FIFTH FIVE-YEAR REVIEW REPORT FOR KING OF PRUSSIA SUPERFUND SITE WINSLOW TOWNSHIP, CAMDEN COUNTY, NEW JERSEY

Prepared by

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

Evangelista, Pat

Digitally signed by Evangelista, Pat
Date: 2020.06.12 13:46:46 -04'00'

See Signature Block

Pat Evangelista, Director
Superfund and Emergency Management Division

Date:

598773

Table of Contents

I. Introduction 3

II. Response Action Summary 5

Basis for Taking Action: *5*

Status of Implementation *7*

System Operations/Operation and Maintenance (O&M): *9*

III. Progress Since the Last Review 10

V. Technical Assessment Summary 15

1. Is the remedy functioning as intended by the decision documents? *15*

2. Are the (a) exposure assumptions, (b) toxicity data, (c) cleanup levels, and (d) remedial action objectives (RAOs) used at the time of the remedy still valid? *15*

3. Has any other information come to light that could call into questions the protectiveness of the remedy? *16*

VI. ISSUES/RECOMMENDATIONS 16

VII. Protectiveness Statement(s) 17

X. Next Review 17

TABLES AND FIGURES 21

List of Abbreviation & Acronyms

ARAR-	Applicable or Relevant and Appropriate Requirement
CAMU-	Corrective Action Management Unit
CD-	Consent Decree
CERCLA-	Comprehensive Environmental Response, Compensation, and Liability Act
ENR-	Enterprise Network Resolution Contracting LLC
EPA-	United States Environmental Protection Agency
CFR-	Code of Federal Regulations
ESD-	Explanation of Significant Difference
ISCR-	In-Situ Chemical Reduction
MCL-	Maximum Contaminant Level
MCLG-	Maximum Contaminant Level Goal
MII-	Morton International Inc., a Rohm & Haas Company
NCP -	National Contingency Plan
NJDEP-	New Jersey Department of Environmental Protection
NPL-	National Priorities List
O&M-	Operation and Maintenance
PAH-	Polyaromatic Hydrocarbon
PCB-	Polychlorinated Biphenyl
PRP-	Potentially Responsible Party
RA-	Remedial Action
RAO-	Remedial Action Objective
RD-	Remedial Design
RI/FS-	Remedial Investigation/Feasibility Study
ROD-	Record of Decision
SARA-	Superfund amendments & Reauthorization Act
SDWA-	Safe Drinking Water Act
VOC-	Volatile Organic Compound

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 and is functioning as intended by the decision documents. The methods, findings, and conclusions of reviews are documented in the FYR. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

This is the fifth FYR for the King of Prussia Technical Corporation Superfund Site (Site), located in Winslow Township, Camden County, New Jersey. This FYR was conducted by United States Environmental Protection Agency (EPA) Remedial Project Manager (RPM) Trevor Anderson. The review was conducted pursuant to Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. §9601 et seq. and 40 CFR 300.430(f)(4)(ii), and in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). This report will become part of the Site file.

The Site cleanup is divided into three phases or operable units (OUs). OU1 addressed the soil contamination, the sediment contamination, the contamination found in the tanker and buried drum areas of the Site, and surface water and sediments of the Great Egg Harbor River. OU1 is complete. OU2 addressed the residually-contaminated soils associated with the area of the Site referred to as the Former Buried Drum Area. OU2 is complete. OU3 addresses the cleanup of contaminated groundwater and OU3 is ongoing. All work has been completed at OU1 and OU2 and they do not require a FYR. OU3 is the subject of this FYR.

The triggering action for this policy review is the completion date of the previous FYR. A FYR is required at this Site 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 will require five or more years to complete.

The King of Prussia Superfund Site FYR was led by Trevor Anderson, the EPA Project Manager. Other EPA's participants included Charles Nace (Human Health Risk and Ecological Risk Assessor) and Kathryn Flynn (Hydrologist). Representatives from the PRP Group included Brian Bussa (PRPs Project Coordinator), Tom Patterson (Roux Associates), and Veronica Smith (Roux Associates). The review began on September 1, 2019.

Site Background

The Site, which is located at 847 Piney Hollow Road, is identified as Block 8801, Lot 1.01 on the tax map of Winslow Township, Camden County, New Jersey. The Site encompasses approximately twenty-three (23) acres of undeveloped land. A groundwater treatment facility occupies ten (10) acres of this land and it is surrounded by a security fence (See Figures 1 and 2). The Site is located approximately thirty miles northeast of Philadelphia, Pennsylvania and twenty-five miles northwest of Atlantic City, New Jersey. The Atlantic City Expressway and

U.S. Route 322 (Black Horse Pike) are located approximately two miles northeast and southeast of the Site, respectively. The Great Egg Harbor River flows in a southeasterly direction approximately 1,000 feet southwest of the Site. Two facilities, the South Jersey Shooting Club and the Enterprise Network Resolutions (ENR) Contracting, LLC, are located across the street from the Site. ENR, a contractor for the Potentially Responsible Parties (PRPs), operates and maintains the groundwater treatment facility. The Great Egg Harbor River serves as the boundary between Camden and Gloucester Counties.

The Site lies in a rural area characterized by agricultural land use and sparse population. The state-owned Winslow Wildlife Management Area occupies land immediately adjacent to the southwest and northeast of the Site and is primarily used for recreational purposes. The nearest residence is a single-family home approximately one-mile northeast (up-gradient) of the Site.

The Great Egg Harbor River, located approximately 1,000 feet southwest of the Site, runs in an easterly direction through Camden County and throughout Atlantic County. The river discharges to the Atlantic Ocean north of Ocean City, New Jersey.

There are no residential wells in the vicinity of the Site. The two wells that are located on the ENR facility located across from the Site on Piney Hollow Road are not being used for potable water purposes. These two wells are located within a half mile radius of the Site.

The New Jersey Department of Environmental Protection (NJDEP) was first notified of possible unauthorized activities at the Site in January 1975. Subsequent Site inspections and samples by NJDEP and a ground-water study by Geraghty and Miller (an NJDEP contractor) in 1976 indicated contamination of the soils and groundwater at the Site. EPA confirmed contamination with additional sampling and investigations during 1979, 1980 and 1982. Based on the NJDEP and EPA investigations, it was determined in 1983 that contaminants in Site soils and/or groundwater and/or surface water included arsenic, vinyl chloride, phthalate esters, chloroform, trichloroethene (TCE) copper, zinc and 1,1,2,2-tetrachloroethane (1, 1, 2, 2-PCA).

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: King of Prussia Superfund Site		
EPA ID: NJD980505341		
Region: 2	**State:** NJ	**City/County:** Winslow Township/Camden County
SITE STATUS		
NPL Status: Final		

Multiple OUs?	Has the Site achieved construction completion?
Yes	Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**
Author Name (Federal or State Project Manager): Trevor Anderson
Author Affiliation: EPA
Review period: 05/30/2015 – 02/15/2020
Date of site inspection: 11/19/2019
Type of review: Policy
Review Number: 5
Triggering action date: 05/30/2015
Due date (*five years after triggering action date*): 5/30/2020

II. Response Action Summary

Basis for Taking Action:

In December 1985, the Site was placed on the National Priorities List (NPL). In April 1985, EPA entered into an Administrative Order on Consent (AOC) with five PRPs to conduct a remedial investigation and feasibility study (RI/FS). In July 1988, at the request of EPA, the PRPs installed a fence around the Site property to restrict access and prevent health risks associated with direct contact with contaminated soils, and prevent illegal dumping. A chronology of Site events is provided in Appendix A.

Inorganic substances that were identified as being detected during the RI in the groundwater at the Site include: Beryllium, Cadmium, Chromium, Copper, Mercury, Nickel, and Zinc. Organic substances that were detected in the groundwater during the RI at the Site include: Benzene, 1-1-Dichloroethane, Trans-1, 2-Dichloroethene, Ethylbenzene, Tetrachloroethene, 1, 1, 2, 2-Tetrachloroethane, Trichloroethene, 1, 1, 1-Trichloroethane, and Toluene.

The human health risk assessment that was conducted for the Site groundwater concluded that unacceptable cancer and non-cancer risks at the Site exist and primarily resulted from potential use of contaminated groundwater, although there are no users of the groundwater in the proximity of the Site. The further migration of these contaminants to potable water supplies, the river, and to unaffected areas of the Site would significantly impact human health and the environment.

Response Actions

Removal Actions - In September 1990, EPA completed the excavation and recycling/disposal of 120 plastic containers, 159 tons of heavy metal contaminated soil and 150 gallons of acid. In November 1991, EPA excavated and disposed of 200 rusted steel drums and 235 plastic carboys containing acids and organic liquids within the portion of the Site designated as the Buried Drum Area (now known as the Former Buried Drum Area). The disposal of two rusted steel tankers was completed in August 1991.

In March 1994, a groundwater Classification Exception Area (CEA) was established by the NJDEP to restrict the construction of drinking water wells within any areas of the contaminated plume. Since the Site is located in the Pinelands, the Pinelands Commission has regulations in place to restrict the construction of wells and other facilities in the Pinelands.

Remedial Action Objectives (RAOs)

The remediation of the Site has been accomplished through construction activities based on two Records of Decision (RODs) and removal actions performed by both EPA and the PRPs. The first ROD (1990 ROD), issued by EPA for this Site addressed the soil, buried drums, tankers, sediment, and the contaminated groundwater. The second ROD (1995 ROD), issued by EPA for this Site addressed the contaminated soils associated with the Former Buried Drum Areas. As indicated above, in order to facilitate the remediation of the Site, EPA decided to divide the work into three operable units, OU1, OU2, and OU3. All work has been completed for OU1 and OU2 soils.

The OU3 remedy for groundwater is addressed in the 1990 ROD. The Remedial Action Objectives (RAOs) are described below:

Groundwater RAOs:

- Mitigate the groundwater contamination such that no unacceptable levels of contaminants migrate to the Great Egg Harbor River;
- Mitigate the groundwater contamination such that Applicable or Relevant and Appropriate Requirement (ARARs) are met;
- Mitigate the groundwater contamination such that no unacceptable risk to human health can occur.

Remedy Components selected in the 1990 ROD:

The major OU3 component of the 1990 ROD was:

- Construction of an on-site groundwater extraction, treatment and reinjection system to address the contaminated groundwater.

On April 15, 1991, EPA issued the 1991 Order to direct a group of five PRPs to complete the remedial activities described in the September 1990 ROD.

Status of Implementation

Operable Unit 1

Operable Unit 1, a component of the 1990 ROD, involved the remediation of the former lagoon soils using a multi-phased soil washing technology. OU1 was performed by the PRPs, with EPA oversight. The remedial design (RD) for this portion of the remedy was completed in January 1993 by Alternative Remedial Technologies (ART), the PRPs' contractor.

OU1 RA activities are fully described in the July 1994 final Remedial Action Report (RAR). In summary, 19,200 tons of metals-contaminated soils and sludges were successfully treated to meet the established remediation goals set forth in EPA's September 1990 ROD. Soils meeting the established treatment goals were backfilled on-site.

Operable Unit 2

Operable Unit 2, identified in the 1990 ROD, addressed the residually-contaminated soils associated with the area of the Site referred to as the Former Buried Drum Area. In 1991, under a federally- funded removal action, EPA excavated and disposed of the buried drums as well as plastic carboys containing acids and organic liquids within the Former Buried Drum Area. In September 1993, EPA issued a Removal Action Memorandum to the PRPs for the excavation and disposal of the soil from the Former Buried Drum Area. The PRPs completed the removal action in February 1994. On September 27, 1995, EPA issued a No Further Action ROD for the Former Drum Area. The 1995 ROD documented all activities associated with the removal action and set forth EPA's decision not to take any additional action in the Former Drum Area, which signified the completion of all activities associated with OU2.

Operable Unit 3

Operable Unit 3 (OU3), which is a component of the 1990 ROD, is being performed by the PRPs under the terms of the April 1991 Order. OU3 includes the design and construction of a groundwater extraction, treatment and reinjection system as specified in the 1990 ROD.

The selected groundwater remedy for the Site established cleanup levels for the contaminants in the ground water based on risk to human health. The remedy was selected to eliminate unacceptable risks posed to human health and the environment by extracting groundwater, which is contaminated with volatile organic and inorganic contaminants, and treating the water to health-based cleanup levels.

The design of the extraction, treatment and reinjection system was completed by the PRPs and approved by EPA on July 22, 1994. Remedial action construction completion was achieved in September 1995 and documented in a preliminary closeout report. The system began treating contaminated water in 1995. The original groundwater treatment system consisted of eleven

recovery wells, which could extract the contaminated groundwater at a combined rate of 200 gallons per minute (gpm), or about 280,000 gallons per day; monitoring wells to monitor the progress of the remedy; electrochemical cells to remove the metals; and two air strippers with carbon polishing to remove the volatile organic compounds (VOCs). In addition, five on-site infiltration trenches and ten infiltration galleries are designed to re-inject the treated water into the aquifer through perforated manholes. The infiltration galleries are located outside the fence and adjacent to the river.

Up until 2019, seven of the eleven recovery wells were still operating at the Site. These wells included shallow wells R-1S through R-6S and intermediate well R-8I. Four recovery wells (intermediate wells R-9I and R-11I, and deep wells R-7D and R-11D) were shutdown in 2000 because VOCs and metals in these four wells were detected at concentration below cleanup levels. The seven recovery wells were extracting groundwater at a rate of between 95 and 110 gpm or approximately 144,000 gallons per day.

As indicated in the 2015 FYR, in March 2013, the PRP conducted an In-Situ Chemical Reduction (ISCR) Pilot Testing at the Site under an EPA-approved work plan. The testing was initiated to determine if the concentration of metals and VOCs in the groundwater at the Site could be chemically reduced to meet cleanup standards for the Site. Three areas of high metals and VOCs concentrations were selected for the testing. A total of 13 injection points were utilized to inject the ISCR substrate and bacteria into each testing areas. Data collected during the testing indicates that if the proper reducing environment could be maintained throughout the testing area, ISCR could be used to reduce the levels of the metal and VOCs concentrations in the groundwater to meet Site cleanup standards. A second testing, under an approved work plan, was conducted in 2016, the results indicated that chemical reduction is a viable option for reducing the contaminant to meet Site cleanup standards.

In December 2018, based on the results of the two ISCR testing phases, the PRPs submitted a work plan to continue ISCR testing at three downgradient areas of the Site. These areas included R-4, MW-42S and R-6. In addition, the work plan called for the temporary shutdown of the treatment plant for two years to avoid any interference from recovery wells located in the vicinity of the test areas. Importantly, since the plant would be shut down during the testing, the work plan proposed several contingencies that would be implemented if site-related contaminants were to be detected in the river. On March 7, 2019 EPA approved the work plan. A detail description of the testing is provided below. This ISCR testing is ongoing. The treatment plant was temporarily shut down in May 2019.

IC Summary Table

Table 1, below summaries the status of the institutional control

Table 1: Summary of Planned and/or Implemented Institutional Controls

Media, engineered, controls, and areas that not support UU/UE based on	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implementation and Date (or

current conditions					Planned)
Groundwater	Yes	No	Groundwater	Protect against groundwater use	Classification Exception Area (CEA) Implemented June 1993

Although the 1990 ROD did not indicate the need for institutional controls, the Site is surrounded by fencing and warning signs posted to prevent access to the contaminated materials. In addition, off-site recovery and monitoring wells are housed in below-ground vaults to prevent vandalism. Also, the June 1993 CEA restricts the construction of drinking water wells within any areas of the contaminated plume.

System Operations/Operation and Maintenance (O&M):

The removal and remedial actions which took place at the Site between 1990 and 1993 reduced the levels of the soil contamination to meet cleanup goals. The groundwater contamination remains above applicable standards and O&M activities are conducted to reduce the groundwater contamination at the Site.

The PRPs, through their consultants, ENR and Roux Associates, have operated the groundwater extraction and treatment system under EPA oversight from 1995 thru 2019. The O&M Plan developed by the PRPs was finalized in September 1994. The O&M Plan conforms to the requirements set forth in the New Jersey Discharge Elimination System/Discharge to Groundwater Permit Equivalent and the Pinelands Comprehensive Management Plan.

Until the system was turned off in 2019, monitoring was performed to ensure that the groundwater remedy continues to be effective in capturing the contaminated plume and preventing the migration of the contaminated groundwater to the Great Egg Harbor River. Monitoring continues to ensure there is no plume migration while the system is turned off. A network of wells is monitored semi-annually for any changes in groundwater quality at the Site (see Figure 2). In addition, the entire groundwater treatment system undergoes routine maintenance, as necessary. The monitoring plan also requires that three surface water samples from the Great Egg Harbor River be collected annually and analyzed for VOCs and metals to evaluate the impact of groundwater discharge to the river.

Based on data presented in the first and second quarter 2019 groundwater monitoring report, 1, 1, 2, 2-PCA, PCE, TCE, and beryllium were detected at levels in the influent at concentrations above their respective ROD limits. 1,1,1-trichloroethane, benzene, 1,1 dichloroethane ethylbenzene, toluene, and trans-1,2-dichloroethylene were detected below their respective ROD limits in influent samples. In June 2019, while the treatment plant was restarted for routine maintenance following temporary shutdown, influent samples were collected and Beryllium was detected below the ROD cleanup level

Since its start-up, the groundwater treatment plant has treated over 1,167.1 million gallons of contaminated groundwater and removed over 27.9 tons of VOCs and over 1.43 tons of metals.

In addition, while the treatment plant was in operation, it was able to reduce the total influent VOC concentrations from 1,917 microgram per liter (µ/L) to 5µ/L, and the metal concentrations went from 41µ/L to 5.5µ/L. As described above, the treatment plant was temporarily shut down in May 2019.

III. Progress Since the Last Review

This is the fifth FYR for the Site. The previous FYR report found the implemented remedies protective of human health and the environment. The previous FYR report made no recommendations.

As mentioned in the last review, in March 2013, the PRP Group, under an EPA-approved work plan, conducted two ISCR pilot testing studies at the Site (2013 and 2016). Overtime, as with most pump and treatment systems, concentrations in the aquifer had reached equilibrium. This was demonstrated with detections of consistent, low-level contaminant concentrations collected from monitoring well samples over recent years and, Mann-Kendall analyses indicating declining influent concentrations to the groundwater treatment plant. The ISCR study was conducted by the PRPs to determine if chemical reduction could effectively reduce the current levels of contaminants in the groundwater to meet site-specific ARARs and to overcome this equilibrium. The study involved the injection of a reducing agent, a pH buffering compound, and microbial organisms into three upgradient areas of the Site showing high levels of VOCs and metals contamination. The three areas were identified as the MW-29S Area, MW-5S Area, and the R-6 Area. A total of eight monitoring and recovery wells were involved in the study.

The first ISCR study, which was completed in 2013, reduced VOC concentrations in the MW-29S and R-6 areas of the Site. However, due to the high pumping rate at R-3, permanent reduction in VOC concentrations could not be achieved in the MW-5S study area. The pumping rate made it difficult to achieve the proper geochemical and biological conditions for ICSR to work in the MW-5S area. The successful application of ISCR in the MW-29S and R-6 areas indicated that if groundwater geochemical and biological conditions could be maintained by addition of appropriate combinations of reducing agent, pH buffering, and microbial organism into the injection areas, ISCR could be a viable option for addressing the remaining groundwater contamination at the Site.

In January 2016, using the information obtained from the initial testing, a second ISCR study was initiated at the Site. To address the high pumping rate at R-3 and its impact on MW-5S, R-3 was shutoff during the testing. In addition, adjustments were made to the ISCR reagent, pH buffering solutions, and the microbial organisms to obtain the appropriate geochemical and biological conditions in the injections to improve the effectiveness ISCR to reduce the concentrations of contaminants at the Site.

In September 2016, the results of the second ISCR testing were presented in the ISCR Pilot Summary Report. Based on the results, the concentrations of most VOCs and metals were

reduced to meet site-specific ARARs. Ethylbenzene was the only contaminants that remained above ROD requirements in MW-40S.

In December 2018, based on the results of the two ISCR testing phases, the PRPs submitted a work plan to conduct a third ISCR testing at three downgradient areas of the Site. These areas included R-4, MW-42S and R-6. In addition, the PRPs requested the temporary shutting down of the treatment plant to avoid any interference from recovery wells located in the vicinity of the test areas. The treatment plant would be shut down for two years. The Work Plan included the injection of ISCR materials between the river and the study areas to act as a barrier to prevent contaminants from migrating to the river and the collection of surface water, sediment, and groundwater samples throughout the testing period. A new monitoring well (MW-43S) was planned to be installed between the river and the barrier. This well would be monitored to determine if the barrier is preventing the migration of contaminants toward the river.

In addition, since the plant would be shut down during the testing, the PRPs proposed several contingencies that would be implemented if site-related contaminants were to be detected in the river. The first contingency requires increasing the amount of ISCR material being injected into the barrier area. Groundwater samples would be collected from MW-27S, MW-31S and MW-43S and sediment and surface water samples would be collected. If the increased injection of ISCR materials fails to correct the detection of contaminants in the river, the second contingency requires the start-up of the treatment plant with limited pumping from recovery wells in the vicinity of the study areas. If there is a need to implement the final contingency, the treatment plant would operate at full capacity with full pumping for all recovery wells.

In April 2019, the ISCR testing was initiated at the Site and the treatment plant was shut down in May 2019. To date, surface water and sediment samples collected from the river did not detect any site-related VOCs. All metals were detected near the river at concentrations well below site-specific ARARs. The data to date indicates the ISCR barrier is effective in preventing the migration of contaminants to the river.

However, EPA will continue to monitor the ISCR testing data collected from monitoring/recovery wells, and the sediment and surface water to determine if there is a need to implement any of the contingencies described in the work plan.

IV. Five-Year Review Process

Community Notification and Involvement & Site Interview:

On October 1, 2019, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at Superfund sites in New York, New Jersey, Puerto Rico and the U.S. Virgin Islands, including the King of Prussia site. The announcement can be found at the following web address: https://www.epa.gov/aboutepa/fiscal-year-2020-five-year-reviews.

The EPA Community Relation Coordinator for the King of Prussia Superfund Site, Patricia Seppi, sent the five-year review notice to the M. Allan Vogelson Regional Branch Library in Voorhees on November 20, 2019. The notice informed the community of the initiation of the five-year review process. The notice was posted on the Township's Website on December 16,

2019. The notice indicated that upon completion of the five-year review, the document would be available to the public at the following locations: M. Allan Vogelson Regional Branch Library (formerly the Camden County Public Library), 203 Laurel Road, Voorhees, NJ 08043 and the U.S. EPA's Record Center, located at 290 Broadway, New York, N.Y. and online at: https://www.epa.gov/superfund/king-of-prussia. In addition, the notice included the RPM's name, address and telephone number for questions related to the five-year review process or the King of Prussia Superfund Site in general. There were no interviews conducted during the Site inspection.

***Document Review*:**

This fifth FYR consisted of a review of the relevant documents including operation and maintenance records, monitoring data and the ISCR reports. Applicable ROD cleanup standards were reviewed as well as current groundwater cleanup standards. A list of documents reviewed can be found in Appendix B.

***Data Review*:**

Groundwater

The groundwater extraction and treatment system has been operating since 1995, although it has been temporarily shut down since May 2019. In general, most contaminants were detected at their highest levels during the RI/FS phase of the cleanup and immediately following the completion of the construction of the extraction, treatment and reinjection system.

Groundwater sampling is conducted to evaluate the change in contaminant concentrations with time at selected locations within the plume. Groundwater samples are analyzed for VOCs and metals, and water level measurements are obtained to determine groundwater flow directions. Surface water and sediment samples are analyzed for VOCs and metals. There are 44 groundwater monitoring and six recovery wells are located at the Site (see Figure 2). In accordance with the 2012 Operation, Maintenance, and Monitoring Plan, groundwater samples are routinely collected semi-annually from select recovery and monitoring wells. However, in addition to the monitoring wells sampled on a semi-annual basis there are seven additional shallow wells, one intermediate well, and one deep well that are sampled annually. Also, in 2017 and 2019, as required by the approved ISCR work plan, there was additional groundwater monitoring performed for the ISCR programs described below.

Quarterly surface water and sediment samples are collected from one location along the Great Egg Harbor River.

The results of the data from the 2017 and 2019 ISCR program indicate:

- The initial ISCR pilot study and extended ISCR pilot study at the Site caused decreases in VOC and metal concentrations at some shallow monitoring wells since 2017. The wells with decreases in concentration include R-1, MW-38S, and MW-39S. Wells R-2 and MW-1S are further away from the treatment area and they show stable concentrations of

VOCs. However, beryllium and chromium showed elevated concentrations above the standards during this period.

- Monitoring well MW-17S has shown elevated chromium concentrations starting in 2015. MW-15S, located downgradient of MW-17S, had elevated chromium in 2018. However, since MW-17S is located upgradient of Site sources, the chromium exceedances at MW-17S and MW-15S during this period may not be Site related.

- Downgradient of the former facility boundary, recovery well R-6 showed declining VOC concentrations from low in 2018 to non-detect in September 2019, probably due to the April-June 2019 ISCR program. R-4 also showed VOC declines, but beryllium concentrations are stable.

- In the central area of the plume, MW-5S showed declines in copper and beryllium concentrations to below standards in the past five years due to the extended ISCR pilot study. MW-41S generally showed declines in VOC concentrations in this period, but concentrations are still above standards.

- Initial testing results indicated that the ISCR injections at MW-42S were not effective. Since, concentrations of 1,1,2,2-tetrachloroethane, tetrachloroethane, and trichloroethane remained significantly above standards, and mercury was slightly above the standard. In July and September 2019, the nickel concentrations at MW-42S increased above the standard for the first time in this review period.

- Monitoring well MW-43S was installed within the downgradient ISCR barrier area in April 2019. It is located between MW-42S and the river. Baseline sampling showed exceedances of 1,1,2,2-PCA, PCE, TCE, and mercury at this location. July and September sampling showed the same exceedances, except for mercury which decreased to non-detect levels.

- Downgradient shallow wells MW-27S and MW-31S are located outside the ISCR barrier and next to the river. From 2015 to March 2019, these wells did not have elevated VOCs or metals, except for MW-27S slightly exceeded the chromium standard. These results were similar to the data in the previous FYR. Since the extraction wells were turned off in May 2019, MW-27S and MW-31S showed increasing concentrations of VOCs and metals. TCE increased from non-detect to slightly exceeding the standard in September 2019, at 2.9 ug/l and 1.6 ug/l, respectively. At MW-31S, beryllium was elevated above the standard in July and September 2019 and nickel was elevated in July 2019.

In summary, these initial increases in VOC and metal concentrations in some of the wells were expected since previous ISCR testing had shown that concentrations in wells in the vicinity of the test areas will increase during the initial phases of the study due to the formation of daughter compounds resulting from the ISCR agent breaking down or reducing TCE and PCE. These temporary increases in concentrations are short lived and overtime the data has shown that levels decrease., ISCR has proven to be a viable option for addressing the groundwater contamination at the Site. The locations R-6, MW-42S, R-4, MW-3S were sampled in December 2019 and the

data should be available for evaluation during in late 2020. Although this proven technology was successfully applied at the Site during past ISCR studies, EPA will review the data to ensure that the ISCR testing is effectively reducing the concentrations found in the above monitoring wells.

Groundwater monitoring results in the intermediate and deep wells were consistent with the previous FYR period. MW-2I exceeded the beryllium and nickel standards every year. Copper was elevated only in 2016. The intermediate wells MW-33I and RW-8I exceeded the standard for PCE twice in the past five years. RW-8I also exceeded the standard for beryllium twice in the past five years. The deep well MW-24D had elevated chromium and mercury only once in September 2018.

Before the temporary shut-down of the treatment plant in May 2019, the effluent concentrations being discharged from the treatment plant showed non-detect levels for VOCs. The concentration of beryllium met ARARs that were established for the Site (see Tables 1 and 2).

As stated previously, to conduct the ISCR testing, the treatment plant has been shut down since May 2019, and the shutdown will continue for a period of two years. The PRPs have in place several contingencies that would be implemented if site-related contaminants were to be detected in the river. The first contingency requires increasing the amount of ISCR material being injected into the barrier area. Groundwater samples would be collected from MW-27S, MW-31S and MW-43S and sediment and surface water samples would be collected and analyzed. If the increased injection of ISCR materials fails to reduce levels in the river, the second contingency requires the start-up of the treatment plant with limited pumping from recovery wells in the vicinity of the study areas. If there is a need to implement the final contingency, the treatment plant would operate at full capacity with full pumping for all recovery well. The implementation of any of these contingencies should address any conditions that could bring the protectiveness of the remedy into questions.

1,4-Dioxane

In 2010, groundwater samples collected from 29 monitoring wells and 10 recovery wells and were analyzed for 1,4-Dioxane. All samples showed non-detect levels for 1, 4-Dioxane.

Surface Water and Sediment

Surface water and sediment samples were collected from location SW-3A/SED-3A. Since SW-3A/SED-3A are located approximately 760 feet downstream from MW-31S and to the southeastern limit of the Downgradient ISCR Barrier, any detection of Site-related contaminants at these locations would indicate that the barrier has failed to prevent the migration of contaminants to the river and would trigger the implementation of the contingencies. In 2019, the surface water sample showed no detections of VOCs. Chromium, copper, and zinc were found below surface water quality standards. No VOCs were detected in the sediment sample, and beryllium, chromium, copper, mercury, and nickel were below standards. These results are consistent with the data in the previous FYR. However, the surface water and sediment sampling locations immediately downgradient of MW-43S have not been sampled in this

monitoring period. These locations were sampled in December 2019 and the data should be available for evaluation during Spring 2020.

***Site Inspection*:**

The Site was inspected on November 21, 2019 by Trevor Anderson, the EPA RPM and Jeff Josephson, Section Chief of the New Jersey Project/State Coordination Section and the following representatives of the PRPs: Brian Bussa (PRPs Project Coordinator), Tom Patterson (Roux Associates), and Veronica Smith (Roux Associates). The purpose of the Site inspection was to assess the protectiveness of the remedy and the working condition of the groundwater treatment plant. The fence and security gate, the soil covering the Site, and the monitoring and recovery wells were also inspected, as well as the infiltration trenches and galleries. The treatment plant was shut-down during the inspection to facilitate the implementation the ISCR testing.

The inspection indicated the fencing, the soil covering, the monitoring and recovery wells were all in good conditions. Although the plant was shut-down, it was well maintained.

Areas outside the fence were also inspected. These areas of the Site contain several monitoring and recovery wells, the infiltration galleries, and the perforated manholes. The vaults housing the recovery wells were inspected and appear to be in good conditions. In the past, the vault covers were a target by vandals for scrap metals. As a result, most of the metal covers were replaced with plexiglass covers.

V. Technical Assessment Summary

1. Is the remedy functioning as intended by the decision documents?

As stated in the previous FYRs, the soil cleanup was completed in 1993 and the groundwater remediation is on-going. From a human health perspective, there is no current potable use of groundwater from the Site and there is no exposure to contaminated groundwater, therefore, the remedy is serving to prevent exposure. The CEA is in place and it protects against exposure by preventing the installation of drinking water wells until the groundwater is restored. The operation of the pump and treatment system successfully reduced contaminant levels and it is temporarily shut down while the pilot ISCR program continues to reduce the remaining contaminant levels. Likewise, from an ecological perspective, the surface water concentrations are below NJ surface water quality criteria, therefore, the remedy is also functioning with respect to ecological receptors in the river.

2. Are the (a) exposure assumptions, (b) toxicity data, (c) cleanup levels, and (d) remedial action objectives (RAOs) used at the time of the remedy still valid?

Human Health

(a and b) The previous FYRs 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 review and they remain valid at

this time. The previous FYR indicated that the TCE toxicity had changed and was more stringent, but concluded that there was no current exposure to drinking water and therefore the change in toxicity values did not affect the protectiveness of the remedy. This conclusion is still valid.

(c) Since the remedy was selected in 1990, the state of New Jersey has clarified its position on groundwater quality in the Pinelands, which is considered Class I. Class I groundwaters are "non-degradation" waters, meaning “natural quality” should be maintained. Non-degradation standards in the Pinelands are set at the practical quantitation limit (PQL) for constituents or natural background. However, the cleanup values presented in the 1990 ROD are still valid and protective of human health, although as noted in the previous FYR review, several cleanup values in the ROD are greater than the current NJDEP regulations, specifically arsenic in soil. However, there is no exposure to arsenic since the site is surrounded by fencing and signs are posted. 1,2-dichloroethane and 1,1,2,2-tetrachloroethane in groundwater are greater than the current NJDRP regulations. Additionally, there are no current potable water supplies utilizing the groundwater as a drinking water source so there is no exposure to these contaminate in the groundwater.

(d) The goal of the remedial actions was to clean up the soils in OU1 and OU2 through either treatment or excavation and off-site disposal and the groundwater in OU3 through extraction, treatment and reinjection. The goals for OU1 and OU2 have been met and are still valid. The goal for OU3 is currently on-going and remains valid.

Ecological

The previous FYRs indicated there is a potential for localized groundwater discharge to the surface water that may contain site-related contamination, however the localized discharge to the river was not expected to adversely impact the aquatic organisms in the river on a population-level. Sediment and surface water samples were collected in September of 2019 and the site-related concentrations were below NJ surface water quality criteria and the project action levels that were established for the Site in the 1990 ROD. In addition, while the plant was operating, the effluent data were below the ROD cleanup values. The exposure assumptions and toxicity values used in the previous evaluations are also still valid. Based on a review of the most recent monitoring data, the remedy is functioning as intended for the protection of ecological receptors.

3. Has any other information come to light that could call into questions the protectiveness of the remedy?

No other information has come to light that would affect the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU3

VII. Protectiveness Statement(s)

Protectiveness Statement(s)		
Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU3	Protective	N/A
Protectiveness Statement:		
The OU3 remedy for groundwater is protective of human health and the environment.		

Sitewide Protectiveness Statement (if applicable)	
For the Sites that have achieves construction completion, enter a sitewide protectiveness determination and statement.	
Protective Determination:	*Addendum Due Date (if applicable):*
Protective	N/A
Protectiveness Statement:	
The remedy for the King of Prussia Superfund Site is protective of human health and the environment.	

X. Next Review

The sixth five-year review for King of Prussia Superfund Site is required five years from the completion of this review.

APPENDIX A

Chronology of Site Events

Events	Date
Operation of the waste recycling facility began.	1971
Waste recycling operation ceases and the Site was abandoned.	1973-1974
NJDEP was notified of waste recycling activities.	1975
NJDEP inspected and collected groundwater samples at the Site.	1976
The Site was placed on the National Priorities List.	1985
Remedial Investigation/Feasibility Study (RI/FS) began.	1985
Buried drums and plastic containers were excavated and removed from the Site.	1989
RI/FS and Supplemental Feasibility Study (SFS) were issued to the public.	1990
EPA issued a Record of Decision for the Site to address soils, groundwater, and buried drums.	1990
Potentially Responsible Parties signed an Administrative Order to complete the remedial activities described in the ROD.	1991
The removal of buried drums from the Former Buried Drum Area was completed by EPA under a removal action.	1991
EPA removed the tankers and their contents from the Site.	1991
Contaminated soil associated with the tankers area was removed and treated by soil washing. Approximately 19,200 tons of metal contaminated soil were removed and treated by the PRP.	1993
Focused Feasibility Study to address the contaminated soil in the Former Buried Drum Area was completed by the PRPs. Soil removal was selected.	1993
The PRPs completed the removal of the soil from the Former Buried Drum Area of the Site.	1994
EPA approved the Remedial Design Report for the groundwater treatment system.	1994
EPA issued a No Further Action ROD for the Former Buried Drum Area.	1995
Operation of the groundwater treatment plant began.	1995
EPA completed First Five-year Review	2000

EPA completed Second Five-year Review	2005
EPA completed Third Five-year Review	2010
PRPs completed first ISCR Study	2014
EPA completed Fourth Five-year Review	2015
PRPs completed second ISCR Study	2018
PRP Submitted Proposal for the Groundwater Shutdown and Remedial Optimization Testing for Operable Unit 3	2019
EPA approved Work Plan to Shut-down the Treatment Plant	2019
PRPs Shut-down Treatment Plan	2019

APPENDIX B - REFERENCE LIST

Documents, Data, and Information Reviewed in Completing the Five-Year Review

Document Title, Author	Date
Record of Decision for the King of Prussia Superfund Site - EPA	1995
ISCR Pilot Test Report – Roux Associates	2014
Fourth Five-Year Review - EPA	2015
In-Situ Chemical Reduction Pilot Test Summary Report – Roux Associates	2018
Proposal for the Groundwater Shutdown and Remedial Optimization Testing for Operable Unit 3 – ROUX Associates	2019
Semi-Annual Progress Report First Quarter 2019 –Second Quarter 2019 – Roux Associates	2019

TABLES AND FIGURES

Table 1. Influent Monitoring Data Summary - Fourth Quarter 2014. King of Prussia Technical Corporation Superfund Site; Winslow Township, New Jersey.

Table 3. Influent Monitoring Data Summary - First and Second Quarter 2019. King of Prussia Technical Corporation Superfund Site; Winslow Township, New Jersey.

Sampling Quarter / Sample Date	ARAR	Influent Sampling Results (µg/L)											
		2013	2014	2015	2016	2017	2018	1Q2019		2Q2019			2019
		Annual Average	Annual Average	Annual Average	Annual Average	Annual Average	Annual Average	02/01/19	Average	04/09/19	6/13/2019[1]	Average	Annual Average
METALS (µg/L)													
Beryllium	4	13	12	10	11	7.6	5.3	8.7	8.7	5.6	2.3	4	6.3
Chromium	50	39	38	70	48	32	24.5	26	26	17	31	24	25
Copper	1,000	528	514	453	483	375	276.3	430	430	290	93	192	311
Nickel	210	132	124	107	116	88	70.8	92	92	61	37	49	70.5
VOLATILE ORGANIC COMPOUNDS (µg/L)													
1,1,1-Trichloroethane	26	0.47	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	1.4	12	9.1	9.0	13	12.2	9.3	7.3	7.3	5.2	1.0 U	2.9	5.1
1,1-Dichloroethane	2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Benzene	1	0.27	1.0 U	1.0 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	50	1.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	1	23	18	15	17	9.4	6.2	3.8	3.8	5.4	13.0	9.2	6.5
Toluene	2,000	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethylene	10	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethylene	1	12	10	9.1	13	10.7	7.6	5.8	5.8	5.8	3.0	4.4	5.1

Notes:

1. The first quarter 2019 system operations report was submitted to USEPA on May 8, 2019.
2. See Appendix A for the second quarter 2019 system operations report.
3. Only routinely monitored parameters are listed.
4. ARAR = Applicable or Relevant and Appropriate Requirement.
5. µg/L = micrograms per liter.
6. U = not detected at indicated reporting limit (RL).
7. NA = not analyzed.
8. For clarity, all detected concentrations are shown in bold-face type.
9. Values in red with shaded cells exceed the corresponding ARAR.
10. Averages calculated by setting non-detect values at 1/2 of RL.

Footnotes:

[1] Due to commencement of the GWRTS Shutdown and Remedial Optimization Test on April 22, 2019, R-1 and R-2 were the only recovery wells pumping during June 2019 influent sample collection.

Table 2. Effluent Monitoring Data Summary - Fourth Quarter 2014. King of Prussia Technical Corporation Superfund Site; Winslow Township, New Jersey.

Table 4. Effluent Monitoring Data Summary - First and Second Quarter 2019. King of Prussia Technical Corporation Superfund Site; Winslow Township, New Jersey.

Sampling Quarter / Sample Date	Discharge Limit/ ARAR	Effluent Sampling Results (µg/L) 2013 Annual Average	2014 Annual Average	2015 Annual Average	2016 Annual Average	2017 Annual Average	2018 Annual Average
METALS (µg/L)							
Beryllium	4	**1.3**	**0.7**	**0.9**	**0.9**	**0.8**	**1.0**
Chromium	50	**4.2**	**2.7**	**3.5**	**3.6**	**3.6**	**4.2**
Copper	1,000	**60.4**	**37.0**	**48.8**	**41.5**	**51.3**	**52.4**
Nickel	210	**26.9**	**20.4**	**21.1**	**32.9**	**26.7**	**30.0**
VOLATILE ORGANIC COMPOUNDS (µg/L)							
1,1,1-Trichloroethane	26	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	1.4	**0.49**	**0.82**	1.0 U	1.0 U	**0.6**	**0.5**
1,1-Dichloroethane	2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Benzene	1	1.0 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	50	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	2,000	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trans-1,2-Dichloroethylene	10	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethylene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Notes:

1. 1Q 2019 system operations report was submitted to USEPA on May 8, 2019.
2. See Appendix A for the second quarter 2019 system operations report.
3. Only routinely monitored parameters are listed.
4. ARAR = Applicable or Relevant and Appropriate Requirement.
5. µg/L = micrograms per liter.
6. U = not detected at indicated reporting limit (RL).
7. For clarity, all detected concentrations are shown in bold-face type.
8. Averages calculated by setting non-detect values at 1/2 of RL.
9. NA = sample not analyzed for this constituent.
10. Values in red with shaded cells exceed the corresponding ARAR.

Footnotes:

(1) Due to a tetrachloroethene (PCE) ARAR exceedance observed in the 2/1/19 DMR sample (1.7 µg/L), a second sample was collected on 2/14/19 and a non-detect result was obtained. The average concentration of the two DMR samples using 1/2 of RL for the non-detect value is reported herein and is below the ARAR.

(2) Due to a beryllium ARAR exceedance observed in the 5/2/19 DMR sample (4.4 µg/L), a second sample was collected on 5/31/19 and a non-detect result was obtained. The average concentration of the two DMR samples using 1/2 of RL for the non-detect value is reported herein and is below the ARAR.

Figure 1 Site Location Map

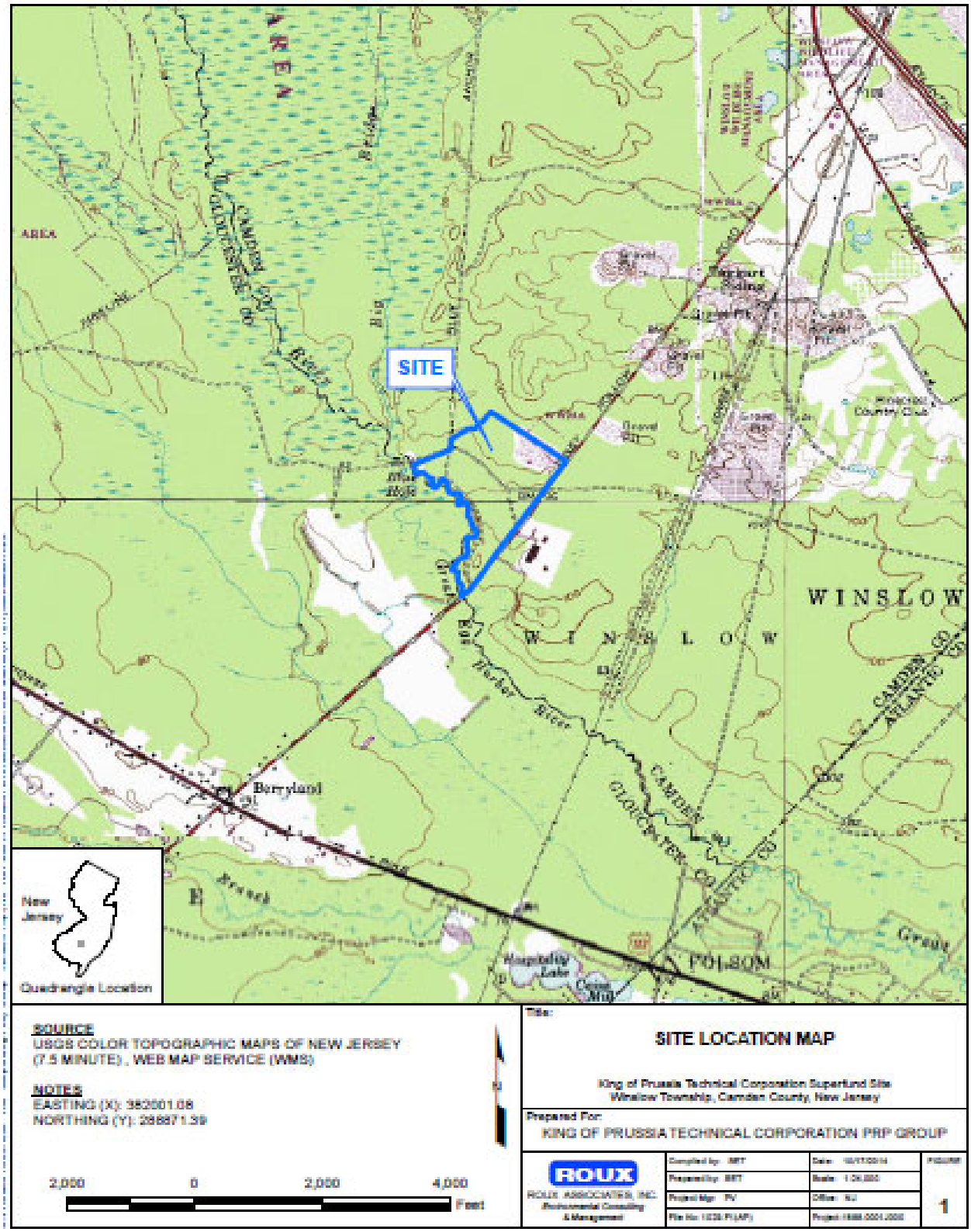

Figure 2: Locations of Monitoring and Recovery Wells