FIFTH FIVE-YEAR REVIEW REPORT FOR LONE PINE LANDFILLSUPERFUND SITE MONMOUTH COUNTY, NEW JERSEY

Prepared by

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

Pat Evangelista, Acting Division Director
Superfund and Emergency Management Division

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Date

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LIST OF ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEA	Classification Exception Area
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FYR	Five-Year Review
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RI	Remedial Investigation
ROD	Record of Decision

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 fifth FYR for the Lone Pine Landfill Superfund Site. The triggering action for this statutory review is the previous FYR, signed September 18, 2014. The FYR has been prepared due to the fact that hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

The Site consists of 2 operable units, which will be addressed in this FYR. Operable Unit 1 addresses containment of the landfill and cleanup of the contaminated landfill leachate directly beneath the landfill. Operable Unit 2 addresses the contaminated groundwater beyond the perimeter of the landfill.

The Lone Pine Landfill Superfund Site FYR was led by the United States Environmental Protection Agency (EPA). Participants included Remedial Project Manager Nigel Robinson, Rachel Griffiths (EPA-Hydrologist), Charles Nace (EPA-Human Health Risk Assessor), Michael Clemetson (EPA-Ecological Risk Assessor) and Natalie Loney (EPA-Community Involvement Coordinator). The Lone Pine Landfill Potentially Responsible Parties' Group was notified of the initiation of the FYR. The review began on October 15, 2018.

Site Background

The Lone Pine Landfill Superfund Site is located in the Township of Freehold, New Jersey. The site (See Figure 1) is bounded by the Manasquan River to the north, Burke Road to the east, a forested wetland to the west, and a leaf composting facility to the south. The location is rural to suburban and the closest resident is approximately 600 feet south of the landfill. A local sportsman's club and the Turkey Swamp Wildlife Management Area are approximately 1,000 feet from the landfill. The Lone Pine Landfill began operation in 1959 and throughout its history was operated by the now-defunct Lone Pine Corporation. Until it was closed, the landfill accepted a wide variety of wastes for disposal, including municipal, commercial and industrial wastes.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Lone Pine Landfill Superfund Site		
EPA ID: NJD980505424		
Region: 2	**State:** NJ	**City/County:** Freehold/Monmouth

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA
Author name (Federal or State Project Manager): Nigel Robinson
Author affiliation: EPA
Review period: 10/15/2018 - 8/14/2019
Date of site inspection: 4/9/2019
Type of review: Statutory
Review number: 5
Triggering action date: 9/14/2014
Due date *(five years after triggering action date)*: 9/14/2019

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The site was placed on the National Priorities List in September 1993. The remedial investigation (RI) of the site indicated high levels of volatile organics, phenolic compounds, polyaromatic hydrocarbons (PAHs) and inorganic compounds in soils, groundwater and surface water.

In evaluating the potential risk to human health and the environment associated with the site, EPA focused on the groundwater contaminants that were likely to pose the most significant risk to human health and the environment. EPA identified several potential pathways by which the public could potentially be exposed to contaminant releases, including exposure to contaminated groundwater at the site.

The following hazardous substances were identified in the groundwater:

Acetone	Benzene	2-Butanone
Chlorobenzene	Chloroethane	1,1-Dichloroethane
1,2-Dichloroethane	1,2-Dichloroethene	Ethylbenzene
Toluene	2-Hexanone	Methylene chloride
Xylenes	2-Methylphenol	4-Methyl-2-pentanone
Phenol	Carbon Disulfide	Styrene
Trichloroethene	Chloroform	Vinyl chloride

1,1,2,2-Tetrachlorothane Aluminum Barium

At the time of the RI, EPA concluded that there was no exposure through the groundwater medium to nearby residents, since there were no private wells located within the contaminated plume. However, under future land-use or plume migration scenarios, the area impacted by the site could be developed residentially and the groundwater potentially used as a source of drinking water. The potential routes of exposure to residents for that scenario were ingestion of contaminants in groundwater and inhalation of groundwater vapors, via showering.

A macroinvertebrate survey was conducted by DEP in the Manasquan River near the site in 1988, and it was concluded that there are adverse impacts to the macroinvertebrate community if migration of contaminants from the landfill were not controlled.

Response Actions

The first Record of Decision (ROD) for Operable Unit 1 was issued in September 1984; a second ROD was issued in September 1990 for Operable Unit 2. The purpose of the 1984 ROD was to contain the landfill, landfill leachate and contaminated groundwater.

The ROD required the following:

- Installation of an impermeable cap and methane gas venting system to reduce the infiltration of precipitation and eliminate the problem of methane gas build-up from decaying garbage beneath the cap;

- Installation of a slurry wall around the perimeter of the landfill to control the migration of contaminants and groundwater through the area;

- Installation of a groundwater/leachate collection and treatment system to prevent contamination from leaching through and under the slurry wall; and

In addition to the above ROD components, the 1984 ROD also set forth the following remedial action objectives:

- To maintain an adequate and safe drinking water supply for the population that could be affected by groundwater contamination migration;

- To protect the Manasquan River surface water uses (fishing, swimming and water supply) from contaminant release; and

- To prevent local exposure to contaminated materials at the site and in adjacent areas (soils, sediments, and leachate).

A requirement of the 1984 ROD was the performance of a RI/FS to determine the nature and extent of off-site groundwater contamination and to assess the need for further remediation. A potentially responsible (PRP) Group agreed to fund and perform this RI/FS under EPA oversight. The RI/FS began in late 1985 and was completed in 1990. Based upon the RI/FS and public comments, EPA issued a ROD in September 1990 to address the contaminated groundwater beyond the perimeter of the landfill. The ROD required the following components:

- Installation of a 2,800-foot long interceptor trench to collect contaminated groundwater and prevent it from entering the Manasquan River;

- Installation of three extraction wells for pumping leachate and contaminated groundwater;

- Construction of an on-site waste water and leachate treatment plant to treat the collected contaminated groundwater and leachate; this treatment plant could be built separately from Operable Unit 1 or the two systems could be integrated into a single design;

- Installation and connection of piping from the interceptor trench to the groundwater treatment plant;

- The conduct of a long-term monitoring program; and

- Institutional controls to restrict groundwater usage in the area affected by the site.

In addition, the 1990 ROD set forth the following remedial action objectives:

- To prevent the discharge of contaminated ground water from the Water Table and Red Bank aquifers into the Manasquan River;

- To prevent further migration of the contaminant plume; and

- To restore the contaminated ground water between the landfill and the river to beneficial uses.

Status of Implementation

The design of the Operable Unit 1 landfill remedy was prepared by the U.S. Army Corps of Engineers (COE) under EPA's supervision. Design work was initiated in September 1984 and was completed in June 1989 by the COE.

A group of PRPs agreed to fund and implement the Operable Unit 1 remedy based upon a modified version of EPA's design, and to design and construct the Operable Unit 2 groundwater remedy. A single treatment system was implemented to address leachate and groundwater for both remedies. Construction of the Operable Unit 1 remedy was performed by a group of PRPs under EPA and COE oversight. Construction began in July 1991 and was completed in December 1993. The construction components included: installation of a 57-acre multi-layer cap; installation of a 5,965-foot slurry cut-off wall; installation of a chemical leachate and methane gas collection system; construction of a powder activated carbon treatment wastewater treatment plant with piping to the Ocean County Utilities Authority sewage treatment plant; installation of a methane gas flare; construction of a perimeter drainage system; and installation of a hydraulic monitoring system. The treatment plant design was modified to include the treatment requirements of Operable Unit 2. The selected remedies from the 1984 and 1990 RODs were implemented under two consent decrees. The PRPs are in compliance with both consent decrees.

Although not explicitly selected in the RODs, the state of New Jersey has established a Classification Exception Area (CEA) for the landfill proper and adjacent properties. The CEA is an institutional control that prevents or limits the installation of wells in aquifers underlying the landfill and adjacent property.

Systems Operations/Operation & Maintenance

Since 1994, the PRP Group has been operating the extraction and treatment system under EPA oversight and have conducted long-term monitoring and maintenance activities according to the EPA-approved operation and maintenance (O&M) plan.

The primary O&M activities are associated with groundwater, the landfill cap and the interceptor drain, and are described below:

Groundwater

- Monitor, observe, and evaluate the distribution and migration of groundwater impact during the operation of the treatment system and post-closure, and assess the performance of the treatment system.

- Collect and analyze the groundwater and treatment plant discharge for volatile organic compounds.

- Monitor the hydraulic gradient within the slurry wall to maintain an inward gradient across the slurry wall and evaluate the effectiveness of the slurry wall.

Landfill Cap

The multilayer landfill cap consists of a manufactured prefabricated clay liner; a polyethylene geomembrane liner; a sand drainage layer with an overlying filter fabric; a soil cover; and a grass-covered topsoil layer. Regular inspection of the landfill cap and monitoring of the infiltration cell indicate the cap is operating as intended.

Interceptor Drain

The interceptor drain and the groundwater extraction well system were placed into service in 1994. The interceptor drain prevents water from flowing towards the Manasquan River and is equipped with several sumps and submersible pumps. The water collected by the drain flows to the sumps and is pumped to the waste water treatment plant for treatment. There are also three groundwater extraction wells that pump from the Red Bank aquifer to the waste water treatment plant. A fourth well, a shallow groundwater extraction well, pumps into the interceptor drain sump. Over time, pumps are replaced and are flushed out at least once per month due to the build-up of iron precipitation and iron bacteria. Over the years, routine inspections indicated corrosion in on-site tanks. Occasionally, the treatment plant may be shut down for 4-8 weeks, to inspect and repair tanks, along with other maintenance requirements.

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 the climate change in the region and near the site.

III. PROGRESS SINCE THE LAST REVIEW

The last FYR stated that the remedy remained protective of human health and the environment. There were no recommendations from that FYR report.

Table 1: Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The remedy is protective of human health and the environment.
2	Protective	The remedy is protective of human health and the environment.

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 Lone Pine Landfill Superfund site. 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 posted to the Manalapan Township website at: http://mtnj.org/images/uploads/applications/Lone_Pine_Five-Year_Review_Report_Notice_April_2019'pdf. The results of the review and the report will be made available at: https://www.epa.gov/superfund/lone-pine and at the Site information repository located at: EPA Region 2 - Superfund Records Center, 290 Broadway, 18th Floor, New York, New York 10007 (212) 637-4308 and at Monmouth County Public Library, 125 Symmes Drive, Manalapan, New Jersey 07202 (732) 431-7220.

During the FYR process, EPA communicated with representatives of the PRPs. No interview was conducted for this FYR.

Data Review

Groundwater Monitoring

Groundwater monitoring has been performed at the site since completion of the remedies to determine if the OU1 and OU2 remedies are achieving their intended goals. For the 2014 through 2019 period, 15 wells were sampled quarterly and an additional 13 are sampled semiannually for a total of 28 monitoring locations.

Wells of the monitoring network are screened in the shallow water-table aquifer (Hornerstown) and in two zones of the deeper Red Bank aquifer (see Figure 2). Analysis of groundwater samples showed that volatile organic compounds (VOCs) were consistently detected above ROD cleanup goals in six wells (MWID-3, UR-1, UR-3, UR-6, UR-7, and EPA-03A), with chlorobenzene and benzene being the most frequently detected chemical constituents. The six aforementioned monitoring locations exhibit generally stable or decreasing trends, with seasonal fluctuations.

Contaminant impacts in the shallow aquifer are limited to benzene and chlorobenzene, and with the exception of MWID-3, concentrations are at or below their respective ROD Action Levels of 1 ug/L (microgram per liter) and 4 ug/L, respectively. Monitoring location MWID-3 (screened in the shallow zone, located near section 3 of the trench) exhibited concentrations of chlorobenzene that averaged around 115 ug/L, with seasonal fluctuations to a maximum of 194 ug/L, whereas concentrations of benzene fluctuated around 4.5 ug/L with a maximum concentration of 11.9 ug/L. Maximum concentrations for this well consistently occurred during the September sampling events and the long-term trends show concentrations are otherwise relatively stable (Figure 3).

Several monitoring locations within the Upper Red Bank aquifer have exhibited concentrations of benzene, chlorobenzene, 1,2-dichloroethane (1,2-DCA), and vinyl chloride above their respective cleanup goals of 1 ug/L, 4 ug/L, 2 ug/L, and 2 ug/L, respectively. Contaminant concentrations in the Upper Red Bank aquifer exhibited decreasing trends throughout the review period as shown on Figures 4 through 7 for UR-1, UR-3, UR-6, and UR-7, though most remain above cleanup goals. The aquifer-wide decreasing trends indicate that ongoing impacts from the landfill to the Upper Red Bank are limited, and existing impacts are attenuating. Maximum contaminant concentrations in the Upper Red Bank were detected in well UR-6, located near Burke Road about 250 feet from the northeast corner of landfill. The highest concentration of benzene at this location during the review period was 247 ug/L in March 2017, which was an anomalous concentration in an otherwise decreasing trend. The maximum concentration of chlorobenzene at UR-6 was 66.9 ug/L in March 2015. Concentrations of 1,2-DCA and vinyl chloride also peaked in March 2015 to maximum respective concentrations of 11.1 ug/L and 11.9 ug/L before decreasing below the ROD cleanup goal of 2 ug/L. In general, concentrations at UR-6 have very strong seasonal trends with an overall decrease during the review period (Figure 6).

Within the Middle Red Bank aquifer, the only monitoring location with concentrations above ROD cleanup goals is well EPA-03A, located near Burke Rd between the landfill and interceptor trench. At this location, concentrations of benzene and chlorobenzene spiked in June 2014 to maximum respective concentrations of 359 ug/L and 63.7 ug/L, and have been below ROD cleanup goals since 2015 as shown on Figure 8.

Phenol has been sporadically detected sitewide above its ROD cleanup goal of 3.5 ug/L, but significantly below the NJGWQS (New Jersey Groundwater Quality Standard) of 2,000 ug/L. Phenol was most frequently detected in 2017, though occurrences do not appear to be related to other site contaminants and there are no clear trends. The maximum detected concentration during the review period was 53 ug/L at shallow monitoring well S-5, which did not exhibit any other exceedances of COCs. Concentrations of phenol were also detected in background monitoring wells above cleanup goals. Phenol is a known site COC and will continue to be monitored, though no conclusions can be made about its presence during this review period.

Analysis of 1,4-dioxane in groundwater was initiated during the 2016 sampling period at monitoring wells UR-1 and MW02-1 through MW02-6 as part of the Biennial Certification Sampling for the NJ Classification Exception Area. Wells MW02-1 through MW02-6 were installed downgradient of the toe of the landfill during the review period to support the CEA sampling. Results indicate 1,4-dioxane is present at concentrations significantly above its NJGWQS of 0.4 ug/L in all monitoring locations. Reported concentrations ranged from 48.1 ug/L at MW02-2 to 1,050 ug/L at MW02-6. Further investigation will be performed to characterize the nature and extent of 1,4-dioxane outside the landfill and interceptor trench and determine if trends are decreasing consistent with other site contaminants.

The wastewater treatment plant is designed to treat up to 150 gallons per minute of groundwater

contaminated with high levels of VOCs and metals from both Operable Units 1 and 2, and continues to operate as designed. The effluent from the treatment plant shows that all contaminants of concern meet the permit discharge limits. The treated effluent is discharged to the Ocean County Utilities Authority sewage system.

Surface Water and Sediment Monitoring

Prior to implementing the remedies, VOCs, heavy metals and pesticides were detected in the Manasquan River above health-based levels. Since implementation of the Operable Unit 2 remedy, surface water monitoring has indicated that the landfill has negligible impact on the water quality of the Manasquan River. Surface water quality samples are collected from three transect locations along the Manasquan River to assess the influence of landfill on the river. The interceptor trench prevents contaminated groundwater flow from the site to the river.

Surface water-quality results show that chlorobenzene was detected in transects 2 and 3 during the second and third quarters of each year. The maximum chlorobenzene concentration detected in the review period was 3.4 ug/L. Benzene was also detected in transect 3 in the third quarter of 2015, 2016 and 2017 at a maximum concentration of 0.91 ug/L. These detections are low, appear to be seasonally driven, and do not impact downstream surface water quality. No exceedances of the ROD cleanup goals for metals were reported for surface water.

Sediment data have indicated that only trace amounts of VOCs (benzene and chlorobenzene) have been detected in river sediment. The detections are sporadic and limited to transect 2. Concentrations of benzene and chlorobenzene in 2017 were 0.28 ug/kg and 20.7 ug/kg, respectively. Pesticides have been detected in the river sediments but are likely the result of past agricultural practices from the north side of the river or upstream of the landfill.

Hydraulic Monitoring

A network of 36 monitoring wells and piezometers is used to monitor water levels in and adjacent to the landfill on a quarterly basis. Six pairs of monitoring points are used to monitor the effectiveness of the of the slurry wall by determining horizontal hydraulic gradients between the shallow water bearing zone within the landfill and the shallow water table outside the slurry wall. During the review period, water-level data have shown groundwater gradients to be predominantly inward, characterized by declining water table elevations inside the landfill and relatively stable to declining water table elevations outside of the landfill. The inward groundwater gradient indicates that the slurry wall, landfill cap, and leachate extraction within the landfill are functioning as an effective mechanism for shallow groundwater containment.

Six pairs of monitoring wells are used to monitor the vertical hydraulic gradients beneath the landfill by comparing piezometric levels within the Red Bank aquifer with the piezometric levels in the shallow water bearing zone inside the perimeter of the of the slurry wall. Generally, strong upward gradients (>1 foot) are the dominant hydraulic force, and downward gradients, when present, are typically weak (<0.5 feet) compared to the upward gradients. The exception is well pair P-1/PRB-1, which exhibits a strong downward gradient that is consistent with historic results. The gradient outside of slurry wall remains upward, indicating that deeper groundwater migrating away from the landfill is being captured by the collection trench. These results are consistent with historical water level measurements and show that, for different locations over the landfill, both upward and downward gradients can be manifest depending on the season.

Site Inspection

The inspection of the Site was conducted on April 9, 2019. In attendance were Nigel Robinson, EPA's RPM, and representatives of the PRP Group. The purpose of the inspection was to assess the protectiveness of the remedy, including the operation of the waste water treatment plant, the leachate collection system, the methane gas venting system, the integrity of the landfill cap, slurry wall and fencing to restrict access to the site. The site was found to be in good condition. The fence surrounding the site remains intact and there are no visible signs of trespass onto the site. The landfill cap is properly maintained.

No significant issues were identified during this inspection.

V. TECHNICAL ASSESSMENT

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

Based on the information provided in the annual monitoring reports, the remedial technologies (i.e., the treatment facility, slurry wall and interceptor trench) appear to be functioning as designed. Though the concentrations of COCs in groundwater remain above the cleanup standards, groundwater data has shown continued reduction of COC concentration and extent since implementation of the remedy. In addition, surface water quality data continue to show low levels or no detections of VOCs and metals in the reach of the Manasquan River adjacent to the landfill, an indication that the interceptor trench is functioning properly, and the contaminated groundwater and leachate are effectively contained. The inward groundwater gradient also indicates that the slurry wall is functioning as an effective mechanism for shallow groundwater containment. In addition, the landfill cap, the interceptor trench, and leachate and gas collection systems are functioning as intended by the decision documents. Additional efforts to characterize the nature and extent of 1,4-dioxane, as well as the contaminant trends, are necessary.

A CEA was established at the site and at buffer zones adjacent to the site. The establishment of the CEA will ensure that wells will not be established within the contaminated groundwater associated with the site and thus ensure protection of human health and the environment. Additionally, downgradient residents receive public water.

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?

Human Health
The previous FYR evaluated the exposure assumptions and toxicity data and indicated that the exposure assumptions and toxicity data were still valid. The exposure assumptions and toxicity data were reviewed as part of this FYR and they remain valid at this time. The cleanup levels have not changed since the last FYR and therefore are still valid. The remedial action objectives that were used at the time of the remedy are still valid. Currently, vapor intrusion is not a concern.

Ecological
The previous FYR indicated the exposure pathways, environmental media, and ecological receptors that were used in the evaluation for potential ecological impacts identified in the RODs were still valid. The remedial actions that have occurred at the site have eliminated the pathways of exposure for ecological receptors. The landfill is capped, which prevents exposure to contaminated soils, and the groundwater is

being captured and/or impeded through a combination of pumping and the slurry wall, which prevents exposure to contaminated groundwater. The interceptor trench was designed to prevent discharge of contaminants into the river. Based on the operations of the trench and extraction wells, confirmed with the long-term monitoring of the sediment and surface water, the migration of contaminants to the river is under control. Given that the potential exposure pathways for ecological receptors have been eliminated, the remedy is protective for ecological receptors.

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

No information that would alter the protectiveness of the remedy was identified.

VI. ISSUES/RECOMMENDATIONS

No issues and recommendations that affect protectiveness were identified as part of this FYR; however, additional efforts to characterize the nature and extent of 1,4-dioxane, as well as the concentration trends, are necessary to confirm that this contaminant is being effectively contained along with other site contaminants.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
Operable Units: 1 & 2	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedies are 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 are protective of human health and the environment.	

VIII. NEXT REVIEW

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

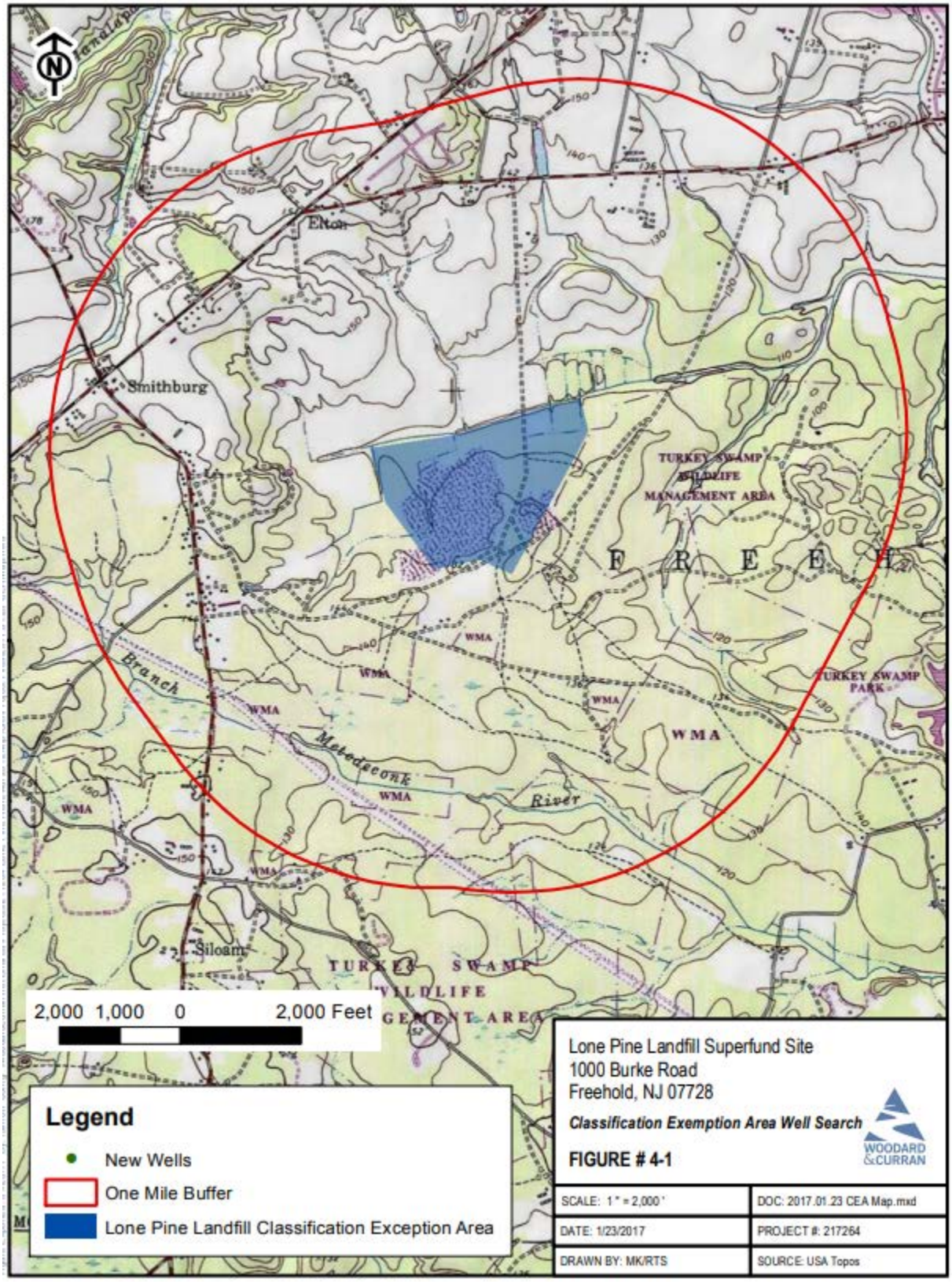
APPENDIX A – REFERENCE LIST

Table 2: Documents, Data and Information Reviewed in Completing the Five-Year Review	
Document Title	**Submittal Date**
Fouth Five-Year Review Report for the Lone Pine Landfill Superfund Site	September 2014
Record of Decision (OU1) for Lone Pine Landfill Superfund Site	September 1984
Record of Decision (OU2) for Lone Pine Landfill Superfund Site	September 1990
Consent Decree for the Lone Pine Landfill (OU1) Superfund Site	1989
Consent Decree for the Lone Pine Landfill (OU2) Superfund Site	1991
Lone Pine Landfill Superfund Site Annual Operational and Maintenance Reports	2015 – 2018
Annual Operation and and Maintenance Report (OU1 & OU2)	2014-2018
Lone Pine Landfill Superfund Site 2017 Biennial Monitoring Report	March 14, 2011
Lone Pine Landfill (OU-1 & OU2) Annual Performance Evaluation Report	2014-2018
Lone Pine Landfill Superfund Site CEA – Biennial Certification Monitoring Report	March 2017

Table 3: Chronology of Site Events	
Event	**Date(s)**
Landfill operating	1959-1979
Pre-NPL responses	1981
Initial studies conducted by EPA and NJDEP to ascertain the potential threat to public health and the environment from the landfill	1981-1982
Final NPL listing	1983
Remedial Investigation/Feasibility Study (RI/FS) for OU1	1982-1984
ROD signature (OU1)	1984
Remedial Design performed by the U.S. Army Corps of Engineers	1984-1989
Enforcement documents, AOC (OU1) for RI/FS	1985
Potentially Responsible Parties (PRPs) signed Consent Decree for (OU1)	1990
Remedial Action (OU1)	1988-1989
RI/FS (OU2) performed by PRPs	1985-1990
Record of Decision (OU2)	1990
Consent Decree (OU2) signed by PRPs	1992
Remedial Design (OU2) performed by PRPs	1992-1993
Remedial Action (OU2) performed by PRPs	1993-1994
Approval of Operations and Maintenance Plan	1993
Operation of the groundwater treatment plant began	1993
EPA completed first five-year review	1999
NJDEP established Classification Exemption Area	2005
EPA completed third five-year review	2009
EPA completed fourth five-year review	2014
EPA completed fifth five-year review	2019
Ongoing operations and maintenance	2014-2019

APPENDIX B – FIGURES

Figure 1: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Smithburg
TURKEY SWAMP
WILDLIFE
MANAGEMENT AREA
F R E E H
WMA
Branch
Metedeconk
River
TURKEY SWAMP
PARK
Siloam
2,000 1,000 0 2,000 Feet
Legend
New Wells
One Mile Buffer
Lone Pine Landfill Classification Exception Area
Lone Pine Landfill Superfund Site
1000 Burke Road
Freehold, NJ 07728
Classification Exemption Area Well Search
FIGURE # 4-1
WOODARD &CURRAN
SCALE: 1 " = 2,000 '
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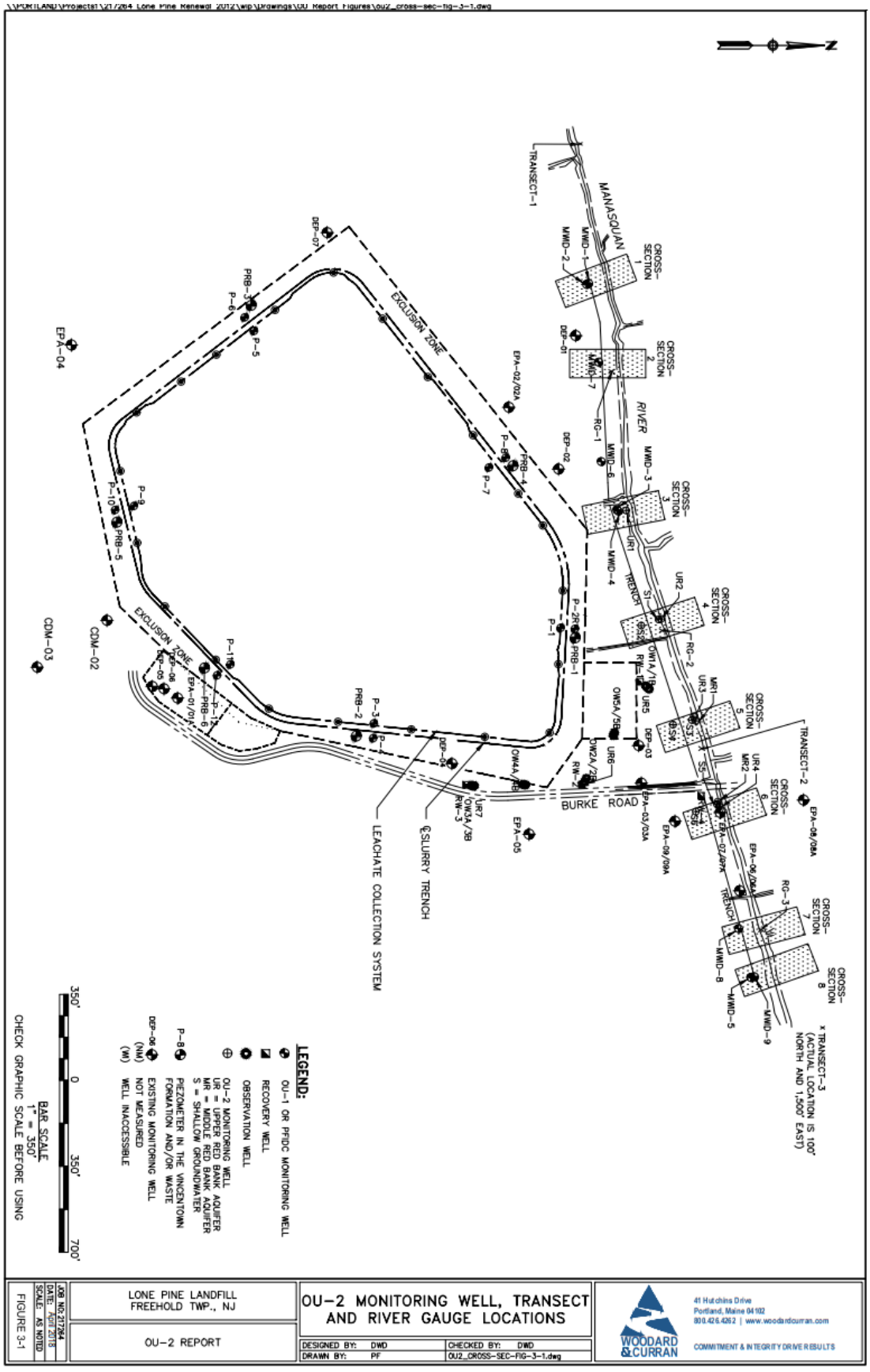
DATE: 1/23/2017
PROJECT #: 217264
DRAWN BY: MK/RTS
SOURCE: USA Topos

Figure 2: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RIVER
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CROSS-SECTION 2
CROSS-SECTION 3
CROSS-SECTION 4
CROSS-SECTION 5
CROSS-SECTION 6
CROSS-SECTION 7
CROSS-SECTION 8
MWID-1
MWID-2
MWID-3
MWID-4
MWID-5
MWID-6
MWID-7
MWID-8
MWID-9
DEP-01
DEP-02
DEP-03
DEP-04
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DEP-06
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S4
S5
S6
S7
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P-4
P-5
P-6
P-7
P-8
P-9
P-10
P-11
P-12
PRB-1
PRB-2
PRB-3
PRB-4
PRB-5
PRB-6
EXCLUSION ZONE
EXCLUSION ZONE
BURKE ROAD
LEACHATE COLLECTION SYSTEM
SLURRY TRENCH
TRANSECT-2
TRANSECT-3
(ACTUAL LOCATION IS 100' NORTH AND 1,500' EAST)
LEGEND:
OU-1 OR PFDC MONITORING WELL
RECOVERY WELL
OBSERVATION WELL
OU-2 MONITORING WELL
UR = UPPER RED BANK AQUIFER
MR = MIDDLE RED BANK AQUIFER
S = SHALLOW GROUNDWATER
PIEZOMETER IN THE VINCENTOWN FORMATION AND/OR WASTE
EXISTING MONITORING WELL NOT MEASURED (NM)
WELL INACCESSIBLE (W)
BAR SCALE
1" = 350'
350' 0 350' 700'
CHECK GRAPHIC SCALE BEFORE USING
LONE PINE LANDFILL
FREEHOLD TWP., NJ
OU-2 REPORT
OU-2 MONITORING WELL, TRANSECT AND RIVER GAUGE LOCATIONS
DESIGNED BY: DWD
DRAWN BY: PF
CHECKED BY: DWD
OU2_CROSS-SEC-FIG-3-1.dwg
JOB NO: 217264
DATE: April 2018
SCALE: AS NOTED
FIGURE 3-1
41 Hutchins Drive
Portland, Maine 04102
800.426.4262 | www.woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

Figure 3:

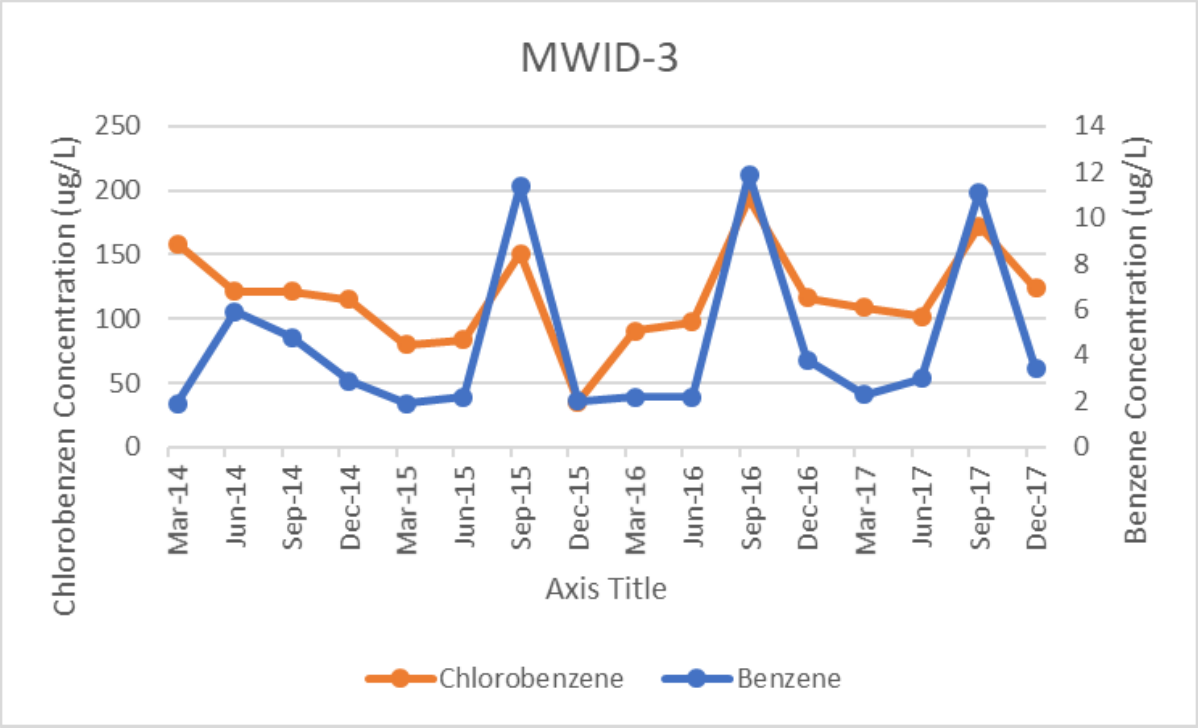

Figure 4:

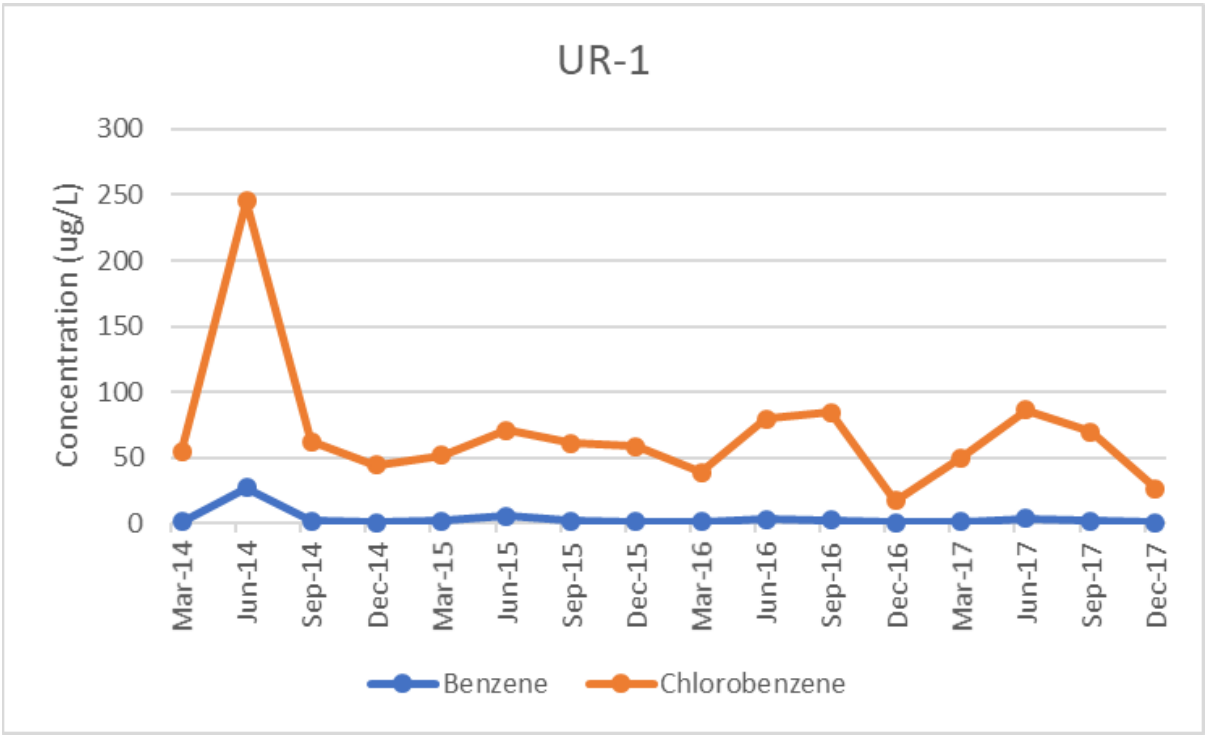

Figure 5:

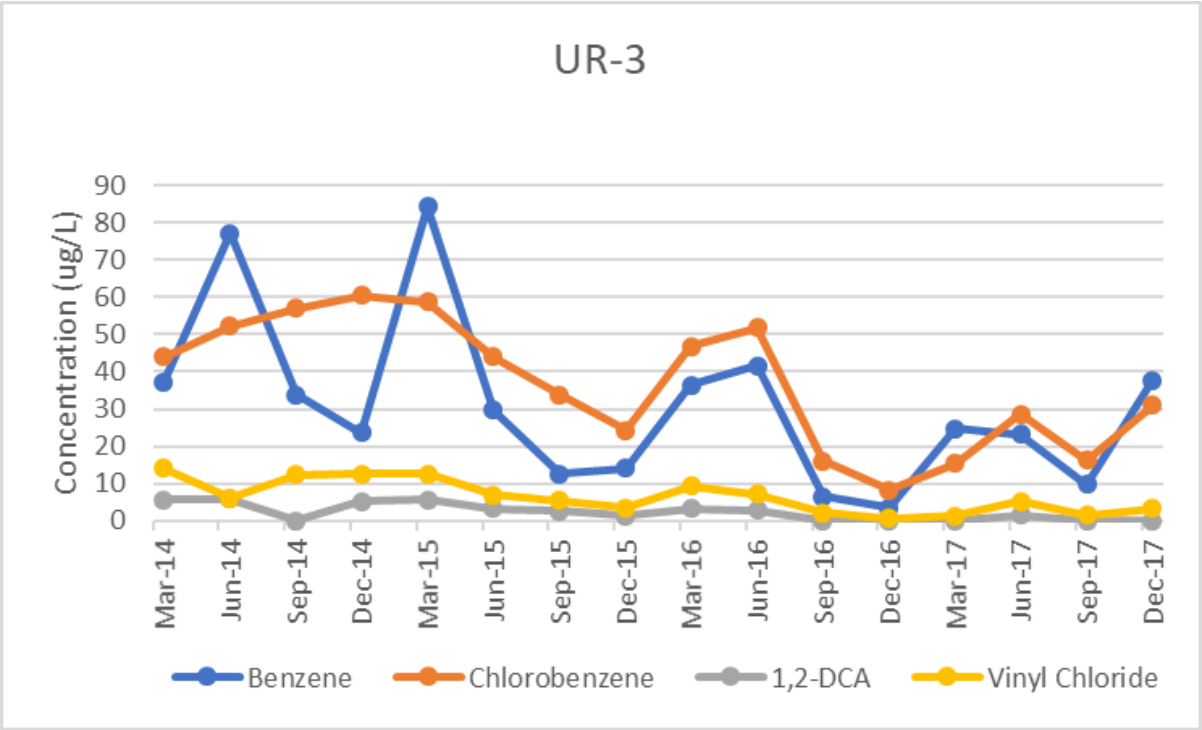

Figure 6:

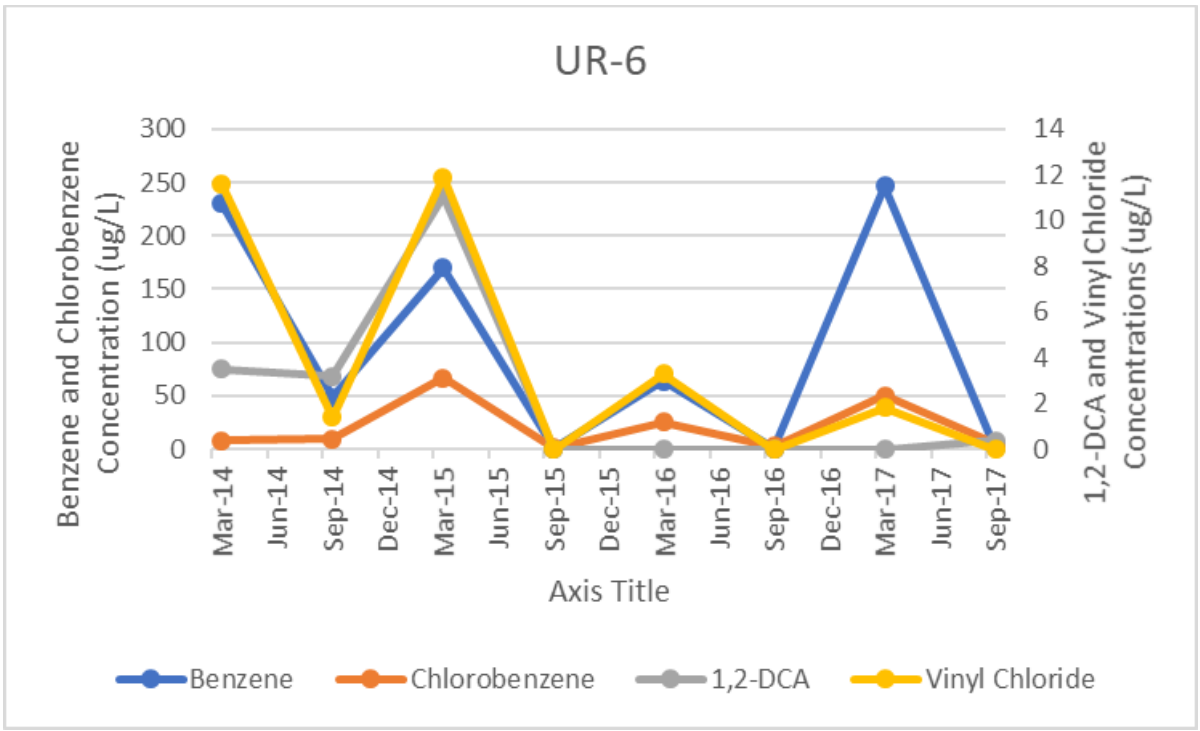

Figure 7:

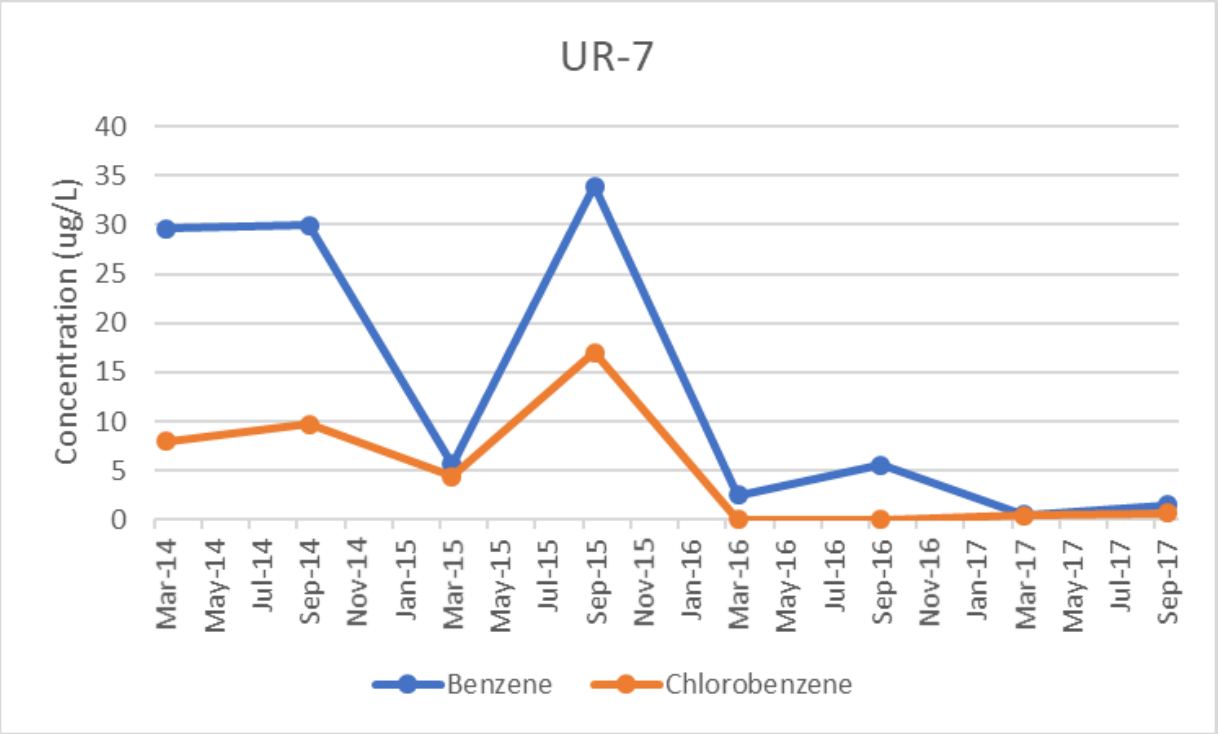

Figure 8: