

DRAFT

Decision Document for the Param Petroleum Site

This Decision Document identifies the selected remedy for the Param Petroleum Site located at the intersection of Route 130 South and Wood Street in the City of Burlington, Burlington County, New Jersey and provides the rationale for the selected remedy. The primary contaminants of concern that will be addressed as part of this Decision Document are gasoline-related contaminants in groundwater due to discharges from leaking Underground Storage Tanks (USTs). These contaminants are related to historical operations. The media investigated during the Remedial Investigation (RI) included soil, groundwater, surface water and sediment. Table 1 includes an evaluation of the Remedial Action Alternatives. Figure 1 shows the site location.

Soil

No further action is required for soil. Contamination of soil observed during UST removal in 1994 was no longer present as determined during the 2004 soil investigation.

Groundwater

“Enhanced Monitored Natural Attenuation” (Enhanced MNA) is the Selected Remedy for groundwater. The Enhanced MNA remedial alternative entails the use of Oxygen Release Compound (ORC) to enhance biodegradation or In-Situ Chemical Oxidation (ISCO) to promote In-Situ oxidation. A bench scale treatability study would need to be conducted to evaluate for the most appropriate product for the Site. For a conceptual design purposes ORC Advanced (calcium oxy-hydroxide) was used as a bioremediation agent and the chemical oxidizing agent RegenOx® and Modified Fenton’s Reagent for In-situ Chemical Oxidation.

To track the effectiveness of the remedial action, a groundwater monitoring program consisting of a two (2) quarterly groundwater monitoring events for ORC and (1) year for ISCO, semi-annual groundwater monitoring for the next three (3) years, and quarterly thereafter for two (2) years to track the effectiveness of contaminant degradation at the Site. Additionally, the Mann-Whitney U test will be conducted after the last eight (8) quarters of groundwater monitoring to evaluate the trend of groundwater contaminant degradation. A Classification Exception Area (CEA) would also be established to protect human health and the environment until contaminant concentrations are reduced to applicable standards

Background

The Param Petroleum Service Station has reportedly been operating as a retail gasoline/diesel service station since at least 1979, and currently remains active. The Site is approximately one acre in size, and is almost entirely paved with asphalt or concrete. There are two structures on the Site: one small building near the center of the Site, which houses the office and restroom; and a larger building that is leased to a car wash located on the eastern portion of the Site.

NJDEP has confirmed three documented discharges of gasoline product to the Site sanitary sewer, with one discharge resulting in free product accumulating in the City of Burlington Sewer Department's grit chamber. In December 1991 and January 1992, the NJDEP received several notifications of possible gasoline discharges detected by odors, following the delivery of gasoline to the Param facility. The odors were detected in a sanitary sewer collection system along Wood Street, and a kitchen floor drain at Santucci Caterers, a business located near the Site. NJDEP issued the site owner an NOV for these incidents and the owner was required to investigate and remediate the source of the vapors. In October of 1994, free product was found in the City of Burlington's sewer plant and sanitary sewer system. The NJDEP's Bureau of Emergency Response and the City of Burlington police and fire units traced the source back to the Site.

In late October and early November 1994, ten gasoline and three diesel USTs totaling 52,000 gallons capacity were removed and replaced with three new 12,000 gallon USTs of unknown construction. During the tank removal activities, numerous one- and two-inch diameter holes were identified in many of the tanks and at least one empty tank was observed filling with groundwater. Groundwater was typically encountered between 5 and 10 feet below grade. Additionally, in one of the excavations free product was observed. The current Site owner proposed a number of remedial investigation activities, including a receptor evaluation, though none were completed.

During a January 1995 site visit, NJDEP personnel observed the release of approximately 300 gallons of petroleum-contaminated groundwater to the soil from a tanker truck at the rear of the Param Petroleum property. Soil staining and PID detections were later observed in the vicinity of the release.

In January 1996, NJDEP again received notification of odors in the sanitary sewer collection system along Wood Street and kitchen floor drain at Santucci Caterers. These odors were traced to the site and an incident report was generated. The NJDEP issued another NOV for the incident requiring the owner to investigate and remediate the source of the vapors.

In July 1998, a NOV and Offer of Settlement was issued to the Site owner for failure to submit a RI report and receptor evaluation. A Directive and Notice to Insurers directing cleanup and removal of discharges by implementing a RI and related Remedial Action (RA), as well as an Administrative Consent Order (ACO) were issued.

During June 2000 and March 2001, the NJDEP completed two field sampling efforts at the Site. At several locations, sample results indicated MTBE, Xylenes, and other gasoline-related constituents occurring in subsurface soils at levels in excess of the most stringent NJDEP Soil Clean-up Criteria (SCC). The soil analytical results indicated the potential for residual source contamination in the areas of the former USTs. Groundwater samples also exhibited exceedances of the NJDEP Groundwater Quality standards (GWQS) at several locations.

Based on the results of the June 2000 and March 2001 NJDEP sampling event, the Louis Berger Group Inc. (Berger) was engaged to take over the investigation of this Site under NJDEP oversight. Berger submitted the RI report in August 2008 and the Remedial Action Evaluation Report (RASR) in March 2009. This document presents the Department's recommended final remedy for the clean-up of the site

Enforcement Status

On October 23, 1998, Param executed an ACO with the Department to perform the cleanup. Param, however, neither established the remediation funding source that the ACO required nor complied with the ACO. On December 6, 2002, the DEP issued an Administrative Order and Notice of Administrative Penalty Assessment for violation of the Underground Storage of Hazardous Substance Act and Spill Control Act. The Administrative Order assessed a penalty of \$100,000 and sought recovery of \$227,000 in economic benefit for their failure to expend the necessary funds to remediate the site. Rather than litigate the matter, Param agreed to comply with the most recent December Consent Order dated December 12, 2005. The 2005 Consent Order required that Param would pay \$100,000 penalty and at the conclusion of the remediation the Department would recalculate the economic benefit using the actual numbers that the remediation cost and interest until the remediation is complete. The Department also reserved the right to pursue a future action against Param to recover its past cost totaling \$361,332.

Soil

Despite previous indications of soil contamination at the time of the UST removal, no soil contamination was detected at the Site above the Soil Cleanup Standards (SCC) during July 2004 soil sampling event. Since then, the NJDEP introduced new Soil Remediation Standards (SRS) in June 2008 (NJDEP, 2008). The soil sampling results have been compared to the new SRS and there are no exceedances of the new criteria. Accordingly, no further action is warranted for soils at this site.

Groundwater

Groundwater on-site remains the only contaminated medium of concern that warrants action at this site.

Groundwater samples were collected and analyzed for Target Compound List Volatile Organic Compounds (TCL VO+10) with Tertiary Butyl Alcohol (TBA) and MTBE, Total Petroleum Hydrocarbons (TPHC), Target Compound List (TAL) Semi-Volatile Organic Compounds (SVOC)+20, and Target Analyte List (TAL) Metals. The results of groundwater sampling in December 2006, which is the most recent groundwater results for this Site, indicated the presence of benzene, TBA, and lead above the GWQS. Benzene concentrations were detected at 483 µg/L and 151 µg/L, which were above the GWQS for benzene of 1 µg/L. TBA concentrations screened at approximate depth interval of 1 to 11 feet bgs and screened at approximate depth interval of 42 to 52 feet bgs were at 6,870 µg/L and 261 µg/L, respectively, compared to its GWQS of 100 µg/L. When the October 2004 sampling event is compared to the September 2006 groundwater results, it appears that concentrations of benzene and TBA have been decreasing over time. Further, the relatively low concentrations of TBA at depth (MW-7), coupled with a

slight upward gradient and clean samples collected in association with Hydropunch® screening activities, indicate that TBA at depth is not a primary concern for remediation. Figure 2 shows groundwater exceedances for 2004 and 2006.

Lead was also detected off-site at the concentration of 5.4 µg/L, which was slightly above the GWQS of 5 µg/L. However, lead was never detected in any of the previous groundwater sampling events conducted at the Site. MW-8 is also located off-site, adjacent to Rte 130, and is likely anthropogenic contamination attributed to high automobile traffic along adjacent Rte 130. Therefore, lead contamination detected at MW-8 is not considered as site-related.

Groundwater beneath the Site was generally found to flow northwest in the eastern portion of the site, and southwest in the western portion of the Site, towards an unnamed tributary of the Delaware River. The overall evaluation of groundwater analytical results indicates that the site related contamination is confined to the property boundaries and contaminated groundwater is not migrating off-site.

Well Search

The well search did not identify any domestic wells, public supply wells, or irrigation wells within one mile of the site.

Baseline Ecological Evaluation

Contaminants of Ecological Concern related to gasoline products (MTBE, Benzene, Toluene, Ethylbenzene, Xylene, and lead) were previously identified in the Site groundwater and soils. Two surface water and two sediment samples were collected at the drainage channel west of Wood Street. Only lead in the sediment exceeded ecological criteria. Sediment samples SED101 and SED102 both exceeded the LEL of 31 mg/kg for lead and SED102 also exceeded the lead SEL of 250 mg/kg. The surface water sample SW101 (DUP101) and SW102 exceeded the human health SWQS (0.15 ppm) for benzene. No other exceedances of the ecological criteria were identified in the surface water and sediment samples. These lead exceedances in sediment are attributed to the heavy, long term vehicle traffic on surrounding roadways.

No environmentally sensitive areas exist on, or immediately adjacent to, the Site. The nearest environmentally sensitive area is the drainage channel which appears to begin just west of Wood Street, draining water from the adjacent roads and impervious areas. The channel flows northwest under Route 130 into a pond and, eventually, to the Delaware River.

No environmentally sensitive areas exist on, or immediately adjacent to, the Site. Although contaminants of ecological concern are present in the nearby drainage channel, these are not site-related and there is no direct contamination migration pathway from the Site to the channel. Surrounding roads and paved areas discharge to this channel. There were no signs of ecological stress observed in the drainage channel, and all investigated vegetated areas appeared healthy. Therefore, there is minimal ecological risk posed by the Site and no further ecological investigations are recommended.

Vapor Intrusion Modeling

The only structure within 100 feet of the single groundwater sample that exceeded the NJDEP groundwater level for vapor intrusion is the gas station pavilion which is regulated by OSHA. There is a school directly down gradient from the Site but the distance is greater 200 feet from the gas station and there are two clean wells between the gas station and the school. Based on this, it is determined that there was no need to do any further vapor intrusion investigations at the Site.

Remedial Action Selection Evaluation for Ground Water

No Further Action

The "No Further Action" alternative involves leaving the Site in its current condition with no remedial action considered. This remedial alternative does not entail any measures to control exposure to the contaminants of concern at the Site. The contaminants may continue to pose risks to human health and the environment. Additionally, the alternative may be perceived as unprotective by the community. Therefore, this remedial alternative is not pursued further in this evaluation process.

Monitored Natural Attenuation

The Monitored Natural Attenuation (MNA) remedial alternative uses natural processes which can reduce groundwater contamination levels over time through degradation, volatilization, adsorption/desorption, chemical transformation, advection and dispersion. Review of groundwater monitoring results from 2004 and 2006 remedial investigations indicate that natural processes have begun to attenuate contamination in groundwater at the Site. Institutional controls would limit exposure and long-term monitoring would track contaminant migration and exposure to potential receptors. The institutional controls for the Site would consist of establishment of a Classification Exception Area (CEA).

Proposed monitoring activities for the MNA alternative include sampling of groundwater at monitoring wells MW-1 through MW-9 semi-annually for the first 8 years and quarterly thereafter for 2 years to track the effectiveness of contaminant degradation by natural processes at the Site. Additionally, the Mann-Whitney U test will be conducted after the last eight (8) quarters of groundwater monitoring to evaluate the trend of groundwater contaminant degradation. **The total estimated cost for this alternative is \$350,000, which assumes a 10-year groundwater monitoring period.**

Enhanced Monitored Natural Attenuation

The Enhanced MNA remedial alternative entails the use of Oxygen Release Compound to enhance biodegradation or In-Situ Chemical Oxidation to promote In-situ oxidation. A bench scale treatability study would need to be conducted to evaluate for the most appropriate product for the Site. For conceptual design purposes ORC Advanced (calcium oxy-hydroxide) was used as a bioremediation agent and the chemical oxidizing agent RegenOx® and Modified Fenton's Reagent for In-situ Chemical Oxidation. A detailed description of biodegradation and chemical oxidation and costs associated with these enhanced monitored natural attenuation processes are described below:

Enhanced Monitored Natural Attenuation – Oxygen Release Compound

The Enhanced Monitored Natural Attenuation (EMNA) remedial technology entails the injection of materials enhancing biodegradation activities of subsurface microorganisms to degrade Site contamination such as Oxygen Release Compound Advanced (ORC Advanced®) by Regenesis Inc, EHC-OTM by Adventus Americas, Inc., etc.

ORC Advanced® is a proprietary formulation of calcium oxy-hydroxide that releases oxygen for approximately 12 months to stimulate indigenous aerobic microbes to significantly accelerate rates of biodegradation. It is assumed that one mandatory injection event plus an optional injection one year later would be implemented.

A total of approximately 9,000 pounds of ORC Advanced® would be injected (approximately 4,500 lbs of ORC Advanced® for each injection event) at approximately 40 locations to the subsurface at 5 to 15 feet bgs. A field pilot study would need to be conducted to increase effectiveness and applicability of this technology to the Site conditions. Figure 3 shows proposed ORC injection locations.

To track the effectiveness of the remedial action, a groundwater monitoring program consisting of quarterly groundwater monitoring for two (2) years, semi-annual groundwater monitoring for the next three (3) years, and quarterly thereafter for two (2) years to track the effectiveness of contaminant degradation at the Site. Additionally, the Mann-Whitney U test will be conducted after the last eight (8) quarters of groundwater monitoring to evaluate the trend of groundwater contaminant degradation is proposed. Groundwater samples would be collected from monitoring wells MW-1 through MW-9. A CEA would also be established to protect human health and the environment until contaminant concentrations are reduced to applicable standards. **The total estimated cost for this approach is \$600,000 which assumes a 5-year groundwater monitoring period.**

Enhanced Monitored Natural Attenuation - In-Situ Chemical Oxidation

The In-situ Chemical Oxidation remedial technology entails the use of chemical oxidizing agent such as RegenOx® (by Regenesis Inc.) and Modified Fenton's Reagent. A bench scale treatability study would need to be conducted to evaluate for the most compatible chemicals for the Site.

Once in the subsurface, RegenOx® produces oxidation reactions via a number of mechanisms including: surface mediated oxidation, direct oxidation and free radical oxidation. However, compared to the ORC alternative, RegenOx® has a short "life span", about 30 days in-situ; thus this alternative depends on the distribution of RegenOx® in the subsurface; so that it contacts the contamination soon after injection.

An approximate total of 30,000 lbs of RegenOx® is proposed to be applied to the subsurface at approximately 5 to 15 feet bgs and at multiple locations using direct push

method. A total of 150 injection points with a spacing to allow approximately 10 feet radius of influence are proposed. Figure 4 shows proposed RegenOx injection locations.

The ISCO alternative would entail a total of two (2) applications (one mandatory injection event plus one optional injection event) of an equal amount of RegenOx® injection.(i.e., approximately 10 lbs/foot or 15,000 lbs for each application). A field pilot study would need to be conducted to increase effectiveness and applicability of this technology to the Site conditions.

To track the effectiveness of the remedial action, a groundwater monitoring program consisting of quarterly groundwater monitoring for one (1) year, semi-annual groundwater monitoring for the following three (3) years, and quarterly sampling thereafter for two (2) years to track the effectiveness of contaminant degradation at the Site. Additionally, the Mann-Whitney U test will be conducted after the last eight (8) quarters of groundwater monitoring to evaluate the trend of groundwater contaminant degradation) is proposed. Groundwater samples would be collected from monitoring wells MW-1 through MW-9. A CEA would also be established to protect human health and the environment until contaminant concentrations are reduced to applicable standards. **The total estimated cost development of this approach is \$550,000, which assumes a 5-year groundwater monitoring period.**

Air Sparging/Soil Vapor Extraction (AS/SVE)

Air Sparging/Soil Vapor Extraction (AS/SVE) is a proven in-situ remediation technology for the saturated and unsaturated (vadose) zones. This alternative involves the injection of air into the groundwater source zone, volatilizing volatile and semi-volatile organic contaminants into the unsaturated zone. The application of SVE concurrently in the unsaturated soil removes the generated vapor-phase contaminants from the vadose zone. The extracted contaminated vapor would then be treated by GAC adsorption or other processes prior to discharge into the atmosphere.

Horizontal extraction trenches would be installed to collect extracted vapor due to shallow groundwater table at the Site. The flow rate of the AS wells is estimated to be 50 cfm. The extracted vapor is assumed to be treated ex-situ by GAC adsorption for this alternative. A field pilot study would be conducted to ensure effectiveness of the design specifications (e.g., flow rate and radius of influence). Figure 5 shows the Soil Vapor Extraction/Air Sparging System.

It is estimated that this alternative would require approximately five (5) years of operation to accomplish remedial goal. Groundwater sampling would be conducted quarterly for the first five (5) years and semi-annually for the next three (3) years to track the effectiveness of the remedial action. An additional two (2) years of groundwater monitoring along with the Mann-Whitney U test would be conducted thereafter to evaluate the trend of groundwater contaminant degradation weekly vapor pressure and/or flow rate readings would also be recorded at the AS/SVE wells and the monitoring points to monitor the system performance. The SVE wells and the GAC system influent/effluent would be sampled and tested monthly to determine the need for carbon

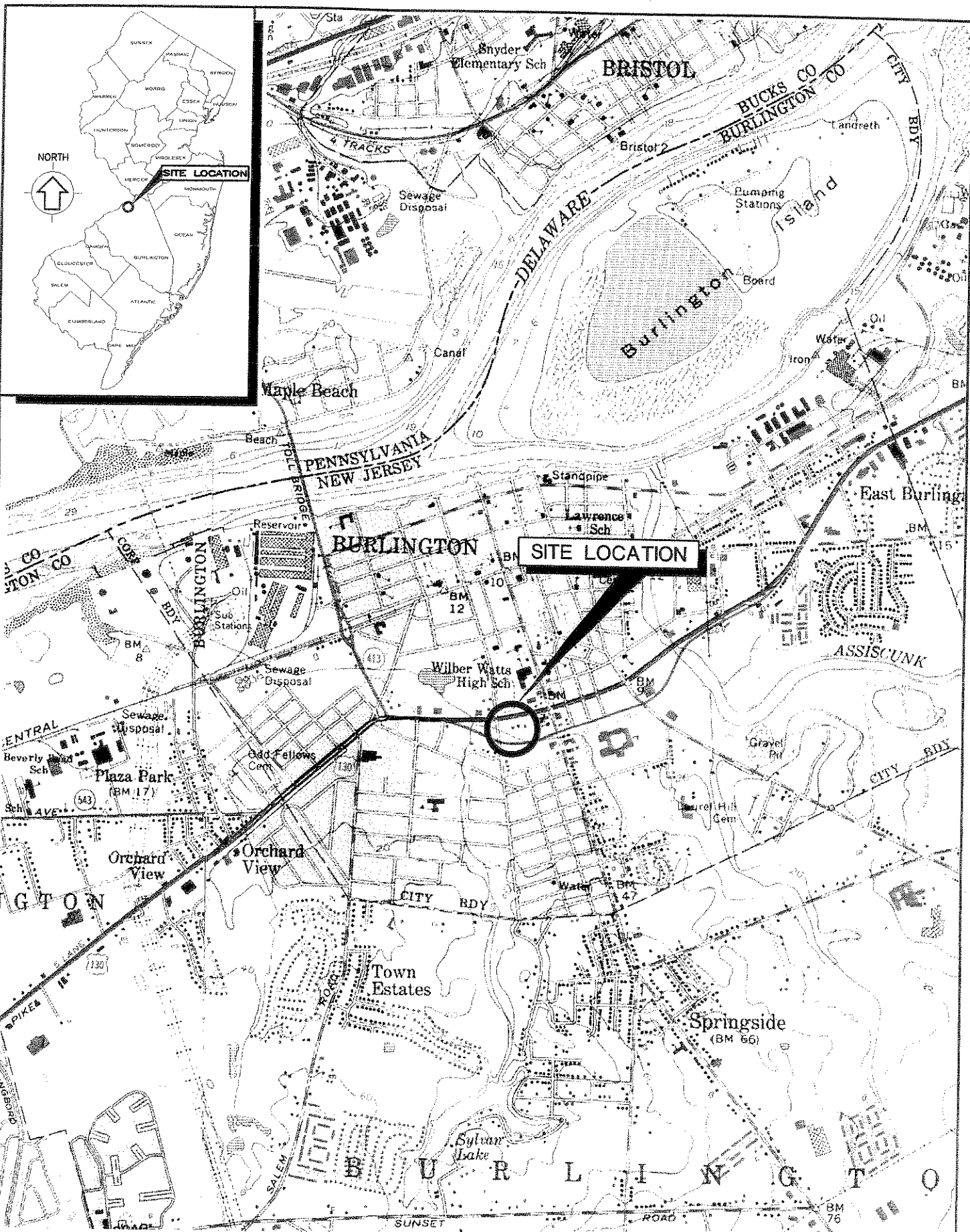
replacement and monitor the air discharge, respectively. The total estimated cost development of this approach is \$1,700,000, which assumes a 8-year groundwater monitoring period.

NJDEP Selected Remedy:

Groundwater: Enhanced Monitored Natural Attenuation – Oxygen Release Compound

The Enhanced Monitored Natural Attenuation remedial technology entails the injection of materials enhancing biodegradation activities of subsurface microorganisms to degrade Site contamination to the applicable NJDEP GWQS. To track the effectiveness of the remedial action, a groundwater monitoring program would be initiated. A CEA would also be established to protect human health and the environment until contaminant concentrations are reduced to applicable standards.

The Estimated Net Present Value Cost for Enhanced Monitored Natural Attenuation is \$600,000.



Source: USGS 7.5 Min. Quadrangle, Beverly, N.J., Bristol, PA. - N.J.

Scale: 1" = 2000'



N.J. Department of Environmental Protection

PARAM PETROLEUM SITE, ROUTE 130 AND WOOD STREET
 BURLINGTON CITY, BURLINGTON COUNTY, NEW JERSEY

SITE LOCATION MAP

NJDEP CONTRACT No. A-60243



The Louis Berger Group, Inc.
 30 Vreeland Road
 Florham Park, NJ

FIGURE 1