THIRD FIVE-YEAR REVIEW REPORT FOR
WOODLAND TOWNSHIP ROUTE 532 AND 72 SUPERFUND SITES
BURLINGTON COUNTY, NEW JERSEY

Prepared by

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

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6/19/19
Date

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LIST OF ACRONYMS

ACO	Administrative Consent Order
AS/SVE	Air Sparging/Soil Vapor Extraction
AIGWQ	Areas Impacting Groundwater Quality
ARAR	Applicable or Relevant and Appropriate Requirement
BLL	Blood lead level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
GWQS	Groundwater Quality Standards
GWRG	Groundwater Remediation Goals
ICs	Institutional Controls
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NJDEP	New Jersey Department of Environmental Protection
OBS	Oxygen Biosparging System
O&M	Operation and Maintenance
OU	Operable Unit
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
TBC	To be Considereds
TRW	Technical Review Workgroup

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the third FYR for the Woodland Township Route 532 and Route 72 Superfund Sites. The triggering action for this policy review is the completion date of the previous FYR. The FYR has been prepared due to the fact that the remedial action will not leave hazardous substances, pollutants or contaminants on site above levels that allow for unlimited use and unrestricted exposure, but requires five or more years to complete.

The Sites consist of Operable Units 1 and 2 (OU1 and OU2). OU1 will be addressed in this FYR. OU1 addresses contaminated surface materials, surface soils, sediment and groundwater on both Route 532 and Route 72. OU2 addressed the remediation of contaminated subsurface soils, also in both Route 532 and Route 72. The selected remedy for OU2 was no further action; therefore, it is not included in this FYR.

The Woodland Township Route 532 and Route 72 Superfund Sites FYR was led by Grisell V. Díaz-Cotto, Remedial Project Manager, EPA. Participants included the following EPA personnel: Nicholas Mazziotta, Human Health Risk Assessor; Michael Clemetson, Ecological Risk Assessor; Kathryn Flynn, Hydrologist; and Pat Seppi, Community Involvement Coordinator. The Potentially Responsible Party (PRP) was notified of the initiation of the FYR. The review began on 08/21/2018.

Site Background

Both sites are situated in an uninhabited area of the Pinelands. The Woodland Township Route 72 site is approximately 12 acres in size and is located 1/4 mile south of Route 72 along Crawley Road. Approximately 800 acres of wetlands, including cedar swamp, bog hardwood swamp, and pitch-pine lowland are located in close proximity to the Route 72 site. Pope Branch, an intermittent stream, is located approximately 500 feet to the north and 1,000 feet west of the site. (Page 18, top figure)

The Woodland Township Route 532 site is located approximately 3 miles from the Woodland Township Route 72 site. The site is approximately 20 acres in size and is located at the end of an access road approximately 1/8 mile south of Route 532. The unnamed site access road meets Route 532 approximately 1 and 1/8 mile west of the intersection of Route 532 and Route 72. Goodwater Run, an intermittent stream, and Bailey Road border the Route 532 site to the east. An unpaved forest fire control road runs along the southern edge of the site. More than 200 acres of wetland, including cedar swamp, bog, hardwood swamp and pitch-pine lowland are located downgradient of the former disposal area of the Route 532 site. Inactive commercial cranberry bogs are located approximately one mile west-southwest of the site. (Page 18, bottom figure)

The Woodland Township Route 532 and Route 72 sites were operated concurrently as chemical manufacturing waste disposal areas from the early 1950s until about 1962. At the Woodland Township Route 72 site, concrete pads, possible basements, a utility building, and sidewalks existed prior to disposal activities. Liquids, drums, and general refuse were disposed of in several excavated trenches. At the Woodland Township Route 532 site, a pine forest existed prior to the beginning of disposal operations. Liquids, drums, and general refuse were disposed into a series of bermed areas. By 1962, most of the disposal areas at both sites had been graded, and cover conditions were established.

SITE IDENTIFICATION		
Site Name: Woodland Township Route 532 Woodland Township Route 72		
EPA ID: Woodland Township Route 532: NJD980505887 Woodland Township Route 72: NJD980505879		
Region: 2	**State:** NJ	**City/County:** Woodland Township/Burlington
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: State ***[If "Other Federal Agency", enter Agency name]*:**		
Author name (Federal or State Project Manager): Grisell V. Díaz-Cotto		
Author affiliation: EPA		
Review period: 4/25/2014 – 4/25/2019		
Date of site inspection: 10/23/2018		
Type of review: Policy		
Review number: 3		
Triggering action date: 4/24/2014		
Due date *(five years after triggering action date)*: 4/24/2019		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

A remedial investigation/feasibility study (RI/FS) was conducted in phases from 1985 through 1989. The RI activities primarily consisted of sample collection and analysis of soils, wastes, groundwater, potable wells, air, surface water, sediments, and cranberries.

It was determined that soil at both sites was contaminated with volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and inorganics. The soil contaminants included:

- benzene
- creosols
- toluene
- ethylbenzene
- xylenes
- polychlorinated biphenyls
- arsenic
- cadmium
- chromium
- lead
- nickel
- silver
- zinc

Groundwater was contaminated at both sites with VOCs, SVOCs and inorganics. The major contaminants included:

- 1,2-dichloroethane (1,2-DCA)
- ethylbenzene
- toluene
- xylenes

The human health risk assessment performed during the RI/FS demonstrated that the soil, waste, and groundwater exceeded carcinogenic and noncarcinogenic target risks at both sites. Ecological risk assessments indicated that the risk to receptors in the downgradient wetlands from groundwater discharge was negligible at the Route 72 site, and no measurable impact to the ecosystem related to the groundwater plume was observed or anticipated downgradient of the Route 532 site.

Response Actions

In April 1979, the Burlington County Health Department advised NJDEP of environmental problems at the sites.

In December 1979, soil samples were collected by the Potentially Responsible Parties (PRPs) consultant. NJDEP subsequently conveyed the information to EPA.

In September 1981, a field investigation report was submitted to EPA by its Field Investigation Team contractor. Monitoring wells were installed and groundwater samples were collected.

The sites were proposed for inclusion on the National Priorities List (NPL) on September 8, 1983, and finalized on the NPL on September 21, 1983.

On March 4, 1985, NJDEP issued a directive to the Rohm and Haas Company, the Minnesota Mining and Manufacturing (3M) Company, Hercules, Inc. and other companies identified as PRPs to arrange for

the investigation and remediation of the sites. On March 27, 1985, NJDEP entered into an Administrative Consent Order (ACO) with Hercules, Inc. to help pay for the investigative and administrative costs. On July 6, 1987, NJDEP entered into a similar ACO with 3M and Rohm and Haas Company.

During March and July of 1985, the PRPs collected soil and waste samples.

In 1986, a temporary six-foot high chain-link security fence was built around the former disposal areas at both sites.

On January 2, 1990, NJDEP entered into a Second Administrative Consent Order (ACO II) with Hercules, 3M and Rohn and Hass. The purpose of this ACO was to compel the PRPs to remove liquids and sludges from isolated locations on the site's surfaces.

A third order, ACO III, was signed with Hercules, 3M and Rohm and Hass on June 15, 1990. It required the PRPs to excavate for off-site disposal all visibly contaminated surface soils from both sites, as specified in the OU1 ROD, dated May 16, 1990.

1990 ROD – OU1

Remedial Action Objectives (RAOs)

- Satisfy applicable or relevant and appropriate local, state, and federal requirements (ARARs).
- Reduce direct contact risks and stop continued degradation of the groundwater.

Surface Materials

Remedy components

- Excavation and further characterization of contaminated surface materials and sediments (soil, sludges, debris, etc.): 26,000 cubic yards from the Route 532 site and 28,000 cubic yards from the Route 72 site.
- Disposal of the excavated materials at a permitted off-site facility.
- Off-site disposal of an estimated 19 cubic yards (combined total from the Route 72 and Route 532 sites) of radiologically contaminated surface materials. This material included a drum containing radioactive pellets found at the Route 532 site.

Table 1: *Soil Cleanup Objectives*

Contaminant	Concentration (mg/Kg)	Contaminant	Concentration (mg/Kg)
Total Volatiles	1	(DDT) and metabolites	10
Total Acid Extractables	10	Lead	250-1000*
Total Base-Neutrals (excluding phthalates)	10	Mercury	1

Total Phthalates	25	Molybdenum	1
Antimony	10	Nickel	100
Arsenic	20	Selenium	4
Barium	400	Silver	5
Berylium	1	Thallium	5
Cadmium	3	Uranium and Thorium Series Radionuclides	**
Chlordane	1	Vanadium	100
Chromium (total)	100	Zinc	350
Copper	170		

*The cleanup objective for lead is not representative of background concentrations. It is based on a risk assessment that has been completed by the New Jersey Department of Health.
**Cleanup in accordance with 40 CFR 192.

1990 ROD – OU1 (continued)

Groundwater

Remedy components -

- Extraction of the contaminated groundwater plume, estimated to be 4,000 feet long, and 25 to 50 feet deep.
- Treatment of the extracted groundwater prior to reinjection. The specific components of the treatment system were to be developed during the remedial design. The feasibility study discussed treatment via air stripping, metals removal, biological treatment, and advanced oxidation. Activated carbon adsorption was to be used as a contingency if the advanced oxidation process was determined to be unsuitable. Treatment of the groundwater was to continue for an estimated 30 years or until the remedial objectives were obtained.

1999 ROD AMENDMENT – OU1 (Groundwater Only)

Modified Remedy – An assessment of environmental impacts associated with the groundwater extraction and treatment remedy was completed to satisfy the requirements of the 1990 ROD. The assessment led to the determination that air sparging and soil vapor extraction was a more appropriate remedy for the sites, because this technology would have minimal impact to the surrounding wetlands and remediate the groundwater contamination in less time and at substantially lower costs that groundwater extraction and treatment.

Modified Remedy Components

- Groundwater in the site disposal areas at both the Route 72 and Route 532 sites was to be remediated using an air sparging system to inject air into the saturated zone and strip away volatile and semi-volatile organic compounds dissolved in groundwater and adsorbed to the soil; a soil vapor extraction system to capture sparged vapors; and a vapor treatment system to treat the soil vapor extraction offgas.
- The downgradient portion of the plumes at both sites would be allowed to naturally attenuate.

Remedial Action Objectives

- The groundwater at the site is classified as 1-PL (Preservation Area). Pursuant to the Groundwater Quality Standards (N.J.A.C. 7:9-6 et seq.), the groundwater quality criterion for Class 1-PL areas is the natural quality for each constituent. For a constituent whose natural quality is less than the Practical Quantitation Level (PQL), which is the lowest concentration of a constituent that can be reliably detected during routine laboratory operating conditions, then the PQL is the Groundwater Quality Criterion. The Groundwater Remediation Goals (GWRGs) for site related contaminants are listed in Table 2 below.
- Adverse environmental impacts and permanent ecological damage in sensitive areas must be avoided.
- Human health and the environment must continue to be protected through remediation and institutional controls.
- A standard of performance equivalent to the groundwater extraction and treatment remedy specified in the ROD must be attained.
- All parts of the groundwater plume containing chemical concentrations exceeding either the NJDEP's Groundwater Quality Standards (GWQS) or the Federal Maximum Contaminant Levels (MCLs) must be remediated. Groundwater within the site disposal areas that is considered to potentially impact groundwater quality downgradient will be actively remediated, while remaining areas outside of the vertical and horizontal extent of these areas will naturally attenuate. Those areas where groundwater contains aromatic hydrocarbon concentrations (ethylbenzene, toluene and total xylenes) in excess of one percent solubility or 1,2-DCA concentrations in excess of 100 times the groundwater quality standard are considered areas impacting groundwater quality (AIGWQ).

Contingency Remedy

The 1999 ROD Amendment included a contingency remedy that would be a remedy modified from the 1990 ROD. The contingency remedy would be implemented at the sites if it were determined that:

- the MNA remedy for the downgradient plume was not adequately protective of human health and the environment, or
- the AS/SVE remedial action was no longer decreasing the levels of contamination and levels of contamination remain onsite at levels requiring active remediation, or
- the groundwater plume was migrating toward the potable wells at Dukes Bridge.

The conditions identified in the 1999 ROD Amendment that would trigger a contingency remedy have not occurred.

Table 2: *Remediation Goals*

COCs	AIGWQ Criteria (ug/l)	GWRGs (ug/l)
1,2-Dichloroethane	200	2
Ethylbenzene	1,500	5
Toluene	5,400	5
Xylenes, total	2,000	2

1993 ROD – OU2

OU2 is the second and final operable unit for the sites. The OU2 decision document addressed subsurface soils. NJDEP selected no further action for OU2. EPA concurred with the selected remedy.

Status of Implementation

OU1

Response Action:

Surface Materials. The excavation and off-site disposal of the surface materials was conducted in 1990. The total amount of contaminated materials and sediments removed from the Route 72 and 532 sites was 37,200 and 60,200 cubic yards, respectively. Contaminated subsurface soils were removed along with the removal of the visibly contaminated surface material. These soils had been acting as a source of continuing contamination of the groundwater.

Groundwater. The remedial action work plan (RAWP) for air sparging and soil vapor extraction (AS/SVE) at the Woodland Township Route 532 and Route 72 sites presented a phased approach for implementing the AS/SVE groundwater remedy in the former disposal areas of each site. Construction and operation of the AS/SVE systems were implemented in phases so that operating and performance data collected during Phase 1 could be used to optimize the construction and operation of the full systems Phase 2. The AS/SVE RAWP was approved on July 8, 2000.

The transition from active remediation by AS/SVE to monitored natural attenuation (MNA) was outlined in the AS/SVE RAWP. The process involved ceasing AS/SVE operations when the areas impacting groundwater quality (AIGWQ) RAO was achieved. The aquifer beneath the former disposal areas would no longer be a source and natural attenuation processes could complete the remediation and attain site-wide GWRGs.

AS/SVE - Route 72 Site

Construction activities were separated into two phases, addressing different areas of the site. Construction activities for Phase 1 began on September 5, 2000 and were completed on August 31, 2001. Start-up of operations at the site occurred on July 9, 2001.

Construction activities for Phase 2 were started on March 31, 2003. Phase 2 employed an oxygen biosparging system (OBS), rather than air sparging, to promote organic

contaminant removal. The OBS system for Phase 2 is comprised of five treatment zones. Construction of the first treatment zone was completed on July 18, 2003, and the start-up of a two-month trial period occurred on July 21, 2003. The remaining four zones of the OBS system were built during the interval between August 4, 2003, and February 2, 2004, and were placed online as each unit was completed.

The full Phase 2 OBS system became operational in January 2004, and was expanded in 2008 with the addition of 32 OBS wells upgradient of the Phase 2 area. OBS operation reduced contaminant concentrations to below AIGWQ criteria and sparging concluded in October 2009. Quarterly rebound monitoring indicated elevated VOC concentrations in several zones of the Phase 2 area, and lower oxygen demand in the aquifer. In 2011, the OBS system was reconfigured for air sparging and biosparging resumed in October 2011 in OBS Zone 2 and the OBS Expansion Area. In January 2012, biosparging resumed in sections of OBS Zones 3 and 5. Sparging in all areas ended in August 2012 and was followed by rebound monitoring.

Due to the results of expanded rebound monitoring performed in September 2015, the biosparge system was reactivated and was running since November 2015, as a Phase 3, to treat residual Toluene, Ethylbenzene and Total Xylenes (TEX) and reduce downgradient flux from the Phase 2 Area. However, the system was shut down on December 11, 2018, following sustained monitoring results below AIGWQ.

Performance monitoring was conducted quarterly throughout 2017. Monitoring in the sparging area was changed to semiannually in 2018.

AS/SVE - Route 532 Site

Operation of the Phase 1 AS/SVE system at the Woodland Route 532 site began on April 11, 2001. On March 27, 2003, AS/SVE operations began on the Phase 2 portion of the system. Phase 2 AS/SVE was concluded in December 2004 and Phase 1 operations ended in July 2005, when concentrations of contaminants declined to below AIGWQ criteria in both areas. No rebound effects were observed during the post-remediation monitoring period, and concentrations of 1,2-DCA and other VOCs in the source area were below the AIGWQ criteria.

AS/SVE systems and unused monitoring wells were decommissioned in 2011 and 2012, respectively.

MNA - Route 72 Site and Route 532 Site

The requirements for natural attenuation monitoring for the Route 72 site were included in the 1999 RAWP and the requirements for the Route 532 site were included in the 2005 Revised RAWP. The following three networks of monitoring wells were chosen to monitor the plumes at both sites and are categorized according to performance objectives and monitoring strategy:

- Source Depletion Monitoring Wells: This set of wells is located immediately downgradient of the fenced former disposal area at each site where COC concentrations are expected to decrease relatively quickly in response to the on-site

groundwater remedy (AS/SVE). The wells are screened in both shallow and intermediate depths to ensure source remediation is effectively addressing the entire vertical plume profile. The Route 532 site also has disposal area wells to monitor groundwater concentrations near the source.

- Plume Stability Monitoring Wells: The plume stability wells are designed to provide data used to define the horizontal and vertical plume dynamics, and the extent and mechanisms of natural attenuation of the plumes. As such, plume stability wells are located primarily along the principal flow path of the plumes and at the toe and edges of the plume. Screen zones were selected to represent shallow, intermediate, deep plume conditions.

- Sentinel Monitoring Wells: The sentinel monitoring wells are designed to provide protection of downgradient potable groundwater users.

IC Summary Table

The remedy required the implementation of a Classification Exeption Area (CEA) and a Well Restriction Area (WRA) as institutional controls at both sites. The CEA suspends the designated original uses of the groundwater beneath each site until groundwater applicable or relevant and appropriate requirements (ARARs) are attained, and the WRA restricts the use of potable water at a CEA. CEAs and WRAs were established separately for the Woodland Township Route 532 and Route 72 sites on October 1, 1999. As required by the CEAs, the PRPs have submitted biennial certifications. The most recent biennial certification monitoring reports for the groundwater CEAs were submitted in October 2018.

Table 3: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	Yes	Both sites	Restrict installation of groundwater wells and potable water use.	Classification Exception Area and Well Restriction Area established in October 1999

Systems Operations/Operation & Maintenance

AS/SVE – Route 72

At the Route 72 site, the AS/SVE system was reconfigured in 2011, to address the Phase 2 and OBS expansion areas, where concentrations of toluene, ethylbenzene, and total xylenes rebounded. Sparging

resumed in October 2011, and continued through August 2012. The module 1 AS/SVE components not in use were decommissioned during April through May 2012. Sparging in all areas ended in August 2012.

Due to the results of the expanded rebound monitoring performed in September 2015, the biosparge system was reactivated in November 2015, as a Phase 3, to treat residual toluene, ethylbenzene and total xylenes (TEX) and reduce downgradient flux from the Phase 2 Area. The system was shut down on December 11, 2018, following sustained monitoring results below AIGWQ. (See Tables 1a and 1b in Appendix 2)

Performance monitoring in these areas has been conducted quarterly throughout 2017. However, monitoring in the sparging area was changed to semiannually starting in 2018, and is expected to occur through 2019, at a minimum.

MNA – Route 72
The MNA program at the **Route 72 site** consists of the following:

- Quarterly groundwater sampling at 21 Source Depletion wells for the first two years of the MNA program and semi-annually thereafter.

- Annual groundwater sampling at 47 Plume Stability and Sentinel wells (68 wells total).

- Biennial sediment sampling at Pope Branch and Long Cripple Branch, and biennial surface water sampling at Pope Branch, Long Cripple Branch, and Shoal Branch.

Surface water and sediment sampling locations were revised after 2006 to focus on areas of known groundwater discharge. Two new locations were added and sampled for surface water and sediment during the 2018 biennial sampling event.

In addition, there are ongoing efforts to install a new sentinel well cluster. Details on the new sentinel well cluster are included in the Data Review section below.

MNA- Route 532
The MNA program at the **Route 532 site** involves annual monitoring at all wells in the groundwater monitoring well network.

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

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR as well as the recommendations from the last FYR and the current status of those recommendations.

Table 4: Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The OU1 remedy for surface materials and groundwater is protective of human health and the environment.
Sitewide	Protective	The remedies at the Woodland Township Route 72 and the Woodland Township Route 532 sites are protective of human health and the environment.

Table 5: Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	VOCs were above AIGWQ criteria in Module 1 AS/SVE Area at the Route 72 site	Sparging should be re-evaluated in 2015 if AIGWQ criteria have not been achieved	Completed	There was only one exceedance of the AIGWQ. The recommendation was to continue sparging and change the monitoring in the sparging area to semiannually instead of quarterly. However, the system was shut down on December 11, 2018 following sustained monitoring results below the AIGWQ.	2018
1	VOC contaminant concentrations in surface water and sediment are not declining at the Route 72 site	The surface water and sediment monitoring program needs to be revised for Pope Branch and Long Cripple Branch.	Completed	Two new locations were added to the sampling program in 2018. Recent sampling indicate that the Route 72 plume impacts to the surface water and sediment in Long Cripple Branch and Pope Branch are decreasing.	2018

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 1, 2018, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 42 Superfund sites in New York and New Jersey, including the Woodland

Township Route 532 and 72 Superfund sites. The announcement can be found at the following web address: https://www.epa.gov/aboutepa/fiscal-year-2019-five-year-reviews.

In addition to this notification, a public notice was made available by posting it in the Woodland Township website on 5/9/2019, stating that there was a FYR and inviting the public to submit any comments to the U.S. EPA. The results of the review and the report will be made available at https://www.epa.gov/superfund/woodland-route-532 and https://www.epa.gov/superfund/woodland-route-72 in addition to the Site information repositories located at the:

EPA Region 2, Superfund Records Center
290 Broadway, 18th Floor
New York, NY 10007-1866
Phone (212) 637-4308

and

NJDEP Office of Community Relations
401 East State Street, 5th Floor
Mail Code 401-05H
PO Box 420
Trenton, NJ 08625
(609) 984-3081

Data Review

AS/SVE - Route 532 Site

AS/SVE systems and unused monitoring wells were decommissioned in 2011 and 2012, respectively.

MNA - Route 532 Site
Groundwater monitoring data shows decreasing trends or attainment of GWRG. The 2017 monitoring results show that 1,2-DCA levels in two wells in the former disposal area are elevated, but the downgradient plume stability well is close to the 1,2-DCA remediation goal. There are isolated exceedences of GWRGs for other VOCs and bis(2-chloroethyl)ether. There are no exceedences at the sentinel wells except for 1.2 ug/l of chloroform at 532-DEP-35I.

AS/SVE – Route 72
Biosparging was shut down on December 11, 2018, following sustained monitoring results below AIGWQ. However, the monitoring in the sparging area is expected to occur through 2019, at a minimum.

MNA – Route 72
In this period, the majority of source depletion wells have met the AIGWQ criteria, but most source wells exceed the GWRGs for at least one VOC or bis(2-chloroethyl)ether. The plume stability wells generally have higher 1,2-DCA, TCE, and BTEX concentrations than the source depletion wells. At the plume stability wells, the maximum 1,2-DCA concentration in 2017 was 530 ug/l at 72-DEP-16I. VOC concentrations have overall decreased in these wells since 2001.

There are downgradient wells with high 1,2-DCA concentrations, including 72-WPSG-25B, 72-WPSG-25, and 72-WPSG-28C. In 2017, the 1,2-DCA concentration at plume stability well 72-WPSG-25C was 330 ug/l. The well 72-WPSG-28C concentration was 100 ug/l in 2017. Data from the two sentinel wells downgradient of 72-WPSG-28C have consistently shown non-detect concentrations. The hydraulic gradient in the intermediate and deep zones of the downgradient plume was evaluated from 2014 to 2016. The vertical gradients were generally low but upward. The direction of deep groundwater flow ranged from west/southwest to south/southwest.

The transport model for the Route 72 site re-calculated the transport of 1,2-DCA using the 2017 groundwater data. The model was applied to show the future concentrations at the nearest private well 6,619 feet downgradient of the site will be below the GWRG. The model predicts no immediate risk at the private well. There are ongoing efforts to install a new sentinel well cluster to confirm the model results. The monitoring well cluster will include three wells screened in the shallow, medium, and deep groundwater zones. The location will be along the revised deep groundwater flow pathway, about 3,160 feet downgradient of the distance that 1,2-DCA is estimated to have traveled from WPSG-25C since 1,2-DCA was first detected in May 2009. The installation is anticipated to occur in 2019.

Results of biennial surface water sampling are compared to baseline or historic maximum values. Surface water and sediment have mostly been decreasing or stable since 2012. The Pope Branch surface water location SS09 and the wetland location SS09-2 had increasing total VOC concentrations in the previous five-year review period, but these concentrations decreased in 2014, and 2016, and there were no exceedences in 2018. Total VOCs did increase in surface water at SS10 in 2016, but were not detected in 2018. There were no elevated concentrations at the new Long Cripple Branch locations, SS19 and SS20. (See Tables 2a and 2b in Appendix 2)

At the stream sediment locations, there was only one elevated VOC in this period. Chlorobenzene at SS10 was detected at a level above the baseline maximum value but below the Tier 1 stream sediment toxicity threshold in 2016. (See Tables 3a and 3b in Appendix 2)

Site Inspection

The inspection of the Site was conducted on October 23, 2018. In attendance were Grisell V. Díaz-Cotto, Kathryn Flynn and Nicholas Mazziotta, from EPA; Lindsey Kitchen and Willard Potter, from de maximis, inc., and Andy Janson, from Envirogen Technologies, Inc. The purpose of the inspection was to assess the protectiveness of the remedy.

V. TECHNICAL ASSESSMENT

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

Question A Summary:

Yes, the remedies for the Woodland Township Route 72 and Route 532 sites are functioning as intended by the decision documents. The remedy selected in 1990, addressed surface materials and groundwater. Excavation of surface materials was conducted in 1990. The total amount of contaminated materials and sediments removed from the Route 72 and 532 sites was 37,200 and 60,200 cubic yards, respectively.

The 1999 ROD Amendment addressed contaminated groundwater at OU1. The selected remedy was AS/SVE in the source areas and natural attenuation of the downgradient plumes.

At the Route 532 site, an estimated 44,500 pounds of organic constituents were biodegraded, and another 1,600 pounds of VOCs were stripped from the subsurface by July 2005, when AS/SVE operations ceased. Annual monitoring of MNA wells shows that contaminant concentrations in groundwater are approaching GWRGs.

AS/SVE is complete at the Route 72 site Phase 1 area. An estimated 46,500 pounds of organic constituents were biodegraded, and another 2,960 pounds of VOCs were stripped from the subsurface through January 2007, when AS/SVE operations concluded. Sparging began in the Phase 2 area in 2003, and continued through 2009. Mass removal from the Phase 2 area was estimated at 81,400 pounds of organic constituents biodegraded in 2009. Biosparging continued from 2011-2012, in the Phase 2 expansion area, and then resumed from 2015 to 2018, as Phase 3

Groundwater concentrations of COCs continue to decline in the plume stability and sentinel monitoring wells. Although groundwater at the sites has not yet met the groundwater remedial goals established in the OU1 ROD, there are currently no receptors that could be exposed to groundwater and a CEA/WRA is in place to prevent the installation of drinking water wells in the contaminated plume. The new sentinel well cluster will confirm the MNA model results showing the limit of 1,2-DCA contamination. The Route 72 plume impacts to the surface water and sediment in Long Cripple Branch and Pope Branch are decreasing.

The required institutional controls of CEA/WRA are in place at both sites.

The conditions identified in the 1999 ROD Amendment which would require the contingency remedy have not occurred.

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

Question B Summary:

There are no changes in the physical conditions of the sites or site uses that would affect the protectiveness of the selected remedy. The human health risk assessment concluded that exposure to surface soil and groundwater would result in cancer risk and/or noncancer hazard exceeding EPA threshold criteria at both sites. The exposure assumptions and the toxicity values that were used to estimate the potential risks and hazards to human health followed the general risk assessment practice at the time the risk assessment was performed. Although the risk assessment process has been updated in recent years and specific parameters including PQLs have changed, the risk assessment process that was used is still consistent with current practice and the need to implement a remedial action remains valid. The RAOs described in Section II are still valid and protective of human health as well.

Changes in Toxicity Characteristics and Remediation Goals

Soil: Since the OU1 ROD was issued, EPA has developed several new toxicity values that allow for the derivation of chemical-specific remediation goals for contaminated media, including soils. The cleanup goals for soils in the OU1 ROD would not necessarily be considered protective today. Excavation of

contaminated surface soils was conducted based on visual inspection and post excavation samples were not taken. However, soil samples collected in 1991 and 1993 at the Route 532 and 72 sites as part of the subsurface soil investigation confirmed that the remaining soil at the sites did not pose an unacceptable risk although there were some exceedances of the NJDEP residential direct contact soil standards being proposed at the time. Comparing the 1991 and 1993 data to current risk-based screening levels indicates that the conclusions of the subsurface soils risk assessment are still valid. In 2005, additional soil investigation at Route 532 confirmed that the elevated concentrations did not pose a threat from direct contact or migration to groundwater.

The lead remedial action level for soil identified in the ROD was 250 - 1,000 mg/kg (NJ State Action Level). Since the ROD was finalized, EPA issued a lead memorandum in December 2016 (OLEM Directive 9200.2-167) that indicates a blood lead level (BLL) of 10 micrograms/deciliter (µg/dL) is no longer considered health-protective. Current scientific information indicates that adverse health effects are evident with BLLs between 2 and 8 µg/dL. A target BLL of 5 µg/dL reflects current scientific literature on lead toxicology and epidemiology that provides evidence that the adverse health effects of lead exposure do not have a threshold. The 1991 and 1993 subsurface investigations indicates post remediation lead concentrations are below the residential lead screening concentration of 200 mg/kg[1] at both the Route 72 and 532 sites. Furthermore, the sites are situated in an uninhabited area of the Pinelands and are fenced, thus controlling access to site soils.

Groundwater: The remediation goals for groundwater identified in the OU1 ROD are New Jersey GWQS for the Pinelands, which remain valid. Contaminant concentrations in the groundwater at the Route 532 site are approaching these levels. The Route 72 site is not expected to reach these levels for several years, however, the contaminant concentrations in the groundwater at this site have continued to decline. Although the groundwater concentrations have not yet met the remediation goals, groundwater remediation is ongoing and there are no residential or public supply wells within one mile of the contaminated area. The CEA/WRA prohibiting private wells from being installed has been established as well. Therefore, there is no exposure to contaminated groundwater from the sites.

Surface Water/Sediment: At the Route 72 site, no remediation goals were established for surface water and sediment; still, results of the biennial surface water and sediment sampling are compared to baseline and historic maximum values as well as to Tier 1 Stream Sediment Toxicity Threshold (See Tables 2a, 2b, 3a, and 3b in Appendix 2). Since these surface water bodies are in a remote portion of the Pinelands, exposure to surface water and sediment by recreators or trespassers is not expected to be significant.

Vapor Intrusion

Soil vapor intrusion was not evaluated in the original risk assessment. This pathway was considered in the first FYR, which determined that if buildings were constructed on or adjacent to the contaminated plumes, they would need to be sampled or constructed to include a vapor mitigation system. Current concentrations in groundwater suggest that vapor intrusion would still be a concern. However, development is extremely unlikely given the sites are in a protected area of the Pinelands. Therefore, the remedy is currently protective of this pathway.

[1] Based on the evidence summarized in OLEM Directive 9200.2-167, and consultation with the EPA Lead and Bioavailability Technical Review Workgroups (TRWs), the BLL used to evaluate risks is 5 µg/dL. Therefore, a residential soil lead screening level of 200 mg/kg is selected to reflect EPA Integrated Exposure Uptake Biokinetic modeling results based on a target blood lead level of 5 µg/dL.

Ecological

Ecological risk assessments were performed to estimate the ecological risk associated with the downgradient discharge of site-related compounds to potential receptors. The ecological risk assessments indicated that the risk to receptors in the downgradient wetlands from chemicals discharging from groundwater was negligible at the Route 72 site and no measurable impact to the ecosystem related to the groundwater plume was observed or anticipated in the surface water and wetlands downgradient of the Route 532 site. This information is documented in the reports entitled Ecological Risk Assessment, Route 72 Groundwater Plume, dated September 1994 and Ecological Risk Assessment, Wetland Study Area, Route 532 Superfund Site, Woodland Township, Burlington County, New Jersey, dated April 4, 1995.

The remedial actions objectives used at the time of the remedy selection are still valid and protective of the environment. Contaminated surface materials and sediments (soils, sludges, debris, etc.) were excavated and disposed at a permitted off-site facility. Surface water and sediment samples have been collected on a biennial basis. A comparison of surface water and sediment data to site-specific aquatic toxicity thresholds and stream sediment toxicity thresholds indicates that contaminant concentrations are below their respective thresholds.

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

There is no other information that calls into question the protectiveness of the OU1 and OU2 remedies.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: 1	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The OU1 remedy is protective of human health and the environment.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedies at the Woodland Township Route 72 and the Woodland Township Route 532 sites are protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the Woodlands Township Route 532 and 72 Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

2016 Annual Groundwater Remedy Update
Phase 3 Biosparging and Monitored Natural Attenuation
August 1, 2017

2017 Annual Groundwater Remedy Update
Phase 3 Biosparging and Monitored Natural Attenuation
July 9, 2018

2017 Second Quarter Progress Report

2017 Third Quarter Progress Report

2017 Fourth Quarter Progress Report

2018 First Quarter Progress Report

2018 Second Quarter Progress Report

2018 Third Quarter Progress Report

2018 Fourth Quarter Progress Report

1990 ROD OU1 - https://semspub.epa.gov/work/02/99347.pdf

1993 ROD OU2 Route 72 - https://semspub.epa.gov/work/02/99348.pdf

1993 ROD OU2 Route 532 - https://semspub.epa.gov/work/02/99346.pdf

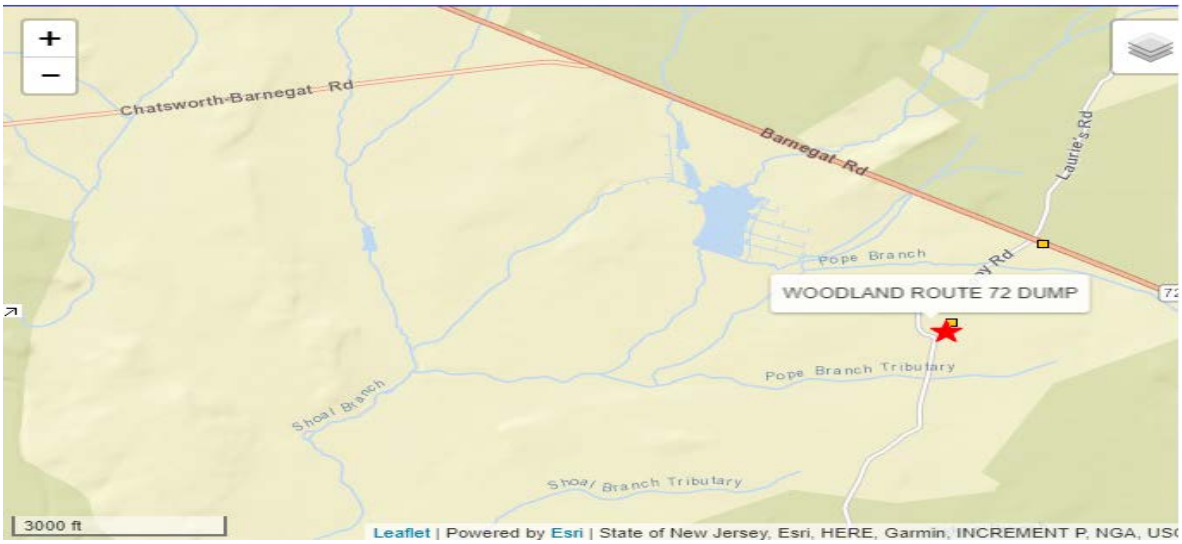
1999 ROD Amendment OU1 - https://semspub.epa.gov/work/02/451956.pdf

2009 (First) Five-Year Review - https://semspub.epa.gov/work/02/105107.pdf

2014 (Second) Five-Year Review - https://semspub.epa.gov/work/02/265513.pdf

APPENDIX 1 - Figures

Woodland Route 72 Site



Woodland Route 532 Site

APPENDIX 2 - Tables

Table 1a
Groundwater Concentrations and Water Quality Parameters September 2015 Through December 2018
Phase 3 Biosparge Area
Woodland Township Superfund Site-Route 72 Former Disposal Area

	AIGWQ	72-PMW-7												72-PMW-13												72-WPSG-14									
	Criteria	9/16/15	12/22/15	3/7/16	6/24/16	9/28/16	12/20/16	3/2/17	5/16/17	9/27/17	12/18/17	3/8/18	**12/11/18**	9/8/15	12/23/15	3/8/16	6/24/16	9/28/16	12/21/16	2/28/17	5/18/17	9/27/17	12/18/17	3/8/18	**12/10/18**	9/10/15	12/23/15	3/10/16	6/23/16	9/29/16	12/21/16	3/2/17	5/17/17	9/28/17	12/19/17	3/9/18	**12/11/18**
1,2-DCA (µg/L)	200	14 J	17 J	2.5 U	8.2	15	15	6.5	2.3	23	19	5.2	**0.56 J**	7.0 J	7.9 J	31	35	60	35	16	6.3	7.6	49	13	**7.1**	6.2 J	17 J	11	3.9 J	4.0	1.4	2.5	0.54 J	0.97 J	0.25 UF1	2.7	**0.43 U**
Toluene (µg/L)	5,400	20,000	12,000	1,700	130	25	76	56	0.66 J	0.25 U	0.54 J	0.25 U	**0.38 U**	780	1,400	4,500	1,800	1,200	620	0.63 J	0.25 U	1.9	0.26 J	0.59 J	**0.38 U**	5,400	7,200	3,300	1,100	110	73	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	**0.38 U**
Ethylbenzene (µg/L)	1,500	4,500	5,500	2,800	400	130	1,800	410	0.30 U	0.30 U	0.30 U	0.30 U	**0.30 U**	1,700	1,600	3,000	3,700	1,500	1,600	4.1	0.47 J	6.1	4.7	8.1	**0.34 J**	3,200	3,200	1,400	1,400	480	240	1.8	0.30 U	0.30 U	0.30 U	0.30 U	**0.30 U**
Total Xylene (µg/L)	2,000	4,000	4,000	1,000	140	95	460	120	1.3 J	0.28 U	0.28 U	0.28 U	**0.65 U**	630	780	1,300	1,700	530	700	1.9 J	0.32 J	7.4	1.7 J	3.6	**0.87 J**	1,700	2,400	1,200	730	130	75	0.82 J	0.28 U	0.28 U	0.28 U	0.28 U	**0.65 U**
DO (mg/L	NA	0.21	0.15	1.16	0.79	0.43	0.46	2.29	6.11	0.05	3.22	9.72	**3.85**	0.52	0.13	0.00	0.14	0.12	9.99	4.25	7.49	0.0*	4.6	10.35	**5.02**	3.65	1.89	1.09	2.79	2.19	3.38	5.30	2.32	2.27	7.98	8.00	**6.08**
pH		6.84	6.54	5.70	5.57	6.07	6.21	5.84	5.17	5.26	5.42	5.39	**4.68**	5.79	6.37	6.03	6.03	6.02	6.43	5.34	5.33	6.16	5.22	5.18	**5.04**	6.06	6.18	5.94	5.96	5.79	6.05	5.64	6.02	5.82	5.21	6.07	**6.14**
Specific Conductance (mS/cm		554	223	85	107	126	327	104	67	58	74	112	**76**	125	114	82	197	130	146	70	52	191	124	128	**70**	164	153	161	110	59	71	69	75	61	50	96	**75**
Turbidity (NTU		0.0	0.0	0.0	19.2	5.2	0.0	1.0	0.9	0.0	0.0	0.0	**0.0**	0.0	0.0	12.3	10.0	0.0	103.1	1.0	0.0	1.0	0.0	0.0	**2.7**	9.3	0.9	20.2	74.0	2.8	14.1	1.6	11.1	20.1	18	6.0	**68.0**
Temperature (°C		17.24	14.42	11.38	14.69	20.00	13.28	11.19	12.77	18.04	15.02	11.18	**13.94**	16.80	14.22	12.09	14.52	16.97	12.75	12.73	13.7	18.99	14.79	11.22	**13.22**	16.69	14.47	12.82	13.40	15.73	13.73	12.12	14.01	16.29	14.72	10.74	**14.11**
ORP (mV		-248.2	-307.3	-182.6	52.1	-6.8	-102	69.1	259.8	137.8	220.6	206.2	**145.5**	-56.4	-276.8	-165.5	-63.2	-13.5	-41.7	282.3	279	6.3	208.6	278.1	**161.2**	-16.5	-223.2	-207.0	-12.6	66	8.3	12.3	190	183	50	139.8	**148**

	AIGWQ	72-PMW-16												72-PMW-17												OS6012									
	Criteria	9/16/15	12/22/15	3/7/16	6/21/16	9/27/16	12/20/16	3/2/17	5/16/17	9/28/17	12/18/17	3/8/18	**12/11/18**	9/15/15	12/22/15	3/7/16	6/21/16	9/29/16	12/20/16	3/2/17	5/16/17	9/28/17	12/19/17	3/8/18	**12/11/18**	9/9/15	12/29/15	3/10/16	6/23/16	9/28/16	12/20/16	3/28/17	5/18/17	9/28/17	12/19/17	3/9/18	**12/11/18**
1,2-DCA (µg/L)	200	2.9 J	3.2	2.6	2.8	2.8 J	3.9	4.8	2.5	3.3	2.7	1.2	**0.71 J**	7.6 J	6.8 J	1.4	0.74 J	1.4	2.0	1.1	0.87 J	0.43 J	0.25 U	0.51 J	**0.43 U**	24 J	33	25	12	13 J		2.5 U	6.0	12	5.5	4.2	**4.3 U**
Toluene (µg/L)	5,400	2,400	620	31	7.9	860	240	52	75	680	5.0	30	**44**	7,300	4,900	27	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	**0.38 U**	10,000	8,100	3,600	710	2,300	Dry	640	200	180	1.4	74	**1,600**
Ethylbenzene (µg/L)	1,500	290	110	3.1	1.8	120	41	21	1.5	69	1.0	5.4	**3.0**	210	370	7.0	0.30 U	2.1	17	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	**0.30 U**	5,600	4,000	2,000	210	1,700		2,100	110	220	1.8	160	**3,600**
Total Xylene (µg/L)	2,000	2,000	980	52	23	1,700	460	320	94	1,500	23	96	**72**	1,200	890	9.0	0.28 U	3.2	2.8	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	**0.65 U**	3,300	2,900	1,400	270	860		550	71	96	1.2 J	93	**1,200**
DO (mg/L	NA	0.16	0.13	1.73	0.29	0.12	0.39	0.17	2.36	0.33	0.90	0.34	**0.0***	0.29	0.23	8.3	5.12	0.14	3.08	10.46	10.13	2.33	9.94	12.92	**10.30**	6.39	1.45	3.74	7.36	0.20		3.63	9.48	5.81	9.43	11.04	**2.16**
pH		5.86	5.77	5.39	4.87	5.58	5.65	5.54	5.17	5.47	5.48	5.81	**5.95**	6.14	6.00	5.31	4.88	5.36	5.51	4.44	4.40	4.73	4.76	4.73	**5.22**	6.32	6.42	5.91	5.13	5.97		5.99	5.43	5.23	5.04	5.59	**6.58**
Specific Conductance (mS/cm		209	88	36	58	88	138	70	50	147	93	158	**98**	262	119	59	58	85	124	103	110	83	82	99	**50**	301	236	61	51	159		241	43	85	72	76	**280**
Turbidity (NTU		3.3	0.0	35.1	0.0	2.7	0.0	3.3	0.3	7.1	0.0	7.3	**0.0***	6.3	4.1	45.2	5.1	1.7	7.4	0.0	0.0	0.0*	0.0	0.0	**29.4**	11.8	0.7	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	**0.0**
Temperature (°C		17.89	14.98	11.61	14.80	18.02	13.97	12.45	13.72	18.07	15.37	11.47	**15.11**	17.15	14.62	11.49	14.32	17.39	13.16	11.83	12.92	18.02	14.90	10.59	**13.81**	18.78	13.72	11.38	13.65	18.1		10.8	13.35	17.99	14.95	10.13	**14.29**
ORP (mV		-126.6	-183.2	-9.5	-128.6	-2.9	-53.1	77.6	174.4	49.9	115.6	4.9	**-21**	-131.6	-217.1	-27.4	86.0	107.3	88.6	348.1	315.9	287.0	320.6	334.7	**138.2**	-23.5	-245.4	-107.0	-48.6	30.7		49.8	151.4	165.4	302.6	119.8	**-33.8**

	AIGWQ	OS6019												OS6029												72-WPSG-13									
	Criteria	9/9/15	12/29/15	3/10/16	6/23/16	9/28/16	12/22/16	3/2/17	5/17/17	9/28/17	12/19/17	3/9/18	**12/12/18**	9/9/15	12/23/15	3/9/16	6/23/16	9/28/16	12/22/16	3/22/17	5/17/17	9/28/17	12/19/17	3/9/18	**12/12/18**	9/8/15	12/22/15	3/7/16	6/24/16	9/27/16	12/21/16	2/28/17	5/18/17	9/27/17	12/18/17	3/8/18	**12/10/18**
1,2-DCA (µg/L)	200	13 U	0.25 U	0.25 U	0.57 J	2.5 U	0.25 U	1.2	4.3	0.69 J	1.5	1.3	**0.43 U**	13 U	7.3	1.9	0.25 U	3.0	9.1 J	0.30 J	0.25 J	2.3	0.82 J	0.37 J	**0.95 J**	22	23	12 J	2.8 J1	4.5 J	5.4	2.8 J	2.7	1.2 J	4.3	3.0	**1.3**
Toluene (µg/L)	5,400	10,000	40	0.25 U	0.38 J	830	0.76 J	0.49 J	0.25 U	0.25 U	0.25 U	0.26 J	**1.3**	20,000	1,800	14	0.25 U	290	6,100	0.25 U	0.25 U	3.1	0.25 U	0.25 U	**0.85 J**	6,000	4,700	2,600	1000 J1	1,800	2,400	550	260	720	250	360	**23**
Ethylbenzene (µg/L)	1,500	370	48	1.0	3.3	360	6.6	4.0	1.6	0.30 U	0.30 U	0.30 U	**4.8**	2,300	410	14	0.30 U	390	1,200	0.30 U	0.30 U	8.7	0.30 U	0.30 U	**4.9**	2,400	1,900	1,200	660 J1	760	1,300	200	240	330	150	230	**24**
Total Xylene (µg/L)	2,000	2,200	91	2.5	4.7	1,100	4.4	3.9	1.4 J	1.2 J	0.28 U	0.28 U	**1.7 J**	10,000	3,100	63	0.28 U	1,400	7,000	0.28 U	0.28 U	32	0.28 U	0.28 U	**10**	5,500	4,100	2,900	2100 J1	2,100	3,300	1,000	720	810	450	780	**45**
DO (mg/L	NA	1.34	0.89	3.15	5.02	0.29	3.35	6.39	3.05	4.22	6.67	9.61	**21.12**	2.28	2.50	9.41	10.08	1.49	0.69	13.96	11.29	3.81	10.10	12.29	**25.09**	1.79	0.24	0.00	2.04	0.33	0.41	0.15	0.51	0.0*	0.33	1.11	**2.54**
pH		6.13	5.71	5.42	4.33	5.54	4.91	4.09	3.81	3.44	4.09	4.05	**3.86**	5.67	5.65	5.44	4.86	5.55	5.85	5.29	5.2	4.75	5.47	5.67	**4.64**	6.06	6.07	6.25	5.78	5.95	6.24	6.19	6.04	6.32	6.30	6.14	**6.53**
Specific Conductance (mS/cm		137	54	33	72	113	65	101	118	219	246	174	**112**	264	104	26	66	126	316	96	66	132	49	69	**80**	284	168	147	130	169	263	158	141	191	283	345	**219**
Turbidity (NTU		0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.8	0.9	0.0	0.0	2.9	0.0	25.8	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	2.7	0.9	58.4	18.2	7.0	15.7	26.7	**3.7**
Temperature (°C		17.09	14.04	12.28	13.88	17.40	13.01	12.35	12.56	16.63	15.00	11.23	**14.29**	17.29	14.34	11.60	14.40	18.10	13.41	11.18	12.86	18.00	15.13	10.96	**14.50**	15.30	13.30	11.13	13.45	16.73	12.48	12.47	13.53	16.72	14.30	10.12	**13.43**
ORP (mV		-20.5	-133.4	-34.6	16.4	80.2	132.8	326.5	375.4	334.0	394.6	372.9	**184.0**	9.4	-142.3	39.5	22.0	41.5	-96.0	242.0	265.7	221.0	287.3	247.3	**168.8**	-93.4	-244.0	-230.3	33.7	-52.1	-109.1	-21.3	-17	-20.1	-41.3	-36.2	**-47.5**

Notes:

AIGWQ = area impacting groundwater quality
Bold = most recent sampling event
°C = degrees Celsius
DCA = dichloroethane
DO = dissolved oxygen
F1 = MS and/or MSD Recovery is outside acceptance limits.
J = concentration below reporting limit but greater than or equal to method detection limit
J1 = sample analyzed outside of holding time, result is estimated
µg/L = micrograms per liter
Meets "Area Impacting Groundwater Quality" (AIGWQ) Criteria

* = value recorded as negative in field notes. Reported as 0.0 in table.
mg/L = milligrams per liter
mS/cm = millisiemens per centimeter
mV = millivolts
NA = not applicable
NTU = nephelometric turbidity unit
ORP = oxidation reduction potential
U = concentration below the indicated method detection limit

Table 1b
Groundwater Concentrations and Water Quality Parameters September 2015 Through December 2018
Downgradient Wells
Woodland Township Superfund Site-Route 72 Former Disposal Area

	AIGWQ	72-DEP-11S												72-DEP-24SI											
	Criteria	9/8/15	12/22/15	3/8/16	6/21/16	9/27/16	12/20/16	2/28/17	5/16/17	9/27/17	12/18/17	3/8/18	**12/10/18**	9/16/15	12/29/15	3/10/16	6/23/16	9/28/16	12/22/16	3/22/17	5/17/17	9/28/17	12/19/17	3/9/18	**12/12/18**
1,2-DCA (µg/L)	200	4.1 J	4.0 J	5.5 J	4.0 J	2.8 J	4.0 J	1.4	1.2	0.83 J	1.2	0.91 J	**1.9 J**	15	21	16	12	13	23	17	10	8.1	6.0	8.0	**2.3 J**
Toluene (µg/L)	5,400	1,500	2,700	2,700	2,100	1,400	1,300	47	8	53	55	51	**800**	39	41	40	25	28	27	21	17	17	14	15	**8.2**
Ethylbenzene (µg/L)	1,500	1,400	1,900	1,600	1,400	1,100	1,200	300	220	250	310	180	**720**	130	120	130	120	130	120	120	140	160	150	150	**100**
Total Xylene (µg/L)	2,000	2,300	4,600	3,500	3,000	2,100	2,700	590	370	550	640	320	**1,200**	760	810	920	710	870	940	900	660	500	620	580	**120**
DO (mg/L)	NA	0.43	0.41	0.19	0.30	0.34	0.20	0.17	0.83	1.01	0.98	0.41	**0.87**	0.67	0.17	0.00	0.14	0.83	0.23	1.03	0.17	0.93	0.36	0.19	**0.0***
pH		6.22	6.50	6.25	6.31	6.35	6.62	6.57	6.54	6.52	6.59	6.54	**6.58**	4.63	4.46	4.30	4.26	4.28	4.47	4.31	4.42	4.53	3.97	4.34	**4.22**
Specific Conductance (mS/cm)		247	291	360	285	250	426	254	226	274	268	388	**423**	316	336	192	268	188	278	328	253	217	200	266	**166**
Turbidity (NTU)		0.0	2.8	20.2	5.7	1.7	1.7	2.2	0.0*	1.9	0.0*	0.0	**1.3**	0.0	0.0	3.1	57.3	1.4	4.3	58	0.0*	120	0.0	0.0	**21.0**
Temperature (°C)		16.88	14.58	13.08	14.43	16.28	14.25	13.62	13.11	17.05	14.70	12.98	**15.32**	13.84	13.24	12.47	12.65	14.16	13.30	11.39	12.19	14.92	13.65	11.43	**13.20**
ORP (mV)		-84.3	-280.3	-302.2	-97.7	-121	-173	-147	-89	-106	-96	-105	**-135**	23.9	43.2	77.1	166.8	243	173	233	218	217	48	240	**222**

	AIGWQ	72-PMW-1												72-PMW-3											
	Criteria	9/9/15	12/22/15	3/8/16	6/21/16	9/27/16	12/20/16	2/28/17	5/16/17	9/27/17	12/18/17	3/8/18	**12/10/18**	9/8/15	12/23/15	3/9/16	6/21/16	9/28/16	12/20/16	3/2/17	5/17/17	9/27/17	12/18/17	3/9/18	**12/11/18**
1,2-DCA (µg/L)	200	5.4 J	6.0 J	4.3	3.5	3.5	3.9	2.5	4.0	20	4.1	3.7	**1.3**	4.4 J	8.8 J	5.4	4.1 J	6.9	5.8	5.2	4.4	2.6	1.9	2.0	**3.5**
Toluene (µg/L)	5,400	2,000	2,300	330	67	2.3	0.90 J	0.71 J	0.25 U	0.25 U	0.27 J	0.25 U	**1.6**	1,400	2,800	1,100	680	1,200	840	380	92	0.25 U	0.25 U	0.25 U	**0.38 U**
Ethylbenzene (µg/L)	1,500	1,500	1,800	260	92	49	41	9.3	1.8	7	11	4.7	**41**	2,600	4,400	1,500	1,200	1,500	1,200	710	420	55	13	2.4	**0.30 U**
Total Xylene (µg/L)	2,000	2,400	3,500	610	130	21	9.4	5.5	1.5 J	0.54 J	0.40 J	0.29 J	**15**	890	1,800	590	450	690	500	270	140	5.7	1.5 J	0.28 U	**0.65 U**
DO (mg/L)	NA	0.59	0.16	0.10	0.06	0.28	0.13	0.10	1.48	0.18	0.17	0.14	**1.22**	1.40	0.82	0.74	0.28	4.73	1.82	3.06	1.61	0.81	0.92	2.39	**2.63**
pH		7.04	6.83	6.61	6.68	6.60	6.74	6.80	6.86	6.7	6.76	6.75	**6.73**	6.22	6.45	5.92	5.88	6.08	6.36	6.26	6.39	6.31	6.42	6.53	**6.26**
Specific Conductance (mS/cm)		624	424	307	230	191	355	247	270	263	264	444	**355**	267	232	225	202	135	247	165	195	168	143	176	**152**
Turbidity (NTU)		0.0	0.0	0.0	0.0	4.2	0.0*	0.0	0.0*	3.4	0.0*	0.0	**3.4**	0.0	0.0	0.0	19.3	8.1	2.3	3.7	0.0*	2.0	0.0*	1.3	**0.0**
Temperature (°C)		16.16	14.57	12.77	13.42	16.34	14.30	12.18	12.62	16.12	14.69	11.18	**14.46**	17.00	14.31	12.02	13.58	17.13	13.73	11.81	12.55	16.98	14.28	10.89	**14.03**
ORP (mV)		-113.5	-318.1	-339.0	-147.1	-134	-192	-175	-164	-123	-120	-156	**-126**	-53.2	-278.9	-254.6	-50.3	-25	-107	-56	-79	-48	-58	-72	**-32**

	AIGWQ	72-PMW-14											
	Criteria	9/15/15	12/22/15	3/9/16	6/23/16	9/28/16	12/21/16	3/2/17	5/16/17	9/27/17	12/18/17	3/8/18	**12/10/18**
1,2-DCA (µg/L)	200	19	34	30	22	21	34	19	18	16	14	10	**7.4**
Toluene (µg/L)	5,400	150	130	1,100	400	180	71	79	82	51	50	71	**37**
Ethylbenzene (µg/L)	1,500	320	450	820	480	370	420	470	250	190	240	180	**140**
Total Xylene (µg/L)	2,000	760	420	760	490	480	250	360	620	380	380	530	**280**
DO (mg/L)	NA	1.04	0.28	0.08	0.09	3.5	0.18	0.44	3.24	0.18	0.04	0.20	**0.55**
pH		6.56	6.23	5.94	6.12	6.00	6.22	6.18	6.26	6.26	6.26	6.31	**6.36**
Specific Conductance (mS/cm)		215	219	274	210	181	224	288	379	260	238	406	**284**
Turbidity (NTU)		53.9	1.6	63.8	18.3	65	3.0	9.1	2.0	7.5	7.2	0.0	**1.4**
Temperature (°C)		16.70	14.75	13.11	13.41	16.7	14.42	12.43	12.91	16.79	14.58	11.85	**14.29**
ORP (mV)		-243.4	-264.0	-295.8	-62.2	-58	-127	-115	-120	-105	-95	-128	**-125**

Notes:
AIGWQ = area impacting groundwater quality
Bold = most recent sampling event
°C = degrees Celsius
DCA = dichloroethane
DO = dissolved oxygen
J = concentration below reporting limit but greater than or equal to method detection limit
J1 = sample analyzed outside of holding time, result is estimated
µg/L = micrograms per liter
Meets "Area Impacting Groundwater Quality" (AIGWQ) Criteria

* = value recorded as negative in field notes. Reported as 0.0 in table.
mg/L = milligrams per liter
mS/cm = millisiemens per centimeter
mV = millivolts
NA = not applicable
NTU = nephelometric turbidity unit
ORP = oxidation reduction potential
U = concentration below the indicated method detection limit

XDD Environmental

Table 2a
Summary of MNA COC Concentrations in Surface Water
Baseline and Biennially between 2001 and 2018
Route 72 site

Station	Location	Ref./Date	Benzene	Toluene	Ethyl-benzene	1,2-DCA	TCE	BCEE	BEHP[1]	Chloro-benzene	Total VOCs	Total SVOCs
			µg/L									
SW-2 (Pope Br.)	Upstream of Plume	(1)	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		22-Aug-01	<1	<5	<4	<2	<1	<1	<10	<5	nd	nd
		25-Aug-03	<1	6.2	<4	<2	<1	<1	<10	<5	6.2	nd
		03-Aug-06	<1.0	3J	<4.0	<2.0	<1.0	<1.0	<10	<5.0	3	nd
SS17 (Long Cripple Br.)		(2)	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		23-Aug-01	<1	<5	<4	<2	<1	<1	<10	<5	nd	nd
		25-Aug-03	<1	<5	<4	<2	<1	<1	<10	<5	nd	nd
		19-Jul-06	<1.0	<5	<4	<2	<1	<1.1	<11	<5	nd	nd
SS10 (Long Cripple Br.)	Edge of Plume - Discharge Area	(2)	nd	nd	nd	6	nd	nd	nd	nd	6	nd
		23-Aug-01	<1	<5	<4	3.1	<1	0.3J	190	<5	3.1	190.3
		26-Aug-03	<1	<5	<4	<2	<1	0.2J	<10	<5	nd	0.2
		21-Jun-06	<1.0	<5	<4	<2	<1	<1	<10	<5	nd	nd
		21-Jul-08	14	<10	<8	280	3.9	46	<0.40	9.8J	307.7	46
		06-Jul-10	<1	<1	<1	<1	<1	<1	<2.5	<1	nd	nd
		18-Jul-12	0.19J	<1	<1	<1	<1	<1.1	<2.2	0.11J	0.3	nd
		05-Aug-14	0.42J	<1	<1	1.5	<1	<1	<10	0.35J	2.27	nd
		31-Aug-16	26	1.5	<1	230	5.1	150	<2	26	288.6	150
		01-Aug-18	<0.43	<0.38	<0.30	<0.43	<0.31	<0.3	<1.7	<0.38	nd	nd
SS19 (Long Cripple Br.)		01-Aug-18	<0.43	<0.38	<0.30	5.8	<0.31	0.74J	<1.7	<0.38	5.8	0.74
SS20 (Long Cripple Br.)		01-Aug-18	<0.43	<0.38	<0.30	<0.43	<0.31	<0.3	<1.7	<0.38	nd	nd
SS09 (Pope Br.)		(2)	1	nd	nd	59	nd	15	nd	nd	60	15
		23-Aug-01	2.4	<5	<4	37	<1	9.2	31	0.9J	40.3	40.2
		21-Jun-06	1.5	<5	<4	12	<1	4	<10	0.9J	14.4	4
		21-Jul-08	1.5	<5	<4	16	<1	2	<0.40	1.3J	18.8	2
		07-Jul-10	<1	<1	<1	11	<1	2.6	<2.4	0.96J	11.96	2.6
		18-Jul-12	1.7	<1	<1	13	0.2J	3.4	<2.0	1.4	16.30	3.4
		06-Aug-14	0.63J	<1	<1	4	<1	<1	<10	0.66J	5.29	nd
		31-Aug-16	1.2	<1	<1	4.7	<1	2.5	<2	1.5	nd	nd
		01-Aug-18	0.52J	<0.38	<0.30	2.6 F1	<0.31	0.58	<1.7	<0.38	3.12	0.58
7SG-1 (end Pope Br.)	Downstream of Discharge Area	(3)	nd	nd	nd	20	nd	nd	nd	nd	20	nd
		22-Aug-01	<1	<5	<4	9.2	<1	0.9J	<10	<5	9.2	0.9
		26-Aug-03	<1	<5	<4	<2	<1	<1	<10	<5	nd	nd
		13-Jun-06	<1	<5	<4	3	<1	0.7J	<10	<5	3	0.7
		10-Jul-08	<1	<5	<4	2.3	<1	0.4J	<0.40	<5	2.3	0.4
		06-Jul-10	<1	<1	<1	2.6	<1	<1	<2.4	<1	2.6	nd
		17-Jul-12	<1	<1	<1	2.3	<1	0.56J	<2.0	<1	2.30	0.56
		14-Aug-14	<1	<1	<1	0.63J	<1	<1	<10	<1	0.63	nd
		30-Aug-16	<1	<1	<1	0.81J	<1	<1	1.0J	<1	0.81	1
		31-Jul-18	<1	<1	<1	0.79J	<1	<1	<2	<1	0.79	nd

Table 2b
Summary of MNA COC Concentrations in Surface Water
Baseline and Biennially between 2001 and 2018
Route 72 site

Station	Location	Ref./Date	Benzene	Toluene	Ethyl-benzene	1,2-DCA	TCE	BCEE	BEHP[1]	Chloro-benzene	Total VOCs	Total SVOCs
			µg/L									
Baseline Maximum at MNA Sampling Locations (**shown in bold**)			1	nd	nd	69	9	15	nd	nd		
Historic Maximum Detection in Tier 1 Analysis (September 1994 ERA)			1	nd	nd	59	2	15	nd	nd		
Maximum Level from 2001-2004 at MNA Sampling Locations			2.4	6.2	<4	37	2.1	9.2	190	0.9J		
Tier 1 Aquatic Toxicity Threshold (September 1994 ERA)			530	1,750	32,000[2]	20,000	21,900	19,000	3	50		

nd = not detected.
F1 = MS or MSD recovery is outside acceptance limits
J = Estimated concentration below quantitation limit
< = Concentration below reporting limit
= 2018 monitoring results

Value COC detected in 2006 or later above the higher (highlighted in gray) of the following criteria:
- Baseline Maximum Levels
- Historic Maximum Levels
- Maximum Level from 2001-2004

[1] Bis (2-ethylhexyl) phthalate (BEHP) was a Compound of Potential Concern (CPOC) in the September 1994 Ecological Risk Assessment. Results prior to 2009 are based on reporting limits. Results after 2009 are based on method detection limits.
[2] Ambient Water Quality Criteria chronic LOEL used to calculate ethylbenzene threshold using approach outlined in September 1994 ERA.

References for MNA Baseline Data (**shown in bold**)
(1) CDM (Camp, Dresser and McKee, Inc.), 1989. Final Draft Remedial Investigation Report for the Woodland Township Route 532 and Route 72 Hazardous Waste Sites. Burlington County, New Jersey, July 1989.
(2) HLA (Harding Lawson Associates), 1993. Stream Reconnaissance of the Route 72 Site, May 10, 1993.
(3) EEC, 1993.
(4) HLA, 1994. Final Draft, Route 72 Superfund Site, Lower Shoal Branch Wetlands Sampling Results, December 19, 1994.

Table 3a
Summary of MNA COC Concentrations in Stream Sediment
Baseline and Biennially between 2001 and 2018
Route 72 site

Station	Location	Ref./Date	Benzene	Toluene	Ethyl-benzene	1,2-DCA	TCE	BCEE	BEHP[1]	Chloro-benzene	Total VOCs	Total SVOCs
			µg/kg									
SD-2 (Pope Br.)	Upstream of Plume	(1)	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		22-Aug-01	<760	<3800	<3000	<1500	<760	<2700	<27000	<3800	nd	nd
		25-Aug-03	<12	60	<46	<23	<12	<400	<4000	<58	60	nd
		3-Aug-06	<7.1	<36	<28	<14	<7.1	<240	<2400	<36	nd	nd
SS17 (Long Cripple Br.)		(2)	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		23-Aug-01	<12	110	<48	<24	<12	<410	<4100	<60	110	nd
		25-Aug-03	<12	<59	<47	<23	<12	<400	<4000	<59	nd	nd
		19-Jul-06	<11	<57	<46	<23	<11	<390	<3900	<57	nd	nd
SS10 (Long Cripple Br.)	Edge of Plume - Discharge Area	(2)	nd	nd	nd	40	nd	nd	210	nd	40	210
		23-Aug-01	82	850	14J	28	<12	<400	<4000	<60	974	nd
		26-Aug-03	<7.8	240	<31	<16	<7.8	<260	<2600	<39	240	nd
		21-Jun-06	<12	<59	<47	<24	<12	<420	<4200	<59	nd	nd
		21-Jul-08	660	9.8J	140	520	63	3,700	<160	830	2223	3700
		6-Jul-10	19	3	2	10	3	<100	<140	17	54	nd
		18-Jul-12	71	1.1J	1.9J	79	1.8	<52	<170	68J	222.8	nd
		5-Aug-14	<1.5	<1.5	<1.5	<1.5	<1.5	<48	<480	<1.5	nd	nd
		31-Aug-16	30	5.9	<1.3	9.4	2.7	77	<430	60	108	77
		1-Aug-18	<0.31	<0.76	<0.24	<0.36	<0.17	<5.3	<23	<0.21	nd	nd
SS19 (Long Cripple Br.)		1-Aug-18	<0.30	<0.73	<0.23	2.5	<0.17	<4.8	<21	2.6	5.1	nd
SS20 (Long Cripple Br.)		1-Aug-18	<0.29	<0.71	<0.23	<0.34	<0.16	<4.7	<21	<0.2	nd	nd
SS09 (Pope Br.)		(2)	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		23-Aug-01	<11	500	<43	58	8.1J	<350	<3500	14J	580	nd
		21-Jun-06	12	66	<34	<17	<8.4	<290	<2900	26J	104	nd
		21-Jul-08	<13	<64	<51	47	<13	<430	<240	<64	47	nd
		7-Jul-10	6.5	<2.2	<2.2	<2.2	<2.2	<79	<110	<2.2	6.5	nd
		18-Jul-12	<1.5	<1.5	<1.5	<1.5	<1.5	<56	<190	<1.5	nd	nd
		18-Aug-14	<1.2	<1.2	<1.2	<1.2	<1.2	<43	<430	<1.2	nd	nd
		31-Aug-16	<1.3	<1.3	<1.3	<1.3	<1.3	<43	<430	<1.3	nd	nd
		1-Aug-18	0.81J	<0.72	<0.23	5.6	0.30J	<4.8	<21	<0.2	6.7	nd
7SG-1 (end Pope Br.)	Downstream of Discharge Area	(3)	nd	nd	nd	28	nd	nd	nd	nd	28	nd
		22-Aug-01	<1.1	1.4J	<4.6	<2.3	<1.1	<40	6,700	<5.7	1.4	6700
		26-Aug-03	<1.2	<5.8	<4.6	<2.3	<1.2	<39	<390	<5.8	nd	nd
		13-Jun-06	<1.2	<5.8	<4.6	<2.3	<1.2	<41	<410	<5.8	nd	nd
7SG-5 (Shoal Br.)	End of Plume - Discharge Area	(3)	93	20	nd	1,900	43	nd	340	nd	2056	340
		24-Aug-01	7	1J	0.8J	82	14	<46	<460	22	127	nd
		25-May-06	<1.3	<6.5	<5.2	<2.6	<1.3	<45	<450	<6.5	nd	nd

Table 3b
Summary of MNA COC Concentrations in Stream Sediment
Baseline and Biennially between 2001 and 2018
Route 72 site

Station	Location	Ref./Date	Benzene	Toluene	Ethyl-benzene	1,2-DCA	TCE	BCEE	BEHP[1]	Chloro-benzene	Total VOCs	Total SVOCs
			µg/kg									
WS-1 (Shoal Br.)	Downstream of Plume	**(4)**	**12**	**nd**	**nd**	**840**	**130**	**nd**	**nd**	**10**	**992**	**nd**
		24-Aug-01	<1.3	<6.6	<5.3	2J	3	56	<460	3J	8	56
		27-Aug-03	<1.4	<6.9	<5.5	<2.8	0.9J	<48	<480	<6.9	1	nd
		13-Jun-06	<1.1	<5.7	<4.6	<2.3	<1.1	<40	<400	<5.7	nd	nd
WS-4 (Shoal Br.)		**(4)**	**nd**	**140**	**nd**	**126**	**nd**	**nd**	**nd**	**nd**	**266**	**nd**
		23-Aug-01	<1.6	12	<6.4	<3.2	<1.6	<110	<1100	<8	12	nd
		26-Aug-03	<11	350	<45	<22	<11	<380	<3800	<56	350	nd
		25-May-06	<11	<55	<44	<22	<11	<760	<7600	<55	nd	nd
Baseline Maximum at MNA Sampling Locations (**shown in bold**)			93	140	nd	1,900	130	nd	340	10		
Historic Maximum Detection in Tier 1 Analysis (September 1994 ERA)			93	20	nd	1,900	43	2,250	3,800	51.5		
Tier 1 Stream Sediment Toxicity Threshold (September 1994 ERA)			850	5,540	126,000[2]	7,680	52,500	14,400	454,000	151		

nd = not detected.
J = Estimated concentration below quantitation limit
< = Concentration below reporting limit
= 2018 monitoring results

1,- Value COC detected in 2006 or later above the higher (highlighted in gray) of the following criteria:
- Baseline Maximum Levels
- Historic Maximum Levels

[1] Bis (2-ethylhexyl) phthalate (BEHP) was a Compound of Potential Concern (CPOC) in the September 1994 Ecological Risk Assessment. Results prior to 2009 are based on reporting limits. Results after 2009 are based on method detection limits.
[2] Ambient Water Quality Criteria chronic LOEL used to calculate ethylbenzene threshold using approach outlined in September 1994 ERA.

References for MNA Baseline Data (**shown in bold**)

(1) CDM (Camp, Dresser and McKee, Inc.), 1989. Final Draft Remedial Investigation Report for the Woodland Township Route 532 and Route 72 Hazardous Waste Sites. Burlington County, New Jersey, July 1989.
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