POET systems. Additional upgrades and new installations would be relatively easy to install. Long-term OM&M would be limited to the impacted area but would require long-term commitment. Alternative 3 would present more challenges to implementation in the short-term as permits exemptions or approvals would be needed for construction.

4.3.7 Cost

Alternative 3 would have the highest overall costs at $8.7 million. Alternative 2 would have significantly lower costs at $3.2 million. Alternative 1 would have no capital or present worth costs.

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Section 5
References

Engineering & Environmental Solutions (EES JV). 2016. Revised Data Evaluation Summary Report Mansfield Trail Dump Site, Byram Township, Sussex County, NJ. May.

New Jersey Department of Environmental Protection (NJDEP). 2015a. Immediate Environmental Concern Technical Guidance. Version 1.1. March.

_____. 2015b. Granular Activated Carbon Point-of-Entry Treatment System Minimum Specifications for LSRPs. March.

U.S. Environmental Protection Agency (EPA). 1988a. Guidance Document for Providing Alternate Water Supplies. EPA/540/G-87/006. Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-03. February.

_____. 1988b. Guidance for Conducting Remedial Investigations and Feasibility Studies (RI/FS) under CERCLA. EPA/540/G-89/004. OSWER Directive 9355.3-01. October.

_____. 2000. A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. EPA/540/R-00/002. July.

_____. 2010. Memorandum Concerning Update on Providing Alternative Water Supply as Part of Superfund Response Actions, OSWER Directive 9355.3-22. September 24.

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Tables

Table 2-1
Chemical-Specific ARARs, Criteria, and Guidance*
Mansfield Trail Dump Site - OU1
Byram Township, Sussex County, New Jersey

Regulatory Level	ARAR	Status	Requirement Synopsis	Comments
Federal	National Primary Drinking Water Standards-MCLs and MCLGs (EPA 816/F-09/004) *	Relevant and appropriate	Establishes health-based standards for public drinking water systems. Also establishes drinking water quality goals set at levels at which no adverse health effects are anticipated with an adequate margin of safety.	MCLs and MCLGs will be used in the development of the remedial alternatives and PRGs.
State	NJDEP Safe Drinking Water Standards (N.J.A.C. 7:10 Subchapter 5) *	Applicable	Sets MCLs for public drinking water supplies.	The standards will be used in the development of the remedial alternatives and PRGs.

Acronyms:
ARAR - applicable or relevant and appropriate requirements
MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goals
*These ARARs are considered chemical-specific for Remedial Alternatives relying on POETs
N.J.A.C. - New Jersey Administrative Code
NJDEP - New Jersey Department of Environmental Protection
PRG - preliminary remediation goal

Table 2-2
Location-Specific ARARs, Criteria, and Guidance
Mansfield Trail Dump Site - OU1
Byram Township, Sussex County, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	Comments
Federal	Fish and Wildlife Conservation Act (16 USC 2901 et seq.)	Applicable	This act protects and conserves nongame fish and wildlife.	This requirement will be considered during the development of alternatives, to determine if conservation measures are appropriate.
Federal	Fish and Wildlife Coordination Act (16 USC 661)	Potentially applicable	This act maintains and coordinates wildlife conservation. Consultation required with USFWS when federal agency proposes any modification of stream or other water body, requires adequate consideration to protect fish and wildlife resources.	This requirement will be considered during the development of alternatives.
Federal	National Historic Preservation Act (40 CFR 6.301)	Potentially applicable	This requirement requires federal agencies to take into account the effect of any federally assisted undertaking on historical structures and archeological data. If the project results in adverse effects, the agency must consult with NJHPO to develop ways to avoid, reduce, minimize and mitigate the impacts.	The effects on historical and archeological data will be evaluated during the identification, screening, and evaluation of alternatives.

Table 2-2
Location-Specific ARARs, Criteria, and Guidance
Mansfield Trail Dump Site - OU1
Byram Township, Sussex County, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	Action to be Taken to Attain ARARs
Federal	Clean Water Act (CWA) Section 404 (40 CFR 404)	Applicable	This requirement regulates the discharge of dredged and fill material into the waters of the United states, including wetlands. Guidelines specify the information and conditions to be evaluated for impacts on the aquatic ecosystem and provide for compensatory mitigation for unavoidable impacts.	The effects on wetlands will be evaluated during the identification, screening, and evaluation of alternatives.
State	New Jersey Highlands Water Protection and Planning Act (N.J.S.A. 13:20-1 et seq.)	Applicable	This requirement preserves open space and natural resources (including water resources) within the Highlands Region of New Jersey.	Since the site is located within the preservation area, remedial alternatives that are considered "major Highlands development" as defined by this act. Consultation with NJDEP will establish compliance.

Acronyms:
ARAR - applicable or relevant and appropriate requirements
CFR - Code of Federal Regulations
CWA - Clean Water Act
EPA - Environmental Protection Agency
EO - Executive Order
USC - United States Code
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
NEPA - National Environmental Policy Act
N.J.A.C. - New Jersey Administrative Code
NJDEP - New Jersey Department of Environmental Protection
N.J.S.A. - New Jersey Statutes Annotated
OSWER - Office of Solid Waste and Environmental Response
USC - United States Code

Table 2-3
Action-Specific ARARs, Criteria, and Guidance
Mansfield Trail Dump Site - OU1
Byram Township, Sussex County, New Jersey

Regulatory Level	ARARs	Status	Requirement Synopsis	Comments
General Site Remediation				
State	New Jersey Soil Erosion and Sediment Control Act (N.J.A.C. 2:90)	Potentially Applicable	Requires soil erosion and sediment control measure for construction that will potentially result in erosion of soils and sediment. Applicable to land disturbance activities involving greater than 5,000 square feet.	Will be considered during the development of alternatives.
State	New Jersey Ambient Air Quality Standards (N.J.A.C. 7:27-13)	Applicable	This standard provides the requirement for ambient air quality control.	This standard will be applied to any alternatives implemented at the site.
State	New Jersey Noise Control (N.J.A.C. 7:29)	Applicable	This standard provides the requirement for noise control.	This standard will be applied to any alternatives implemented at the site.
Water Supply				
State	NJDEP Granular Activated Carbon Point-of-Entry Treatment System Minimum Specifications for LSRPs	Relevant and appropriate	This standard provides the minimum specifications for a POET system.	This standard will be applied to any POET systems installed and/or maintained at the site.

Acronyms:
ARAR - applicable or relevant and appropriate requirements
CFR - Code of Federal Regulations
LSRPs - Licensed Site Remediation Professional
NJDEP - New Jersey Department of Environmental Protection
OSHA - Occupational Safety and Health Administration
POET - Point of entry treatment system

Table 2-4
General Response Actions Screening
Mansfield Trail Dump - OU1
Byram Township, Sussex County, New Jersey

GRA	Description of Response Action	Effectiveness	Implementability	Relative Cost	Retained?
No Action	No action would be implemented. Although there are existing POET systems within the study area, it is assumed for the No Action alternative that these systems would not be operating, and no monitoring would be conducted.	Not effective, but retained as a baseline for comparison with other alternatives as required by the NCP. Not protective of human health and the environment. Does not meet the RAO.	Implementable. Minor administrative action may be needed.	None.	Yes
Removal of Contaminants via Treatment	Treatment systems include community treatment facilities, POET systems, and POU systems. Currently, individual POET systems are already installed at each of the 18 properties in the study area to treat water extracted from the existing private wells prior to consumption or other household use by the residents.	Effective in meeting the RAO as long as the treatment systems are operated and maintained correctly.	Implementable. The POET systems are already in place and are maintained by NJDEP or individual homeowners.	No capital costs and low O&M costs.	Yes (via POET systems)
Connection to Existing Water Supply	Water mains would be constructed to expand an existing public water supply system and deliver water from the storage tank area to the study area. A service connection from the main would be extended to each house within the water district in accordance with Byram Township, Sussex County, and New Jersey regulations. The delivery route of the water mains will be determined when an existing public water supplier is selected for this alternative.	Effective in meeting the RAO by connecting each property in the study area to a nearby existing public water supply system.	Implementable. At least one public water supply is very close or adjacent to the study area. Extending water mains to the study area is feasible. However, since the study area is at a higher elevation than neighboring water suppliers, additional infrastructure (such as an uphill water storage tank) would need to be constructed to ensure adequate water pressure to properties within the study area.	Moderate capital costs and low O&M costs.	Yes
Development of New Water Resource	A new water supply and distribution system (e.g., a new water district) would be constructed to supply drinking water to the study area.	Effective in meeting the RAO through providing a new water supply.	Difficult to implement. The area around the study area is space-limited due to steep topography, which would make siting new water supply wells or water storage tanks challenging. The groundwater contamination plume from Mansfield Trail Dump Site limits the availability of uncontaminated groundwater in the area to be used as a drinking water supply. Furthermore, no surface water bodies are available upgradient of the study area. It would also be cost prohibitive to build a new water supplier for a small number of residences.	High capital costs and moderate O&M costs.	No

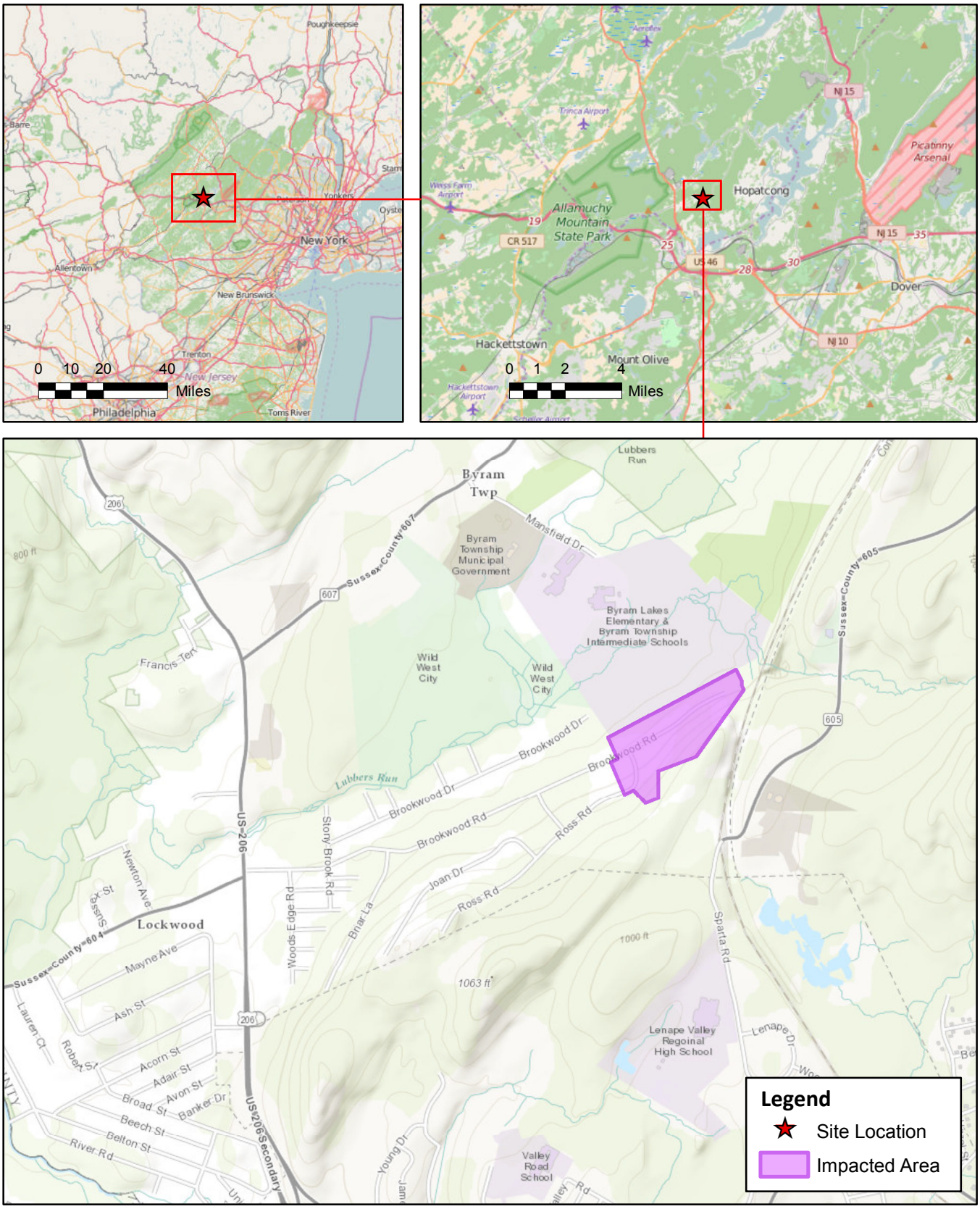
Note:
Highlighted rows indicate technology eliminated from further evaluation.

Acronyms:
GRA - general response action
NJDEP - New Jersey Department of Environmental Protection
RAO - remedial action objective
NCP - National Contingency Plan
POET - point-of-entry treatment
O&M - operation and maintenance
POU - point-of-use treatment

Table 4-1
Summary of Comparative Analysis of Remedial Action Alternatives
Mansfield Trail Dump Site – OU1
Byram Township, Sussex County, New Jersey

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Treatment via POET System	ALTERNATIVE 3 Connection to Existing Water Supply
Summary of Components	None	- Installation, operations, maintenance, and monitoring of POET systems - Monitoring at nearby properties	- Connection of impacted properties to existing water supply system - Monitoring at nearby properties
Overall Protection of Human Health and the Environment	This alternative would not provide protection of human health or the environment since potentially contaminated groundwater would continue to be used as a source of potable water. There would be no means available to prevent current and future exposure to the contaminated groundwater.	This alternative would be protective of human health because contaminated groundwater would be treated prior to use by residents within the impacted area. However, the overall protectiveness of this alternative relies upon consistent and effective monitoring and maintenance of each POET system. This alternative would have no impact to the environment.	This alternative would be protective of human health in providing a clean drinking water source to residents within the impacted area. The extracted water would be treated to meet all PRGs prior to distribution and use. The water supply would be operated, maintained, and monitored by a single entity such as EBEPOA. This alternative would have minimal impact to the environment.
Compliance with ARARs	Due to the continued presence of site-related contaminants above drinking water standards, this alternative would not comply with the chemical-specific ARARs for drinking water. Location- and action-specific ARARs are not applicable to this alternative.	This alternative would meet chemical-specific ARARs by treating contaminated groundwater to below PRGs at the point-of-entry to residences in the study area. This alternative would also be designed to comply with action-specific ARARs. As minimal disturbances to existing structures and landscape is expected, location-specific ARARs would be met. This alternative would also be designed to comply with action-specific ARARs.	This alternative would meet action-specific ARARs by providing a clean drinking water source that meets PRGs to residences in the impacted area. Residents would not be exposed to the contaminated groundwater. Location-specific ARARs would be met through applying for the appropriate approvals and/or exemptions for work within the Highlands Region.
Long-term Effectiveness and Permanence	This alternative would not be effective in the long term as the existing risk to human health would remain. Because there are no mechanisms to prevent exposure, this alternative would not provide any adequate or reliable control of risk.	This alternative would have long-term effectiveness and permanence as long as the POET systems are properly maintained and monitored. Adequate control of risk to human health would also be provided thorugh long-term system monitoring and maintenance to ensure effectiveness.	This alternative would have long-term effectiveness and permanence. The residents would not be exposed to contaminated groundwater once the properties in the impacted area are connected to the alternate water supply and existing private wells are abandoned.
Reduction of Toxicity/ Mobility/Volume (T/M/V) Through Treatment	This alternative would not affect the toxicity, mobility, or volume of the contaminants.	The treatment of extracted groundwater under this alternative would reduce the T/M/V of the contaminants through the operation of the POET system such that the residents would not be exposed to contaminant concentrations above the PRGs at the points-of-use.	This alternative would provide potable drinking water that meets drinking water standards. This alternative would reduce T/M/V of contaminants in the potable water provided to the residents by the water supplier. Any effects to T/M/V of the contaminated groundwater will be addressed under OU2.
Short-term Effectiveness	This alternative would not require any construction or installation; therefore, it would have no short-term impacts to the community, workers, or the environment.	This alternative would include very limited site work and would have minimal short-term impact to the communities and workers. There would be no adverse environmental impacts to habitats or vegetation due to the implementation of this alternative.	Implementation of this alternative would have limited short-term impact to the residential community. There would be no adverse environmental impacts to habitats or vegetation as implementation would only affect already developed areas such as roads and private properties.
Implementability	This alternative could be implemented immediately since no services would be required.	This alternative would be easily implemented as the properties in the impacted area already have POET systems that continue to operate as designed, providing clean, potable water. Any new installations or upgrades required can be implemented relatively easily as long as proper access agreements are established.	This alternative would be technically implementable with conventional construction methods and equipment. Materials and services for implementation are readily available. Due to construction on main roads, there would be local traffic disruptions for a limited period of time. Obtaining permits and right-of-way access for installation of piping and construction of the treatment facility would be needed. However, depending on the water supplier ultimately selected, distance from the impacted area and capacity of the existing system would affect implementability.
Present Worth	$0	$3.2 million	$8.7 million

Figures



Top two images adapted from EES JV Revised Data Evaluation Summary Report (2016)

Figure 1-1
Site Location Map
Mansfield Trail Dump Site, OU1
Byram Township, NJ

N

0 0.25 0.5 1
Miles

CDM Smith

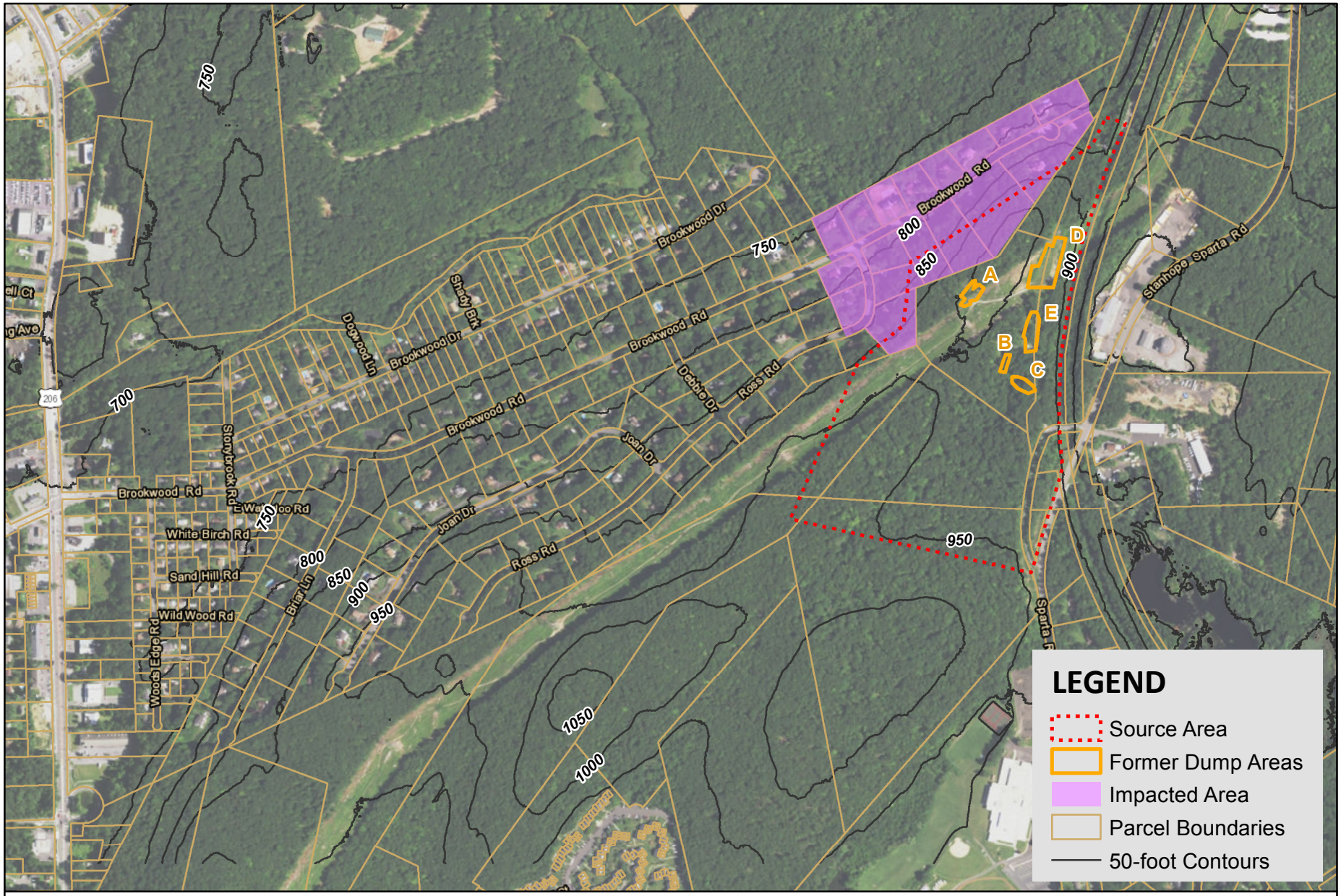
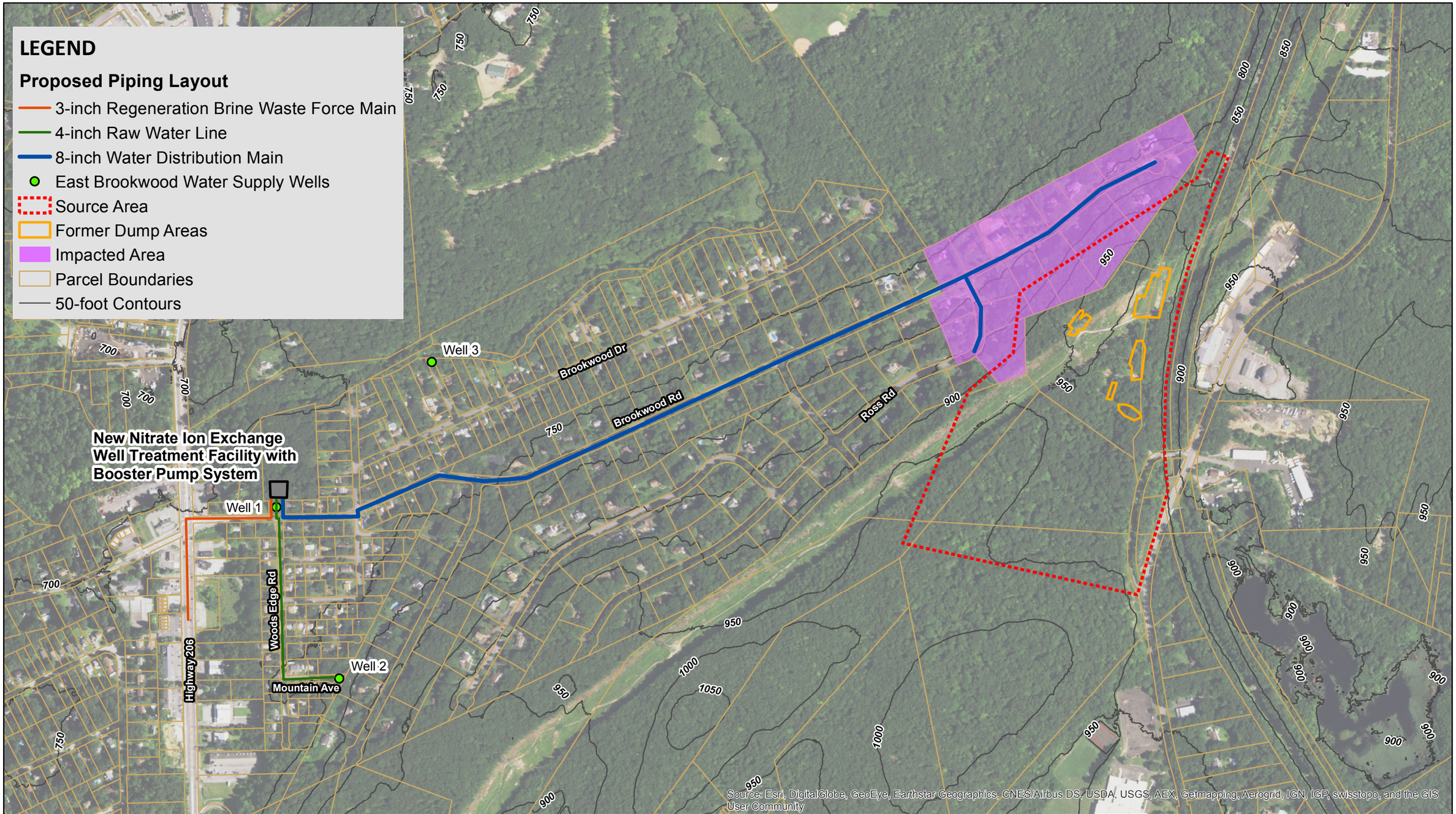


Figure 1-2
Site Map
Mansfield Trail Dump Site, OU1
Byram Township, NJ

CDM Smith

liuy2 \\Nynsvr1\IMS\GIS\Mansfield Trail Dump Site\MXD\Figure 1-2 Site Map.mxd 1/31/2017



Note: Well 1 and Well 2 would be treated with the Ion Exchange Well Treatment Facility.
Well 2 would be upgraded from 18 gpm to 30 gpm and connected to the Treatment Facility.

N

0 0.05 0.1 0.2 Miles

CDM Smith

Figure 3-1 Alternative 3
Connection to an Existing Water Supply System
East Brookwood POA Service Area
Mansfield Trail Dumpsite OU1
Byram Township, NJ

liuy2 \\Nynsvr1\IMS\GIS\Mansfield Trail Dump Site\MXD\Figure 3-1 Alternative 3A.mxd 1/31/2017

Appendix A

Appendix A
Drinking Water Standards

Drinking Water Standards by Constituent

constituents name	casrn	standard µ *g/l or ppb* (unless otherwise specified)	type	comment
Adipates (Di(ethylhexyl)adipate) (DEHA)	103-23-1	400	Primary	FEDERAL MCL
Alachlor	15972-60-8	2	Primary	FEDERAL MCL
Aldicarb	116-06-3		Primary	No MCL - Monitoring Required
Aldicarb sulfone	1646-88-4		Primary	No MCL - Monitoring Required
Aldicarb sulfoxide	1646-87-3		Primary	No MCL - Monitoring required
Aluminum	7429-90-5	200	Secondary	FEDERAL MCL - Recommended upper limit
Antimony (Total)	7440-36-0	6	Primary	FEDERAL MCL
Arsenic (Total)	7440-38-2	5	Primary	STATE MCL
Asbestos	1332-21-4	$7x10^{6}$ fibers/l >10 um	Primary	FEDERAL MCL
Atrazine	1912-24-9	3	Primary	FEDERAL MCL
Barium	7440-39-3	2000	Primary	FEDERAL MCL
Benzene	71-43-2	1	Primary	STATE MCL
Benzo(a)pyrene(BaP)	50-32-8	0.2	Primary	FEDERAL MCL
Beryllium	7440-41-7	4	Primary	FEDERAL MCL
BHC (gamma-HCH/Lindane)	58-89-9	0.2	Primary	FEDERAL MCL
Bis(2-ethylhexyl) phthalate (DEHP)	117-81-7	6	Primary	FEDERAL MCL
Bromate	15541-45-4	10	Primary	FEDERAL MCL
Bromoacetic Acid	79-08-3	See Haloacetic Acids	Primary	FEDERAL MCL
Bromodichloromethane(Dichlorobromomethane)	75-27-4	See Trihalomethanes	Primary	FEDERAL MCL
Bromoform	75-25-2	See Trihalomethanes	Primary	FEDERAL MCL
Cadmium	7440-43-9	5	Primary	FEDERAL MCL
Carbofuran	1563-66-2	40	Primary	FEDERAL MCL
Carbon Tetrachloride	56-23-5	2	Primary	STATE MCL
Chloramine	10599-90-3	4000	Primary	FEDERAL -Maximum residential disenfectant load
Chlordane	57-74-9	0.5	Primary	STATE MCL
Chloride	16887-00-6	250,000	Secondary	STATE MCL -Recommended upper limit
Chlorine dioxide	10049-04-4	800	Primary	FEDERAL -Maximum residential disenfectant load
Chlorine Produced Oxidants	7782-50-5	4000	Primary	FEDERAL -Maximum residential disenfectant load
Chlorite	7758-19-2	1,000	Primary	FEDERAL MCL
Chlorobenzene	108-90-7	50	Primary	STATE MCL
Chloroform	67-66-3	See Trihalomethanes	Primary	FEDERAL MCL
Chromium (Total)	7440-47-3	100	Primary	FEDERAL MCL
Coliform bacteria		Presence or absence	Primary	FEDERAL MCL

constituents name	casrn	standard μ *g/l or ppb* (unless otherwise specified)	type	comment
Color (measure by "Color Unit")		10 color units	Secondary	STATE Recommended upper limit
Copper	7440-50-8	1300	Primary	FEDERAL Action Level
Cyanide (free cyanide)	57-12-5	200	Primary	FEDERAL MCL
Dalapon (2,2-Dichloropropionic acid)	75-99-0	200	Primary	FEDERAL MCL
Dibromoacetic Acid	631-64-1	See Haloacetic Acids	Primary	FEDERAL MCL
Dibromochloromethane (Chlorodibromomethane)	124-48-1	See Trihalomethanes	Primary	FEDERAL MCL
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	0.2	Primary	FEDERAL MCL
Dichloroacetic acid	79-43-6	See Haloacetic Acids	Primary	FEDERAL MCL
1,2-Dichlorobenzene (ortho)	95-50-1	600	Primary	FEDERAL/STATE MCL
1,3-Dichlorobenzene (meta)	541-73-1	600	Primary	STATE MCL
1,4-Dichlorobenzene (para)	106-46-7	75	Primary	FEDERAL MCL
1,1-Dichloroethane (1,1-DCA)	75-34-3	50	Primary	STATE MCL
1,2-Dichloroethane	107-06-2	2	Primary	STATE MCL
cis-1,2-Dichloroethylene	156-59-2	70	Primary	FEDERAL MCL
trans-1,2-Dichloroethylene	156-60-5	100	Primary	FEDERAL MCL
1,1-Dichloroethylene (1,1-DCE)	75-35-4	2	Primary	STATE MCL
2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7	70	Primary	FEDERAL MCL
1,2-Dichloropropane	78-87-5	5	Primary	FEDERAL MCL
Dinoseb	88-85-7	7	Primary	FEDERAL MCL
Diquat	85-00-7	20	Primary	FEDERAL MCL
Endothall	145-73-3	100	Primary	FEDERAL MCL
Endrin	72-20-8	2	Primary	FEDERAL MCL
Ethylbenzene	100-41-4	700	Primary	FEDERAL MCL
Ethylene dibromide (EDB) (1,2-Dibromoethane)	106-93-4	0.05	Primary	FEDERAL MCL
Fluoride	16984-48-8	4,000	Primary	FEDERAL MCL
Fluoride	16984-48-8	2,000	Secondary	FEDERAL MCL-Recommended upper limit
Foaming Agents (ABS/LAS)		500	Secondary	STATE Recommended upper limit
Glyphosate	1071-83-6	700	Primary	FEDERAL MCL
Gross Alpha		15 (pCi/l)	Primary	FEDERAL MCL
Haloacetic Acids		60 (Total of 5 individual HAAs)	Primary	FEDERAL MCL
Hardness (as CaCO3)		250,000	Secondary	FEDERAL MCL - Recommended upper limit
Heptachlor	76-44-8	0.4	Primary	FEDERAL MCL
Heptachlor epoxide	1024-57-3	0.2	Primary	FEDERAL MCL
Hexachlorobenzene	118-74-1	1	Primary	FEDERAL MCL
Hexachlorocyclopentadiene	77-47-4	50	Primary	FEDERAL MCL

constituents name	casrn	standard μ *g/l or ppb* (unless otherwise specified)	type	comment
Iron	7439-89-6	300	Secondary	FEDERAL MCL - Recommended upper limit
Lead (Total)	7439-92-1	15	Primary	FEDERAL Action Level
Manganese	7439-96-5	50	Secondary	FEDERAL MCL - Recommended upper limit
Mercury (Total)	7439-97-6	2	Primary	FEDERAL MCL
Methoxychlor	72-43-5	40	Primary	FEDERAL MCL
Methyl tert butyl ether (MTBE)	1634-04-4	70	Primary	STATE MCL
Methylene chloride	75-09-2	3	Primary	STATE MCL
Monochloroacetic acid	79-11-8	See Haloacetic Acids	Primary	
Naphthalene	91-20-3	300	Primary	STATE MCL
Nickel (Soluble salts)	7440-02-0		Primary	FEDERAL - No MCL - Monitoring Required
Nitrate	84145-82-4	10,000	Primary	FEDERAL MCL
Nitrite	14797-65-0	1,000	Primary	FEDERAL MCL
Odor (measure by Threshold Odor Number)		3	Secondary	FEDERAL MCL Recommended upper limit
Oxamyl	23135-22-0	200	Primary	FEDERAL MCL
Pentachlorophenol	87-86-5	1	Primary	FEDERAL MCL
pH		6.5-8.5	Secondary	STATE - Optimum range
beta/Photon emitters		4 mrem/yr.	Primary	FEDERAL MCL
Picloram	1918-02-1	500	Primary	FEDERAL MCL
PCBs (Polychlorinated biphenyls)	1336-36-3	0.5	Primary	FEDERAL MCL
Radium-226 & Radium-228 combined		5 (pCi/l)	Primary	FEDERAL MCL
Selenium (Total)	7782-49-2	50	Primary	FEDERAL MCL
Silver	7440-22-4	100	Secondary	STATE Recommended upper limit
Simazine	122-34-9	4	Primary	FEDERAL MCL
Sodium	7440-23-5	50,000	Secondary	STATE MCL
Styrene	100-42-5	100	Primary	FEDERAL MCL
Sulfate	14808-79-8	250,000	Secondary	FEDERAL MCL Recommended upper limit
Taste		No objectionable taste	Secondary	STATE Recommended upper limit
TDS (Total Dissolved Solids)		500,000	Secondary	STATE Recommended upper limit
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	3×10^{-5}	Primary	FEDERAL MCL
1,1,2,2-Tetrachloroethane	79-34-5	1	Primary	STATE MCL
Tetrachloroethylene (PCE)	127-18-4	1	Primary	STATE MCL
Thallium	7440-28-0	2	Primary	FEDERAL MCL
Toluene	108-88-3	1,000	Primary	FEDERAL MCL
Toxaphene	8001-35-2	3	Primary	FEDERAL MCL
Trichloroacetic acid	76-03-9	See Haloacetic Acids	Primary	FEDERAL MCL

constituents name	casrn	standard μ *g/l or ppb* (unless otherwise specified)	type	comment
1,2,4-Trichlorobenzene	120-82-1	9	Primary	STATE MCL
1,1,1-Trichloroethane (TCA)	71-55-6	30	Primary	STATE MCL
1,1,2-Trichloroethane	79-00-5	3	Primary	STATE MCL
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1	Primary	STATE MCL
2-(2,4,5-Trichlorophenoxy)propionic acid (Silvex) (2,4,5-TP)	93-72-1	50	Primary	FEDERAL MCL
Trihalomethanes		80 (total of four individual THMs)	Primary	FEDERAL MCL
Turbidity		0.3 NTU 1 NTU	Primary	FEDERAL MCL
Uranium	7440-61-1	30	Primary	FEDERAL MCL
Vinyl chloride	75-01-4	2	Primary	FEDERAL MCL
Xylenes (Total)	1330-20-7	1000	Primary	STATE MCL
Zinc	7440-66-6	5,000	Secondary	FEDERAL MCL Recommended upper limit

Drinking Water Explaination of Terms

**** Coliform bacteria standards are based on the presence or absence of coliforms in a sample. The number of samples collected by a public water system is determined by the size of the population served. A system collecting at least 40 samples/month can have coliform in no more than 5% of the samples. A system collecting fewer than 40 samples/month can have no more than one coliform positive. Any number exceeding these amounts triggers an MCL exceedence.***

For more information of Drinking Water Standards contact the Division of Water Supply, Safe Drinking Water at (609) 292-5550

Appendix B

Appendix B
Supply Need and Available Capacity Memos

Memorandum

To: *Project Files*

From: *Paul R. Cabral, P.E., Mihir Chokshi, P.E.*

Date: *December 9, 2016, Revised February 15, 2017*

Subject: *Mansfield Trail Area Water Supply Need Evaluation Summary*

The purpose of this technical memorandum is to summarize the water system supply needs for the homes impacted by the groundwater contamination from the Mansfield Trail Superfund Site (see Figure 1).

Mansfield Trail Hook-up Water Supply Needs

Within the study area of the Focused Feasibility Study (FFS) for Mansfield Trail Superfund Site, there are 18 single family homes in which the point of entry treatment systems (POETs) have been installed to reduce the levels of volatile organic compounds (VOCs) discovered within the homes private well water system to below maximum contamination levels (MCLs). To calculate the water supply needs for the impacted properties, existing water supply data from the East Brookwood Estate Property Owners Association, Inc. (EBEPOA) water system was compared to New Jersey Administrative Code 7:10 Safe Drinking Water Act Rules, Subchapter 11 Standards for the Construction of Public Community Water Systems, Section 5 (N.J.A.C. 7:10-11.5).

Water Supply Needs Calculation Option 1 – N.J.A.C. Method

The water supply needs for the homes impacted by the groundwater contamination from the Mansfield Trail Superfund Site estimated based on N.J.A.C. 7:10-11.5(f) and (g) is shown in Table 1. As required by N.J.A.C 7:10-11.5(f), the average daily water demand for residential development shall be in accordance with the Department of Community Affairs' Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21-5.2, Table 5.1 "Water Demand/Generation by Type/Size of Housing".

Table 1 – Mansfield Trail Superfund Site Hook-up Area Water Supply Needs – Calculation Option 1

	Impacted Mansfield Trail Area
No of Residential Properties	18 Parcels
Average Daily Water Demand per Residential Connection [1]	395 gpd
No of Commercial Properties	0
Average Daily Supply per Commercial Connection [2]	800 gpd
Average Daily Water Demand	7,110 gpd
Average Daily to Peak Daily Water Demand Ratio [3]	3
Peak Daily Water Demand	21,330 gpd
Peak Month Water Demand [4]	0.331 MGM
Annual Water Demand [5]	2.595 MGY

Note 1. Average daily water demand per N.J.A.C. 5:21-5.2, Table 5.1 for 4-bedroom single family is 395 gpd
2. The average daily supply per commercial connection was assumed to be 800 gpd as used for the Hopewell Precision Superfund Project FFS
3. Average daily to peak daily water demand ratio of 3 per N.J.A.C 7:10-11.5(f)3
4. Peak month water demand equals average daily water demand multiplied by 1.5 and 31 days per N.J.A.C 7:10-11.5(g)2
5. Annual water demand equals average daily water demand multiplied by 365 days per N.J.A.C 7:10-11.5(g)3
gpd = gallons per day, MGM = Million Gallons per Month, MGY = Million Gallons per Year

Water Supply Needs Calculation Option 2 – Existing Water Supply Data

NJDEP is able to grant an exception from following the N.J.A.C. calculation shown in Option 1 per N.J.A.C 7:10-11.5(e)3 since the proposed water system extension is necessary to alleviate a threat to public health where individual domestic wells are threatened by a contamination. Thus Option 2 presents calculations of water supply need based on water supply information provided by NJDEP for the EBEPOA water system for 2011 through 2015 as summarized in Table 2 (attached to the end of the Technical Memorandum). The per property water usage for the impacted homes was conservatively estimated as shown in Table 3.

Table 3 – Mansfield Trail Superfund Site Area Water Supply Needs – Calculation Option 2

	Impacted Mansfield Trail Area
No of Residential Properties	18 Parcels
Average Daily Supply per Residential Connection [1]	250 gpd
No of Commercial Properties	0
Average Daily Supply per Commercial Connection [2]	800 gpd
Total Average Daily Supply Need	4,500 gpd
Peak Daily Supply to Average Daily Supply Ratio [3]	2
Total Peak Daily Supply Need	9,000 gpd
Total Peak Month Supply Need [4]	0.279 MGM
Total Average Annual Supply Need [5]	1.643 MGY

Note 1. The average daily supply per residential connection was rounded up from 198.4 gpd to 250 gpd to account for the relatively larger homes within the hook-up area compared to the rest of the neighborhood.
2. The average daily supply per commercial connection was assumed to be 800 gpd as used during Hopewell Precision Superfund Project Focused Feasibility Study (FFS)
3. The average daily supply to peak daily supply ratio was rounded up from 1.411 to 2 to be conservative
4. Total peak month supply need equals total peak daily supply multiplied by 31 days
5. Total average annual supply need equals total average daily supply multiplied by 365 days
gpd = gallons per day, MGM = Million Gallons per Month, MGY = Million Gallons per Year

Water Supply Needs Calculation Conclusion

Option 2 will be used as the basis for water supply alternatives in the FFS. This is a reasonable assumption since New Jersey law permits exceptions to N.J.A.C. water supply need calculations for contaminated sites, and the supply need calculations are conservatively based off of actual recorded water usage data from the neighboring EBEPOA. The information presented above will be used when evaluating the available capacity of the alternative water system supplies and to cost the installation of the required water system infrastructure.

cc: Christopher Gurr, CDM Smith
Yeqing Liu, CDM Smith

Memorandum

To: *Project Files*

From: *Paul R. Cabral, P.E., Mihir Chokshi, P.E.*

Date: *February 2, 2017, revised February 15, 2017*

Subject: *East Brookwood Estate Property Owners Association, Inc. (EBEPOA)*
Water Supply System Capacity Evaluation Summary

The purpose of this technical memorandum is to summarize the available water system supply capacity of the East Brookwood Estate Property Owners Association, Inc. (EBEPOA) based on our review and discussions with New Jersey Department of Environmental Protection (NJDEP) Bureau of Water System Engineering (BWSE). The available water system supply capacity of the EBEPOA water system was reviewed for the Mansfield Trail Superfund Site Focused Feasibility Study (FFS).

EBEPOA Water Supply System Background and Capacity

The EBEPOA water supply system is located within one mile of the homes impacted by the groundwater contamination from the Mansfield Trail Superfund Site (see Figure 1). The EBEPOA water supply service area includes 179 developed residential parcels and 2 developed commercial parcels along Brookwood Road (between Route 206 and west of Briar Lane), Route 206 (at Brookwood Road), Woods Edge Road, Pleasant Hill Road, Mountain Ave, Wildwood Road, Sand Hill Road, White Birch Road, Stony Brook Road, East Waterloo Road, Brookwood Drive, Trout Brook Road, Dogwood Lane, Shady Brook Road, and Sandy Brook Road via 8-inch diameter and 6-inch diameter ductile iron water mains and a 70,000-gallon water storage standpipe.

Existing EBEPOA Water Storage Tank and Well No. 2

EBEPOA Water Supply System Capacity Summary

Based on water supply information provided by NJDEP for 2011 through 2015 as summarized in Table 1 (attached to end of technical memorandum), the EBEPOA water system used the following amount of water:

- Max Peak Month Supply: 1.335 MGM (million gallons per month)
- Max Peak Daily Supply: 0.043 MGD (million gallons per day)
- Max Annual Total Supply: 11.586 MGY (million gallons per year)
- Max Average Daily Supply: 0.032 MGD
- Max Average Daily Supply per Connection: 198.4 gpd (gallons per day)
- Max Average Daily Supply to Peak Daily Supply Ratio: 1.411

As noted on Figure 1, there may be up to 21 residential parcels within the EBEPOA water system with private wells, therefore, the average daily supply per connection is based on an assumed 160 connections to be conservative.

According to NJDEP, "firm capacity" for a ground water system is calculated considering the largest well for the system out of service, in accordance with regulation N.J.A.C 7:10-11.4(a)3. The "firm capacity" must meet peak daily demand, which is the average daily demand as recorded in the peak month of the prior five years as defined under N.J.A.C 7:10-11.5(e)1. Supply for the EBEPOA water system is from three bedrock wells with capacities as shown in Table 2 and a firm capacity of 0.076 mgd with the largest well (currently Well No. 1) offline.

Table 2 - EBEPOA Water Supply Capacity

Well No.	Location	Allocation Capacity [1]	Production Capacity [1]	Firm Capacity [1]
Well No. 1	Brookwood Road	64 gpm	0.092 mgd	0.092 mgd
Well No. 2 [2]	Mountain Ave	30 gpm	0.026 mgd	0.026 mgd
Well No. 3	Trout Brook Road	35 gpm	0.050 mgd	0.050 mgd
			Total	0.168 mgd
			Firm Capacity with Largest Well Offline	0.076 mgd

Note 1: Per NJDEP supplied information.
2. Production Capacity based on 18 gpm, per NJDEP supplied information
gpm = gallons per minute

According to the Allocation Permit No. 11251A, the maximum monthly withdrawal is 1.550 MGM and an annual limit of 18.6 MGY.

Table 3 - EBEPOA Available Capacity Summary

Firm Capacity [1]	0.076 MGD
Month Allocation	1.550 MGM
Yearly Allocation	18.600 MGY

Note 1: Per NJDEP supplied information and assumes all wells available.

Based on the water supply information from the last five years as provided by NJDEP with all three wells available, the EBEPOA water supply system has the following surplus:

- Firm Capacity Surplus: 0.033 MGD (the difference between the firm capacity with the largest well offline of 0.076 MGD and the observed max peak daily demand of 0.043 MGD)
- Monthly Allocation Surplus: 0.215 MGM (the difference between the permit monthly allocation of 1.550 MGM and the observed max monthly demand of 1.335 MGM)
- Yearly Allocation Surplus: 7.014 MGY (the difference between the permit annual allocation of 18.6 MGY and the observed max annual supply total of 11.586 MGY)

For the spreadsheet information supplied from NJDEP, please see Attachment A.

EBEPOA Water Supply Needs with Mansfield Trail Superfund Site – Impacted Properties

Tables 4 present the projected water supply needed from the EBEPOA water supply system to supply both the existing EBEPOA area and the 18 properties impacted by the Mansfield Trail Superfund Site.

Table 4 - EBEPOA Water System with Impacted Mansfield Trail Properties Water Supply Needs

	EBEPOA Properties with the Impacted Mansfield Trail Area	
No. of EBEPOA Properties [1]	181 Parcels	Available Supply from EBEPOA?
EBEPOA Average Daily Supply per Connection [2]	200 gpd	
Total EBEPOA Average Daily Supply Need	36,200 gpd	
No. of Mansfield Trail Impacted Properties to be Connected	18 Parcels	
Impacted Properties Average Daily Supply per Connection [3]	250 gpd	
Total Impacted Properties Average Daily Supply Need	4,500 gpd	
Combined Average Daily Supply Need	40,700 gpd	
Average Daily Supply to Peak Daily Supply Ratio [4]	2	
Combined Peak Daily Supply Need	0.0814 MGD	No
Additional Well Supply Needed to Meet Firm Capacity	0.005 MGD (3.75 gpm)	
Combined Peak Month Supply Need [5]	2.523 MGM	No
Combined Average Annual Supply Need [6]	13.213 MGY	Yes

Note: 1. Assumes all developed parcels within EBEPOA service area are connected to EBEPOA Water System
2. The average daily supply per EBEPOA connection was rounded up from 198.4 gpd to 200 gpd
3. Assumed 250 pgd for Mansfield Trail homes due to newer and larger home size.
4. The average daily supply to peak daily supply ratio was rounded up from 1.411 to 2
5. Total peak month supply need equals total peak daily supply multiplied by 31 days
6. Total average annual supply need equals total average daily supply multiplied by 365 days
gpd = gallons per day, MGM = Million Gallons per Month, MGY = Million Gallons per Year

Based on the EBEPOA available capacity (see Table 3 above), the EBEPOA water system appears to have sufficient yearly allocation capacity to supply both the EBEPOA water system and the 18 impacted properties. However, the EBEPOA water system does not have enough firm capacity surplus or monthly allocation surplus to supply the impacted Mansfield Trail properties. An increase in the well supply system capacity would be required, which could be accomplished by

increasing the well pump flow rate from Well No. 2 from 18 gpm to 30 gpm (the well's allocated capacity). In addition, an adjustment to the EBEPOA water system monthly allocation permit would need to be reviewed with NJDEP.

EBEPOA Water Supply System Capacity – Well No. 1 Nitrate Issues

It is important to note that elevated nitrate levels at just above the 10 mg/L maximum contamination levels (MCLs) were detected by EBEPOA in Well No. 1. As a result, Well No. 1 was taken offline in April 2016.

According to discussions with NJDEP, if Well No. 1 is not utilized by December 2018, Well No. 1 will be removed from the water supply capacity calculations. Then only Well No. 2 and 3 would be considered in the water supply capacity and as a result, the firm capacity (with the largest well offline) would drop to 0.026 MGD, which is less than the existing peak daily demand of 0.043 MGD as recorded over the past five years. Therefore, if the operation of Well No. 1 is not maintained, the EBEPOA water supply system does not have enough firm capacity to supply the existing EBEPOA system and the existing EBEPOA system cannot be used to supply the homes impacted by the groundwater contamination from the Mansfield Trail Superfund Site.

Non-treatment Options to Mitigate Nitrate

The following is a list of typical non-treatment options to mitigate nitrate contamination in water supply wells:

- Redrilling or modifying an existing well
- Developing a new well
- Connecting to a nearby water system
- Blending with a less contaminated source

Redrilling or modifying an existing well and developing a new well appear to be the most viable non-treatment options. Connecting to a nearby system such as Brookwood Musconetcong River Property Owners Association (BMRPOA), which is located approximately 1,500-ft away, may also be a viable non-treatment option.

In terms of blending with a less contaminated source, this non-treatment option was reviewed with NJDEP. If water from Well No. 1 was blended with water from Well No. 2 (which is the closest existing well), according to NJDEP, Well No. 1 and No. 2 would be considered one combined source with a total flow rate of 82 gpm (64 gpm plus 18 gpm). Therefore, the firm capacity with the largest supply source offline would be just Well No. 3 at 35 gpm or 0.050 MGD, which would be enough firm capacity to supply the existing EPEPOA system but not enough firm capacity to supply the existing EPEPOA system along with the 18 impacted properties. It is important to note that EBEPOA has communicated that the nitrate level within Well No. 2 is also trending upwards and may eventually exceed the MCL. Therefore, installing the raw water infrastructure needed to blend water from Well No. 1 and Well No. 2 together to achieve nitrate level compliance may not be viable for supplying the impacted properties.

Treatment Options to Mitigate Nitrate Contamination

Nitrate is a stable and highly soluble ion which makes removal using filtration or activated carbon adsorption difficult. As a result, more complex treatment processes such as ion exchange, reverse osmosis, electrodialysis and biological treatment are required.

Of the treatment processes listed, ion exchange is most commonly used. The ion exchange process involves the exchange of chloride ions for nitrate ions with periodic regeneration of the ion exchange resin with a salt solution. The ion exchange process generates a strong salt brine solution and significant amount of backwash water, which must be disposed of (typically via a sanitary sewer connection).

The second most common method for treating nitrate is reverse osmosis, which uses high pressure to force water through a membrane to remove nitrate, along with other dissolved ions. As a result, the post treated water would need to be re-stabilized. Reverse osmosis also generates a strong concentrate that would need to be disposed of.

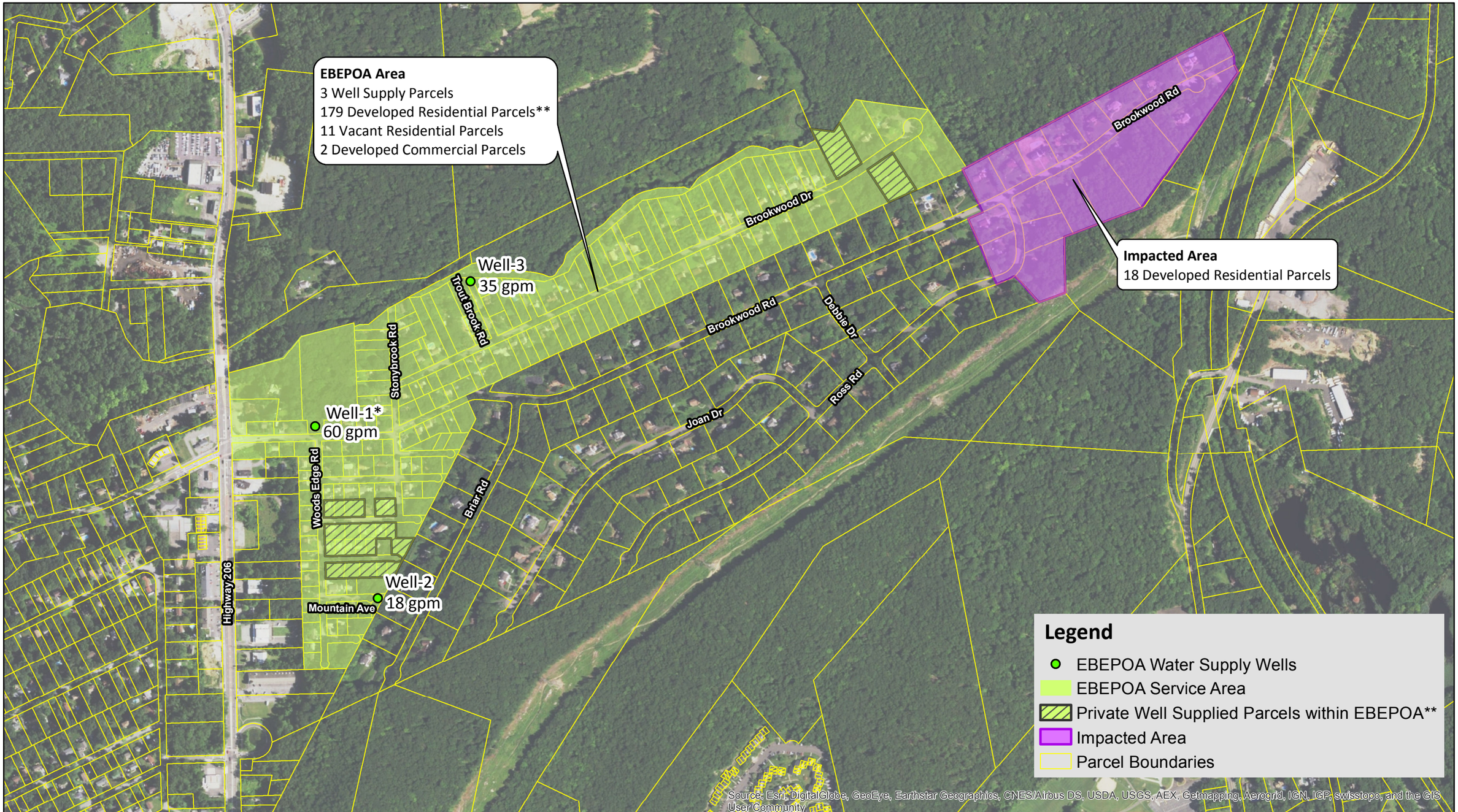
EBEPOA Water Supply System Capacity Conclusions

First, the operation of Well No. 1 must be maintained in order for the EBEPOA water supply system to have sufficient firm capacity to supply the existing EBEPOA system. To maintain the operation of Well No. 1, it is assumed for the FFS that an ion exchange well treatment facility needs to be installed.

For the EBEPOA water supply system to supply the impacted Mansfield Trail properties, it is also assumed that the well supply system capacity can be increased by increasing the well pump flow rate from Well No. 2 from 18 gpm to 30 gpm (the well's allocated capacity).

This EBEPOA water supply system capacity information will be incorporated into the needed water system infrastructure evaluation for the Mansfield Trail Superfund Site FFS.

cc: Christopher Gurr, CDM Smith
Yeging Liu, CDM Smith



* Well-1 is currently out of service due to nitrate contamination.

** Up to 21 developed residential parcels within the EBEPOA Service Area may be on private wells based on data from EQuIS provided by EPA.

Note: One of the 18 impacted properties was privately installed with a POET systems and not maintained by NJDEP.

CDM Smith

Figure 1
Hook-Up Areas
Mansfield Trail Dumpsite OU1
Byram Township, NJ

liuy2 \\Nynsvr1\IMS\GIS\Mansfield Trail Dump Site\MXD\Figure 1 Capacity and Supply Need Memo.mxd 2/15/2017

Table 1 - EBEPOA Water Supply Summary

	Monthly Totals (MGM)				
	2011	**2012**	**2013**	**2014**	**2015**
January	0.908	0.986	0.876	0.694	1.098
February	0.833	1.049	0.720	0.775	1.025
March	0.907	0.836	0.816	0.761	1.163
April	1.082	0.884	0.860	0.863	0.983
May	1.020	0.953	1.072	0.975	1.058
June	0.731	1.051	1.058	1.099	0.902
July	1.335	1.316	1.243	1.118	0.882
August	0.897	0.933	1.048	1.250	0.916
September	0.856	0.834	0.989	1.094	0.858
October	0.838	0.804	1.133	1.061	0.868
November	0.843	0.627	0.906	0.721	0.686
December	0.951	0.741	0.865	0.944	0.737

Peak Month (MGM)	1.335	1.316	1.243	1.250	1.163	Max Peak Month (MGM)	**1.335**
Peak Daily (MGD)	0.043	0.042	0.040	0.040	0.038	Max Peak Daily (MGD)	**0.043**
Annual Total (MGY)	11.201	11.014	11.586	11.355	11.176	Max Annual Total (MGY)	**11.586**
Average Daily (MGD)	0.031	0.030	0.032	0.031	0.031	Max Average Daily (MGD)	**0.032**
No. of Connections	160	160	160	160	160	Max No. of Connections	**160**
Average Daily per Connection (GPD)	191.8	188.1	198.4	194.4	191.4	Max Average Daily per Connection (gpd)	**198.4**
Average Daily to Peak Daily Ratio	1.40	1.41	1.26	1.30	1.23	Max Average Daily to Peak Daily Ratio	**1.411**

Note:

Peak Daily is the Average during Peak Month

Number of developed parcels within EBEPOA is 181 but assumed that only 160 developed parcels are connected to the EBEPOA water system

MGD = Million Gallons per Day

MGM = Million Gallons per Month

MGY = Million Gallons per Year

gpd = Gallons per Day

Attachment A – EBEPOA Water System Supply Capacity Information from NJDEP

Cabral, Paul

From: Rizvi, Syed-Imteaz <Syed-Imteaz.Rizvi@dep.nj.gov>
Sent: Friday, October 28, 2016 10:21 AM
To: Cabral, Paul
Cc: Brennan, Jeffrey; Pudney, Steven
Subject: RE: EPA Mansfield Trail Superfund Site - East Brookwood POA Water System
Attachments: 1904002 Deficit-Surplus Table-1.XLS; 1904002 Deficit-Surplus Table-2.XLS

Mr. Paul Cabral,

Under the regulations at N.J.A.C 7:10-11.4(a) 3, Firm capacity for a ground water system is calculated considering the largest well for the system out of service. Each source of water supply is required to be utilized every year. If any source of water supply (well) is not operated for more than two year, the Bureau will no more consider that source as a source for the water system and no credit will be given in calculating for source and firm capacity for the system.

Please find attached two deficit/surplus tables. Under current situation, the Bureau credits for three wells as available sources for the East Broowood Water System (EBWS) and the firm capacity is 0.076 MGD based on the largest Well # 1 out of service since April 2016. If Well # 1 is not utilized by December 2018, no credit will be given towards source capacity for Well #1, only well # 2 and 3 will be the source for the system and firm capacity for the EBWS will be 0.026 MGD based on based on the largest Well # 2 out of service.

If you are considering to treat Well # 1 and 2 combined (60+18=78 GPM), The proposed treatment facility will be considered as one source of water supply. With the largest well out of service the EBWS will have a firm capacity of 35 GPM or 0.05 MGD.

The Bureau therefore recommends that the EBWS should be looking for either having a treatment system installed at Well # 1 for Nitrate removal (which is not expensive) or drill a new well approved by the Department to have a firm capacity available for the system to expand.

Syed Imteaz Rizvi
Environmental Engineer 4
NJDEP-BWSE
(609) 292-2957 (Bus)
(609) 633-1495 (Fax)

From: Brennan, Jeffrey
Sent: Thursday, October 27, 2016 11:45 AM
To: Rizvi, Syed-Imteaz <Syed-Imteaz.Rizvi@dep.nj.gov>
Subject: FW: EPA Mansfield Trail Superfund Site - East Brookwood POA Water System
Importance: High

Hey Syed,

I believe this question is better suited for you. Could you answer Paul Cabral's question and let him know whether or not blending the two wells is a viable option?

Thanks,

Jeff

From: Cabral, Paul [mailto:CabralPR@cdmsmith.com]
Sent: Wednesday, October 26, 2016 8:04 PM
To: Brennan, Jeffrey <Jeffrey.Brennan@dep.nj.gov>
Cc: Chokshi, Mihir K. <chokshimk@cdmsmith.com>; Gurr, Christopher <gurrc@cdmsmith.com>; Liu, Yeqing <liuy2@cdmsmith.com>
Subject: EPA Mansfield Trail Superfund Site - East Brookwood POA Water System
Importance: High

Jeff –

Thank you again for speaking with me today regarding the EPA Mansfield Trail Superfund Site and the evaluation we are doing to assess the feasibility of extending the East Brookwood POA water system to supply the homes with private wells impacted by groundwater contamination.

More information regarding the superfund site can be found at the following links:
https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0206345
https://cumulis.epa.gov/supercpad/CurSites/dsp_ssppSiteData1.cfm?id=0206345
https://cumulis.epa.gov/supercpad/CurSites/dsp_ssppSiteData2.cfm?id=0206345

I also attached 2 figures for your information. The first figure shows the East Brookwood POA water system versus the homes with POET systems and homes which are being monitored by EPA. The second figure attached shows the impacted homes versus the location of the other community water systems in the area.

As you know, Well No. 1 of the East Brookwood system has elevated levels of nitrate and was taken offline. The three options that we are evaluating to mitigate the elevated nitrate levels in Well No. 1 in order to re-activate the well includes:

- Drilling a replacement well next to Well No. 1
- Piping in water from another well and blend the two supplies together before it enters the system
- Installing treatment at Well No. 1

The first question that we had for NJDEP is whether blending the Well No. 1 water with water from another well together through a common header before it enters the system. We know this will add operation complexity (i.e., both wells have to run together) and potentially limit the operation of Well No. 1 (i.e., if the other well is unavailable for operation, Well No. 1 will also have to remain offline).

The second question that we had, which I forgot to ask you, is about well supply redundancy. In NYS, DOH follows 10 States Standard and according to 10SS, for a water system supplied by just groundwater “the total developed groundwater source capacity, unless otherwise specified by the reviewing authority, shall equal or exceed the design maximum day demand with the largest production well out of service.” I ran this by our engineers that do a lot of water system work in NJ and they stated that NJDEP looks at it on a case by case basis, which is why we wanted to reach out to you to get NJDEP’s position on well supply capacity redundancy.

I look forward to getting your feedback on these two questions. In the meantime, if you have any questions, please feel free to call me in the office directly at 518-782-4530 or cell phone at 518-487-0282.

Thank you again,
Paul Cabral

Paul R. Cabral, P.E. | CDM Smith | 11 British American Blvd | Suite 200 | Latham, NY 12110 | T: 518-782-4500 x24530 | F: 518-786-3810 | www.cdmsmith.com

PWSID 1904002

SYSTEM NAME East Brookwood Property Owners

Evaluation Date Oct-27-2016

Total Well Supply

	2011	2012	2013	2014	2015	Max
Jan	0.908	0.986	0.876	0.694	1.098	
Feb	0.833	1.049	0.720	0.775	1.025	
Mar	0.907	0.836	0.816	0.761	1.163	
Apr	1.082	0.884	0.860	0.863	0.983	
May	1.020	0.953	1.072	0.975	1.058	
Jun	0.731	1.051	1.058	1.099	0.902	
Jul	1.335	1.316	1.243	1.118	0.882	
Aug	0.897	0.933	1.048	1.250	0.916	
Sep	0.856	0.834	0.989	1.094	0.858	
Oct	0.838	0.804	1.133	1.061	0.868	
Nov	0.843	0.627	0.906	0.721	0.686	
Dec	0.951	0.741	0.865	0.944	0.737	
Peak (MGM)	1.335	1.316	1.243	1.250	1.16	1.316
Total (MGY)	11.201	11.014	11.586	11.355	11.176	11.586

Well # 1 25-12659

	2011	2012	2013	2014	2015	Max
Jan	0.605	0.324	0.355	0.195	0.369	
Feb	0.659	0.385	0.315	0.310	0.347	
Mar	0.513	0.464	0.353	0.233	0.396	
Apr	0.801	0.617	0.375	0.271	0.350	
May	0.632	0.630	0.352	0.373	0.433	
Jun	0.437	0.403	0.424	0.422	0.363	
Jul	0.574	0.468	0.499	0.424	0.338	
Aug	0.257	0.400	0.453	0.447	0.227	
Sep	0.331	0.466	0.397	0.424	0.000	
Oct	0.435	0.379	0.462	0.388	0.233	
Nov	0.529	0.342	0.353	0.283	0.335	
Dec	0.669	0.354	0.306	0.372	0.347	
Peak (MGM)	0.801	0.630	0.499	0.447	0.433	0.630
Total (MGY)	6.442	5.232	4.644	4.142	3.738	5.232

PWSID 1904002

SYSTEM NAME East Brookwood Property Owners

Evaluation Date Oct-27-2016

Well # 2	**25-10921**					
	2011	**2012**	**2013**	**2014**	**2015**	**Max**
Jan	0.168	0.270	0.215	0.203	0.246	
Feb	0.088	0.360	0.140	0.179	0.214	
Mar	0.265	0.181	0.158	0.195	0.239	
Apr	0.164	0.224	0.180	0.131	0.183	
May	0.140	0.224	0.210	0.162	0.164	
Jun	0.253	0.199	0.234	0.262	0.164	
Jul	0.247	0.296	0.259	0.253	0.143	
Aug	0.329	0.194	0.220	0.300	0.152	
Sep	0.254	0.185	0.197	0.189	0.214	
Oct	0.196	0.148	0.240	0.236	0.163	
Nov	0.164	0.104	0.206	0.113	0.105	
Dec	0.103	0.069	0.196	0.186	0.094	
Peak (MGM)	0.329	0.360	0.259	0.300	0.246	0.360
Total (MGY)	2.371	2.454	2.455	2.409	2.081	2.455

Well # 3	**22-08086**					
	2011	**2012**	**2013**	**2014**	**2015**	**Max**
Jan	0.135	0.392	0.306	0.296	0.483	
Feb	0.086	0.304	0.265	0.286	0.464	
Mar	0.129	0.191	0.305	0.333	0.528	
Apr	0.117	0.043	0.305	0.461	0.450	
May	0.248	0.099	0.510	0.440	0.461	
Jun	0.041	0.449	0.400	0.415	0.375	
Jul	0.514	0.552	0.485	0.441	0.401	
Aug	0.311	0.339	0.375	0.503	0.537	
Sep	0.271	0.183	0.395	0.481	0.644	
Oct	0.207	0.277	0.431	0.437	0.472	
Nov	0.150	0.181	0.347	0.325	0.246	
Dec	0.179	0.318	0.363	0.386	0.296	
Peak (MGM)	0.514	0.552	0.510	0.503	0.644	0.644
Total (MGY)	2.388	3.328	4.487	4.804	5.357	5.357

PWSID 1904002

SYSTEM NAME East Brookwood Property Owners

Evaluation Date Oct-27-2016

TOTAL WATER USAGE (BASED ON PUMPAGE)

	2011	2012	2013	2014	2015
January	0.908	0.986	0.876	0.694	1.098
February	0.833	1.049	0.720	0.775	1.025
March	0.907	0.836	0.816	0.761	1.163
April	1.082	0.884	0.860	0.863	0.983
May	1.020	0.953	1.072	0.975	1.058
June	0.731	1.051	1.058	1.099	0.902
July	**1.335**	1.316	1.243	1.118	0.882
August	0.897	0.933	1.048	1.250	0.916
September	0.856	0.834	0.989	1.094	0.858
October	0.838	0.804	1.133	1.061	0.868
November	0.843	0.627	0.906	0.721	0.686
December	0.951	0.741	0.865	0.944	0.737
					Peak Day **0.043**
Peak (MGM)	**1.335**	1.316	1.243	1.250	1.163 Max Month **1.335**
Total (MGY)	11.201	11.014	11.586	**11.355**	11.176 Max Year **11.586**

	MGD	MGM	MGY
Firm Capacity of System =	**0.076**	**1.550**	**18.600**

Comments

PWSID **1904002**

SYSTEM NAME **East Brookwood Property Owners**

Evaluation Date **Oct-27-2016**

Bulk Purchase from ……. (PWSID)

Bulk Purchase from

	Daily (MGD)	Monthly (MGM)	Yearly (MGY)
Contract amount			

	Allocation Permit No.	Monthly (MGM)	Yearly (MGY)
Limits	11251W	1.550	18.600

Ground Water Source

Well No.	Allocation Capacity	Prod Capacity	Firm Capacity used		
Well 1	64	0.092	0.092	NIU	Nitrate problem in well water
Well 2	30	0.026	0.026		
Well 3	35	0.050	0.050		
Total			**0.168**		
Largest well			-0.092		
Firm Capacity			**0.076**		

PWSID #: 1904002 **Last Updated:** Oct-27-2016

County: Sussex **Updated By:** SR

Name: East Brookwood Property Owners

Firm Capacity: 0.076 **MGD**

Allocation Limits:

(Monthly)	1.550	**MGM**
(Yearly)	18.600	**MGY**

Contract Limits:

(Monthly)	0.000	**MGM**
(Yearly)	0.000	**MGY**

Total Limits:

(Monthly)	1.550	**MGM**
(Yearly)	18.600	**MGY**

Five Year Peak Demand:

(Daily)	0.043	**MGD**
Month/Year	07/2011	
(Monthly)	1.335	**MGM**
Month/Year	07/2011	
(Yearly)	11.586	**MGY**
Year	2014	

Allocated Demand:

(Daily)	0.000	**MGD**
(Monthly)	0.000	**MGM**
(Yearly)	0.000	**MGY**

Total Peak Demand:

(Daily)	0.043	**MGD**
(Monthly)	1.335	**MGM**
(Yearly)	11.586	**MGY**

Allocation Deficit/Surplus:

(Monthly)	0.215	**MGM**
(Yearly)	7.014	**MGY**

Firm-Peak Deficit/Surplus:

(Daily)	0.033	**MGD**

WAP Number:

Bureau of Safe Drinking Water Comments:

Bureau of Water Allocation Comments:

Appendix C

Appendix C
Cost Estimates

Appendix C
Cost Estimate for Alternative 2 - Treatment via POET Systems
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

No.	Description	Cost
	REMEDIAL ACTION	
01a	General Requirements (Upgrades, Year 0)	$73,000
01b	General Requirements (New Installations, Year 5)	$62,743
02a	POET System Installation - Upgrades	$4,600
02b	POET System Installation - New Install	$11,194
	Subtotal	*$151,537*
	Contingency (20%)	$30,307
	Subtotal	*$181,844*
	General Contractor Markup (Insurance, Bonds, Fees, etc.) 10%	$18,184
	Subtotal of Remedial Action	*$381,872*
	OPERATION, MAINTENANCE, AND MONITORING (OM&M) COSTS	
03	Annual OM&M of POET Systems (Year 1 to Year 5)	$219,612
03	Annual OM&M of POET Systems (Year 6 to Year 30)	$231,844
	Present Worth for OM&M of POET Systems (30 Years)	*$2,826,806*
	Total Present Worth	**$3,209,000**

Note: The project cost presented herein are prepared to facilitate alternative comparison between alternatives for feasibility study level evaluation. These Expected accuracy range of the cost estimate is -30% to +50%.

Appendix C
Cost Estimate for Alternative 2 - Treatment via POET Systems
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith **CDM Federal Programs Corporation**	**PROJECT:**	Mansfield Trail Dump FFS	**COMPUTED BY :**	YL	**CHECKED BY:** CG
	JOB NO.:	101995.3323.069	**DATE :**	11/3/2016	**DATE CHECKED:** 2/1/2017
	CLIENT:	EPA			

Description: FFS Cost Estimate for Alternative 2 - Individual Cost Item Backup

01 - General Requirements

01a - Project Schedule (Upgrades in Year 0)

	Quantity	Unit
Assume the following construction schedule:		
Pre-construction Work Plans and Meetings	2	weeks
Field Mobilization, Installation, and Demobilization (Construction Activities)	1	week
Project Closeout	2	weeks
Total Project Duration	**5**	**weeks**

General Conditions	Unit Cost	Unit	Quantity		Total
A) Project Management					
Assume the following staff for 20 hours per week for the duration of project:					
Project Manager	$150	hour	100	=	$15,000
Project Engineer	$110	hour	100	=	$11,000
Procurement	$90	hour	100	=	$9,000
Total Management and Office Support:					$35,000
B) Work Plan and Sampling Documents Preparation					
Estimated # of Hours Required for Work Plan/HASP/QAPP Preparation					
Project Engineer	$110	hour	100	=	$11,000
Project Manager	$150	hour	40	=	$6,000
Total Cost:					$17,000
C) Permits					
Permit Specialist	$125	hour	40	=	$5,000
Project Manager	$150	hour	20	=	$3,000
Total Permitting Cost:					$8,000
D) Onsite Supervisory					
Assume the following full time site supervisory staff for the 1 week of field events					
Site Superintendent	$120	hour	40	=	$4,800
Environmental Technician (QC)	$85	hour	40	=	$3,400
Pickup Truck #1	$100	day	5	=	$500
Per Diem for Superintendant	$142	day	5	=	$710
Total Onsite Supervisory Staff for Field Duration:					$10,000

Safety and Health Requirements

Safety and Health Requirements to include the Site Health and Safety Officer (SHSO) and personnel protective equipment and supplies

Assume PPE required for 20 people per work day for the duration of construction activities.

Total Construction Duration: 1 week

SHSO	$125	hour	10	=	$1,250
PPE	$10	day	5	=	$1,000
					$2,250

TOTAL COST FOR GENERAL REQUIREMENTS (UPGRADES IN YEAR 0) **$73,000**

Appendix C
Cost Estimate for Alternative 2 - Treatment via POET Systems
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Federal Programs Corporation	PROJECT:	Mansfield Trail Dump FFS	COMPUTED BY :	YL	CHECKED BY:	CG
	JOB NO.:	101995.3323.069	DATE :	11/3/2016	DATE CHECKED:	2/1/2017
	CLIENT:	EPA				

Description: FFS Cost Estimate for Alternative 2 - Individual Cost Item Backup

01b - Project Schedule (New Installations in Year 5)

Assume the following construction schedule:

Pre-construction Work Plans and Meetings	2	weeks
Field Mobilization, Installation, and Demobilization (Construction Activities)	2	week
Project Closeout	2	weeks
Total Project Duration	**6**	**weeks**

General Conditions	Unit Cost	Unit	Quantity		Total
A) Project Management and Site Supervisory					
Assume the following staff for 20 hours per week for the duration of project:					
Project Manager	$150	hour	120	=	$18,000
Project Engineer	$110	hour	120	=	$13,200
Procurement	$90	hour	120	=	$10,800
Total Management and Office Support:					$42,000
B) Work Plan and Sampling Documents Preparation					
Estimated # of Hours Required for Revised Work Plan/HASP/QAPP Preparation					
Project Engineer	$110	hour	70	=	$7,700
Project Manager	$150	hour	30	=	$4,500
Total Cost:					$12,200
C) Permits					
Permit Specialist	$125	hour	50	=	$6,250
Project Manager	$150	hour	25	=	$3,750
Total Permitting Cost:					$10,000
D) Onsite supervisory					
Assume the following full time site supervisory staff for the 2 weeks of field events					
Site Superintendent	$120	hour	80	=	$9,600
Environmental Technician (QC)	$85	hour	80	=	$6,800
Pickup Truck #1	$100	day	10	=	$1,000
Per Diem for Superintendant	$142	day	10	=	$1,420
Total Onsite Supervisory Staff for Field Duration:					$19,000

Safety and Health Requirements

Safety and Health Requirements to include the Site Health and Safety Officer (SHSO) and personnel protective equipment and supplies

Assume PPE required for 2 people per work day for the duration of construction activities.

Total Construction Duration: 2 weeks

SHSO	$125	hour	20	=	$2,500
PPE	$10	day	10	=	$2,000
					$4,500

TOTAL COST FOR GENERAL REQUIREMENTS (NEW INSTALLATIONS IN YEAR 5) **$88,000**

TOTAL PRESENT COST FOR GENERAL REQUIREMENTS (NEW INSTALLATIONS IN YEAR 5) **$62,743**

Appendix C
Cost Estimate for Alternative 2 - Treatment via POET Systems
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith	**PROJECT:**	Mansfield Trail Dump FFS	**COMPUTED BY :**	YL	**CHECKED BY:** CG
	JOB NO.:	101995.3323.069	**DATE :**	11/3/2016	**DATE CHECKED:** 2/1/2017
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FFS Cost Estimate for Alternative 2 - Individual Cost Item Backup

02 - POET System Installation

02a - Upgrades

Assume upgrade is addition of a water softener. Assume installation will take 2 hours per upgrade.

Water Softener (Year 0)	$600
Equipment Shipping and Delivery	$100
Subcontractor Installation Labor (2 hr)	$220
Total Cost of Single Home Upgrade:	**$920**

02b - New Installations

Assume 5 drinking water wells in the vicinity of the impacted homes would become impacted in Year 5 and POET systems would be installed, operated, monitored, and maintained in these homes for the remainder of the 30-year time period. Construction management/oversight will be 4 hours for one installation. Installations of POET systems will occur in Year 5.

POET System with Water Softener	$2,500
Equipment Shipping and Delivery	$200
Subcontractor Installation Labor (4 hr)	$440
Total Cost of Single Home Installation (in Year 5):	$3,140
Total Present Worth of Single Home Installation:	**$2,239**

	Quantity	Unit
Estimated number of homes for upgrade	5	homes
Estimated number of homes for new installation	5	homes

TOTAL CAPITAL COST FOR POET SYSTEM UPGRADES (YEAR 0)	**$4,600**
TOTAL CAPITAL COST FOR POET SYSTEM NEW INSTALLATIONS (YEAR 5)	**$11,194**

Appendix C
Cost Estimate for Alternative 2 - Treatment via POET Systems
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith	**PROJECT:**	Mansfield Trail Dump FFS	**COMPUTED BY :**	YL	**CHECKED BY:** CG
	JOB NO.:	101995.3323.069	**DATE :**	11/3/2016	**DATE CHECKED:** 2/1/2017
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FFS Cost Estimate for Alternative 2 - Individual Cost Item Backup

03 - Annual Operation, Maintenance, and Monitoring of POET Systems

03a - O&M Overall

Assume the following construction schedule:

Pre-construction Work Plans and Meetings	1	weeks
Field Mobilization, Installation, and Demobilization	1	week
Project Closeout	1	weeks
Total Project Duration	**3**	**weeks**

POET System with Water Softener	Unit Cost		Quantity		Total
A) Project Management					
Assume the following staff for 10 hours per week for the duration of project:					
Project Manager	$150	hour	30	=	$4,500
Project Engineer	$110	hour	30	=	$3,300
Procurement	$90	hour	30	=	$2,700
Total Management and Office Support:					$10,500
B) Onsite Supervisory					
Assume the following full time site supervisory staff for the 1 week of field events					
Site Superintendent	$120	hour	40	=	$4,800
Environmental Technician	$85	hour	40	=	$3,400
Pickup Truck #1	$100	day	5	=	$500
Per Diem	$142	day	5	=	$710
Total Onsite Supervisory Staff for Field Duration:					$10,000
Safety and Health Requirements to include the Site Health and Safety Officer (SHSO) and personnel protective equipment and supplies					
Assume PPE required for 2 people per work day for the duration of O&M activities.					
Annual O&M Field Duration:	1	week			
SHSO	$125	hour	10	=	$1,250
PPE	$10	day	5	=	$1,000
					$2,250
Subtotal Cost for Annual O&M Overall					$23,000

03b - O&M Per System

Sediment filter change, water softener replacement	Cost	
and general maintenance	$382	
Carbon Change-out	Quantity	Unit
System Treatment Rate	5	gal/minute
Approximate Maximum Concentration	75	ug/L
Contaminant Removal	2.0439	g/day
Approximate Adsorption Capacity	0.03	lb VOC/lb GAC
Volume of GAC Tank	1.5	cubic feet
Weight of GAC per Tank	42	lbs
Approximate Usage Time Before Breakthrough	1	year
Carbon Changeout Cost (1 tank, including labor)	$500	each
Labor for Carbon Change-out/General Maintenance (2 hr)	$220	each
Subtotal Annual O&M per POET System		$1,102

Appendix C
Cost Estimate for Alternative 2 - Treatment via POET Systems
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith	**PROJECT:**	Mansfield Trail Dump FFS	**COMPUTED BY :**	YL	**CHECKED BY:** CG
	JOB NO.:	101995.3323.069	**DATE :**	11/3/2016	**DATE CHECKED:** 2/1/2017
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FFS Cost Estimate for Alternative 2 - Individual Cost Item Backup

03c - Monitoring and Sampling Overall

Assume that 11 homes adjacent/nearby to the impacted properties will be monitored during the 30 year time period. Assume that 5 of these monitored homes become impacted in Year 5, another 5 nearby homes would be added to the list of monitored properties.

	Quantity	Unit
Estimated Number of Existing POET System Homes	18	homes
Estimated Number of Homes for New Installation (in Year 5)	5	homes
Estimated Number of Monitored Only Homes	11	homes
Total Homes	34	homes
Sampling Events per Year	4	per year

Project Schedule (Monitoring and Sampling)

Assume the following Monitoring and Sampling Event Schedule

Pre-construction Work Plans and Meetings	0.5	weeks		
Field Mobilization, Installation, and Demobilization	6	days	1.5	weeks
Project Closeout	0.5	weeks		
Total Project Duration	**3**	**weeks**		

	Unit Cost	Unit	Quantity		Total
A) Project Management and Site Supervisory					
Assume the following staff for 10 hours per week for the duration of project:					
Project Manager	$150	hour	25	=	$3,750
Project Engineer	$110	hour	25	=	$2,750
Procurement	$90	hour	25	=	$2,250
Total Management and Office Support:					$8,750
B) Onsite supervisory					
Assume the following full time site supervisory staff for the 6 days of field events					
Site Superintendent	$120	hour	72	=	$8,640
Pickup Truck #1	$100	day	6	=	$600
Per Diem	$142	day	6	=	$852
Total Onsite Supervisory Staff for Field Duration:					$11,000
Safety and Health Requirements to include the Site Health and Safety Officer (SHSO) and personnel protective equipment and supplies					
Assume PPE required for 2 people per work day for the duration of O&M activities.					
Sampling Field Duration:	6	days			
SHSO	$125	hour	72	=	$9,000
PPE	$10	day	6	=	$1,200
					$10,200

Subtotal Cost for Each Monitoring and Sampling General Requirements Event: $30,000

	Quantity	Unit	Unit Cost		Total
C) Field Sampling *(Assume 1 person, 6 days x 12 hours per day for sampling)*					
Project Manager	4	hour	$150	=	$600
Purchasing Specialist	6	hour	$90	=	$540
Project Scientist	6	day	$1,200	=	$7,200
Van/Car Rental	6	day	$100	=	$600
Equipment and PPE	6	day	$300	=	$1,800
Shipping	6	day	$100	=	$600
Per Diem for 1 Person	6	day	$142	=	$852
Miscellaneous	6	day	$100	=	$600
Subtotal (per Event)					$12,792

Appendix C
Cost Estimate for Alternative 2 - Treatment via POET Systems
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith	**PROJECT:**	Mansfield Trail Dump FFS	**COMPUTED BY :**	YL	**CHECKED BY:** CG
	JOB NO.:	101995.3323.069	**DATE :**	11/3/2016	**DATE CHECKED:** 2/1/2017
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FFS Cost Estimate for Alternative 2 - Individual Cost Item Backup

D) Sample Analysis					
(Assume raw water from impacted homes and monitored homes will be sampled annually but					
a sample will be taken between GAC tanks from each POET system quarterly)					
Year 1 through Year 5 (1st Quarter)	Quantity	Unit			
Field Samples	47	count			
Field Duplicates	3	count			
Trip Blanks	3	count			
Year 1 through Year 5 (2nd through 4th Quarter)					
Field Samples	18	count			
Field Duplicates	1	count			
Trip Blanks	1	count			
			Unit Cost		Total
VOC Analysis	113	each	$80	=	$9,040
Data Management	40	hour	$100	=	$4,000
Data Analysis/Summary	96	hour	$110	=	$10,560
Subtotal (Annual)					$23,600
Subtotal Annual Monitoring Costs (Year 1 through Year 5)				=	**$194,768**
Year 6 through Year 30 (1st Quarter)					
Field Samples	57	count			
Field Duplicates	3	count			
Trip Blanks	3	count			
Year 6 through Year 30 (2nd through 4th Quarter)					
Field Samples	23	count			
Field Duplicates	2	count			
Trip Blanks	2	count			
VOC Analysis	144	each	$80	=	$11,520
Data Management	56	hour	$100	=	$5,600
Data Analysis/Summary	120	hour	$110	=	$13,200
Subtotal (Annual)					$30,320
Subtotal Annual Monitoring Costs (Year 6 through Year 30)				=	**$201,488**
Sampling Report					
Project Manager	4	hour	$150	=	$600
Project Engineer	40	hour	$110	=	$4,400
Annual Subtotal Reporting Cost					**$5,000**
TOTAL ANNUAL OM&M COST (Year 1 to Year 5)					**$219,612**
TOTAL ANNUAL OM&M COST (Year 6 to Year 30)					**$231,844**

Appendix C
Cost Estimate for Alternative 2 - Treatment via POET Systems
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith CDM Federal Programs Corporation	PROJECT:	Mansfield Trail Dump FFS	COMPUTED BY :	YL	CHECKED BY:	CG
	JOB NO.:	101995.3323.069	DATE :	11/3/2016	DATE CHECKED:	2/1/2017
	CLIENT:	EPA				

Description: FFS Cost Estimate for Alternative 2 - Individual Cost Item Backup

Present Worth Calculation for Operation and Maintenance Cost

This is a recurring cost every year

This discount factor is (P/A,i,n)

P = Present Worth

A = Annual amount

i = interest rate 7%

$$P = A \times \frac{(1+i)^n - 1}{i(1+i)^n}$$

Operation and Maintenance Cost for First 5 Years

n = number of years 5

The multiplier for (P/A) = **4.100** for 5 years

Operation and Maintenance Cost for 30 Years

n = number of years 30

The multiplier for (P/A) = **12.409** for 30 years

Present Worth Calculation for POET System New Installation (at Year 5)

Present Worth of single payment

$$P = A \times \frac{1}{(1+i)^n}$$

i = interest rate 7%

n = number of years 5

0.7130

Appendix C
Cost Estimate for Alternative 3 - Alternate Water Supply for Impacted Area
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

No.	Description	Cost
	REMEDIAL ACTION	
01	General Requirements	$710,000
02	Alternate Water Supply	$5,603,000
	Subtotal	*$6,313,000*
	Contingency (20%)	$1,262,600
	Subtotal	*$7,575,600*
	General Contractor Markup (Insurance, Bonds, Fees, etc.) 10%	$757,560
	Subtotal of Remedial Action	*$8,333,160*
	OPERATION AND MAINTENANCE COSTS	
02	Annual O&M Cost for Alternate Water Supply (Year 1)	$77,278
02	Annual Monitoring and Sampling Cost (Year 1 to Year 30)	$27,016
	Present Worth for O&M (Year 0 to Year 30) *Includes 1 Year of Alternate Water Supply O&M Cost and 30 Years of Monitoring and Sampling*	*$412,521*
	Total Present Worth	**$8,746,000**

Note: The project cost presented herein are prepared to facilitate alternative comparison between alternatives for feasibility study level evaluation. These costs are subject to change pending the results of the pre-design investigation, which is intended to collect sufficient data to assist in the development of remedial design and associated detailed cost estimate. Expected accuracy range of the cost estimate is -30% to +50%.

Appendix C
Cost Estimate for Alternative 3 - Alternate Water Supply for Impacted Area
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith	**PROJECT:**	Mansfield Trail Dump FFS	**COMPUTED BY :**	YL	**CHECKED BY:** CG
	JOB NO.:	101995.3323.069	**DATE :**	11/3/2016	**DATE CHECKED:** 2/1/2017
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FFS Cost Estimate for Alternative 3 - Individual Cost Item Backup

01 - General Requirements

Assume project will take a total of 8 months to complete

Assume pre-construction work plans and meetings will take 1.5 months

General Conditions

	Quantity	Unit	Unit Cost		Total
A) Project Management					
Assume the following staff for 20 hours per week for the duration of project:					
Project Manager	672	hour	$150	=	$100,800
Project Engineer	672	hour	$110	=	$73,920
Procurement Staff	672	hour	$90		$60,480
Subtotal					$235,200
B) Work Plan Preparation					
Project Engineer	252	hour	$110	=	$27,720
Project Manager (Half-Time)	126	hour	$150	=	$18,900
Subtotal					$46,620
C) Permits					
Permit Specialist	40	hour	$125	=	$5,000
Project Manager	20	hour	$150	=	$3,000
Subtotal					$8,000
D) Safety and Health Requirements					
Safety and Health Requirements to include the Site Health and Safety Officer (SHSO) and personnel protective equipment and supplies.					
Assume SHSO is onsite during any onsite activities, approximately 20 hours a week.					
Total Construction Duration:	8	months			
SHSO	672	hour	$125	=	$84,000
PPE for All Onsite Staff	168	day	$100	=	$336,000
Subtotal					$420,000
TOTAL COST FOR GENERAL REQUIREMENTS					**$710,000**

Appendix C
Cost Estimate for Alternative 3 - Alternate Water Supply for Impacted Area
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith	**PROJECT:**	Mansfield Trail Dump FFS	**COMPUTED BY :**	PC	**CHECKED BY:** GS
	JOB NO.:	101995.3323.069	**DATE :**	11/21/2016	**DATE CHECKED:** 2/1/2017
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FFS Cost Estimate for Alternative 3 - Individual Cost Item Backup

02 - Alternate Water Supply

Costs are based on the Hopewell 100% Design Cost Estimate to USACE. Unit costs were derived from dividing total costs by total LF used in Hopewell Design

All costs include the following GR costs: project-dedicated supervisory staff and equipment, temporary facilities, surveying, and best management practices

	Amount	Unit	Unit Cost		Total
Upgrade Well No. 2 Pump from 18 gpm to 30 gpm				=	$15,000
Upgrade Well No. 2 Electrical & Back-up Power Improvement				=	$90,000
Well Treatment Facility with Submersible Wastewater Pump & Finished Water Pump System				=	$1,400,000
Raw Water Main from Well No. 2 to Well Treatment Facility	1,350	linear foot	$400	=	$540,000
Wastewater Force Main from Well Treatment Facility	1,000	linear foot	$300	=	$300,000
8" Water Main from Well Treatment Facility to Impacted Area	6,400	linear foot	$450	=	$2,880,000
Install Water Service Line, Remove POET Systems & Abandon Private Wells	18	each	$21,000	=	$378,000
Subtotal					$5,603,000

TOTAL CAPITAL COST FOR ALTERNATE WATER SUPPLY **$5,603,000**

TOTAL ANNUAL O&M COST FOR ALTERNATE WATER SUPPLY (178 CONNECTIONS) **$77,278**

For O&M calculations, see Appendix C: Operations and Maintenance Estimates for Alternative 3A and 3B

Appendix C
Cost Estimate for Alternative 3 - Alternate Water Supply for Impacted Area
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith	**PROJECT:**	Mansfield Trail Dump FFS	**COMPUTED BY :**	YL	**CHECKED BY:** CG
	JOB NO.:	101995.3323.069	**DATE :**	11/3/2016	**DATE CHECKED:** 2/1/2017
CDM Federal Programs Corporation	**CLIENT:**	EPA			

Description: FFS Cost Estimate for Alternative 3 - Individual Cost Item Backup

03 - Monitoring and Sampling (M&S)

Assume 11 nearby properties will be monitored annually for 30 years. If any of the nearby properties become impacted within the 30-year period, the option for additional connections to the water supply system will be evaluated at that point in time and is not included in this cost estimate.

Estimated Number of Monitored Only Homes	11	homes
Assume the following Monitoring and Sampling Event Schedule		
Pre-construction Work Plans and Meetings	3	days
Field Mobilization, Installation, and Demobilization	3	days
Project Closeout	3	days
Total Project Duration	**9**	**days**

	Unit Cost	Unit	Quantity		Total
A) Project Management and Site Supervisory					
Assume the following staff for 10 hours per week for the duration of project:					
Project Manager	$150	hour	9	=	$1,350
Project Engineer	$110	hour	9	=	$990
Procurement	$90	hour	9	=	$810
Total Management and Office Support:					$3,150
B) Onsite supervisory					
Assume the following full time site supervisory staff for the 3 days of field events					
Site Superintendent	$120	hour	36	=	$4,320
Pickup Truck #1	$100	day	3	=	$300
Per Diem	$142	day	3	=	$426
Total Onsite Supervisory Staff for Field Duration:					$6,000
Safety and Health Requirements to include the Site Health and Safety Officer (SHSO) and personnel protective equipment and supplies					
Assume PPE required for 2 people per work day for the duration of O&M activities.					
SHSO	$125	hour	36	=	$4,500
PPE	$10	day	3	=	$600
					$5,100
Subtotal Cost for Monitoring and Sampling General Requirements Annually					$15,000

	Quantity	Unit	Unit Cost		Total
C) Field Sampling *(Assume 1 person, 3 days x 12 hours per day for sampling)*					
Project Manager	2	hour	$150	=	$300
Purchasing Specialist	3	hour	$90	=	$270
Project Scientist	3	day	$1,200	=	$3,600
Van/Car Rental	3	day	$100	=	$300
Equipment and PPE	3	day	$300	=	$900
Shipping	3	day	$100	=	$300
Per Diem for 1 Person	3	day	$142	=	$426
Miscellaneous	3	day	$100	=	$300
Subtotal (Annually)					$6,396

Appendix C
Cost Estimate for Alternative 3 - Alternate Water Supply for Impacted Area
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

D) Sample Analysis					
(Assume raw water from impacted homes and monitored homes will be sampled annually but					
a sample will be taken between GAC tanks from each POET system quarterly)					
Year 1 through Year 5 (1st Quarter)	Quantity	Unit			
Field Samples	11	count			
Field Duplicates	1	count			
Trip Blanks	1	count			
VOC Analysis	13	each	$80	=	$1,040
Data Management	6.5	hour	$100	=	$650
Data Analysis/Summary	13	hour	$110	=	$1,430
Subtotal (Annual)					$3,120
Sampling Report					
Project Manager	2	hour	$150	=	$300
Project Engineer	20	hour	$110	=	$2,200
Annual Subtotal Reporting Cost					**$2,500**
TOTAL ANNUAL OM&M COST					**$27,016**

Appendix C
Cost Estimate for Alternative 3 - Alternate Water Supply for Impacted Area
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

CDM Smith **CDM Federal Programs Corporation**	**PROJECT:** Mansfield Trail Dump FFS	**COMPUTED BY :** YL	**CHECKED BY:** CG
	JOB NO.: 101995.3323.069	**DATE :** 11/3/2016	**DATE CHECKED:** 2/1/2017
	CLIENT: EPA		

Description: Cost Estimate for Alternative 3 - Alternate Water Supply for Impacted Parcels - Individual Cost Item Backup

Present Worth Calculation for Operation and Maintenance Cost

This is a recurring cost every year

This discount factor is (P/A,i,n)

P = Present Worth

A = Annual amount

i = interest rate 7%

$$P = A \times \frac{(1+i)^n - 1}{i(1+i)^n}$$

O&M Cost for 30 Years

n = number of years 30

The multiplier for (P/A) = **12.409** for 30 years

Mansfield Trail - Alternative 3 - O&M Cost

Item	Calculations					Costs				Notes
Well 1										
Operator Cost									**Monthly Cost**	
Monthly Operator Cost									$1,000	Based on 12/5/16 email from Kyle Steimle - JCO/Operator in East Fishkill, NY
Chemical and Treatment	**Salt Cost per Day per Tank**	**# of Tanks**						**Daily Cost**	**Monthly Cost**	
Salt Cost	$10.00	2						20	$620.00	Based on Westech Proposal
	GPD wastewater produced	**Disposal $/gal**						**Daily Cost**	**Monthly Cost**	
Regen Disposal Sewer Cost	2500	$0.01						$25.00	$775.00	Based on Westech Proposal
	Dosage (gal/month)	**Gal/Tote**	**Totes/Month**	**$/Tote**					**Monthly Cost**	
Hypo Cost	22.5	5	5	$2.00					$10.00	Sold in pallets of 32 five-gallon totes at $2 per tote
Electrical Cost	**HP**	**kW**	**Run Hours Per Day**			**kWh**	**$/kWh**	**Daily Cost**	**Monthly Cost**	
Well 1 Pump	15	11.2	24			268.5	$0.18	$48.32	$1,497.96	Assumed Well 1 runs 24 hours a day
Waste Water Pump	5	3.7	6			22.4	$0.18	$4.03	$124.83	Assumed waste pump runs 6 hours a day
Finish Water Boosters	3	2.2	24			53.7	$0.18	$9.66	$299.59	Assumed booster pump runs 24 hours a day
Brine Pump and Air Blower	3	2.2	1			2.2	$0.18	$0.40	$12.48	Assumed regeneration system runs 1 hour a day
	KVA	**Utilization**	**Run Hours Per Day**	**Utility Factor**	**kW**	**kWh**	**$/kWh**	**Daily Cost**	**Monthly Cost**	
Treatment Lighting Board	28	0.7	12	0.8	15.68	188.16	$0.18	$33.87	$1,049.93	Based on Wyandotte Treatment Facility, assume 12 hours a day
Well 2										
Electrical Cost	**HP**	**kW**	**Run Hours Per Day**			**kWh**	**$/kWh**	**Daily Cost**	**Monthly Cost**	
Well 2 Pump	10	7.5	0			0.0	$0.18	$0.00	$0.00	Assumed Well 2 does not run for O&M cost
	KVA	**Utilization**	**Run Hours Per Day**	**Utility Factor**	**kW**	**kWh**	**$/kWh**	**Daily Cost**	**Monthly Cost**	
Well 2 Lighting Board	14	0.7	12	0.8	7.84	94.08	$0.18	$16.93	$524.97	Based on Hopewell Junction pump station, assume 12 hours a day
Well 3										
Electrical Cost	**HP**	**kW**	**Run Hours Per Day**			**kWh**	**$/kWh**	**Daily Cost**	**Monthly Cost**	
Well 3 Pump	10	7.5	0			0.0	$0.18	$0.00	$0.00	Assumed Well 3 does not run for O&M cost
	KVA	**Utilization**	**Run Hours Per Day**	**Utility Factor**	**kW**	**kWh**	**$/kWh**	**Daily Cost**	**Monthly Cost**	
Well 3 Lighting Board	14	0.7	12	0.8	7.84	94.08	$0.18	$16.93	$524.97	Based on Hopewell Junction pump station, assume 12 hours a day

Total Monthly Cost:	**$6,439.73**
Total Yearly Cost:	**$77,276.80**
Number of Connections:	**178**
Annual Cost Per Connection:	**$434.14**