SIXTH FIVE-YEAR REVIEW REPORT FOR SOUTH BRUNSWICK TOWNSHIP LANDFILL SUPERFUND SITE MIDDLESEX, NJ

Prepared by

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Region 2
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Date

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
FS	Feasibility Study
GWQS	Groundwater Quality Standard
ICs	Institutional Controls
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
TBC	To be considereds
USACE	United States Army Corps of Engineers

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 review 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 sixth FYR for the South Brunswick Township Landfill Superfund Site. The triggering action for this statutory review is the 2012 FYR. 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 (UU/UE).

The South Brunswick Township Landfill Superfund Site FYR was led by Farnaz Saghafi, EPA Remedial Project Manager. Participants from EPA included Rachel Griffiths, Hydrogeologist, and Nicholas Mazziotta, human health risk assessor. The PRP, Republic Services Inc. (Republic), was notified of the initiation of the five-year review. The review began on 2/15/2017. The Site is addressed as one operable unit (OU), which is the subject of this FYR.

Site Background

Physical Characteristics

The South Brunswick Township Landfill, owned by Republic Services, Inc. (Republic), is located along New Road approximately one-half mile northwest of U.S. Route 1 in South Brunswick, Middlesex County, New Jersey. The landfill occupies an area of approximately 68 acres. A significant portion of the land surrounding the site is wooded. A private residence is located adjacent to the site, a school and park are located directly across New Road and a housing development has been constructed north of the site.

The site is in close proximity to Heathcote Brook, which is a tributary to the Millstone River. The City of New Brunswick occasionally draws water for drinking from an intake 10 miles downstream.

Geology/Hydrogeology

The site is located in the Piedmont physiographic province and lies within an outlier or erosional remnant of coastal plain sediment. The main outcrop of coastal plain sediment is approximately 1.5 miles to the southeast. Three distinct geologic units underlie the site. These units include from top to bottom, the Raritan Formation, residual soil or saprolite, and diabase or basaltic bedrock. Previous investigations have shown that only the sands of the Raritan Formation and the fractured basalt in the northeastern area of the site are capable of transmitting any significant amounts of water.

Groundwater exists at relatively shallow depths in the fill and underlying the Raritan Formation.

Typically, the shallow groundwater occurs under unconfined conditions, however, confined or semi-confined conditions are locally observed as a result of the variable lithology of the Raritan Formation. Groundwater flows in a southeasterly direction and the nearest public groundwater supply is located approximately one mile north of the site.

Groundwater flow occurs primarily in the horizontal direction and discharges to a stream or topographic low within a short distance from the site. The water table is highly variable and subject to seasonal fluctuations in response to differential rates of groundwater recharge. Groundwater within the fractured bedrock in the northeastern area of the site occurs under confined conditions. The unit is confined by the low permeability residual soils above and the relatively unfractured bedrock below.

Land and Resource Use

General land use and drinking water sources in the vicinity of the site have not changed since the issuance of the Record of Decision (ROD) in September 1987. However, in 2017, Republic Services is planning the installation of solar panels on the property for generation of renewable energy. Construction is scheduled to begin in late summer of 2017. All construction plans and specifications will be reviewed by the EPA and the NJDEP to ensure that the integrity of the landfill cap is protected and that all engineering controls, monitoring and maintenenace systems remain intact, accessible and in good operating condition.

This site is being addressed under one operable unit; however site remediation has been performed in three phases, consisting of the following elements:

- Phase I involved a hydrogeologic investigation designed to determine the nature and extent of contamination related to the site.

- Phase II called for the development of a Remedial Plan and construction of the EPA-selected remedy for the landfill. The Remedial Plan consisted of a leachate collection/treatment system, slurry wall, clay cap and gas venting system.

- Phase III consists of an on-going post remedial environmental monitoring program designed to provide a continuous assessment of the long-term effectiveness of the completed on-site remedial action.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: South Brunswick Landfill		
EPA ID: NJD980530679		
Region: 2	**State:** NJ	**City/County:** South Brunswick/Middlesex

SITE STATUS	
NPL Status: Deleted	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**
Author name (Federal or State Project Manager): Farnaz Saghafi
Author affiliation: EPA
Review period: 8/1/2012 - 8/1/2017
Date of site inspection: 2/15/2017
Type of review: Statutory
Review number: 6
Triggering action date: 9/1/2012
Due date *(five years after triggering action date)*: 9/1/2017

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The site, which operated for more than twenty years as a solid waste landfill, accepted municipal refuse, pesticides, chemical wastes and hazardous wastes. The landfill was registered with the New Jersey Department of Environmental Protection (NJDEP) on August 19, 1970. Pursuant to a closure order from the NJDEP on July 24, 1978, the site was officially closed on December 31, 1978.

In June 1980, the EPA conducted an investigation of the landfill. Sampling results revealed elevated levels of volatile organic compounds in seven on-site monitoring wells and at five on-site surface water sampling locations. As a result, the site was included on the National Priorities List (NPL) in December 1982.

Response Actions

Republic (previsouly known as Browning-Ferris Industries of South Jersey, Inc. (BFI)), as the owner and operator of the landfill since 1973, was identified by the EPA as a potentially responsible party with respect to the site. Accordingly, EPA entered into negotiations with the company and on April 5, 1982, EPA and BFI entered into an Administrative Order on Consent (AOC) which required BFI to investigate and remediate the site.

In accordance with the Administrative Order on Consent (RCRA-700320101) dated April 5, 1982, between BFI and EPA, several environmental investigations were conducted and served to develop a Remedial Plan for the Site. The Remedial Plan was submitted to EPA in February 1983.

The Remedial Action Plan consisted of the following elements:

- Multi-Layered Cap
- Slurry Wall
- Leachate Collection System
- Gas Venting System

The Remedial Action was initiated in May 1983 and completed in September 1985. In addition, a security fence was constructed along the site perimeter to restrict access, eliminate any nuisance threats and preserve the integrity of the remedial action.

The following describes in more detail each of the remedial components:

Multi-Layered Cap

A multi-layered cap was constructed over the entire Site. The cap consists of a 12-inch layer of compacted clay with a maximum permeability of 1.0×10^{-7} cm/sec overlain by a 6-inch sand drainage layer and a 6-inch vegetated soil layer. The cap functions to reduce infiltration of precipitation, promote surface water drainage and prevent direct contact with waste materials.

Slurry Wall

A slurry wall was constructed near the perimeter of the site with a length of over 7,000 feet and a minimum 3 foot width. The alignment was based on geologic conditions where the slurry wall could be keyed into competent bedrock or saprolite. Approximately 63% of the slurry wall is keyed into bedrock and the remaining length is keyed into saprolite. The slurry wall was reported to have a maximum permeability of 1.0×10^{-7} cm/sec and the slurry consists of a shale/silty sand mixture with 1% bentonite. The slurry wall functions to restrict potential horizontal movement of leachate from the Site.

Leachate Collection System

The leachate collection system is located on the inward (landfill) side of the slurry wall. The collection

system was constructed in a 3-foot wide trench and consists of a 6-inch diameter perforated corrugated polyethylene pipe in a coarse stone backfill. The stone and pipe are enclosed in a filter fabric envelope. In addition to the perimeter collection system, there is an interior collection system consisting of a collection line and a french drain which tie into the perimeter system. The collection line is located in the low lying area west of the drainage swale in the central area of the site and the french drain is located to the east of the drainage swale in the central area of the site. A second french drain was constructed in the northern section of the site outside the cut-off wall. The leachate collection system functions to control potential off-site leachate migration and reduce leachate heads within the landfill.

Gas Venting System

The gas collection system consists of three interior passive vents and a passive vent on each leachate manhole. The interior system consists of three 10-inch aluminum vent risers with shallow collection pipes radiating from the risers. A security fence is located around each vent riser. The manholes are vented by a 4-inch aluminum riser. The gas system functions to control the potential migration of landfill gas generated by the decomposition of waste.

Site Security Fence

A security fence circumscribes the site. A main gate is located in the southeastern corner of the site providing access from New Road. Various locking gates are located around the site. The purpose of the security fence is to prevent unauthorized access to the site.

Status of Implementation

On September 30, 1987, EPA issued a ROD that evaluated and concurred with the remedial action that was implemented by BFI, pursuant to the AOC. In addition, the ROD selected long term monitoring requirements for the site which included:

- Installation of groundwater monitoring wells along the perimeter of the site;
- Sampling and analysis of groundwater, surface water, sediments, and air;
- Measuring hydraulic gradients along the slurry wall;
- Identification of state and federal ambient and chemical specific ARARs; and
- Investigation of any potential off-site soil contamination related to previous off-site leachate migration

No remedial actions were conducted since all remedial activities were conducted under the AOC.

Institutional Controls

A Deed Notice filed in May 2002 has restricted use of the site to landfill closure, inspection, maintenance and monitoring. In accordance with this document, no owner or operator shall make any alteration, improvement, or disturbance in, to, or about the affected areas of the site which disturbs any engineering control or which creates an unacceptable risk of exposure to humans or the environment without first obtaining the express written consent of the EPA and the NJDEP.

IC Summary Table

Table 1: 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)
Soils	Yes	No	Capped area of landfill	Restrict use of site to landfill closure, inspection, maintenance and monitoring.	Deed Notice, May 2002

Systems Operations/Operation & Maintenance

As part of routine adjustments, Republic (formerly BFI) implemented other improvements to the remedy including construction of an on-site leachate pretreatment plant and surface water drainage improvements. The treatment plant was constructed in 1992 and 1993. Prior to construction of the plant, leachate was discharged directly to the sanitary sewer line for primary treatment by the Stony Brook Regional Sewerage Authority (SBRSA). The on-site plant was constructed pursuant to an Administrative Consent Order entered between BFI and NJDEP which required iron concentrations in the effluent to be reduced. On June 26, 1996, BFI was notified by Stony Brook Regional Sewerage Authority (SBRSA) of a change in classification from a Class 1 to Restricted Industrial User (RIU). Effective July 26, 1996, BFI was no longer required to monitor for iron and pre-treatment was no longer necessary. The plant was decommissioned shortly thereafter. Currently, Republic discharges directly to the sanitary sewer line while still monitoring pH, Chemical Oxygen Demand (COD), and flow on a monthly schedule under a license issued by the SBRSA.

Upgrades were made to the surface water drainage system in 1991 in compliance with the Freehold Soil Conservation District. The upgrades consisted of grading in the central area of the site, construction of five surface water drainage channels, improvements to five existing culverts, installation of energy dissipaters and a scour pad, and revegetation.

The draft Post-Closure Operation and Maintenance (O&M) Plan was submitted to EPA in 1997 and finalized in 2000. The O&M Plan provides for periodic inspection, maintenance and monitoring to evaluate and maintain the effectiveness of the existing source control measures. The O&M Plan is comprised of the following major elements:

- Inspection and Maintenance Plan;
- Monitoring Plan; and,
- Safety Plan.

The Inspection Plan is used for routine inspections of the following elements of the remedy in order to identify components requiring maintenance or repair:

1. Surface water drainage system (annual inspection in the spring);

2. Leachate collection system (semi-annual inspection in early spring and late fall);
3. Protective cover system (annual inspection in the spring);
4. Groundwater monitoring wells (semi-annual inspection);
5. Passive gas venting system (semi-annual inspection); and
6. Site security system (quarterly inspection).

The O&M Plan provides for scheduled monitoring and maintenance of the components of the remedy to ensure the continued effectiveness of the remedial systems:

1. Leachate is discharged to the sanitary sewer line for treatment by the SBRSA. Leachate is metered during discharge to the SBRSA. The meter is calibrated quarterly and a copy of the calibration certificate is provided to the SBRSA. In accordance with a letter from the SBRSA dated March 10, 2004, no further leachate sampling is required.

2. The Landfill Gas Emissions (LFG) venting system consists of three interior passive vents (PV-1, PV-2, and PV-3). The LFG vents are monitored annually for methane and non-methane hydrocarbons, and are analyzed by Air Toxics LTD of Folsom, California. In addition to sampling of the passive LFG vents, BFI monitors fourteen (14) gas monitoring probes along the perimeter of the site on the outboard side of the slurry wall. The gas monitoring probes are monitored monthly for percentage of the lower explosive limit and methane.

3. Groundwater is monitored by sampling fourteen (14) monitoring wells semi-annually for Target Compound List (TCL) VOCs, annually for Target Analyte List (TAL) metals and bi-annually for TCL SVOCs. Monitoring well R-10 is sampled quarterly for VOCs and annually for SVOCs and metals. Five off-property wells in the area of monitoring well R-10 are sampled quarterly for VOCs.

4. Surface water monitoring for VOCs and metals is performed quarterly as part of the Post Closure Plan.

5. Groundwater and leachate levels are monitored quarterly to evaluate the effectiveness of the leachate collection system in maintaining hydraulic control.

Since 1998, annual site investigations have been conducted to evaluate the effectiveness of the completed Remedial Action and evaluate the potential for off-site migration of contaminants, as required by the ROD.

The persistence of VOCs in groundwater outside the landfill slurry wall led to an investigation of the area near monitoring well R-10 beginning in July of 2001, during which a network of temporary borings and piezometers were installed to characterize the extent of contamination in the shallow groundwater in the R-10 area. An additional monitoring well, R-11, was installed at the property boundary downgradient of R-10. Results from groundwater sampling indicated that VOC contamination extends approximately 130 feet downgradient of R-10 to well R-11 and about 300 feet farther west of R-10 to temporary boring GW-5. Concentrations of chlorobenzene, chloroform, TCE, benzene and methylene chloride were observed in boreholes and newly installed wells in July 2001 and again in May 2002. Exceedances of chloroethane, 1,1-Dichloroethene, and 1,1,1-TCA were also observed, with a maximum concentration of chloroethane of 14,600 parts per billion (ppb) observed in PZ-1.

The investigation concluded that the downgradient extent of VOC impacts was localized as defined by off-Site wells TB-1, TB-3, TB-4 and TB-13 and the source area was determined to be limited to an approximately 500-foot length along the perimeter of the landfill. A remedial evaluation report was submitted by BFI to EPA in July 2003. In February 2004, EPA approved this report which called for the construction of an interceptor trench.

Construction of the 360-foot long interceptor trench took place in the fall of 2006 and included placement of bedding stone, installation of perforated high density polyethylene pipe (HDPE) and placement of filter sand. A groundwater transmission system including HDPE sump, pumps, power and control systems was also installed. The leachate from this area is collected and pumped with other landfill leachate to the POTW. The monitoring system for the interceptor trench consists of piezometers, measuring inward flow of groundwater.

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 2: Protectiveness Determinations/Statements from the 2012 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Protective	The remedy at the South Brunswick Landfill is currently protective of human health and the environment. In order for the remedy to be protective in the long term, two additional wells will be installed outside of the southwestern portion of the slurry wall to evaluate if an outward gradient exists.

Table 3: Status of Recommendations from the 2012 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
Sitewide	Evaluation of groundwater gradient	Install two wells in southwestern portion of slurry wall	Completed	While both wells were installed in December 2013, one had to be abandoned in April 2015 due to damage from a construction vehicle. Because of absence of VOC detections during previous monitoring events, the abandoned well was not recommended for replacement.	12/31/2013

Since the last Five Year Review, a solar farm developer (CEP Solar) has expressed interest in leasing capped areas of the Site from the current owner for solar panel construction and production of renewable energy. Republic has agreed to the redevelopment and land use change. Currently, construction mobilization is expected to begin during the Summer of 2017 and last approximately one year. The Site will continue to be monitored during as well as post-construction of the solar panels to ensure that the current remedy remains functioning as intended and protective of human health and the environment.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On November 14, 2016, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 38 Superfund sites in New York and New Jersey, including the South Brunswick Landfill Superfund site. The announcement can be found at the following web address: https://www.epa.gov/sites/production/files/2016-11/documents/five_year_reviews_fy2017_final.pdf. The results of the review and the report will be made available at the Site information repository located at South Brunswick Township Health Department and at EPA Region 2's office located at 290 Broadway, New York, NY.

Data Review

Hydraulic Monitoring

As part of the Post-Closure Monitoring Program, groundwater and leachate levels have been measured quarterly to evaluate the effectiveness of the leachate collection system to maintain hydraulic control in the landfill (i.e., the maintenance of inward groundwater flow gradients within the landfill). During the last five years, an inward hydraulic gradient has generally been maintained along the perimeter of the slurry wall as intended by the design. Hydraulic gradient data collected in the vicinity of the interceptor trench, constructed in 2006, indicate that the trench is operating as intended and is effective in capturing contaminated groundwater. Seasonal lows in groundwater level and outward gradients, especially during drier seasons, have been observed along the downgradient side of the landfill (near R-1, R-2, and R-3).

It has been concluded that the seasonal occurrence of an outward gradient at this section of the landfill would not itself compromise the effectiveness of hydraulic containment provided that 1) outward gradients do not persist year round and 2) groundwater and surface water quality data remain compliant with state and federal water-quality standards. Water quality data collected in wells R-1 through R-3, both historically and within the past five years, indicate only sporadic detections of VOCs at concentrations below NJDEP Ground Water Quality Standards (GWQS) and Federal Maximum Contaminant Levels (MCLs).

In response to the previous FYR recommendation to address uncertainty regarding the inward gradient and flow direction of the groundwater around the area of monitoring wells R-1, R-2, and R-3 in the southwestern portion of the site, monitoring wells R-12 and R-13 were installed outside of the slurry wall in December 2013 as shown on Figure 1. Though R-12 was decommissioned in April 2015 after construction activities rendered it unusable, the wells were sampled and gauged as part of the regular

sampling and analysis plan for the site. R-13 remains part of the site sampling and analysis plan. Hydraulic data captured from the wells confirms occasional seasonal variations in hydraulic gradient in the area.

Groundwater Monitoring

Groundwater data over the past five years were collected and analyzed for VOCs, SVOCs and metals. Offsite and piezometer VOC data is collected semi-annually, whereas on-site VOCs are monitoring annually. All metals data is collected annually, and only on-site SVOC data is collected every other year. VOCs historically detected at the site include benzene, chlorobenzene, chloroform, methylene chloride, trichloroethylene, and vinyl chloride. No SVOCs have been detected at the site since 2007.

Monitoring wells R-12 and R-13 were included in the regular sampling and analysis plan after their installation in 2013, and neither location has recorded concentrations of VOCs exceeding NJ GWQS or Federal MCLs during any sampling event. The groundwater monitoring results in this area confirm that seasonal outward hydraulic gradients are not having a negative effect on leachate containment along the slurry wall between locations R-1 and and the area of decommissioned well R-12.

Review of the groundwater sampling data since the last five-year review indicates that the levels of VOCs continue to exceed applicable groundwater quality standards at wells R-10 and R-11 (Figure 2), which are located outside of the slurry wall but upgradient of the groundwater interceptor trench. Concentrations of VOCs in these wells have been stable or decreasing, and are more elevated in the vicinity of monitoring well R-10, which is closer to the landfill. However, the groundwater interceptor trench downgradient of both wells has had no contaminant detections. Sampling data, coupled with hydraulic gradient data, indicate the interceptor trench is functioning as intended and demonstrate that this localized area of contamination is contained.

With the exception of sporadic chromium detections, the concentrations of metals detected in monitoring wells at the site are consistent with the results obtained during the last decade. Iron, manganese, aluminum, lead and other metal results indicate localized areas of metallic waste within the landfill but no significant migration into the groundwater. Concentrations of chromium currently exhibit no specific trend at this time (the maximum site detection for the past five years was noted at upgradient well R-8 in 2014. Chromium concentrations in monitoring wells R-8 (8,340 ug/1), located upgradient of the landfill and slurry wall to the northeast of the site, and R-10 (200 ug/l) and R-11 (79.9 ug/l) located in the southern portion of the site, exhibited concentrations above NJ GWQS and the MCL in the past five years. The observed contaminant concentrations do not appear to be site-specific and occur in conjunction with high turbidity conditions. However, as part of the monitoring plan, chromium will continue to be monitored.

In a response to EPA comments addressing the topic dated May 2, 2016, Republic Services proposed to remove dedicated pumps from wells R-7 (upgradient, prior chromium detections up to 264 ug/L) and R-8, sample using low-flow methods with a peristaltic pump, and analyze the groundwater samples for both total and dissolved metals concentrations for both sampling events in 2016. Data available from the first sampling event in July 2016 indicates that dissolved concentrations of chromium present in R-7 (28.6 ug/l) are comparable to total concentrations (41.6 ug/l), whereas dissolved chromium in R-8 (19.8 ug/l) was an order of magnitude lower than total concentrations (121 ug/l). This recent data indicates that chromium detections exceeding the NJ GWQS are associated with suspended particles due to high turbidity during sampling, however, the locations will continue to be monitored for chromium. Any

apparent trends or significant observations will be monitored in future monitoring reports, and any need for further action will be evaluated.

Surface Water Monitoring

Surface water monitoring for VOCs is performed semi-annually at location PCSW-1, in accordance with the Post-Closure Plan for the site, to evaluate the quality of surface water downgradient of the site as a result of VOC detections reported in monitoring well R-10 and to ensure that the remedy will continue to be protective of ecological receptors. No VOCs were detected above Federal MCLs or New Jersey GWQS during the last five years. However, the last round of sampling indicated that aluminum and manganese exceeded conservative ecological screening values. Therefore, surface water will continue to be monitored.

Gas Vent Sampling

The landfill gas extraction system is operated in accordance with the site standard operating procedure. The site does not produce sufficient landfill gas for the flare to operate continuously; therefore it is equipped with controls which automatically attempt to restart it sixteen hours after shutdown. Perimeter gas monitoring probes number 1 through 20 (GMP-1 through GMP-20) are monitored and the flare operation is verified on a routine basis. The venting system consists of three interior passive landfill gas vents (PV-1, PV-2 and PV-3) that are monitored annually for methane and non-methane hydrocarbons. There has been no measurable landfill gas flow at any of the vents during the sampling events.

Site Inspection

The inspection of the Site was conducted on 2/15/2017. In attendance were Farnaz Saghafi, EPA, Rachel Griffiths, EPA, Nicholas Mazziotta, EPA, Karl Schmit, Republic and Andrew Sokol, Taylor Geoservices. The purpose of the inspection was to assess the protectiveness of the remedy.

The site inspection consisted of a physical inspection of the landfill cap, leachate collection system, slurry wall, surface water drainage system (such as culverts for collection of surface runoff), security fence, surrounding wetlands and other components of the landfill.

The inspection commenced at the southeast corner of the property, near the site entrance. The inspection team walked the perimeter of the site and recorded relevant observations in a field logbook. The inspection proceeded along the perimeter of the site in a counterclockwise direction until the entire perimeter was traversed. In addition to inspecting cap features, gas monitoring probes, monitoring wells, gas vents, and leachate manholes, pump stations and the site fence were visually inspected. The interceptor trench system near monitoring well R-10 and surrounding wetlands were inspected. After inspection of the site perimeter, the central portion of the site was traversed and the surface water drainage features were inspected.

The following sections present the results of the site inspection broken down by each element of the site remedy.

Multi-Layered Cap

Inspection of the landfill cap resulted in discovery of several animal burrows of various sizes and depths. Animal burrows have commonly been found and backfilled at the site as part of the regular annual inspection performed by Republic. Small slope irregularities, depressions in the cap and areas of differential settlement and distressed vegetation were also noted in the cap. Some drainage swales did not appear to drain positively off the cap based on observation of ponded water at these locations. Since the site visit, measures have been taken to correct the slope and rectify the drainage of ponding water. No cracking, excessive erosion, seeps, slope instability, or excessive vegetative growth were observed on the landfill cap. All monitoring wells inspected during the site visit were locked and in good condition.

Slurry Wall

While inspecting the perimeter of the site, the slurry wall was assessed for signs of distress or settlement. No obvious signs of distress or settlement were observed along the slurry wall alignment during the site inspection.

Leachate Collection System

Pump Station A as well as Pump Station B have relatively light "Bilko" doors. These doors are normally secured with a lock and chain to prevent unauthorized entry. The remaining manholes have heavy-duty, street rated sewer lids which are difficult to remove, making accidental entry improbable.

Gas Venting System

All passive gas vents and gas monitoring probes observed during the site inspection were in good condition, labeled, and locked.

Site Security Fence

The security fence was generally in good shape. Republic personnel indicated that occasional trespassers break through the fence in order to drive their all terrain vehicles through the property. Republic regularly inspects the fence and repairs any such areas of damage. All personnel gates observed during the site inspection were locked.

Record Keeping

Site specific documents such as the Health and Safety Plan, As-Built Drawings, Maintenance Logs and the Final Post Closure Operation and Maintenance Plan are not kept at the site due to the lack of a suitable place within the site property. However, they are maintained at the offices of Republic's contractor, Taylor Geoservices, in Newtown Square, PA.

V. TECHNICAL ASSESSMENT

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

All components of the remedy are functioning as intended by the decision documents. The remedy consists of a multilayered cap, a perimeter slurry wall/leachate collection system, and a gas venting system. The cap is composed of a 6-inch sand drainage layer over topped by a 6-inch layer of vegetated soil cover and a 12-inch layer of compacted clay. The cap is generally in good condition and has been functioning to reduce infiltration and promote surface water drainage. Water-quality data in monitoring wells around the landfill show that contaminated groundwater is contained within the landfill area, except for seasonal fluctuations around monitoring wells R-2 and R-3.

A low permeability slurry wall constructed near the perimeter of Site restricts horizontal movement of leachate from the Site. A leachate collection system, also installed along the Site perimeter, collects and conveys leachate by gravity to one of two pumps. There is also an interior collection system consisting of collection lines and French drains that are tied into the perimeter system. The slurry wall and leachate collection system function to contain leachate within the landfill. Post-closure monitoring data indicate that inward hydraulic heads are generally maintained. Operation and maintenance records indicate that regular inspections and maintenance to the collection and pumping systems are being performed in accordance with the approved O&M Plan.

In the fall of 2006, a 360-foot long interceptor trench was installed outside the slurry wall to address one area of groundwater contamination detected outside the slurry wall in the area of well R-10. This trench connects to the leachate collection system sending leachate to the POTW.

A gas venting system, consisting of three interior passive vents and a passive vent on each leachate manhole, is operational. As indicated in the most recent annual post closure environmental monitoring report, only one (PV-2) of the three passive gas vents was intact for the June 2016 monitoring event, and it was determined to have no measurable flow. The two damaged passive gas vents (PV-1 and PV-3) were repaired as of February 2017 and will be included in future monitoring events. During the Site inspection, no noticeable gas odors were observed at the site. The security fence surrounding the Site is in good condition.

A palustrine forested wetland area along the southem border of the South Brunswick Landfill site was impacted as a result of remedial activities associated with the construction of a groundwater interceptor trench in late 2006. Consequently, restoration work was performed to mitigate the disturbance. Wetland monitoring is continuing on an annual basis to ensure success of the restoration effort.

A monitoring program involving periodic surface water sampling is being conducted to ensure that the remedy will continue to be protective of ecological receptors. The last round of sampling indicated that aluminum and manganese exceeded conservative ecological screening values. Therefore, the surface water sampling should be continued.

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?

Land and Resource Use

There have been no changes in the physical conditions of the Site over the past five years that would change the protectiveness of the remedy. In general, the Site has limited access based on

its location with a significant portion of the property around the landfill being wooded. A private residence is located adjacent to the Site, a school and park are located directly across New Road to the east, and a housing development exists north of the Site. A new residential development is currently undergoing construction adjacent to the southwestern border of the Site; however, the landfill cap, perimeter fencing and signage provide barriers to residential or trespasser exposure. In the past, trespassers have cut through the fencing to ride all-terrain vehicles on the Site. During the most recent Site inspection, BFI personnel indicated that trespassing has not occurred in recent years, although fence and cap inspections and maintenance activities are still performed routinely.

The property is zoned R-1, residential, and drinking water in the area is provided by a municipal source. Groundwater use at the Site is not expected to change.

Since the last FYR, a solar farm developer (CEP Solar) has indicated interest in leasing areas of the Site from the current owner for solar panel construction and production of renewable energy. Although specific designs and contract developments are ongoing, construction mobilization is anticipated to begin during the Summer of 2017 and last approximately one year. During the Site inspection, a representative from CEP Solar stated that all construction is expected to be surficial. If any subsurface work were to occur, which is highly unlikely, it would be performed under the supervision of the EPA and NJDEP and in accordance with site-specific health and safety and landfill cap management protocols, to maintain the integrity of the cap and prevent exposure to potentially contaminated material beneath. In addition, the Site will continue to be monitored to ensure the remedy remains functioning as intended and protective of human health.

Changes in Toxicity Characteristics

As discussed in the previous FYR, the chemicals of concern in Site groundwater include benzene, chloroform, 1,2-dichloroethane, methylene chloride, trichloroethylene, vinyl chloride, chlorobenzene, 4-methyl-2-pentanone, and toluene. The ROD established state and federal MCLs as the cleanup criteria for each of these contaminants, which remains valid. The toxicity values for many of these chemicals have been updated since the 1987 ROD; however, these changes would not impact the remedial decision, or cleanup criteria chosen for the Site.

Soil Vapor Intrusion

Currently, there are no residences or other structures on the Site, except for a wastewater treatment plant that is no longer operating. Although elevated levels of site-related VOCs have been detected outside of the slurry wall to the southeast (near wells R-10 and R-11), there are no structures presently located, or expected to be erected, in this area. A new residential housing development is currently undergoing construction just southwest of the Site. Three monitoring wells (R-2, R-3, and R-13) currently exist outside the slurry wall in this area, approximately within 100 feet of potential future residences. Data recently collected from these wells, between 2013 and 2015, indicates that site-related VOCs were non-detect with the exception of toluene and chlorobenzene. These chemicals, however, were detected at levels below 5 µg/l, several orders of magnitude below respective MCLs and target groundwater vapor intrusion screening levels, reflecting a cancer risk of 1×10^{-6} and noncancer hazard of 1. Therefore, no vapor intrusion concerns currently exist.

Remedial Action Objectives

No remedial action objectives were identified in the 1987 ROD; therefore, they cannot be evaluated in this review. However, based on the past remedial actions and ongoing monitoring at the site, human and ecological exposure pathways have been addressed.

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

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1

OTHER FINDINGS

None.

VII. PROTECTIVNESS STATEMENT

The remedy at the South Brunswick Landfill is currently protective of human health and the environment.

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

VIII. NEXT REVIEW

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

FIGURE 1

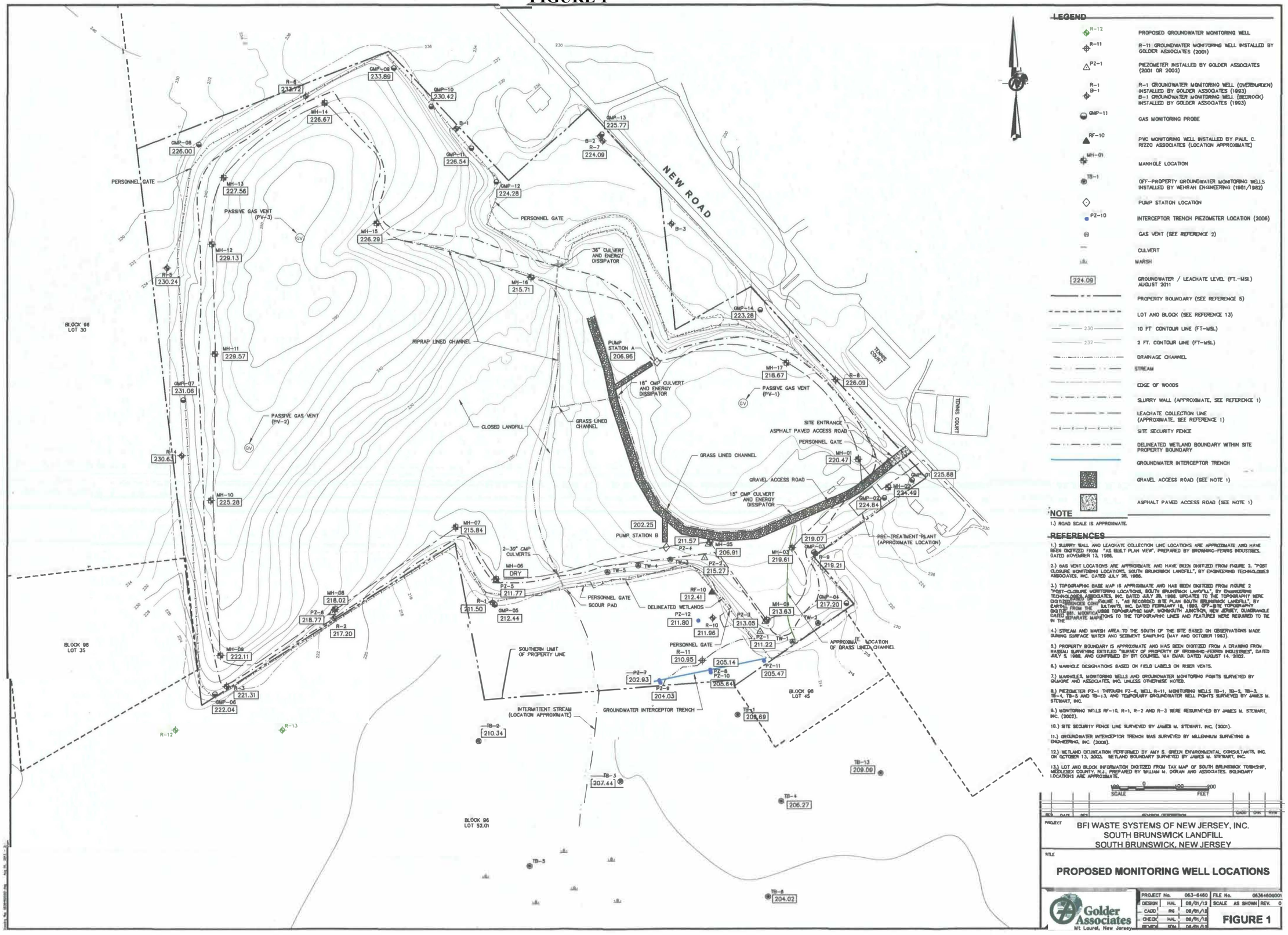
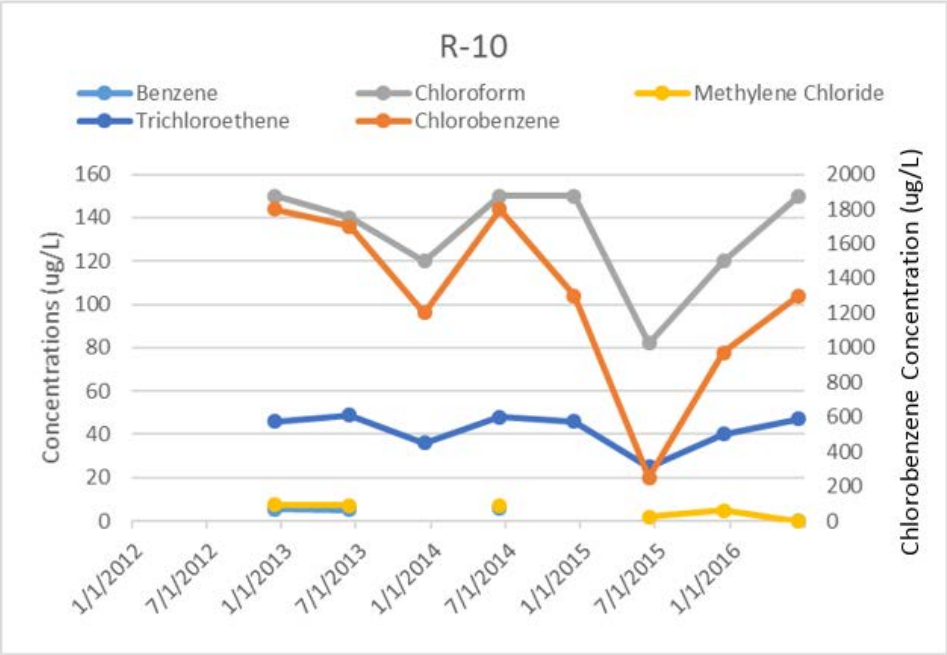
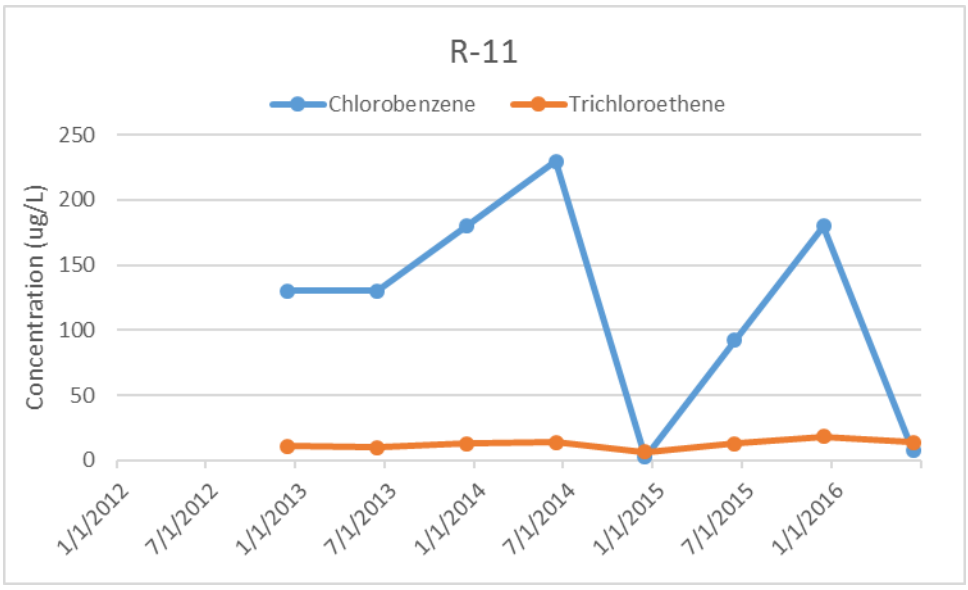

NEW ROAD
PERSONNEL GATE
PASSIVE GAS VENT (PV-3)
PASSIVE GAS VENT (PV-2)
PASSIVE GAS VENT (PV-1)
36" CULVERT AND ENERGY DISSIPATOR
RIPRAP LINED CHANNEL
CLOSED LANDFILL
GRASS LINED CHANNEL
PUMP STATION A
206.96
18" CMP CULVERT AND ENERGY DISSIPATOR
15" CMP CULVERT AND ENERGY DISSIPATOR
SITE ENTRANCE
ASPHALT PAVED ACCESS ROAD
GRAVEL ACCESS ROAD
PRE-TREATMENT PLANT (APPROXIMATE LOCATION)
TENNIS COURT
TENNIS COURT
2-30" CMP CULVERTS
PUMP STATION B
202.25
SCOUR PAD
DELINEATED WETLANDS
APPROXIMATE LOCATION OF GRASS LINED CHANNEL
SOUTHERN LIMIT OF PROPERTY LINE
INTERMITTENT STREAM (LOCATION APPROXIMATE)
GROUNDWATER INTERCEPTOR TRENCH
BLOCK 95 LOT 30
BLOCK 96 LOT 35
BLOCK 96 LOT 52.01
BLOCK 96 LOT 45
R-6 214.72
GMP-08 233.89
GMP-10 230.42
MH-14 226.67
GMP-08 226.00
MH-13 227.56
MH-12 229.13
R-5 230.24
MH-11 229.57
GMP-07 231.06
R-4 230.63
MH-10 225.28
MH-15 226.29
GMP-11 226.54
B-1
B-2
R-7 224.09
GMP-13 225.77
GMP-12 224.28
B-3
MH-16 215.71
GMP-14 223.28
MH-17 218.67
R-8 226.09
MH-01 220.47
GMP-01 225.88
MH-02 224.49
GMP-02 224.84
MH-03 219.61
GMP-03 219.07
R-9 219.21
MH-04 213.63
GMP-04 217.20
MH-05 206.91
PZ-4 211.57
PZ-2 215.27
MH-06 DRY
PZ-5 211.77
R-1 211.50
GMP-05 212.44
MH-07 215.84
MH-08 218.02
PZ-6 218.77
R-2 217.20
MH-09 222.11
R-3 221.31
GMP-06 222.04
RF-10 212.41
PZ-12 211.80
R-10 211.96
PZ-3 213.05
PZ-1 211.22
R-11 210.95
205.14
PZ-11 205.47
PZ-7 202.93
PZ-8 PZ-10 205.64
PZ-9 204.03
TB-1 208.69
TB-2 210.34
TB-3 207.44
TB-4 206.27
TB-5
TB-6 204.02
TB-13 209.09
R-12
R-13
LEGEND
R-12 PROPOSED GROUNDWATER MONITORING WELL
R-11 R-11 GROUNDWATER MONITORING WELL INSTALLED BY GOLDER ASSOCIATES (2001)
PZ-1 PIEZOMETER INSTALLED BY GOLDER ASSOCIATES (2001 OR 2002)
R-1 B-1 R-1 GROUNDWATER MONITORING WELL (OVERBURDEN) INSTALLED BY GOLDER ASSOCIATES (1993) B-1 GROUNDWATER MONITORING WELL (BEDROCK) INSTALLED BY GOLDER ASSOCIATES (1993)
GMP-11 GAS MONITORING PROBE
RF-10 PVC MONITORING WELL INSTALLED BY PAUL C. RIZZO ASSOCIATES (LOCATION APPROXIMATE)
MH-01 MANHOLE LOCATION
TB-1 OFF-PROPERTY GROUNDWATER MONITORING WELLS INSTALLED BY WEHRAN ENGINEERING (1981/1982)
PUMP STATION LOCATION
PZ-10 INTERCEPTOR TRENCH PIEZOMETER LOCATION (2006)
GAS VENT (SEE REFERENCE 2)
CULVERT
MARSH
224.09 GROUNDWATER / LEACHATE LEVEL (FT.-MSL) AUGUST 2011
PROPERTY BOUNDARY (SEE REFERENCE 5)
LOT AND BLOCK (SEE REFERENCE 13)
10 FT CONTOUR LINE (FT-MSL)
2 FT. CONTOUR LINE (FT-MSL)
DRAINAGE CHANNEL
STREAM
EDGE OF WOODS
SLURRY WALL (APPROXIMATE, SEE REFERENCE 1)
LEACHATE COLLECTION LINE (APPROXIMATE, SEE REFERENCE 1)
SITE SECURITY FENCE
DELINEATED WETLAND BOUNDARY WITHIN SITE PROPERTY BOUNDARY
GROUNDWATER INTERCEPTOR TRENCH
GRAVEL ACCESS ROAD (SEE NOTE 1)
ASPHALT PAVED ACCESS ROAD (SEE NOTE 1)
NOTE
1.) ROAD SCALE IS APPROXIMATE.
REFERENCES
1.) SLURRY WALL AND LEACHATE COLLECTION LINE LOCATIONS ARE APPROXIMATE AND HAVE BEEN DIGITIZED FROM "AS BUILT PLAN VIEW", PREPARED BY BROWNING-FERRIS INDUSTRIES, DATED NOVEMBER 13, 1986.
2.) GAS VENT LOCATIONS ARE APPROXIMATE AND HAVE BEEN DIGITIZED FROM FIGURE 2, "POST CLOSURE MONITORING LOCATIONS, SOUTH BRUNSWICK LANDFILL", BY ENGINEERING TECHNOLOGIES ASSOCIATES, INC. DATED JULY 28, 1988.
3.) TOPOGRAPHIC BASE MAP IS APPROXIMATE AND HAS BEEN DIGITIZED FROM FIGURE 2 "POST-CLOSURE MONITORING LOCATIONS, SOUTH BRUNSWICK LANDFILL", BY ENGINEERING TECHNOLOGIES ASSOCIATES, INC. DATED JULY 28, 1988. UPDATES TO THE TOPOGRAPHY WERE DIGITIZED FROM FIGURE 1, "AS RECORDED SITE PLAN, SOUTH BRUNSWICK LANDFILL", BY EARTH CONSULTANTS, INC. DATED FEBRUARY 18, 1992. OFF-SITE TOPOGRAPHY DIGITIZED FROM THE USGS TOPOGRAPHIC MAP, MONMOUTH JUNCTION, NEW JERSEY, QUADRANGLE DATED 1951, MODIFICATIONS TO THE TOPOGRAPHIC LINES AND FEATURES WERE REQUIRED TO TIE IN THE SEPARATE MAPPINGS.
4.) STREAM AND MARSH AREA TO THE SOUTH OF THE SITE BASED ON OBSERVATIONS MADE DURING SURFACE WATER AND SEDIMENT SAMPLING (MAY AND OCTOBER 1983).
5.) PROPERTY BOUNDARY IS APPROXIMATE AND HAS BEEN DIGITIZED FROM A DRAWING FROM MASSAU SURVEYING ENTITLED "SURVEY OF PROPERTY OF GROWMARK-FERRIS INDUSTRIES", DATED JULY 5, 1988, AND CONFIRMED BY BFI COUNSEL VIA EMAIL DATED AUGUST 14, 2002.
6.) MANHOLE DESIGNATIONS BASED ON FIELD LABELS ON RISER VENTS.
7.) MANHOLES, MONITORING WELLS AND GROUNDWATER MONITORING POINTS SURVEYED BY GRAHAM AND ASSOCIATES, INC. UNLESS OTHERWISE NOTED.
8.) PIEZOMETER PZ-1 THROUGH PZ-6, WELL R-11, MONITORING WELLS TB-1, TB-2, TB-3, TB-4, TB-5 AND TB-13, AND TEMPORARY GROUNDWATER WELL POINTS SURVEYED BY JAMES M. STEWART, INC.
9.) MONITORING WELLS RF-10, R-1, R-2 AND R-3 WERE RESURVEYED BY JAMES M. STEWART, INC. (2002).
10.) SITE SECURITY FENCE LINE SURVEYED BY JAMES M. STEWART, INC. (2001).
11.) GROUNDWATER INTERCEPTOR TRENCH WAS SURVEYED BY MILLENNIUM SURVEYING & ENGINEERING, INC. (2008).
12.) WETLAND DELINEATION PERFORMED BY AMY S. GREEN ENVIRONMENTAL CONSULTANTS, INC. ON OCTOBER 13, 2003. WETLAND BOUNDARY SURVEYED BY JAMES M. STEWART, INC.
13.) LOT AND BLOCK INFORMATION DIGITIZED FROM TAX MAP OF SOUTH BRUNSWICK TOWNSHIP, MIDDLESEX COUNTY, N.J., PREPARED BY WILLIAM M. DORAN AND ASSOCIATES. BOUNDARY LOCATIONS ARE APPROXIMATE.
100 0 100 200
SCALE FEET
REV. DATE DES. REVISION DESCRIPTION CADD CHK. RVW.
PROJECT
BFI WASTE SYSTEMS OF NEW JERSEY, INC.
SOUTH BRUNSWICK LANDFILL
SOUTH BRUNSWICK, NEW JERSEY
TITLE
PROPOSED MONITORING WELL LOCATIONS
Golder Associates
Mt Laurel, New Jersey
PROJECT No. 063-6460 FILE No. 0636460001
DESIGN HAL 08/01/12 SCALE AS SHOWN REV. 0
CADD PG 08/01/12
CHECK HAL 08/01/12
REVIEW RDM 08/01/12
FIGURE 1

Figure 2


R-10
Benzene
Chloroform
Methylene Chloride
Trichloroethene
Chlorobenzene
Concentrations (ug/L)
Chlorobenzene Concentration (ug/L)
160
140
120
100
80
60
40
20
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1/1/2012
7/1/2012
1/1/2013
7/1/2013
1/1/2014
7/1/2014
1/1/2015
7/1/2015
1/1/2016


R-11
Chlorobenzene
Trichloroethene
Concentration (ug/L)
250
200
150
100
50
0
1/1/2012
7/1/2012
1/1/2013
7/1/2013
1/1/2014
7/1/2014
1/1/2015
7/1/2015
1/1/2016

APPENDIX A – REFERENCE LIST

- Wehran Engineering, Certification Report for Slurry Trench Cut off Wall Construction South Brunswick Township Landfill Remedial Action Plan, June, 1984
- Browning Ferris Industries, Leachate Collection Systems Construction Report, May, 1986
- Record of Decision, September 1987
- Hydro Group, Inc., Field Operation Procedures (FOP) for Excavation, Storage, Cap Disruption, and Placement of Material at the Browning Ferris of South Jersey South Brunswick Landfill (Closed), November 17, 1992
- First Five-Year Review Report (PCOR), 1993
- Post Remedial Environmental Monitoring, Final Report, June 1996
- Second Five-Year Review Report, September 1997
- First Annual Post Closure Report, December 1998
- Second Annual Post Closure Report, December 1999
- Final Post Closure Operation and Maintenance Plan, October 2000
- Third Annual Post Closure Report, January 2001
- R-10 Area Groundwater Investigation Interim Data Report, November 2001
- Fourth Annual Post Closure Report, January 2002
- Leachate Collection System Field Investigation Report, March 2002
- USACE Inspection Report, August 2002.
- Third Five-Year Review Report, September 2002
- R-10 Area Groundwater Investigation Report, 2002
- Fifth Annual Post Closure Report, February 2003
- Final Focused Remedial Alternatives Analysis Report, 2004
- Sixth Annual Post Closure Report, April 2004
- Seventh Annual Post Closure Report, March 2005
- Eighth Annual Post Closure Report, March 2006
- Ninth Annual Post Closure Report, March 2007
- Construction Completion Report, Groundwater Interception Trench, April 2007
- Fourth Five-Year Review Report, September 2007
- Tenth Annual Post Closure Report, March 2008
- Eleventh Annual Post Closure Report, March 2009
- Twelfth Annual Post Closure Report, March 2010
- Thirteenth Annual Post Closure Report, March 2011
- Fourteenth Annual Post Closure Report, March 2012
- Fifteenth Annual Post Closure Report, March 2013
- Groundwater Sampling Results, Monitoring Wells R-12 and R-13, May 2014
- Sixteenth Annual Post Closure Report, August 2014
- Seventeenth Annual Post Closure Report, June 2015
- Eighteenth Annual Post Closure Report, March 2016
- Nineteenth Annual Post Closure Report, May 2017