Superfund Program
Proposed Plan

U.S. Environmental Protection Agency,
Region 2

Ringwood Mines/Landfill Superfund Site Operable Unit Three

January 2020

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan identifies the Preferred Alternatives to address contaminants in groundwater and mine water at the Ringwood Mines/Landfill Superfund Site (Site), located in the Borough of Ringwood, Passaic County, New Jersey, and provides the basis for these preferences. Groundwater and mine water have been designated as Operable Unit Three (OU3) of the Site.

The U.S. Environmental Protection Agency's (EPA's) Preferred Alternative to address contaminants in groundwater at the Site is Alternative 3, In-Situ Treatment with Monitoring in the Peters Mine Pit Area/O'Connor Disposal Area. This alternative would provide for the installation of wells near the Peters Mine Pit and Peters Mine Pit Airshaft and perpendicular to the direction of groundwater flow for the introduction of an oxygen-releasing compound into the aquifer to enhance the degradation of organic contaminants. In addition, long-term groundwater and surface water monitoring would be conducted to ensure the protection of drinking water resources. The EPA's Preferred Alternative for mine water in the Peters Mine Pit Airshaft is Alternative 3, Treatment/Closure in the Peters Mine Pit Airshaft. Under this alternative, granular activated carbon and resin would be introduced into the Peters Mine Pit Airshaft to treat organic contaminants; the Peters Mine Pit Airshaft would then be closed using conventional mine shaft closure technology.

This Proposed Plan includes summaries of the cleanup alternatives for groundwater and mine water at the Site. This document is issued by the EPA, the lead agency for Site activities, in consultation with the New Jersey Department of Environmental Protection (NJDEP), the support agency. The EPA, in consultation with NJDEP, will select the final remedies for OU3 after reviewing and considering all information submitted during a 30-day public comment period. The EPA, in consultation with NJDEP, may modify the preferred alternatives or select other response actions presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this document.

MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:
January 30, 2020 – March 2, 2020
EPA will accept written comments on the Proposed Plan during the public comment period.

PUBLIC MEETING: February 10, 2020
EPA will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Focused Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held in the Martin J. Ryerson Middle School, 130 Valley Road, Ringwood, NJ at 7:00 PM.

For more information, see the Administrative Record file at the following locations:

U.S. EPA Records Center, Region 2
290 Broadway, 18th Floor.
New York, New York 10007-1866
(212) 637-4308
Hours: Monday-Friday - 9 am to 5 p.m., by appointment.

Ringwood Public Library
30 Cannici Drive
Ringwood, New Jersey 07456
Hours: Monday – Thurs. 10am to 9pm, Friday 10am – 5pm, Saturday 10am – 4pm

Send comments on the Proposed Plan to:

Joe Gowers, Remedial Project Manager
U.S. EPA, Region 2
290 Broadway, 19th Floor
New York, NY 10007-1866
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Email: gowers.joe@epa.gov

EPA's website for the Ringwood Mines/Landfill Site is:
http://epa.gov/superfund/ringwood-mines

The EPA is issuing this Proposed Plan as part of its community relations program under Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA, commonly known as Superfund). Community Advisory Group Meetings have been held with the community since 2007. This Proposed Plan summarizes information that can be found in greater detail in the OU3 Remedial Investigation and Focused Feasibility Study (RI/FFS) and Risk Assessment and other documents contained in the Administrative Record for the Site.

SITE DESCRIPTION

The Ringwood Mines/Landfill Superfund Site consists of approximately 500 acres in a historic mining district and is approximately 1.5 miles long and 0.5 miles wide. Portions of the Site are currently used as State of New Jersey parkland (Ringwood State Park), utility corridors (Public Service Electric & Gas and Rockland Electric Company), Borough of Ringwood facilities, including a Recycling Center and a Public Works yard, a power sub-station and open space (Borough of Ringwood property). In addition, 48 residential properties are dispersed throughout the Site. Residents living within the boundaries of the Site currently receive their drinking water from the municipal water supply, which obtains water from well fields located in a different subwatershed approximately two miles southeast of the Site. The Site is drained by four streams that ultimately lead to the Wanaque Reservoir, located approximately one mile south of the Site. The Wanaque Reservoir serves as a source of drinking water for over two million New Jersey residents.

United States Census Bureau records indicate that 866 people live within one mile of the Site. At least 200 people are estimated to live within the 48 residences located within the Site boundaries. Many of the residents living within the boundaries of the Site are members of the Ramapough Lenape Indian Nation, which is recognized as a Native American tribe by the State of New Jersey. Members of this community have strong ties to the land and hunt game and consume vegetation gathered from the Site.

SITE HISTORY

The land which comprises the Site was utilized for the mining of iron ore almost continuously from the mid-1700s to the early 1900s. Prior to 1940, the entire mine area was purchased by the U.S. Government and administered by the U.S. Government Defense Plant Corporation. The mine area was subsequently leased to the Alan Wood Steel Company as part of the World War II effort. In 1956, the U.S. Government sold the property to the Pittsburgh Pacific Company. It is believed that there was some use of the mines during the period of Pittsburgh Pacific Company's ownership.

Mining operations conducted at the Site consisted of the crushing and grinding of the iron ore, with magnetic separation of the iron from the other ore constituents (tailings). It has been reported that much of the mine tailings was sold off as road dressing. However, mine tailings are found throughout the Site, including the O'Connor Disposal Area, which was used for the disposal of fine mine tailings (this "slime pond" area was utilized for the settlement of waste mine tailings from wet ore processing operations).

The Ringwood Realty Corporation (Ringwood Realty), a wholly-owned subsidiary of the Ford Motor Company (Ford), purchased the mine area in January 1965. Records indicate that in 1967, Ringwood Realty entered into a contract with the O'Connor Trucking and Haulage Corporation for the disposal of wastes generated at the Ford factory located in Mahwah, New Jersey. This contract provided for the disposal of these wastes, which included plant trash, paint sludge, drummed waste and other non-liquid plant wastes, at the Site. These wastes were disposed of at various locations on the Site property including the Peters Mine Pit, O'Connor Disposal Area and Cannon Mine Pit.

In 1970, Ringwood Realty donated 290 acres of the Site to the Ringwood Solid Waste Management Authority. During the same year, additional acreage was sold to the Public Service Electric and Gas Company for use as a transmission line right of way. In 1973, 109 acres were donated to the NJDEP; this area was added to the Ringwood State Park. In that same year, Housing Operation with Training Opportunity (HOW TO), a New Jersey not for profit corporation, accepted the donation of over 35 acres of the Site. It is believed that by December 21, 1973, Ford/Ringwood Realty no longer owned any portion of the Site.

The results of a July 1982 Site Inspection conducted by NJDEP identified levels of benzene, ethylbenzene, and xylene in water samples collected from the Peters Mine Pit Airshaft, which led to the Site's inclusion on the National Priorities List (NPL) in 1983.

In March 1984, Ford, a Potentially Responsible Party for the Site, entered into an Administrative Order on Consent (AOC) with the EPA which required the performance of a RI for the Site. The required RI was conducted by Ford's contractor in four phases between March 1984 and April 1988. In June 1987, the EPA issued Unilateral Administrative Orders (UAOs) to Ford which required the performance of a feasibility study (FS), and the removal and off-site disposal of paint sludge and associated soil. Pursuant to these UAOs, Ford completed a FS and removed over 7000 cubic yards of paint sludge and associated soil from the Site in 1988. As part of this removal, pockets of paint sludge were removed from the northern portion of the Site near the Peters Mine Pit and the O'Connor Disposal Area, and from an area near the Cannon Mine Pit.

In September 1988, the EPA issued a Record of Decision (ROD) which selected long-term monitoring of groundwater and surface water as the remedy for the Site. The ROD noted that the known areas of paint sludge had been removed from the Site.

Additional paint sludge deposits and drums were identified in the O'Connor Disposal Area in 1989, prompting the removal of 600 cubic yards of paint sludge and 54 drum remnants in 1990. Some of the drum contents were reported to have contained polychlorinated biphenyls (PCBs) at concentrations in excess of 50 parts per million (ppm).

The Site was deleted from the NPL in 1994, with the presumption that all paint sludge and drums of hazardous substances had been removed from the Site. The deletion was further supported by the determination that groundwater at the Site did not pose an unacceptable threat to human health and the environment.

From 1990 through 1995, Ford conducted a five-year Environmental Monitoring Program which provided for the sampling of monitoring wells and potable wells in the area of the Site. The results of this program indicated that groundwater contaminant levels had been reduced since paint sludge had been removed from the Site.

In 1995, the EPA was notified by a local resident of additional paint sludge located in a utility right-of-way near the Cannon Mine Pit, prompting the removal of an additional 5 cubic yards of paint sludge. In 1998, another resident notified the EPA of the presence of paint sludge in the O'Connor Disposal Area, prompting the removal of an additional 100 cubic yards of paint sludge and soil.

In September 2003, representatives of the Upper Ringwood residents wrote to the EPA regarding their concern over past exposures and paint sludge remaining at the Site, but provided no details regarding the location of remaining paint sludge. Additional paint sludge areas were subsequently identified during an April 2004 Site visit arranged by the residents' representatives.

In December 2004, Ford began the voluntary removal of surficial pockets of paint sludge identified at the Site. The discoveries of additional significant quantities of paint sludge at the Site prompted the EPA to restore the Site to the NPL in September 2006. Ford has removed over 53,800 tons of paint sludge and associated soil from 16 distinct areas of the Site, in addition to the O'Connor Disposal Area and the Peters Mine Pit Area, since December 2004.

In September 2005, Ford signed an AOC which required the performance of an additional RI and risk assessment for the Site. In May 2010, Ford signed an AOC which required the performance of FSs for the Peters Mine Pit, Cannon Mine Pit and O'Connor Disposal Areas of the Site, as well as Site-related groundwater contamination. The Borough of Ringwood, which has also been identified as a Potentially Responsible Party for the Site, coordinated with Ford on the performance of the RI/FSs for the Site pursuant to UAOs issued by the EPA.

In June 2014, the EPA issued the Operable Unit Two (OU2) ROD for the Site. The OU2 ROD selected a remedy to address waste located in the Peter's Mine Pit, Cannon Mine Pit and O'Connor Disposal Areas of the Site. In addition, the OU2 ROD identified a contingency capping remedy for the O'Connor Disposal Area, which would facilitate the Borough of Ringwood's plan to construct a new recycling center in this area, if within six months of the OU2 ROD the Borough could provide (1) detailed engineering plans for the new recycling center; (2) financial assurance(s) indicating sufficient funds will be available for the construction of the recycling center, and (3) assurances and supporting documentation indicating that the construction of the contingency remedy, including the recycling center, can and will be completed within either a shorter or, at least within a comparable timeframe as the selected remedy. In April 2015, based upon information submitted by the Borough, the EPA issued an Explanation of Significant Differences (ESD) to select the contingency remedy as the remedy for the O'Connor Disposal Area of the Site.

In October 2014, Ford signed an AOC which required the preparation of the remedial design (RD) for the OU2 remedy. The Borough of Ringwood coordinated with Ford during the preparation of the OU2 RD pursuant to a UAO issued by the EPA. The Final OU2 RD Report was approved by the EPA in October 2018. A judicial Consent Decree which requires that Ford and the Borough of Ringwood implement the OU2 remedy was lodged with the Court on May 6, 2019. The public comment period on this judicial Consent Decree closed on July 29, 2019.

SITE CHARACTERISTICS

The 500-acre Site is located in the northern portion of the Borough of Ringwood, Passaic County, New Jersey. The Site terrain is mountainous with peaks up to 900 feet above sea level and valleys which are generally below 500 feet in elevation. Bedrock in the valleys and other topographically low areas is covered by overburden which consists of unconsolidated and reworked glacial deposits and weathered bedrock.

The Peters Mine Pit Area is located in the north central part of the Site and is bound to the north by Park Brook. Most of the Peters Mine Pit Area falls within the Ringwood State Park and is expected to remain in use as part of the state park in the future. From 1967 through 1971, the 375-foot long, 200-foot wide and 90-foot deep mine pit was filled to the ground surface with waste from Ford's Mahwah facility. Since this time, settling of the fill in this area has occurred, and a 300-foot long pond currently occupies what was once the deepest part of the mine pit. The pond is believed to be an expression of the water table.

The Cannon Mine Pit Area is located in the southwestern part of the Site. The pit was reportedly 180 feet long, 140 feet wide and 200 feet deep when mining operations ceased. Attempts were made to blast the pit closed when Ford purchased the property, which resulted in reducing the depth of the pit to approximately 60 feet. During the period of Ford ownership, the pit was reportedly filled to the ground surface with waste from Ford's Mahwah facility. Only minimal settling of the fill material has been noted in this area.

The 12-acre O'Connor Disposal Area is located to the south of the Peters Mine Pit Area along the Peters Mine Road. During the period of active mine operations, this area was utilized for the settling of waste mine tailings from wet ore processing operations. Subsequently, during the period of Ford/Ringwood Realty ownership, the O'Connor Disposal Area was utilized for the disposal of waste from Ford's Mahwah facility. The results of investigations conducted in this area indicate that waste and fill materials are present to a maximum depth of approximately 20 feet below ground surface. In general, a layer of undisturbed mine tailings appears to underlie waste materials disposed of by Ford's contractor and other fill materials. The O'Connor Disposal Area generally slopes to the east toward the Park Brook.

Paint sludge and other drummed industrial wastes originating from Ford's former Mahwah facility are the primary sources of contamination at the Site. However, levels of arsenic above New Jersey background soil levels have been found in some samples of mine tailings collected from the Site. Given that arsenic has also been found at elevated levels in some paint sludge samples collected from the Site, the EPA believes that paint sludge is also a source of arsenic in other media at the Site.

The Site is drained by four brooks which include the Mine Brook, Peters Mine Brook, Park Brook and the North Brook. The Peters Mine Brook joins the Mine Brook along the southern boundary of the Site. Mine Brook then flows into the Ringwood Creek, just upstream of the Wanaque Reservoir. Park Brook, which flows adjacent to the Peters Mine Pit and O'Connor Disposal Areas, and the North Brook each flow into Sally's Pond and subsequently to the Ringwood Creek, about one mile upstream of the Wanaque Reservoir.

Site-Related Groundwater Remedial Investigation

From 2004 through 2014, groundwater samples were collected from up to fifty-five monitoring wells located at the Site to characterize groundwater quality and the nature and extent of groundwater contamination. These wells are primarily located in proximity to the Peters Mine Pit, Cannon Mine Pit and O'Connor Disposal Areas, as well as downgradient of the Site. Mine water samples were also collected from the flooded Peters Mine Pit Airshaft and Cannon Mine Elevator Shaft during these sampling events. Groundwater sampling was conducted twice a year from 2004 through 2009 and on an annual basis from 2010 through 2014. In addition, from 2005 through 2012, a surface water sampling program was implemented to assess surface water quality in surface water bodies at the Site. As part of the surface water sampling program, samples were collected from the Mine Brook, Peters Mine Brook, Park Brook, North Brook, a pond near the Peters Mine Pit and two groundwater seep locations. Furthermore, a sediment pore water investigation was conducted in August and September 2014 to better characterize the potential for discharge of contaminants from the Peters Mine Pit through sediment pore water beneath the Park Brook. Sediment pore water samples were collected from beneath Park Brook during this investigation.

Sediment investigations were conducted in 2005 and 2011 in the Mine Brook, Peters Mine Brook, Park Brook, North Brook, the Peters Mine Pit pond and the Peters Mine Pit Airshaft. In 2005, ten sediment samples were collected from the above-referenced brooks to determine whether contaminants are present at levels which may be of ecological concern. Similarly, six sediment samples were collected from the Peters Mine Pit pond in 2011 to determine whether contaminants are present at levels of ecological concern. An additional sediment sample was collected from the base of the Peters Mine Pit Airshaft in October 2011 to evaluate whether this sediment serves as a source of the benzene and other contaminants detected in mine water.

In April 2007, video logging was conducted of the Peters Mine Pit Airshaft to the base of the shaft, located 232 feet below the water surface. During this investigation two horizontal shafts were identified at approximate depths of 180 feet and 200 to 232 feet below the water surface. A pile of sediment/leafy debris was observed at the base of the shaft, but no waste materials were identified. Video logging of the Cannon Mine Elevator Shaft was conducted in March 2010. The video equipment was advanced to a depth of 379 feet before remnant debris from mining operations prevented further progress. Waste materials were not observed during the video logging.

O'Connor Disposal Area

Groundwater sampling associated with the O'Connor Disposal Area indicated that no volatile organic contaminants (VOCs) were detected at levels above applicable New Jersey Groundwater Quality Standards (NJGWQSs) with the exception of methyl tertiary butyl ether (MTBE), which was only detected in one well associated with the O'Connor Disposal Area during one groundwater sampling event. This MTBE is not believed to be associated with Ford's disposal activities as MTBE was not widely used in the United States until the 1980s and the detection was in a well which is hydrologically upgradient of the O'Connor Disposal Area. Bis(2-ethylhexyl)phthalate was the only semivolatile organic contaminant (SVOC) which was detected above its NJGWQS of 3 micrograms per liter (ug/L) in samples collected from two wells during the 2007 groundwater sampling event. However, bis(2-ethylhexyl)phthalate was not detected in groundwater samples associated with the O'Connor Disposal Area during subsequent sampling events. Pesticides and polychlorinated biphenyls (PCBs) were not detected at levels above NJGWQSs in any groundwater sample associated with the O'Connor Disposal Area.

Arsenic has been sporadically detected above its NJGWQS of 3 ug/L in groundwater samples collected from five monitoring wells located in the O'Connor Disposal Area. However, arsenic has not been detected above its NJGWQS in groundwater samples collected from monitoring well OB-18, which is located hydrologically downgradient of the O'Connor Disposal Area. Lead has also been sporadically detected above its NJGWQS of 5 ug/L in groundwater samples collected from monitoring wells located in the O'Connor Disposal Area. However, since 2011, lead has only been detected above its NJGWQS in groundwater samples collected from monitoring well OB-25, which is located hydrologically upgradient of the O'Connor Disposal Area. Furthermore, lead has not been detected above its NJGWQS in groundwater samples collected from monitoring well OB-18, which is located hydrologically downgradient of the O'Connor Disposal Area.

The results of surface water samples collected from the Park Brook near the O'Connor Disposal Area from 2005 through 2012 did not indicate the presence of VOCs, SVOCs, PCBs or pesticides at concentrations that exceed applicable Surface Water Quality Standards (SWQSs). However, arsenic was detected in two of the surface water samples collected in 2012 from the Park Brook at concentrations which exceeded the SWQS of 0.017 ug/L. In addition, antimony was detected above its SWQS of 5.6 ug/L in one sample collected from the Park Brook during the 2005 surface water sampling event.

Cannon Mine Pit

Groundwater sampling associated with the Cannon Mine Pit indicated that no VOCs were detected at levels above applicable NJGWQSs with the exception of benzene and trichloroethene (TCE). Benzene was detected above its NJGWQS of 1 ug/L in groundwater samples collected from well RW-9 during 2008 but not during subsequent sampling events. Benzene has also been sporadically detected at concentrations above its NJGWQS in groundwater samples collected from well RW-8. TCE was detected above its NJGWQS of 1 ug/L in groundwater samples collected from monitoring well OB-3 during 2008 and 2009. However, TCE was not detected in groundwater samples collected from this well during subsequent sampling events. Bis(2-ethylhexyl)phthalate was the only SVOC which was sporadically detected above its NJGWQS of 3 ug/L in groundwater samples collected during pre-2013 groundwater sampling events. Pesticides and PCBs were not detected in any groundwater sample associated with the Cannon Mine Pit. Arsenic and lead are detected sporadically above their respective NJGWQSs in groundwater samples collected from the Cannon Mine Pit with no consistent spatial pattern.

The results of surface water samples collected from the Mine Brook near the Cannon Mine Pit from 2005 through 2012 did not indicate the presence of VOCs, pesticides or PCBs. Bis(2-ethylhexyl)phthalate is the only SVOC which was detected at levels above the SWQS of 1.2 ug/L in two upstream surface water samples collected in 2012. Lead was only detected in one surface water sample collected in 2012 at a concentration in excess of its 5.0 ug/L SWQS. Arsenic was detected in surface water samples collected from this area at concentrations from 0.32 ug/L to 1.2 ug/L, in excess of the 0.017 ug/L SWQS.

Peters Mine Pit

Prior to 2014, groundwater sampling conducted in and immediately downgradient of the Peters Mine Pit indicated the presence of benzene in groundwater in this area at levels which slightly exceeded the NJGWQS of 1 ug/L. However, groundwater sampling conducted in September 2014 indicated the presence of benzene in groundwater collected from the Peters Mine Pit at a concentration of 56 ug/L. In addition, groundwater concentrations of benzene in a monitoring well adjacent to the Peters Mine Pit increased to 88 ug/L during the September 2014 sampling event. Groundwater samples collected from the Peters Mine Pit and adjacent wells during October 2014 indicated the presence of benzene at levels less than 10 ug/L, which is consistent with historic groundwater sampling results for the Peters Mine Pit Area. Bis(2-ethylhexyl)phthalate was the only SVOC which was sporadically detected above its NJGWQS of 3 ug/L in groundwater samples collected from the Peters Mine Pit Area. During the 2014 groundwater sampling event, bis(2-ethylhexyl)phthalate was detected in groundwater samples collected from two monitoring wells in the Peters Mine Pit Area at concentrations of 3.6 ug/L and 6.6 ug/L, respectively. Pesticides and PCBs were not detected in any groundwater sample associated with the Peters Mine Pit. Groundwater samples collected from the Peters Mine Pit from 2006 through 2013 indicated the presence of lead at concentrations from 5.4 ug/L to 9.9 ug/L, which exceeds the NJGWQS of 5 ug/L. In addition, lead and arsenic have been sporadically detected at concentrations in excess of their NJGWQSs in groundwater samples collected from monitoring wells located hydrologically upgradient and downgradient of the Peters Mine Pit.

Water samples collected from the Peters Mine Pit Airshaft through 2014 indicated that benzene was the only VOC detected at concentrations above its NJGWQS. Benzene was detected at concentration up to 26.4 ug/L in samples collected from the 180 feet below ground surface (bgs) sampling depth, and up to 33.2 ug/L in samples collected from the 230 feet bgs sampling depth. SVOCs were not detected above their applicable NJGWQSs with the exception of bis(2-ethylhexyl)phthalate, which was detected sporadically in water samples collected from the Peters Mine Pit Airshaft. Lead was detected above its NJGWQS in water samples collected during the May 2008 and September 2014 groundwater sampling event. Arsenic was only detected in the Peters Mine Pit Airshaft at a concentration which exceeds its NJGWQS of 3 ug/L in a sample collected during September 2014.

The results of surface water samples collected from the Park Brook and North Brook near the Peters Mine Pit from 2005 through 2012 did not indicate the presence of VOCs, SVOCs, PCBs or pesticides. Arsenic was consistently detected above the SWQS of 0.017 ug/L in all surface water samples, including samples collected upstream of the Peters Mine Pit, with concentrations ranging from 0.35 ug/L to 0.65 ug/L. Thallium was also detected above its SWQS of 0.24 ug/L in two surface water samples collected from the Park Brook. Surface water samples collected from the pond in the Peters Mine Pit did not indicate the presence of VOCs, pesticides or PCBs. In addition, lead and arsenic were not detected in pond surface water samples at concentrations which exceed applicable SWQSs. Benzene was also detected in water samples collected from a groundwater seep near the Peters Mine Pit at concentrations of 1.2 µg/L, 0.48 µg/L, and 0.85 µg/L, respectively, during the May 2010, May 2011, and May 2012 groundwater sampling events. It is believed that the benzene in the seep may originate from groundwater in the Peters Mine Pit Area. However, the results of sediment pore water samples collected from beneath Park Brook in August and September 2014 did not indicate the presence of VOCs, which suggests that benzene in groundwater is not discharging to the Park Brook at these sample locations.

In order to verify whether or not microbially enhanced natural attenuation mechanisms have affected the benzene concentrations in groundwater within the Peters Mine Pit Area, a stable isotope probe study using Bio-Trap® samplers was performed as part of the groundwater RI. Bio-Trap® samplers containing benzene marked with Carbon-13 were installed in the Peters Mine Pit Airshaft and monitoring wells in the Peters Mine Pit Area where benzene was historically detected. After 33 days, the Bio-Trap® samplers were removed and analyzed for the presence of petroleum-degrading bacteria, percent mass loss of Carbon-13-labeled benzene as well as the presence of Carbon-13-labeled benzene in the microbial community. Carbon-13 was incorporated into the biomass at all sampling locations, indicating that microbial communities capable of degrading benzene exist in Peters Mine Pit Area groundwater.

Site-Related Groundwater Remedial Investigation Addendum

Groundwater sampling conducted in the Peters Mine Pit Area during March 2015 once again indicated the presence of levels of benzene in groundwater samples collected from the Peters Mine Pit (150 ug/L) and one well adjacent to the Peters Mine Pit (344 ug/L), that were much higher than historical levels as these locations, prompting the need for additional groundwater sampling to evaluate these spikes in benzene concentrations. Additional groundwater sampling events were conducted in the Peters Mine Pit Area in April and June 2015. The results of these sampling events indicated that benzene levels in groundwater in the Peters Mine Pit and adjacent monitoring wells had returned to historic levels of less than 10 ug/L. However, a groundwater split sample collected by the Borough of Ringwood during the April 2015 groundwater sampling event indicated the presence of an emerging contaminant, 1,4-dioxane, in a sample collected from the Peters Mine Pit Airshaft. As a result, 1,4-dioxane was added to the compounds analyzed for during the August 2015 annual groundwater and surface water sampling event. The results of the August 2015 sampling event indicated the presence of 1,4-dioxane at levels greater than its NJGWQS of 0.4 ug/L in water samples collected from the Peters Mine Pit Airshaft as well as monitoring wells located primarily in the Peters Mine Pit Area of the Site. 1,4-dioxane was also detected in surface water samples collected from Site brooks and ponds.

Due to the detection of 1,4-dioxane at the Site, additional groundwater monitoring wells were installed in and downgradient of the Peters Mine Pit Area to define the extent of 1,4-dioxane in groundwater. Subsequently, groundwater and/or surface water sampling events were conducted at the Site in December 2015, January 2016, March 2016, May/June 2016, August 2016, February 2017 and August 2017. The results of these sampling events indicate that 1,4-dioxane and benzene are detected at their greatest concentration in water samples collected from the Peters Mine Pit Airshaft at a depth of 230 feet bgs. 1,4-dioxane and benzene were detected at concentrations as high as 146 ug/L and 33 ug/L respectively in water samples collected from the 230 feet bgs depth during these sampling events, with levels of these contaminants decreasing at shallower sampling intervals in the Peters Mine Pit

Airshaft. However, the results of these sampling events do not indicate that 1,4-dioxane or benzene in groundwater is migrating off the Site property at concentration in excess of their applicable NJGWQSs of 0.4 ug/L and 1 ug/L, respectively. Sampling results also indicate the presence of 1,4-dioxane in the Park Brook upstream of Sally's Pond and in the groundwater seeps near the Peters Mine Pit at concentrations up to 4.78 ug/L. However, 1,4-dioxane has consistently been detected at concentrations of less than 1 ug/L in surface water samples collected at the confluence of Park Brook and Sally's Pond and is undetected in surface water downstream of Sally's Pond. Furthermore, a numerical analysis conducted as part of the groundwater RI utilizing historic surface water flow data for the Wanaque Reservoir indicated that 1,4-dioxane would continue to be undetected in surface water at the confluence of Ringwood Creek and the Wanaque Reservoir. Therefore, Site-related impacts on the Wanaque Reservoir are not anticipated.

While residents at and near the Site receive their potable water from the Borough of Ringwood's municipal water supply system, a private well search was conducted within a one-mile radius of the Site. The results of this search identified five potable wells located at the Ringwood State Park and one potable well located at a nearby elementary school. In August 2018, water samples were collected from all of these potable wells and analyzed for VOCs, SVOCs, including 1,4-dioxane, PCBs and metals. 1,4-dioxane and benzene were not detected in any of samples collected from these potable wells. Furthermore, no compounds were detected at concentrations greater than their applicable NJGWQS or drinking water standard in any of the potable well samples.

Saint George's Pit Area Soil Investigation

In order to investigate the nature and extent of fill material located in a suspected disposal area near the center of the Site, in December 2010, a Soil Investigation was conducted in the Saint George's Pit Area. This investigation included the excavation of 1430 linear feet of test trenches and the installation of 15 soil borings to characterize the fill material. The results of this investigation indicated that the Saint George's Pit Area had been utilized for the disposal of common garbage. Paint sludge and other hazardous or industrial wastes were not identified in this area of the Site. Therefore, this area is not considered to be part of the Site.

PRINCIPAL THREATS

The remedial alternatives that are being evaluated in this Proposed Plan address contaminated groundwater. Since contaminated groundwater generally is not considered to be a source material, no principal threat wastes have been identified for this OU.

WHAT IS A "PRINCIPAL THREAT"?

The NCP establishes an expectation that the EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP 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 ground water may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

SCOPE AND ROLE OF THE ACTION

The EPA is addressing the cleanup of this Site through immediate actions to address imminent threats to human health, and three phases of long-term cleanup.

Site remediation activities are sometimes separated into different phases, or Operable Units (OUs), so that remediation of different aspects of a site can proceed separately, resulting in a more efficient and expeditious cleanup of the entire site. At this Site, remediation activities have been separated into three OUs.

OU1 was originally intended to comprehensively address the Site. Subsequent to the restoration of the Site to the NPL, EPA created two additional operable units, OU2 and OU3. OU2 addresses waste, fill material and soil located in the Peters Mine Pit, Cannon Mine Pit and the O'Connor Disposal Areas. The OU2 remedy, as detailed in the June 2014 OU2 ROD and April 2015 ESD, provides for the excavation of fill material down to the water table and containment of remaining fill in the Peters Mine Pit Area, as well as the consolidation and containment of fill material in the Cannon Mine Pit and O'Connor Disposal Areas. The design of the OU2 remedy was completed in 2018. OU3, which is the subject of this Proposed Plan, addresses contaminated groundwater and mine water at the Site. The OU3 FFS evaluated cleanup alternatives for groundwater and mine water.

In addition, paint sludge and associated soil contamination which were located on non-residential properties outside of the Peters Mine Pit, Cannon Mine Pit and O'Connor Disposal Areas have been addressed by Ford under removal authority. Furthermore, paint sludge and lead-contaminated soil which was located on residential properties at the Site have been addressed by the EPA under removal authority.

SUMMARY OF OPERABLE UNIT 3 RISKS

As part of the RI/FS for Site-Related Groundwater, a baseline risk assessment was conducted to estimate the current and future effects of contaminants that currently exist in water at the Site 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 in the absence of any actions or controls to mitigate such releases, under current and future land, groundwater and surface water/sediment uses. The baseline risk assessment includes a human health risk assessment (HHRA).

The cancer risk and noncancer health hazard estimates in the HHRA are based on current and future reasonable maximum exposure scenarios. Consistent with risk assessment guidance that calls for characterizing activity patterns of site-specific populations (EPA, 1989) scenarios were developed based on conversations with Upper Ringwood community members who identified unique, site-specific exposure characterizations that address traditional and cultural practices, and when applicable, these were incorporated into the groundwater risk assessment. In addition, the EPA also evaluated default assumptions regarding exposure that are consistently used in Superfund risk assessments. These sources of information – site-specific community input and traditional default information – were used to develop the exposure scenarios and assumptions that were carried into the HHRA, along with information on the toxicity of the chemicals of potential concern (COPCs). Cancer risks and noncancer health hazard indices (HIs) associated with exposure to groundwater and mine water at the Site are summarized below.

Human Health Risk Assessment for Site-Related Groundwater

The HHRA estimates potential risks to a hypothetical future residential user of groundwater and mine water at the Site. Because the NJDEP has classified the groundwater aquifers at the Site as Class IIA (potential drinking water resource), the hypothetical future resident was assumed to be exposed to groundwater and mine water used as a potable water source via ingestion, dermal contact while showering, and inhalation of VOCs while showering. The calculated potential risks to a hypothetical future residential user of groundwater at the Site were first presented in the May 2015 HHRA for Site-Related Groundwater. Subsequent to the EPA's approval of this document, 1,4-dioxane was detected in groundwater and mine water at the Site, prompting the performance of additional groundwater and mine water sampling events. Therefore, the risk calculations were updated to incorporate the groundwater and mine water sampling results from these additional sampling events. The revised risk calculations are presented in the May 2018 Addendum to the Draft Baseline HHRA Calculations for Site-Related Groundwater.

The cumulative potential cancer risk calculated for the hypothetical future resident scenario for the adult, older child (or youth), and young child is $2x10^{-4}$, which slightly exceeds the EPA's target cancer risk range of $1x10^{-6}$ to $1x10^{-4}$, primarily due to the presence of arsenic. Potential noncancer risks were also estimated by calculating hazard indices. Hazard indices assessed by target organ for the hypothetical future resident scenario for the adult, older child, and young child, are all at or below the USEPA's target hazard index limit of 1.

Anticipated blood lead levels in Site receptors were also evaluated to determine whether exposure to lead in groundwater at the Site presents an unacceptable risk. Estimated blood lead levels following potential exposure to lead in Site-related groundwater for a young child resident are predicted to exceed 5 micrograms per deciliter (µg/dL) blood lead level in 4% of the hypothetically exposed population, which is below EPA's regional target (no more than 5% exceeding 5 µg/dl) .

As stated previously, groundwater at the Site is considered potable, and mine water was considered representative of groundwater. Due to the higher levels of contamination detected in the mine shaft, exposures associated with this area were evaluated separately. The cumulative potential cancer risk calculated for the hypothetical future resident scenario for exposure to mine water in the Peters Mine Pit Airshaft for the adult, older child (or youth), and young child is $4x10^{-4}$, which exceeds the EPA's target cancer risk range of $1x10^{-6}$ to $1x10^{-4}$. The most significant contribution to this risk is from benzene and 1,4-dioxane. Potential noncancer risks were also estimated by calculating hazard indices. Hazard indices assessed by target organ for the hypothetical future resident scenario for the adult, older child, and young child are all at or below the EPA's target hazard index limit of 1 with the exception of the GI tract target organ, which is due to the naturally occurring iron concentrations in the Peters Mine Pit Airshaft.

Anticipated blood lead levels in Site receptors were also evaluated to determine whether exposure to lead in mine water in the Peters Mine Pit Airshaft presents an unacceptable risk. Estimated blood lead levels following potential exposure to lead in Peters Mine Pit Airshaft mine water for a young child resident are predicted to exceed 5 µg/dL blood lead level in 27% of the hypothetically exposed population, which is above EPA's regional target (no more than 5% exceeding 5 μg/dl).

Ecological Risk

The Site-Related Groundwater Ecological Assessment (EA) was completed to evaluate the potential of risk to ecological receptors associated with exposure to contaminants in groundwater at the Site. However, because ecological receptors are not directly exposed to groundwater, constituents in groundwater at the Site were determined to only be of concern if they discharge to surface water at concentrations of concern. Therefore, only constituents which were detected at concentrations above ecologically based screening levels (EBSLs) in both groundwater and surface water were identified as constituents of potential ecological concern. The results of this screening indicated that only total (unfiltered) aluminum, barium, copper, and manganese as well as dissolved (filtered) manganese were detected at maximum concentrations in groundwater and surface water which exceeded applicable EBSLs. Benzene and 1,4-dioxane were not detected at concentrations which exceeded their respective EBSLs. However, when potential risk under more realistic exposure assumptions (e.g., 95% Upper Confidence Limit and dissolved metal concentrations) was evaluated, only dissolved manganese exceeded the applicable EBSL. It should be noted that manganese is naturally occuring at the Site and its presence in groundwater is likely associated with native soil and bedrock, as well as historic mining activities.

Potential ecological risk associated with exposure to sediment at the Site was also evaluated. There are no risks to ecological receptors from exposure to Site contaminants of potential ecological concern in sediment.

Conclusion of the Risk Assessment

It is the EPA's judgment that the Preferred Alternatives identified in this Proposed Plan for groundwater and mine water, or one of the other active measures considered in the Proposed Plan, are necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

WHAT IS 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 for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the contaminants of concern at the site in various media (i.e., soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and 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 and dermal contact with 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 (dose) and severity of adverse effects (response), 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 exposure information 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 noncancer 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 may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current Superfund guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of 10^{-4} to 10^{-6} (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk). For noncancer health effects, a "hazard index" (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a noncancer HI is that a "threshold level" (measured as an HI of less than 1) exists below which noncancer health effects are not expected to occur.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) were identified for groundwater and mine water at the Site in order to develop cleanup alternatives to address the human health risks presented by potential exposure to this media. Groundwater beneath the Site is classified by the NJDEP as Class IIA, which means that it has the potential for use as a potable water source. Based on the Class IIA aquifer designation, and the results of the risk assessments, the RAOs for Site-related groundwater include:

- Prevent exposure to groundwater and mine water containing contaminant concentrations above their respective NJGWQS.
- Restore the aquifer outside of the capped mine shaft area to Class IIA NJGWQSs.
- Reduce or eliminate the potential for migration of contamination above NJGWQS.

Consistent with the identified RAOs, the preliminary remediation goals (PRGs) for groundwater and mine water at the Site are the applicable Class IIA NJGWQSs for identified contaminants. Therefore, the groundwater cleanup goals are 1 ug/L and 0.4 ug/L for benzene and 1,4-dioxane, respectively.

SUMMARY OF REMEDIAL ALTERNATIVES

General response actions, which are broad categories of cleanup response which may meet the RAOs for groundwater, were first identified. Potential applicable technologies and process options applicable to these general response actions were then identified and screened using effectiveness, implementability and cost as the criteria, with the most emphasis on the effectiveness of the remedial technology. Those technologies and process options which passed the initial screening were assembled into remedial alternatives for Site-wide groundwater and the Peters Mine Pit Airshaft.

Site-Wide Groundwater

Alternative 1 – No Action
The No Action alternative would not include implementation of any corrective action for groundwater. The No Action Alternative was retained, as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and provides a baseline for comparison with other alternatives.

Total Capital Cost	$0
Operation and Maintenance	$0 (Total)
Total Present Net Worth	$0
Construction Duration	0 months

Alternative 2 – Monitoring with Institutional Controls
This alternative would include active monitoring of groundwater quality and the attenuation processes that are expected to continue to reduce the mobility, toxicity, and volume of Site contaminants in groundwater over time. A long-term groundwater monitoring plan would be implemented which would provide for the monitoring of contaminant concentrations and biogeochemical parameters from groundwater monitoring wells located in and downgradient of the Peters Mine Pit, Cannon Mine Pit and O'Connor Disposal Areas. This alternative also provides for the installation of additional groundwater monitoring wells downgradient of the Peters Mine Pit and O'Connor Disposal Areas which, along with existing monitoring wells, would serve as a sentinel monitoring well network to provide advanced warning of any movement of groundwater contamination toward drinking water resources. In addition, surface water monitoring would be conducted in and downstream of the Site brooks to confirm that Site-related contaminants are not threatening downstream receptors, including the Wanaque Reservoir. Finally, a Classification Exception Area/Well Restriction Area (CEA/WRA) would be established as an institutional control to restrict future withdrawal and use of Site groundwater which contains contaminants at concentrations in excess of NJGWQSs. A CEA/WRA is required pursuant to New Jersey regulations for groundwater which documents the area where water quality standards cannot be met and limits installation of groundwater extraction wells. Sufficient groundwater sampling would be conducted to estimate the extent and duration of the CEA/WRA. Five-year reviews would be required until groundwater reaches remedial goals.

Total Capital Cost	$248,000
Operation and Maintenance	$1,191,000 (Total)
Total Present Net Worth	$1,439,000
Construction Duration	6 months

Alternative 3 – In-Situ Treatment with Monitoring in the Peters Mine Pit Area/O'Connor Disposal Area
Under this alternative, in-situ treatment, likely oxidation, would be implemented to promote and support the degradation of groundwater contaminants through attenuation processes. Introduction of an oxygen release compound (ORC) to the aquifer would be accomplished through wells that would be installed in a barrier-style configuration perpendicular to the direction of groundwater flow. The principal location for these wells would be in the overburden. The focus on the overburden is a consequence of the difficulty of introducing any material into a low-yield fractured bedrock environment and the fact that groundwater flow within the area downgradient of the Peters Mine Pit is generally upward from the bedrock, into the overburden, and ultimately to surface water. Therefore,

a portion of the bedrock groundwater would pass through an oxygen-enriched overburden aquifer. The radius of influence for diffusion of ORC varies with formation characteristics, but is typically limited. Therefore, a well spacing of approximately 20 feet is assumed. The recommended barrier arrangement of wells is situated adjacent to an existing gravel access road for ease of access, and down gradient of the Peters Mine Pit and Peters Mine Pit Air Shaft where Site contaminants have typically been detected at their highest concentrations (see Figure 2).

Wells for introduction of oxygen into the bedrock aquifer may also be installed on a limited scale. These bedrock aquifer wells may be installed in key areas where contaminants have been detected at their highest concentrations (see Figure 3). Given the difficulty of promoting movement of any additives in the low-yield bedrock formation, these wells would be assessed during the initial period of enhancement, and if diffusion of oxygen is not demonstrated, use of the bedrock wells may be terminated. Specific details concerning well placement and ORC application would be determined during design of this alternative.

1,4-dioxane has been found at concentrations exceeding the NJGWQS in O'Connor Disposal Area monitoring well OB-17. However, a focused investigation in the area upgradient of monitoring well OB-17 did not identify a source of 1,4-dioxane and 1,4-dioxane was not detected in paint sludge and soil samples collected during this investigation. This suggests the possibility of some diffuse source of 1,4-dioxane in the area of monitoring well OB-17. Under this alternative, ORC may also be introduced into this monitoring well to promote biodegradation of 1,4-dioxane in this localized area.

This alternative would also provide for the implementation of the long-term groundwater monitoring plan and surface water monitoring plan described in Alternative 2. Furthermore, a CEA/WRA would be established as an institutional control to restrict future withdrawal and use of Site groundwater which contains contaminants at concentrations in excess of NJGWQSs. Sufficient groundwater sampling would be conducted to estimate the extent and duration of the CEA/WRA. Five-year reviews would be required until groundwater reaches remedial goals.

Total Capital Cost	$631,000
Operation and Maintenance	$2,184,000 (Total)
Total Present Net Worth	$2,815,100
Construction Duration	12-18 months

Peters Mine Pit Airshaft

Alternative 1 – No Action

The No Action alternative would not include implementation of any corrective action in the Peters Mine Pit Airshaft. The No Action Alternative was retained, as required by the NCP, and provides a baseline for comparison with other alternatives.

Total Capital Cost	$0
Operation and Maintenance	$0 (Total)
Total Present Net Worth	$0
Construction Duration	0 months

Alternative 2 - Oxygen Diffusion in the Peters Mine Pit Airshaft

Under this alternative, canisters of ORC would be installed at various depths within the Peters Mine Pit Airshaft to enhance the aerobic biodegradation of organic contaminants contained in the mine water. The focus of the canisters would be on the lower portion of the airshaft where the concentrations of organic contaminants are highest. To promote aerobic conditions, it is assumed that the canisters of ORC would be installed horizontally and vertically across the lower part of the Peters Mine Pit Airshaft.

In order to implement this alternative, a cap would be installed across the Peters Mine Pit Airshaft with locking sleeves installed through the cap from which ORC canisters would be suspended on cable. Monitoring of the mine water would be conducted to assess the effects of aerobic conditions on organic contaminants in mine water. Replacement of the ORC canisters would occur as necessary to maintain appropriate aerobic conditions. Because waste would be left in place, five-year reviews would be required.

Total Capital Cost	$91,000
Operation and Maintenance	$261,000 (Total)
Total Present Net Worth	$352,000
Construction Duration	6-12 months

Alternative 3 - Treatment/Closure in the Peters Mine Pit Airshaft

Under this alternative, the Peters Mine Pit Airshaft would be closed using conventional mine shaft closure technology. In addition, prior to closure granular activated carbon (GAC) and resin would be introduced into the shaft to treat organic contaminants.

While details regarding the introduction of treatment materials and closure of the Peters Mine Pit Airshaft would be determined during the design, it is anticipated that GAC and angular stone would first be introduced to the base of the Peters Mine Pit Airshaft. Resin would also be introduced in canisters or socks and lowered to the base of the shaft. Subsequent to this treatment step, fast-setting grout would be placed so that it would not flow into the GAC, resin and angular stone or the adjacent mine openings. Flowable flyash/concrete grout would be placed above the fast-setting grout to the top of the Peters Mine Pit Airshaft, fully sealing the shaft. A poured concrete slab would then be placed above the grout to serve as a final closure surface.

It is estimated that closure of the shaft would result in the displacement of approximately 450,000 gallons of mine water which would need to be addressed. The FFS assumes that the displaced water would be treated through filtration and GAC and then discharged to groundwater. Because waste would be left in place, five-year reviews would be required.

Total Capital Cost	$598,000
Operation and Maintenance	$0 (Total)
Total Present Net Worth	$598,000
Construction Duration	12-18 months

Alternative 4 – Peters Mine Pit Airshaft Closure
Under this alternative, the Peters Mine Pit Airshaft would be closed using conventional mine shaft closure technology. However, treatment of organic contaminants would not occur.

Angular stone or quick-setting grout could be used as a stabilizing course at the base of the shaft to prevent the movement of material into the adjacent mine openings. Flowable flyash/concrete grout would be placed above the fast-setting grout to the top of the Peters Mine Pit Airshaft, fully sealing the shaft. Bentonite would be added to the grout in order to reduce its permeability. A poured concrete slab would then be placed above the grout to serve as a final closure surface.

It is estimated that closure of the shaft would result in the displacement of approximately 450,000 gallons of mine water which would need to be addressed. The FFS assumes that the displaced water would be treated through filtration and GAC and then discharged to groundwater. Because waste would be left in place, five-year reviews would be required.

Total Capital Cost	$646,000
Operation and Maintenance	$0 (Total)
Total Present Net Worth	$646,000
Construction Duration	12-18 months

EVALUATION OF REMEDIAL ALTERNATIVES

Nine criteria are used to evaluate the different remedial alternatives individually and against each other in order to select the best alternative. This section of the Proposed Plan profiles the relative performance of all alternatives against the nine criteria, noting how they compare to the other options under consideration. The nine evaluation criteria are discussed below. A more detailed analysis of the presented alternatives can be found in the Site-Related Groundwater FFS Report.

THE NINE SUPERFUND EVALUATION CRITERIA

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

2. Compliance with Applicable or Relevant and Appropriate Requirements (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 (TMV) 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 contamination 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 operations 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. A discount rate of 7% was utilized in the calculation of present worth costs for the Site. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

8. State/Support Agency Acceptance considers whether the State agrees with the 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.

Site-Wide Groundwater

Overall Protection of Human Health and the Environment

Alternative 1 would not provide for protection of human health and the environment as no action would be taken to remediate impacted groundwater or to prevent the potential future use of this water as drinking water. Therefore, Alternative 1 would not meet the remedial goals.

Alternatives 2 and 3 provide for the establishment of a CEA/WRA which is an institutional control which would serve to prevent the future use of impacted groundwater at the Site as drinking water by documenting the area where water quality standards cannot be met and limiting installation of groundwater extraction wells. Furthermore, Alternatives 2 and 3 would use naturally occurring attenuation mechanisms to restore the aquifer to Class IIA NJGWQSs. Therefore, Alternatives 2 and 3 are expected to meet all of the RAOs over time and are considered protective of human health and the environment. However, it should be noted that the ability of Alternatives 2 or 3 to meet the RAO of restoring the aquifer to Class IIA NJGWQS within a reasonable timeframe is not certain because of the absence of a defined source, the natural presence of certain contaminants at the Site, and the potential presence of sources related to the larger mine workings.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Class IIA NJGWQSs are ARARs for Site-wide groundwater. Alternatives 1 would not comply with ARARs. In addition, because no remedial action would be taken under Alternative 1, this alternative would not meet the RAO of restoring the aquifer to Class IIA NJGWQSs.

Alternatives 2 and 3 provide for establishment of a CEA/WRA and would comply with State of New Jersey requirements for controlling use of groundwater by a CEA/WRA. In addition, Alternatives 2 and 3 are designed to meet the NJGWQSs over time through the use of natural attenuation mechanisms. Therefore, Alternatives 2 and 3 are expected to comply with ARARs.

Long-Term Effectiveness and Permanence

Alternatives 2 and 3 would be effective in the long-term through maintenance of the institutional control provided by the CEA/WRA. As long as the CEA/WRA is in effect, these alternatives would be protective by preventing the use of impacted groundwater. Alternative 1 does not include a CEA/WRA, and therefore, a mechanism to ensure protectiveness over the long term would not be in place.

Alternatives 2 and 3 would be similar with respect to permanence as they both rely upon the use of natural attenuation mechanisms to reduce concentrations of contaminants in groundwater naturally, over the long-term with the objective of achieving restoration of the aquifer. The ongoing addition of oxygen release compound and nutrients under Alternative 3 is intended to improve the effectiveness of the natural attenuation mechanisms and shorten the timeframe to restore the aquifer to Class IIA NJGWQSs.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The No Action Alternative would not include any removal or treatment-based remedial actions to reduce toxicity, mobility, or volume of contaminants in groundwater.

Alternatives 2 and 3 would reduce the toxicity and mobility of contaminants present in groundwater through the natural attenuation mechanisms of biodegradation, advection, and dispersion. In addition, redox conditions within and downgradient of the Peters Mine Pit Area help to inhibit the mobility of soluble metals in the downgradient direction. Monitoring would be conducted to confirm these processes are maintained.

Alternative 3 is the only alternative that includes an active measure as it requires the introduction of oxygen and nutrients, which provides the additional step of supporting and enhancing the natural attenuation mechanisms, aiding the positive effects of redox conditions, and thus would enhance the reduction of toxicity and mobility of contaminants.

Short-Term Effectiveness

Alternative 1 includes no construction or remedial activities and would have no short-term impacts. For Alternatives 2 and 3, remedial construction activities would be limited and would not have any significant short-term impacts and would occur over a relatively short duration. Alternative 2 would involve the installation of additional groundwater monitoring wells and establishing compliance with the substantive requirements of state law and may take 6 months to implement. Alternative 3 would require the installation of additional wells downgradient of the Peters Mine Pit Area for the introduction of ORC and is estimated to take 12 to 18 months to implement. Health and safety of workers and the public would be maintained during the installation of these wells utilizing safeguards, as provided for in a Site-specific health and safety plan, to limit short-term exposure risks.

Implementability

Alternatives 1 does not have implementation components. The administrative task of setting up the CEA/WRA, a component of Alternatives 2 and 3, is readily accomplished through coordination with the NJDEP.

Alternatives 2 and 3 are readily implemented with conventional equipment and materials available in the marketplace. While Alternatives 2 and 3 may require consultation with NJDEP to reach compliance on substantive requirements for well installations and placement of oxygen release compound in the aquifer, impediments to establishing compliance are not anticipated.

Cost

Alternative 1 would have no cost as no action would be required.

Alternative 2, which provides for establishment of a CEA/WRA and long-term groundwater monitoring, has an estimated cost of $1,439,000. Alternative 3, which provides for the introduction of an oxygen release compound into the aquifer to enhance the degradation of organic contaminants in addition to establishment of a CEA/WRA and long-term monitoring, is estimated to cost $2,815,000. The total costs are calculated using a discount rate of 7 percent.

State/Support Agency Acceptance

The State of New Jersey agrees with the preferred alternative for Site-Wide Groundwater and Mine Water, which is presented in this Proposed Plan.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the Responsiveness Summary of the OU3 ROD for this Site. The ROD is the document that formalizes the selection of the remedy for a site.

<u>**Peters Mine Pit Airshaft**</u>

Overall Protection of Human Health and the Environment

Alternative 1 would not provide for protection of human health and the environment because no action would be taken to address risks associated with the potential future potable use of mine water in the Peters Mine Pit Airshaft. Alternatives 2, 3 and 4, would be protective assuming a CEA/WRA would be put into place for the Site-wide groundwater alternatives and would also cover the area of and down-gradient from the Peters Mine Pit Airshaft. In addition, Alternatives 3 and 4 would prevent future use of the mine water in the Peters Mine Pit Airshaft as a potable water supply because the airshaft would be permanently closed.

Under the assumption that the Peters Mine Pit Airshaft is hydraulically connected to the surrounding Peters Mine Pit Area aquifer, the treatment associated with Alternatives 2 and 3 would be potentially beneficial in reducing the contaminant concentrations which may result in meeting the RAO of restoring the aquifer to Class IIA NJGWQS within a reasonable timeframe. Alternatives 3 and 4 (both of which physically isolate the Peters Mine Pit Airshaft through closure) may also contribute to reducing contaminant concentrations in groundwater by eliminating the airshaft's connection to the aquifer, which may result in a shorter period of time to meet the RAO of attempting to restore the aquifer to Class IIA NJGWQS within a reasonable timeframe. However, the timeframe for meeting this RAO is considered uncertain because of the absence of a defined source, the natural presence of certain contaminants at the Site, and the potential presence of sources related to the historic mine workings.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternative 1 would not comply with ARARs as no action would be taken.

N.J.A.C. 7:14A-7.5, which establishes state limitations on pollutants in discharges to groundwater, would be an ARAR for Alternatives 3 and 4. Alternatives 2, 3, and 4 would meet the substantive requirements for the actions to be implemented (i.e., underground injection, dewatering of the Air Shaft) through consultation with NJDEP.

Long-Term Effectiveness and Permanence

Under Alternative 1, no action would be taken to address risks associated with the potential future potable use of mine water in the Peters Mine Pit Airshaft. In addition, under this alternative there would not be any mechanisms to monitor the concentrations of contaminants in mine water in the Peters Mine Pit Airshaft to determine whether concentrations change over time. Therefore, Alternative 1 would not be effective over the long-term.

Under Alternative 2, ORC could be placed in the Peters Mine Pit Airshaft indefinitely, and therefore, to the extent there are beneficial effects from oxygen diffusion, the effectiveness could be maintained for the long term. Furthermore, monitoring of the mine water quality to assess the performance of the oxygen diffusion would confirm that the concentrations of contaminants in the Peters Mine Pit Airshaft decline over time.

Alternatives 3 and 4 are permanent remedies as the closure component would permanently seal the airshaft and isolate it from the surrounding environment. Furthermore, for Alternative 3, contaminants would remain adsorbed to the

GAC and resin as there would not be a mechanism to regenerate the carbon or resin and release the contaminants. Being a permanent closure of the Peters Mine Pit Airshaft, Alternatives 3 and 4 would be effective for the long-term without any operation and maintenance.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1 would not treat the contaminants in mine water and would not reduce their toxicity, mobility, or volume.

Alternative 2 would reduce contaminant toxicity and volume by introducing oxygen and essential nutrients into the base of the Peters Mine Pit Airshaft to promote aerobic biodegradation of contaminants in mine water.

Alternative 3 would reduce the mobility of contaminants within the Peters Mine Pit Airshaft through treatment with GAC and resin at the base of the airshaft to adsorb contaminants and bind them in the GAC and resin matrices. Isolating the airshaft from the surrounding aquifer through the closure process would also reduce mobility of contaminants.

Alternative 4 would reduce the mobility of contaminants in the airshaft, but only by isolating the airshaft from the surrounding aquifer through the closure process, not through treatment.

Short-Term Effectiveness

Under Alternative 1, no remedial or construction activities would occur. Therefore, no short-term impacts would be associated with implementation of this alternative.

Minimal short-term risks are associated with implementation of Alternatives 2, 3, and 4. The most significant construction element associated with Alternative 2 is the concrete cap on the Peters Mine Pit Airshaft, which would be complete in a relatively short period of time. The most significant construction element associated with Alternatives 3 and 4 is the grouting and closure of the Peters Mine Pit Air Shaft, which would also be completed in a relatively short period of time. Alternatives 2, 3, and 4 are not anticipated to have any significant short-term impacts as the health and safety of workers and the public would be maintained during construction of each of these alternatives. Safeguards, as provided for in a Site-specific health and safety plan, would be implemented to protect human health and the environment during implementation of these alternatives.

Construction of Alternatives 2, 3 and 4 is expected to be of short duration. The anticipated schedule to have Alternative 2 in place is on the order of six months to one-year and one-year to 18 months for Alternatives 3 and 4.

As part of Alternatives 3 and 4, the placement of stone/grout or GAC and resin at the base of the Air Shaft has the potential to disturb sediments and debris, which could in turn alter the geochemistry in the base of the shaft on a short-term basis. Such a disturbance could potentially cause a short-term increase in contaminant concentrations in the bedrock aquifer adjacent to the Peters Mine Pit Airshaft. Alternative 3 may have the advantage of providing some additional mitigation of potential short-term groundwater quality impacts from disturbance of the sediments and debris in the airshaft because it includes the use of adsorbents to close the airshaft at the same time as the disturbance, whereas Alternative 4 does not.

Implementability

Alternative 1 does not require any remedial activity and, therefore, implementability is not a consideration.

The implementability of Alternatives 2, 3, and 4 is similar in that they can all be implemented with conventional equipment, materials, means and methods available commercially. While Alternatives 2 and 3 may require consultation with NJDEP to reach compliance on substantive requirements for well installations and placement of ORC in the aquifer, impediments to establishing compliance are not anticipated. Therefore, all of these alternatives are readily implementable.

Cost

Alternative 1 would have no cost as no action would be required. Alternative 2, which includes installation of the airshaft cap, 30 years of mine water monitoring and reporting, and routine operation and maintenance activities, is estimated to cost $334,000. Alternative 3, which includes site preparation, installation of stone, GAC, resin, grouting the full depth of the airshaft, and a concrete cap, is estimated to cost $598,000. Alternative 4 is only slightly more costly than Alternative 3 because of the additional cost of using a bentonite additive as part of the closure grouting operation. Alternative 4 is estimated to cost $646,000. The total costs are calculated using a discount rate of 7 percent.

State/Support Agency Acceptance

The State of New Jersey agrees with the preferred alternative for the Peters Mine Pit Airshaft, which is presented in this Proposed Plan.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the Responsiveness Summary of the OU3 ROD for this Site.

SUMMARY OF THE PREFERRED ALTERNATIVES

Site-Wide Groundwater

Alternative 3, In-Situ Treatment With Monitoring in the Peters Mine Pit Area/O'Connor Disposal Area, is the preferred alternative for Site-Wide Groundwater. Under this alternative, in-situ treatment, likely oxidation, would be conducted to promote and support the degradation of contaminants. Since the preferred biodegradation pathway for benzene and 1,4-dioxane is aerobic, this alternative would focus on using oxygen as the electron acceptor.

While subject to modification during the design, in concept, the introduction of ORC to the aquifer would be accomplished through wells that would be installed in a barrier-style configuration perpendicular to the direction of groundwater flow. The principal location for these wells would be in the overburden. The focus on the overburden is a consequence of the difficulty of introducing any material into a low-yield fractured bedrock environment, and the fact that groundwater flow within the area downgradient of the Peters Mine Pit is generally upward from the bedrock, into the overburden, and ultimately to surface water. Therefore, a portion of the bedrock groundwater would pass through an oxygen enriched overburden aquifer. The radius of influence for diffusion of ORC varies with formation characteristics, but is typically limited. Therefore, a well spacing of approximately 20 feet is assumed. The recommended barrier arrangement of wells is situated adjacent to an existing gravel access road for ease of access, and down gradient of the Peters Mine Pit and Peters Mine Pit Air Shaft where Site contaminants have typically been detected at their highest concentrations (**see Figure 2**).

Wells for introduction of oxygen into the bedrock aquifer may also be installed on a limited scale. These bedrock aquifer wells may be installed in key areas where contaminants have been detected at their highest concentrations (**see Figure 3**). Given the difficulty of promoting movement of any additives in the low-yield bedrock formation, these wells would be assessed during the initial period of enhancement, and if diffusion of oxygen is not demonstrated, use of the bedrock wells may be terminated.

Furthermore, 1,4-dioxane has been found in concentrations exceeding the NJGWQS in O'Connor Disposal Area monitoring well OB-17. However, a focused investigation in the area upgradient of monitoring well OB-17 did not identify a source of 1,4-dioxane and 1,4-dioxane was not detected in paint sludge and soil samples collected during this investigation. This suggests the possibility of some diffuse source of 1,4-dioxane in the area of monitoring well OB-17. Under this alternative, ORC may also be introduced into this monitoring well to promote biodegradation of 1,4-dioxane in this localized area.

Commercial ORC products are available that can be applied in socks/canisters within wells in a solid or granular form. These commercially available products can also be supplied with buffering compounds and essential inorganic nutrients to further support the microbial populations. This alternative assumes the use of a chemical, slow release source of oxygen, applied in the above-described array of wells, at a typical application rate in the range of 2-5 pounds of ORC per foot of saturated thickness within the treatment zone. Furthermore, it is assumed that ORC socks contained in reusable canisters would be suspended in each well to allow for the replacement of ORC, once exhausted. However, the specific details concerning well placement and ORC application will be determined during design of the preferred alternative.

Furthermore, a long-term groundwater and surface water monitoring program would be conducted which would include the sampling of groundwater monitoring wells in and downgradient of the Peters Mine Pit, Cannon Mine Pit and O'Connor Disposal Areas, and surface water monitoring in the four brooks which drain the Site. In addition, the EPA currently assumes that at least three additional groundwater monitoring wells would be installed in bedrock downgradient of the Peters Mine Pit and O'Connor Disposal Areas to serve as sentinel monitoring wells. These wells would be used to provide advanced warning of any movement of contaminants toward drinking water supplies. The specific details of the long-term groundwater and surface water monitoring program, including sampling location and frequency, would be determined during design of the preferred alternative.

Finally, a CEA/WRA would be established as an institutional control to restrict future withdrawal and use of Site groundwater which contains contaminants at concentrations in excess of NJGWQSs. A CEA/WRA is required pursuant to New Jersey regulations for groundwater which does not meet applicable NJGWQSs. Sufficient groundwater sampling will be conducted to estimate the extent and duration of the CEA/WRA.

Peters Mine Pit Airshaft

Alternative 3, Treatment/Closure in the Peters Mine Pit

Airshaft is the preferred alternative for the Peters Mine Pit Airshaft. Under this alternative, the Peters Mine Pit Airshaft would be permanently closed using conventional mine shaft closure technology. Closure of the Peters Mine Pit Airshaft would constitute isolation of the shaft and its contents from the surrounding environment. In addition, this alternative includes a treatment step using GAC and resin prior to permanent closure of the Airshaft.

Implementation of the preferred alternative would begin with the introduction of GAC and resin to the base of the Peters Mine Pit Airshaft, to adsorb organic contaminants. The amount of GAC and resin to be introduced to the airshaft would be determined during design of this alternative. Angular stone would be interspersed with smaller sized GAC at the bottom of the shaft. The resin density is less than that of water. Therefore, the resin would be introduced in canisters or socks lowered to the base of the air shaft. The rock would provide bearing strength to temporarily support grout that would be placed above the rock. In addition, the angular shape of the rock would limit its movement within the mine workings toward the adjacent mine slope entry. Methods to mitigate the potential flow of mine water from the deeper mine workings to the Peters Mine Pit will also be considered during design of this remedy.

Subsequent to the treatment step of addition of stone, GAC and resin, measures would be taken to permanently close the Peters Mine Pit Airshaft. Fast-setting, low-slump grout mix would be placed on top of the stone and GAC/resin to a total thickness of approximately 10 feet. The fast setting grout would initially be placed so that the grout would not flow deeply into the rock and carbon and seal it from contacting the mine water. The fast-setting grout would also limit the potential for loss of grout into the adjacent mine slope entry.

Flowable flyash/concrete grout would then be placed using a tremie pipe above the fast setting grout, to the top of the airshaft, fully sealing the shaft. The flyash grout is a slower-setting, low-strength mix commonly used in mine shaft closures. The grout mix would be designed to have a strength of between 500 to 1000 pounds per square inch (at 28 days). The grout would encapsulate any remaining wood material and fill voids within the airshaft. Flyash grout mixtures have become commonly available as a ready-mixed material. Therefore, material for the Peters Mine Pit Airshaft closure could be supplied by ready-mix vendors or a mixing plant could be used on site.

This grouting operation would displace the water in the airshaft. The EPA assumes that the displaced water would be treated through filtration and GAC and then discharged to groundwater within the same general locations, pursuant to the substantive requirements of NJAC 7:14A-7.5, which establishes state limitations on pollutants in discharges to groundwater. Based on the dimensions of the airshaft, the total volume of water that will be displaced is approximately 450,000 gallons. At a flow rate of 50 gallons per minute, the total quantity of displaced water would require approximately only six days to treat and discharge.

Following placement of the low-strength grout fill, a concrete cap would be placed with a marker as a final closure and identification measure. The concrete cap would be a conventional poured slab that would provide a durable, final closure surface. Closure of the Peters Mine Pit Airshaft would be permanent and would isolate the shaft from the environment.

Basis for the Preferred Remedy

While Alternatives 2 and 3 for Site-Wide Groundwater would both be expected to reduce the levels of contaminants in groundwater at the Site through the attenuation processes of biodegradation, advection, and dispersion, Alternative 3 would enhance these processes through the introduction of oxygen and nutrients to the aquifer. Therefore, the EPA expects that Alternative 3, In-Situ Treatment with Monitoring in the Peters Mine Pit Area/O'Connor Disposal Area, may result in a greater likelihood and/or shorter timeframe to restore the aquifer to Class IIA NJGWQSs than Alternative 2.

For the Peters Mine Pit Airshaft, the EPA believes that the treatment associated with Alternatives 2 and 3 would be potentially beneficial to reducing contaminant concentrations in mine water and groundwater, which may result in a greater likelihood of restoring the surrounding aquifer to Class IIA NJGWQSs within a shorter time period. Furthermore, Alternatives 3 and 4 would prevent the potential for future exposure to impacted mine water in the Peters Mine Pit Airshaft through permanent closure of the airshaft. Therefore, only Alternative 3, Treatment/Closure in the Peters Mine Pit Airshaft, provides the potential benefit of reducing contaminant levels through treatment, while preventing the potential for future exposure to impacted mine water in the airshaft through permanent closure.

Based on information currently available, the EPA believes that the Preferred Alternatives for Site-Wide Groundwater and the Peters Mine Pit Airshaft meet the threshold criteria and provide the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The EPA expects the Preferred Alternatives to satisfy the following statutory requirements of CERCLA §121: (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element or explain why the preference for treatment will not be met. However, the EPA's Preferred Alternatives may change based upon public comments received during the public comment period or if new information indicates that other alternatives better satisfy the screening criteria.

The total present worth cost, calculated using a discount rate of 7 percent, for the Site-Wide Groundwater and Peters Mine Pit Airshaft preferred alternatives is $3,413,100.

Consistent with the EPA Region 2's Clean and Green policy, the EPA will evaluate the use of sustainable technologies and practices with respect to any remedial alternatives selected for the Site.

Because these remedies will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the remedial action to ensure that the remedies are, or will be protective of human health and the environment.

COMMUNITY PARTICIPATION

The EPA provided information regarding the cleanup of the Ringwood Mines/Landfill Superfund Site to the public through public meetings, the Administrative Record file for the Site and announcements published in the Bergen Record newspaper. The EPA encourages the public to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted there.

The dates for the public comment period; the date, the location and time of the public meeting; and the locations of the Administrative Record files are provided on the front page of this Proposed Plan.

For further information on the EPA's preferred alternatives for the Ringwood Mines/Landfill Superfund Site:

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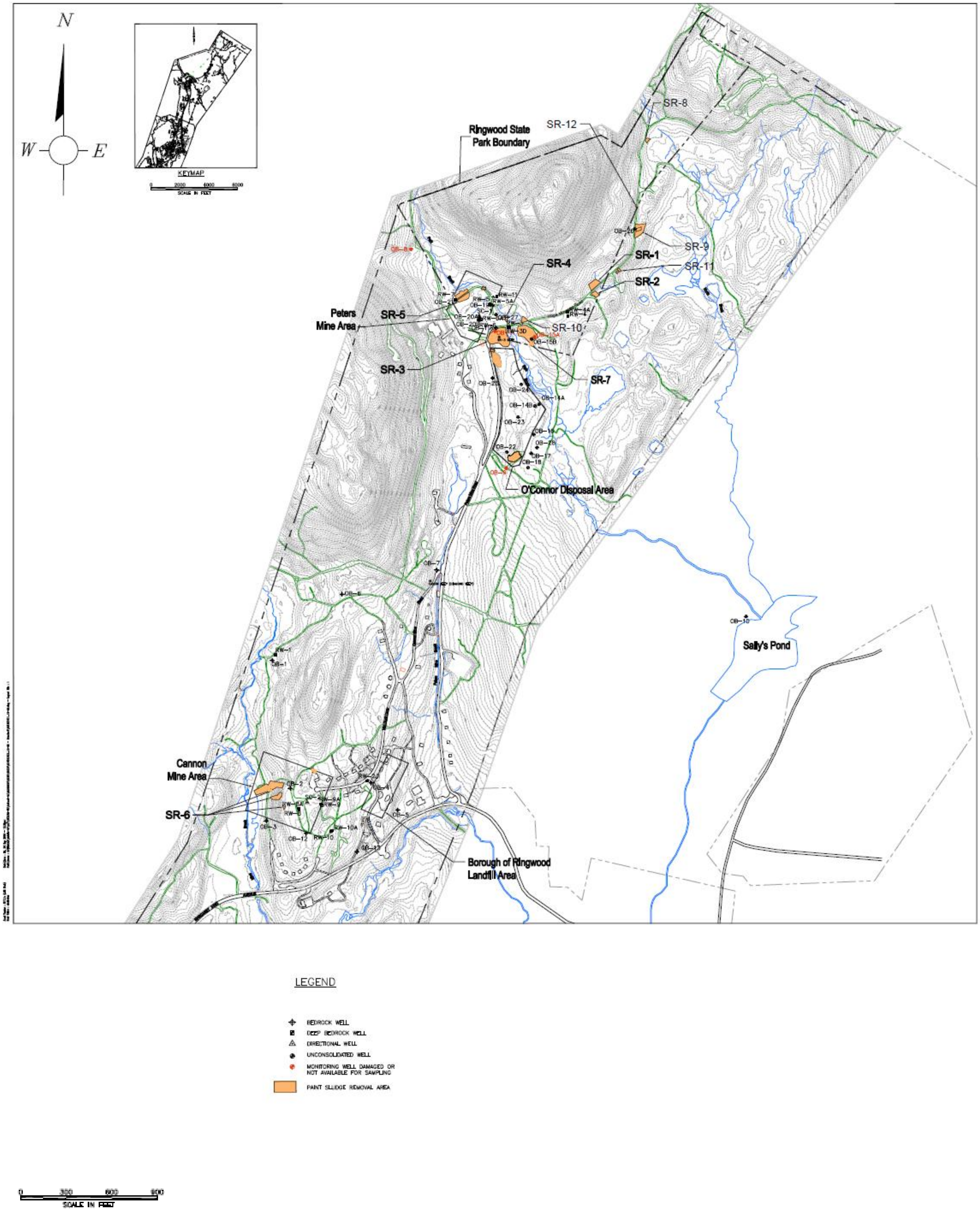

Figure 1 – Location of the Ringwood Mines/Landfill Site Areas of Concern

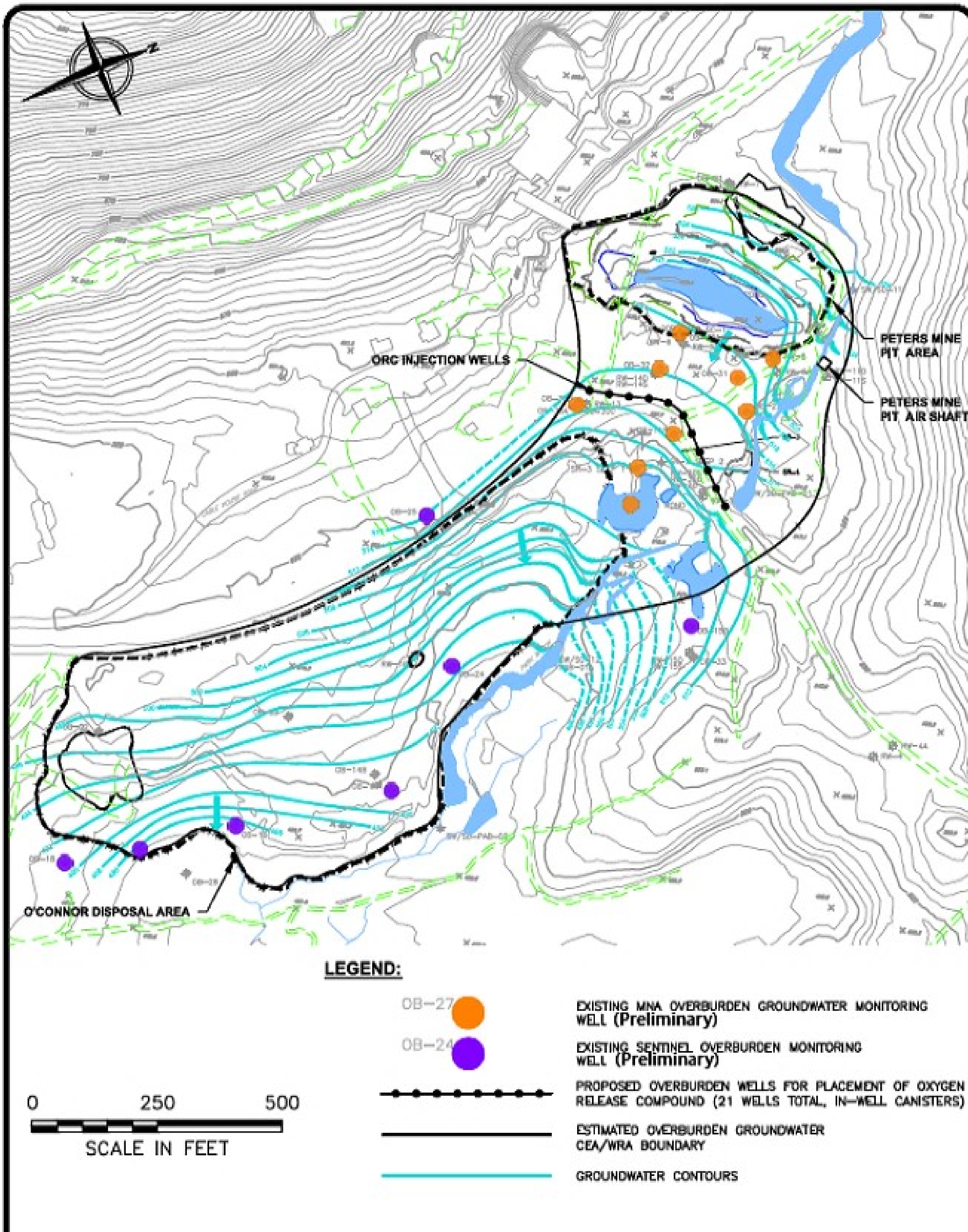

FIGURE 2

ALTERNATIVE 3 - IN-SITU TREATMENT WITH MONITORING (OVERBURDEN)

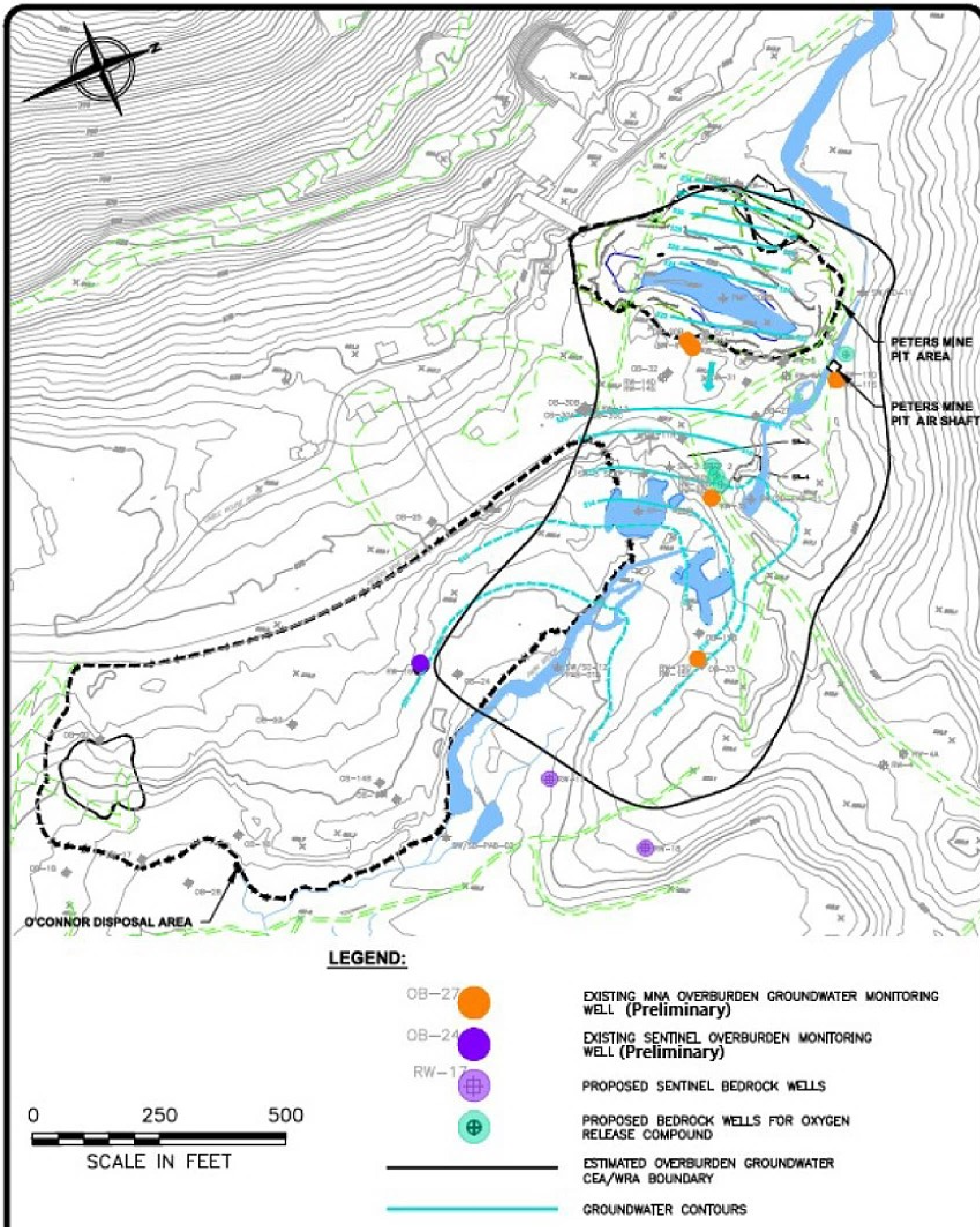

FIGURE 3

ALTERNATIVE 3 - IN-SITU TREAMENT WITH MONITORING (BEDROCK)