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September 1990

EPA

Superfund Record of Decision:

Lone Pine Landfill, NJ

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 45-acre Lone Pine Landfill site is an abandoned, privately owned waste disposal facility in Freehold Township, Monmouth County, New Jersey. The site lies within a semi-wooded wetlands area, and in the Manasquan River floodplain. Contaminated ground water underlies the site within the surficial Water Table Aquifer and the deeper Red Bank Aquifer. Ground water from both aquifers discharges into the Manasquan River downgradient from the site. From 1959 to 1979, municipal, commercial, and industrial wastes, including approximately 17,000 drums containing hazardous waste, tanks containing liquid chemicals, and containers of chemical sludges, were disposed of onsite. Following a chemical fire in 1977 and an explosion at the site in 1978, the State ordered the owner to mitigate the potential environmental damage. In 1979, when the owner failed to comply, the State ordered the landfill closed, and the site was abandoned. A 1984 Record of Decision (ROD) addressed Operable Unit One (OU1), the source control remedy, which included constructing a landfill containment system; capping the landfill; installing a slurry wall around the landfill perimeter; and collecting and treating leachate from within the slurry wall containment area. This ROD addresses OU2, contaminated ground water outside of the containment system. The primary

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Lone Pine Landfill, NJ
Second Remedial Action - Final
Contaminated Medium: gw
Key Contaminants: VOCs (benzene, PCE, phenols, TCE, toluene, xylenes), metals (arsenic, chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 85
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

contaminants of concern affecting the ground water are VOCs including benzene, PCE, phenols, TCE, toluene, and xylenes; and metals including arsenic, chromium, and lead.

The selected remedial action for this site includes pumping and treating ground water after installation of an interceptor drain parallel to the Manasquan River that is keyed into the Water Table Aquifer to capture contaminated ground water; supplementing the drain with extraction wells screened within the Red Bank Aquifer; constructing an onsite wastewater treatment plant consisting of an air stripper to remove VOCs, precipitation/filtration for removal of metals, and carbon adsorption to treat recovered ground water; dewatering and testing of residual solids to determine proper method for offsite disposal; reinjecting the treated ground water into the Red Bank Aquifer or discharging into a recharge trench onsite; conducting long-term monitoring of ground water, surface water, river sediments and biota; and implementing institutional controls including deed restrictions and land and ground water use limitations. The estimated present worth cost for this remedial action is $10,267,661, which includes an annual O&M cost of $482,600.

PERFORMANCE STANDARDS OR GOALS: Chemical-specific ground water cleanup goals include benzene 1 ug/l (State MCL), PCE 1 ug/l (State MCL), phenols 0.0035 ug/l (State), TCE 1 ug/l (State MCL), toluene 50 ug/l (State MCL), xylenes 44 ug/l (State MCL), arsenic 50 ug/l (State MCL), chromium 50 ug/l (State MCL), and lead 50 ug/l (State MCL).

DECLARATION STATEMENT

RECORD OF DECISION

LONE PINE LANDFILL SITE

SITE NAME AND LOCATION

Lone Pine Landfill
Freehold Township, Monmouth County, New Jersey

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Lone Pine Landfill site, in Freehold Township, New Jersey, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision document explains the factual and legal basis for selecting the remedy for this site.

The New Jersey Department of Environmental Protection concurs with the selected remedy. The information supporting this remedial action decision is contained in the administrative record for this site.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The remedial action described in this document represents the second of two planned operable units for the site. A landfill containment system including a cap, slurry wall and leachate collection/treatment will be implemented as part of the first operable unit. This action will address the contaminated ground water outside of the containment system.

Once implemented, the above actions will effectively eliminate the landfill as a source of contamination to area ground water and the nearby Manasquan River. However, because of the lengthy period of time projected to clean up the ground water, long-term management and controls will be necessary.

The major components of the selected remedy for the second operable unit include the following:

- Extraction and on-site treatment of the contaminated ground water;
- Reinjection of the treated water back into the ground;
- Environmental monitoring of the aquifers and the Manasquan River, including additional sediment and biota studies; and
- Institutional controls to ensure the effectiveness of the remedy.

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and it satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as their principal element.

Because this remedy will result in hazardous substances remaining on the site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Constantine Sidamon-Eristoff
Regional Administrator

Date

ROD FACT SHEET

SITE

SITE NAME:	LONE PINE LANDFILL (SECOND OPERABLE UNIT)
LOCATION:	FREEHOLD TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY
REGION:	2
HRS SCORE & DATE:	9/83, GROUP 1, 66.3
NPL RANK:	15

ROD

DATE SIGNED:	9/28/90
REMEDY:	GROUND WATER EXTRACTION/TREATMENT (GRANULAR ACTIVATED CARBON)/REINJECTION
CAPITAL COST:	$ 5,441,662
O&M/YEAR:	$ 482,600
PRESENT WORTH:	$10,267,661
LEAD:	ENFORCEMENT/EPA/PRP
PRIMARY CONTACT:	SHARON JAFFESS, RPM, FTS 264-2598
SECONDARY CONTACT:	JANET FELDSTEIN, SECTION CHIEF, FTS 264-0613
MAIN PRPs:	> 300 PRPs, INCLUDING FREEHOLD CARTAGE, SCP, NESTLE, COCA COLA, GE, LONE PINE CORP., DUPONT, 3M, CIBA-GEIGY, CHEMICAL CONTROL, ...
PRP CONTACT:	NOT CURRENTLY AVAILABLE

WASTE

TYPE:	VOLATILE ORGANICS, METALS
MEDIUM:	GROUND WATER & SURFACE WATER
ORIGIN:	LANDFILL
ESTIMATED QUANTITY:	GROUND WATER CONTAMINANT PLUME COVERS APPROXIMATELY 90 ACRES TO A DEPTH OF APPROXIMATELY 100 FEET BELOW GRADE. GROUND WATER PLUME DISCHARGES INTO THE MANASQUAN RIVER.

DECISION SUMMARY FOR THE RECORD OF DECISION

LONE PINE LANDFILL SITE

SITE DESCRIPTION

Location

The Lone Pine Landfill (site) is located in Freehold Township, Monmouth County, New Jersey. It is in a rural, marshy area five miles southwest of the town of Freehold, and one-half mile southeast of the intersection of Route 537 and Elton-Adelphia Road. The landfill is situated about 300 feet south of the Manasquan River, and about 1000 feet west of the Turkey Swamp Fish and Wildlife Management Area. It is bounded to the east and south by Burke Road and to the west by a swamp which drains into the Manasquan River at the landfill's northern boundary (Figure 1).

The landfill mound rises about 45 feet above the natural grade. It occupies an area of approximately 45 acres within a 144-acre, mostly wooded parcel owned by the Lone Pine Corporation.

The area in the vicinity of the site is rural to suburban with only about half a dozen residences in the immediate vicinity, the closest being about 600 feet south of the landfill. A local sportsman club, the Fin, Fur and Feather Club, is located about 100 feet to the east of the landfill. A 700-acre municipal potable water supply reservoir has been constructed at a location 16 miles downstream of the landfill off the Manasquan River. The Manasquan River, in its reach adjacent to the site and downstream approximately 16,000 feet to Jackson Road, is classified as Fresh Water 2 - Nontrout (FW2-NT). This classification designates it for maintenance, migration and propagation of natural biota, primary recreation, industrial, agricultural, and public water supply with treatment.

Topography, Hydrology, and Geology

The on-site topography is relatively flat but gradually slopes toward the Manasquan River to the north. The site lies within the 2.4 square mile subbasin of the regional Manasquan River watershed. Surface waters within the subbasin drain into tributaries of the easterly flowing Manasquan River. Ground water discharge in the immediate vicinity of the landfill provides a major source of water for the Manasquan River, which has a variable flow rate of approximately 2 to 70 cubic feet per second (cfs). The ground water in the vicinity of the site is currently utilized as a source of drinking water and is classified as such.

Figures 2 and 3 show a generalized geologic cross section beneath the landfill and delineate the geologic formations and corresponding hydrologic units. The geology is typical of the Atlantic Coastal Plain Physiographic Province; gently southeastward

dipping unconsolidated marine and fluvial deposits of clay, silt, sand, and gravel. The shallow geologic units beneath the landfill in descending order are the Vincentown Formation and the Hornerstown Formation of Tertiary age, and the Red Bank Formation, Navesink Formation, Mount Laurel Formation and Wenonah Formation of Late Cretaceous age.

The Vincentown Formation is a medium-grained sand which is absent north of the landfill and is up to 30 feet thick on the south side of the landfill. The Hornerstown Formation is a silty, fine-grained sand with varying amounts of clay that is considered to be a confining layer. The Red Bank Formation, which is 50 to 60 feet in thickness, contains four distinct lithologic units. The upper unit is a partially indurated, silty, fine-grained sand which is about 10 feet in thickness. The next unit, which is called the Tinton Sand Member, is 5 to 10 feet in thickness; it is a ferric carbonate sandstone. Beneath the Tinton Sand Member is a poorly sorted, medium- to coarse-grained sand, 10 to 35 feet in thickness. The basal unit is a massive, silty, fine-grained sand, which is 10 to 20 feet in thickness. The Navesink Formation is a massive, poorly sorted, clayey sand that is about 30 feet in thickness. This formation is considered to be a confining layer that separates the Wenonah-Mount Laurel aquifer system from the overlying Red Bank Formation.

The uppermost saturated units (Vincentown and Hornerstown Formations) comprise what is referred to as the Water Table aquifer. Horizontal flow in the Water Table aquifer is from the landfill toward the river. Calculated ground water flow velocity from the landfill to the river ranges from 80 to 740 feet per year. Horizontal ground water flow in the underlying Red Bank aquifer is also toward the river from the landfill, with calculated velocities ranging from 12 to 91 feet per year. Vertical ground water flow in the vicinity of the landfill is downward from the Water Table aquifer to the Red Bank aquifer beneath the landfill, and is upward in the valley of the Manasquan River. Vertical ground water flow is also upward over the entire area from the Navesink Formation to the Red Bank aquifer. Figure 4 is a schematic diagram which depicts ground water flow in the vicinity of the landfill. Detailed potentiometric maps of the Water Table and Red Bank aquifers are located in the Remedial Investigation and Feasibility Study (RI/FS) reports.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Lone Pine Landfill began operation in 1959 and throughout its history was operated by the now defunct Lone Pine Corporation. Until it was closed, the landfill accepted a wide variety of wastes for disposal, including municipal, commercial and industrial wastes. In addition, the landfill received thousands of drums containing chemical wastes from the facilities of Scientific Chemical Processing Company (SCP) in Newark and Carlstadt, New Jersey. Drums, as well as tankers of liquid chemicals and containers of chemical sludges, were transported to the Lone Pine Landfill by Taylor

Pumping Services, Inc. and disposed of at the landfill.

In the early 1970's, the New Jersey Department of Environmental Protection (DEP) unsuccessfully attempted to force the Lone Pine Corporation, the owner and operator, to update its operation to minimize the leachate and surface runoff problems at the landfill. Following a DEP sampling investigation in 1977 and a chemical fire and explosion at the site on June 23, 1978, DEP issued an administrative order directed at mitigating potential environmental damage from the site. Failure by the Lone Pine Corporation to meet the requirements of the administrative order resulted in a DEP's issuance of a closure order in April 1979. This closure order required the termination of waste disposal at the site after November 1979. The site has been abandoned since landfill operations ceased. DEP filed suit against Lone Pine Corporation and its principals in October 1979 to ensure proper closure.

Due to the enactment of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §9601 et seq. in 1980, the United States Environmental Protection Agency (EPA) assumed the lead role in the investigation of the landfill and took over enforcement activity from DEP. In addition, in 1980, a United States Grand Jury for the District of New Jersey investigated activities at the Lone Pine Landfill and indicted SCP and its three officers and Taylor Pumping Services, Inc. for conspiracy to obstruct a grand jury investigation.

In 1981, the site was ranked in the top 20 sites on EPA's Interim National Priorities List and the Lone Pine Corporation filed a "Notification of Hazardous Waste Site" form for the Lone Pine Landfill with EPA Region II, pursuant to Section 103(c) of CERCLA, 42 U.S.C. §9603(c). During 1981 and 1982, EPA and DEP pursued various studies and investigations, seeking to ascertain the extent of the contamination emanating from the site and to determine the potential threat to public health and the environment. These studies included a subsurface investigation (magnetometric) to map concentrations of buried metal (drums), a drum excavation and sampling program, and a hydrogeological investigation.

The magnetometric study in the summer of 1981 indicated the possible presence of tens of thousands of steel drums. It was later determined that at least 17,000 drums containing chemical wastes were illegally disposed of in the landfill by SCP. EPA performed a limited drum excavation and sampling program. A total of 69 drums were excavated. Of these, 35 had retained partial contents with 25 drums containing sludge, and 10 containing liquid. A variety of organic priority pollutant substances, heavy metals, and pesticides were contained in these drums.

The results of a fall 1981 - winter 1982 hydrogeological investigation indicated severe ground water contamination in both the surficial Vincentown and Hornerstown Formations (Water Table aquifer) as well as the deeper Red Bank Formation (Red

Bank aquifer).

After learning the identities of some of the potentially responsible parties (PRPs), and before beginning a FS to evaluate remedial alternatives, EPA sent "notice" letters to the identified PRPs on July 6, 1982 and September 3, 1982. These letters informed the PRPs that they "...may be a responsible party with respect to releases and threatened releases..." of hazardous substances at the site. These letters also offered the PRPs the opportunity to perform the FS. No PRP was willing to undertake an FS so EPA continued its investigation.

In July 1982, EPA and DEP signed a State Superfund Contract to undertake the FS at the landfill. EPA held a public meeting on September 16, 1982 to outline its proposed work. EPA then took several actions: ground water and surface water (Manasquan River) were re-sampled in September 1982; aquifer tests were conducted in the fall of 1982 to determine the hydrologic properties of the aquifers; additional ground water monitoring wells were installed in April 1983; additional ground water sampling was conducted in April 1983; landfill leachate seeps were sampled in April 1983; and surface water/sediment (Manasquan River) sampling was conducted in April 1983. Private ground water wells in the vicinity of the landfill were sampled in 1984.

The sampling data indicated that volatile organic compounds (VOCs), primarily benzene, toluene, and ethylbenzene, as well as heavy metals, have leached from the landfill and contaminated the ground water. The contaminated ground water was found to extend in a northeasterly direction from the site to the Manasquan River. In addition, contaminated surface water runoff and leachate from the landfill were found to be discharging into the Manasquan River. No contamination from the landfill was detected in existing drinking water supplies in the vicinity of the landfill.

In March 1983, the United States District Court for New Jersey obtained criminal convictions against SCP and its three officers as well as the transporter and the landfill manager for conspiracy and one defendant for mail fraud. U.S. v. Case, et al., Crim. No. 82-200 (D.N.J. 1983). At trial, the government presented evidence that at least 17,000 drums of chemical waste were transported for disposal to the Lone Pine Landfill from SCP's two facilities in Newark and Carlstadt, New Jersey.

In 1983, additional PRPs were identified; the Lone Pine Corporation defendants in DEP's October 1979 suit impleaded nearly 100 third-party defendants who allegedly had used the landfill for waste disposal. The DEP action has been stayed pending resolution of EPA's CERCLA proceedings.

In June 1983, EPA released for public comment a three-volume "Draft Feasibility Study Evaluation of Remedial Action Alternatives" (Draft FS), prepared by EPA's

consultants, Camp, Dresser & McKee (CDM). This Draft FS presented several remedial action alternatives, ranging from no action to total excavation and removal of contaminants.

A public meeting was held on June 24, 1983, to discuss the Draft FS and EPA's work regarding the site. EPA expressed a preference for a plan which would involve placement of a clay cap over the landfill, construction of an underground slurry wall around the landfill, and pumping and treatment of contaminated ground water. Local citizens favored complete excavation and removal of drums from the site. In response to comments received, EPA decided to perform additional sampling and a supplemental FS, evaluating additional remedial options for the site. In September 1983, the site was placed number 15 on EPA's National Priority List.

The additional ground water and surface water sampling was conducted in February and March 1984. As part of a leachate treatability study, a well was installed at the northeastern toe of the landfill in May 1984. In addition, air quality monitoring was performed in June 1984.

The supplemental FS was released for public comment on June 27, 1984. EPA held another public meeting on August 1, 1984. In September 1984, prior to issuance of the Record of Decision (ROD), EPA sent notice letters to approximately 140 PRPs, offering them the opportunity to undertake the Remedial Design and Remedial Action (RD/RA) prior to initiation of a fund-financed response. No PRP offered to undertake any part of the proposed remedial plan. On September 28, 1984, EPA issued the ROD for the Lone Pine Landfill, after analysis and consideration of all comments received. The ROD adopted EPA's preferred remedial plan. The remedy selected required:

- Installation of an impermeable cap and methane gas venting system to reduce infiltration of precipitation and eliminate the problem of methane gas build-up from decaying garbage beneath the cap;

- Installation of a slurry wall around the perimeter of the landfill to control the migration of contaminants and ground water through the area;

- Installation of a ground water/leachate collection and treatment system to prevent contamination from leaching through and under the slurry wall; and

- Performance of an additional RI/FS to determine the nature and extent of off-site ground water contamination and to assess the need for further off-site remediation.

Since no PRP offered to perform the remedy adopted in the ROD, EPA initiated the remedial design utilizing public funds.

In October 1984, the Lone Pine Steering Committee (a group of PRPs) filed suit, seeking to block implementation of EPA's remedial cleanup plan. The district court granted EPA's motion to dismiss, ruling that neither CERCLA, 42 U.S.C. § 9601 et seq. nor the Administrative Procedure Act authorized pre-enforcement review of EPA's remedial plan. [Lone Pine Steering Committee v. EPA, 600 F.Supp. 1487 (D.N.J. 1985)]. That ruling was upheld on appeal, 777 F.2d 882, by the United States Court of Appeals for the Third Circuit. In February 1986, the Lone Pine Steering Committee filed a petition for a Writ of Certiorari with the United States Supreme Court to block implementation of EPA's cleanup plan. The Supreme Court denied the Lone Pine Steering Committee's petition in May 1986 [106 S.Ct. 1970 (1986)].

During this period of protracted litigation, EPA, in consultation with the United States Army Corps of Engineers, prepared the remedial design required for implementation of the remedy.

In July 1985, EPA sent notice letters to the 140 PRPs, offering them the opportunity to enter into an Administrative Order on Consent to perform the additional hydrogeologic investigation described in the ROD (off-site RI/FS), as well as the opportunity to implement construction of the selected remedy. None of the PRPs offered to undertake the construction activities. However, the Minnesota, Mining, & Manufacturing Company (3M) agreed to perform the off-site RI/FS. This RI/FS was performed, under EPA oversight, pursuant to Administrative Order Index Number II-CERCLA-50110, issued by EPA on September 27, 1985 to 3M.

In September 1985, EPA sent additional notice letters to approximately 200 newly identified PRPs. These parties were offered the opportunity to implement construction of the selected remedy, upon completion of the fund-financed remedial design. No parties voluntarily offered to undertake the construction, and EPA continued with the remedial design.

During 1986 and 1987, representatives of the Lone Pine Steering Committee continued to urge EPA to alter the remedial plan set forth in the 1984 ROD. In May 1987, EPA responded to the Lone Pine Steering Committee's "Motion to Reopen the Record and Modify Record of Decision", dated March 19, 1986, and the "Motion to Supplement Record and Segment Remedial Implementation", dated March 25, 1987, and other letters and data submitted after issuance of the ROD. In a detailed technical response, EPA rejected the specific factual allegations made in the PRPs' "motions", and rejected the Steering Committee's request to reopen the ROD and modify the selected remedy.

In February 1988, the Lone Pine Steering Committee met with EPA to discuss the possibility of settlement. In the Spring and again in the Fall of 1988, in an effort to identify additional PRPs, EPA sent out additional letters requesting information from

PRPs. By letter dated February 7, 1989, EPA invited all PRPs to a meeting to discuss imminent EPA construction activities and to encourage private party implementation of the remedial action. At that meeting, EPA informed representatives of the PRPs that they had until May 15, 1989 to reach a settlement to implement the remedy. Negotiations ensued which culminated in a settlement for a privately-funded remedial action.

The settlement, embodied in a Consent Decree, provides for private party implementation of EPA's selected remedy, as set forth in the ROD and EPA-completed remedial design, and for post-remedial monitoring, operation and maintenance. EPA estimates that the remedy will cost approximately $36 million. The Consent Decree also provides for reimbursement of $1,372.86 in Agency for Toxic Substances and Disease Registry (ATSDR) costs. The work to be performed pursuant to the Consent Decree addresses only the first of the two operable units for the site, the landfill containment system selected in the 1984 ROD. The second operable unit consists of the remedial action for off-site ground water contamination, which is the subject of this ROD and subsequent RD/RA negotiations.

The Consent Decree was lodged for public comment with the United States District Court for New Jersey on August 25, 1989. A number of PRPs who did not join the settlement intervened in the proceedings and attempted to block the entry of the Consent Decree. On March 5, 1990, in the United States District Court for New Jersey, the non-settlors' opposition to the Consent Decree was heard. At the conclusion of the oral argument, the Court approved and entered the Consent Decree.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI/FS Report and the Proposed Plan for the site were released to the public for comment on July 17, 1990. These two documents were made available to the public in the administrative record file, located at information repositories maintained at the EPA Docket Room in Region II, the Monmouth County Public Library and the Freehold Township Health Department. The notice of availability for these documents was published in the Asbury Park Press on July 17, 1990. A public comment period was held from July 17, 1990 to September 15, 1990. In addition, a public meeting was held on August 1, 1990. At this meeting, representatives from EPA answered questions related to the site and the remedial alternatives under consideration. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD.

SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION WITHIN SITE STRATEGY

The scope of this response action is to address the remaining concerns (principal threats) at the site. As discussed, a previous remedy was selected at the site in 1984. This remedy, which consists of a landfill containment system, is known as the first operable unit remedy.

The second operable unit remedy, as described herein, is necessary to address contaminated ground water emanating from the site. The primary goal of this remedy is to prevent the migration of contaminants into the Manasquan River and other areas. In addition, long-term restoration of the aquifer between the landfill and the river will also be achieved through implementation of the selected remedy. The goals will be met through implementation of a ground water extraction and treatment system.

The selected alternative for the second operable unit remedy, in conjunction with the first operable unit landfill containment system, will address all concerns related to the migration of contaminants from the landfill. Long-term monitoring of the Manasquan River, including additional sediment and biota studies, will be conducted to address any impacts of the contaminated ground water on the river environment. If necessary, any additional response action required to address contamination of the Manasquan River will be addressed as a third operable unit.

SUMMARY OF SITE CHARACTERISTICS

Contamination Present in the Landfill

Drums excavated from the landfill in 1981 provide a depiction of the types of hazardous substances present in the landfill. A variety of organic substances, heavy metals, and pesticides were found in rusted, ruptured drums in the form of liquid, viscous material, sludge, and solids. Table 1 presents the hazardous substances and the concentrations found in the sampled drums.

Ground Water Contamination

Ground water sampling was conducted during various hydrogeologic investigations at the site from 1976 to 1989. The most recent sampling events occurred during the second operable unit RI conducted by 3M under EPA oversight.

The ground water investigations at the site included both water quality and water level sampling. The monitoring wells were placed in various locations to define the vertical and horizontal extent of contamination. In order to determine the vertical extent, ground water monitoring wells were screened in the Water Table aquifer

(Vincentown and Hornerstown Formations), the Red Bank aquifer, and in a stratigraphic unit just below the Red Bank aquifer. In order to determine the horizontal extent, the monitoring wells were placed directly through the landfill (on-site wells) and downgradient and upgradient of the landfill (off-site wells). The upgradient wells were used to determine background water quality (ground water unaffected by the landfill). The locations of monitoring wells are shown on Figure 5.

Twelve off-site ground water monitoring wells were installed by 3M in 1986 for the second operable unit RI. Seven of these wells were installed north of the Manasquan River to determine whether or not the contaminant plume had migrated north of the river (four screened in the Water Table aquifer and three screened in the Red Bank aquifer). Two of these wells were installed in Red Bank aquifer, south of the river and east of the landfill to assess the eastern extent of contamination. Three of these wells were installed northeast and east of the landfill, screened in a stratigraphic unit just below the Red Bank aquifer, to assess the potential for downward ground water flow from the landfill into deeper hydrologic units.

Sampling of all wells was conducted in 1986. In 1989, selected wells south and north of the river were resampled. The on-site Water Table aquifer wells showed high concentrations of VOCs such as benzene, chlorobenzene, trans-1,2-dichloroethene, 1,1-dichloroethene, 1,2-dichloroethane, methylene chloride, trichloroethylene and vinyl chloride exceeding the federal and state Maximum Contaminant Levels (MCLs). In 1986, the total VOCs ranged from 323 to 471,000 parts per billion (ppb). All metals on the Target Compound List, with the exception of beryllium and thallium, have been reported in samples from these wells. The only dissolved metals that have been reported at concentrations above their respective MCLs are arsenic, chromium and selenium.

The off-site wells demonstrate that the ground water plume contains the same types of contaminants found beneath the landfill. The off-site Water Table aquifer samples showed high concentrations of benzene, chlorobenzene, trans-1,2-dichloroethene, 1,1-dichloroethene, 1,2-dichloroethane, methylene chloride, trichloroethene, and vinyl chloride exceeding the MCLs. Eighteen different VOCs were detected in the Water Table aquifer. Sampling indicated that the total VOC concentration in the Water Table aquifer ranged from 2 to 26,220 ppb. The off-site Red Bank samples showed twelve of the eighteen VOCs detected in the Water Table aquifer. The total VOC concentrations in the off-site Red Bank aquifer ranged from 7 to 6,093 ppb.

Metals were also detected off site in both aquifers. In the off-site downgradient wells, arsenic, cadmium, chromium, iron, lead, and manganese exceeded the MCL of 50 micrograms per liter (ug/L) in 1986. However, upgradient well samples collected indicated the presence of cadmium, chromium, iron, lead, manganese, and zinc which exceeded the MCLs. Therefore, with the exception of arsenic, upgradient sources

other than the Lone Pine Landfill may be contributing metals to the ground water. To date, no contamination from the landfill has been detected in existing drinking water supplies. The nearest domestic wells include a residential well approximately 600 feet south (upgradient) of the landfill, a non-residential well approximately 1,000 feet east of the landfill (south of the Manasquan River), and several residential wells 1/2 mile north of the site and the Manasquan River. The nearest public water supply well is 4 miles from the site in the Englishtown Formation, which is not impacted by contamination from the site. No potable wells are currently located in the contaminant plume.

The results of the second operable unit RI confirm the following:

- Ground water moves horizontally toward the Manasquan River in both the Water Table and Red Bank aquifers. South of the river, ground water moves generally northward toward the river. North of the river, ground water moves generally southward toward the river.

- The Water Table and Red Bank aquifers are hydraulically connected. Near the Manasquan River, ground water moves upward from the Red Bank aquifer into the Water Table aquifer. In areas away from the river, ground water moves downward, from the Water Table aquifer into the Red Bank aquifer. Ground water that originates either south or north of the river eventually discharges upward from the Red Bank aquifer into the Water Table aquifer and then discharges from the Water Table aquifer into the Manasquan River.

- A ground water contaminant plume emanates from the landfill and moves in a north-northeasterly direction, discharging into the Manasquan River, following the flow paths of the Water Table and Red Bank aquifers. This plume is limited to a strip of land from the landfill's western boundary to an area immediately east of Burke Road and has not migrated north of the river (Figures 6 and 7).

- There is no potential for dissolved contaminants in the Red Bank aquifer to migrate downward to deeper aquifers.

- The contaminant plume emanating from the landfill in both the Water Table and Red Bank aquifers contain VOCs and heavy metals at concentrations exceeding the MCLs. The MCLs are listed in Table 2. Tables 3 through 6 contain the chemicals and concentration ranges detected in the Water Table and Red Bank aquifers, on and off site, in 1986 and 1989.

Surface Water Contamination

Surface water sampling has been conducted periodically in the Manasquan River near the site since 1977. As part of the second operable unit RI, surface water samples were obtained from the Manasquan River at sampling stations upgradient of the landfill, immediately downgradient of the landfill (Burke Road), approximately 12,000 feet downstream of the landfill (Jackson Road), and approximately 16,000 feet downstream of the landfill (Georgia Road) (Figure 5).

Due to the fact that horizontal ground water flow in the vicinity of the landfill is in a northeasterly direction and discharges into the Manasquan River, the river has also been contaminated by the landfill. This is verified by the presence of VOCs in the river at surface water sampling stations downstream of the site during the 1986 sampling events. The VOCs detected at the Burke Road sampling station (RS-3A) are methylene chloride, 1,2-dichloroethane, acetone, 2-butanone and 4-methyl-2-pentanone. The VOCs detected at the seep sampling station (RS-3) are methylene chloride, benzene, ethylbenzene, toluene, acetone, 2-butanone, 4-methyl-2-pentanone and xylenes.

The Clean Water Act provides for the protection of existing and designated uses of surface waters of the United States. Since this surface water is classified as FW2-NT, a fishable and drinkable classification, EPA's ambient water quality criteria under the Clean Water Act are ARARs.
No numeric water quality criteria are available in the state water quality standard regulation. No ambient water quality criteria under the Clean Water Act are available for xylenes, 4-methyl-2-pentanone, acetone and 2-butanone.

Ambient water quality criteria based on the protection of human health at the 10^{-6} risk level for fish and water consumption have been exceeded at the seep station for methylene chloride and benzene. These criteria have also been exceeded at the Burke Road sampling station for methylene chloride and 1,2-dichloroethane.

Ambient concentrations of aluminum, iron, manganese and zinc exceeded the EPA ambient water quality criteria upstream of the landfill. However, concentrations of iron and manganese significantly exceeded upstream concentrations. In addition, thallium was detected downstream at a level exceeding the EPA ambient water quality criterion.

Contamination Summary

On-site ground water sampling data demonstrates that numerous hazardous substances present in the sampled drums are also present in the Water Table aquifer beneath the landfill. In addition, the off-site, downgradient wells screened in the Water Table and

Red Bank aquifers contain many of the same hazardous substances as the on-site wells. Furthermore, the contaminants found in the surface water are a subset of the contaminants found in the landfill drums and ground water. Therefore, it is clear that the landfill is a source of ground water and surface water contamination.

Table 7 illustrates some examples of the types of hazardous substances detected in drums excavated from the landfill, in ground water within the landfill mound (on-site), in ground water adjacent to the landfill (off-site), and in the Manasquan River.

SUMMARY OF SITE RISKS

EPA conducted an Endangerment Assessment (EA) of the "no action" alternative to evaluate the potential risks to human health and the environment associated with the Lone Pine Landfill site in its current state. The EA focused on the ground water contaminants which are likely to pose the most significant risks to human health and the environment (indicator chemicals). These "indicator chemicals" and their concentrations in the ground water are shown in Table 8.

EPA's EA identified several potential exposure pathways by which the public may be exposed to contaminant releases, including, exposure to ground water contaminants at the site. There is currently no exposure through the ground water medium to the nearby residents, since there are no private wells located within the contaminant plume at this time. However, under a future land-use or plume migration scenario, the area impacted by the site may be developed residentially and the ground water used as a source of drinking water. The primary potential routes of exposure to residents for that scenario are ingestion of contaminants in the ground water and inhalation of ground water vapors (via showering).

A quantitative assessment of the risks associated with the ground water exposure pathway was performed. Under current EPA guidelines, the likelihood of carcinogenic (cancer causing) and non-carcinogenic effects due to exposure to site chemicals are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and non-carcinogenic risks associated with exposures to individual indicator compounds were summed to indicate the potential risks associated with mixtures of potential carcinogens and non-carcinogens, respectively.

Non-carcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of mg/kg-day, are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) are compared with the RfD to derive the hazard quotient for the contaminant in the particular media. The hazard index is obtained by adding the

hazard quotients for all compounds across all media. A hazard index greater than 1 indicates that potential exists for non-carcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. The reference doses and hazard indices for the indicator chemicals at the Lone Pine Landfill are presented in Table 9.

The hazard index for non-carcinogenic effects from exposure to ground water contaminants is 9, suggesting that non-carcinogenic effects may occur.

Potential carcinogenic risks were evaluated using the cancer potency factors developed by EPA for the indicator compounds. Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes the underestimation of the risk highly unlikely. The CPFs for the indicator chemicals and their corresponding cancer risk levels are presented in Table 10.

For known or suspected carcinogens, the EPA considers excess upper bound individual lifetime cancer risks of between 1×10^{-4} to 1×10^{-6} to be acceptable. This level indicates that an individual has not greater than a one in ten thousand to one in a million chance of developing cancer as a result of exposure to site conditions. The carcinogenic risks associated with exposure at the site are presented in Table 10. The cumulative upper bound risk at Lone Pine Landfill is 3.5×10^{-4}. The potential risks to residents due to carcinogens at the site are greater than the acceptable EPA risk range of 10^{-4} to 10^{-6}.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is significant uncertainty as to the actual levels present. For example, as shown on Table 1, there

are numerous chemicals found in landfill drums that have not yet been detected in ground water. These substances could potentially contaminate the ground water. In addition, environmental chemistry analysis error can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the EA provides upper bound estimates of the risks to populations at the site, and is highly unlikely to underestimate actual risks related to the site.

For more specific information concerning potential public health risks, including quantitative evaluation of the degree of risk associated with the ground water exposure pathway, please see the documents entitled Final Endangerment Assessment, Lone Pine Landfill, Freehold, New Jersey and Exposure Calculations for Offsite Ground Water, Lone Pine Landfill, located in the Administrative Record.

In summary, the risks associated with exposure to contaminated ground water were quantitatively assessed. This assessment indicates that should exposure occur, individuals would have an increased risk of cancer greater than EPA's acceptable risk range, as well other non-carcinogenic health effects. As discussed in the EA, there are several other potential exposure pathways which were not quantitatively assessed. Ground water flows in a northeasterly direction from the landfill and recharges to the Manasquan River. The Manasquan River provides drinking water to wildlife and supports a variety of aquatic biota further downstream. Downstream of the site, the river is currently used for canoeing, sport fishing, limited irrigation, and nature walks along its banks. In addition, a potable water reservoir has been constructed with its intake on the Manasquan River approximately 16 miles downstream of the site. Since contaminants are discharging to the river, individuals using the river for recreational purposes could be exposed to contaminants. In addition, a macroinvertebrate survey was conducted by DEP in the Manasquan River near the site in 1988, and it was concluded that there are adverse impacts to the macroinvertebrate community. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF ALTERNATIVES

Remediation Goals

Appropriate remedial technologies identified during the screening process of the FS were assembled into combinations to address the remedial action goals for the site. These goals are:

- To prevent the discharge of contaminated ground water from the Water Table and Red Bank aquifers into the Manasquan River;
- To prevent further migration of the contaminant plume; and
- To restore the contaminated ground water between the landfill and the river to beneficial uses.

Note that restoration of the contaminated ground water under this second operable unit includes only that area of contaminated ground water outside the boundary of the landfill containment system (area of attainment). Therefore, as shown in Figure 7, the area of attainment for the Red Bank aquifer includes a 23 acre area northeast of the landfill and the 54 acre area underlying the landfill. This 54 acre area is included because the landfill containment system will not capture the contaminated ground water underneath the landfill in the Red Bank aquifer. However, as shown in Figure 6, the Water Table aquifer area of attainment is the 35 acre area north and northeast of the landfill between the landfill and the river. The contaminated Water Table aquifer ground water in the 54 acres area underlying the landfill is not included in the second operable unit remediation because it will be extracted by the first operable unit remedy.

Alternative Synopsis

Six remedial alternatives were selected for the detailed evaluation in the FS. Except for Alternative 1 (No Action), all alternatives share several components. These common components are: long-term monitoring; institutional controls and treatment of contaminated ground water with a wastewater treatment plant.

Long-term monitoring would be required to assess the effectiveness of the action through ground water and surface water quality monitoring, water level measurements, and biota monitoring.

Institutional controls include, but are not necessarily limited to, limitations on future use of the site property through deed restrictions and limitations on pumpage of the Water Table and Red Bank aquifers in the vicinity of the site. Such controls are necessary since the effectiveness of the first operable unit remedy relies on a stable upward water pressure within the landfill from the ground water in the underlying Red Bank aquifer. This upward pressure prevents the contaminated ground water and

other waste leachate from escaping beneath the slurry wall. Consequently, uncontrolled pumping in the vicinity of the site could impact this source control remedy. In addition, since all of the remedial alternatives may require a lengthy period of time to achieve the MCLs, it is necessary to restrict both exposure and the further migration of the contaminant plume. The State of New Jersey is currently in the process of developing well restriction regulations under the authority of the New Jersey Safe Drinking Water Act. As such, implementation of well restriction zones will have to be conducted through local ordinances. EPA will work closely with the municipality in order to develop technical and managerial aspects of a well restriction zone in the vicinity of the site.

As previously stated, all of the alternatives, except for Alternative 1 (No Action), require treatment of the contaminated ground water in a wastewater treatment plant (WWTP). For costing purposes, it was assumed that the treatment system would include an equalization tank to provide a uniform flow rate, an air stripper to remove at least 90 percent of the VOCs from the liquid stream and to precondition the ground water for further removal of calcium and heavy metals, a metals treatment unit utilizing precipitation, filtration to lower the total solids concentration, a two-stage carbon adsorption system to provide high effluent quality, a clear well for backwash capacity, and a backwash storage tank to provide for liquid/solids separation. Solids will be dewatered and tested to determine if classifiable as a hazardous waste. If classified as a hazardous waste, disposal at a Resource Conservation and Recovery Act (RCRA) permitted hazardous waste facility in compliance with 40 CFR 268 (Land Disposal Restrictions) will be required.

Discharge of the treated ground water would be sent to either the Ocean County Utilities Authority (OCUA) or the Manasquan River, or would be injected into the Red Bank aquifer. Based on information obtained from the implementation of the source control remedy, the OCUA will not accept an untreated discharge from this site. Current information reveals that the OCUA would require extensive pretreatment. For discharge to the Manasquan River, compliance with federal and state surface water standards would be required.

The implementation times for all alternatives except Alternative 1 (No Action) were estimated to be approximately 18 to 24 months for design and 24 months for construction. Though all action alternatives vary in terms of complexity of the extraction/injection well scenario and thus are expected to vary in terms of the design/construction time required, it is the design and construction of the wastewater treatment plant which is expected to take the greatest amount of time. Since all action alternatives include a treatment plant (18 to 24 months for the design and 24 months for construction), the design and construction of the other components of each alternative are expected to be completed by the time the treatment plant is finished. Consequently, the time required for design and construction for all action alternatives is comparable.

All six alternatives were analyzed with the aid of a computer simulation in order to facilitate the alternative comparison. This computer simulation modeled the site's ground water flow and subsequent contaminant flow in three dimensions. This analysis was performed in order to provide an estimate for comparison of the time required for ground water remediation to MCLs under each alternative. Note, however, that the actual remediation time can only be determined based upon measurements taken during the remedial action. It is in recognition of the possible limitations of the effectiveness of extraction and treatment systems that EPA will require periodic evaluation of the system and may modify of the remediation goals to reflect limitations of the response action. In the case of the Lone Pine Landfill, where the pumping of contaminated ground water is severely restricted by the source control remedy hydraulic requirements, the MCLs may not be fully achievable. Therefore, in the case where complete ground water restoration is not practicable, the remedial action may focus on plume containment to prevent contaminant migration and further contamination of the ground water, prevention of exposures, and evaluation of further risk reduction measures. Although estimated time frames to achieve MCLs are provided for each alternative, it should be noted that, for all alternatives except Alternative 1 (No Action), it is expected that a significant reduction in contaminant levels would be achieved by operation of the extraction system over a shorter period of time.

The six alternatives selected for detailed evaluation in the FS are described as follows:

Alternative 1 - No Further Action

This alternative involves taking no action at the site beyond the first operable unit source control remedy. It includes ground water and surface water monitoring, as well as institutional restrictions preventing the placement of wells in areas of contaminated ground water, and pumpage restrictions on wells in the vicinity of the site to prevent gradient reversals affecting the source control remedy. Contaminants already present in the ground water would continue to migrate into the Manasquan River under this scenario. The amount of contamination in the ground water is expected to decrease over time because the first operable unit source control remedy will mitigate the introduction of new contamination into the ground water.

The computer simulation estimated that it will take approximately 22 years for all of this existing contamination to flush out of the Water Table aquifer naturally and approximately 365 years for this contamination to flush out of the Red Bank aquifer.

The estimated costs for the estimated operational life, including equipment replacement, are as follows:

Capital Cost:	$ 42,333
Annual Operation & Maintenance Costs:	$ 67,800
Present Worth:	$ 720,333

Alternative 2A - Interceptor Drain with Treatment of Contaminated Ground Water in a New On-Site WWTP and Discharge to the OCUA

This alternative consists of installing a 2,800 foot interceptor drain approximately 100 feet from the river, in parallel, penetrating into the upper aquitard (Hornerstown Formation). Ground water from the Water Table aquifer, the Red Bank aquifer, and the upper aquitard will discharge to the drain, thus prohibiting the contamination from entering the Manasquan River.

It was calculated that the flow into the interceptor drain at equilibrium under this alternative is approximately 75 gallons per minute (gpm). Therefore, the computer simulation estimated that the area of contamination would reach the MCLs in approximately 12 years in the Water Table aquifer and approximately 315 years in the Red Bank aquifer.

Note that this alternative, along with all of the alternatives except Alternative 1, provides for virtually immediate elimination of any further discharge of contaminated ground water into the river.

The ground water extracted from the interceptor drain in this alternative would be treated to meet a minimum of drinking water standards in a new on-site WWTP and discharged via a pipeline connected to the OCUA at a rate of approximately 75 gpm.

The estimated costs for the estimated operational life, including equipment replacement, are as follows:

Capital Cost:	$ 4,288,828
Annual Operation & Maintenance Cost:	$ 716,300
Present Worth:	$11,451,828

Alternative 2B - Interceptor Drain with Treatment of Contaminated Ground Water in a New On-Site WWTP and Discharge to the Manasquan River

This alternative is the same as Alternative 2A except that the treated ground water would be discharged to the Manasquan River in accordance with applicable New Jersey Pollution Discharge Elimination System (NJPDES) permit requirements. Note that the capital costs for Alternative 2A are higher than the capital costs for Alternative 2B due to the greater cost for an effluent discharge system to the OCUA than the river. In addition, the OCUA option has a higher annual operation and maintenance cost than the river option due to OCUA and local municipality usage costs.

The computer simulation estimated that the ground water would meet the NJPDES standards in approximately 12 years in the Water Table aquifer and approximately 315 years in the Red Bank aquifer.

The estimated costs for the estimated operational life, including equipment replacement, are as follows:

Capital Cost:	$ 3,340,271
Annual Operation & Maintenance Cost:	$ 445,700
Present Worth:	$ 7,797,271

Alternative 3 - Interceptor Drain and Injection Wells with Treatment of Contaminated Ground Water in a New On-Site WWTP and Discharge via Injection

This alternative is the same as Alternatives 2A and 2B except that the treated ground water would be discharged via injection wells into the Red Bank aquifer. The ground water would be treated to meet the MCLs. In addition, the use of injection wells for disposal would hydraulically push contaminated ground water through the Red Bank aquifer decreasing the time for Red Bank aquifer cleanup. However, the time required for cleanup of the Water Table aquifer is slightly lengthened, due to a change in its gradient.

It was estimated that approximately 21 injection wells would be used for disposal. This alternative would also include a recharge trench which would be utilized for temporary injection if the injection wells require maintenance.
Under the scenario evaluated, the computer simulation estimated cleanup of the Water Table aquifer in approximately 14 years and cleanup of the Red Bank aquifer in approximately 255 years.

The estimated costs for the estimated operational life, including equipment replacement, are as follows:

Capital Cost:	$ 5,232,047
Annual Operation & Maintenance Cost:	$ 466,100
Present Worth:	$ 9,893,047

Alternative 4A - Interceptor Drain and Extraction Wells with Treatment of Contaminated Ground Water in a New On-Site WWTP and Discharge to the OCUA

The interceptor drain in this alternative is the same interceptor drain discussed in Alternatives 2A, 2B and 3. However, in this alternative, the interceptor drain would be supplemented with extraction wells located in the Red Bank aquifer. The purpose of the extraction wells is to expedite the remediation of the Red Bank aquifer.

The preliminary results of the computer simulation calculations indicated that the optimum scenario for the extraction wells would be three wells pumping at a rate of 5 gpm. With the interceptor drain, this translates into a total of approximately 90 gpm extracted out of the aquifers. The placement, numbers and rates of extraction well

pumping would be designed in order to not disturb the hydraulic balance maintained within the landfill's slurry wall.

Under the scenario evaluated, the computer simulation estimated that cleanup of the Water Table aquifer would take approximately 12 years and cleanup of the Red Bank aquifer would take approximately 195 years.
The estimated costs for the estimated operational life, including equipment replacement, are as follows:

Capital Cost:	$ 4,498,443
Annual Operation & Maintenance Cost:	$ 785,300
Present Worth:	$12,351,443

Alternative 4B - Interceptor Drain and Extraction Wells with Treatment of Contaminated Ground Water in a New On-Site WWTP and Discharge to the Manasquan River

This alternative is the same as Alternative 4A except that the treated ground water would be discharged into the Manasquan River. The ground water would be treated to meet the NJPDES requirements. Note that the capital costs for Alternative 4A are higher than the capital costs for Alternative 4B due to the greater cost for an effluent discharge system to the OCUA than the river. In addition, the OCUA option has a higher annual operation and maintenance cost than the river option due to OCUA and local municipality usage costs.

The computer simulation estimated that a total of approximately 90 gpm would be extracted from the aquifers, resulting in an estimated cleanup time of 12 years for the Water Table aquifer and an estimated cleanup time of 195 years for the Red Bank aquifer.

The estimated costs for the estimated operational life, including equipment replacement, are as follows:

Capital Cost:	$ 3,549,886
Annual Operation & Maintenance Cost:	$ 469,700
Present Worth:	$ 8,246,886

Alternative 5 - Interceptor Drain, Extraction and Injection Wells with Treatment of Contaminated Ground Water in a New On-Site WWTP and Discharge via Injection

This alternative is the same as Alternatives 4A and 4B except that the treated ground water would be discharged via injection wells into the Red Bank aquifer. The ground water would be treated to meet the MCLs. In addition, as with Alternative 3, the use of injection wells for disposal would hydraulically push contaminated ground water

through the Red Bank aquifer, decreasing the time for Red Bank aquifer cleanup. However, the time required for cleanup of the Water Table aquifer is slightly lengthened due to a lower hydraulic gradient which causes a reduced rate of flow.

As with Alternative 3, this alternative would include a recharge trench which would be utilized for temporary injection if the injection wells require maintenance.

It was estimated that approximately 3 wells would be used for extraction and 24 injection wells would be used for disposal. Under the scenario evaluated, the computer simulation estimated a cleanup time of 14 years for the Water Table aquifer and 165 years for the Red Bank aquifer.

The estimated costs for the estimated operational life including equipment replacement, are as follows:

Capital Cost:	$ 5,441,662
Annual Operation & Maintenance Cost:	$ 482,600
Present Worth Cost:	$10,267,661

Alternative 6 - Interceptor Drain, Extraction and Injection Wells (including Injection through the Landfill) with Treatment of Contaminated Ground Water in a New On-Site WWTP and Discharge via Injection

Under this alternative, the same interceptor drain as discussed in the previous alternatives would be constructed. However, the well pumping scenario is altered in order to obtain a more rapid remediation of the Red Bank aquifer than in the other injection alternatives. The computer simulation estimated that this could be accomplished by placing 13 injection wells into the Red Bank aquifer through the landfill.

In addition, whereas the previous alternatives required an on-site WWTP with a maximum capacity of 100 gpm, this alternative would require a WWTP with the capacity to handle a much larger volume of ground water (up to 750 gpm).

This alternative, like Alternatives 3 and 5, would require a recharge trench. The recharge trench in this case would handle temporary injection if the injection wells required maintenance and for handling WWTP effluent in excess of the injection well capacity.

For this alternative, the computer simulation estimated that 13 injection wells located in the landfill, penetrating into the Red Bank aquifer, would have to inject approximately 32.5 gpm each. Another 14 injection wells located along the eastern and western boundaries of the contaminant plume in the Red Bank aquifer would have to inject approximately 20 gpm each. A total of 46 extraction wells would be located around the perimeter of the landfill with a proposed discharge of 11 gpm

each. Ten extraction wells would be located along the interceptor drain and would need to discharge 20 gpm each. All of the wells mentioned would be screened in the Red Bank aquifer.

The computer simulation estimated that the remediation time would be approximately 19 years in the Water Table aquifer and would be approximately 14 years in the Red Bank aquifer.

The estimated costs for the estimated operational life, including equipment replacement, are as follows:

Capital Cost:	$12,860,558
Annual Operation & Maintenance Cost:	$ 1,240,500
Present Worth Cost:	$23,237,241

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In accordance with the National Oil and Hazardous Substances Contingency Plan (NCP), a detailed analysis was performed on the six alternatives with respect to the each of nine evaluation criteria. The following is a summary of the comparison of the alternatives considering these evaluation criteria. The criteria are:

Threshold Criteria

- Overall Protection of Human Health and the Environment: This criterion addresses whether or not a remedy provides adequate protection and describes how risks are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs): This criterion addresses whether or not a remedy will meet all of the ARARs of other environmental statutes and/or provide grounds for invoking a waiver.

Primary Balancing Criteria

- Long-term Effectiveness and Permanence: This criterion refers to the ability of the remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- Reduction of Toxicity, Mobility or Volume through Treatment: This criterion addresses the degree to which a remedy utilizes treatment technologies to reduce the toxicity, mobility or volume of contaminants.

- Short-term Effectiveness: This criterion considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

- Implementability: This criterion examines the technical and administrative feasibility of a remedy, including availability of materials and services needed to implement the chosen solution.

- Cost: This criterion includes capital and operation and maintenance costs.

Modifying Criteria

- State Acceptance: This criterion indicates whether, based on its review of the RI/FS and Proposed Plan, the state concurs with, opposes, or has no comment on the proposed alternative.

- Community Acceptance: This criterion addresses whether, based on comments received, the public accepts EPA's proposed alternative. Detailed responses to public comments are addressed in the Responsiveness Summary, which is attached as Exhibit 1.

The selected remedy must, at a minimum, attain the Threshold Criteria. The selected remedy should also provide the best balance of tradeoffs among the Primary Balancing criteria. The Modifying Criteria were evaluated following the public comment period.

Overall Protection of Human Health and the Environment

With the exception of the Alternative 1 (No Action), all of the alternatives will prevent the discharge of contaminants into the Manasquan River as soon as the interceptor drain is installed. Alternatives 4A/B, 5 and 6 will be most protective of human health and the environment since they provide the additional benefit of an active pumping system which should restrict any further migration of the contaminant plume. Therefore, all of the alternatives, except for no action, provide for adequate protection of human health and the environment by eliminating the migration of contaminated ground water into the Manasquan River and/or the surrounding area and expediting cleanup of both the Water Table and Red Bank aquifers.

Current risk information indicates that the risk to human health from the current discharge to the Manasquan River is low. However, a 1988/1989 DEP macroinvertebrate study indicates environmental degradation to the river. Therefore, the no action alternative does not adequately protect human health and the environment. In addition, no action will not restrict potential migration of the contaminant plume. Furthermore, changes in the local hydrology due to pumping or natural conditions could pose a future risk with respect to human exposure to contaminated ground water.

Compliance with ARARs

There are three types of applicable or relevant and appropriate requirements which must be considered in evaluating remedial alternatives: location-specific ARARs, action-specific ARARs, and chemical-specific ARARs.

Location-Specific ARARs:

Location-specific ARARs restrict activities or limit concentrations of contaminants in effluent because a site is in a special location such as a floodplain, wetland, or historical area. Location-specific ARARs for all remedial alternatives include the: Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq.; Clean Water Act §404 (40 CFR 230, 33 CFR 320 - 330); Executive Order 11990, Protection of Wetlands; Executive Order 11988 (40 CFR 6, Appendix A), Floodplain Management; National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq. and 469; New Jersey Flood Hazard Area Regulations, N.J.A.C. 7:13-1.1 et seq.; and New Jersey Freshwater Wetlands Protection Act Rules; N.J.A.C. 7:7A-1.1 et seq.

Information currently available on the site indicates the following:

- Except for transient species, no federally listed or proposed threatened or endangered flora or fauna are know to exist within the vicinity of the site (therefore, the Endangered Species Act of 1973, as amended, is not an ARAR).

- The site exists within a wetlands. The wetlands exist primarily along the western, northern and eastern edges of the landfill. EPA is currently conducting a wetlands delineation and assessment in consultation with DEP. Preliminary results indicate that various remedial alternatives could potentially have a negative impact on wetlands at the site. For example, for the interceptor drain, which is component of action alternatives, it is estimated that approximately 3 acres of moderate to high-quality wetlands in the northern portion of the site would be damaged. Further assessment of impacts to wetlands can only be performed during design of the selected remedy, when more information regarding the optimum location for various components becomes available. It is EPA's intent to ensure that mitigation to replace wetlands lost due to remedial activities is undertaken.

- The sites exists within an area sensitive with respect to potential impacts to cultural resources. Therefore, in accordance with the National Historic Preservation Act of 1966, as amended, a Stage 1A cultural resources survey must be conducted. Upon completion of the Stage 1A survey, a determination will be made as to whether further field investigations are necessary.

Chemical-Specific ARARs:

Chemical-specific ARARs are health- or environmentally-based numerical values limiting the amount of a contaminant that may be discharged to, or allowed to remain in, environmental media.

GROUND WATER

Two kinds of standards are considered ARARs for the ground water at the site: Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) which include the Federal Resource Conservation and Recovery Act (RCRA) Maximum Concentration Limits, and the promulgated State of New Jersey standards [New Jersey Safe Drinking Water Act A-280 Amendments, and New Jersey Pollution Discharge Elimination System regulations (N.J.A.C. 7:14A-1.1 et seq.), N.J.A.C. 7:10-16 et seq., and 7:9-6 et seq.]. CERCLA requires remedies to comply with state requirements that are more stringent than federal requirements. Therefore, the most stringent standard is the cleanup goal for ground water at the site. Table 2 lists most of the chemicals comprising the contaminant plumes in the Water Table and Red Bank aquifers with their federal and state standards under the regulations listed above. The last column in the table provides the cleanup requirement for each chemical. Complete listings of all chemicals with currently promulgated standards are in: Drinking Water Regulations and Health Advisories (EPA, 1990); N.J.A.C. 7:9-6.1 et seq., and the New Jersey Safe Drinking Water Act (N.J.A.C. 7:10-16 et seq.).

SURFACE WATER

The Clean Water Act (33 U.S.C. 1251 - 1376) Water Quality Criteria (40 CFR 131) and the New Jersey Surface Water Quality Standards (N.J.A.C. 7:9-4.1 et seq.) are ARARs for the site since the ground water discharges into the Manasquan River. These standards apply to all alternatives which have a discharge to the Manasquan River including Alternative 1, No Action. The action alternatives which include the discharge of treated ground water into the Manasquan River (Alternatives 2B and 4B) must comply with the discharge standards developed for the site by EPA based on the Water Quality Criteria and New Jersey Surface Water Quality Standards mentioned above. The standards developed by EPA for these alternatives are included in the Administrative Record.

Action-Specific ARARs

Action-specific ARARs are technology- or activity-based limitations.

WASTEWATER TREATMENT PLANT

All of the alternatives, except for Alternative 1, require the use of a wastewater treatment plant. The design of the wastewater treatment plant was approximated in the FS for purposes of costing and meeting the ground water and surface water

standards. The design was assumed to include, among other components, an air stripper as well as granular activated carbon. The ARARs associated with the use of a wastewater treatment plant are listed on Table 11. In addition to those requirements listed on Table 11, any sludge generated by the operation of a wastewater treatment plant would have to be disposed of in accordance with the requirements of the Resource Conservation and Recovery Act, including the Land Disposal Restrictions.

DISCHARGE TO MANASQUAN RIVER

Alternatives 2B and 4B include the discharge of treated ground water to the Manasquan River. The following ARARs would apply to such an action: National Pollutant Discharge Elimination System, Clean Water Act §§302 and 402; New Jersey Pollutant Discharge Elimination System requirements, N.J.A.C. 7:14A et seq.; and New Jersey Surface Water Quality Standards, N.J.A.C. 7:9-4.1 et seq.

DISCHARGE TO THE PUBLICALLY OWNED TREATMENT WORKS (OCEAN COUNTY UTILITIES AUTHORITY)

Alternatives 2A and 4A include the discharge of treated ground water to the Ocean County Utilities Authority. The following ARARs would apply to such an action: Clean Water Act §§301 and 307; New Jersey Wastewater Discharge Guidelines; 40 CFR 403.5; 40 CFR 270.60; and Local Publically Owned Treatment Works Regulations.

INJECTION OF TREATED GROUND WATER INTO RED BANK AQUIFER

Alternatives 3, 5, and 6 include the injection of treated ground water into the Red Bank aquifer. The following ARARs would apply to such an action: Safe Drinking Water Act, 40 CFR 144; New Jersey Pollutant Discharge Elimination System, N.J.A.C. 7:14A et seq.; and New Jersey Ground Water Quality Criteria, N.J.A.C. 7:9-6 et seq.

ADDITIONAL ACTION-SPECIFIC ARARS:

Additional Action-specific requirements would apply to all action alternatives. These ARARs are listed in Table 11.

ARAR Evaluation

It is the policy of EPA's Superfund program to use as a guide the framework provided by EPA's "Ground Water Protection Strategy" (EPA, 1984) in determining the appropriate remediation for contaminated ground water. Under this strategy, three classes of ground water have been established on the basis of ground water value and vulnerability to contamination. Ground water affected by contamination from the Lone Pine Landfill is classified as IIA, current and potential sources of drinking water and water having other beneficial uses (potentially available).

With the exception of Alternative 1 (No Action), all of the alternatives evaluated will comply with its particular set of ARARs. Because the No Action alternative allows the continued discharge of contaminants to the Manasquan River, this alternative is not expected to comply with the surface water ARARs identified above.

It is the time to achieve the ground water cleanup standards which distinguishes one alternative from another as well as by the fact that the No Action Alternative relies on natural attenuation to meet ARARs, rather than active restoration. For the No Action Alternative, it will take an estimated 22 years to meet ARARs in the Water Table aquifer. In contrast, Alternatives 2A/B and 4A/B achieve ARARs in the Water Table aquifer in 12 years, Alternatives 3 and 5 require 14 years, and Alternative 6 will require 19 years.

The alternatives vary a great deal in achieving ARARs in the Red Bank aquifer. The No Action Alternative will take an estimated 365 years; Alternatives 2A/B, the interceptor drain, will take an estimated 315 years; Alternative 3, the interceptor drain with injection wells, will take an estimated 255 years; Alternatives 4A/B, the interceptor drain and extraction wells, will take an estimated 195 years; Alternative 5, the interceptor drain, extraction and injection wells, will take an estimated 165 years, and Alternative 6 the interceptor drain, extraction wells, and injection wells through the landfill, will take an estimated 14 years.

All alternatives will eventually comply with ground water ARARs. Alternative 6 was estimated to achieve ARARs in the Red Bank aquifer in the shortest period of time, followed by Alternatives 5, 4A/B, 3, 2A/B and 1. For the Water Table aquifer, Alternatives 2A/B and 4A/B were estimated to achieve ARARs in the shortest period of time, followed by Alternatives 3 and 5, 6 and 1. However, it was estimated that the period of time to achieve the ground water ARARs in the Water Table aquifer is similar for Alternatives 2A/B, 3, 4A/B and 5. Alternatives 1 and 6 were estimated to take a longer period of time to meet the ground water ARARs in the Water Table aquifer.

Long-Term Effectiveness and Permanence

Alternative 1 (No Action) does not provide for long-term protection of human health and the environment, since it does not prohibit the migration of contaminants to the Manasquan River and does not contribute to the restoration of ground water. In addition, Alternative 1 does not prevent potential further migration of contaminated ground water.

The remaining alternatives provide for reliable long-term protection of human health and the environment by restoring ground water quality, restricting migration of the contaminant plume, and preventing the contaminant plume from discharging to the Manasquan River. With all these alternatives, the contamination in the ground water will have been remedied, and the successful operation and maintenance of the first operable unit remedy (the source control remedy) will protect these aquifers from

contamination in the future.

Reduction of Toxicity, Mobility, or Volume through Treatment

By allowing the contaminated ground water to continue to migrate into the Manasquan River, Alternative 1 would not reduce the toxicity, mobility or volume of contamination in the ground water.

Alternatives 2A/B, 3, 4A/B, 5 and 6, whether utilizing an on-site wastewater treatment plant or the OCUA, would reduce the toxicity, mobility, and volume of contamination in the ground water by removal of the contaminants from the ground water.

Short-Term Effectiveness

Short-term effectiveness is directly related to the time it takes for the remedy to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until ARARs are achieved.

Alternative 6 has the fastest cleanup time for the Red Bank aquifer (14 years) of any of the alternatives. However, it has a longer cleanup time for the Water Table aquifer (19 years) than Alternatives 2, 3, 4 and 5. Furthermore, remediation of the Water Table aquifer under Alternative 6 would only be 60 percent complete when the Red Bank aquifer is entirely remediated. This could lead to the possibility that the Red Bank aquifer would become recontaminated (from the Water Table aquifer), if a problem occurs with the extraction or injection wells. In addition, the Water Table aquifer is more highly contaminated than the Red Bank aquifer.

Note that the time frames for cleanup represent estimates for the time required to restore the contaminated ground water to drinking water quality and should be primarily considered for comparisons among the various alternatives. These estimates are based on simulations for the time it takes five pore volumes of the aquifer's water to be replaced; it was calculated that it would take the extraction and treatment of five pore volumes of water from each aquifer to achieve the ground water cleanup standards. It is important to note that although these time frames to meet ground water standards appear lengthy, the bulk of contamination will be removed during the replacement of one to three pore volumes. For example, a significant amount of the contamination will be removed in the time it takes to remove one pore volume from the Red Bank aquifer. The estimated times for removing one pore volume are: Alternative 1 - 73 years; Alternative 2 - 63 years; Alternative 3 - 51 years; Alternative 4 - 39 years; Alternative 5 - 33 years; Alternative 6 - 2.8 years.

Implementability

All six alternatives can be implemented. However, they vary in complexity due to their design requirements. Alternative 1 is the simplest to implement since it would only involve a monitoring program and institutional controls. Alternatives 2A and 2B would be slightly more complicated than Alternative 1 since they require installation of an interceptor drain in addition to the monitoring program and institutional controls. Alternatives 3, 4A, 4B, 5 and 6 are more complex than Alternatives 2A and 2B since they require various extraction and/or injection wells/recharge trench designs in addition to the interceptor drain, monitoring program and institutional controls.

In comparing Alternatives 3, 4A, 4B, 5 and 6, it is expected that Alternatives 4A and 4B would be the simplest to implement since they only require and estimated three extraction wells. Alternative 3 would have a greater logistical complexity than Alternatives 4A and 4B since it would require approximately 21 injection wells. The more wells associated with an alternative, the more field work necessary to implement the alternative. Proper well placement requires detailed data collection during the drilling process to ensure that the well screen is situated in the correct formation and to ensure that the well can withdraw or inject a ceratin amount of water. As such, Alternative 5 would have greater logistical complexity than Alternative 3 since it requires approximately 27 wells (24 injection and 3 extraction). Finally, Alternative 6 would have the greatest logistical complexity since it would require approximately 83 wells (27 injection and 56 extraction).

In addition to the logistical complexity simply caused by the numbers of wells required, there is an added complication due to well proximity to the landfill containment system. The landfill containment system requires maintenance of an upward head from the aquifers into the landfill mound. Therefore, the extraction of contaminated ground water outside of the containment system cannot be permitted to reverse the required hydraulics of the first operable unit remedy. Typically, the greater the distance from the landfill containment system and the lower the pumping rate, the less chance there is to impact the containment system. Therefore, Alternative 6 (which requires injection wells through the landfill and extraction wells at the boundary of the slurry wall) is expected to be significantly more difficult to implement than the other alternatives from a hydraulic standpoint. Alternatives 4A/B and 5, which also include extraction wells, would be easier to implement since the wells would be placed farther away from the landfill containment system.

A supplemental problem concerning Alternative 6, which adds complications to its implementation, is the placement of injection wells through the landfill and its cap. The physical placement of the wells can potentially compromise the landfill containment system by potentially creating pathways for precipitation infiltration. Extreme care would need to be taken during the installation of such wells. Additional contaminant pathways could also be created due to waste subsidence during the operation of the injection wells. Furthermore, maintenance of the wells could require the movement of heavy equipment onto the landfill which could potentially cause

subsidence and damage to the cap. In addition, drilling into the landfill poses health and safety risks. The landfill contains toxic chemicals, some of which are contained in an estimated 17,000 to 50,000 drums. Drums could be punctured during drilling and increase contaminant loading to the landfill containment system. Drilling would have to be performed using very stringent health and safety procedures. In addition, safeguards would be required to ensure that all drilling equipment on the landfill was adequately supported to preclude accidents triggered by abrupt waste subsidence.

In summary, implementation of Alternative 6 would be the most difficult, followed by 5, 3, 4A/B, 2A/B, and 1. Alternatives 6 and 5 require the most wells. Alternative 6 requires wells through and adjacent to the landfill, in close proximity which could interfere the first operable unit remedy. Furthermore, Alternative 6 would require the most stringent health and safety requirements. All alternatives which require extraction and/or injection wells will undergo extensive field testing. However, it is expected that the Alternative 6 design requirements would be the most difficult to implement since this alternative requires the most complex hydrologic scheme.

Cost

The estimated present worth value of each alternative is as follows:

Alternative 1 - No Action	$ 720,333
Alternative 2A - Interceptor Drain with Discharge to the OCUA	$11,451,828
Alternative 2B - Interceptor Drain with Discharge to the Manasquan River	$ 7,797,271
Alternative 3 - Interceptor Drain & Injection Wells	$ 9,893,047
Alternative 4A - Interceptor Drain & Extraction Wells with Discharge to the OCUA	$12,351,443
Alternative 4B - Interceptor Drain & Extraction Wells with Discharge to the Manasquan River	$ 8,246,886
Alternative 5 - Interceptor Drain, Extraction & Injection Wells	$10,267,661
Alternative 6 - Interceptor Drain, Extraction & Injection Wells (including injection through the landfill)	$23,237,241

It should be noted that for Alternatives 2 and 4, the costs of discharging to the OCUA are at least $3 million higher than discharging to the River; this is due to the higher operation and maintenance costs which include charges imposed by the OCUA.

Alternative 6 is far more expensive than the other alternatives for the reasons delineated in the implementability section as well as the added cost of a 750 gpm WWTP as opposed to the 100 gpm WWTP necessary for the other alternatives.

State Acceptance

The State of New Jersey concurs with Alternative 5. In addition, the State of New Jersey has stated that Alternatives 2B and 4B, which include a discharge of treated effluent to the Manasquan River, are not acceptable, due to the presence of a drinking water supply reservoir downstream from the landfill.

Community Acceptance

In general, the officials and local residents expressed a strong preference for Alternative 6, noting the shorter cleanup time frames while the potentially responsible parties urged EPA to defer its decision. A more detailed discussion of community concerns and comments is provided in the attached Responsiveness Summary.

SELECTED REMEDY

EPA is selecting Alternative 5 for the remediation of ground water contamination at the site. Although the community expressed a preference for Alternative 6 because of its faster cleanup time frames, EPA has concerns about the implementation of this alternative. These concerns include both safety issues associated with the installation of the injection wells and technical issues involving the operation of the system and its potential impact on the landfill containment remedy. However, during the design of the ground water remedy, EPA will investigate possible modifications to the described components to maximize and accelerate the cleanup.

The selected remedy will protect public health and the environment by controlling the discharge of contaminated ground water into the Manasquan River, almost immediately after installation of the interceptor drain. In addition, the extraction and injection wells will expedite remediation time for the Red Bank aquifer. Long-term monitoring in the river and Water Table and Red Bank aquifers will ensure that the drain and wells are operating effectively.

Alternative 5 provides the best balance of tradeoffs among the various alternatives. Of all the action alternatives, Alternatives 4A/B, 5, and 6 are most protective of human health and the environment since, in addition to preventing contaminant discharge to the river, they include measures to restrict and control plume migration. Alternative 5 achieves the ground water cleanup ARARs in both aquifers more quickly than Alternatives 4A/B. Although Alternative 6 achieves ARARs in the Red Bank aquifer in the shortest time, it poses several difficulties in terms of implementation and is twice as costly as Alternative 5.

The selected remedy includes the following components:

- Installation of a 2,800-foot long interceptor drain, keyed into the Hornerstown Formation and located approximately 100 feet from and parallel to the Manasquan River which will extract approximately 81 gpm at equilibrium;

- Installation of 3 extraction and 24 injection wells screened in the Red Bank aquifer. The extraction wells will pump approximately 5 gpm each and the injection wells will operate at a rate of approximately 4 gpm each;

- Construction of an on-site wastewater treatment plant with a capacity of 100 gpm to treat the ground water captured by the interceptor drain and extraction wells to meet the ARARs which would include federal and state MCLs;

- Construction of a recharge trench to discharge treated ground water in excess of the capacity of the injection wells during maintenance of the injection wells;

- Long-term monitoring of the Water Table and Red Bank aquifers, and the Manasquan River, including additional sediment and biota studies; and

- Institutional controls to restrict ground water usage in the area affected by the site.

As previously indicated, these components may be modified during design to accelerate the cleanup of the contaminated ground water. The details regarding the optimum number of extraction and injection wells as well as the pumping and injection rates will be refined during the design phase.

In addition, the construction and operation of one wastewater treatment plant to treat the leachate and ground water for both the first and second operable units will be considered during the design phase. This combination of treatment for the two remedial actions will be considered if it is determined to be practicable and does not delay implementation of the first operable unit remedy. Note that if one wastewater treatment plant is constructed, the costs associated with implementation of Alternative 5 will be significantly reduced. The discharge from any such combined treatment plant would either be reinjected into the Red Bank aquifer or sent to the OCUA. Negotiations with OCUA related to discharge of the treated leachate from the first operable unit plant are ongoing, and it is possible that OCUA may accept the additional estimated 90 gpm from the second operable unit remedy.

Contingency Measures

The selected remedy will include ground water extraction for an estimated period of 165 years, during which time the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation.

As previously discussed, the goals of this remedial action are to protect the Manasquan River from contamination, prevent migration of the contaminant plume, and restore ground water to its beneficial use, which is as a potable source of drinking water. Based on information obtained during the RI/FS, and on a careful analysis of all remedial alternatives, EPA and the State of New Jersey believe that the selected remedy will achieve these goals. However, a recent study was conducted by EPA on ground water extraction systems at a number of Superfund sites and RCRA hazardous waste facilities. The study found that ground water extraction was effective in containing contaminant plumes and achieving significant mass removal of contaminants. However, in most cases, contaminant concentrations did not decrease linearly over time to reach desired cleanup goals; after significant initial decreases, concentrations typically leveled off, often at concentrations higher than the desired cleanup levels. Therefore, at this site, it may not be possible to reduce contaminants to cleanup standards (i.e., federal and state MCLs) throughout the area of attainment. Ground water contamination may be especially persistent in the immediate vicinity of the landfill, where concentrations are relatively high. The practicability of achieving cleanup goals throughout the contaminant plume cannot be determined until the extraction and treatment system has been implemented and plume response monitored over time.

If it becomes apparent during operation of the remedial action that contaminant levels have ceased to decline and are remaining constant at levels higher than the cleanup standards, or the hydraulics associated with the first operable unit prevent pumping at a rate adequate to achieve cleanup standards, the remedy as it affects restoration of ground water may be reevaluated. If it is determined that the selected remedy cannot meet the ground water cleanup standards, contingency measures may be taken.

Those contingency measures may include discontinuing operation of extraction wells in areas where cleanup goals have been attained; placement of extraction wells in other locations; alternating pumping at wells to eliminate stagnation points; and pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into ground water. These contingency measures are still considered to be protective of human health and the environment.

If it is determined, in spite of any contingency measures that may be taken, that portions of the aquifers cannot be restored to their beneficial use, ARARs may be waived in accordance with the statutory waiver provisions of CERCLA for those portions of the aquifers based on the technical impracticability of achieving further contaminant reduction.

The decision to invoke a contingency measure may be made during a periodic review of the selected remedial action, which will occur at intervals no less often than every 5 years.

STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedial action for a site must comply with applicable or relevant and appropriate environmental standards established under and Federal and State environmental laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The selected remedy provides for protection of human health and the environment by preventing the contaminant plume from discharging to the Manasquan River, restricting migration of the contaminant plume, and removing contaminants from ground water.

Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will be designed to meet all ARARs (Table 12). The Land Ban Requirements of RCRA do not apply to the disposal of the treated ground water to the Red Bank aquifer, although they may apply to the wastewater treatment plant sludge depending upon whether it is classified as a hazardous waste under RCRA.

Cost-Effectiveness

The selected remedy is cost effective since it has been determined to provide the greatest overall effectiveness proportional to its costs - present worth estimated at $10,267,661. When compared to Alternative 6 and Alternative 4A, which provide an equivalent degree of protectiveness, the selected remedy is less costly.

Utilization of Permanent Solutions and Alternative Treatment (or resource recovery) Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the second operable unit remedy for the site. Of the action alternatives which are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility and volume achieved

through treatment, short-term effectiveness, implementability, and cost, also considering the statutory preference for treatment as a principal element, and considering State and community acceptance.

Preference for Treatment as a Principal Element

The statutory preference for treatment as a principal element is satisfied in the selected remedy. The selected remedy includes ground water treatment to drinking water standards, to the extent practicable.

Documentation of Significant Changes

During the public comment period, local area representatives expressed concern that the cost estimates associated with Alternatives 2A/B, 3, 4A/B and 5 were not accurate, since they did not account for replacement of equipment and materials over time (e.g., the treatment plant, injection wells, etc.). The costs noted herein reflect EPA's revised cost estimates, and account for such replacement costs and operation and maintenance costs over the period of time necessary to operate.

FIGURES

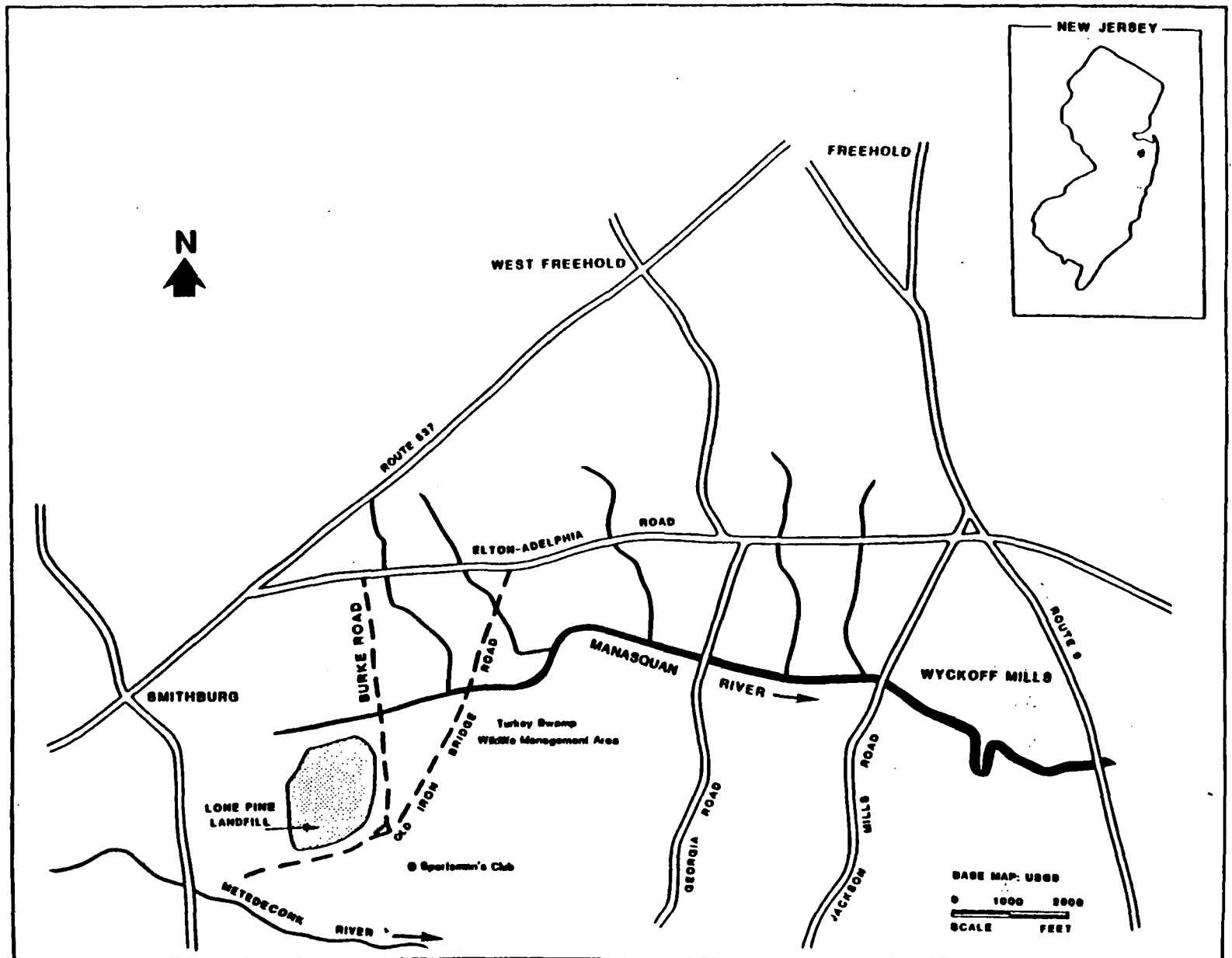


Figure 1 Lone Pine Landfill, Freehold Township, Monmouth County, New Jersey

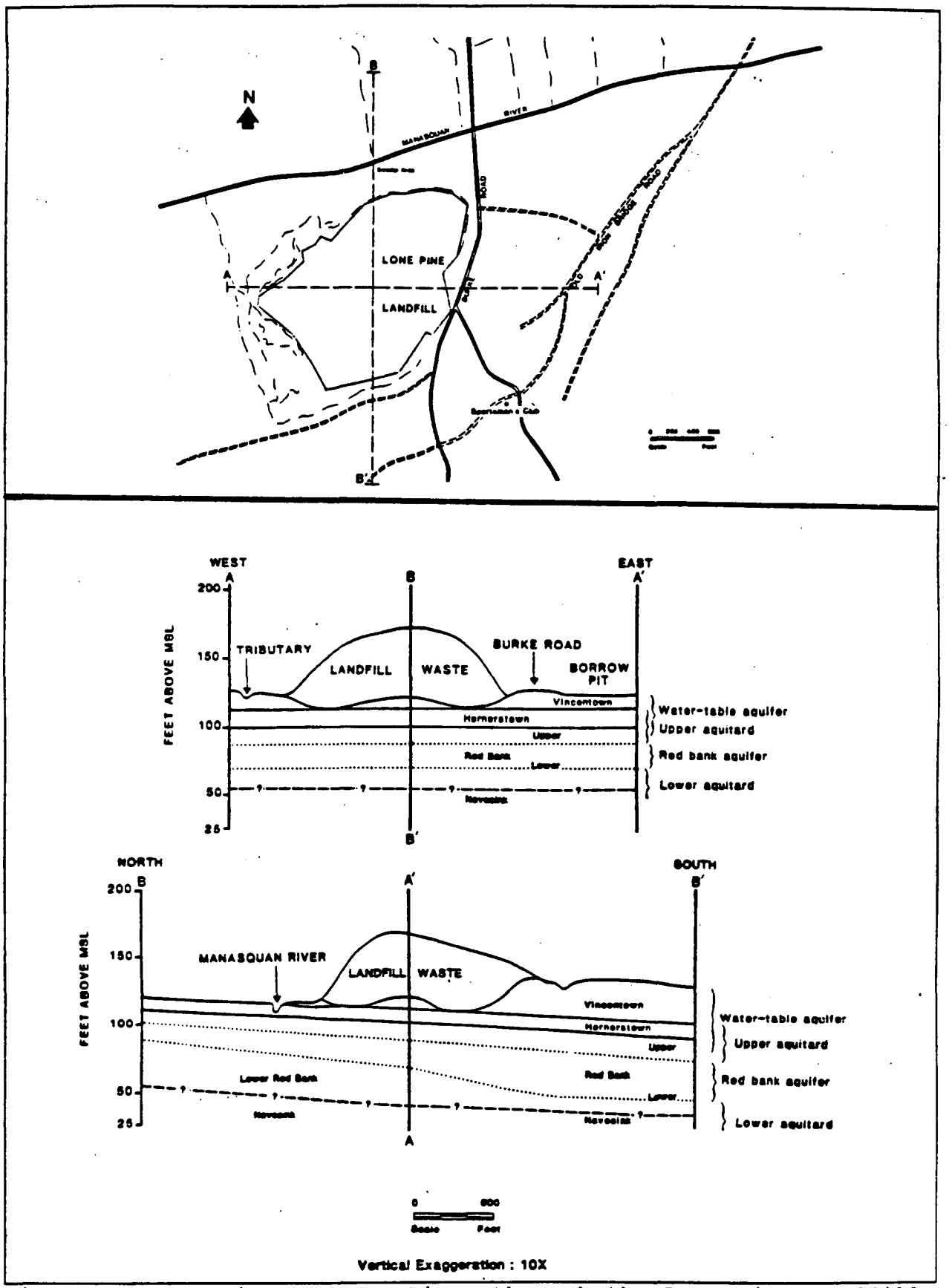


Figure 2 Geologic Cross Sections through the Lone Pine Landfill

SYSTEM	GEOLOGIC SUBDIVISION	HYDROLOGIC UNIT	CHARACTER OF MATERIALS	THICKNESS
TERTIARY	VINCENTOWN FORMATION	WATER-TABLE AQUIFER	SAND, FINE TO MEDIUM, BROWN	0-30'
	HORNERSTOWN SAND	UPPER AQUITARD	GLAUCONITE SAND AND CLAY, GREEN	10-12'
CRETACEOUS	RED BANK SAND, UPPER	RED BANK AQUIFER	SILT, CLAY AND SAND	8-12'
			TINTON SAND, INDURATED, CEMENTED	5-10'
	RED BANK SAND, LOWER		SILT AND CLAY; POORLY SORTED SAND, MEDIUM TO COARSE	0-20'
		LOWER AQUITARD	SILT AND CLAY	10-35'
				10-20'
	NAVESINK FORMATION		SILT, CLAY AND SAND, BLACK	10-45'
	MOUNT LAUREL SAND	MOUNT LAUREL-WENONAH AQUIFER	SAND, MEDIUM TO COARSE, GREENISH-GRAY	75'
	WENONAH FORMATION		SAND AND SILT, DARK GRAY	

Figure 3 Geologic and Hydrogeologic Subdivisions

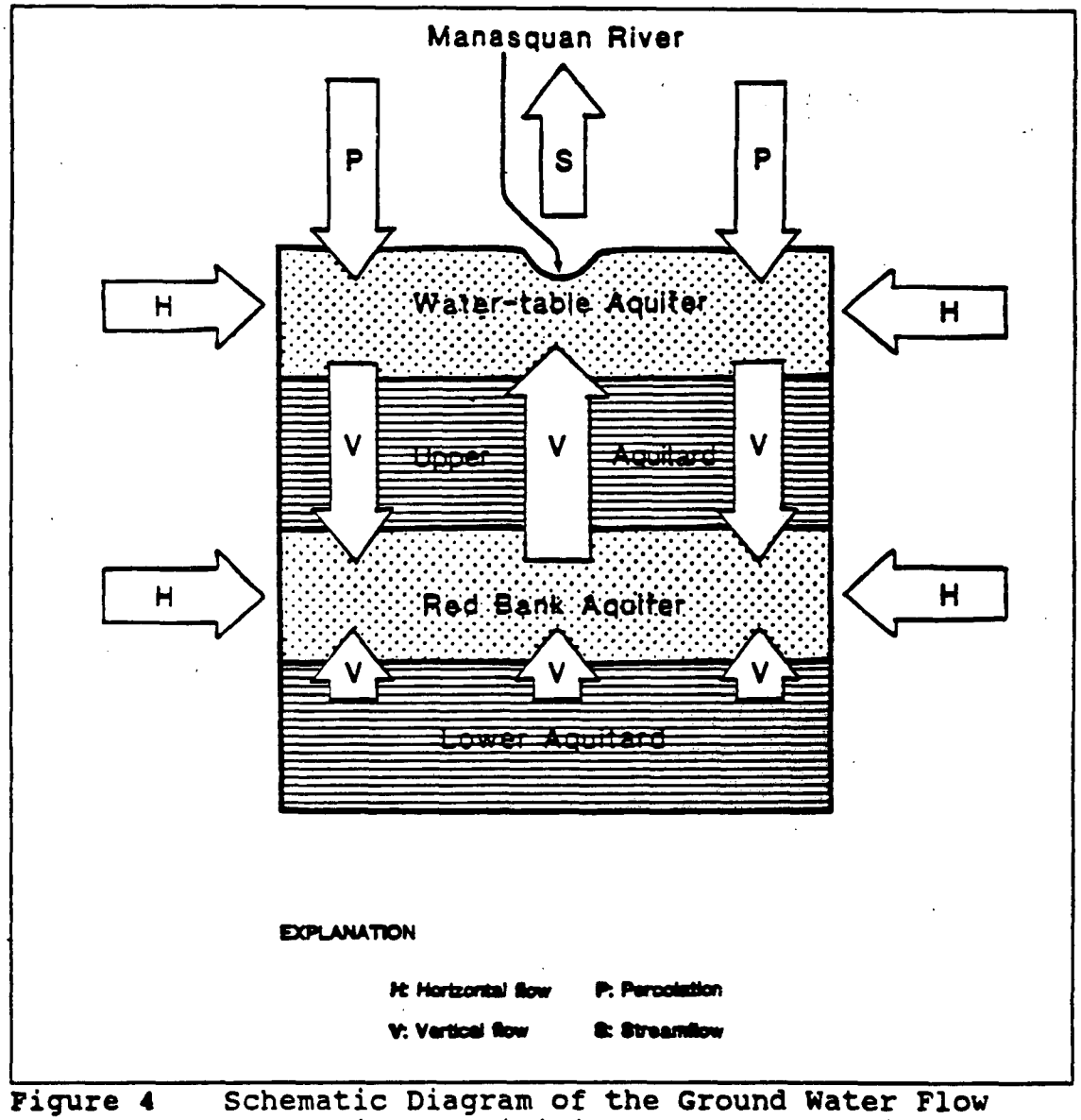
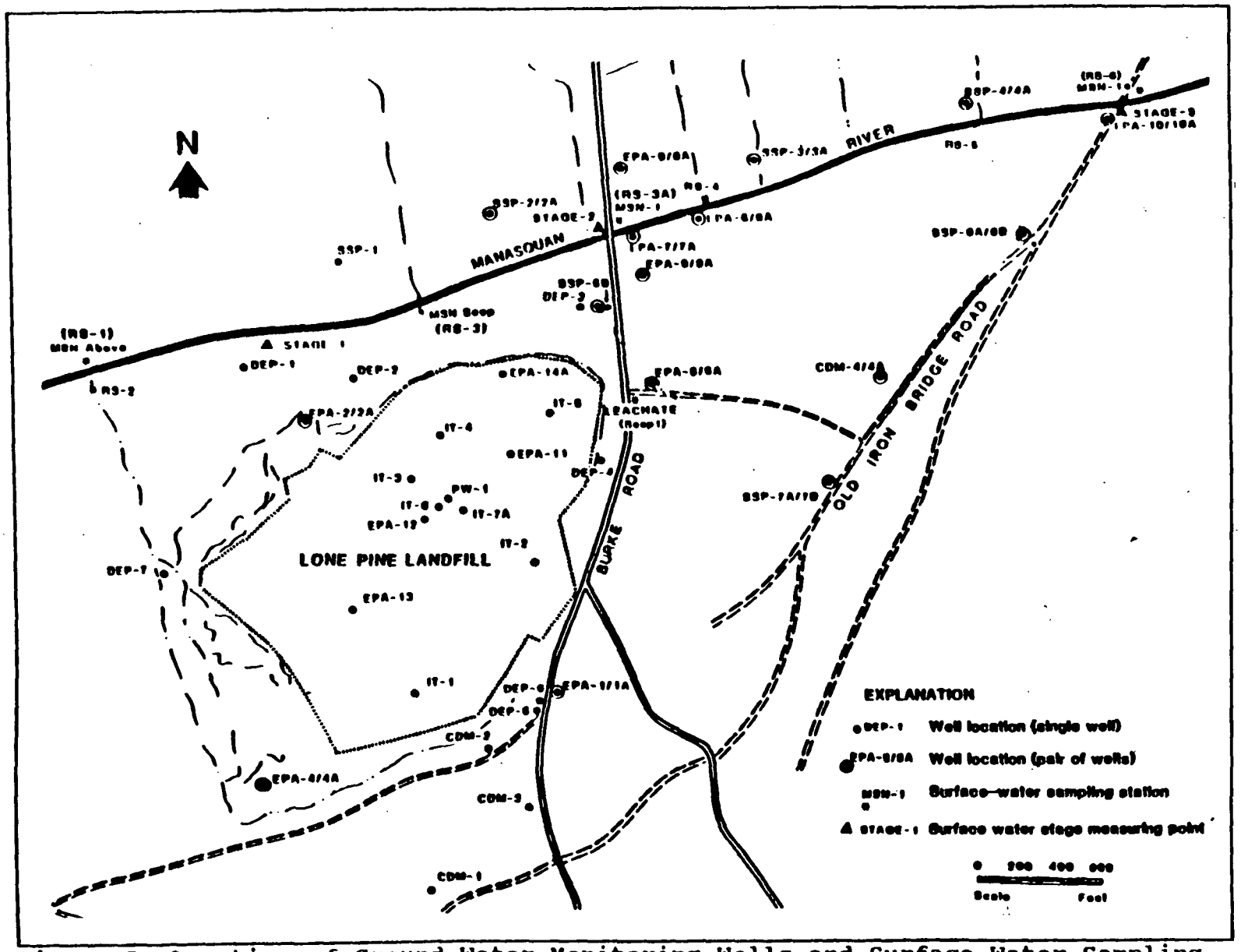


Figure 4 Schematic Diagram of the Ground Water Flow System in the vicinity of the Lone Pine Landfill



EXPLANATION

- DEP-1 Well location (single well)
- EPA-8/8A Well location (pair of wells)
- MSN-1 Surface-water sampling station
- STAGE-1 Surface water stage measuring point

0 200 400 600
Scale Feet

Figure 5 Location of Ground Water Monitoring Wells and Surface Water Sampling Stations

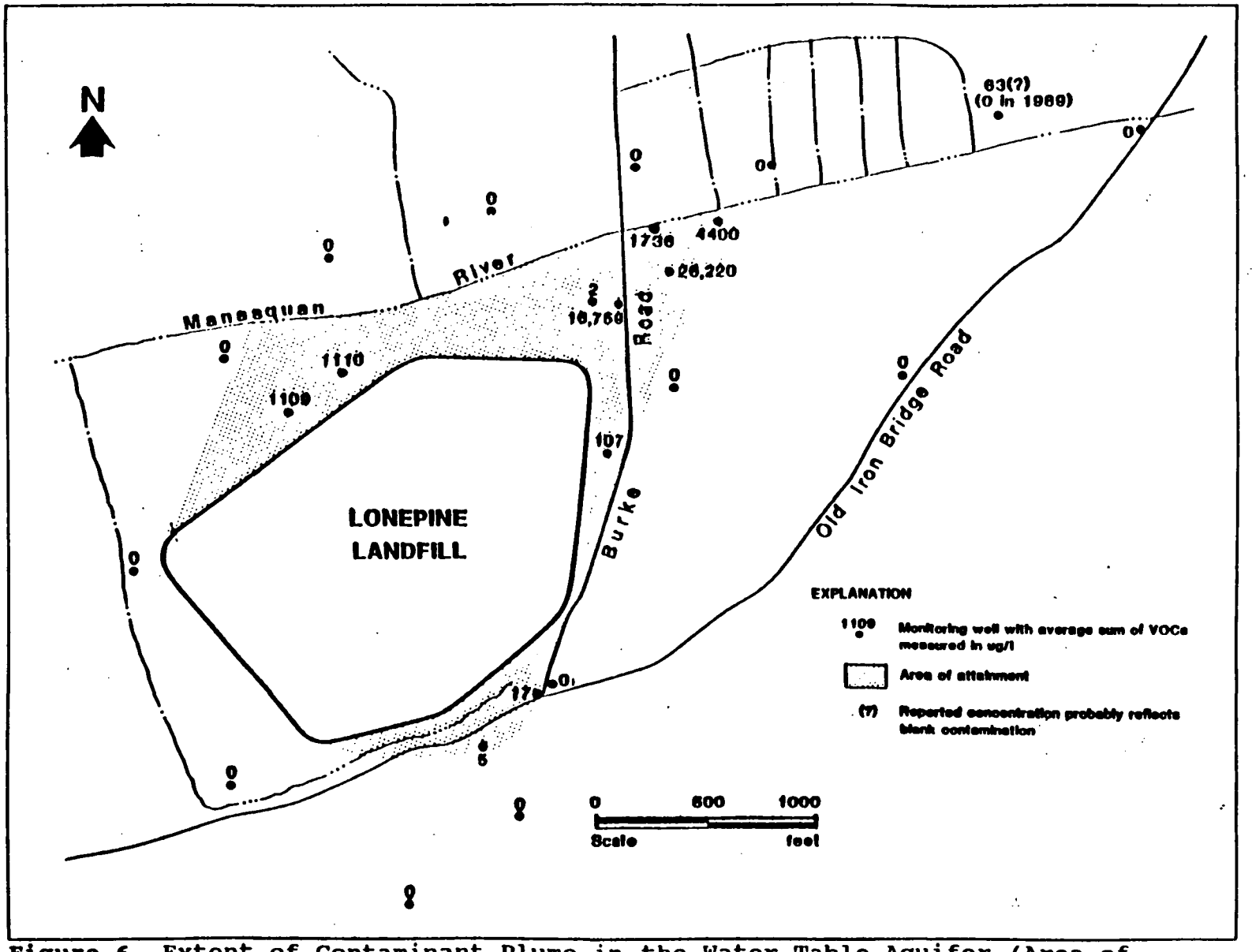


Figure 6 Extent of Contaminant Plume in the Water Table Aquifer (Area of Attainment)

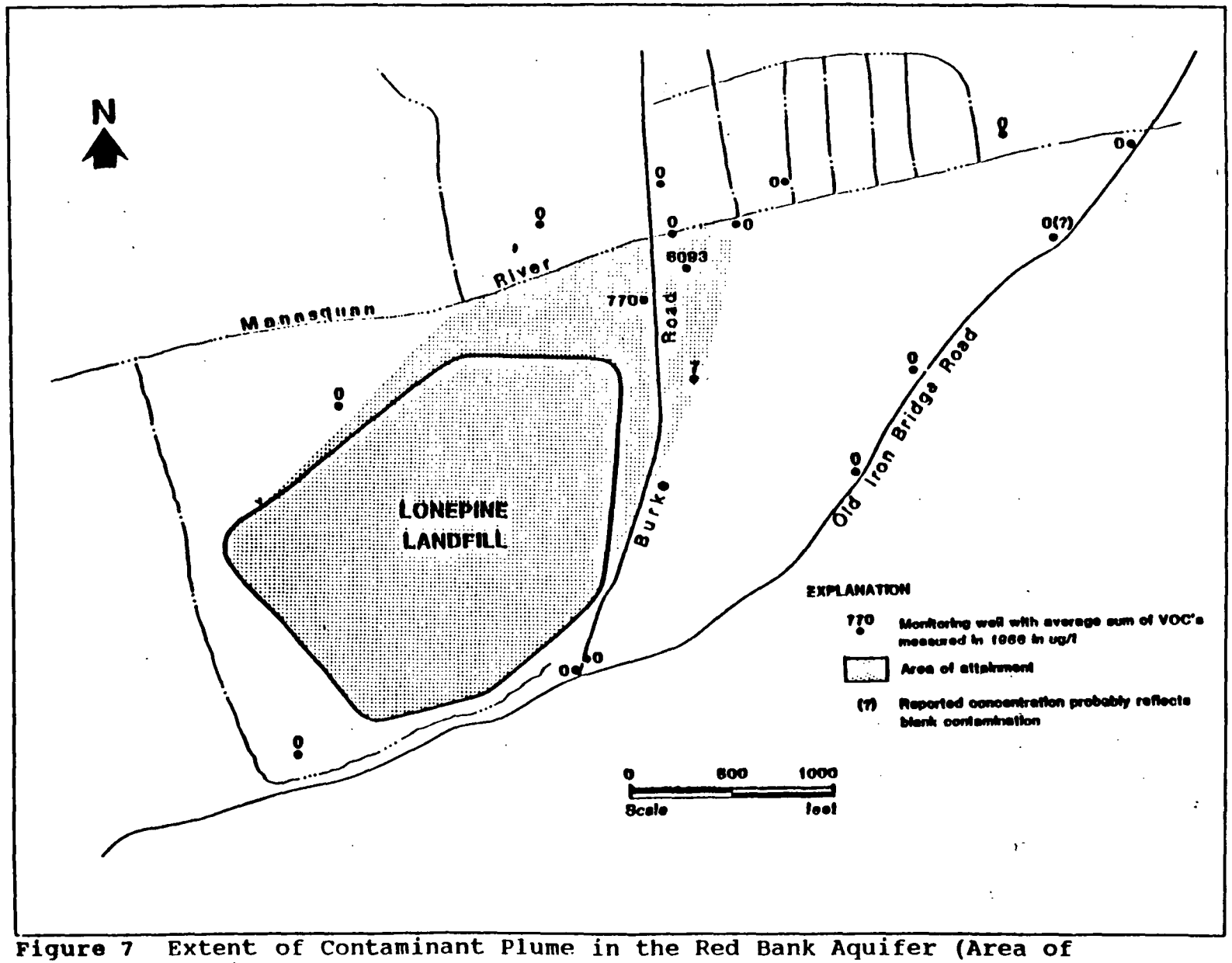


Figure 7 Extent of Contaminant Plume in the Red Bank Aquifer (Area of Attainment)

TABLES

TABLE 1
SUMMARY OF EXCAVATED DRUM SAMPLES

COMPOUND	MAXIMUM DETECTED CONCENTRATION (ppm)			
	LIQUID	VISCOUS MATERIAL	SLUDGE	SOLID
Nitrobenzene	-	-	-	1800.0
Bis(2-ethylhexyl)phthalate	16.0	-	2200.0	19,000.0
Butyl benzyl phthalate	3.5	-	-	4500.0
Di-n-butyl phthalate	54.0	1200.0	1000.0	13,000.0
Naphthalene	1.1	2200.0	400.0	-
Di-n-octyl phthalate	1.9	-	340.0	-
1,4-Dichlorobenzene	0.11	-	-	-
Diethyl phthalate	32.0	3700.0	3600.0	4500.0
Benzo (a)pyrene	3.7	-	-	-
Isophorone	-	-	3200.0	-
Aldrin	-	-	0.4	57.0
4,4-DDT	-	-	-	1.43
Alpha-endosulfin	-	0.2	1.68	22.0
Heptachlor	-	-	0.82	33.0
Heptachlor epoxide	-	-	120.0	-
Beta-BHC	-	-	0.82	105.0
Delta-BHC	-	-	0.17	-
PCB-1260	-	0.71	-	-
2-Nitrophenol	3.6	-	-	-
Phenol	50.0	-	-	-
Benzene	27.0	110.0	150.0	8.5
Chlorobenzene	-	-	0.81	4.8
1,2-Dichloroethane	11.0	-	38.0	10.0
1,1,1-Trichloroethane	-	-	0.79	0.7
1,1,2-Trichloroethane	-	-	-	14.0
Chloroform	0.21	-	0.63	3.2
1,1-Dichloroethylene	0.16	-	0.16	0.18
1,2-trans-Dichloroethylene	1.4	-	7.1	8.3
Ethylbenzene	43.0	2000.0	300.0	3400.0
Methylene Chloride	340.0	160.0	240.0	38.0
Tetrachloroethylene	410.0	28.0	52.0	58.0
Toluene	2400.0	220.0	5600.0	5900.0
Trichloroethylene	4.5	-	8.6	19.0
Arsenic	80.0	200.0	230.0	80.0
Antimony	230.0	68.0	780.0	320.0
Chromium	1400.0	24.0	1000.0	1600.0
Beryllium	3.0		9.0	3.0
Cadmium	14.0	trace	trace	140.0
Copper	2400.0	210.0	29,000.0	610.0
Lead	410.0	20.0	8900.0	500.0
Nickel	2000.0	39.0	200.0	300.0
Selenium	40.0	100.0	trace	1900.0
Silver	18.0	52.0	12.0	50.0
Thallium	40.0	100.0	trace	trace
Zinc	5800.0	97.0	1200.0	880.0

TABLE 2

CHEMICAL	FEDERAL RCRA MCL	FEDERAL SDWA MCL	NEW JERSEY MCL	NEW JERSEY GROUND WATER QUALITY STANDARDS	FEDERAL MCLG	GROUND WATER CLEANUP REQUIREMENTS
ACETONE	-	-	*	-	-	*
BENZENE	-	5	1	-	0	1
2-BUTANONE	-	-	*	-	-	*
CHLOROBENZENE	-	-	4	-	-	4
CHLOROETHANE	-	L	*	-	L	*
CHLOROFORM	-	L	5	-	L	5
1,2-DICHLOROETHANE	-	5	2	-	0	2
1,1-DICHLOROETHANE	-	L	*	-	L	*
1,1-DICHLOROETHENE	-	7	2	-	7	2
ETHYLBENZENE	-	P700	*	-	P700	*
METHYLENE CHLORIDE	-	-	2	-	-	2
4-METHYL-2-PENTANONE	-	-	*	-	-	*
TETRACHLOROETHENE	-	P5	1	-	P0	1
TOLUENE	-	P2000	*	-	P2000	*
TRANS-1,2-DICHLOROETHENE	-	P100	10	-	P100	10
1,1-TRICHLOROETHANE	-	200	26	-	200	26
TRICHLOROETHENE	-	5	1	-	0	1
VINYL CHLORIDE	-	2	2	-	0	2
XYLENES	-	P10000	44	-	P10000	44
PHENOL	-	-	-	.0035	-	.0035
ANTIMONY	-	T10/5	2.8	-	T3	2.8
ARSENIC	50	-	50	50	T0	50
CHROMIUM	50	P100	50	50	P100	50
LEAD	50	P5 E50	50	50	P0	50
SELENIUM	10	P50	10	10	P50	10
ZINC	-	L	5000	5000	L	5000

* COMBINDED TOTAL SHALL NOT EXCEED 50 ppb
E EXISTING STANDARD
T TENTATIVE STANDARD (PHASE V)
P PROPOSED STANDARD (PHASE II)
\- NO STANDARD
L LISTED FOR REGULATION

TABLE 3
(Page 1 of 2)
LONE PINE LANDFILL

Onsite and Offsite
Groundwater and Surface Water Sampling
CDM FPC and Versar Data
April and May, 1986

CHEMICAL	ONSITE WELL Range (ug/l)	WATER TABLE AQUIFER Range (ug/l)	RED BANK AQUIFER Range (ug/l)	SURFACE WATER Range (ug/l)
Acetone	ND - 86000(C)	(10(V) - 6400(V)	ND - 2300(C)	ND - 150J(C)
Benzene	ND - 3600(V)	2*(V) - 860(V)	ND - 690(V)	ND - 17(C)
Bromomethane	10U(C) - 10000U(C)	(10(V) - 2000U(C)	10U(C) - 100U(C)	10U(C/V)
Bromoform	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
Bromodichloromethane	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
2-Butanone (MEK)	ND - 200000(C)	(10(V) - 4000(V)	ND - 1500(C)	ND - 17(C)
Carbon Disulfide	ND - 6(V)	5U(C) - 1000U(C)	ND	ND
Carbon tetrachloride	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
Chlorobenzene	ND - 4400(V)	5U(C) - 130(V)	ND - 29*(C)	ND
Chloroethane	ND - 600(V)	(10(V) - 2000U(C)	ND - 4*(V)	ND
2-Chloroethylvinyl ether	10U(C) - 5000U(C)	(10(V) - 2000U(C)	10U(C) - 100U(C)	10U(C/V)
Chloroform	ND - 5*(C)	5U(C) - 1000U(C)	ND	ND
Chloromethane	10U(C) - 5000U(C)	(10(V) - 2000U(C)	10U(C) - 100U(C)	10U(C/V)
1,1-Dichloroethane	ND	5U(C) - 1000U(C)	ND -20*(C)	ND
1,2-Dichloroethane	ND - 9700(V/C)	5U(C) - 41(V)	ND - 10*(C)	ND - 2.7*(C)
1,1-Dichloroethene (cis)	ND	5U(C) - 21(V)	ND - 2*(C)	ND
1,2-Dichloroethene (trans)	ND - 2800*(C)	5U(C) - 250(V)	ND - 200(C)	ND - 1.2*(C)
1,2-Dichloropropane	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
trans 1,3-dichloropropene	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
cis 1,3-dichloropropene	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
Ethylbenzene	32*(V) - 2000(V)	5U(C) - 80(V)	ND - 1400(V)	ND - 6.7(C)
2-Hexanone	ND - 27(V)	5.4J(C) - 8200(V)	ND	ND
Methylene chloride	ND - 130000*(C)	5U(C) - 800(B)	ND - 42b(C)	ND - 6J(C)
4-Methyl-2-pentanone	ND - 77000(C)	4.3J(C) - 16000(C)	ND - 620(C)	ND - 6.9(C)
Styrene	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C)
Tetrachloroethene	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
1,1,2,2-Tetrachloroethane	5U(C) - 5000U(C)	1.9J(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
Toluene	ND - 22000(C)	1.4J(C) - 2600(C)	ND - 1800(V)	ND - 11(C)
1,1,1-Trichloroethane	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
1,1,2-Trichloroethane	5U(C) - 5000U(C)	5U(C) - 1000U(C)	5U(C) - 50U(C)	5U(C/V)
Trichloroethene	ND - 8100(C)	5U(C) - 1000U(C)	ND - 2*(V)	ND
Vinyl acetate	10U(C) - 10000U(C)	10U(C) - 2000U(C)	10U(C) - 100U(C)	10U(C)
Vinyl Chloride	ND - 4*(V)	10U(C) - 21(V)	ND - 51(C)	ND
Total Xylenes	ND - 9200(C)	4.2J(C) - 1000U(C)	ND - 160(V)	ND - 14(V)

TABLE 3 (cont.)
(Page 2 Of 2)
LONE PINE LANDFILL

Onsite and Offsite
Groundwater and Surface Water Sampling
CDM FPC and Versar Data
April and May, 1986

CHEMICAL	ONSITE WELL Range (ug/l)	WATER TABLE AQUIFER Range (ug/l)	RED BANK AQUIFER Range (ug/l)	SURFACE WATER Range (ug/l)
Metals:				
Aluminum	421(C) - 10650(C)	ND - 5008(C)	ND - 9480(C)	31(C) - 4147(C)
Antimony	ND - 45(V)	ND - 25(V)	ND - 68.6(V)	ND
Arsenic	ND - 617(C)	ND - 288(C)	ND - 17(C)	ND - 200(V)
Barium	57(C) - 848(C)	21(C) - 333(C)	27(C) - 216(C)	28(C) - 140(C)
Beryllium	ND - 0.4(C)	ND - 1.1(C)	ND	ND
Cadmium	ND - 8.2(C)	ND - 13.2(C)	ND - 5.3(C)	ND
Calcium	10130(C) - 443400(C)	850(C) - 45580(C)	9198(C) - 36450(C)	1960(C) - 69410(C)
Chromium	ND - 212(C)	ND - 228(C)	ND - 191(C)	ND - 48(C)
Cobalt	ND - 29(C)	ND - 7(C)	ND - 8(C)	ND - 6(C)
Copper	ND - 78(V)	ND - 20(C)	ND - 38(C)	ND - 21(C)
Iron	ND - 198700(C)	224(C) - 90760(C)	ND - 86320(C)	3078(C) - 41010(C)
Lead	ND - 298(C)	ND - 318(C)	ND - 67310(C)	ND - 94(C)
Magnesium	16060(C) - 82150(C)	667(C) - 12720(C)	1080(C) - 6915(C)	1619(C) - 34210(C)
Manganese	9(C) - 2558(C)	11(C) - 382(C)	19(C) - 389(C)	37(C) - 338(C)
Mercury	ND - 0.4(C)	ND - 1.3(C)	ND - 0.3(C)	ND
Nickel	ND - 100(C)	ND - 73(V)	ND - 73(V)	ND - 28(C)
Potassium	29260(C) - 576100(C)	ND	ND - 7152(C)	2676(C) - 105300(C)
Selenium	ND - 11(V)	ND	ND	ND
Silver	ND	ND	ND - 13(V)	ND
Sodium	36020(C) - 1979000(C)	2559(C) - 78020(C)	1648(C) - 22440(C)	1.6(C) - 178800(C)
Thallium	ND	ND	ND	ND - 8561(C)
Tin	ND - 113(C)	ND	ND	ND
Vanadium	50(C) - 121(C)	ND - 67.1(C)	ND - 2.8(C)	ND - 46.2(C)
Zinc	47(C) - 30200(C)	32.4(V) - 23970(C)	11(V) - 32620(C)	24(C) - 93(V)

NOTES:

ND - Indicates that the compound was not detected.
(C) - Indicates that the value provided is from CDM FPC data.
(V) - Indicates that the value provided is from Versar data.
* - Estimated value.
U - Indicates compound was analyzed for but not detected.
The number is the minimum attainable detection limit for the sample.
J - This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the preseesence of a compound that meets the identification criteria but the result is less than the specific detection limit but greater than zero.
B - This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination.

TABLE 4

LONE PINE LANDFILL

Organic Compounds Onsite and Offsite
Groundwater Sampling
CDM FPC and Versar Data
January and March, 1989

CHEMICAL	ONSITE WELL Range (ug/l)	WATER TABLE AQUIFER Range (ug/l)	RED BANK AQUIFER Range (ug/l)
Acetone	39000B(V)	0.55(V) - 1700B(V)	0.68(V) - 910J(C)
Benzene	3100(V) - 4600J(C)	0.32J(V) - 690(V)	0.195J(V) - 750(V)
2-Butanone (MEK)	89000(V) - 140000J(C)	61(V) - 3400J(C)	0.88(V) - 5900J(C)
Chlorobenzene *		0.9J(C) - 31J(C)	ND - 6.4(C)
Chloroethane	ND	ND - 23J(C)	ND
Chloroform	ND	ND - 2.8J(C)	ND
1,1-Dichloroethane	380J(V)	1.7(C) - 15J(V)	ND - 0.8J(C)
1,2-Dichloroethane	8300(V) - 15000(C)	ND - 0.179J(C)	ND - 0.32J(V)
1,1-Dichloroethene (cis)	5000(V)	ND - 78(V)	ND - 36J(V)
1,2-Dichloroethene (trans) *		ND - 3.2(C)	ND
Ethylbenzene	2700(V)	130(V) - 2100J(C)	4(C) - 2100(C)
2-Hexanone *		ND - 15J(C)	ND
Isopropylbenzene	ND	2.2J(V) - 28J(C)	ND - 26J(V)
Methylene chloride	50000J(V)-53000J(C)	0.272BJ(V) - 73B(V)	0.226BJ(V) - 240B(V)
4-Methyl-2-pentanone	57000(V) - 89000(C)	1200(V) - 4400(V)	ND - 3500(C)
1,2,4-Trimethylbenzene *		ND - 1.4J(C)	ND
Toluene	1600B(V) - 26000B(C)	110B(V) - 7600(C)	0.136J(V) - 330J(C)
Vinyl Chloride	ND	7.3(V) - 29J(C)	ND - 29J(V)
Xylene (m-,p-) *		ND - 81J(C)	ND - 28J(C)
Xylene (o-) *		ND - 43J(C)	ND - 12(C)
Total Xylenes **	690(V)	120(V) - 210(V)	ND
Benzoic Acid *		ND - 120(C)	ND
Bis(2-ethylhexyl)phthalate *		ND - 7J(C)	ND
2,4-Dimethylphenol *		ND - 11(C)	ND
2-Methylphenol *		22(C) - 85(C)	ND - 10(C)
4-Methylphenol *		15(C) - 100(C)	ND - 13(C)
Phenol *		ND - 26(C)	ND - 24(C)
Carbon Disulfide **	ND	0.32J(V) - 8.1J(V)	0.211J(V) - 0.962(V)
Dichlorofluoromethane **	400(V)	ND	0.273J(V) - 0.571(V)
Styrene **	ND	ND - 5J(V)	12J(V) - 160(V)
Trichloroethene **	2400(V)	ND	ND

NOTES:

ND Indicates the compound was not detected.
Blank indicates not detected.
* Values presented in CDM FPC data only.
** Values presented in Versar data only.

TABLE 5

LONE PINE LANDFILL
Concentrations of Total Metals in Selected Ground Water
January 1989 Analysis by Versar, Inc.

METAL	ONSITE WELL Range (ug/l)	WATER TABLE AQUIFER Range (ug/l)	RED BANK AQUIFER Range (ug/l)
Aluminum	4360	1290 - 8620	ND - 21000
Antimony	ND	ND	ND - 17
Arsenic	ND	ND - 12	ND - 30
Barium	887	67 - 351	42 - 310
Beryllium	ND	ND - 3.2	ND
Cadmium	4.6	ND - 6.4	ND - 75
Calcium	337000	12000 - 36200	11700 - 48200
Chromium	76	49 - 182	ND - 398
Cobalt	ND	ND - 84	ND - 12
Copper	30	ND - 228	ND - 148
Iron	780000	38300 - 162000	26100 - 133000
Lead	23	ND - 295	ND - 5400
Magnesium	66100	2780 - 7090	2100 - 7780
Manganese	2220	101 - 665	108 - 306
Mercury	ND	ND	ND
Nickel	32	ND - 94	ND - 80
Potassium	23000	4830 - 8430	2820 - 18000
Selenium	ND	ND	ND
Silver	ND	ND	ND - 4
Sodium	40700	3220 - 6210	1960 - 12500
Thallium	ND	ND	ND
Vanadium	77	21 - 116	ND - 250
Zinc	133	52 - 30600	13 - 92000

NOTE:
ND Indicates that the metal was not detected.
The only onsite well sampled was EPA-14A, screened in the Red Bank unit.

TABLE 6

LONE PINE LANDFILL
Concentrations of Dissolved Metals in Selected Ground Water
January 1989 Analysis by Versar, Inc:

METAL	ONSITE WELL Range (ug/l)	WATER TABLE AQUIFER Range (ug/l)	RED BANK AQUIFER Range (ug/l)
Aluminum	3480	ND - 712	ND - 259
Antimony	ND	ND	ND
Arsenic	ND	ND	ND
Barium	934	21 - 171	18 - 159
Beryllium	ND	ND	ND
Cadmium	ND	ND	ND
Calcium	354000	11200 - 36900	10400 - 34600
Chromium	64	ND	ND
Cobalt	ND	ND - 4.8	ND - 9
Copper	19	ND	2.3
Iron	804000	8460 - 133000	66 - 65400
Lead	13	ND - 176	ND - 2100
Magnesium	69600	2280 - 6800	1420 - 5970
Manganese	2290	92 - 568	12 - 240
Mercury	ND	ND	ND
Nickel	27	ND - 46	ND
Potassium	22800	3130 - 5400	2250 - 5400
Selenium	ND	ND - 4	ND - 3.6
Silver	ND	ND	ND
Sodium	43200	3240 - 7480	2880 - 11400
Thallium	ND	ND	ND
Vanadium	71	ND - 9	ND - 5.7
Zinc	84	34 - 3030	13 - 12400

NOTE:

ND Indicates that the metal was not detected.
The only onsite well sampled was EPA-14A, screened in the Red Bank unit.

TABLE 7

Maximum Concentration Detected (parts per billion)

Compound	Drums (Solids)[1]	Ground Water (Mound)[2]	Ground Water (Toe)[3]	Ground Water (Plume)[4]	Manasquan River[4]
Benzene	8,500	4,700	3,000	1,939(c)	ND(a)
Ethylbenzene	3,400,000	1,400	2,000	3,635(c)	1.7(a)
Chlorobenzene	4,800	4,400	ND[6]	97(c)	ND(a)
Methylene Chloride	38,000	280	120,000	527(c)	3.0(a)
Toluene	5,900,000	1,600	18,000	4,708(c)	ND(a)
2-Butanone	NAF[5]	1,425	200,000	7,400(a)	17.0(a)
Arsenic	80,000	617	ND	110(b)	ND(a)
Chromium	1,600,000	212	65	320(b)	3.0(a)

1 Source: Lone Pine Landfill, Final Report, Excavation and Sampling, January 15, 1982.

2 Source: Lone Pine Landfill Off-Site Remedial Investigation, S.S. Papadopulos & Associates, July, 1990.

3 Well installed at "toe" of landfill; Source: Lone Pine Landfill, Off-Site Investigation, S.S. Papadopulos & Associates, July, 1990.

Source:

a) Off-Site Remedial Investigation Report, S.S. Papdopulos & Associates, July, 1990;
b) Presentation of Analytical Chemical Data, Lone Pine Landfill, NUS Corporation, March 20, 1984;
c) Lone Pine Landfill, Hydrogeologic Investigation, Fred C. Hart Associates, April, 1982.

5 NAF = Not analyzed for

6 ND = Not detected

TABLE 8

CONCENTRATION OF INDICATOR CHEMICALS IN GROUND WATER

INDICATOR CHEMICAL	MAXIMUM CONCENTRATION*
ACETONE	7.9×10^{3}
BENZENE	1.1×10^{3}
2-BUTANONE	7.4×10^{3}
CHLOROBENZENE	2.9×10^{1}
CHLOROFORM	1.5×10^{0}
1,2-DICHLOROETHANE	3.9×10^{1}
1,1-DICHLOROETHENE	4.0×10^{1}
ETHYLBENZENE	1.2×10^{3}
METHYLENE CHLORIDE	8.0×10^{2}
4-METHYL-2-PENTANONE	1.6×10^{4}
1,1,2,2-TETRACHLOROETHANE	1.9×10^{0}
TOLUENE	2.6×10^{3}
TRICHLOROETHENE	1.1×10^{1}
VINYL CHLORIDE	5.1×10^{1}
XYLENES	1.5×10^{2}

* PARTS PER BILLION

TABLE 9

NON-CANCER RISKS ASSOCIATED WITH THE LONE PINE LANDFILL
(GROUND WATER EXPOSURE)

CHEMICAL	ORAL RfD* (mg/kg/day)	INGESTION HI**	INHALATION RfD (mg/kg/day)	INHALATION HI	
ACETONE	1.0×10^{-1}	1×10^{0}	-	-	
BENZENE	-	-	-	-	
2-BUTANONE	5.0×10^{-2}	2×10^{0}	9.0×10^{-2}	2×10^{-1}	
CHLOROBENZENE	2.0×10^{-2}	2×10^{-2}	5.0×10^{-3}	1×10^{-2}	
CHLOROFORM	1.0×10^{-2}	2×10^{-3}	-	-	
1,2-DICHLOROETHANE	-	-	-	-	
1,1-DICHLOROETHENE	9.0×10^{-3}	7×10^{-2}	-	-	
ETHYLBENZENE	1.0×10^{-1}	2×10^{-1}	-	-	
METHYLENE CHLORIDE	6.0×10^{-2}	2×10^{-1}	3.0×10^{0}	5×10^{-4}	
4-METHYL-2-PENTANONE	5.0×10^{-2}	5×10^{0}	-	-	
TETRACHLOROETHANE	-	-	-	-	
TOLUENE	3.0×10^{-1}	1×10^{-1}	1.0×10^{0}	5×10^{-3}	
TRICHLOROETHENE	-	-	-	-	
VINYL CHLORIDE	-	-	-	-	
XYLENES	2.0×10^{0}	1×10^{-3}	4.0×10^{-1}	7×10^{-4}	
SUM		8.6×10^{0}		0.2×10^{0}:	8.8×10^{0}

*RfD = reference dose
**HI = hazard index
- = not applicable

TABLE 10

CANCER RISKS ASSOCIATED WITH THE LONE PINE LANDFILL
(GROUND WATER EXPOSURE)

CHEMICAL	ORAL CPF* [1/(mg/kg/day)]	INGESTION RISK	INHALATION CPF [1/(mg/kg/day)]	INHALATION RISK	
ACETONE	-	-	-	-	
BENZENE	2.9×10^{2}	6×10^{5}	2.9×10^{-2}	8×10^{-6}	
2-BUTANONE	-	-	-	-	
CHLOROBENZENE	-	-	-	-	
CHLOROFORM	6.1×10^{1}	2×10^{-8}	8.1×10^{-2}	3×10^{-8}	
1,2-DICHLOROETHANE	9.1×10^{2}	7×10^{-6}	9.1×10^{-2}	8×10^{-7}	
1,1-DICHLOROETHENE	6.0×10^{1}	5×10^{-5}	1.2×10^{0}	1×10^{-5}	
ETHYLBENZENE	-	-	-	-	
METHYLENE CHLORIDE	7.5×10^{1}	1×10^{-5}	1.4×10^{-2}	3×10^{-6}	
4-METHYL-2-PENTANONE	-	-	-	-	
TETRACHLOROETHANE	2.0×10^{-1}	7×10^{-7}	2.0×10^{-1}	9×10^{-8}	
TOLUENE	-	-	-	-	
TRICHLOROETHENE	1.1×10^{-2}	2×10^{-7}	1.3×10^{-2}	3×10^{-8}	
VINYL CHLORIDE	2.3×10^{0}	2×10^{4}	3.0×10^{-1}	4×10^{-6}	
XYLENES	-	-	-	-	
SUM		3.3×10^{-4}		2.6×10^{-5}:	3.5×10^{-4}

*CPF = cancer potency factor
- = not applicable

TABLE 11

Action-Specific ARARs

Wastewater Treatment Plant:

Clean Water Act, 42 U.S.C. 7401 et seq.;
Resource Conservation and Recovery Act, 40 CFR Parts 264 and 265 Subparts X, Y, Z, AA, and BB;
National Ambient Air Standards, 40 CFR 50;
Hazardous Materials Transportation Act, 49 U.S.C. 1801 - 1813;
Hazardous and Non-hazardous Waste Regulations, N.J.A.C. 7:26 et seq.;
Air Pollution Control Regulations, N.J.A.C. 7:27 et seq.;
Prohibition of Air Pollution, N.J.A.C. 7:27-5;
Control and Prohibition of Air Pollution by Volatile Organic Substances, N.J.A.C. 7:27-16;
Control and Prohibition of Air Pollution by Toxic Substances, N.J.A.C. 7:27-17;
Emission Offset Rule, N.J.A.C. 7:27-18;
New Jersey Ambient Air Quality Standards, N.J.A.C. 7:27-13;
Spill Notification requirements, N.J.A.C. 7:1(e);
Notice of Release of Hazardous Substances to Atmosphere, N.J.S.A. 26:2c-19; and
Air Pollution Emergencies, N.J.A.C. 7:27-12.

Other Action-Specific ARARs:

General Ground Water Monitoring Requirements, 40 CFR 264.97;
Occupational Safety and Health Administration requirements, 29 U.S.C. 651-678 (40 CFR 300.38, 40 CFR 61, 40 CR 1910.120);
General Requirements for Permitting Wells, N.J.A.C. 7:9-7;
Sealing of Wells Procedures, N.J.S.A. 7:9-9;
Well Drillers and Pump Installers Act, N.J.S.A. 58:4A-5 et seq.;
Noise Control Act of 1971, N.J.S.A. 13:1G-1 et seq.;
Noise Pollution Regulations, N.J.A.C. 7:29-1; and
Storage Tank Regulations, 40 CFR 264.190 - 198.

TABLE 12

ARARS Associated With the Selected Remedy

Location-Specific ARARs

Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq.;
Clean Water Act §404 (40 CFR 230, 33 CFR 320 - 330);
Executive Order 11990, Protection of Wetlands;
Executive Order 11988 (40 CFR 6, Appendix A), Floodplain Management;
National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq. and 469;
New Jersey Flood Hazard Area Regulations, N.J.A.C. 7:13-1.1 et seq.; and
New Jersey Freshwater Wetlands Protection Act Rules; N.J.A.C. 7:7A-1.1 et seq.

Chemical-Specific ARARs

Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) (including the RCRA Maximum Concentration Limits;
New Jersey Safe Drinking Water Act A-280 Amendments;
New Jersey Pollution Discharge Elimination System regulations (N.J.A.C.7:14A-1.1 et seq.)
N.J.A.C. 7:10-16 et seq., and 7:9-6 et seq.
SEE ALSO TABLE 2

Action-Specific ARARs

WASTEWATER TREATMENT PLANT

Clean Water Act, 42 U.S.C. 7401 et seq.;
Resource Conservation and Recovery Act, 40 CFR Parts 264 and 265 Subparts X, Y, Z, AA, and BB;
National Ambient Air Standards, 40 CFR 50,
Hazardous Materials Transportation Act, 49 U.S.C. 1801 - 1813;
Hazardous and Non-hazardous Waste Regulations, N.J.A.C. 7:26 et seq.;
Air Pollution Control Regulations, N.J.A.C. 7:27 et seq.;
Prohibition of Air Pollution, N.J.A.C. 7:27-5;
Control and Prohibition of Air Pollution by Volatile Organic Substances, N.J.A.C. 7:27-16;
Control and Prohibition of Air Pollution by Toxic Substances, N.J.A.C. 7:27-17;
Emission Offset Rule, N.J.A.C. 7:27-18;
New Jersey Ambient Air Quality Standards, N.J.A.C. 7:27-13;
Spill Notification requirements, N.J.A.C. 7:1(e);
Notice of Release of Hazardous Substances to Atmosphere, N.J.S.A. 26:2c-19; and
Air Pollution Emergencies, N.J.A.C. 7:27-12.

TABLE 12 (continued)

ARARS Associated With the Selected Remedy

WASTEWATER TREATMENT PLANT (CONTINUED)

Sludge generated by the operation of a wastewater treatment plant would have to be disposed of in accordance with the requirements of the Resource Conservation and Recovery Act, including the Land Disposal Restrictions.

INJECTION OF TREATED GROUND WATER INTO RED BANK AQUIFER

Safe Drinking Water Act, 40 CFR 144;
New Jersey Pollutant Discharge Elimination System, N.J.A.C. 7:14A et seq.; and
New Jersey Ground Water Quality Criteria, N.J.A.C. 7:9-6 et seq.

ADDITIONAL ACTION-SPECIFIC ARARS

General Ground Water Monitoring Requirements, 40 CFR 264.97
Occupational Safety and Health Administration requirements, 29 U.S.C. 651 - 678 (40 CFR 300.38, 40 CFR 61, 40 CR 1910.120);
General Requirements for Permitting Wells, N.J.A.C. 7:9-7;
Sealing of Wells Procedures, N.J.S.A. 7:9-9;
Well Drillers and Pump Installers Act, N.J.S.A. 58:4A-5 et seq.;
Noise Control Act of 1971, N.J.S.A. 13:1G-1 et seq.;
Noise Pollution Regulations, N.J.A.C. 7:29-1; and
Storage Tank Regulations, 40 CFR 264.190 - 198.

EXHIBIT I

LONE PINE LANDFILL SITE
OPERABLE UNIT II

RESPONSIVENESS SUMMARY
FOR THE
RECORD OF DECISION

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RESPONSIVENESS SUMMARY
LONE PINE LANDFILL SITE
OPERABLE UNIT II

This community relations responsiveness summary is divided into the following sections:

Overview: This section discusses EPA's preferred alternative for remedial action.

Background: This section provides a brief history of community interest and concerns raised during remedial planning at the Lone Pine Landfill Site.

Summary of Comments: This section provides a summary of commentators' major issues and concerns, and expressly acknowledges and responds to all significant comments raised by the local community. "Local community" includes local homeowners, businesses, the municipality, and potentially responsible parties (PRPs).

OVERVIEW

At the initiation of the public comment period, EPA presented its preferred alternative for the second operable unit at the Lone Pine Landfill Site, located in Freehold Township, New Jersey. The first operable unit remedy is a landfill containment system (cap, slurry wall, and leachate collection/treatment) which will prevent the migration of landfill leachate into the aquifer system. The second operable unit remedy was devised to remediate ground water outside the boundary of the first operable unit's slurry wall.

The selected remedy for the second operable unit includes the installation of a 2,800-foot long interceptor drain keyed into the Hornerstown Formation; installation of approximately 3 extraction and 24 injection wells screened in the Red Bank aquifer; construction of an on- site wastewater treatment plant to treat the ground water captured by the interceptor drain and extraction wells to meet the applicable or relevant and appropriate requirements (ARARs) which would include federal and state Maximum Contaminant Levels (MCLs); and the construction of a recharge trench to discharge treated ground water during maintenance of the injection wells. In addition, long-term monitoring of the aquifers and the Manasquan River, including sediment and biota studies, and institutional controls to restrict ground water usage in the area affected by the site will be necessary.

The principal threat at this site is the contaminated ground water which currently migrates off-site into the Manasquan River. However, upon construction and implementation of the second operable unit remedy's interceptor drain and extraction wells, the contamination will cease migrating into the river thereby eliminating the threat to human health and the environment. However, due to the lengthy period of time estimated for cleansing the aquifer to MCLs, long-term management will be required.

BACKGROUND

The RI/FS Report and the Proposed Plan for the Lone Pine Landfill Operable Unit II were released to the public for comment on July 17, 1990. These two documents were made available to the public in the administrative record file, located at the information repositories maintained at the EPA Docket Room in Region II, the Monmouth County Public Library and the Freehold Township Health Department. The notice of availability for these documents was published in the Asbury Park Press on July 17, 1990. A public comment period on these documents was held from July 17, 1990 to September 15, 1990. In addition, a public meeting was held on August 1, 1990. At this meeting, representatives from EPA answered questions relating to the site and the remedial alternatives under consideration. Responses to the comments received during the comment period are included in this Responsiveness Summary.

COMPREHENSIVE SUMMARY AND RESPONSES TO SIGNIFICANT COMMENTS

This section provides a comprehensive response to all significant comments and summarizes the major issues and concerns raised by the local community. The questions and comments on the proposed remedy for the Lone Pine Landfill site received at the public meeting on August 1, 1990 and during the public comment period through September 15, 1990, can be grouped into six categories:

A. Operable Unit I, Source Control Remedy for the Lone Pine Landfill

B. Operable Unit II, Ground Water Remedy For the Lone Pine Landfill

C. Remedial Alternatives for Operable Unit II

D. Computer Modeling

E. Risks and Contamination Associated with Operable Unit II

F. General Comments

A summary of the comments and EPA's response to them is provided below.

A. Operable Unit I, Source Control Remedy

1. The Mayor of Freehold Township asked for an explanation of the length of time that has elapsed since the signing of Operable Unit I Record of Decision and a timetable for implementation. A citizen of Freehold Township also provided written comments on this subject. (References A and E)

EPA Response: The delay in implementation of the first operable unit ROD is unusual and is the result of several factors. First, there has been difficulty in reaching an agreement for disposition of the leachate from the treatment plant. The ROD provided for two alternatives: discharge to the local publicly owned treatment works [in this case, the Ocean County Utilities Authority (OCUA)], or discharge to the Manasquan River.

EPA's preference was to gain access to the OCUA. Consequently, EPA performed treatability studies on the leachate which proved that, once passed through EPA's proposed treatment system, the leachate meets all technical requirements for OCUA. However, OCUA nevertheless refused to commit to acceptance of the leachate, admittedly because the treated leachate is from a Superfund site. After several years of additional studies for OCUA and unsuccessful attempts to convince OCUA to accept the treated leachate, EPA had no choice but to proceed with the other disposal option, discharge to the Manasquan River. EPA then re-designed the treatment plant in order to meet applicable discharge requirements.

In the Summer of 1989, EPA reached agreement with 116 potentially responsible parties (PRPs) for privately-funded implementation of EPA's design, which provided for the river discharge. Due to the expected public opposition to river discharge, EPA included a provision in the PRP agreement to require the PRPs to make a final attempt to gain access to OCUA. Unfortunately, the issue of leachate disposition is still not resolved, since an agreement with OCUA has not yet been reached. EPA's goal is to resolve the issue in October, 1990.

An additional source of delay relates to the agreement with the PRPs, in the form of a judicial Consent Decree. Though the Consent Decree was signed by a large number of PRPs in the Summer of 1989, a group of PRPs which did not sign the agreement felt it was "unfair". This group instituted proceedings to challenge the agreement, which had to be contested in court by EPA and the Department of Justice. The government was eventually successful and the Consent Decree was entered in Federal District Court in March, 1990. There was a lengthy period of delay caused by the challenge, but the PRPs who signed the Consent Decree are now proceeding ahead with the negotiations with OCUA and the final construction plans for implementation of the Operable Unit I remedy.

2. The Township Administrator reiterated the Township's unconditional opposition to direct discharge into the Manasquan River for the treated leachate from the Operable Unit I treatment plant, and stated that the public feels very strongly that this disposal option should not be pursued. (Reference A)

EPA Response: Final disposition of the treated leachate has not yet been resolved. As stated in the response to Comment 1.A., above, EPA first attempted to dispose of the treated leachate through OCUA, but to date, has not been successful. EPA only proceeded with the design for the river discharge after years of unsuccessful negotiations with OCUA. EPA hopes to make a final decision in October 1990. EPA is aware of the public concern about river discharge, but must balance the public's concern with the need to have the Operable Unit I remedy implemented. Another option EPA is considering is to reinject the treated leachate from Operable Unit I along with the treated ground water from the Operable Unit II remedy. In order to implement reinjection for Operable Unit I, the PRPs who settled with EPA for implementation of Operable Unit I ROD would have to agree.

B. Operable Unit II, Off-Site Ground Water Remedy

1. The Mayor of Freehold Township asked about the timetable for implementation of the Operable Unit II remedy and who would perform the work. (Reference A)

EPA Response: After the Operable Unit II ROD is finalized, the design of the selected remedy will be implemented and when complete, construction will be initiated. Under the Superfund program, EPA may provide the PRPs with the opportunity to design and implement the selected remedy. If it does so, EPA will set very strict deadlines for negotiations with the PRPs. If an agreement with the PRPs cannot be reached, EPA will either move ahead and design and implement the remedy utilizing Superfund monies and later recover the costs from the PRPs, or will order the PRPs to implement the design and construction. After the negotiation stage, whether EPA or the PRPs implement the design, EPA anticipates that it would take from 12 to 18 months to complete the design, and approximately 2 years to complete the construction.

2. The PRPs commented that institutional controls on ground water use and land development in the Lone Pine Landfill vicinity would be adequate as a remedy for Operable Unit II. (References C and F)

EPA Response: The National Contingency Plan (NCP) states that institutional controls shall not substitute for an active response measure as the sole remedy :

"EPA expects to use institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants or contaminants.... The use of institutional controls shall not substitute for active response measures (e.g., treatment and/or containment of source material, restoration of ground waters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of trade-offs among alternatives that is conducted during the selection of the remedy."

40 CFR §300.430 (a)(1)(iii)(F)

EPA has determined that, in this case, active response measures are practicable, and therefore will utilize institutional controls only to supplement such active measures. In addition, institutional controls such as deed restrictions and land use restrictions would be difficult to enforce, and consequently, cannot be relied upon as the sole protective measures to prohibit exposure to contaminated ground water.

3. The PRPs commented that the NCP requires that each operable unit be consistent with the overall remedy at the site. These Commenters argue that this requirement has not been met with the proposed remedy for Operable Unit II, since the two remedies have not been integrated and the implementation of the Operable Unit II remedy would have a hydraulic impact on the Operable Unit I remedy. (References C and F)

EPA Response: The selected remedy for Operable Unit II is consistent with the overall goal for remedial action at the Lone Pine Landfill site, which is to contain contaminants within the landfill and remediate contamination which has already emanated from the landfill boundaries. The computer modeling undertaken during the Operable Unit II RI/FS was performed with the assumption that the Operable Unit I remedy was in place and operational. Thus, the modeling results provide the foundation for evaluating the best available alternatives for remediating the off-site plume assuming no further contaminant migration from the landfill occurs. The selected remedy was specifically designed so as not to compromise the effectiveness of the Operable Unit I remedy. The design of the selected remedy for Operable Unit 2 will be implemented in a way which will avoid any hydraulic impact to the landfill containment system. The modeling conducted shows that the selected remedy can be implemented without compromising the effectiveness of the Operable Unit I remedy.

In addition, the ROD for Operable Unit II provides for the possibility of combining the Operable Unit I and II treatment plants thus producing one effluent stream.

4. The PRPs commented that the Operable Unit I and II remedies are inconsistent since EPA has decided to manage the "same ground water" with two different technologies. The Commenters cite EPA's 1984 ROD, which calls for either river discharge or OCUA treatment, and argue that this decision is inconsistent with the proposed remedy, which calls for reinjection of the treated ground water. (Reference F)

EPA Response: EPA is not choosing two distinct technologies to handle the "same ground water." There are several reasons why the disposal options selected for the two operable units are different. First, the leachate to be collected within the slurry wall as part of the Operable Unit I remedy is a concentrated waste stream, with extremely high levels of contaminants, while the ground water plume is more dilute. Consequently, the influent concentrations to the two anticipated treatment plants are expected to be significantly different.[1]

Second, in 1984, when disposal options for the Operable Unit I remedy were evaluated, reinjection was still an emerging technology, and little was known about its feasibility for use as a disposal mechanism. Moreover, when EPA selected the Operable Unit I remedy, the Agency simultaneously established the need for a comprehensive ground water study (the Operable Unit II RI/FS), and could not have planned for reinjection of the leachate as not enough was known the hydrology and ground water conditions which were the subject of the future study.

Third, the reinjection component of the selected remedy for Operable Unit II functions not only as a disposal mechanism, but also serves to expedite cleanup of the Red Bank Aquifer.

Finally, the public has expressed opposition to river discharge for the Operable Unit I remedy due to the presence of a drinking water reservoir downstream. Consequently, in evaluating options for remediation for Operable Unit II, EPA determined that reinjection was preferred over river discharge. In addition, the option of sending the treated effluent to OCUA for Operable Unit II was projected to be more costly.

5. The PRPs urged EPA to defer the decision relating to Operable Unit II until the Operable Unit I remedy is implemented. Certain Commenters state that, if the river conditions improve as a result of implementation of Operable Unit I, the ground water may qualify for Alternate Concentration Limits (ACLs). (References C and F)

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[1] This difference in expected influent concentrations will have to be evaluated in determining the practicability of combining the Operable Unit I and II treatment plants and having only one facility. (See response to Comment B.3., above.)

EPA Response: The results of the Operable Unit II RI/FS showed that ground water is heavily contaminated at levels which far exceed the applicable standards, and that the contaminant plume is currently discharging into the Manasquan River adjacent to the landfill. Consequently, EPA has adequate information to determine that active measures to control such migration and remediate the ground water are necessary. The NCP stipulates that action should be taken as quickly as possible once the studies are deemed complete and adequate:

> "Remedial actions are to be implemented as soon as site data and information make it possible to do so."
>
> 40 CFR §300.430(a)(1).

It is therefore inappropriate to delay implementation of the Operable Unit II remedy.

At the present time, the Lone Pine Landfill site does not meet the necessary criteria for imposing ACLs. These criteria would require certainty that:

(1) the ground water has a known or projected point of entry to surface water; and

(2) there are no statistically significant increases in contaminant concentration in the surface water or at any point at which the contaminants are expected to accumulate.

In this case, site-related contaminants have been detected in surface water adjacent to the site, and thus the above criteria for use of ACLs is not satisfied. In addition, EPA's policy is that ACLs can be used only when, in addition to the above criteria, cleanup to ARARs is not practicable. (See "Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites", OSWER Directive 9283.1-2 at 2-4.)

EPA has provided for reevaluation of the Operable Unit II remedy if it becomes apparent that ARARs cannot be attained (i.e., if full cleanup is not practicable). The application of ACLs may be considered at a later date as part of an overall reevaluation of the remedy after implementation and operation is monitored.

C. Remedial Alternatives Evaluated for Operable Unit II

1. A member of the Township environmental commission indicated that Alternative 6 should be selected instead of EPA's proposed Alternative 5. The commission feels that the timeframe for the remedy should be kept as short as possible, preferably within the lifetime of the equipment and the residents of Freehold Township. The commission feels that the implementation concerns EPA has regarding Alternative 6 can be successfully

overcome. The commission stated that if the proper balance of pressure and volume are maintained, there should be no problem with recontamination of the Red Bank aquifer, and that since the landfill already has monitoring wells and will have methane vents, drilling through the landfill should not be a problem. In addition, the commission stated that it seemed as though EPA's overriding consideration in proposing Alternative 5 was cost, which is inappropriate since Alternative 5 would probably cost more than Alternative 6 over 165 years. (References A and B)

EPA Response: The NCP requires EPA to perform a detailed analysis consisting of an assessment of individual alternatives against each of nine criteria and a comparative analysis that focuses upon the relative performance of each alternative against those criteria. One of the nine criteria is Implementability. The NCP States that:

> "the ease or difficulty of implementing the alternatives shall be assessed by considering... technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions and the ability to monitor the effectiveness of the remedy...."
>
> 40 CFR §300.430(e)(9)(iii)(F)

In the comparative analyses of the six alternatives, EPA determined that the simplest to implement was Alternative 1 (No Action), and Alternatives 3, 5, and 6 were the most difficult to implement by virtue of the number of wells required and the need to regulate injection and withdrawal so as not to disturb the Operable Unit I remedy. As stated by the Commenter, if the proper balance of pressure and volume are maintained, there should be no problem with recontamination by compromising the landfill containment system. However, because of the number of wells estimated to be required for Alternative 6 and their required location, implementation of Alternative 6 poses potential health and safety risks which none of the other alternatives face. In addition, the risks of compromising the Operable Unit I remedy are significantly increased with Alternative 6. Though monitoring wells were installed through the landfill, these were installed prior to the construction of the cap, and thus did not compromise its integrity. In addition, the installation of monitoring wells or air vents is not directly comparable to the installation of a significant number of injection wells, which are much larger in diameter, and would require intensive maintenance.

Cost was not EPA's overriding consideration in selecting Alternative 5. Cost, along with long-term effectiveness and permanence, reduction of toxicity, mobility and volume, short-term effectiveness and implementability, were used as the primary balancing criteria as required by the NCP.

With respect to costs over the period of operation of Alternative 5, EPA re-estimated the net present value of Capital and Operation and Maintenance costs for the entire estimated operational life of each alternative. EPA included in the revised estimates the replacement costs of all equipment over the time period of required operation. The details of the revised cost estimates are attached in Exhibit 2. The results show that Alternative 5 would cost $10,267,661, while Alternative 6 is still more expensive, at $23,237,241.

2. A meeting attendee inquired, with regard to the clean up times for the two aquifers for Alternative 6 (19 years for the Water Table and 14 years for the Red Bank) why treatment of the Red Bank aquifer couldn't get started first, and pumping of the Water Table aquifer follow later.

EPA Response: The ground water studies conducted at the site indicate that the Water Table aquifer and the Red Bank aquifer are hydraulically connected. Therefore, this precludes pumping of the Red Bank Aquifer separately to equalize the time required for cleanup of both aquifers.

3. A meeting attendee inquired as to why there was a variation in clean up times between the Water Table and Red Bank aquifers.

EPA Response: The area of the Water Table aquifer which requires cleanup is much smaller than that in the Red Bank. This is because a portion of the Water Table Aquifer (within and beneath the Landfill, itself) will be cleaned up by the drains to be installed as part of the Operable Unit I remedy. The slurry wall and the interior drain system will not significantly alter ground water flow in the Red Bank aquifer. Since the portion of the Red Bank Aquifer which underlies the landfill will not be drawn into the drains, the areal extent of contamination requiring cleanup in the Red Bank Aquifer is much larger. (See Figures 6 and 7 of the Operable Unit II ROD, which show the areal extent of contamination in each aquifer to be addressed by the selected remedy.)

4. A meeting attendee discussed the condition of the reported 17,000 to 50,000 drums of chemicals which were disposed of in the landfill. He stated that he believed some of the drums are intact and still contain wastes, and inquired as to how the computer modeling and proposed ground water treatment system dealt with the unknowns associated with rupturing drums.

EPA Response: The remedy selected and designed for Operable Unit I is expected to contain any "new" input of leachate from rupturing drums. The possibility of intact

drums which could rupture was one of the main reasons why the Operable Unit I remedy provides for total containment of the landfill (cap, slurry wall, and a leachate collection system). The computer modeling and conceptual design of the treatment system for Operable Unit II were both performed with the assumption that the landfill containment system was in place, and thus focused on contamination which has already migrated into the ground water.

5. A meeting attendee commented that he perceived that Alternative 6 was included in the evaluation as an extreme and that its purpose was to steer the alternative selection back to one of the other alternatives. (Reference A)

EPA Response: The goal of the Feasibility Study was to develop and evaluate alterative that attain MCLs within different restoration time periods utilizing one or more different technologies, as required by the NCP. Alternative 6 was developed as an option to remediate the contaminated ground water as quickly as possible. EPA did not select Alternative 6 because, based on a comparison of all alternatives against EPA's nine evaluation criteria, Alternative 6 poses significant implementability problems, costs more than double the next most expensive alternative, and does not provide a substantially greater degree of protectiveness.

6. A resident of Freehold Township expressed concern about the operation times for several of the alternatives, how the systems would be maintained for such long periods of time, and how the alternatives were costed out. (Reference A)

EPA Response: The estimated clean up times of the aquifers and consequently, the length of time required for operation of the various remedial alternatives are based on a computer simulation. This simulation uses the best available data for its modeling of hydrogeologic site conditions. Therefore, the time frames represent the best estimates for relative cleanup times among the various alternatives. During the operational life of the selected remedy, the system's performance will be carefully monitored on a regular basis and adjusted as warranted.

The six alternatives were costed on a present value worth basis, for the expected operation time of each alterative, as is standard engineering practice.[2]

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[2] See also response to Comment C.1., which explains the re-evaluation of cost conducted as a result of the concern about replacement costs and operational life.

7. One of the PRPs commented that ARARs should be waived for the Lone Pine site based on the criteria of technical impracticability. (Reference C) In a related comment, a group of PRPs commented that the alternatives are impractical because of the length of time required to achieve protectiveness and that distinctions among the alternatives based on the time required to achieve MCLs would violate the NCP. (Reference F)

EPA Response: According to the NCP:

> "EPA expects to return usable ground waters to their beneficial uses within a timeframe that is reasonable given the particular circumstances of the site. When restoration of ground water to its beneficial uses is not practicable, EPA expects to prevent migration of the plume, prevent exposure to contaminated ground water and evaluate further risk reduction."
>
> 40 CFR §300.430(a)(1)(iii)(F)

For the reasons outlined below, the goals established for remediation of the ground water at the Lone Pine site are consistent with the NCP, and EPA believes that restoration of ground water to its beneficial uses is practicable, despite the fact that a lengthy period is estimated to remediate the Red Bank aquifer.

The timeframes estimated to be required to restore the ground water to meet applicable or relevant and appropriate requirements (ARARs) are a direct result of the necessary limitations on pumping and treating the ground water. The circumstances at this Site preclude the typical pumping and treatment schemes due to the fact that pumping cannot be permitted to reverse the hydraulic gradients of the Operable Unit I landfill containment system. Under other circumstances, pumping could be performed at much higher rates to extract the contamination as quickly as possible. In this case the selected remedy requires extraction and injection farther from the core of the contamination, which results in slower remediation times. Consequently, the "circumstances of the site" necessitate longer remediation times for the Red Bank aquifer.

EPA has determined that it is practicable to remediate the ground water at the Lone Pine site. The goals of the Operable Unit II remedy, as set forth in the ROD, are to prevent migration of the contaminant plume to the Manasquan River or other areas, and to restore the ground water to its beneficial uses. As provided in the ROD, if, after operation of the remedy, it becomes apparent that restoration of ground water quality is not practicable, the remedy will be reevaluated.

The Commenters reference EPA's "Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites", and conclude that the Agency has determined "that any alternative which takes longer than 100 years to implement is impractical." This is an incorrect conclusion. The guidance states that:

"For ground water remedies technical impracticability may be measured in terms of restoration timeframe. A time frame beyond 100 years would generally warrant the technical impracticability waiver. "

OSWER Directive 9823.1-2 at 6-2

In this case, the fact that the selected remedy is estimated to require 165 years to remediate the Red Bank aquifer and 14 years to remediate the Water Table aquifer does not conflict with this guidance. As noted by the Commenters, the timeframes for remediation to cleanup standards are estimates derived by a computer model which provides a simplified simulation of the sites's hydrology. EPA recognizes this and believes it is therefore premature to determine that it will necessarily take 165 years to restore the ground water quality in the Red Bank aquifer to ARARs. In fact, it may take significantly less than 100 years, the time frame cited by the Commenters as the practicality limit. It should be noted that EPA expects a significant amount of the contamination in the Red Bank to be removed within three decades (the time required to remove one pore volume). Furthermore, the timeframes the Commenters appear to criticize as being greater than 100 years all apply to the Red Bank aquifer only. This aquifer is much less contaminated than the Water Table aquifer, which, under any alternative, is expected to take less than twenty years to remediate.

In summary, with the exception of Alternative 6 (which poses some implementability problems) the various remedial alternatives evaluated are technically feasible and can be implemented within a reasonable time frame given the circumstances of the site. Consequently, an ARAR waiver based on technical impracticability is not justified at the present time.

8. The PRPs commented that EPA has ignored implementability problems associated with the use of injection wells. The Commenters further state that the Long Island water authorities have recognized the impracticality of the use of injection wells and therefore, almost exclusive use seepage basins to recharge aquifers. (Reference F)

EPA Response: EPA is aware of the problems often associated with injection wells (e.g.. chemical precipitation, air entrainment, and sand pumping), but does not agree that operation of such wells is technically impracticable. One purpose of the recharge trench, which is a component of all alternatives utilizing injection wells, is to provide for disposition of effluent during periods of necessary injection well maintenance. It is EPA's intent to ensure that the design and construction of the injection wells are optimized and that the wells are maintained on a regular basis in order to avoid any implementation difficulties.

The Commenters compare the general lack of use of injection wells on the entire island of Long Island, New York, to the proposed remediation at the Lone Pine Landfill site. This comparison is not warranted. While both Long Island and the site are situated within the Atlantic Coastal Plan Physiographic Province, there are different geologic formations at each of the two locations, with many varieties within Long Island, itself. The Long Island water authorities are operating to achieve a different set of goals than those for Superfund remediation. At the Lone Pine site, injection is being utilized for the purpose of pushing contaminants through the aquifer as well as for disposal.

9. The PRPs commented that EPA correctly rejected Alternative 6 for implementability reasons. (Reference F)

EPA Response: EPA agrees with the Commenters that Alternative 6 poses implementability problems, and as discussed under the response to Comment C.1., above, Alternative 6 was rejected based on a balance of all evaluation criteria, including implementability.

10. The PRPs commented that, based on EPA's Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites (OSWER Directive 9283.1-2), natural attenuation (Alternative 1, No Action), would be the most appropriate response for Lone Pine.

EPA Response: The guidance cited by the Commenters states:

> "Natural attenuation should be carried through the detailed analyses as a point of comparison, but it is not generally recommended except when active restoration is not practicable, cost-effective, or warranted because of site-specific situations; e.g., Class III ground water is contaminated...."
>
> OSWER Directive 9823.1-2 at 5-7

In addition, the guidance specifically cites the use of reliable institutional controls along with natural attenuation, and states that such controls should not substitute for active response measures, unless such measures are determined not to be practicable. (See discussion of institutional controls in response to Comment B.2.)

The guidance further describes conditions that <u>potentially</u> favor the use of natural attenuation, which include: (1) ground water that is naturally unsuitable for consumption (Class III aquifers); (2) low mobility contaminants; (3) low aquifer transmissivity; (4) low concentrations of contaminants; (5) low potential for exposure; (6) low projected demand for future use of the ground water; and (7) situations which meet the statutory requirements for Alternate Concentration Limits.

EPA has determined that the conditions at Lone Pine do not favor the use of natural attenuation because ground water at the site is classified as IIA (current or potential source of drinking water), there are high levels contaminants, and the contaminants are very mobile. Furthermore, as discussed in response to Comment B.5., the site does not meet the statutory requirement for use of Alternate Concentration Limits.

D. Computer Modeling

1. A member of the audience inquired about the accuracy of the computer modeling for estimating clean up times of the aquifers and the ability of the remedies to meet Maximum Contaminant Levels (MCLs).

EPA Response: A version of the three-dimensional modular ground water flow model developed by the United States Geological Survey (McDonald and Harbaugh, 1988) with a particle tracking routine (Zheng, 1988) and the batch flushing model was used as a tool in the FS in order to simulate the hydrologic conditions that will exist at the site after the landfill containment system is implemented and to analyze the estimated rates of ground water remediation under the various alternatives. It is important to note that the computer modeling for the off-site remedial alternatives was done with the assumption that the Operable Unit I remedy is in place and operational, and since the design for the Operable Unit I remedy has recently been slightly refined, computer modeling will be updated during the design phase for Operable Unit II to make the modeling as accurate as possible.

The model incorporates the hydrogeologic data collected at the site and general hydrogeologic information in the published literature regarding the hydrogeology in the vicinity of the landfill. Therefore the simulation provides the best available tool for comparing the alternatives. EPA recognizes that the model is a simplification of real-world conditions and that the remediation timeframes derived by the model are estimates. However, as the same assumptions are employed for all alternative simulations, the model provides a basis for comparison.

With respect to meeting MCLs, the Record of Decision will contain contingency measures to be followed with regard to ability to achieve these cleanup standards within the contaminant plume. Studies have shown that ground water extraction is effective in containing contaminant plumes and achieving significant mass removal of contaminants. However, in most cases, contaminant concentrations cease to decrease linearly over time in reaching the designed cleanup goals. After significant initial decreases, concentrations typically level off, often at concentrations higher than the desired cleanup levels. At the Lone Pine Landfill site it may not be possible to reduce contaminants to cleanup standards throughout the area of attainment. The practicability of achieving cleanup

goals throughout the contaminant plume cannot be determined until the extraction system has been implemented and plume response is monitored over time.

If it becomes apparent during operation of the remedial action that contaminant levels have ceased to decline and are remaining constant at levels higher than the cleanup standards, the remedy may be re-evaluated. If it is determined that the selected remedy cannot meet the cleanup standards, contingency measures may replace certain aspects of the selected remedy.

E. Risks Associated with Operable Unit II

1. The PRPs commented that no current risk is posed by the Lone Pine Landfill, since the contaminated ground water emanating from the site is not likely to be utilized for drinking water, and that based strictly on risk, only the No Action alternative is justified. In addition, the Commenters state that no current risk is posed by the discharge of contaminated ground water to the surface water (References C and F)

EPA Response: EPA acknowledges the fact that no current risk to human health is posed by actual human exposure via consumption of contaminated ground water at the site. However, as described in the Endangerment Assessment (CDM, 1990), potential risks could be posed by use of the contaminated ground water as a source of drinking water and by exposure of recreational users of the Manasquan River in the vicinity of the site. In addition, a drinking water supply reservoir is located downstream from the site.

EPA's "Risk Assessment Guidance for Superfund, Volume 1 Human Health Evaluation Manual," requires that the endangerment assessment be conducted as if no action were taken at the site and assess both the current and potential future risks. In addition, the NCP states that EPA shall:

> "...conduct a baseline risk assessment to characterize <u>current and potential</u> threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water...."
>
> 40 CFR §300.430(d)(4)

The ground water in the vicinity of the landfill is classified as a source of drinking water (Class IIA), and is utilized for drinking water in the vicinity of the site. The contaminant plume contains chemicals far in excess of the ARARs. Based on the classification of the ground water and the potential for human exposure, EPA has concluded that potential risks relating to ground water exist. EPA quantitatively assessed the risk associated with human exposure to contaminated ground water and concluded that the carcinogenic risks would be 3.5×10^{-4}, which is outside the acceptable risk range

of 1 x 10^{-4} to 10^{-6}. In addition, in the event of exposure to contaminated ground water, adverse non-carcinogenic effects are likely to occur.

As described in more detail in the response to Comment E.2., the surface water in the reach adjacent to the landfill is classified as FW2-NT and is thus recreational and drinkable. Therefore, standards established for protection of human health, the Federal Water Quality Criteria for human health consumption of water and organisms are ARARs for this site.

As required by Section 121(d) of CERCLA, EPA must select remedial actions which at a minimum achieve ARARs.

2. The PRPs commented that contamination of the surface waters in the vicinity of the Lone Pine Landfill does not exceed standards set to protect aquatic life. (References C and F)

EPA Response: Due to the fact that the ground water discharges into the Manasquan River (refer to Comment E.4., below), the river has also been contaminated by the landfill. This is verified by the presence of VOCs in the river at surface water sampling stations downstream of the site during the 1986 sampling events. The VOCs detected at one of the downstream stations (Burke Road/RS-3A) are methylene chloride, 1,2-dichloroethane, acetone, 2-butanone and 4-methyl-2-pentanone.

The Clean Water Act provides for the protection of existing and designated uses of surface waters of the United States. Since this surface water is classified as FW2-NT, a fishable and drinkable classification, the ambient water quality criteria under the Clean Water Act are ARARs. For methylene chloride and 1,2 dichloroethane, ambient water quality criteria for fish and water consumption are exceeded. In addition to the VOCs, concentrations of aluminum, iron, manganese, thallium and zinc exceed the ambient criteria. Though some of these compounds were also found upstream of the landfill, the concentrations of iron and manganese downstream of the landfill significantly exceeded upstream concentrations, and thallium was found only downstream.

The Commenter has stated that standards have not been exceeded for protection of aquatic life. EPA must remind the Commenter that standards for protection of aquatic life have not been established for 1,2-dichloroethane and methylene chloride. Furthermore, as discussed above, the standards for consumption of fish and water are ARARs in addition to those established for protection of aquatic life.

3. The PRPs commented that the New Jersey Department of Environmental Protection (DEP) Manasquan River Macroinvertebrate Studies performed during April 1988 and

October 1989 were flawed and reached an inappropriate conclusion by stating that the Lone Pine Landfill is having a substantial impact on biotic communities of the Manasquan River. (References C and F)

EPA Response: The study in question was conducted by DEP and reviewed by the EPA Biological Technical Assistance Group (BTAG). BTAG concluded that the data supported the DEP determination that an adverse impact to the river adjacent to the landfill has occurred. BTAG recommended additional sampling in order to pinpoint the cause of the disturbance to the river.

The Commenters provided the DEP studies to their representative, Dr. Meier, who concluded that the DEP study was flawed and that the data shows no detrimental impact to the river. While not accepting Dr. Meier's conclusion, as the regulatory agency charged with protecting human health and the environment, EPA is obligated to take a conservative approach in interpretation of the data. Consequently, EPA must prevent the continued discharge of hazardous substances to the river, especially considering the presence of a drinking water reservoir downstream of the site. Note that prevention of continued river discharge is only one of the goals of implementing a remedy for Operable Unit II.

Since there is a question as to the disturbance to the river and its causes, EPA is requiring additional surface water and biota monitoring as part of the remedial action.

4. The PRPs commented that current river conditions are not the correct baseline on which to judge impacts of off-site contamination since existing conditions in the river are primarily a result of long-term seepage from the landfill, not ground water discharge. Furthermore, the Commenters state that the no-action alternative is the only choice that can be justified on the basis of surface water quality alone. These Commenters also state that risks associated with river quality will be reduced to negligible levels after implementation of the Operable Unit I remedy (References C and F).

EPA Response: Current river conditions are due to the discharge of leachate via seeps from the landfill, as well as from the discharge of contaminated ground water. As described in the Remedial Investigation (RI) report (S.S. Papadopulos & Associates, Inc., 1990), the rate at which contaminated ground water discharges from the Water Table aquifer into the river adjacent to the site is approximately 8,000 cubic feet per day (this includes about 700 cubic feet per day which leaks into the Water Table aquifer from the Red Bank aquifer). The RI report also points out that most of the mass discharge into the river occurs from the area with the most highly contaminated ground water and calculates that the present mass discharge of VOCs into the river is approximately .11 kilograms per day. As described in the FS report (S.S. Papadopulos & Associates, Inc., 1990), once the Operable Unit I remedy is in place, and in the absence of other

measures, contaminated ground water will continue to discharge into the Manasquan River.

EPA expects that once the Operable Unit I remedy is in place, contaminant discharge from seeps will be eliminated, thus eradicating one of the pathways of contamination to the river. In addition, as concentrations of contaminants in the ground water decrease, (due to the fact the landfill containment system will prevent continued leakage from the landfill into the ground water) EPA expects that contaminant discharge into the river from the ground water will decrease as well.

In the absence of a remedial action other than the Operable Unit I remedy, it was calculated via computer modeling, that it would take approximately 22 years for the Water Table aquifer to reach MCLs and 365 years for the Red Bank aquifer to reach MCLs. Therefore, contrary to Commenters assertions, contaminated ground water (ground water with its current levels of contaminants and unaffected by continued landfill leakage) would continue to discharge to the river. The Operable Unit I remedy will merely prohibit the introduction of new contaminants to the ground water, and will not address the current plume.

In reference to the Commenters' statement that only the no action alternative can be justified on the basis of surface water quality alone, and that risks to the river will be reduced after implementation of the Operable Unit I remedy, EPA reminds the Commenter that under CERCLA, EPA must choose a remedy based upon the consideration and balancing of nine criteria. The no action alternative does not provide the best balance of tradeoffs among the various alternatives. EPA agrees with the Commenters and expects that over time, risk to the river would be reduced if no further action were taken. However, implementation of any alternative, except the no action alternative, would almost immediately eliminate risk to the river as soon as the interceptor trench is operable.

5. The PRPs commented that EPA contradicts itself regarding a future exposure scenario if EPA believes that the first operable unit remedy will decrease concentrations in the river in the future.

EPA Response: As stated in response to Comment E.4., above, EPA acknowledges that, after implementation of the Operable Unit I remedy, contaminant concentrations in the river would be expected to decline over time due to elimination of ground water seeps. However, there is a ground water contaminant plume with significant levels of chemicals in excess of the applicable standards which will not be addressed by the Operable Unit I remedy.

F. General Comments

1. A concerned citizen inquired about the cost of the implemented remedy and who would pay for the system operation. (Reference A)

EPA Response: EPA would initially attempt to reach an agreement with the responsible parties, so that they would bear the cost of the design, construction and operation and maintenance of the selected remedy. If an agreement could not be reached, than the government would utilize federal Superfund monies to design and implement the system, and the costs of operation would be borne by the State of New Jersey. The government would then seek to recover the costs from the responsible parties.

2. A member of the audience wanted to know if any kind of restrictions should be put on the land on the north side of the Manasquan River, such as development or well restrictions. (Reference A)

EPA Response: During the design phase, EPA will recommend the implementation of institutional controls to prohibit well installation within the contaminant plume or in areas where extensive pumping could increase the spread of contamination or interfere with the hydraulic balance required for landfill containment. These controls will be in addition to the active response measures outlined in the Operable Unit I and II RODs. It would then be the responsibility of the State and local governments to enforce such restrictions. The State of New Jersey is currently developing regulations for well restriction zones under the authority of the Safe Drinking Water Act.

3. A meeting attendee requested an additional explanation of the upward gradients in the area around the landfill and near the Manasquan River and how that assures that contamination from the Red Bank aquifer will not migrate downward into the Englishtown aquifer. (Reference A)

EPA Response: Monitoring wells have been installed deeper than the Red Bank. The potentiometric head in these wells is higher than the shallower wells, indicating that the ground water flow is upward. Therefore, contamination is not expected to migrate into the deeper zones. Furthermore, underlying the Red Bank formation is the Navesink formation, a regional aquitard. This formation restricts the movement of ground water to the underlying Englishtown aquifer.

4. A PRP commented that a reasonable remedy with a minimal cost should be selected for the Operable Unit II remedy. (Reference D)

EPA Response: EPA evaluates the remedial alternatives against 9 criteria, only one of which is cost. Based on a detailed evaluation, EPA selects a remedy based on all nine criteria, which are: (1) Overall protection of human health and the environment, (2) Compliance with ARARs, (3) Long-term effectiveness and permanence, (4) Reduction of toxicity, mobility or volume through treatment, (5) Short-term effectiveness, (6) Implementability, (7) Cost, (8) State acceptance, and (9) Community acceptance.

5. A meeting attendee inquired how EPA would treat the contaminant plume to MCLs if there weren't MCLs for every contaminant. (Reference A)

EPA Response: The plume will be extracted and treated prior to reinjection.
The treatment system will be designed such that the effluent meets all ARARs associated with reinjection, which include Federal and State MCLs. Since the treatment system will be designed to remove all volatile organics and metals which do have MCLs, it is expected that all contaminants will be removed to acceptable levels.

6. The Freehold environmental commission commented that community acceptance should be considered first, since it is the citizens living near the site that are most effected.

EPA Response: EPA always seeks public involvement in selecting response actions at Superfund sites. However, according to the law, EPA must follow a certain evaluation procedure for remedial alternatives. The threshold criteria for evaluation are Overall Protection of Human Health and the Environment, and Compliance With ARARs. Any remedy selected must be protective and must comply with ARARs. Then, EPA evaluates the balancing criteria, which are Long-term Effectiveness and Permanence, Reduction of Toxicity, Mobility or Volume through Treatment, Short-term Effectiveness, Implementability, and Cost. These five criteria are used to compare the remedial alternatives which satisfy the threshold criteria. Finally, Community Acceptance and State Acceptance are used as the two modifying criteria. The modifying criteria are used to further evaluate public and state acceptance of the remedy EPA proposes.

The community's concerns are important. EPA is required to select a remedy that meets all of the threshold requirements, provides the best balance of tradeoffs among the balancing criteria, and considers the community's concerns as modifying criteria.

References:

A. Transcript from Public Meeting, August 1, 1990

B. Written comments submitted by the Township of Freehold, dated September 13, 1990

C. Written Comments submitted by Mott, Pearce, Williams, & Lee on behalf of Minnesota Mining and Manufacturing Co., dated September 13, 1990

D. Written Comments submitted by Cerrato, Dawes, Collins, Saker & Brown on behalf of Guardian, Inc., dated August 16, 1990

E. Written comments Submitted by T.J. Blanchet, received September 13, 1990

F. Written comments submitted by Sidley & Austin on behalf of a group of thirty-seven potentially responsible parties, dated September 14, 1990

EXHIBIT 2

LONE PINE LANDFILL SITE
OPERABLE UNIT II
RECORD OF DECISION

Alternative Summary

REMEDIAL ALTERNATIVE	TIME FRAME	INITIAL COST ESTIMATE	CDM-FPC COST ESTIMATE
1. No Further Action	365 yrs	$676,951	$720,333
2. Interceptor Drain	315 yrs	$6,965,176* $10,251,099	$7,797,271* $11,451,828
3. Interceptor Drain & Injection Wells	255 yrs	$8,364,985	$9,893,047
4. Interceptor Drain & Estraction Wells	195 yrs	$7,320,222* $11,030,356	$8,246,886* $12,351,443
5. Interceptor Drain, Extraction and Injection Wells	165 yrs	$8,743,829	$10,267,661
6. Interceptor Drain, Extraction and Injection Wells	19 yrs	$20,784,979	$23,237,241

* denotes discharge to river

TABLE 1 - CAPITAL COSTS ($ 000)

DESCRIPTION	INITIAL COST	USEFUL LIFE	ALT 1		ALT 2 RIVER DIS.		ALT 2 POTW DIS.		ALT 3		ALT 4 RIVER DIS.		ALT 4 POTW DIS.		ALT 5		ALT 6	
			INIT	REPL	INIT	REPL	INIT	REPL	INIT	REPL	INIT	REPL	INIT	REPL	INIT	REPL	INIT	REPL
I WELLS																		
(A) 4 SHALLOW MONITORING	16.8	15																
2 DEEP MONITORING	15.4	15																
	32.2		32.2	10.1	32.2	10.1	32.2	10.1	32.2	10.1	32.2	10.1	32.2	10.1	32.2	10.1	32.2	7.7
(B) 21 INJECTION	975.8	10							975.8	612.3					975.8	612.3		
27 INJECTION	1,764.0	10															1,764.0	680.1
3 EXTRACTION	128.8	10									128.8	80.8	128.8	80.8	128.8	80.8		
56 EXTRACTION	3,035.2	10															3,035.2	1,170.2
II TREATMENT SYSTEM																		
(A) STRIPPING TOWER	168.0	15																
BLOWERS	28.0	15																
EXCAVATION, RESTORE	56.0	15																
PUMPING SYSTEMS	63.0	15																
PIPING	91.0	15																
	406.0				406.0	127.8	406.0	127.8	406.0	127.8	406.0	127.8	406.0	127.8	406.0	127.8		
(B) FILTER	203.0	20																
GAC FILTER	231.0	20																
CHEMICAL FEED	49.0	20																
METALS REMOVAL SYSTEM	350.0	20																
	833.0				833.0	145.4	833.0	145.4	833.0	145.4	833.0	145.4	833.0	145.4	833.0	145.4		
(C) EQUALIZATION TANK	112.0	30																
CLEAR WELL	63.0	30																
ELECTRIC & CONTROL	105.0	30																
	280.0				280.0	17.0	280.0	17.0	280.0	17.0	280.0	17.0	280.0	17.0	280.0	17.0		
(D) BUILDING	350.0	45			350.0	4.9	350.0	4.9	350.0	4.9	350.0	4.9	350.0	4.9	350.0	4.9		
(E) PLANT @ 750 GPM	4,816.0																4,816.0	
III INTERCEPTOR DRAIN																		
(A) MOBILIZATION/DEMOB	49.0	15																
HEALTH & SAFETY	67.2	15																
TRENCHING	235.2	15																
DRAIN PIPE, FILTER FABRIC	98.0	15																
GRANULAR BACKFILL	126.0	15																
COLLECTION SUMPS & MANHOLES	56.0	15																
PUMPS, CONTROLS AND POWER	30.8	15																
FORCEMAIN TO TREATMENT	126.0	15																
SITE RESTORATION	6.2	15																
	792.6				792.6	269.6	792.6	[illegible]	792.6	269.6	792.6	269.6	792.6	269.6	792.6	269.6	792.6	[illegible]

TABLE 1 - CAPITAL CO[illegible]000)

DESCRIPTION	INITIAL COST	USEFUL LIFE	ALT 1 INIT	ALT 1 REPL	ALT 2 RIVER DIS. INIT	ALT 2 RIVER DIS. REPL	ALT 2 POTW DIS. INIT	ALT 2 POTW DIS. REPL	ALT 3 INIT	ALT 3 REPL	ALT 4 RIVER DIS. INIT	ALT 4 RIVER DIS. REPL	ALT 4 POTW DIS. INIT	ALT 4 POTW DIS. REPL	ALT 5 INIT	ALT 5 REPL	ALT 6 INIT	ALT 6 REPL
IV RECHARGE TRENCH																		
(A) TRENCHING	56.0	15																
DRAIN PIPE, FILTER FABRIC	63.0	15																
GRANULAR BACKFILL	31.5	15																
MANHOLES	56.0	15																
PUMPS	31.5	15																
FORCEMAIN FROM TREATMENT	63.0	15																
	301.0								301.0	94.7					301.0	94.7	301.0	72.1
V EFFLUENT DISCHARGE SYSTEM																		
(A) DUAL PUMP SYSTEM	42.0	15																
6 INCH FORCEMAIN SYSTEM	693.0	15																
	735.0						735.0	231.3					735.0	231.3				
(B) EFFLUENT HOLDING TANK	56.0	30																
ELECTRICAL SERVICE	14.0	30																
	70.0						70.0	4.3					70.0	4.3				
(C) DISCHARGE TO RIVER	70.0	15			70.0	22.0	0.0	0.0			70 0	22.0	0.0	0.0				
PRESENT VALUE INITIAL & REPLACEMENT			32.2	10.1	2,763.6	576.7	3,498.6	790.2	3,970.4	1,261.6	2,892.4	657.5	3,627.4	871.0	6,099.2	1,342.5	10,740.8	2,119.8
TOTAL PRESENT VALUE CAPITAL COSTS				42.3		3,340.3		4,288.8		5,232.0		3,549.9		4,498.4		5,441.7		12,860.6

TABLE 2 - OPERATION & MAINTENANCE COSTS ($ 000)

DESCRIPTION	INITIAL COST	ALT 1	ALT 2 RIVER	ALT 2 POTW	ALT 3	ALT 4 RIVER	ALT 4 POTW	ALT 5	ALT 6
I QUARTERLY SAMPLING									
(a) Collection	1.2								
(b) Analysis 6 @ $250/sample	1.5								
(c) Water Level Measurement	1.0								
(d) Report	2.0								
Cost Per Event	5.7								
Annual Cost	22.8	22.8	22.8	22.8	22.8	23.6	23.6	22.8	31.2
II ANNUAL SAMPLING									
(a) Collection	5.0								
(b) Analysis 30 @ $800/sample	24.0								
Annual Cost	29.0	29.0	29.0	29.0	29.0	29.8	29.8	29.0	49.0
III INTERCEPTOR DRAIN SAMPLING		0.0	11.8	11.8	11.8	11.8	11.8	11.8	11.8
IV EXTRACTION WELL SAMPLING		0.0	0.0	0.0	0.0	9.5	9.5	9.5	168.0
V GENERAL O&M		1.0	25.6	25.6	46.0	33.6	33.6	48.0	117.0
VI TREATMENT PLANT O&M		0.0	311.5	311.5	311.5	311.5	311.5	311.5	813.5
VII EFFLUENT DISCHARGE O&M		0.0	10.0	280.4	0.0	10.0	325.6	0.0	0.0
VIII ANNUAL REPORT		15.0	35.0	35.0	45.0	40.0	40.0	50.0	70.0
TOTAL ANNUAL COSTS		67.8	445.7	716.3	466.1	469.7	785.3	482.6	1,240.5
PRESENT VALUE O&M COSTS		678.0	6,657.0	7,163.0	6,661.0	6,697.0	7,853.0	6,826.0	10,376.7

TABLE 3 - PRESENT VALUE SUMMARY

DESCRIPTION	ALT 1	ALT 2 RIVER	ALT 2 POTW	ALT 3	ALT 4 RIVER	ALT 4 POTW	ALT 5	ALT 6
CAPITAL COSTS	42,333	3,340,271	4,288,828	5,232,047	3,549,886	4,498,443	5,441,662	12,860,558
O&M COSTS	678,000	6,657,000	7,163,000	6,661,000	6,697,000	7,853,000	6,825,999	10,376,683
TOTAL PRESENT VALUE ALL COSTS	720,333	7,797,271	11,451,828	9,893,047	8,246,886	12,351,443	10,267,661	23,237,241