Superfund Proposed Plan

U.S. Environmental Protection Agency

Combe Fill South Landfill Superfund Site

Chester Township, New Jersey

August 2018

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan describes the remedial alternatives considered for the first and second operable units (OU1 and OU2) of the Combe Fill South Landfill (CFS) Superfund Site and identifies the preferred remedial alternatives along with the rationale for the preferences.

The Proposed Plan was developed by the United States Environmental Protection Agency (EPA), the lead agency for the CFS Site, in consultation with the New Jersey Department of Environmental Protection (NJDEP), the support agency. EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9617(a) (CERCLA, commonly known as Superfund), and Sections 300.430(f) and 300.435(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The nature and extent of contamination at the CFS Site and the remedial alternatives summarized in this Proposed Plan, are described in detail in the Final Remedial Investigation (RI) and Feasibility Study (FS) Reports. EPA encourages the public to review these reports for a comprehensive understanding of the RI/FS conducted at the Site.

EPA's preferred alternatives build upon previously completed cleanup actions conducted at the CFS Site. EPA previously selected a remedial action for OU1 in a 1986 Record of Decision (ROD). Previously completed actions at the Site include capping of the 65-acre landfill; pumping and on-site treatment of shallow groundwater and leachate, with discharge to Trout Brook; installing surface water controls to accommodate seasonal precipitation and storm runoff; installing a passive landfill gas collection and treatment system; excavating and off-site disposal of source material from a portion of the North Waste Cell Area; and constructing a public water supply line to properties that were impacted or threatened by Site contamination.

This Proposed Plan describes the remedial alternatives considered for amending the remedial action selected in the 1986 ROD and identifies EPA's preferred amendment to the OU1 remedy. This Proposed Plan also describes the remedial alternatives considered for the OU2 interim remedy and the preferred alternatives for OU2.

The primary components of the preferred alternative for OU1 consist of upgrading and expanding the groundwater extraction conveyance and treatment system.

For OU2, the preferred alternative for the interim remedy addresses Site-related contamination in groundwater located outside of the landfill property boundary in order to protect human health and the environment.

MARK YOUR CALENDAR

Public Comment Period – August 12 to September 11, 2018

EPA will accept written comments on the Proposed Plan during the public comment period. Written comments should be addressed to:

Pamela J. Baxter, Ph.D., CHMM
Remedial Project Manager
U.S. Environmental Protection Agency
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Email: baxter.pamela@epa.gov

Public Meeting – August 22, 2018 at 7:00 PM

EPA will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at:

Chester Township Municipal Building
1 Parker Road
Chester Township, NJ 07930

EPA's website for the CFS Site:
https://www.epa.gov/superfund/combe-fill-south

Community Role in the Selection Process

This Proposed Plan is being issued to inform the public of EPA's preferred alternatives and to solicit public comments pertaining to the remedial alternatives evaluated, including the preferred alternatives. Changes to the preferred alternatives, or a change from the preferred alternatives to another alternative(s), may be made if public comments or additional data indicate that such a change would result in a more appropriate remedial action. EPA is soliciting public comments on all of the alternatives considered in the Proposed Plan because EPA may select a remedy other than the preferred alternative. This Proposed Plan is available to the public for a public comment period that concludes on September 11, 2018.

A public meeting will be held during the public comment period to present the conclusions of the RI/FS, elaborate further on the basis for identifying the preferred alternatives, and receive public comments. The public meeting will include a presentation by EPA of the preferred alternatives and the other evaluated alternatives. Information on the public meeting and submitting written comments can be found in the "Mark Your Calendar" text box on page 1.

Comments received at the public meeting and during the comment period will be documented in the responsiveness summary section of a ROD in which EPA will select an amendment to the OU1 remedy and an interim remedy for OU2.

The OU1 ROD amendment will amend the 1986 ROD and will be the final decision document for OU1. The OU2 ROD will be an interim decision document. When the OU1 amended remedy is implemented and there is additional supporting data for the deep aquifer at the Site, a final OU2 ROD will be issued. EPA will issue the ROD to amend OU1 and select the interim OU2 remedy after taking into consideration the public comments on this Proposed Plan. The ROD will explain the cleanup remedies selected and the basis for the selection.

Scope and Role of the Action

The CFS Site is being addressed as two operable units. OU1 consists of the landfill property and groundwater directly underlying the landfill, and OU2 is defined as groundwater, both overburden and bedrock, surface water and sediment near and downgradient of the landfill property boundary, see Figure 1.

The 1986 ROD addressed the remediation of the landfill and overburden groundwater located directly below the landfill. Subsequent studies have been conducted to investigate the deeper aquifer underlying the landfill and the plume emanating from the Site.

This Proposed Plan proposes a modification to the OU1 ROD that would upgrade the groundwater conveyance system and the OU1 groundwater extraction and treatment system at the landfill property. This Proposed Plan also identifies EPA's preferred interim remedy for OU2 to address Site related contamination in groundwater located outside of the landfill property boundary in order to protect human health and the environment.

SITE BACKGROUND

Site Description

The Combe Fill South Landfill Site is located in Chester and Washington Townships, Morris County, New Jersey. This inactive municipal landfill is located off Parker Road about two miles southwest of the Borough of Chester. The Site consists of three separate fill areas covering about 65 acres of the 115-acre parcel that was owned by the Combe Fill Corporation (CFC).

The Site is situated on a hill with surface waters draining radially from the Site. Landfill leachate, groundwater, and surface water runoff from the southern portion of the Site constitute the headwaters of Trout Brook, which flows southeast toward the Lamington (Black) River. Southwest of the Site, near the headwaters of the west branch of Trout Brook, is a hardwood wetland. Much of the original wetlands were cleared to construct the landfill. The Site is located in an area that is currently zoned as residential and limited commercial.

OU1 Description

OU1 is defined as the landfill property consisting of four tax parcels, and overburden and bedrock groundwater directly underlying the landfill within the waste management boundary. Within OU1 are an approximately 65-acre multilayered cap, a passive landfill gas venting system, a shallow groundwater extraction and treatment system (GWET), security fencing, surface water runoff controls, and a perimeter access road. The shallow groundwater extraction system consists of 18 extraction wells spaced around most of the landfill perimeter. All but one extraction well, RW-T, are screened at the bottom of the overburden material (approximately 20 to 60 feet below ground surface or “bgs”), at the saprolite/bedrock interface. RW-T is screened from 65 to 115 feet bgs (approximately 50 feet into competent bedrock). The individual extraction wells are currently being cycled on and off based on the water level measurements and limitations in pumping and conveyance piping. Extracted groundwater is pumped through a force main to the GWET operated by the NJDEP. A centralized system allows the operator to control the GWET from the control room or remotely.

The groundwater is treated by physical, chemical and biological processes before being discharged to surface water at East Trout Brook. The GWET has been in operation since 1997 and is permitted to operate at 120 gallons per minute (gpm). However, the GWET influent volume currently averages between 45 to 70 gpm, with the OU1 extraction wells cycling on and off due to poor extraction well performance, reduced yield due to seasonal variations, and limitations in the diameter of extraction well conveyance piping.

OU2 Description

OU2 is defined as groundwater, both overburden and bedrock, surface water and sediment near and downgradient of the landfill property boundary. As shown on Figure 1, the OU2 investigation area is based on the Currently Known Extent (CKE) of groundwater contamination. According to NJDEP, CKE areas are geographically defined areas within which the local groundwater resources are known to be compromised because the water quality exceeds drinking water and groundwater quality standards for specific contaminants. Historically, a number of the CKEs have also been identified as Well Restriction Areas (WRAs). The regulatory authority for developing CKEs is in N.J.A.C. 7:1J, entitled Processing of Damage Claims Pursuant to the Spill Compensation and Control Act. CKEs are used by NJDEP staff, water purveyors, and local officials to make decisions concerning appropriate treatment and/or replacement of contaminated drinking water supplies. In addition to the parcels within the CKE boundary, two additional parcels where landfill-related groundwater contamination was detected make up the OU2 investigation area.

Geology and Hydrology

The Site lies in the Piedmont Physiographic Province, known as “The Highlands” and consists of a 20-mile wide series of northeast-to-southwest trending ridges and valleys extending from the Hudson Highlands of New York to the Reading Prong Region of Pennsylvania. In the area, natural unconsolidated deposits of local soils and granite saprolite overlie highly fractured granite bedrock. A shallow aquifer, also referred to as the overburden groundwater, exists in the saprolite layer, saturating much of the waste, with a deeper aquifer in the fractured bedrock.

The deep aquifer is the major source of potable water near the landfill. Prior to installation of a public waterline in 2015, numerous residential wells within one mile of the Site drew water from this aquifer. NJDEP records indicate that there are six public wells within two miles of the landfill, all of which tap the deep aquifer. The nearest municipal well is about one mile southwest of the Site and is not impacted by Site contamination. In localized areas, the soils and saprolite overlying the bedrock are of sufficient thickness to provide domestic water supplies.

Natural (non-fill) overburden material contains unconsolidated sand, silt, clay, and gravel derived from the underlying bedrock. In most areas (except for the ridgelines), the overburden includes saprolite. Overburden thickness ranges from about four feet on the ridges to 100 feet in the low-lying areas. Overburden depths on the northeast trending ridges and at the adjacent horse farm property are shallow, only about five to 10 feet thick, whereas overburden depths in the low-lying area between the northeast trending ridges and to the south of the landfill vary between 40 and 100 feet thick. Very permeable soil and saprolite account for most of the infiltration from precipitation to the bedrock aquifer.

Site History

Starting in the 1940s, the landfill was operated as a municipal refuse and solid waste landfill. In 1972, ownership and operations changed to Chester Hills, Inc. The landfill was originally approved for the disposal of municipal and non-hazardous industrial wastes, sewage sludge, septic tank wastes, chemicals, and waste oils, as stated in its certificate of registration. In 1978, ownership and operations changed to the CFC. From 1973 to 1981, there were numerous operating violations including the absence of an initial layer of residual soil on the bedrock prior to waste placement. In 1981, NJDEP issued an order for CFC to discontinue waste disposal operations upon completion of the existing trench. CFC ceased landfill operations, filed for bankruptcy and was liquidated. On September 1, 1983, the CFS Landfill Site was listed on the National Priorities List (NPL).

According to NJDEP files, wastes accepted at the landfill during its 40 years of operation included typical household wastes, personal care products, pharmaceutical products, calcium oxide, crushed containers of paints and dyes, aerosol product canisters, industrial wastes, dead animals, sewage sludge, septic tank wastes, chemicals, waste oils, and possibly asbestos. Numerous empty 55-gallon drums were scattered across the landfill surface. Most of wastes that were encountered during field reconnaissance, drilling operations, and test pit excavations included typical household wastes (garbage bags, paper, appliances, etc.). Refuse encountered during the drilling of a well that permeated the center of the landfill appeared to be highly decomposed rubbish. Hazardous materials were not found at the surface of the landfill during field operations.

Based on the original landfill design drawings and records of waste volumes received on-site, approximately five million cubic yards (CY) of waste material are buried in the CFS Landfill. No evidence has been found of disposal of hazardous materials outside of the Site boundaries.

Enforcement History

The State of New Jersey and EPA identified numerous potentially responsible parties (PRPs), including CFC and its parent company, Combustion Equipment Associates. CFC declared bankruptcy in October 1981, one month before the landfill was officially closed.

On October 5, 1983, 97 notice letters were sent to PRPs regarding a proposed RI/FS at the Site. None of the acknowledged recipients offered to undertake the RI/FS.

In 1985, EPA filed an application in bankruptcy court seeking reimbursement of Superfund monies spent at the Site to date. Because limited funds remained in the bankruptcy estate, EPA and CFC reached a settlement in which CFC paid $50,000 in May 1986 to resolve EPA's Superfund claims.

In October 1998, EPA and the State of New Jersey filed a complaint seeking the recovery of past and future response costs incurred and to be incurred in connection with the clean-up of the Site. An initial settlement reached in 2005 resulted in a consent decree with former owner/operators that required payment of $12,500,000 in costs to the State and EPA. A second consent decree entered in 2009 settled claims against approximately 300 private parties and municipalities. The consent decree required payment of $69 million in past costs, approximately $3.2 million in natural resource damages, and a $27 million annuity to fund future work at the Site.

OU1 Remedial Investigation

An RI for the Site was performed by NJDEP during 1984 to 1985. During the RI, major contaminants of concern (COCs) found were benzene, chlorobenzene, ethylbenzene, toluene, trichloroethylene (TCE), 1,2-dichloroethane, chloroethane, methylene chloride, and tetrachoroethylene. These hazardous substances and contaminants were consistent with known past usage of the Site and the variety of wastes accepted, and they persisted in groundwater and surface water. Volatile organic compounds (VOCs) were identified within both the unconsolidated and consolidated aquifers in and around the Site. Groundwater contamination predominantly migrates northeast and southwest from the landfill. The RI identified residents living on Schoolhouse Lane, less than one-half mile from the landfill, and pupils of the day-care facility located on Parker Road as being at risk because groundwater was the primary source of potable water in the immediate area surrounding the Site. The 1986 RI Report documented the presence of a wide range of contaminants in groundwater listed above.

Record of Decision (1986)

EPA issued a ROD on September 29, 1986. The major components of the selected remedy included:

- An alternate water supply for affected residences;
- Capping of the 65-acre landfill in accordance with Resource Conservation and Recovery Act requirements;
- An active collection and treatment system for landfill gases;
- Pumping and on-Site treatment of shallow groundwater and leachate, with discharge to Trout Brook;
- Surface water controls to accommodate seasonal

precipitation and storm runoff;

- Security fencing to restrict Site access;
- Appropriate environmental monitoring to ensure the effectiveness of the remedial action; and
- A supplemental feasibility study to evaluate the need for remediation of the deep aquifer.

Post-ROD Actions

An engineering design was performed to develop the details of implementing the remedy. The 1993 Final Design Report provided the design specifications for the cover system, landfill gas collection and treatment system, the shallow groundwater extraction system and the groundwater treatment system, as well as a groundwater extraction system effectiveness monitoring plan and a preliminary operations and maintenance (O&M) plan.

Construction activities began in January 1993 and were completed in September 1997. Initial activities included, installing temporary utilities, clearing and grubbing, conducting some work on the Site access road, and installing perimeter fencing. Buried drums were discovered in three separate areas along the eastern perimeter of the Site and they were either disposed of off-site or placed underneath the cap. Other major Site work included refuse relocation, conducting landfill cap construction, constructing the perimeter road, installation of wells, constructing the groundwater extraction system, and installing underground piping and electrical conduit. These activities are described in more detail in NJDEP's closeout report dated June 30, 2011.

In 2006, EPA issued an Explanation of Significant Differences (ESD) to revise one of the components of the 1986 ROD. The ESD modified the provisions for an active landfill gas and condensate collection and treatment system to a passive landfill gas venting system. The change to the passive system was made based on test results from studies completed after the 1986 ROD.

In 2001, non-native fill was encountered outside the cap limits along the northern property boundary during the installation of landfill gas probes. This area of non-native fill, which became known as the North Waste Cell (see Figure 1) was investigated and delineated by NJDEP through borings, test pits and trenches. From 2006 to 2009, NJDEP excavated a major portion of the North Waste Cell area, disposed of the waste off-site, and installed an impermeable cap over the area. A smaller portion of the North Waste Cell remains on Site.

Public Water Supply Extension

The deep aquifer is the major source of potable water in the vicinity of the landfill. Numerous residential wells within one mile of the site drew water from this aquifer. In the early 1980s, NJDEP collected water samples from several private wells near the landfill. The results of the water samples found that there were a few private wells contaminated with volatile organics. Based on limited information available from sampling results, NJDEP defined an area of approximately 62 affected residences on Schoolhouse Lane, Parker Road, and part of Old Farmers Road in need of an alternate water supply. The area was later expanded in 1989 to include about 325 homes.

Based on the 1986 ROD, water supply alternatives were evaluated for the affected residences and businesses around the Site. The extension of the Washington Township Municipal Utilities Authority (MUA) Hager Water Distribution System was selected as the water supply solution.

In the early 1990s, after additional sampling revealed fewer impacted drinking water supplies than originally projected. NJDEP installed point of entry treatment (POET) systems in 32 residences in the area of the Site. Initially, the POET systems were intended to be an interim measure pending the design and construction of a public water supply system. The POET systems were proven effective in removing contamination from the potable water supplies and the construction of the public water supply was deferred.

Prior to advancements in laboratory analytical technology, it was not possible to detect 1,4-dioxane at low concentrations. In 2008, 1,4-dioxane was first detected in the potable water supply of the residences with POET systems. An investigation conducted by NJDEP indicated that the POET systems were ineffective in treating the 1,4-dioxane contamination. Experiments with various types of treatment media and treatment processes failed to produce results showing a reduction of the contaminant to an acceptable level.

The discovery of 1,4-dioxane in the private drinking water supplies reinforced the need for an alternate water supply for the properties surrounding the Site. In 2010, EPA performed additional studies that were conducted to thoroughly evaluate current Site conditions and the appropriateness of the existing remedy.

In January 2011, EPA initiated a residential well investigation within the area of concern. As part of the investigation, 213 potable water samples were collected from 160 residential properties located in Chester and Washington Townships, NJ. In June 2011, EPA collected an additional 75 potable water samples from 52 residential properties and from the landfill treatment plant. The analytical results of EPA's residential well investigation indicated that 13 residences located north and east of the Site contained concentrations of 1,4-dioxane in their potable water supply above the Site-specific Action Level of 3.0 micrograms per liter (µg/L) established at the time (2011).

In April 2011, EPA initiated a 1,4-dioxane treatability study to determine if the design and potential installation of systems to treat the 1,4-dioxane contamination was a feasible interim measure that could be implemented in the area of concern until the extension of the water main was completed. EPA evaluated treatment of 1,4-dioxane in private supply wells using a combination of ozone addition and ultraviolet radiation.

The study indicated that the developed system was able to reduce 1,4-dioxane concentrations in the tested water supply by more than 50% but would require multiple passes to achieve 99% removal.

Based on this finding, the design for the waterline extension project began in 2011. The design was completed in late 2012 and permits to construct were obtained in the spring of 2013.

From July 2013 to July 2015, construction of the water main extension project was implemented to address the groundwater contamination that originated at the Site. The waterline extension joins the existing Washington Township, New Jersey MUA system at the intersection of Flintlock Drive and Parker Road and was turned over to Washington Township in July 2015.

EPA connected 73 residences and businesses to the waterline (79 total connections) along Parker Road, Schoolhouse Lane, and a small portion of Route 513 that were threatened by contaminated groundwater from the landfill.

SUMMARY OF OU1 AND OU2 REMEDIAL INVESTIGATION ACTIVITIES

In February 2010, EPA initiated RI/FS activities for the deep bedrock aquifer underlying the landfill and areas outside the landfill property boundary. The RI conducted between 2010 and 2015 included the following field activities:

- Installation of 19 bedrock monitoring wells;
- Installation of nine pairs of piezometers and stream gauges;
- Collection of samples from five soil borings;
- Collection of approximately 200 groundwater samples, 22 soil samples, 24 surface water samples, 53 potable well water samples, and 24 sediment samples;
- Collection of short- and long-term water level monitoring data;
- Geophysical surveys including resistivity, Willowstick® electromagnetic, magnetic gradient and electromagnetic terrain conductivity to locate preferential flow pathways in bedrock and also possible buried drums in two locations at the landfill;
- Downhole investigations incorporating FLUTe™ hydraulic profiling, packer testing, and downhole geophysical surveys including single-point resistivity, long normal resistivity and short normal resistivity; fluid temperature; fluid resistivity; caliper; natural gamma; heat pulse flow meter; and acoustic televiewer; and
- Wetland delineation, wildlife surveys, well condition surveys and land surveys (topographic, boundary, stream cross sections and well/piezometer horizontal and vertical locations).

A long-term aquifer pump test and adsorption pilot test were conducted in 2017 in support of the FS, along with background surface water and sediment sampling in support of the Final Screening Level Ecological Risk Assessment (SLERA).

Multiple lines of evidence indicated that the landfill, including the North Waste Cell area, is a continuing source of groundwater contamination, which impacts surface water in some areas. These lines of evidence include:

- The historic waste burial practice of direct placement on fractured rock;

- Historic and recent groundwater analytical data for the landfill and surrounding area indicating COC concentrations above standards and criteria;
- Concentrations of three COCs - 1,4-dioxane, benzene, and TCE - were higher within the landfill property than in the surrounding area;
- The highest 1,4-dioxane concentrations were detected at a bedrock monitoring well located immediately downgradient of the North Waste Cell, and the highest concentrations of benzene and TCE originated near the northeastern corner of the landfill based on the 2010 through 2015 RI data;
- Direction of groundwater flow is nearly radial and flows in line with the topographic high of the landfill to lower elevations in the surrounding area. Vertical groundwater flow in the bedrock aquifer has shown an upward gradient as well as artesian conditions in some areas;
- Detections of 1,4-dioxane in surface water; and
- Both the North Waste Cell and northeastern corner of the landfill towards Schoolhouse Lane, are along the three preferential groundwater flow paths in bedrock.

A summary of the RI results by media is as follows:

Groundwater

Groundwater flow in the overburden aquifer has three major components: 1) Horizontal flow outward from the landfill generally follows topography towards surface water bodies. The horizontal flow direction is nearly radial from higher elevations at and near the landfill. 2) Groundwater also flows along the bedrock surface from higher to lower top of bedrock surface elevations at the overburden/bedrock interface. Two bedrock surface highs beneath the northwest and southeast portions of the landfill frame the sides of a bedrock surface low that developed at the contact between two rock types and crosses CFS from southwest to northeast. The bedrock interface along this low slope to the northeast and southwest from a divide along the landfill's northern perimeter and marks a major fracture zone. From the divide, groundwater at the overburden-bedrock interface predominantly flows either northeast (towards Schoolhouse Lane and the Lamington River Un-named tributary (UNT)) or southwest (towards Trout Brook); and 3) Vertical flow is towards the bedrock interface into mostly steeply dipping bedrock fractures. Downward flow from the overburden to the bedrock aquifer occurs at the landfill and in the immediate vicinity, whereas upward flow occurs near the streams.

Eight target contaminants - 1,4-dioxane, benzene, TCE, di(2-ethylhexyl) phthalate (DEHP), alpha-benzene-hexachloride (alpha- BHC), lead, arsenic, and chromium - exceeded their respective groundwater quality standards (GWQS) in both OU1 and OU2 monitoring wells. 1,4-dioxane and benzene were the most significant organic groundwater contaminants with 1,4-dioxane exceeding the 0.4 μg/l GWQS at 20 locations in 95 samples with concentrations up to 350 μg/l in the aquifers.

The horizontal extent of 1,4-dioxane-contaminated groundwater is roughly three times longer than it is wide, and is oriented in a northeast-southwest direction, with the North Waste Cell as the "hot spot". The contamination extends from the overhead transmission lines that run perpendicular to Parker Road southwest of the landfill, to County Route 513 aka Washington Turnpike to the northeast. To the west, the contamination extends to the southeastern portion of the horse farm, and to the east, it extends to Parker Road.

The highest concentrations of 1,4-dioxane were detected at the northeast edge of the landfill, at and downgradient of the North Waste Cell and in the area between the landfill and Schoolhouse Lane. Samples collected from monitoring wells in all directions from the landfill and from the shallowest to the deepest depth intervals exceeded the GWQS of 0.4 μg/L. The samples with the deepest detections of Site related groundwater contaminants, including 1,4-dioxane above 0.4 μg/L were from approximately 700 feet bgs.

The benzene plume is roughly half the size of the 1,4-dioxane plume, but has the same general shape. Unlike the 1,4-dioxane plume, the benzene plume appears to originate near the northeast corner of the landfill. Most exceedances for benzene were in the shallower depth intervals.

Surface Water

No exceedances of VOCs, SVOCs, or pesticide COCs criteria are associated with the four investigated streams (Trout Brook, Lamington River UNT and Tanner's Brook UNT, and East Trout Brook). Copper, lead, silver, and cadmium concentrations exceed surface water quality standards (SWQS). Maximum surface water concentrations for each of these four metals were less than an order of magnitude above the respective SWQS: copper (6.7 J μg/l vs. 2.2 μg/l SWQS), lead (9 J μg/l vs. 5.4 μg/l SWQS), silver (0.54 J μg/l vs. 0.12 μg/l SWQS), and cadmium (0.19 μg/l vs. 0.056 μg/l SWQS). Though widespread in surface water near CFS, 1,4-dioxane did not exceed the comparison criterion value (22,000 μg/L). Its presence in streams and seeps indicates that contaminated groundwater originating at the landfill is upwelling into the streams and seeps, but not at levels that would be of ecological concern.

Sediment

In sediment, concentrations of the polycyclic aromatic hydrocarbons (PAHs) anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene, along with benzyl butyl phthalate, exceeded the freshwater ecological screening criteria (lowest effects levels, or LELs) at two locations on the Lamington River UNT and at one location on the Tanners Brook UNT. These PAHs were not detected at intervening sediment sample locations between the landfill and the stream headwaters.

Soils

Five soils borings were installed along the landfill perimeter road to determine if remaining source areas within the landfill, such as possible buried drums and the un-remediated portion of the North Waste Cell, impacted soil. Collection of soil samples did not occur outside the landfill property boundary. Concentrations of nine metals - aluminum, arsenic, beryllium, cadmium, cobalt, manganese, nickel, silver and vanadium - exceeded criteria in various combinations at all five soil boring locations. Arsenic was the only metal in soil that is also a groundwater COC. 1,4-dioxane was not detected in any soil samples.

SUMMARY OF SITE RISKS

As part of the RI/FS, a baseline risk assessment was conducted to estimate the current and future effects of contaminants on human health and the environment. A baseline risk assessment is an analysis of the potential adverse human health and ecological effects of releases of hazardous substances from a site if no actions to mitigate such releases are taken, under current and future groundwater, surface water, and sediment uses. The baseline risk assessment includes a human health risk assessment (BHHRA) and a SLERA.

Human Health Risk Assessment

EPA conducted a four-step BHHRA to assess Site-related cancer risks and noncancer health hazards in the absence of any remedial action. The four-step process is comprised of: Hazard Identification, Exposure Assessment, Toxicity Assessment, and Risk Characterization (refer to the text box "What is Human Health Risk and How is it Calculated").

The BHHRA began with selecting chemicals of potential concern (COPCs) in groundwater and surface water that could potentially cause adverse health effects in exposed populations. Site groundwater is designated as a potable water source. Although current exposure has been eliminated by construction of the water line, future exposure to groundwater was considered. The baseline risk assessment evaluated residential exposure to the most contaminated portion of the groundwater plume through the ingestion of, dermal contact with, and inhalation of volatile contaminants during daily activities and while showering/bathing. Risks and hazards were also evaluated for ingestion of and dermal contact with contaminated surface water from Trout Brook, Lamington River UNT, and Tanners Brook UNT, as well as consumption of fish from these water bodies. Sediment was not evaluated since there is minimal and infrequent contact with the medium based on review of the analytical data, Site use and conditions, potential for bioaccumulation, and exposure pathways. Subslab soil gas and indoor air samples were collected from nearby residences during the early part of the RI to assess the potential for vapor intrusion from Site contaminants; these samples were qualitatively evaluated in the BHHRA. Soil was not evaluated since it was capped as part of the OU1 remedy.

WHAT IS *HUMAN HEALTH* RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land uses. A four-step process is utilized to assess site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at a site in various media (*e.g.*, soil, surface water, and sediment) are identified based on such factors as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and potential for bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of contaminated soil. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people might be exposed to and the potential frequency and duration of exposure. Using these factors, a reasonable maximum exposure scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health effects.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a one-in-ten-thousand excess cancer risk; or one additional cancer

Summary of Risks:

Cancer risks and noncancer health hazards were evaluated for exposure to the most contaminated portion of the Site groundwater plume. Residential exposure to the site-related contaminants 1,4-dioxane, benzene, TCE, DEHP, alpha BHC, arsenic, and chromium results in an estimated excess lifetime cancer risk of 7 x 10^{-3} and a hazard index of 13 for the adult resident and 15 for the child resident. The exposure to site-related contaminants in groundwater results in an excess lifetime cancer risk that exceeds EPA's target risk range of 1 x 10^{-4} to 1 x 10^{-6} and a noncancer hazard index above 1. Recreational exposure to site-related contamination in surface water, as well as ingestion of fish, results in a lifetime cancer risk that is within EPA's target risk range of 1 x 10^{-4} to 1 x 10^{-6} and a noncancer hazard index below 1. A child residents' exposure to lead in groundwater was evaluated separately using the integrated exposure uptake biokinetic (IEUBK) model. The model predicted 68% of the population of children age 1-6 would be expected to have a blood lead concentration above 5 µg/dl, which exceeds the regional threshold of 5%. Subslab soil gas, indoor air, and groundwater sample results were compared to vapor intrusion screening levels. This analysis concluded that residents are currently unlikely to be exposed to Site contaminants through the vapor intrusion pathway, though this could change if the groundwater plume migrated over time.

At the time of the OU1 ROD, migration of contaminated groundwater posed a risk to downgradient well users. Although the water line has been installed as part of the OU1 remedy to eliminate this risk, groundwater in OU1 and OU2 continues to be contaminated above drinking water standards and additional efforts to control migration are necessary to protect human health and the environment. Detailed information regarding the human health risk assessment can be found in the June 2018 Final RI report.

WHAT IS ECOLOGICAL RISK AND HOW IS IT CALCULATED?

A Superfund baseline ecological risk assessment is an analysis of the potential adverse health effects to biota caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land and resource uses. The process used for assessing site-related ecological risks includes:

***Problem Formulation*:** In this step, the contaminants of potential ecological concern (COPECs) at the site are identified. Assessment endpoints are defined to determine what ecological entities are important to protect. Then, the specific attributes of the entities that are potentially at risk and important to protect are determined. This provides a basis for measurement in the risk assessment. Once assessment endpoints are chosen, a conceptual model is developed to provide a visual representation of hypothesized relationships between ecological entities (receptors) and the stressors to which they may be exposed.

***Exposure Assessment*:** In this step, a quantitative evaluation is made of what plants and animals are exposed to and to what degree they are exposed. This estimation of exposure point concentrations includes various parameters to determine the levels of exposure to a chemical contaminant by a selected plant or animal (receptor), such as area use (how much of the site an animal typically uses during normal activities); food ingestion rate (how much food is consumed by an animal over a period of time); bioaccumulation rates (the process by which chemicals are taken up by a plant or animal either directly from exposure to contaminated soil, sediment or water, or by eating contaminated food); bioavailability (how easily a plant or animal can take up a contaminant from the environment); and life stage (*e.g.*, juvenile, adult).

***Ecological Effects Assessment*:** In this step, literature reviews, field studies or toxicity tests are conducted to describe the relationship between chemical contaminant concentrations and their effects on ecological receptors, on a media-, receptor- and chemical-specific basis. To provide upper and lower bound estimates of risk, toxicological benchmarks are identified to describe the level of contamination below which adverse effects are unlikely to occur and the level of contamination at which adverse effects are more likely to occur.

***Risk Characterization*:** In this step, the results of the previous steps are used to estimate the risk posed to ecological receptors. Individual risk estimates for a given receptor for each chemical are calculated as a hazard quotient (HQ), which is the ratio of contaminant concentration to a given toxicological benchmark. In general, an HQ above 1 indicates the potential for unacceptable risk. The risk is described, including the overall degree of confidence in the risk estimates, summarizing uncertainties, citing evidence supporting the risk estimates and interpreting the adversity of ecological effects.

Ecological Risk Assessment

The SLERA was prepared to evaluate potential hazards for aquatic biota, benthic invertebrates, amphibians, and plants as well as wildlife exposure to contaminants present in surface water, seep/spring water, and sediment. Plant exposure to contaminants is via uptake and root absorption while wildlife is exposed via ingestion of water, plants, and invertebrates and incidental ingestion of sediment.

The evaluation of surface water and sediment exposure pathways from local streams and seep/spring pathways indicates that aquatic biota, benthic invertebrates, amphibians, and plants may potentially be adversely impacted by inorganics, PAHs, 2,3,4,6-tetrachlorophenol, and alpha-chlordane. Sediment exceedances of conservative screening levels were for inorganics, PAHs, and 2,3,4,6-tetrachlorophenol. Surface water exceedances of conservative screening levels were for inorganics. There were also some VOCs and one pesticide (alpha chlordane) identified as COPCs because no screening criteria are available. Though widespread in surface water near CFS, 1,4-dioxane did not exceed the comparison criterion value of 22,000 µg/L. Its presence in streams and seeps indicates that contaminated groundwater originating at the landfill is upwelling into the streams and seeps, but not at levels that would be of ecological concern.

For wildlife exposure via bioaccumulation of COPCs in the food chain, the evaluation of surface water and sediment exposure pathways from the four local streams (Trout Brook, Lamington River UNT, Tanners Brook UNT, and East Trout Brook) have LOAEL-based hazard quotients (HQs) less than 1 for all receptor groups, except for spotted sandpipers, representing avian invertivores. Exposure to vanadium in East Trout Brook for this receptor resulted in a HQ of 1.7, which is just above the acceptable limit of 1. However, vanadium was not found at significant levels in the groundwater plume and therefore the landfill is the unlikely source.

In summary, the wildlife food chain modeling HQs are less than 1, except for the spotted sandpiper which has an HQ of 1.7 for exposure to vanadium in sediment from East Trout Brook. This risk estimate, as well as other exceedances of conservative surface water and sediment screening values are not from compounds that are considered to be site-related.

Although 1,4-dioxane is impacting the surface water, it is not at levels of ecological concern. Further remediating the groundwater will reduce any impacts to surface water. Detailed information regarding the ecological risk assessment can be found in the 2018 Final RI report.

EPA has determined that the Preferred Alternatives identified in this Proposed Plan, are necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from this Site which may present an imminent and substantial endangerment to public health or welfare.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are defined as media-specific goals for protecting human health and the environment. RAOs are developed through an evaluation of data generated during the RI, including: the identified contaminants of concern, impacted media of interest, fate and transport processes, receptors at risk, and the associated pathways of exposure included in the conceptual site model. RAOs also consider preliminary remediation goals (PRGs), identified via an evaluation of applicable or relevant and appropriate requirements (ARARs) and advisories, criteria or guidance to be considered, and other technical and policy considerations that may be applicable to the Site.

The following RAOs were developed for the OU1 ROD amendment:

- Limit migration of contaminated groundwater and leachate from OU1 to OU2;
- Enhance the GWET to reduce concentrations of 1,4-dioxane being discharged to surface water;
- Reduce the toxicity, mobility and volume of contamination in the North Waste Cell to reduce impact on groundwater; and
- Prevent exposure to contaminated groundwater.

The following RAO was developed for the OU2 interim remedy:

- Prevent current and future exposure to human receptors (via ingestion, dermal contact and inhalation) to site-related contaminants in groundwater and surface water at concentrations in excess of federal and state standards.

The ultimate goal for OU2 is to achieve restoration of the groundwater in order for it to be used as a drinking water source in the future. EPA and NJDEP have promulgated maximum contaminant limits (MCLs) and NJDEP has promulgated GWQSs, which are enforceable, health-based, protective standards for various drinking water contaminants. The more stringent of the MCLs and GWQSs are the PRGs for the COCs in the OU2 groundwater.

SUMMARY OF REMEDIAL ALTERNATIVES

The FS identifies and evaluates remedial action alternatives. RAOs were developed for the Site, and then technologies were identified and screened based on overall implementability, effectiveness, and cost. Remedial alternatives consisting of one or more technologies were assembled and analyzed in detail with respect to seven of the nine criteria for remedy selection under CERCLA. The remaining two criteria, state acceptance and community acceptance, will be addressed in the ROD following the public comment period.

Remedial Alternatives

CERCLA Section 121(b)(1), 42 U.S.C. §9621(b)(1), mandates that remedial actions be protective of human health and the environment, be cost effective, and use permanent solutions and, alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which use, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants at a site. The NCP establishes an expectation that treatment will be used to address the principal threats posed by a Site wherever practicable (40 C.F.R. Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in groundwater may be viewed as source material. The groundwater contamination at the CFS Site is not considered principal threat waste. However, the waste material in the North Waste Cell is source material, and is considered principal threat waste. As noted above, CERCLA Section 121(d), 42 U.S.C. §9621(d), specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA Section 121(d)(4), 42 U.S.C. §9621(d)(4).

Remedial alternatives for the Site are summarized below. Capital costs are those expenditures that are required to construct a remedial alternative. O&M costs are those post-construction costs necessary to ensure or verify the continued effectiveness of a remedial alternative and are estimated on an annual basis. Present worth is the amount of money which, if invested in the current year, would be sufficient to cover all the costs over time associated with a project, calculated using a discount rate of seven percent and up to a 30-year time interval. Construction time is the time required to construct and implement the alternative and does not include the time required to design the remedy, or procure contracts for design and construction.

Common Elements

The alternatives for each OU contains a "No Action" alternative (OU1-G1 and OU2-G1 for OU1 and OU2, respectively). The No Action alternatives provide a baseline for comparison with other active remedial alternatives. Because no remedial activities would be implemented under the No Action alternatives, long-term human health and environmental risks would remain the same as those identified in the BHHRA and SLERA, with the exception of any changes due to incidental natural attenuation. There are no capital, operations/maintenance, or monitoring costs, no permitting or institutional legal restrictions.

Long-Term Monitoring (LTM) and Institutional Controls (ICs) would be implemented with all the alternatives except the No Action alternatives. ICs include establishing a classification exception area (CEA) to limit future use of Site groundwater and establishing deed restrictions. Current LTM involves collecting samples at groundwater monitoring wells to assess groundwater conditions over time.

For OU1, Alternatives OU1-G2 and OU1-G3, 1,4 dioxane treatment, North Waste Cell removal and upgrading the GWET are common components of the alternatives. The active OU2 alternatives are contingent upon the implementation of either OU1-G2 or OU1-G3.

Additionally, because alternatives OU1-G2 and OU1-G3 would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years.

The alternatives for OU1 and OU2 are summarized below.

Remedial Alternatives OU1	
Alternative	**Description**
OU1-G1	No Action
OU1-G2	Upgrade OU1 GWET System, Source area removal with LTM/ICs
OU1-G3	Upgrade OU1 GWET System, Additional groundwater extraction, Source area removal with LTM/ICs

Alternative OU1-G1: No Action

Capital Cost	$0
Annual O&M Cost	$0
Present Worth Cost	$0
Time Frame	0 months

The NCP requires EPA to consider the No-Action alternative. Under this alternative, no additional actions would be taken to improve the existing OU1 GWET system and operations. This alternative would also not involve ICs. Contaminants present in overburden and bedrock groundwater that are not being captured by the existing OU1 GWET system would remain in place.

Alternative OU1-G2: Upgrade OU1 GWET system, source area removal, LTM/ICs

Capital Cost	$ 9,828,414
Annual O&M Cost	$ 890,660
Present Worth Cost	$ 20,936,217
Time Frame	>30 years

Under its current configuration, the OU1 GWET system is not fully capturing the leachate or shallow groundwater underlying the landfill.

Primary components of Alternative OU1-G2 consist of upgrading the groundwater conveyance system to increase the volume of contaminated groundwater that can be captured and to provide treatment for 1,4-dioxane as part of the GWET system. The components of this alternative are as follows:

The conveyance system around the northeast landfill perimeter would be upgraded to accommodate additional groundwater flow from the overburden extraction wells and RW-T to allow for continuous operation and achieve the intended capture. This alternative includes upgrading piping from a 2-inch diameter line to a larger line which will allow for additional capacity. The one existing bedrock extraction well will be operated at a continuous rate rather than in cycles as is the current practice. The continuous pumping of the bedrock extraction well, RW-T, would increase hydraulic influence up to 1,800 feet or more to the northeast of the landfill.

The OU1 GWET was originally designed to treat approximately 120 gpm of contaminated groundwater; however, it currently treats on average only 45 to 70 gpm of groundwater flow due to poor extraction well performance and limitations in the diameter of extraction well conveyance piping and reduced yield due to seasonal variations. Under this alternative, the OU1 GWET would be upgraded to operate at a minimum of 120 gpm, from the current operating flow rate of 45 to 70 gpm. An evaluation of the existing system and treatment requirements will be conducted during the remedial design (RD) phase to develop the details of the necessary improvements to upgrade the treatment capacity. The existing system operates in batch-flow and utilizes a sequencing batch reactor (SBR) to remove the ammonia concentrations that are typically found in landfill leachate. The necessity of SBR under the new pumping scenario will be evaluated in RD.

The OU1 GWET upgrade includes adding treatment for reducing 1,4-dioxane concentrations to or below the current GWQS of 0.4 µg/l. Various treatment technologies, such as adsorption and advanced oxidation processes, have been evaluated and pilot tested for use at the Site and adsorption results were positive. Recent studies into the potential efficacy of biological treatment are also being considered. A final ex-situ treatment option would be selected in the RD phase.

With reduced impact from contamination in the overburden aquifer, the conditions in the bedrock groundwater within OU1 would be assessed over time with LTM. Establishment of a CEA would limit future groundwater use and restrict installation of wells other than for monitoring within the known extent of the OU2 threatened and impacted area. Deed restrictions would limit future land use and protect the integrity of the cap.

As part of this alternative, remaining source material, including soil contamination and solid waste (buried drums and containers) located in the North Waste Cell would be excavated and disposed of off-site to a permitted facility.

Alternative OU1-G3: Addition of new bedrock extraction wells, upgrade OU1 GWET system, source area removal, and LTM/ICs

Capital Cost	$10,457,289
Annual O&M Cost	$920,360
Present Worth Cost	$21,933,592
Time Frame	>30 years

Alternative OU1-G3 utilizes the OU1 existing GWET overburden extraction well network, as well as the addition of new bedrock extraction wells to establish hydraulic control in the bedrock aquifer at the OU1/OU2 boundary. The OU1 GWET would be upgraded as described in Alternative OU1-G2 plus treatment of added volume from new bedrock extraction wells to operate at approximately 200 gpm. The new extraction wells would be installed within preferential flow paths identified via geophysical methods or other means during RD and previous investigations. It is estimated that three bedrock extraction wells would be installed within OU1 or near the OU1/OU2 boundary. Bedrock extraction wells would be installed to target groundwater contamination located approximately 100 to 350 feet bgs.

It is likely that pumping from the proposed bedrock extraction wells would establish hydraulic control at the OU1/OU2 border. Pumping from the bedrock aquifer in this area, especially within a preferential flow path, could influence groundwater far downgradient. This hydraulic control would limit the migration of contaminants from OU1 to OU2. LTM of OU1 monitoring wells would be expected to show reduced contaminant concentrations and monitor the impact of the increased extraction over time. Establishment of a CEA would limit future groundwater use and prevent installation of wells other than for monitoring within the extent of the landfill property boundary. Deed restrictions would limit future land use and protect the integrity of the cap.

As described in the OU1-G2 Alternative, the source area material in the North Waste Cell area would be excavated and disposed of off-site.

Remedial Alternatives OU2	
Alternative	**Description**
OU2-G1	No Action
OU2-G2	LTM/ICs
OU2-G3	Extraction and Treatment of OU2 groundwater/LTMs/ICs

Alternative OU2-G1: No Action

Capital Cost	$0
Annual O&M Cost	$0
Present Worth Cost	$0
Time Frame	0 months

Under this alternative, no actions would be taken in OU2 to address groundwater contamination. This alternative would also not include ICs or monitoring. Contaminants present in overburden and bedrock groundwater and surface water in OU2 would remain unaddressed and unmonitored.

Alternative OU2-G2: Long-term monitoring/institutional controls

Capital Cost	$0
Annual O&M Cost	$111,200
Present Worth Cost	$ 781,100
Time Frame	10 years

Alternative OU2-G2 consists of long-term groundwater and surface water monitoring and institutional controls. Alternative OU2-G2 assumes an active groundwater remedial alternative for OU1. Alternative OU2-G2 includes multiple rounds of groundwater and surface water sampling to be collected from the existing or expanded monitoring well network located within OU2. LTM is expected to take place over a period of ten years or less, at which point a decision would be made about a permanent remedy for OU2 groundwater.

The effectiveness of LTM/ICs would be assessed over time in conjunction with the OU1 amended remedy.

This alternative assumes land and groundwater use in the OU2 area remains the same over the foreseeable future.

Establishment of a CEA would limit future groundwater use and restrict installation of wells other than for monitoring within the known extent of the OU2 threatened and impacted area.

Alternative OU2-G3: Installation of extraction wells and groundwater treatment with LTMs/ICs

Capital Cost	$9,056,339
Annual O&M Cost	$ 246,060
Present Worth Cost	$10,784,639
Time Frame	10 years

Alternative OU2-G3 consists of pumping groundwater from approximately three bedrock extraction wells located in the northeast and west-southwest portions of the OU2 area within the most predominant groundwater flow directions. This would establish some hydraulic control of the OU2 plume. The three bedrock extraction wells would be constructed to a depth of approximately 100 to 350 feet bgs.

The three bedrock extraction wells in this alternative would be in addition to the three bedrock extraction wells in OU1-G3, should that alternative be selected for OU1. If OU1-G2 is selected, these would be the only bedrock extraction wells at the Site with the exception of existing RW-T. The recovered groundwater would be pumped to and treated at the OU1 GWET. The OU1 GWET would be upgraded and expanded as described in Alternative OU1-G2 or OU1-G3 to handle the additional groundwater volume from this alternative, which is estimated to be approximately 100 gpm. The treated groundwater effluent would either be discharged to East Trout Brook at the existing OU1 GWET effluent location, at a new infiltration/detention basin, returned to the streams nearest the extraction wells, or a combination of discharge locations to maintain the hydrology of the streams and avoid adverse impacts to open water and wetlands. These determinations would be made in the RD phase.

This alternative is contingent on the remedy selected to address the OU1 groundwater. It is assumed that the OU1 GWET system will be upgraded to accept the additional volume from Alternative OU1-G2 or OU1-G3. LTM and a CEA as described previously are also components of this alternative.

This alternative also includes: multiple rounds of groundwater sampling to be collected from the existing or expanded OU2 monitoring well network as well as surface water sampling; statistical analysis and groundwater modeling to predict the timeframe for groundwater restoration; and ICs to assure the interim remedy remains protective. It is likely that this alternative would be implemented for up to 10 years, at which point a decision would be made regarding a permanent remedy for OU2.

Comparative Analysis of Alternatives

This section includes a comparative analysis of the three alternatives developed for both OU1 and OU2. Each alternative is compared relative to seven of the nine NCP criteria, with the remaining two (community acceptance and state acceptance) to be addressed in the ROD following the public comment period.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES

1. Overall Protection of Human Health and the Environment evaluates whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

2. Compliance with ARARs evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

3. Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contaminant present.

5. Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.

6. ***Implementability*** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

7. ***Cost*** includes estimated capital and annual operation and maintenance costs, as well as present-worth cost. Present-worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

8. ***State Acceptance*** considers whether the State agrees with EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

9. ***Community Acceptance*** considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Overall Protection of Human Health and the Environment

Alternatives OU1-G1 and OU2-G1 would not meet the RAOs and would not be protective of human health and the environment since no actions would be taken. For OU1, the existing treatment plant would remain, but it primarily treats leachate and some shallow groundwater, and deeper bedrock groundwater would continue to migrate from the landfill to downgradient areas uncontrolled. OU2 contamination would remain in groundwater for a long time in the future, while no mechanisms would be implemented to prevent exposure to contaminated groundwater, or to reduce the toxicity, mobility, or volume of contamination except through natural processes, which would not be monitored.

For Alternatives OU1-G2 and OU1-G3, RAOs would be met over time and would provide protection to human health and the environment through treatment processes, ICs, and LTM. The implementation of a deed restriction would provide a greater degree of overall protection of human health and the environment by providing limited use of the Site.

Alternative OU1-G3 would be more protective compared to Alternative OU1-G2 as it would provide a more comprehensive hydraulic control remedy with the addition of bedrock extraction wells for OU1 and would capture both overburden and bedrock contaminated groundwater underlying the landfill property to a depth of approximately 350 feet bgs.

Additional protection would occur based on the excavation and off-site disposal of source material in the North Waste Cell as part of both Alternatives OU1-G2 and OU1-G3.

For OU2, Alternatives OU2-G2 and OU2-G3 would meet RAOs and would provide protection to human health and the environment through the implementation of either long-term monitoring (OU1-G2) or groundwater extraction and treatment (OU1-G3). Alternative OU2-G3 would actively treat contaminated groundwater in the OU2 area of the Site, which may be more protective than the LTM called for in OU2-G2. However, the bedrock extraction wells which are part of Alternative OU1-G3, are expected to capture a portion of the OU2 bedrock plume, which depending on the success of the OU1 remedy, may provide similar protectiveness compared with OU2-G3. Further, streams and wetlands in the OU2 area could be negatively impacted by extraction and discharge of treated OU2 groundwater.

Compliance with ARARs

EPA and NJDEP have promulgated MCLs and GWQS (40 CFR Part 141 and N.J.A.C. 7:9C, respectively), which are enforceable standards for various drinking water contaminants (and are chemical-specific ARARs). If any state standard is more stringent than the federal standard, then compliance with the more stringent ARAR is required. As groundwater within Site boundaries is a source of drinking water, achieving the more stringent of the federal MCLs and GWQS in the groundwater is an ARAR.

Alternatives OU1-G1 and OU2-G1 would not achieve drinking water standards for the aquifer. Action-specific ARARs do not apply to these No Action alternatives since no remedial action would be conducted.

Alternatives OU1-G2 and OU1-G3 could meet the RAOs within the active treatment areas over the long term.

Alternatives OU2-G2 and OU2-G3 would meet the RAO for OU2 over the long term, provided that an active remedy for OU1 is effective. OU2-G2 would likely take longer than OU2-G3 to achieve compliance with ARARs within OU2.

Alternatives OU1-G2, OU1-G3, and OU2-G3 would meet action-specific and location-specific ARARs for example, by complying with substantive New Jersey Pollution Discharge Elimination System requirements for discharge of the treatment plant effluent to surface water and/or groundwater, implementing Resource Conservation Recovery Act requirements, and the Clean Water Act requirements. Locating extraction wells and conveyance piping within regulated areas, such as freshwater wetlands, would be avoided to the extent practicable. Alternative construction techniques such as directional drilling vs. open trenching of conveyance piping would be evaluated for greater compliance with location-specific ARARs for Alternative OU2-G3.

Excavation of contaminated soils and solid waste from the North Waste Cell as part of Alternatives OU1-G2 and OU1-G3 would achieve compliance with soil standards. Excavated materials would be disposed of at an off-site permitted facility.

Long-Term Effectiveness and Permanence

Alternatives OU1-G1 and OU2-G1 would not be effective or permanent since there would be no mechanisms to prevent or monitor migration and exposure to contaminated groundwater. Alternatives OU1-G2 and OU1-G3 would provide long-term effectiveness and permanence by hydraulically containing the contaminant mass within the overburden in the case of OU1-G2 and, in the case of OU1-G3, overburden and bedrock aquifers within OU1 and treating the contaminated groundwater ex-situ. Alternative OU1-G3 would provide more hydraulic control and additionally in the bedrock aquifer compared to OU1-G2. Additionally, ICs and deed restrictions would ensure continued protection of human health receptors in the long-term under both Alternative OU1-G2 and OU1-G3 by providing protection against potential exposures to low-level threat buried landfill materials is maintained.

Eliminating the source material remaining in the North Waste Cell area would help achieve long-term effectiveness and permanence as part of both Alternatives OU1-G2 and OU1-G3.

Alternatives OU2-G2 and OU2-G3 are both contingent on the successful implementation of an active OU1 remedy. Alternative OU2-G2 would rely on the implementation of either OU1-G2 or OU1-G3, for long-term effectiveness. Alternative OU2-G3 will use extraction from OU2 extraction wells and treatment at the OU1 plant to restore the OU2 aquifer to PRGs. The bedrock OU2 extraction wells in alternative OU2-G3 may expedite removal of contaminant mass from OU2. Both OU2 alternatives are expected to improve groundwater quality outside the landfill and bring the site closer to the long-term goal of restoration. The final remedy for OU2 would be later considered based on the effectiveness of the OU1 amended remedy and OU2 selected interim remedy.

Reduction of Toxicity, Mobility, or Volume

Alternatives OU1-G1 and OU2-G1 would not provide any reduction of toxicity, mobility or volume of contaminants since no remedial action would be conducted.

Alternatives OU1-G2 and OU1-G3 would provide reduction of toxicity, mobility, and volume through treatment and removal of contaminants in OU1. Alternative OU1-G3 would be more effective compared to OU1-G2 in reducing toxicity, mobility and volume of contamination in groundwater by hydraulically controlling and treating more contaminated groundwater, from both the overburden and bedrock zones underlying the landfill. Both OU1-G2 and OU1-G3 would reduce the toxicity, mobility, and volume of 1,4-dioxane by addition of treatment elements to the existing GWET system to address this contaminant, which is not currently being treated by the GWET.

The reduction of toxicity, mobility, and volume of source material would be achieved by the removal of the remaining source material from the North Waste Cell area under both Alternative OU1-G2 and OU1-G3.

Alternatives OU2-G2 and OU2-G3 would both see the reduction of contaminant toxicity, mobility, and volume through the successful implementation of an active OU1 remedy which would improve hydraulic control of contamination in the OU1 area and therefore limit migration of contaminants to the OU2 area.

Alternative OU2-G3 would be the most effective in reducing toxicity, mobility and volume of contamination in groundwater through extraction and treatment at the furthest downgradient portions of the OU2 plume.

Short-Term Effectiveness

Alternatives OU1-G1 and OU2-G1 would not have short-term impacts since no action would be implemented.

There would be minimal short-term impacts to the local community and workers for Alternatives OU1-G2 and OU1-G3 due to the fact that associated construction, operation and treatment activities would occur within the OU1 property boundary. In addition, there would be minimal short-term impacts related to the removal of the source material in the North Waste Cell area.

Alternative OU2-G2 could be performed with limited impact to Site workers or the community. Coordination and access would be required for construction of the OU2 extraction wells and pumping in Alternative OU2-G3.

For Alternatives OU1-G2, OU1-G3, and OU2-G3, Site workers would undergo required training and would wear appropriate personal protective equipment to minimize exposure to contamination and as a protection from physical hazards. Best construction practices to control dust, noise and vibration related to construction would be used. These precautions would provide effective protection to the Site workers and the community from the impacts related to construction.

Implementability

All groundwater alternatives developed for OU1 and

OU2 are implementable. Alternatives OU1-G1 and OU2-G1 would be the easiest to implement as no work would be performed.

For OU1, Alternatives OU1-G2 and OU1-G3 would be similarly implementable. Services, materials and experienced vendors are readily available. During remedial design site-specific design parameters for Alternatives OU1-G2 and OU1-G3 and substantive requirements of otherwise required state and local permits would be met for on-site work. The North Waste Cell source area removal is implementable by using standard practices for excavating waste material.

In accordance with CERCLA, no permits would be required for on-site work (although such activities would comply with substantive requirements of otherwise required permits). Permits would be obtained as needed for off-site work.

For OU1, ICs, requiring the establishment of a deed restriction, the performance of five-year reviews and continued monitoring and maintenance, are easily implementable.

For OU2 groundwater, Alternative OU2-G2 would be technically and administratively easier to implement than Alternative OU2-G3 as it only includes sampling, while OU2-G3 involves construction of extraction wells and extensive piping from the OU2 area back to the OU1 plant. While implementable, this work would be more difficult to implement compared to OU2-G2.

For OU2-G3, it is possible that groundwater extraction from these proposed locations would have a negative hydraulic impact (i.e. dewater) on the nearby streams and wetlands. Since these water bodies are headwaters to trout streams, it is likely that this alternative would include returning the treated water to those streams to mitigate any hydraulic disturbances. This would involve constructing two miles of conveyance lines. Getting the hydraulic balance right would be challenging and would require significant modeling in the design phase.

Cost

A summary of the cost estimates for each alternative is presented in Appendix A of the FS. In summary, alternatives OU1-G1 and OU2-G1 are No Action alternatives and have no cost. For OU1, alternative OU1-G2 is approximately $1,000,000 less than Alternative OU1-G3 with total present values estimated at $20,936,217 and $21,933,592, respectively. The added costs for Alternative OU1-G3 are a result of the drilling (capital cost) and operation (O&M cost) of the bedrock extraction wells.

For OU2, Alternative OU2-G2 is substantially less expensive than Alternative OU2-G3 with a total present value of $781,100 (OU2-G2) compared to $10,784,639 (OU2-G3). The major costs associated with Alternative OU2-G3 are from the extraction well installation and the groundwater conveyance lines to and from the GWET system. It is assumed that groundwater extraction from these proposed locations will have a negative hydraulic impact (i.e. dewater) on the nearby streams and tributaries. Since these water bodies are headwaters to trout streams, it is assumed that this remedy would have to include returning the treated water to those streams to mitigate any hydraulic disturbances. The water conveyance line is approximately two miles long and direct discharge to surface water for Alternative OU2-G3 represents a significant cost.

State Acceptance

NJDEP defers concurrence on the proposed alternative until the remedial design is completed, specifically for the treatment of 1,4-dioxane and the characterization of the North Waste Cell source area.

Community Acceptance

Community acceptance of the preferred alternative will be assessed in the ROD following review of the public comments received during the public comment period.

PREFERRED ALTERNATIVES

EPA is identifying Alternatives OU1-G3 and OU2-G2 as the preferred alternatives because they satisfy the two threshold criteria (protection of human health and the environment and compliance with ARARs) and provide the best balance of tradeoffs among the other alternatives with respect to the five balancing criteria (short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; implementability; and cost). The major components of the preferred alternatives are as follows:

OU1-G3

- Upgrading the existing groundwater conveyance system to handle an increased volume of contaminated groundwater;

- Installation of bedrock extraction wells near the OU1/OU2 border to increase hydraulic control of contaminated groundwater in OU1;
- Upgrading the OU1 GWET treatment system to include treatment for 1,4-dioxane;
- Excavation and off-site disposal of source material in the North Waste Cell area; and,
- LTM/ICs

OU2-G2

- LTM/ICs

These two preferred alternatives work well together, are protective of human health and the environment, and meet the RAOs established for the CFS Site.

BASIS FOR THE REMEDY PREFERENCE

Under the OU1-G3 Alternative, the GWET system would be expanded and improved. Currently, the GWET operates at a rate of about 45 to 70 gpm. It is limited in the volume of groundwater that can be extracted due to poor extraction well performance and limitations in the diameter of extraction well conveyance piping. This requires the extraction wells to be run intermittently instead of continuously. The current system also extracts mostly shallow groundwater. Increasing the size of the conveyance piping will enable the system to operate at approximately 200 gpm. This increase in extraction rate allowing for continuous operation, along with the addition of much deeper bedrock extraction wells will significantly improve containment and hydraulic control of the OU1 contaminated groundwater.

ICs (in the form of a CEA and deed restrictions) and LTM will ensure that human health and the environment are protected during the operation of the GWET system by preventing inadvertent installation of wells other than for monitoring and by observing the effects the enhanced GWET has on groundwater contaminant concentrations over time.

Alternative OU1-G3 would be reliable in achieving the OU1 RAOs, since additional extraction wells will be installed to pump and treat the deep aquifer and the increased extraction rate will increase containment and treatment of overburden groundwater.

In addition, the source material in the North Waste Cell area will be excavated and disposed of off-site. Removal of this source material, which is principal threat waste, will assist in the remediation of groundwater.

Alternative OU2-G2 is an interim remedy. A final groundwater remedy for OU2 will be selected at a later time, based on the results of the implementation of the amended OU1 remedy and the interim OU2 remedy. It is expected that the more aggressive pumping as part of the OU1 ROD amendment will take place near the OU1/OU2 border. This pumping is expected to have a significant impact on groundwater in OU2, and its effects will be monitored through LTM throughout the OU2 area as the primary element of the OU2 preferred alternative.

EPA expects to select a final remedy for OU2 based on groundwater and surface water data from the implementation of the final remedies selected for OU1 and OU2 after input from the public and to be documented in a Record of Decision. A final remedy will identify and address the long-term OU2 RAOs and PRGs. In addition, impacts of the selected ROD amendment for OU1 and interim remedy for OU2 will be evaluated over time to measure impacts on very deep groundwater quality (deeper than the estimated range of 350 feet bgs to be addressed in the OU1 ROD amendment).

The total estimated, present-worth cost for the preferred alternative to amend the OU1 ROD, OU1-G3, is $21,933,592. The estimated present-worth cost for the preferred alternative for the OU2 interim remedy is $781,100. Details of the cost estimates for all alternatives are presented in the FS Report. This is an engineering cost estimate that is expected to be within the range of plus 50 percent to minus 30 percent of the actual project cost.

Consideration will be given during the remedial design, to technologies and practices that are sustainable in accordance with EPA Region 2's Clean and Green Energy Policy. This would include green remediation technologies and practices.

Because the preferred alternative to amend the OU1 ROD would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA five-year reviews will be required.

Based upon the information available, EPA believes the preferred alternatives meet the threshold criteria (protection of human health and the environment and compliance with ARARs) and provide the best balance of tradeoffs among the other alternatives with respect to the balancing criteria. The preferred alternatives satisfy the following statutory requirements of Section 121(b) of CERCLA: 1) the proposed OU1 ROD amendment and OU2 interim remedy are protective of human health and the environment; 2) the preferred alternatives comply with ARARs; 3) the preferred alternatives are cost effective; 4) the preferred alternatives utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and, 5) the OU1 remedy satisfies the preference for treatment. For OU2 the preference for treatment will be addressed in the final ROD.

Long-term monitoring would be performed to assure the protectiveness of both the OU1 and OU2 remedies. With respect to the two modifying criteria of the comparative analysis (state acceptance and community acceptance), the state is reviewing the remedy and community acceptance will be evaluated upon the close of the public comment period.

COMMUNITY PARTICIPATION

EPA and NJDEP provided information regarding the cleanup of the Combe Fill South Landfill Superfund Site to the public through meetings, the administrative record file for the Site, and announcements published in the Daily Record. EPA and NJDEP encourage the public to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted. The dates for the public comment period, the date, location and time of the public meeting, and the locations of the administrative record file, are provided on the front page of this Proposed Plan.

FOR FURTHER INFORMATION

The administrative record file, which contains copies of the Proposed Plan and supporting documentation, is available at the following locations:

Chester Library
250 West Main Street
Chester, NJ 07930
(908) 879 - 7612
Summer Hours: Monday - Thursday 9:00 a.m. - 9:00 p.m., Friday 9:00 a.m.- 5:00 p.m., Saturday 9:00 a.m. - 1:00 p.m. Sunday CLOSED

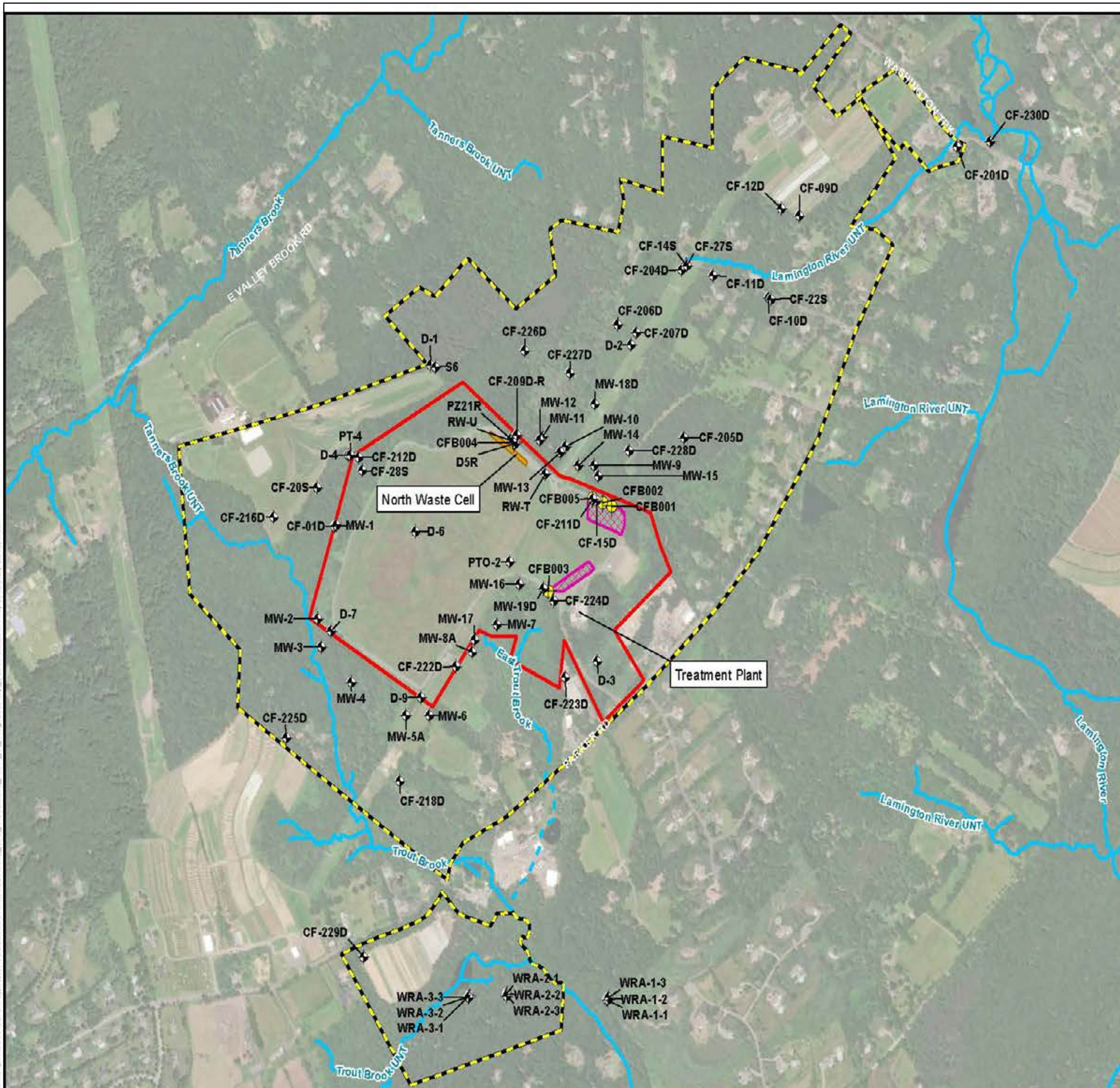
EPA Region 2 Superfund Records Center
290 Broadway, 18th Floor
New York, New York 10007-1866
(212) 637-4308
Hours: Mon – Fri, 9:00 AM-5:00 PM

In addition, select documents from the administrative record are available on-line at: https://www.epa.gov/superfund/combe-fill-south

Combe Fill South Landfill Superfund Site Proposed Plan

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane New Jersey FIPS 2900 Feet
Projection: Transverse Mercator
Datum: North American 1983
Units: Foot US



Legend

- OU1 Landfill Property Boundary
- OU2 Investigation Area
- Monitoring Well
- 2014 Soil Boring (identified as CFB00#)
- North Waste Cell Excavation
- 2011 Buried Drum Delineation Report Geophysical Investigation Areas (Delta Geophysics)
- Surface Water

N

0 400 800 Feet

Operable Units and Site Features

Figure 1
July, 2018