UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION III

STATEMENT OF BASIS

ROHM AND HAAS COMPANY
BRISTOL PLANT
North Parcel
Former Wastewater Treatment Area
Manufacturing Area

200 Route 413
Bristol, Pennsylvania

EPA ID NO. PAD 002 292 068

Prepared by
RCRA Corrective Action Program
Land, Chemicals and Redevelopment Division

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List of Acronyms

Act 2	**Pennsylvania Land Recycling Program**
AOC	**Area of Concern**
BA	**Butyl Acrylate**
BCEE	**Bis(2-chloroethyl)ether**
BCMCC	**Former Bucks County Mosquito Control Commission**
bgs	**Below Ground Surface**
DDX	**4,4'-DDD, 4,4'-DDE, and 4,4'-DDT**
Drinking Water Standard	**MCL or RSL where an MCL is not established for a constituent**
EA	**Ethyl Acrylate**
EPA	**United States Environmental Protection Agency**
Final Decision	**Final Decision and Response to Comments**
ISCO	**In Situ Chemical Oxidation**
MCL	**Federal Maximum Contaminant Level for Drinking Water**
mg/kg	**Milligram per Kilogram**
mg/l	**Milligram per Liter**
NAPL	**Non-Aqueous Phase Liquid**
PADEP	**Pennsylvania Department of Environmental Protection**
PAH	**Polycyclic Aromatic Hydrocarbon**
PCB	**Polychlorinated Biphenyl**
PCE	**Tetrachloroethylene**
POC	**Point of Compliance**
RCRA	**Resource Conservation and Recovery Act**
RFI	**RCRA Facility Investigation**
RSL	**EPA Region 3 Screening Level**
SHS	**Pennsylvania Act 2 Statewide Health Standard**
SSS	**Pennsylvania Act 2 Site-Specific Standard**
SVOC	**Semivolatile Organic Compound**
SWMU	**Solid Waste Management Unit**
SWQC	**Pennsylvania Surface Water Quality Criterion**
TCE	**Trichloroethylene**
ug/l	**Micrograms per Liter**
VOC	**Volatile Organic Compound**

Section 1: Introduction

The United States Environmental Protection Agency (EPA) has prepared this Statement of Basis to solicit public comment on its proposed remedy for the following three areas of the Rohm and Haas Company Bristol Plant (hereafter referred to as Facility): the North Parcel, the Former Wastewater Treatment Area, and the Manufacturing Area. The Facility is located at 200 Route 413, Bristol, Pennsylvania 19047. Rohm & Haas Company was purchased by Dow Chemical Company in 2009. Rohm & Haas Company is a wholly-owned subsidiary of Dow Chemical Company.

EPA's proposed remedy for the Facility areas consists of the following components:

1) Implement soil and groundwater use restrictions through institutional controls;
2) Remediate selected areas of contamination by treatment or soil removal; and
3) Monitor groundwater in selected areas to document the control of contamination.

Many elements of the proposed remedy are already implemented.

This Statement of Basis highlights key information relied upon by EPA in proposing its remedy for the Facility.

The Facility is subject to EPA's Corrective Action program under the Solid Waste Disposal Act, as amended, commonly referred to as the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Sections 6901 et seq. The Corrective Action Program requires that owners and/or operators of facilities subject to certain provisions of RCRA investigate and address releases of hazardous waste and hazardous constituents, usually in the form of soil or groundwater contamination, that have occurred at or from their property. The Commonwealth of Pennsylvania is not authorized for the Corrective Action Program under Section 3006 of RCRA. Therefore, EPA retains primary authority in the Commonwealth of Pennsylvania for the Corrective Action Program. EPA notes that several areas of the Facility received a release of liability from the Pennsylvania Department of Environmental Protection (PADEP) under Pennsylvania's Land Recycling Program (commonly known as Act 2).

EPA is providing a thirty (30) day public comment period for this Statement of Basis. EPA may modify its proposed remedy based on comments received during this period. EPA will announce its selection of a final remedy for the Facility in a Final Decision and Response to Comments (Final Decision) after the public comment period has ended.

Information on the Corrective Action Program can be found by navigating to https://www.epa.gov/hw/learn-about-corrective-action. A fact sheet for the Facility can be found by navigating to https://www.epa.gov/hwcorrectiveactionsites/hazardous-waste-cleanup-dow-chemical-formerly-rohm-and-haas-chemicals-llc. The Administrative Record for this proposed remedy contains all documents, including data and quality assurance information, on which EPA's proposed remedy is based. See Section 8, Public Participation, for information on how you may review the Administrative Record.

Section 2: Facility Background

The Facility has been an active chemical manufacturing plant since 1917. It covers approximately 800 acres along the west bank of the Delaware River, in Bristol Township, Bucks County. The Facility is adjacent to the communities of Croydon and Bristol Borough, PA. Land use surrounding the Facility includes residential and industrial property to the north, west and east. The Delaware River bounds the Facility to the south. (Figure 1, Location Map)

Due to the Facility's large size and the diversity of operations, it was divided into the following study areas for the purpose of environmental investigations (Figure 2, Corrective Action Study Areas):

- Bristol Landfill,
- Ammonium Sulfate Area,
- North Parcel,
- Former Wastewater Treatment Area,
- Manufacturing Area, and
- Trailer Staging Area.

The proposed remedy described in this Statement of Basis is for the North Parcel, the Former Wastewater Treatment Area, and the Manufacturing Area. The Bristol Landfill and the Ammonium Sulfate Area were addressed in previous EPA Final Decisions, issued in December 1991 and December 2016, respectively. The Trailer Staging Area will be addressed in a future Final Decision after necessary public participation requirements are met.

Groundwater from the Facility discharges to the surrounding surface water bodies. Shallow groundwater discharges to small tributary streams, impoundments, and the Delaware River. Deeper groundwater discharges to the Delaware River. Groundwater monitoring continues at the Facility under the EPA RCRA Corrective Action Program and the PADEP Act 2 Program. The locations of the monitoring wells are noted on Figure 2, Corrective Action Study Areas.

Section 3: Environmental Investigations and Remediation

For all environmental investigations conducted at the Facility, contaminant concentrations were screened as follows.

- Groundwater contaminant concentrations were screened against Drinking Water Standards:
  - federal Maximum Contaminant Levels (MCLs) for drinking water, promulgated pursuant to Section 42 U.S.C. §§ 300f et seq. of the Safe Drinking Water Act and codified at 40 CFR Part 141, or
  - EPA Region III Screening Levels (RSLs) for tap water, if there is no MCL for a contaminant.

- Soil contaminant concentrations were screened against RSLs for industrial direct contact. Industrial exposure screening standards were used, rather than residential exposure, since current and expected future use of the Facility is industrial use or open space.

- Surface water contaminant concentrations were screened against Pennsylvania Chapter 93 Surface Water Quality Criteria (SWQC) for human health and for fish and aquatic life.

In March 2011, the Facility entered the One Cleanup Program established by EPA and PADEP (Memorandum of Agreement dated April 21, 2004) to complete federal corrective action and, concurrently, receive a liability release under Act 2. Several areas were remediated under Act 2, in accordance with the provisions of the One Cleanup Program.

For consistency with the Administrative Record, when discussing investigations performed under oversight of PADEP, Act 2 standards are referenced herein where applicable. Act 2 standards include Statewide Health Standards (SHS) for non-residential exposure to soil and groundwater, and Site-Specific Standards (SSS) for contaminants with an incomplete exposure pathway.

North Parcel

The North Parcel is mostly wooded and wetland, undeveloped land located north of River Road. It consists of approximately 110 acres, divided into three areas: 80-acre western area (also known as Croydon Woods), 19-acre central area, and 11-acre eastern area. The east, west and main branches of Hog Run Creek cross the North Parcel property and flow south to the Delaware River. (Figure 3, North Parcel)

The North Parcel was never used by Rohm and Haas for manufacturing or any other industrial purpose. It functioned as a buffer zone between the manufacturing plant and the surrounding community.

A small section of the western area, approximately ¼ acre, was used by the former Bucks County Mosquito Control Commission (BCMCC) from the 1950s to early 1970s. The BCMCC reportedly used the ¼-acre property to store and prepare the insecticide 4,4'-DDT for use in community insect control. The building was demolished after BCMCC activities were discontinued, leaving only the foundation.

Another section of the western area was used by EPA and PADEP to site remediation facilities for the Croydon TCE Superfund Site, under an easement granted by Rohm and Haas. Trichloroethylene (TCE) contamination from an unknown source or sources within the Croydon area impacted groundwater beneath the Croydon community and the North Parcel. EPA connected impacted homes and businesses to the public water supply to eliminate exposure to the contaminated groundwater. In 1996, EPA constructed a groundwater extraction and treatment system on the North Parcel. Operation and maintenance activities for the groundwater treatment program were transferred to PADEP in 2006. The treatment system operated until 2009, when it was shut down due to low contaminant concentrations in the influent stream. EPA and PADEP evaluated existing data and determined that the treatment system was no longer effectively remediating the low concentrations of contamination. PADEP continues remediation through enhanced natural attenuation and semi-annual monitoring of surface water and groundwater.

In May 2011, Rohm & Haas Company submitted a Notice of Intent to Remediate the western area of the North Parcel under Act 2.

The North Parcel is currently used as recreational open space. The central and eastern areas were both sold to Bristol Township in 2005. The western area was sold to the Heritage Conservancy in January 2016, to preserve as a green space in perpetuity. Rohm and Haas Company recorded an environmental covenant for the western area with the Bucks County Recorder of Deeds on March 21, 2013. The covenant restricts certain uses of the property, as described in the Section 5: Proposed Remedy.

1. Environmental Investigations

ATTACHMENT A, North Parcel Summary of Environmental Investigations, provides details of the investigations and the results of the environmental sampling.

Rohm & Haas conducted a comprehensive investigation of the North Parcel in 2002. The investigation focused on the BCMCC area and all other areas that showed signs of activity, such as dumping and vehicle trespass. Areas of ecological concern were also included in the investigation; such as streams, ponds and wetland areas. The investigation showed high levels of the insecticide 4,4'-DDT, and related compounds 4,4'-DDD and 4,4'-DDE (collectively referred to as DDX), in the BCMCC area. The area of contamination was defined by a supplemental investigation in 2006. EPA directed Rohm & Haas Company to remediate the BCMCC area in July 2009. Additional sampling conducted in 2010 delineated the area to be excavated. During remediation of the BCMCC soils in 2011, additional soil and groundwater samples were collected.

The investigations identified the following contamination above the appropriate screening levels.

- Soil characterization identified only one area of concern, the BCMCC area. Surface soil in a confined area, approximately 8,000 square feet, was contaminated with 4,4'-DDT and 4,4'-DDD above the RSLs.
- Groundwater monitoring detected TCE contamination in a background well. The TCE contamination is likely residual contamination from the Croydon TCE Superfund Site.

Monitoring of the Croydon TCE Superfund Site continues at 21 groundwater wells and 7 stream locations. The remaining groundwater contamination is primarily in the deep groundwater, at about 55 feet below ground surface (bgs). The contamination has reached a steady state, with TCE concentrations between 5 and 20 micrograms per liter (ug/l). Maximum TCE concentrations in June 2018 were 9.3 ug/l in the shallow groundwater and 15.5 ug/l in the deep groundwater, compared to the MCL of 5 ug/l. Surface water samples show no contamination above Drinking Water Standards or SWQC.

2. Remediation

In July 2011, Rohm & Haas remediated the BCMCC area. The former building concrete slab, footing walls, and contaminated soil were excavated and disposed of off-site. Approximately 67 tons of concrete debris and 724 tons (487 cubic yards) of contaminated soil were removed.

Post-excavation soil samples were collected to confirm that all the contaminated soil was removed. Samples were collected from the bottom and sidewalls of the excavation at twelve

separate locations. The samples confirmed that remediation was complete, and the area was filled with clean soil.

During the excavation, an underground seepage pit was discovered near the former building. The base of the pit was approximately eight feet bgs. Soil samples were collected at the base of the pit. Concentrations of DDX exceeded the RSL for protection of groundwater. The full extent of soil contamination beneath the seepage pit (below eight feet) was not delineated. To evaluate potential groundwater impacts, four temporary wells were installed surrounding the pit, approximately fifty feet out from the perimeter of the pit. All results were below the Drinking Water Standards. The pit was backfilled with clean soil to match the surrounding grade.

The remediation is documented in the Act 2 Final Closure Report, River Road North Parcel Including Former Bucks County Mosquito Control Commission, dated August 2012, and Addendum, dated January 2013. PADEP approved the Report on January 16, 2013, for the attainment of Act 2 standards with the implementation of land and groundwater controls. These controls were implemented through the Environmental Covenant recorded on March 21, 2013.

Former Wastewater Treatment Area

The Former Wastewater Treatment Area includes the property that was formerly used for treatment of industrial wastewater in tanks and earthen basins, and landfarming of sludge from the treatment plant. It covers approximately 140 acres and is zoned for heavy industrial use. It is bounded by the Delaware River to the south, Hog Run Creek to the west, River Road to the north, and Rohm & Haas Manufacturing Area to the east (across Route 413). (Figure 4, Former Wastewater Treatment Area).

The Former Wastewater Treatment Area was originally primarily marshland and floodplain bordering the Delaware River. During the 1930's, the U.S. Army Corps of Engineers filled this area with dredge spoils from the Delaware River. From the 1950's until 1991, Rohm & Haas used the area for wastewater treatment in a series of tanks and earthen basins. The wastewater contained Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs) and metals from the production processes at the Bristol Plant manufacturing areas. Treatment in the units was discontinued in 1991 when a new, completely tank-based, treatment plant came on-line.

Groundwater flows from north to south, discharging into the Delaware River and the wetlands to the east and west of the basins.

Waste was formerly managed in the following areas within the Former Wastewater Treatment Area:

- Parcel South of River Road: An area reportedly used in the 1960's and early 1970's for landfarming of excess sludge from the wastewater treatment plant;

- Former Wastewater Treatment Tanks:
    - Unit 3- two trickling filter concrete tanks,
    - Unit 4- two clarifier concrete tanks, and
    - Steel tanks for sludge treatment and concrete tanks for sludge storage;

- Former Wastewater Treatment Basins:
  - Unit 1- two unlined influent basins,
  - Unit 2- two unlined pump-feed basins,
  - Unit 7- two unlined effluent basins, and
  - Sediment and spill material drying areas;

- Former Treated Water Basins 1, 2, 3a, and 3b: collectively referred to as Unit 8; and,

- Former Burning Area: an area where burning activities may have occurred.

The former wastewater treatment tanks area and the parcel south of River Road are still in use.

In May 2013, Rohm & Haas Company submitted a Notice of Intent to Remediate the open space area under Act 2. The open space area consists of the former wastewater treatment basins, treated water basins, burning area, and adjacent wetland areas. The current and intended future use of those areas is for open space and wildlife habitat. Rohm and Haas Company recorded an environmental covenant for the open space area with the Bucks County Recorder of Deeds on June 3, 2013. The covenant restricts certain uses of the open space area, as described in the Section 5: Proposed Remedy.

1. Environmental Investigations

ATTACHMENT B, Former Wastewater Treatment Area Summary of Environmental Investigations, provides details of the investigations and the results of the environmental sampling.

a. Comprehensive Area Investigation, 2001 through 2007
Rohm & Haas Company conducted a comprehensive investigation of the Former Wastewater Treatment Area from 2001 through 2007. A series of environmental investigations characterized the soil, sediments, surface water and groundwater of the Former Wastewater Treatment Area. Risk assessments for human and ecological exposure were evaluated in the RCRA Facility Investigation (RFI) Screening Ecological Risk Assessment (2003), Baseline Ecological Risk Assessment (2005), Phase VI Supplemental Sediment Sampling Results (2006), and Biological Tissue and Benthic Community Sampling Results (2007).

EPA's review of the environmental data and risk assessments concluded that there was no contamination that posed a risk to human exposure. However, remediation was required for Former Wastewater Treatment Basin Units 1, 2, and 7, to eliminate:
- a direct contact hazard for wildlife, and
- a safety hazard posed by deep basins with steep sidewalls.

b. Former Wastewater Treatment Area Groundwater Investigation, 2013 – 2017
Rohm and Haas conducted an Act 2 groundwater assessment from 2013 through 2017. The monitoring network consisted of 17 wells, including 4 new wells and 5 Point of Compliance (POC) wells along the perimeter of the Delaware River.

The evaluation of the groundwater in the Former Burning Area was broken out into a separate study due to the detection of a unique set of contaminants in well CR-122-53, located in the Former Burning Area between Treated Water Basin 3a and the Delaware River. Groundwater samples collected in 2013/2014 showed concentrations of VOCs and SVOCs several orders of magnitude above the concentrations detected in 2001 and 2004.

The groundwater investigation showed low levels of several contaminants. Bis(2-chloroethyl)ether (BCEE) concentrations at one well adjacent to the Delaware River warranted an evaluation of the groundwater to surface water migration pathway. The results of a mass discharge evaluation identified no potential exceedance of the SWQC for the Delaware River.

c. Former Burning Area Investigation, 2014 through 2016
Rohm and Haas conducted additional investigations to characterize the soil and groundwater at the Former Burning Area to address high levels of VOCs and SVOCs detected during the 2013/2014 groundwater investigation.

The investigation identified two zones of impacted soil: a shallow zone between 2 and 10 feet bgs and a deep zone (top of the saprolite formation) between 40 and 50 feet bgs.

Contaminant concentrations warranted an evaluation of the groundwater to surface water migration pathway. The results of a mass discharge evaluation identified one potential exceedance of the SWQC for the Delaware River. Migration of BCEE in the deep zone may result in surface water concentrations above the human health SWQC. Calculated maximum surface water concentrations of BCEE were 0.044 ug/l from the deep groundwater zone discharge, and 0.009 ug/l from the shallow groundwater zone discharge. The deep zone discharge potentially exceeds the human health SWQC of 0.030 ug/l.

2. Remediation

a. Former Wastewater Treatment Basins: Units 1, 2, and 7
In July 2009, EPA directed Rohm & Haas to fill and cover the areas with clean soil to eliminate the ecological exposure pathway and the safety hazard posed by the deep basins (over seven feet deep) with steep sidewalls. PADEP identified the waters in the basins as regulated Waters of the Commonwealth, therefore, compensatory mitigation for the loss of the basin waters was required. Rohm & Haas submitted the wetland mitigation plan in July 2011. The wetland mitigation work was completed in May 2012. In May and June of 2012, Units 1, 2, and 7 were filled with 7 to 10 feet of clean soil and graded to drain surface water. The remediation and mitigation work are documented in the Act 2 Final Closure Report for Soil and Sediment at the Former Wastewater Treatment Area, dated October 2012, and Addendum, dated March 2013. PADEP approved the Final Closure Report on March 25, 2013, for the attainment of Act 2 standards with the implementation of land and groundwater controls. These controls were implemented through the Environmental Covenant recorded on June 3, 2013.

The Environmental Covenant requires, among other things, the annual inspection of the soil caps over units 1, 2, and 7 for a minimum of five (5) years. On February 20, 2019, PADEP

determined that annual inspections may be discontinued, based on the stability of the caps over the 5-year inspection period.

b. Former Burning Area
Rohm and Haas performed in situ chemical oxidation (ISCO) of the upper five (5) feet of the deep soil zone (saprolite). Contamination in this zone impacts groundwater and potentially surface water quality in the Delaware River. They performed bench-scale studies to determine the required application rate of potassium permanganate to provide a permeable reactive zone to degrade the contaminants as they move toward the Delaware River. The degradation reaction will produce nontoxic byproducts or low concentrations (not exceeding SHSs) of toxic byproducts. Any deeper contamination remaining should be insufficient to exceed the SWQC.

The Former Burning Area Act 2 Cleanup Plan, August 2017, was approved by PADEP on November 6, 2017. The in-situ chemical oxidation project was initiated in November 2017, in accordance with the Clean-Up Plan. Forty-two thousand (42,000) pounds of potassium permanganate was emplaced into multiple horizontal reactive zones within the upper saprolite. The permanganate slurry was injected through 13 casings. The effectiveness of the treatment will be evaluated by post-treatment groundwater monitoring at six treatment area wells and five downgradient wells. Treatment will be considered complete when two sequential semi-annual rounds of groundwater monitoring demonstrate that the mass discharge of BCEE into the Delaware River will not exceed the SWQC of 0.030 ug/l.

Manufacturing Area

The Manufacturing Area includes approximately 60 acres involved in the production of a variety of chemicals and intermediates over the years; including plastics, resins, emulsion polymers, and pesticides. This area is bounded by Otter Creek to the north, Schmidt's Lake and Lake Idaline to the south, Bristol Borough wastewater treatment plant and Trailer Staging Area to the east, and the Wastewater Treatment Area to the west (across Route 413). (Figure 5, Manufacturing Area)

The Manufacturing Area includes the following properties:

- Keystone Development/Arkema Area (formerly known as Bristol Research Technical Center and Atofina Production Area) – The northwestern part of the Manufacturing Area is no longer owned by Rohm and Haas. It was investigated under RCRA Corrective Action. The sale of the properties included deed restrictions limiting use to non-residential, and prohibiting potable water use of the groundwater.

- Bristol Manufacturing Area – The southeastern part of the Manufacturing Area is still owned by Rohm and Haas. In November 2015, Rohm & Haas Company submitted a Notice of Intent to Remediate the area under Act 2.

Shallow groundwater flows east, discharging into Otter Creek, with a small component discharging into Schmidt's Lake to the south. Deeper groundwater flows southeast into the Delaware River.

There are fourteen (14) areas where waste materials were managed on the Manufacturing Area during plant operations. These areas are referred to as Solid Waste Management Units (SWMUs). There are ten (10) additional areas where releases have or may have occurred. These areas are referred to as Areas of Concern (AOCs). The locations of the SWMUs and AOCs are noted on Figure 5, Manufacturing Area. A summary of the historic uses and current conditions of the SWMUs and AOCs is included in Attachment C, Manufacturing Area Summary of Environmental Investigations.

The current and intended future use of the Manufacturing Area is for industrial use. Rohm and Haas Company has recorded or intends to record environmental covenants to restricts certain uses of the Bristol Manufacturing Area, as described in the Section 5: Proposed Remedy.

1. Environmental Investigations

ATTACHMENT C, Manufacturing Area Summary of Environmental Investigations, provides details of the investigations and the results of the environmental sampling.

Rohm and Haas conducted a comprehensive investigation of the entire Manufacturing Area in 1990-1991 (RCRA Facility Investigation). The investigation characterized soil, both surface and subsurface, in twenty-one (21) areas where waste was managed or releases may have occurred. Additional investigations of the Keystone Development/Arkema Area and Bristol Manufacturing Area were conducted to further characterize areas of contamination, to document remediation efforts, and to meet Act 2 requirements.

Keystone Development / Arkema Area

Additional groundwater investigations were conducted in 1998 and 2004, as documented in the Arkema/Keystone Development Group Groundwater Investigations. The investigations identified no soil or groundwater contamination warranting remediation.

Bristol Manufacturing Area

1) Remediation Investigations – Following two chemical release incidents, post-remediation sampling was conducted to document the effectiveness of the remediation.

- Methyl Methacrylate Release Investigation, 2010
  In August 2010, approximately 1,760 pounds of methyl methylacrylate were released during transfer of the material to an aboveground storage tank located west of Building 38. The spilled material and the impacted soil were removed. Post-remediation soil sampling documented that the cleanup was complete. Chemical concentrations were below the Act 2 SHS.

- Tank Farm 30A Investigation and Remediation, 2012-2014
  On May 16, 2012, a lightning strike caused a fire that damaged two aboveground storage tanks and the containment dike liner, allowing some material to escape the containment area. Butyl acrylate (BA) and ethyl acrylate (EA) were released to the area beneath the tank farm. Fire-fighting water contaminated with BA and EA was released to the area

surrounding the tank farm and to Schmidt's Lake through the stormwater system.

Rohm and Haas performed multiple environmental assessments to determine the extent of contamination and to assess the success of the remediation of the area. The impact was limited to the tank farm and the area immediately north of the dyke, less than one acre. Groundwater in the shallow aquifer was impacted, but the deep aquifer was not impacted.

Following in-situ remediation, all soil contaminant concentrations were below the Act 2 direct contact SHS. Subsurface soil concentrations exceeded the SHS for protection of groundwater. Fate and transport analysis predicted that natural attenuation mechanisms would control the migration of contaminated groundwater. Twelve rounds (ten quarters) of groundwater sampling confirmed that contamination did not migrate beyond the source area.

2) Characterization Investigations - The Bristol Manufacturing Area groundwater was further evaluated in the Study Area East Investigation (2001), the Tank Farm 34A Investigation (2009), and the Act 2 Program Groundwater Monitoring Investigation (2015-2018). The soil was further characterized in the Act 2 Program Soil Investigation (2016-2019).

3) Summary of Contamination

   a) Groundwater Contamination
   Groundwater quality was evaluated throughout the Bristol Manufacturing Area, including 69 wells sampled during the Act 2 assessment. Several VOCs, SVOCs, metals and cyanide exceeded Drinking Water Standards. Elevated concentrations of individual contaminants were confined to limited areas.

   The Well W-93 Area contained a localized area of Non-Aqueous Phase Liquid (NAPL), composed of lubrication oil, diesel fuel, and polymer material. Benzene, toluene, ethylbenzene, xylene, naphthalene, and 2,4-dimethylphenol exceeded Drinking Water Standards. The contaminants were not detected in downgradient wells.

   Contaminant concentrations adjacent to Otter Creek warranted an evaluation of the groundwater to surface water migration pathway. The results of a mass discharge evaluation identified no surface water concentrations above the SWQC.

   Arsenic and manganese concentrations in downgradient wells are attributed to naturally occuring conditions.

   b) Soil Contamination
   Historical soil data from 1990/2001 were evaluated and supplemented with approximately 140 additional soil samples in 2016-2019 to identify areas, listed below, that may pose an exposure concern.

A few surface samples contained contaminant concentrations above direct-contact screening levels. The sample locations, contaminant concentrations, and screening levels are provided in Attachment C, Manufacturing Area Summary of Environmental Investigations, page 7. Current exposure is controlled by existing asphalt, concrete, and/or gravel cover.

SWMU 7: Concentrations of benzo(a)pyrene, arsenic and vanadium exceed screening levels. A risk assessment determined that an area, approximately 10 feet by 10 feet, covered only by a six-inch gravel layer, may pose a hazard to future construction or utility workers.

SWMU 11: Two sample exceeded the screening level for benzo(a)pyrene.

SWMU 12: A single sample exceeded the screening level for TCE.

Building 65: A single sample exceeded the screening level for lead.

Zinc Oxide Pile: Several samples exceeded the screening level for zinc.

Subsurface soil at the Well W-93 Area exceeded screening levels for protection of groundwater. Soil samples exceeded the screening concentrations for benzene, toluene, ethylbenzene, xylene, naphthalene, and 2,4-dimethylphenol. This contamination is associated with the NAPL found in this area. The area impacted is less than 500 square feet, extend down to approximately 12 feet bgs.

SWMU 13 soils were not directly sampled because the SWMU is currently beneath warehouse Building 114. The tile drain field received wastewater from the herbicide manufacturing process from 1948 through 1953. Soil and groundwater samples surrounding Building 114 showed no contamination above screening levels.

2. Remediation/Closure

a) Hazardous Waste Storage Tanks Closure (SWMU 11)
Two aboveground storage tanks (No.365 and 369) used to store hazardous waste for less than 90 days were closed in 2003. Closure activities included: removal of liquid waste and sludge, pressure-washing of tanks and piping, and sampling of containment area stone. A post-closure inspection of the tanks, piping, and containment structure documented that they were clean and structurally sound, with no indication of historic releases. Rohm and Haas certified the closure on February 17, 2004. PADEP approved the closure on April 6, 2004.

b) Industrial Boilers (SWMU 6) and Direct Transfer Station (SWMU 9) Closure
The industrial boilers, located in building 42, were used for the conversion of hazardous waste into energy until the late 1990s. The boilers and the waste transfer station were closed in accordance with the March 2004 Closure Plan, approved by PADEP on April 7, 2004. The SWMUs were decontaminated by power washing all surfaces, flushing the piping, and cleaning the combustion chambers of debris and ash. All waste removed from the SWMUs was shipped off-site to a permitted hazardous waste disposal facility. Rohm and Haas submitted a certification of closure on January 17, 2005. PADEP approved the closure on May 12, 2005.

c) Methyl Methacrylate Release Remediation
Approximately 1,760 pounds of methyl methylacrylate were released in August 2010, in an area located west of Building 38. The released material and impacted soil were excavated and disposed of off-site. Post-remediation sampling confirmed that the area was properly remediated. The remediation report, dated December 14, 2010, was approved by PADEP on December 28, 2010.

d) Tank Farm 30A Remediation
Butyl acrylate (BA) and ethyl acrylate (EA) were released from aboveground storage tanks in Tank Farm 30A in May 16, 2012. Interim remedial actions were taken between June and August 2012, including in-situ chemical oxidation (ISCO) using the reagent Cool-Ox™ to control odors and treat the surface soil by degrading the acrylate compounds.

Based on the effectiveness of the interim remedial actions, ISCO was used to destroy the bulk of the BA and EA in the impacted subsurface soil. In December 2012 and January 2013, soil was treated with injections throughout the tank farm area of contamination. An estimated 9,600 cubic yards of soil was treated, up to 20 feet deep.

Post-remediation samples were collected to confirm the effectiveness of the treatment. ISCO reduced the mass of BA and EA in soil by 50% by June 2013. By February 2014, more than 70% of the contaminant mass was eliminated.

The remediation is documented in the Remedial Action Completion Report – Final Report, Tank Farm 30A - Incident No. 43864, Rohm and Haas Bristol Plant, prepared by URS, November 2014. PADEP approved the Final Report on February 17, 2015, for the attainment of Act 2 SSS with the implementation of land and groundwater controls. These controls were implemented through the Environmental Covenant recorded on July 10, 2015.

3. Proposed Remediation / Controls

The following actions are proposed by Rohm and Haas to mitigate future exposure to contamination at the Manufacturing Area. The proposal is detailed in the Act 2 Cleanup Plan for Soil, Manufacturing Area - Bristol Plant, Rohm and Haas Company, dated July 2019.

a) Institutional Controls: SWMU 7, SWMU 11, SWMU 12, Building 65 area, and Zinc Oxide area

Institutional controls through an environmental covenant are proposed to control potential future exposure to surface soil contamination (beneath existing paving) in these areas. Soil removal would be difficult due to existing plant operations, surface paving, subsurface foundations, and utilities. Contaminated soil in a small area of SWMU 7, located in an inactive portion of the site and without a hard cap cover, will be excavated for off-site disposal.

b) Contaminated Soil Excavation and Disposal: SWMU 7 and Well W-93 Area

- SWMU 7: The proposed excavation area includes surface soil at the gravel-covered area (approximately 10 feet by 10 feet) to remove soil contaminated with benzo(a)pyrene, arsenic and vanadium. The area will be backfilled with clean soil.

- Well W-93 Area: Excavation is proposed remove the NAPL and the contaminated soil. Characterization sampling defined the contaminated areas to be approximately 500 square feet, down to 12 feet bgs. The areas will be backfilled with clean soil. A new monitoring well will be installed to monitor groundwater downgradient of the remediated area. At least two rounds of groundwater monitoring will follow the remediation to determine whether groundwater is contaminated above Act 2 standards. If contaminant concentrations exceed the Act 2 standards, the area will be evaluated for additional remediation.

Section 4: Corrective Action Objectives

The corrective action objectives for the Facility are based on the current and intended future uses of the Facility. The current and intended future uses of the Facility are for industrial use and open space. Environmental Covenants are in place or will be recorded to restrict certain uses of the land and groundwater at the Facility. These covenants are described in Section 5: Proposed Remedy.

North Parcel

Soil and Sediment: The Corrective Action Objective for soil and sediment is to prevent exposure to the contaminated soil by restricting excavation in the BCMCC seepage pit area. Only one area, the BCMCC area, was contaminated above RSLs. Excavation of DDX-contaminated soil in 2011 removed the contamination down to eight feet bgs. The soil below the seepage pit was not remediated.

- This objective is already achieved by the existing environmental covenant.

Groundwater: The Corrective Action Objective for groundwater is to control exposure to contaminated groundwater. Generally, EPA expects final remedies to return usable groundwater to its maximum beneficial use within a reasonable timeframe given the particular circumstances of the project. Where aquifers are either currently used for water supply or have the potential to be used for water supply, EPA will use Drinking Water Standards: the National Primary Drinking Water Standard Maximum Contaminant Levels (MCLs) promulgated pursuant to Section 42 U.S.C. §§ 300f et seq. of the Safe Drinking Water Act and codified at 40 CFR Part 141), or EPA Region III Screening Levels (RSLs) for tap water, if there is no MCL for a contaminant. However, at the North Parcel, the only groundwater contaminant above Drinking Water Standards is TCE in a localized area associated with the Croydon TCE Superfund Site. Groundwater sampling for other potential contaminants, including 10 wells in 2002, four temporary wells in 2012 (BCMCC area seepage pit), and 21 Croydon TCE Site wells (ongoing monitoring), identified no other contaminants at concentrations above Drinking Water Standards. The EPA Superfund Program's Selected Remedy for the Croydon TCE Site includes:

- extension of an existing public waterline to all residences and businesses affected by the groundwater contamination, and

- institutional controls in the form of:
    - Bristol Township ordinance prohibiting private well water use for consumption by humans if public water is available, and
    - Bucks County Department of Health restriction on well installation permits in the area of groundwater contamination.

The TCE contamination from the Croydon TCE Site is currently being remediated and monitored by PADEP.

- This objective is already achieved by the controls implemented by the EPA Superfund Program and under an existing environmental covenant.

Surface Water: The Corrective Action Objective for surface water is to prevent the migration of contaminants to Hog Run Creek at concentrations that may exceed SWQC. Surface water samples along Hog Run Creek collected during the 2002 investigation and ongoing stream sampling as part of the Croydon TCE Superfund Site show no contamination above Drinking Water Standards or SWQC.

- This objective has already been achieved.

Former Wastewater Treatment Area

Soil and Sediment:

1. Former Wastewater Treatment Basins: The Corrective Action Objective for soil and sediment at the Former Wastewater Treatment Basins is to prevent the exposure of wildlife to contaminated sediment at the base of the Former Wastewater Treatment Basins. Surface soil did not show contamination above RSLs. However, soil and sediment at the base of Former Wastewater Treatment Basins posed an exposure hazard to wildlife. The basins were filled and capped with clean soil to eliminate the exposure hazard.

    - This objective is already achieved by closing the basins and by the existing environmental covenant.

2. Former Burning Area: The Corrective Action Objective for soil and sediment is to prevent the migration of BCEE to surface water at concentrations that exceed the SWQC of 0.030 ug/l. Surface soil did not show contamination above RSLs. However, migration of BCEE in deep soil, 40 to 50 feet below ground surface in the Burning Area adjacent to the Delaware River, may result in surface water concentrations above the Human Health SWQC.

    - This objective is being addressed by treatment of the BCEE source area soil, as prescribed in the Former Burning Area, Act 2 Cleanup Plan, August 2017. EPA will consider this objective met when post-remediation monitoring demonstrates that the mass discharge of BCEE into the Delaware River will not exceed the SWQC.

Groundwater: The Corrective Action Objective for groundwater is to attain Drinking Water Standards, and to control exposure to contaminated groundwater while contaminants remain above Drinking Water Standards. Groundwater contamination, primarily in the Former Burning Area, exceeds the Drinking Water Standard for several VOCs, SVOCs (primarily for BCEE), and metals. Ground water is not used for any purpose other than monitoring.

- This objective is being addressed by treatment of the BCEE source area soil, as prescribed in the PADEP-approved Act 2 cleanup plan for the Former Burning Area. Control of exposure to contaminated groundwater has already been achieved by the existing environmental covenant.

Surface Water: The Corrective Action Objective is to prevent the migration of BCEE to the Delaware River at concentrations that may exceed SWQC. Migration of BCEE in deep groundwater, 40 to 50 feet below ground surface in the Burning Area adjacent to the Delaware River, may result in surface water concentrations above the Human Health SWQC.

- This objective is being addressed by treatment of the BCEE source area soil, as prescribed in the PADEP-approved Act 2 cleanup plan for the Former Burning Area. EPA will consider this objective met when post-remediation monitoring demonstrates that the mass discharge of BCEE into the Delaware River will not exceed the SWQC of 0.030 ug/l.

Manufacturing Area

Soil and Sediment: Corrective Action Objectives for soil and sediment are:
1) to prevent the exposure of future industrial workers to contaminated soil, and
2) to prevent the migration of contamination at the Well W-93 Area into the groundwater.

Surface soil contamination at SWMU 7, SWMU 11, SWMU 12, Building 65 area, and the Zinc Oxide area exceed the direct exposure screening level. Current exposures are prevented by surface barriers, such as asphalt, gravel and/or concrete paving. In addition, SWMU 13 soils were not directly sampled because the area is currently beneath warehouse Building 114. The soils may contain contamination from past discharge of herbicide wastewater. Current exposure is prevented by the building foundation.

- The objective for surface soil contamination will be achieved by the proposed removal of contaminated soil at SWMU 7, and controls imposed under an environmental covenant.

Subsurface soil contamination at the Well W-93 Area may release contaminants into the groundwater.

- The objective for subsurface soil will be achieved by the proposed removal of the contaminated soil at the Well W-93 Area.

Groundwater: The Corrective Action Objective for groundwater is to attain Drinking Water Standards, and to control exposure to contaminated groundwater while contaminants remain above Drinking Water Standards. Several VOCs, SVOCs, metals and cyanide exceeded Drinking Water Standards. Elevated concentrations of individual contaminants were confined to limited areas. The NAPL contamination at the Well W-93 Area presents the potential to migrate. There is no current potable use of groundwater.

- This objective will be achieved by the proposed removal of NAPL and contaminated soil at the Well W-93 Area, and controls imposed under an environmental covenant.

Surface Water: The Corrective Action Objective for surface water is to prevent the migration of contaminants to Otter Creek at concentrations that may exceed SWQC. Contaminant concentrations adjacent to Otter Creek warranted an evaluation the groundwater to surface water migration pathway. A mass discharge evaluation determined that no discharges to Otter Creek would exceed the SWQC.

- The Corrective Action Objective for surface water quality standards is already achieved.

Section 5: Proposed Remedy

EPA's proposed remedies for the North Parcel, the Former Wastewater Treatment Area and the Manufacturing Area are as follows:

North Parcel

EPA's proposed remedy for the North Parcel is compliance with the Environmental Covenant recorded with the Bucks County Recorder of Deeds on March 21, 2013. That Environmental Covenant places the following activity and use limitations on the Croydon Woods:

- the property may never be used for any type of residential structure;
- the soil cap over the BCMCC area seepage pit shall be maintained and inspected annually;
- groundwater shall not be used for potable, agricultural, or any other consumptive purpose; and
- an evaluation of the vapor-intrusion pathway and installation of a vapor barrier, as necessary, must precede any future construction of occupied buildings in the area above the VOC-contaminated groundwater.

The activity and use limitations of the Environmental Covenant run with land and apply to the current property owner. The current owner of the Croydon Woods, the Heritage Conservancy, is bound by the provisions of the Environmental Covenant.

Former Wastewater Treatment Area

Former Wastewater Treatment Basins – EPA's proposed remedy consists of compliance with the Environmental Covenant recorded with the Bucks County Recorder of Deeds on June 3, 2013. That Environmental Covenant places the following activity and use limitations on the

entire open space area; consisting of former wastewater treatment basins, treated water basins, burning area, and adjacent wetland areas:

- the property may never be used for any type of residential structure;
- groundwater shall not be used for potable, agricultural, or any other consumptive purpose;
- an evaluation of the vapor-intrusion pathway and installation of a vapor barrier, as necessary, must precede any future construction of occupied buildings; and
- the soil cap over /units 1, 2, and 7 shall be maintained and inspected annually for a minimum of five years.

  On February 20, 2019, after five (5) years of inspections, PADEP determined that annual inspections may be discontinued; therefore, the inspection requirement no longer applies.

Former Burning Area – The proposed remedy is continued implementation of the Former Burning Area Act 2 Cleanup Plan, dated August 2017 and compliance with the Environmental Covenant recorded with the Bucks County Recorder of Deeds on June 3, 2013. The remediation required by the Former Burning Area Act 2 Cleanup Plan uses in-situ chemical oxidation to reduce the mass discharge of BCEE into the Delaware River. The remediation was initiated in November 2017, with the injection of a potassium permanganate slurry into the contaminated upper saprolite zone.

Manufacturing Area

EPA's proposed remedy consists of land and groundwater controls at the Bristol Manufacturing Area, and remediation of soil at SWMU 7 and the Well W-93 Area. The proposed restricted and remediation areas are identified in Figure 6, Manufacturing Area Proposed Restrictions/ Remediation.

1) Soil Remediation – Soil excavation and post-excavation monitoring shall be implemented, as described in the Act 2 Cleanup Plan for Soil, Manufacturing Area-Bristol Plant, Rohm and Haas Company (Cleanup Plan), dated July 2019.
   - SWMU 7: The surface soil in the area SB-07-02, identified on Figure 5 of the Cleanup Plan, shall be excavated to remove soils containing arsenic and vanadium at concentrations over their respective RSL.
   - Well W-93 Area: Contaminated soil shall be excavated in two areas to a depth of approximately 12 feet bgs. The area and depth of excavation are identified on Figures 3 and 4 of the Cleanup Plan. Post-excavation groundwater monitoring shall continue for a minimum of two years.

2) Land and groundwater use restrictions shall be implemented for the Bristol Manufacturing Area through an environmental covenant. The covenant shall include the following provisions:
   - The Bristol Manufacturing Area shall not be used for residential purposes.
   - Groundwater at the Bristol Manufacturing Area shall not be used for potable water purposes.
   - SWMU 7, SWMU 11, SWMU 12, Building 65 area, and Zinc Oxide area:
     - Existing surface caps shall be maintained to prevent exposure to contaminated soil.

- Appropriate health and safety measures shall be taken during future excavation through caps to mitigate exposure to contaminated soil and groundwater.

- Upon the removal of the Building 114 foundation, SWMU 13 soils shall be sampled for contamination associated with discharges to the herbicide tile drain field.
- New or newly-occupied buildings shall be assessed for vapor intrusion if the building is within 100 feet of VOC-impacted soil or groundwater

The covenant for the Bristol Manufacturing Area will be recorded after completion of the proposed soil remediation and PADEP approval of the Act 2 Final Report (anticipated in 2021).

Section 6: Evaluation of Proposed Remedy

This section provides an evaluation of the criteria EPA used to evaluate the proposed remedy consistent with EPA guidance. The criteria are applied in two phases. In the first phase, EPA evaluates three decision threshold criteria as general goals. In the second phase, for those remedies which meet the threshold criteria, EPA then evaluates seven balancing criteria.

Threshold Criteria	Evaluation
1) Protect human health and the environment	This criterion is met without additional remedial actions with respect to current exposure. Future exposure to contamination will be prevented by the proposed remediation and land and groundwater use restrictions through environmental covenants.
2) Achieve media cleanup objectives	EPA's proposed remedy meets the media cleanup objectives appropriate for the expected current and reasonably anticipated land and water resource uses. The remedy proposed in this Statement of Basis is based on the current and future anticipated land use which is industrial use and open space. The activity use restriction in the current and proposed environmental covenants will eliminate future unacceptable exposures to both soil and groundwater contamination.
3) Remediate the Source of Releases	In all proposed remedies, EPA seeks to eliminate or reduce further releases of hazardous wastes and hazardous constituents that may pose a threat to human health and the environment. Remediation of the source material at the Former Burning Area is being accomplished by the current remediation of the BCEE contaminated deep soil adjacent to the Delaware River. Remediation of the source material at the Manufacturing Area will be accomplished by removal of the NAPL and contaminated soil at the Well W-93 Area.

Balancing Criteria	Evaluation
4) Long-term effectiveness	The long-term effectiveness of the remedy will be maintained by the implementation of land and groundwater use controls through environmental covenants. These institutional controls are readily implementable and easily maintained. These environmental covenant controls run with the land and cannot be modified without PADEP approval.
5) Reduction of toxicity, mobility, or volume of the Hazardous Constituents	All practical reductions have been accomplished by the past remediation and the proposed remediation at the Manufacturing Area.
6) Short-term effectiveness	Remedies at the North Parcel and Former Wastewater Treatment Area have already been implemented. EPA anticipates that the remaining remediation at the Manufacturing Area will be fully implemented shortly after the Final Decision is issued.
7) Implementability	EPA's proposed remedy is readily implementable. The areas of soil removal have already been defined through sampling. EPA proposes that the institutional controls be implemented through an Environmental Covenant pursuant to the Pennsylvania Uniform Environmental Covenants Act. Therefore, EPA does not anticipate any regulatory constraints in implementing its proposed remedy.
8) Cost	The costs associated with this proposed remedy, estimated to be $300,000, is the most cost-effective option.
9) Community Acceptance	EPA will evaluate community acceptance of the proposed remedy during the public comment period and will describe it in the Final Decision and Response to Comments.
10) State/Support Agency Acceptance	PADEP and EPA jointly have reviewed the assessment of the areas in the Act 2 Program. EPA will evaluate state acceptance during the public comment period and provide an analysis in the Final Decision and Response to Comments.

Section 7: Financial Assurance

EPA is proposing that financial assurance be provided to satisfy the financial assurance requirement of RCRA. The estimated cost of the proposed remedy is $300,000.

Section 8: Public Participation

You are invited to comment on EPA's proposed remedy. The public comment period will last thirty (30) calendar days from the date that notice is published in the local news. Comments may be submitted by mail, email, or phone to Maureen Essenthier at the address listed below.

EPA may hold a public meeting upon request. Requests for a public meeting should be made to Ms. Essenthier at the address listed below. A meeting will not be scheduled unless one is requested.

The Administrative Record contains all information considered by EPA for the proposed remedy. It is available at the following location:

U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103
Contact: Maureen Essenthier (3LD20)
Phone: (215) 814-3416
Email: essenthier.maureen@epa.gov

Section 9: Signature

Date: 3.19.20

John A. Armstead, Director
Land, Chemicals and Redevelopment Division
US EPA, Region III

Section 10: Index to Administrative Record

Croydon TCE Superfund Site

1. Fourth Five-Year Review Report for Croydon TCE Superfund Site, Bucks County, PA, prepared by USEPA< Region 3, dated December 2, 2016.

2. Croydon TCE NPL Site, Sampling and Operation & Maintenance Semi-Annual Report, PADEP, prepared by Michael Baker/O'Brien & Gere, November 2018

North Parcel

3. Environmental Site Evaluation Report, Parcel North of River Road, Rohm & Haas Company, prepared by ST Environmental Professionals (STEP), January 2001

4. Environmental Site Investigation Report, Parcel North of River Road, Rohm & Haas Company, prepared by ST Environmental Professionals, April 2003.

5. Soil Delineation, Former Bucks County Mosquito Control Commission, prepared by Sigma Environmental Services, January 27, 2007.

6. EPA Letter - RCRA Corrective Action remediation requirements for Parcel North of River Road, Rohm & Haas Bristol Plant, EPA to Dow Chemical, dated 7/31/2009

7. DDX Delineation Report, Former Bucks County Mosquito Control Commission SWMU, Rohm and Haas Chemicals LLC Bristol Plant, prepared by URS Corporation, March 14, 2011.

8. Act 2 Final Closure Report, River Road North Parcel Including Former Bucks County Mosquito Control Commission, prepared by URS Corporation, dated August 2012

9. Addendum to Act 2 Final Closure Report, River Road North Parcel Including Former Bucks County Mosquito Control Commission, prepared by URS Corporation, dated 1/7/2013

10. PADEP Act 2 Technical Memo Summary, River Road North Parcel, Rohm & Haas Company, 1/10/2013

11. Rohm and Haas River Road North Parcel, Remedial Investigation and Final Report Approval, PADEP letter to Rohm and Haas Company, 1/16/2013

Former Wastewater Treatment Area

12. RCRA Facility Investigation, Former Wastewater Treatment Plant AOC, Task II Work Plan, Rohm and Haas Company, Prepared by URS, June 6, 2001

13. Environmental Site Evaluation Report/Work Plan, Parcel South of River Road, Rohm & Haas Company, prepared by ST Environmental Professionals (STEP), January 2001

14. RCRA Facility Investigation Report, Former Wastewater Treatment Plant, Bristol Complex, Rohm & Haas Company, prepared by URS for Rohm & Haas, 6/27/2002

15. Screening Ecological Risk Assessment – Addendum Report, Wastewater Treatment Plant, Bristol Complex, Rohm & Haas Company, Rohm & Haas Company, prepared by URS, 2/13/2003
    - Including June 2002 supplemental sampling results (Section 3 and Appendix B)

16. Environmental Site Investigation Report, Parcel South of River Road, Rohm & Haas Company, prepared by ST Environmental Professionals (STEP), April 2003

17. Wetlands Delineation Report, Bristol Site, Former WWTP Site and Croydon Woods North of River Road, Rohm and Haas Company, prepared by URS, December 2003

18. Bristol Site Wastewater Treatment Study Area, Supplemental Groundwater Sampling Results (June 2004), Letter Report, Dow Chemical Company to EPA, dated 6/5/2009

19. Baseline Environmental Risk Assessment, Former Wastewater Treatment Plant, Bristol Complex, Rohm & Haas Company, prepared by URS, August 2005

20. EPA review of Baseline Environmental Risk Assessment, Former Wastewater Treatment Plant (August 2005), memo dated 12/8/2005 (revised)

21. EPA Review Letter - WWTP Area Revised BERA, Rohm & Haas Bristol Plant (URS Corp, August 2005), dated 2/9/2006

22. Rohm & Haas Response Letter, WWTP Area Revised Baseline Ecological Risk Assessment Report, EPA Comments Received 2/9/2006, Rohm & Haas to EPA, dated 5/16/2006

23. Phase VI Supplemental Sediment Sampling Results, Former Wastewater Treatment Plant, Bristol Complex, Rohm & Haas Company (May 2006), Letter Report, Rohm & Haas to EPA, dated 7/14/2006

24. EPA Review Memo, Rohm & Haas Response to EPA BERA Comments of 2/9/2006, EPA Toxicologist, dated 8/3/2006

25. EPA Review Memo, Rohm & Haas Phase VI Supplemental Sediment Sampling Results (7/14/2006), EPA Toxicologist, dated 8/3/2006

26. EPA Review Letter - WWTP Area Revised BERA, Rohm & Haas Bristol Plant and Phase VI Supplemental Sampling, EPA to Rohm & Haas, dated 11/29/2006

27. Biological Tissue and Benthic Community Sampling Results, letter report, URS to EPA, dated 8/16/2007 with 11/1/2007 Rohm & Haas cover letter

28. EPA Review Memo, Bristol Plant WWTP Area, Review of Biological Tissue and Benthic Community Sampling Results (8/16/2007), EPA email to Rohm & Haas, 1/29/2008

29. EPA Letter - RCRA Corrective Action remediation requirements for WWTP Area, Rohm & Haas Bristol Plant, EPA to Dow Chemical, dated 7/31/2009

30. Act 2 Final Closure Report for Soil and Sediment at the Former Wastewater Treatment Plant Area, Rohm and Haas Company, prepared by URS, October 2012

31. Addendum to Act 2 Final Closure Report for Soil and Sediment at the Former Wastewater Treatment Plant Area, Rohm and Haas Company, prepared by URS, March 2013

32. PADEP Act 2 Technical Memo Summary, Rohm & Haas Former Wastewater Treatment Plant, Remedial Investigation, Risk Assessment, and Final report, 3/19/2013

33. PADEP Approval, Act 2 Final Closure Report for Soil and Sediment at the Former Wastewater Treatment Plant Area, PADEP letter to Rohm and Haas Company, 3/25/2013

34. Manganese in Groundwater Technical Memorandum, Regional Geology and Groundwater Quality, Rohm and Haas Chemicals LLC, Former Wastewater Treatment Plant Area, prepared by URS, 3/11/2015

35. Assessment of On-Site and Off-Site Manganese in Groundwater and Potential Influence Due to the Ammonium Sulfate Plume, Rohm and Haas Company, prepared by URS, February 2016

36. EPA Approval of Assessment of On-Site and Off-Site Manganese in Groundwater and Potential Influence Due to the Ammonium Sulfate Plume, email dated 4/7/2016

37. Former Burn Area, Act 2 Remedial Investigation Report, Rohm & Haas Company, prepared by AECOM, June 2017

38. Former Burning Area, Act 2 Clean-up Plan, Rohm & Haas Company Bristol Plant, prepared by AECOM, August 2017

39. PADEP Approval – Remedial Investigation Report, Rohm & Haas Former Burning Area, PADEP to Dow DuPont, Inc., 9/28/2017

40. PADEP Act 2 Technical Memo Summary, Rohm & Haas Former Burning Area Cleanup Plan, 11/2/2017

41. PADEP Approval, Former Burning Area, Act 2 Clean-up Plan, PADEP letter to Dow DuPont, Inc., 11/6/2017

42. Act 2 Final Report for Groundwater at the Former Wastewater Treatment Plant Area, Bristol Plant, Rohm and Haas Company, prepared by AECOM, January 2018

43. PADEP Act 2 Technical Memo Summary, Rohm & Haas Wastewater Treatment Plant Area (Groundwater), Remedial Investigation/Cleanup Plan/Final Report, 4/26/2018

44. PADEP Approval – Act 2 Final Report for Groundwater at the Former Wastewater Treatment Plant Area, PADEP letter to Union Carbide Corp, dated 4/26/2018

45. PADEP Approval – Discontinue Inspection of Former Wastewater Treatment Basins, 2/20/2019 email, PADEP to Dow

Manufacturing Area

46. Manufacturing Area RFI Interim Report, Rohm and Haas Delaware Valley Inc., prepared by BCM, July 1992

47. Baseline Groundwater Sampling Report for Elf Atochem Area Groundwater Monitoring Program, Rohm & Haas Company, prepared by ST Environmental Professionals (STEP), August 1998

48. Groundwater Sampling Report for Bristol Research Technical Center & Atofina Production Area, Rohm and Haas Company, prepared by STEP, September 2004

49. EPA review letter, Bristol Tech Center and Corporate Engineering Office Areas, EPA to Rohm and Haas Bristol, dater 12/15/2004

50. Rohm and Haas response letter, Bristol Tech Center and Corporate Engineering Office Areas, Rohm and Haas to EPA, dated 1/19/2005

51. Engineers Certification of Closure Report, Rohm and Haas Bristol Facility, RCRA Industrial Boilers 7, 8, and Direct Transfer Station, Rohm and Haas Company, prepared by URS, January 2005

52. Groundwater Monitoring Report, Bristol Manufacturing Area, Study Area East, Rohm and Haas Company, prepared by Sigma Environmental Services, October 2005

53. Groundwater Monitoring Report, Bristol plant, Tank Farm 34A Area, Dow Chemical Company, prepared by Sigma Environmental Services, December 2009

54. Remedial Action Completion Report – Final Report, Tank Farm 30A - Incident No. 43864, Rohm and Haas Bristol Plant, prepared by URS, November 2014

55. PADEP Act 2 Technical Memo Summary, Remedial Action Completion Report – Final Report, Tank Farm 30A, 2/11/2015

56. PADEP Approval – Remedial Action Completion Report – Final Report, Tank Farm 30A, PADEP letter to Rohm and Haas Chemicals, dated 2/17/2015

57. Assessment of On-Site and Off-Site Manganese in Groundwater and Potential Influence Due to the Ammonium Sulfate Plume, Rohm and Haas Company, prepared by URS, February 2016

58. EPA Approval of Assessment of On-Site and Off-Site Manganese in Groundwater and Potential Influence Due to the Ammonium Sulfate Plume, email dated 4/7/2016

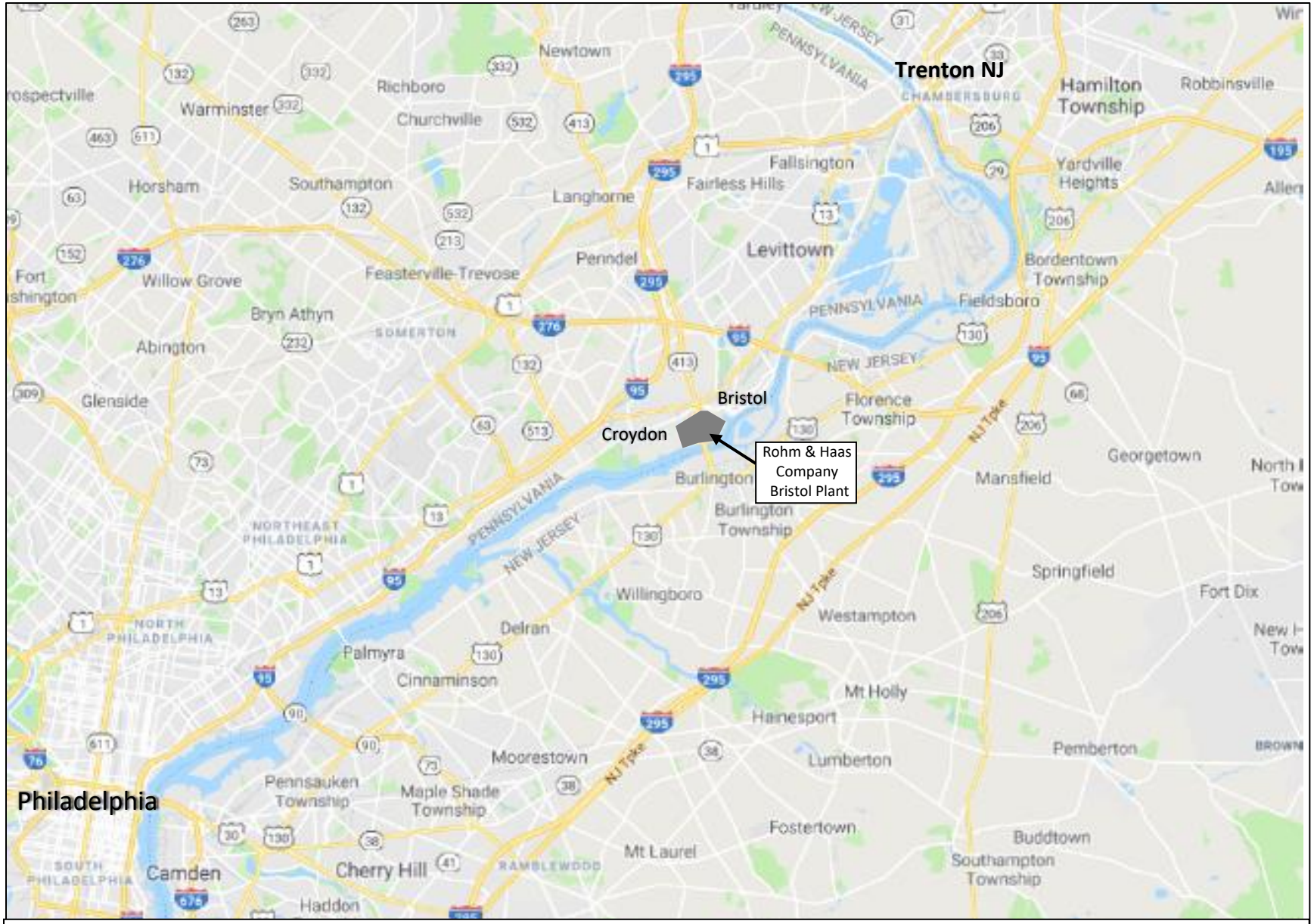
59. Bristol Manufacturing Area, Act 2 Revised Remedial Investigation Report/Focused Risk Assessment/Cleanup Plan for Soil, Rohm and Haas Company, dated July 2019, prepared by AECOM,
    - including Appendix Z: Act 2 Cleanup Plan for Soil, Manufacturing Area – Bristol Plant, Rohm and Haas Company, prepared by AECOM, Revised July 2019

Environmental Covenants

60. Environmental Covenant for Rohm & Haas Company River Road North Parcel, recorded with Bucks County Recorder of Deeds on 3/31/2013

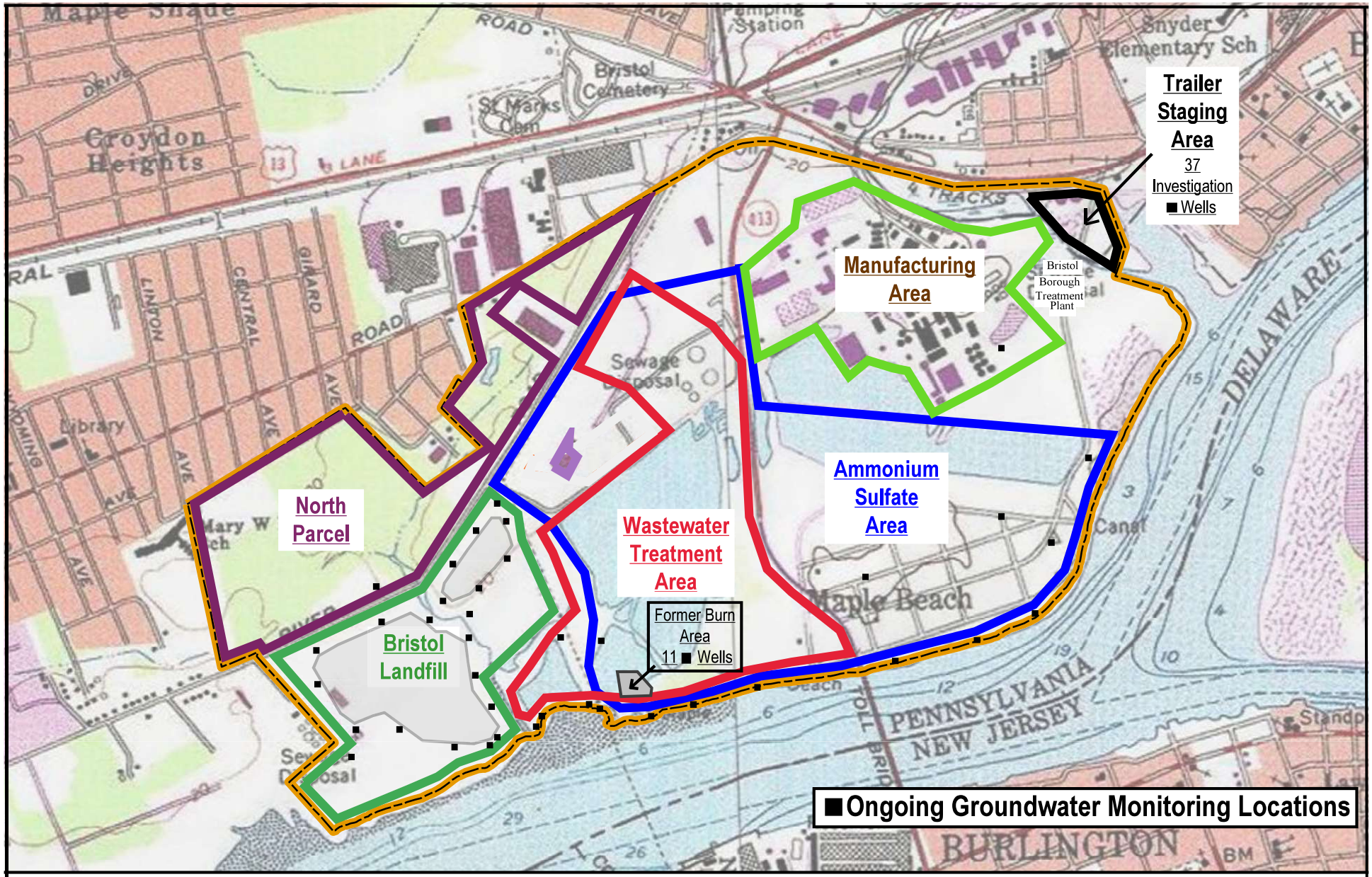
61. Environmental Covenant for Rohm & Haas Company Former Wastewater Treatment Area, recorded with Bucks County Recorder of Deeds on 6/3/2013

62. Environmental Covenant for Rohm & Haas Company Tank Farm 30A Area, recorded with Bucks County Recorder of Deeds on 7/10/2015



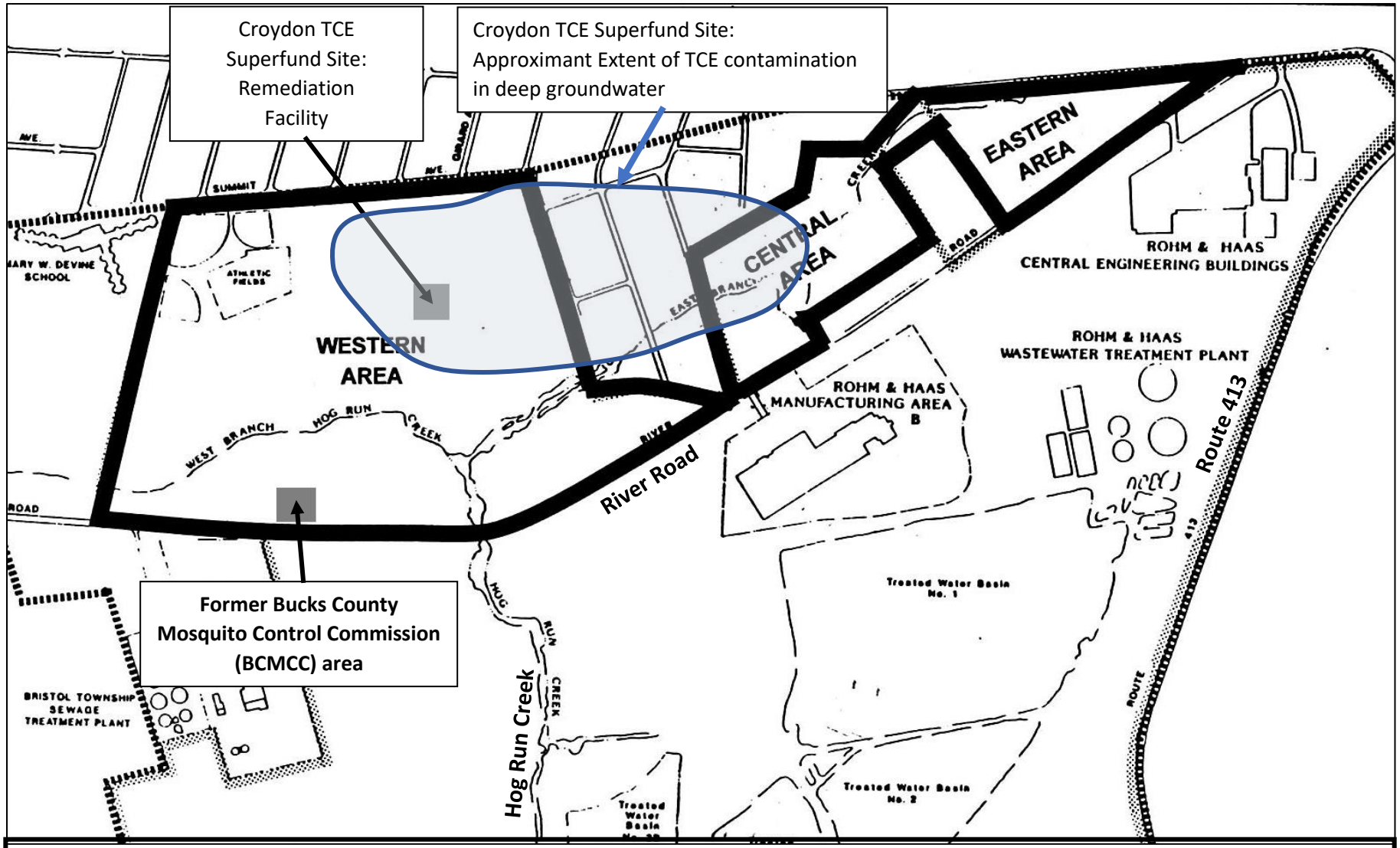
Rohm & Haas Company Bristol Plant
Statement of Basis

FIGURE 1: Location Map



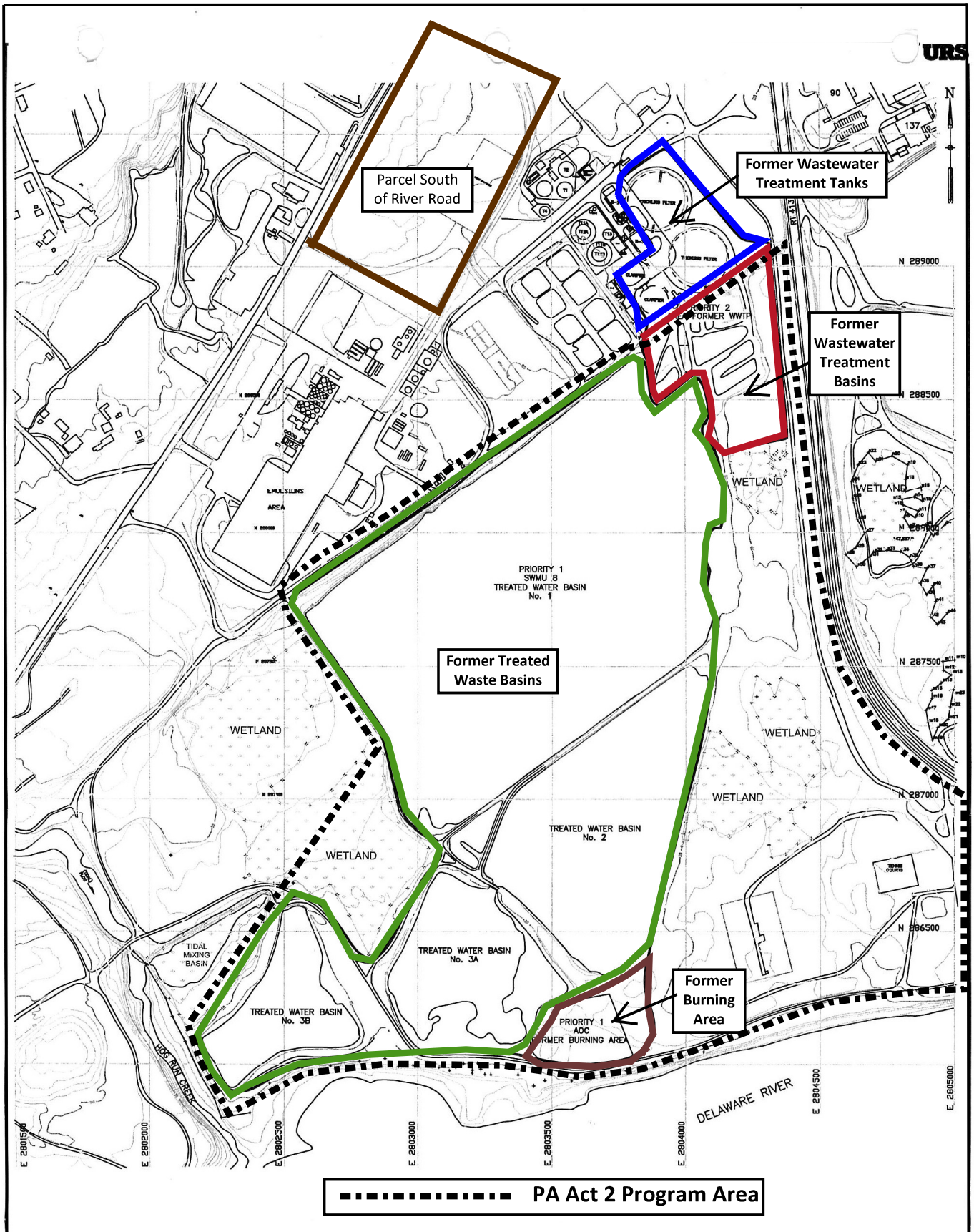
Rohm & Haas Company Bristol Plant **FIGURE 2**

Statement of Basis **Corrective Action Study Areas**



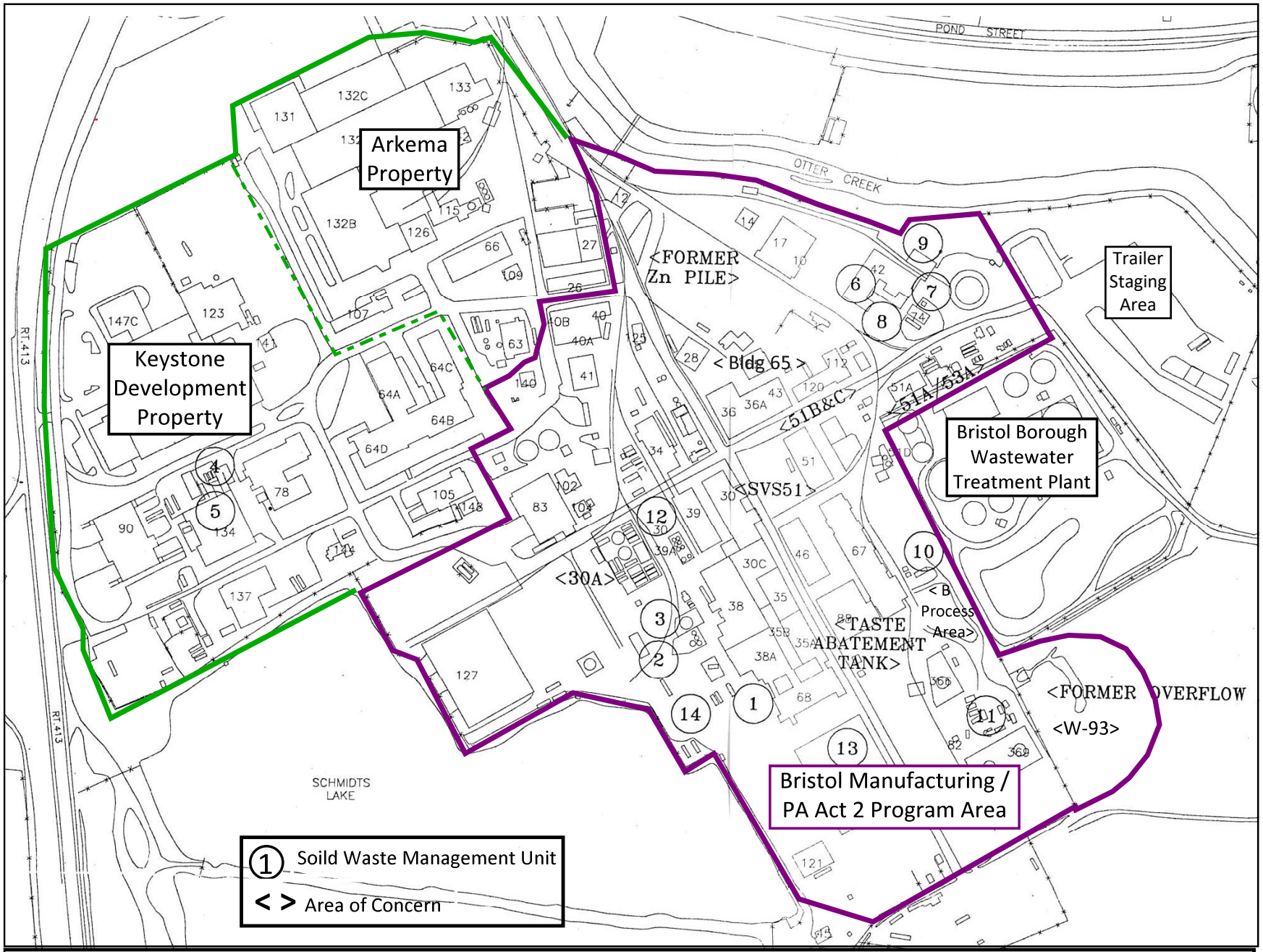
Rohm & Haas Company Bristol Plant
Statement of Basis

FIGURE 3: North Parcel



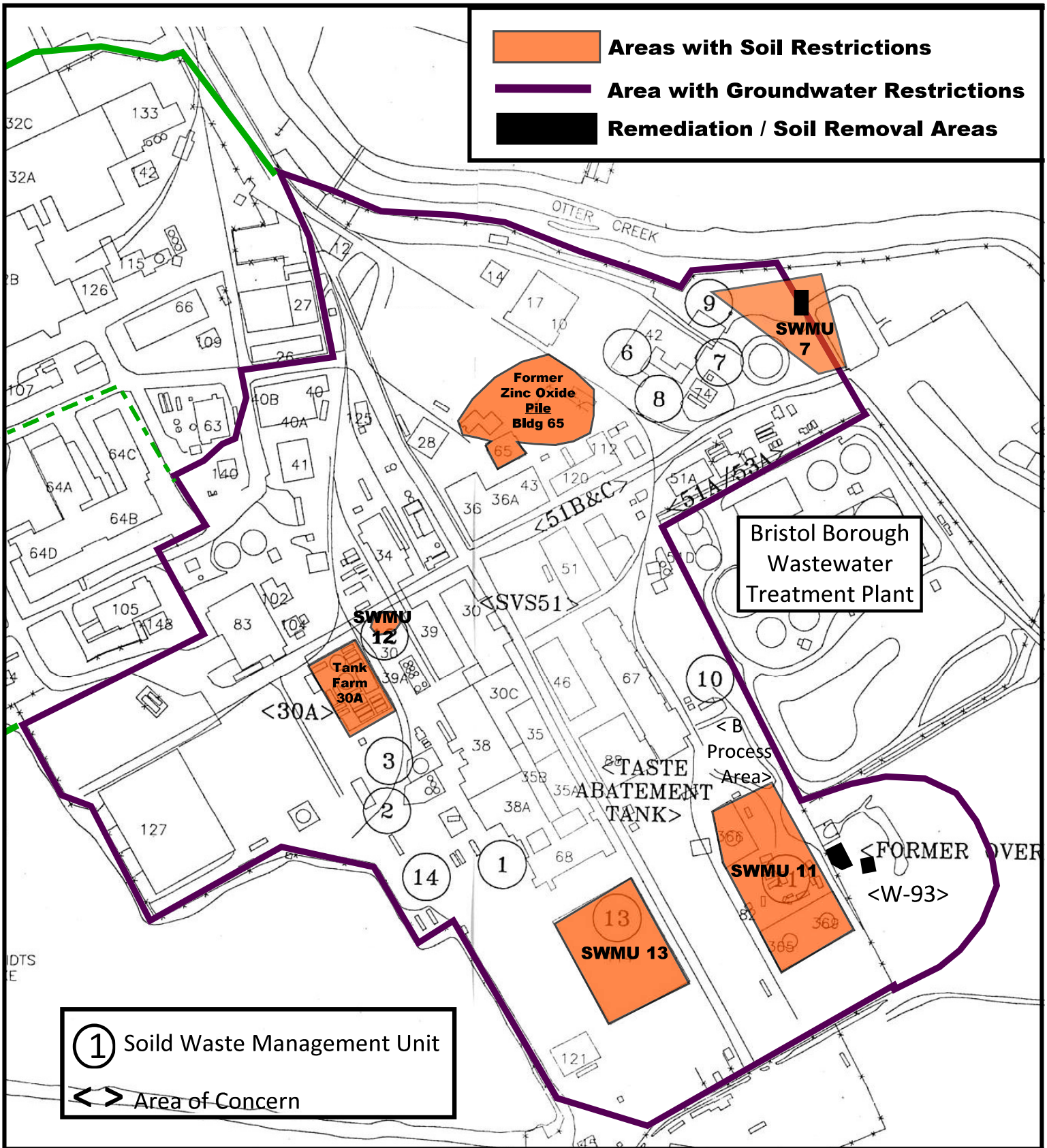
Rohm & Haas Company Bristol Plant **FIGURE 4**

Statement of Basis **Former Wastewater Treatment Area**



Rohm & Haas Company Bristol Plant
Statement of Basis

FIGURE 5
Manufacturing Area



Rohm & Haas Company Bristol Plant
Statement of Basis

FIGURE 6, Manufacturing Area
Proposed Restrictions / Remediation

ATTACHMENT A
North Parcel
Summary of Environmental Investigations

Environmental Site Investigation – 2002: documented in *Environmental Site Investigation Report, Parcel North of River Road*, Rohm & Haas Company, prepared by ST Environmental Professionals, April 2003.

A comprehensive investigation of the North Parcel was conducted in 2002. The scope of the investigation was defined by historical site data, property use, and a site reconnaissance to identify Areas of Potential Environmental Concern (APEC). The investigation focused on the former Bucks County Mosquito Control Commission (BCMCC) area and all other areas that showed signs of activity, such as dumping and vehicle trespass. Areas of ecological concern were also included in the investigation; such as streams, ponds and wetland areas. Thirteen APECs were sampled and analyzed for likely contaminants of concern.

The investigation included the collection of soil, surface water, sediment, and groundwater samples. Samples were analyzed for volatile organic chemicals (VOCs); semi-volatile organic chemicals (SVOCs), including polycyclic aromatic hydrocarbons (PAHs); pesticides; polychlorinated biphenyls (PCBs); and metals.

Soil - Soil samples were collected from forty-five (45) locations. Several samples contained contaminant concentrations above the EPA screening levels.

- Zinc and Cadmium - Three soil samples exceeded the EPA Region 3 Screening Level (RSL) for protection of groundwater for zinc and one sample for cadmium. Zinc and cadmium concentrations in downgradient groundwater samples showed concentrations below the drinking water screening levels. Since groundwater quality is not impacted, the concentrations do not pose a hazard.

- PAHs – One soil sample collected adjacent to a truck repair garage exceeded the direct contact RSLs for several PAHs. Average concentrations for the area were below screening levels. Given the localized extent of contamination, the concentrations do not pose a hazard.

- DDX (4,4'-DDT, 4,4'-DDD and 4,4'-DDE) – The insecticides exceeded the direct contact RSL in samples collected in the BCMCC area. Three of the nine samples collected exceed the RSL of 8.5 milligrams per kilogram (mg/kg) for 4,4'-DDT. 4,4'-DDT concentrations were 700 mg/kg, 150 mg/kg, and 180 mg/kg. Two samples exceeded the RSL of 9.6 mg/kg for 4,4'-DDD. 4,4'-DDD concentrations were 34mg/kg and 11 mg/kg. All the samples exceeded the RSL for protection of groundwater. EPA required further delineation of the contamination prior to removal of the contaminated soil.

Surface Water and Sediment – Two surface water and eight sediment samples were collected. Sample results did not exceed screening levels.

Groundwater – Samples were collected from ten locations. Only one sample contained contamination that exceeded the drinking water screening levels. Well P-5-55 contained 12 ug/l of trichloroethene (TCE). The screening level for TCE is 5 ug/l. Well P-5-55 is a background well for the North Parcel. The TCE contamination was likely residual contamination from the Croydon TCE Superfund site remediation.

Supplemental Characterization of BCMCC Soil – 2006: documented in *Soil Delineation, Former Bucks County Mosquito Control Commission*, prepared by Sigma Environmental Services, January 27, 2007.

Additional sampling was performed on the BCMCC area to define the extent of the 4,4'-DDT and 4,4'-DDD contamination. Twenty-four (24) samples were collected at twelve locations to define the areal extent and the depth of the contamination. The sampling confirmed that the contamination was restricted to shallow soils, within the top two feet of ground surface.

Supplemental Characterization of BCMCC Soil – 2010: documented in *DDX Delineation Report, Former Bucks County Mosquito Control Commission SWMU*, Rohm and Haas Chemicals LLC, prepared by URS Corporation, March 14, 2011.

To complete the delineation prior to soil removal, an additional forty-five (45) soil samples were collected. The total area impacted by DDX was about 8,000 square feet.

Underground Seepage Pit Sampling – 2011: documented in *Act 2 Final Closure report for River Road North Parcel Soil and Groundwater*, Rohm and Haas Company, prepared by URS Corporation, August 2012.

During the excavation, an underground seepage pit was discovered near the former BCMCC building. The base of the pit was approximately eight feet below ground surface (bgs). Two soil samples were collected below the pit, at 9.5 feet bgs and 11 feet bgs. The DDX concentrations were as follows:

	RSL for Industrial Soil	RSL for Protection of Groundwater	0.5-1.5 feet below pit (9.5 feet bgs)	2.0-3.0 feet below pit (11 feet bgs)
4,4'-DDT	8.5	0.077	Non-detect	18
4,4'-DDD	9.6	0.0075	310	59
4,4'-DDE	9.3	0.011	Non-detect	1.1

All concentrations in mg/kg

4,4'-DDT and 4,4'-DDD exceeded the direct contact RSL. All three chemicals exceeded the RSL for protection of groundwater. To evaluate potential groundwater impacts, four temporary wells were installed surrounding the pit, approximately fifty feet out from the

perimeter of the pit. 4,4'-DDT was detected in only one sample, at 0.12 ug/l, below the drinking water screening level of 0.23 ug/l. All other results were non-detect. This result is consistent with the 2002 sampling of four permanent wells in the vicinity of the BCMCC. No insecticides were detected in the 2002 samples. The pit was backfilled with clean soil to match the surrounding grade.

Post-Excavation Sampling – 2011: documented in *Act 2 Final Closure report for River Road North Parcel Soil and Groundwater*, Rohm and Haas Company, prepared by URS Corporation, August 2012.

After completing excavation at the BCMCC area, URS collected 12 soil samples (one sample at 12 separate locations at the bottom and sidewalls of the excavation) to confirm the removal of impacted soils and attainment of the Pennsylvania Statewide Health Standards (SHS) for residential soil. Samples were analyzed for 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE. Sample results confirming attainment of residential SHS.

Act 2 Program Assessment: documented in *Act 2 Final Closure Report for River Road North Parcel Soil and Groundwater*, Rohm and Haas Company, prepared by URS Corporation, August 2012, with January 2013 Addendum.

PADEP approved the Act 2 Final Report on January 16, 2013, for attainment of Act 2 Site-Specific Standards for contaminants identified in soil and groundwater. The approval requires use restrictions, in the form of an environmental covenant, to restrict exposure to:

- 4,4'-DDT contamination in the subsurface soil of the BCMCC seepage pit area, and
- TCE contamination in the groundwater.

These restrictions were implemented through the Environmental Covenant recorded on March 21, 2013.

ATTACHMENT B
Former Wastewater Treatment Area
Summary of Environmental Investigations

Comprehensive Investigations, 2001 through 2007

August 2001 Site-wide Investigation: results documented in *RCRA Facility Investigation Report, Former Wastewater Treatment Plant, Bristol Complex*, Rohm & Haas Company, prepared by URS, June 2002

The investigation was conducted to characterize the nature and extent of contamination. Soil, sediment, surface water, and groundwater samples were collected from all areas. All samples were analyzed for volatile organic chemicals (VOCs), semi-volatile organic chemicals (SVOCs), and metals. Pesticides and polychlorinated biphenyls (PCBs) analysis was performed on a limited number of samples, since these contaminants were not historically detected in the wastewater discharge to the Wastewater Treatment Area. The scope of the sampling included:

- Soil samples: 46
- Sediment samples:17
- Surface water samples: 8
- Ground water samples: 11 wells
    - The groundwater monitoring network included 10 groundwater table (Holocene) wells and one deep aquifer (Trenton Gravel) well.

June 2002, Supplemental Sampling: results documented in *Screening Ecological Risk Assessment – Addendum Report, Wastewater Treatment Plant, Bristol Complex, Rohm & Haas Company*, Rohm & Haas Company, prepared by URS, 2/13/2003

The scope of the sampling included:

- Former Burning Area: 2 surface soil samples, analyzed for metals, SVOCs, pesticides, and PCBs
- Former Treated Water Basins: 8 surface sediment samples, analyzed for metals, VOCs, SVOCs, pesticides, and PCBs

October 2002, Sludge Disposal Area Investigation – results documented in *Environmental Site Investigation Report, Parcel South of River Road*, Rohm and Haas Company, prepared by ST Environmental, April 2003

The scope of sampling supplemented the soil and groundwater investigations of the area conducted as part of the Ammonium Sulfate Area. The investigation included:

- Groundwater samples from 3 wells, analyzed for VOCs, SVOCs, pesticides, and metals; and
- Soil samples from 6 locations analyzed for VOCs, SVOCs, herbicides, pesticides, PCBs, and metals

May 2003, Supplemental Sampling: results documented in *Baseline Environmental Risk Assessment, Former Wastewater Treatment Plant, Bristol Complex*, Rohm & Haas Company, prepared by URS, August 2005

The scope of the sampling included 6 sediment samples from the Former Treated Water Basins. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs.

March and May 2004, Supplemental Sampling – results documented in *Baseline Environmental Risk Assessment, Former Wastewater Treatment Plant, Bristol Complex*, Rohm & Haas Company, prepared by URS, August 2005

The scope of the sampling included:

- Former Burning Area: 5 surface soil samples, analyzed for the pesticide 4,4'-DDT and the SVOC compound bis(2-chloroethyl) ether (BCEE)

- Former Treated Water Basins: 11 sediment samples, analyzed for select metals, SVOCs, and cyanide.

June 2004, Supplemental Groundwater Sampling: results reported in *Bristol Site Wastewater Treatment Study Area, Supplemental Groundwater Sampling Results*, Letter Report, Dow Chemical Company to EPA, dated 6/5/2009

The area wells sampled August 2001 were resampled for VOCs, SVOCs, metals, ammonium, sulfate, and pesticides.

May 2006, Supplemental Sediment Sampling: results documented in *Phase VI Supplemental Sediment Sampling Results, Former Wastewater Treatment Plant, Bristol Complex, Rohm & Haas Company*, Letter Report, Rohm & Haas to EPA, dated 7/14/2006

The scope of the sampling included 17 sediment samples from the Former Treated Water Basins. The samples were analyzed for the pesticides 4,4'-DDT, 4,4'-DDE, and 4,4'-DDD.

May-June 2007, Supplemental Assessment of 4,4'-**DDD and** 4,4'-**DDE**: results documented in *Biological Tissue and Benthic Community Sampling Results, Former Wastewater Treatment Plant, Bristol Complex*, Letter Report, URS to EPA, dated 8/16/2007

Fish tissue and benthic invertebrate samples were collected from 8 areas of Former Treated Water Basins 1 and 2. Samples were analyzed for 4,4'-DDD and 4,4'-DDE to provide empirical data for the biota-sediment accumulation factors used in the environmental risk assessment.

Summary of Comprehensive Site Investigation Results

Soil and Sediments

- Contaminant concentrations were below the EPA Region 3 Screening Level (RSL) for direct contact, except for arsenic. Arsenic concentrations in some samples were two to three times the screening level of 3.0 milligrams per kilogram (mg/kg), but within the range naturally occuring in soils. All arsenic concentrations were below the PA residential direct-contact Statewide Health Standard (SHS) of 12 mg/kg.
- Former Wastewater Treatment Basins: Multiple constituents were at concentrations that may pose a risk to wildlife. In addition, the deep, open basins were a safety hazard to workers and trespassers who might fall into the basins. EPA directed Rohm & Haas to close the basins to eliminate the direct contact and safety hazards.
- Former Treated Water Basins: Several metals, PAHs, PCBs, and 4,4'-DDD and 4,4'-DDE in Treated Water Basins 1 and 2 were detected at concentrations that may pose a risk to aquatic biota and wildlife. The Baseline Environmental Risk Assessment (August 2005), documented that total organic carbon and sulfide concentrations in the sediment reduced the bioavailability of metals and organic constituents (PAHs and PCBs). Further assessment of 4,4'-DDD and 4,4'-DDE was required.
- Fish tissue and benthic invertebrate samples for 4,4'-DDD and 4,4'-DDE showed that concentrations did not pose an exposure concern.

Surface Water – A few chemical constituents were detected in the surface water. The Baseline Environmental Risk Assessment (August 2005), documented that they were not a risk to aquatic biota or wildlife.

Groundwater – The following constituents exceeded the drinking water standards:

- Vinyl chloride – one well in 2004
- arsenic – one wells in 2001, and two wells in 2004;
- lead – two wells in 2001;
- BCEE – 2 wells in 2001 and 2004, and two wells in 2004.

Except for BCEE, concentrations were less than 2 times the drinking water standard. BCEE concentrations were up to 1.3 ug/l, compared to the drinking water standard of 0.014 ug/l.

Manganese was also detected at concentrations above the drinking water standard. Elevated manganese in groundwater is attributed to regional background conditions, as documented in *Assessment of On-Site and Off-Site Manganese in Groundwater and Potential Influence Due to the Ammonium Sulfate Plume*, Rohm and Haas Company, prepared by URS, February 2016, and approved by EPA and PADEP in April 2016.

Wastewater Treatment Plant Area Groundwater Monitoring Investigation, 2013 – 2017: results documented in *Act 2 Final Report for Groundwater at the Former Wastewater Treatment Plant Area, Bristol Plant*, Rohm and Haas Company, prepared by AECOM, January 2018

The monitoring program collected data to meet the Act 2 Program closure requirements for 8 quarters of groundwater data, including Point of Compliance (POC) wells along the Delaware River. The monitoring network consists of 17 wells, including 5 POC wells. Samples were analyzed for VOCs, SVOCs, and metals.
The scope of the monitoring included

- July 2013 through June 2014 - Four consecutive quarterly rounds of sampling from 11 existing well, including 2 POC wells;
- 2015 - Four consecutive quarterly rounds of sampling from four new POC wells;
- November 2016 and January 2017 – Four additional quarterly rounds of sampling from the POC wells.

Summary of Groundwater Investigation

The following constituents exceeded the Pennsylvania SHS for groundwater:

- BCEE – 11 samples in 7 wells;
- Arsenic – 6 samples in 2 wells;
- Chloride – 8 samples in 2 wells; and
- Nitrate – 1 sample

Contaminant concentrations were the same order of magnitude, but slightly above, Act 2 standard.

Only BCEE exceeded the SHS at a POC well, at the perimeter of the Delaware River. Well CR-215-11 contained 0.91 ug/l BCEE in October 2013. Therefore, a fate and transport evaluation was conducted of groundwater contamination discharge to the Delaware River. Using the highest POC concentration, 0.91 ug/l, a surface water concentration of 0.006 ug/l was calculated. This is below the human health Surface Water Quality Criterion (SWQC) of 0.03 ug/l, and the drinking water standard of 0.014 ug/l.

Former Burning Area Investigation, 2014 through 2016: results documented in *Former Burning Area Act 2 Remedial Investigation Report*, Rohm and Haas Company, prepared by AECOM, June 2017

Soil and Groundwater Screening

- A Membrane Interface Probe screening included 16 borings to identify the area of contamination. The screening tool identified the presence of VOCs within the vertical soil profile. The initial boring started near POC well CR-122. Step-out borings defined the horizontal area of contamination.
- 31 shallow and deep groundwater samples were collected through hydropunch borings. The sampling results were used to select permanent well locations.

Soil and Saprolite Investigation

- 18 borings were completed: 15 into the deep (saprolite) zone, and 3 terminating in the shallow zone.
- 122 soil samples were collected. All soil samples were analyzed for VOCs and SVOCs.
- 7 borings were completed as new monitoring wells.

Groundwater Monitoring

25 well locations were monitored; 10 shallow and 15 deep wells. Wells were sampled up to 5 times, depending on the well installation date. Samples were analyzed for VOCs and SVOCs.

Fate and Transport Analysis

The groundwater to surface water migration pathway was evaluated due to the proximity of the groundwater contamination to the Delaware River.

- Tidal Study - Data from pressure transducers installed in the deep wells was collected over multiple tidal cycles. The study determined the direction and magnitude (gradient) of groundwater flow into the Delaware River.
- Passive Flux Meter Investigation - Tubes with sorbent resin were installed in the wells. The sorbent was then analyzed to determine the location and depth of the greatest mass flux into the river.
- Contaminant Mass Discharge Calculation – In stream concentrations of all contaminants of concern were calculated. The mass discharge calculation used the conservative assumptions of no dilution, sorption, advection or dispersion of the contaminant concentrations.

Summary of Burning Area Investigation Results

- No soil samples in the upper 15 feet of soil exceeded the direct contact SHSs.
- Contamination was localized in two zones:
  - a shallow zone at 2-10 feet below ground surface (bgs), and
  - a deep zone at 40-50 feet bgs, in the upper 10 feet of the saprolite formation.
- Groundwater contamination exceeded Nonresidential SHS and the drinking water standards as follows:
  - Benzene, chlorobenzene, 1,2-DCA and BCEE at 6 shallow wells, and
  - Benzene, chlorobenzene, 1,4-DCB, 1,2-DCA, 1,4-dioxane, and BCEE at 8 deep wells.
- The highest mass flux of contaminants was measured at the bottom 1-foot vertical of the well screen for wells CR-122-53 (53 feet bgs) and CR-227-38 (38 feet bgs).
- BCEE in upper 5 feet of saprolite (deep zone) is back diffusing into the deep aquifer.
- A fate and transport analysis of discharges to the Delaware River determined:
  - No remedial action is necessary for the shallow impacted soil or groundwater.
  - BCEE migration from the deep zone was predicted to potentially exceed the human health SWQC.

- Calculated maximum surface water concentrations of BCEE were 0.044 ug/l from the deep groundwater zone discharge, and 0.009 ug/l from the shallow groundwater zone discharge. The discharge potentially exceeds the human health SWQC of 0.030 ug/l.
- There were no exceedances of the fish and aquatic life SWQC.

Act 2 Program Assessments

Soil and Sediment: documented in *Act 2 Final Closure Report for Soil and Sediment at the Former Wastewater Treatment Plant Area*, Rohm and Haas Company, prepared by URS, October 2012, and addendum, March 2013

PADEP approved the Act 2 Final Report for attainment of:

- Residential SHS for surface and subsurface soil, and
- Site-Specific Standard (SSS) for sediment

The approval requires use restrictions, in the form of an environmental covenant to:

- prohibit the construction of residential property, and
- inspect and maintain the closure soil caps for Units 1,2, and 7.

These restrictions were implemented through the Environmental Covenant recorded on June 3, 2013.

Groundwater: documented in *Act 2 Final Report for Groundwater at the Former Wastewater Treatment Plant Area, Bristol Plant*, Rohm and Haas Company, prepared by AECOM, January 2018

PADEP approved the Act 2 Final Report for groundwater at the Former Wastewater Treatment Area, excluding the Former Burning Area, for attainment of:

- SSS for BCEE, and
- Non-residential SHS for other contaminants.

Groundwater use restrictions are included in the Environmental Covenant recorded on June 3, 2013. The covenant prohibits the use of groundwater for potable or any other consumptive use.

Former Burning Area Soil and Groundwater: documented in *Former Burn Area, Act 2 Remedial Investigation Report*, Rohm & Haas Company, prepared by AECOM, June 2017; and *Former Burning Area, Act 2 Clean-up Plan*, Rohm & Haas Company Bristol Plant, prepared by AECOM, August 2017

PADEP approved the remedial investigation and cleanup plan for attainment of nonresidential SHSs and SSSs for soil and groundwater. The approved remedial actions should reduce the back diffusion of contaminants in the upper saprolite such that the surface water discharge can be demonstrated to comply with the SWQC.

ATTACHMENT C
Manufacturing Area
Summary of Environmental Investigations

RCRA Facility Investigation, 1990 through 1991: results documented in *Manufacturing Area RFI Interim Report,* Rohm and Haas Delaware Valley Inc., prepared by BCM, July 1992; and data summary tables in Appendix V of *Bristol Manufacturing Area, Act 2 Remedial Investigation Report/Cleanup Plan for Soil*, Rohm and Haas Company, prepared by AECOM, August 2018

The investigation was conducted to characterize the physical properties of the subsurface soil and to evaluate areas of possible contamination. The scope of the investigation included:

- Subsurface soil property samples - 16 soil borings;
- Soil samples - 96 samples, both surface and subsurface samples, at 21 areas that managed waste, Solid Waste Management Units (SWMUs), or where releases may have occurred, Areas of Concern (AOCs); and
- Groundwater samples from 48 wells.

Soil and groundwater samples were analyzed for parameters appropriate for the materials managed in the area being evaluated. Analytes included volatile organic chemicals (VOCs), semi-volatile organic chemicals (SVOCs), metals, herbicides, pesticides, dioxins, and Rohm and Haas specific chemicals.

Summary of Investigation Results

- Arkema/Keystone Development area
  - Soil: Arsenic concentrations ranged from 3.5 milligrams per kilograms (mg/kg) to 11.2 mg/kg, compared to the EPA Regional Screening Level (RSL) of 3.0 mg/kg. This concentration range is consistent with naturally occuring concentrations in the area, and it is below the Act 2 Statewide Health Standard (SHS) of 12 mg/kg for residential soil.
  - Groundwater: Manganese concentrations ranged from 117 ug/l to 4,460 ug/l, compared to the EPA drinking water standard of 430 ug/l. Elevated manganese in groundwater is attributed to regional background conditions, as documented in *Assessment of On-Site and Off-Site Manganese in Groundwater and Potential Influence Due to the Ammonium Sulfate Plume*, Rohm and Haas Company, prepared by URS, February 2016, and approved by EPA and PADEP in April 2016.

- Bristol Manufacturing area
  - Soil:
    - Arsenic concentrations were generally below 10 mg/kg. Elevated concentrations were detected in three areas; former DNCP process tank (SWMU 1), former ash pile (SWMU 7), and waste blending/pump station (SWMU 9). Arsenic concentrations ranging from 20 mg/kg to 142 mg/kg in those areas.

- Zinc concentrations exceeded the RSL of 35,000 mg/kg in two samples at the Former Zinc Oxide Pile AOC. Zinc concentrations were 75,000 and 91,900 mg/kg.
- Trichloroethylene (TCE) exceeded the RSL of 1.9 mg/kg in one sample at the herbicide neutralize tank (SWMU 2). The surface soil sample contained 294 mg/kg TCE.
- Several other organic compounds and metals exceeded the RSL in individual samples; however, average concentrations in the area were below the RSLs.

o Groundwater: Concentrations of organic chemicals and metals were detected at varying concentrations. Contamination was generally localized and not indicative of a groundwater plume.

Arkema/Keystone Development Group Groundwater Investigation, 1998 - 2004: results documented in *Baseline Groundwater Sampling Report for Elf Atochem Area Groundwater Monitoring Program*, Rohm & Haas Company, prepared by ST Environmental Professionals (STEP), August 1998; and *Groundwater Sampling Report for Bristol Research Technical Center & Atofina Production Area*, Rohm and Haas Company, prepared by STEP, September 2004

The investigation was conducted to update historical groundwater quality and flow direction data. The scope of the investigation included groundwater monitoring at 19 wells located upgradient, within, and downgradient of the area. Groundwater samples were collected in March 1998, April 2004, and July 2004. Samples were analyzed for VOCs, SVOCs, metals, and cyanide.

Summary of Investigation Results

- Groundwater flow patterns were consistent with historical data. Groundwater flow is from northwest to east/southeast, toward Otter Creek.
- Tetrachloroethylene (PCE) was detected above the drinking water standard of 5 micrograms per liter (ug/l) only in the upgradient well, W-18-32. The PCE concentration was 19 ug/l.
- Arsenic was detected above the drinking water standard of 10 ug/l in two wells, at 17 ug/l and 41 ug/l.
- Chromium was detected above the drinking water standard of 100 ug/l in two wells, at 139 ug/l and 153 ug/l.
- Manganese was detected up to 6,970 ug/l, compared to the drinking water standard of 430 ug/l. Elevated manganese in groundwater is attributed to regional background conditions, as documented in *Assessment of On-Site and Off-Site Manganese in Groundwater and Potential Influence Due to the Ammonium Sulfate Plume*, Rohm and Haas Company, prepared by URS, February 2016, and approved by EPA and PADEP in April 2016.
- Except for manganese, average groundwater concentrations were below the drinking water standards.

Study Area East Investigation, 2001: results documented in *Groundwater Monitoring Report, Bristol Manufacturing Area, Study Area East*, Rohm and Haas Company, prepared by Sigma Environmental Services, October 2005; and data summary tables in Appendix V of *Bristol Manufacturing Area, Act 2 Remedial Investigation Report/Cleanup Plan for Soil*, Rohm and Haas Company, prepared by AECOM, August 2018

The investigation was conducted to characterize the inactive area for future land use options. The scope included:

- Soil - 120 samples, both surface and subsurface, collected from 68 soil boring locations; and
- Groundwater – shallow groundwater samples from 16 wells.

Samples were analyzed for VOCs, SVOCs, and metals.

Summary of Investigation

- Groundwater
  - Arsenic exceeded drinking water standard of 10 ug/l in three samples. Arsenic concentrations ranged from non-detect to 39.7 ug/l.
  - Iron exceeded drinking water standard of 14 milligrams per liter (mg/l) in three samples. Iron concentrations ranged from non-detect to 35.2 mg/l
  - Manganese was detected up to 8,100 ug/l, compared to the drinking water standard of 430 ug/l. Elevated manganese in groundwater is attributed to regional background conditions, as documented in *Assessment of On-Site and Off-Site Manganese in Groundwater and Potential Influence Due to the Ammonium Sulfate Plume*, Rohm and Haas Company, prepared by URS, February 2016, and approved by EPA and PADEP in April 2016.
  - Several organic compounds were detected at low concentrations, generally below the drinking water standard.
  - Except for manganese, average groundwater concentrations were below the drinking water standard.

- Soil
  - Zinc concentrations exceeded the RSL of 35,000 milligrams per kilogram (mg/kg) in 5 surface samples in and around the Former Zinc Oxide Pile AOC. Zinc concentrations ranged from 697 to 483,200 mg/kg.
  - Arsenic concentrations were generally below 8 mg/kg, with one detection at 35.3 mg/kg (Oil Tank Area).
  - Benzo(a)pyrene exceeded the RSL of 2.1 mg/kg. Concentrations were generally below 8 mg/kg, with one sample at 12 mg/kg.
  - Naphthalene exceeded the RSL of 17 mg/kg in 4 samples at SWMU 8 and Process Area B-6. Concentrations ranged from non-detect to 240 mg/kg.

Tank Farm 34A AOC Groundwater Investigation, 2009: results documented in *Groundwater Monitoring Report, Bristol plant, Tank Farm 34A Area*, Dow Chemical Company, prepared by Sigma Environmental Services, December 2009

The scope of the investigation was to evaluate groundwater in the area of previous VOCs contamination. Groundwater from 13 wells, in the Tank Farm 34A area and downgradient, were sampled and analyzed for VOCs. No contaminants were above drinking water standards.

Methyl Methacrylate Release investigation, 2010: results documented in *Methyl Methacrylate Release Investigation*, Rohm and Haas Chemicals Bristol Plant, prepared by URS, December 2010

Following removal of the spilled methyl methacrylate and contaminated soil, twelve (12) soil samples were collected from the excavation to document the remediation. Methyl methacrylate concentrations were below the Act 2 SHS.

Tank Farm 30A Investigation and Remediation, 2012 – 2014: results documented in *Remedial Action Completion Report – Final Report, Tank Farm 30A - Incident No. 43864*, Rohm and Haas Bristol Plant, prepared by URS, November 2014; and *Bristol Manufacturing Area Act 2 RI/CUP Plan*, Rohm and Haas Company, prepared by AECOM, August 2018

The scope of the investigation was to determine the area of impact of the butyl acrylate (BA) and ethyl acrylate (EA) release in May 2012; and to characterize soil, groundwater, and surface water quality during and after remediation. Samples were analyzed for VOCs, including acrylate compounds.

- Groundwater monitoring: Thirty-three (33) wells, both shallow and deep aquifer, were monitored over 12 rounds of sampling. Samples were collected monthly from May 2012 through August 2012, followed by quarterly monitoring until October 2014.

- Surface soil and subsurface soil:
  - Pre-remediation/extent of contamination – July and August 2012
    - Membrane interface probe survey – 40 borings
    - 74 surface and subsurface confirmatory samples, up to 20 feet deep
  - Attainment/post-remediation
    - May and June 2013 - 71 samples, both surface and subsurface (2 to 20 feet interval)
    - February 2014 – 65 subsurface samples

- Surface water monitoring: Three rounds of samples were collected from Schmidt's Lake (8 locations) and Lake Idaline (3 locations) in May and June 2012

Summary of Investigation Results

- Groundwater
  - Shallow aquifer flows east toward Otter Creek. Deep aquifer flows south toward the Delaware River.
  - Pre-remediation shallow groundwater results indicated a highly impacted by localized area of contamination.
  - Deep groundwater was not impacted.
  - Exceedances were limited to 100 feet distance from the tank farm.
  - Post-remediation contaminant concentrations decreased up to three orders of magnitude between June 2012 and October 2014.
  - Fate and transport analysis based on 2 years of groundwater analysis show that the plume will not migrate due to ongoing natural attenuation processes.
  - Contaminant concentrations exceeded the Act 2 SHS at only two locations in October 2014, immediately adjacent to the tank farm containment pad.
  - Contamination in 2016 was limited to only one well area, W-111-18. EA concentration average of over 5,000 ug/l in W-111-18 exceeded the Act 2 SHS of 70 ug/l. BA concentration averaged of over 100,000 ug/l. BA does not have a screening value.

- Soil
  - The area of soil impact was less than one acre.
  - Contamination was greatest immediately above and below the groundwater table and in the unsaturated soil zone.
  - Pre-remediation contamination concentrations were up to 190,000 mg/kg BA and 140,000 mg/kg EA.
  - Post-remediation

    Surface soil (0-2 feet) post-remediation concentrations
    - No exceedances of Act 2 SHS.
    - Non-detect to 13 mg/kg of BA, below the Act 2 direct contact Site Specific Standard (SSS) of 10,000 mg/kg
    - Non-detect to 4.2 mg/kg of EA, below the Act 2 direct contact SHS of 1,700 mg/kg

    Sub-surface post-remediation concentrations
    - EA and BA exceed SHS for protection of groundwater.
    - Non-detect to 7,600 mg/kg of BA
    - Non-detect to 21,000 mg/kg of EA
  - 70 % reduction in mass of contaminants, most contamination at 8’ to 15’ deep.

- Surface water
  - BA and EA were detected above 10,000 ug/l in Schmidt’s Lake immediately following the release.

- Concentrations were reduced to 1 ug/l or non-detect within 16 days after the release through volatilization and biodegradation.

Act 2 Program Groundwater Monitoring, Bristol Manufacturing Area, 2015-2018: results documented in *Bristol Manufacturing Area, Act 2 Revised Remedial Investigation Report/Focused Risk Assessment/Cleanup Plan for Soil*, Rohm and Haas Company, prepared by AECOM, July 2019

The groundwater monitoring program collected data to meet the Act 2 closure requirements. Samples were analyzed for VOCs, SVOCs, metals, and Rohm and Haas site-specific constituents. Based on past site operations, selected wells were also analyzed for pesticides, herbicides, and PCBs. Groundwater was sampled during 6 site-wide events between 2015 and November 2018, and one limited sampling event in 2017.

- 2015: Fifty-one (51) wells were sampled.
- 2016: Sixty-seven (67) wells were sampled, during 3 quarterly events.
- 2017: Eleven wells and eight hydropunch locations were sampled.
- 2018: Sixty-nine (69) wells were sampled, during 2 quarterly events.

A groundwater to surface water fate and transport analysis was performed to evaluate the potential impact of groundwater contamination on surface water in Otter Creek. The analysis included a tidal study and contaminant mass discharge calculations for all contaminants of concern detected at wells adjacent to Otter Creek. The evaluation is documented in Appendix N of the Revised Remedial Investigation Report.

Summary of Investigation Results

- Shallow groundwater in the north and central portion of the Bristol Manufacturing area flows north toward Otter Creek or east toward the Trailer Staging Area, Bristol Borough wastewater treatment plant, and a wooded area. Limited flow is to the south near Schmidt's Lake.
- Deep groundwater (Trenton Gravel) flows southeast toward the Delaware River.
- Several VOCs, SVOCs, metals and cyanide exceeded drinking water standards. Elevated concentrations of individual contaminants were confined to limited areas.
- BCEE and 1,2-Dichloroethane concentrations exceed the screening levels at well W-2-10. That well is located at the Trailer Staging Area, downgradient of the Manufacturing Area. The contamination will be evaluated as part of the Trailer Staging Area.
- Well W-93 contained a localized area of petroleum hydrocarbon Non-Aqueous Phase Liquid (NAPL), composed of lubrication oil and diesel fuel.
- Arsenic and manganese concentrations exceeded the drinking water standards at the eastern downgradient wells. The elevated concentrations are not associated with any identified discharges or soil contamination. The concentrations are attributed to naturally occuring soil concentrations and variations in aquifer geochemistry; with reducing conditions associated with elevated concentrations of arsenic and manganese.

- Zinc concentrations in well W-38-12, adjacent to Otter Creek, could potentially impact surface water. The groundwater to surface water mass flux evaluation estimated zinc concentrations in Otter Creek at 4.6 to 7.8 ug/l, below the Surface Water Quality Criterion (SWQC) of 120 ug/l.
- Groundwater discharging to Schmidt's Lake does not exceed SWQC.

Act 2 Program Soil Sampling, Bristol Manufacturing Area, 2016-2019: results documented in *Bristol Manufacturing Area, Act 2 Revised Remedial Investigation Report/Focused Risk Assessment/Cleanup Plan for Soil*, Rohm and Haas Company, prepared by AECOM, July 2019

Sample locations were based on historical soil data and 2015 groundwater monitoring results.

- 2016: Eighty-one (81) soil samples, both surface and subsurface, were collected at 40 boring locations. Samples were analyzed for constituents based on past operations at the area.
- 2017: Thirty-five (35) soil samples were collected to complete the characterization of several areas.
- 2018-2019: Twenty-three (23) additional soil samples were collected in the areas of well W-93-10 and Soil boring SB-07-02 to define the area of contamination.

Summary of Results

- Surface soil contaminant concentrations exceeded screening levels for the following constituents:

location	Contaminant	Direct contact Surface soil Screening level mg/kg	EPA Industrial Direct Contact RSL mg/kg	Exceedance concentrations mg/kg
SWMU 11	Benzo(a)pyrene	12	2.1	9.7 and 16
SWMU 7	Benzo(a)pyrene	12	2.1	21
	Arsenic	61	3.0	65, 69, and 200
	Vanadium	200	5,800	560 and 1,300
Building 65 Area	Lead	1,000	800	1,530
SWMU 12	TCE	160	6.0	294
Zinc Oxide Pile	Zinc	190,000	350,000	310,000, 410,000, and 483,000

- Well W-93 Area - Subsurface soil, up to 12 feet bgs, contained petroleum hydrocarbon contamination related to the NAPL detected in well W-93-10. Benzene, ethylbenzene, toluene, xylene, and naphthylene were detected above the screening level for protection of groundwater.

Risk Assessment

A focused risk assessment was performed for SWMU 7 and SWMU 11, to evaluate the risk for direct exposure to contaminated soil. The assessment showed only one potential adverse risk under likely future exposure (industrial use); the risk to future construction workers exposed to vanadium at SWMU 7. The risk was driven by an elevated concentration at one location, SB-07-02. Removal of that area from the assessment reduced the risk below industrial exposure screening levels.

AECOM

Rohm and Haas Bristol Plant, Manufacturing Area
Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs)
Summary of Historic Uses and Current Conditions

Unit Identification	Additional Information	Date Unit Removed or Process Shut Down	Current Status of Location
SWMU 1 (DNCP Proc Waste Tank) and SWMU 2 (DNCP Neut Tank)	SWMU 1 DNCP wastewater process; SWMU 2 DNCP wastewater neutralization.	1983 removed	Area is vacant and covered with asphalt/concrete
SWMU 3 (Sulf Acid Tank)	Contained sulfuric acid and methacrylic wash residues	1984 removed	Area covered with asphalt and a tank truck loading/unloading station.
SWMU 4 (Waste Tank) and SWMU 5 (<90 storage pad)	SWMU 4 waste storage tanks; SWMU 5 <90 day storage	2008 removed	NFA requested. In 2004 EPA stated groundwater is not an exposure concern. Units removed when Building 134 demolished.
SWMU 6 (Industrial Boilers)	SWMU 6 Industrial Boilers for the recycling of hazardous waste for energy recovery	Early 1990's tanks 5 and 6 closed; 2005 tanks 7 and 8 closed	All tanks closed by 2005. No spills documented. Building containing SWMU 6 (Building 42) is still present but inactive.
SWMU 7 (Ash Pile)	Waste ash from coal fired boilers	1970 removed	Area asphalt/concrete covered in central/southern Section: northern section - gravel and concrete.
SWMU 8 (Waste Pump Station)	Pump station - burning of liquid hazardous waste	1988 removed	Area is asphalt and gravel covered.
SWMU 9 (New Waste Pump Station)	Pump station - burning of liquid hazardous waste	2005 Clean Closure Obtained	Structure is still present.
SWMU 10 (two 4000 gal tanks)	1952 - 1970: Sulfuric Acid. 1970 - 1987: MMA distill. 3rd stage bottoms	1987 removed	Removed. Area is asphalt covered.
SWMU 11 (3 Tanks <90 day Haz Storage)	Storage MMA distillation third stage bottoms	Active as tank-farm/drum-storage until 1984	Area is gravel covered and used for tractor trailer parking. Tank 366 = concrete secondary containment present.
SWMU 12 (Wood Neut Tank)	Neutralization of herbicide manufacturing waste water	1953	Predominantly asphalt with concrete transformer pad: gravel surrounding pad.
SWMU 13 (Tile Drain Field)	Percolation of Herbicide wastewater	1953 covered	Area covered by warehouse building 114
SWMU 14 (MMA Recovery Unit)	Methyl methacrylate recovery unit	1985 removed	Area is asphalt covered
AOC Former Zinc Oxide Pile	Zinc oxides, zinc hydroxides, zinc carbonates.	1972 removed	Area contains plant fire house, asphalt pathways and parking lots, some areas gravel covered.
AOC Taste Abatement Tank	Tank to treat liquids for taste aesthetics.	1990 replaced	Wooden tank replaced in 1990 with new tank
AOC Taste Abatement Tank Overflow Area	Overflow associated with Taste Abatement Tank pumped to the southeast low lying area.	1990 replaced	Replaced with new tank system. Woods and phragmites present.
AOC TF 30A	Contained as many as 24 tanks.	Inactive and demolished by 2012	Tanks removed. Area inactive. Act2 Relief of Liability obtained*.
AOC TF 51B 51C	Storage of oil additives	1988 shutdown	All tanks have been removed. Concrete containment remains: concrete floors may contain cracks
AOC TF 51A 53A	Storage of oil additives	1988 shutdown	All tanks have been removed. Concrete containment floor remains: concrete floors may contain cracks.
AOC SVS Area 51	Location Bldg37 - produced plexiglass molding powder and ion exchange resins.	Bldg37 demolished in 1986	Current area contains package boiler building & air pollution control device.
AOC Building 65	Plant machine shop	Building still present	Building machine shop surrounded by asphalt cover.
AOC B Process Area	Methyl methacrylate production	Late-1970s/early-1980s removed	Asphalt and gravel covered
W-93 area	Petroleum material in well	Well W-93-10 to be abandoned, petroleum material to be remediated.	Gravel in area of well. Woods and phragmites east of well.

* TF30A: Remedial Action Completion Report/Act2 Final Report. Approved by PADEP February 2015.