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EPA Superfund Record of Decision:

Higgins Disposal Site OU 1
Kingston, NJ
9/30/1997

RECORD OF DECISION

Higgins Disposal Site

Franklin Township, Somerset County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York
September 1997

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Higgins Disposal Site
Franklin Township, Somerset County, New Jersey

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) documents the U.S. Environmental Protection Agency's selection of a remedial action to address groundwater contamination at the Higgins Disposal Site, in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §9601-9675, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300. This decision document explains the factual and legal basis for selecting the remedy for the Site.

The New Jersey Department of Environmental Protection (NJDEP) concurs with the selected remedy for groundwater remediation. However, the NJDEP does not concur with EPA's position of no further action for the soils. A copy of the concurrence letter can be found in Appendix IV. The information supporting this remedial action is contained in the Administrative Record for the Site, the index of which can be found in Appendix III to this document.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Higgins Disposal 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 THE SELECTED REMEDY

The selected remedy represents the first and only planned remedy for the Higgins Disposal Site. It addresses both contaminated groundwater and threats to downgradient receptors. The additional removal of contaminated soils and other materials will be the subject of a separate action.

The selected remedy includes the following components:

- Remediation of contaminated groundwater to Federal and State Maximum Contaminant Levels and also to groundwater quality standards promulgated by the State of New Jersey.

- Installation of on-site wells for the extraction of the contaminated groundwater.

- Conveyance of the extracted groundwater via a pipeline to the Higgins Farm Superfund Site for treatment, with discharge to surface water.

- If necessary, the on-site groundwater treatment system at the Higgins Farm Site will be enhanced through the addition of granular activated carbon.

- Connection of the ten neighboring residents on Laurel Avenue who use private well water to a public water supply. Public water would also be provided to the Higgins family. This would be accomplished through the extension of the existing Elizabethtown Water Company pipeline.

- Implementation of an environmental monitoring program to ensure the overall effectiveness of the remedy.

- Five-year reviews of the Site pursuant to CERCLA.

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. The remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This action constitutes the final remedy for the Site.

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

Jeanne M. Fox
Regional Administrator

9/30/97
Date

RECORD OF DECISION

DECISION SUMMARY

Higgins Disposal Site

Franklin Township, Somerset County, New Jersey

United States Environmental Protection Agency
Region II
New York, New York
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SITE NAME, LOCATION AND DESCRIPTION

The Higgins Disposal Site (Site) is located in a rural area on Laurel Avenue (Kingston-Rocky Hill Road) in Kingston, Franklin Township, Somerset County, New Jersey (Figure 1). The Site is 37 acres in area, and is bordered by Laurel Avenue and the Trap Rock Industries' Kingston Quarry. This quarry mines rock known as diabase. The Millstone River and the Delaware and Raritan Canal are located within a half mile to the southwest, while Route 518 is approximately one mile north-northeast of the Site. The Higgins Farm Superfund Site is located approximately 1.5 miles northeast of the Site.

Approximately 1,300 persons reside within one mile of the Site. The Site is located in a Research-Office-Laboratory zoning district on the Franklin Township zoning map. However, there is also agricultural activity within three miles of the Site which includes crop cultivation for sod, animal feed, and fruits and vegetables grown for human consumption.

Within a three-mile radius of the Site, groundwater is used as a drinking water source. Within this radius, there are approximately 179 private wells in Franklin Township, Somerset County; approximately 51 private wells in South Brunswick, Middlesex County; and the Rocky Hill Municipal Wells in Somerset County.

A residence and two businesses currently exist on the Site; the Hasty Acres Riding Club (horse stables and riding facilities) and a vehicle repair garage. As shown on Figure 1, the Higgins residence is located on the west side of the property off of Laurel Avenue. A barn (stable) and several sheds are located in the north central section of the property. East of the barn is a vehicle maintenance building. A large indoor equestrian center is located in the central portion of the property. A waste transfer station and compactor shed are to the south of the indoor equestrian center. An inactive landfill is located southeast of the transfer station. Numerous old vehicles and roll-off containers are scattered along the access road to the landfill. Two ponds are located in the northern part of the property. Additionally, the Dirty Brook and an unnamed brook are located along the northern and southern property boundaries, respectively. There are also three minor wetland systems located in the northwestern and southern sections of the Site, which have a cumulative acreage of less than 0.5 acre.

The Site is relatively flat with minor topographic relief. The highest elevation is approximately 120 feet above mean sea level, and occurs near the center of the Site. From the center, the surface topography slopes downward to the north toward Dirty Brook, and downward to the south toward the unnamed brook. Storm water drainage generally follows the surface topography, as there are no storm sewers to redirect the flow. The two ponds at the north end of the property receive overland stormwater flow from portions of the property, and discharge into Dirty Brook.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

Site History

From the 1950's through 1985, Higgins Disposal Services, Inc. operated as a residential, commercial, industrial and construction waste disposal service. The operation included a transfer station and compactor, an underground storage tank, a truck storage area, a shop and garage for truck repair, an area for container storage and a landfill. As described below, solid waste containing hazardous substances were disposed in several locations on the Site.

In 1982, Higgins Disposal Services, Inc. came to the attention of the New Jersey Department of Environmental Protection (NJDEP) when the landfill and waste transfer station were discovered to be operating without appropriate permits. NJDEP issued an Administrative Order to the company in October 1982 requiring compliance with State landfill and transfer station regulations.

In 1985, the owner of several residences on Laurel Avenue contacted the Franklin Township Health Department (FTHD) and the NJDEP because of medicinal tasting tap water. Sampling of these wells by the FTHD and the NJDEP revealed the presence of various volatile organic compounds (VOCs). NJDEP investigated the area to determine the source of the tap water contamination and Higgins Disposal Services, Inc. was identified as one of the potential source areas. All residences on Laurel Avenue without access to the public water supply were notified by NJDEP or FTHD to use bottled water and/or to install a whole-house point source filter system. In 1986, NJDEP also instituted an Interim Well Restriction Area in this location (i.e., the State restricted the installation of wells for potable use) and began negotiations with the Township and the water company to install a waterline. Such negotiations continued unsuccessfully until approximately 1993. It should be noted that eight of the eleven residences on Laurel Avenue have whole-house point source filter units. Three residences do not have such units; however, analysis of their water did not indicate a need for these units. Currently, there is a 12-inch diameter water line that runs along Laurel Avenue, but ends approximately 500 feet south of the residential properties.

The Site was proposed to the Superfund National Priorities List (NPL) on June 24, 1988. In August 1990, the Site was added to the NPL which made it eligible for funding under the Superfund remedial program. The U.S. Environmental Protection Agency (EPA) initially performed a Removal Assessment at the Site to determine if any emergency response actions were warranted prior to implementation and/or completion of long-term remedial investigation field work and study.

In October 1990, as part of the Removal Assessment, EPA's Environmental Response Team (ERT) collected shallow soil and pond sediment samples from selected areas across the Site that were easily accessible to customers of the Hasty Acres Riding Club. The only immediate problem found was in the Beginners' Riding Ring. Polychlorinated biphenyls (PCBs) were found in the range of 1.2 to 47 parts per million (ppm) in the surface soil of the ring. This contamination is believed to have been the result of the movement of PCB-contaminated soil from the indoor riding ring subsequent to a fire inside the indoor riding ring, in which lighting with PCB ballast dropped to the ground. EPA restricted access to the ring and then excavated and disposed of 765 tons of PCB-contaminated soil. The contaminated soil was shipped to a Toxic Substances Control Act permitted landfill in Grandview, Idaho. No other easily accessible surface locations on the property were found to pose an immediate health concern.

In the spring of 1990, EPA began a Remedial Investigation (RI) to determine the nature and extent of contamination at the Site. In the spring of 1993, during the course of the RI field work, an additional removal action was initiated upon discovery of buried waste in a field on the property, south of the landfill. Initially, only drums were discovered (as EPA had conducted a survey using a probe which could detect metal). Upon test pit excavation work, laboratory glassware and plastic containers were discovered in addition to the drums. The test pits confirmed the presence of hazardous substances in containers and soil in several locations on the Site which were largely near the surface and in areas in an active portion of the Hasty Acres Riding Club. Because this contamination posed a significant threat of potential exposure to the riders and horses, the Agency for Toxic Substances and Disease Registry (ATSDR) recommended immediate placement of warning signs and immediate access restrictions. Therefore, the first phase of this removal action was the placement of warning signs and a fence to prevent access to this area. This fence was erected in May 1993.

The second phase of this removal action was another subsurface survey using different instrumentation to search for additional non-metallic buried waste as well as other buried waste not discovered during the first metallic survey. This survey was conducted in the summer of 1993. After analysis of the results, EPA excavated areas of known and suspected burial in April, 1994. Some locations were found to be clean, while others contained a great deal of buried waste; corroded and leaking containers as well as glass bottles and vials, some empty and some containing material.

By October 1994, approximately 3,200 containers and 850 tons of contaminated soil (other than the soil from the Beginners' Riding Ring) had been excavated and transported off-site for disposal at permitted disposal facilities. In addition, to ensure that all areas used to bury waste were identified, additional test trenching activities were planned. Additional trenching areas were selected through biased and random sampling techniques. Biased sampling locations were selected based upon visual observations, information on past dumping practices revealed through an eyewitness account, through the patterns discovered during the excavation work, and information from historical aerial photographs of the Site. Random locations were selected using a random number generator table and grid system. This additional test trenching was initiated in November 1994. Nine trenches were excavated to a depth of eight feet. No waste materials were encountered in any of these trenches.

During excavation of one additional test trench along a vegetated fence line, additional buried waste (a 55-gallon drum, two 5-gallon plastic lab jugs, a 40 milliliter (ml) vial, and a bag of resinous white material) was encountered. This waste appeared to similar to the wastes previously excavated. In late November 1994, additional excavation work was initiated as part of EPA's removal activities. Work continued dependent upon weather conditions throughout 1995 and 1996, and an approximate total of 7,000 containers and 12,000 tons of contaminated soil to date have been excavated and shipped for off-site disposal at a permitted disposal facility.

Post-excavation sampling in the summer of 1996 revealed the presence of additional waste containers near the previously defined edge of the landfill. In order to supplement the investigatory work that was performed during the RI and to confirm whether or not hazardous substances were present in the landfill, a more comprehensive investigation of the landfill area was performed in the fall of 1996. This investigation revealed laboratory containers, drums and a compressed gas cylinder within the landfill area. Based on these investigatory activities, EPA believes that the landfill contains an estimated 16,200 cubic yards of solid waste mixed with hazardous substances. Additionally, an estimated 8,500 cubic yards of contaminated soil lies beneath the landfill itself. EPA is planning another removal action to excavate and properly dispose of the material in the landfill. It should be noted that the removal of both the material from within the landfill and any underlying contaminated soil is an activity which is separate from the selected remedy described in this document.

Enforcement Activities

EPA issued Notice Letters to potentially responsible parties (PRPs) on November 1, 1988, which offered the PRPs an opportunity to conduct or finance removal activities, the RI and the Feasibility Study (RI/FS), and the remedial design and remedial action at the site. EPA again offered the opportunity to PRPs to undertake these response activities by issuing Special Notice Letters on March 27, 1989. Notice Letters were also issued on March 28, 1990 (for conducting or financing removal activities, the RI/FS, and the remedial design and remedial action), August 28, 1992 (for performance of removal activities), March 16. 1994 (concerning EPA's decision not to offer the PRPs the opportunity to perform removal activities), and September 20, 1996 (providing information concerning EPA's remedial and removal activities). No PRPs came forth to conduct or finance response activities, or to reimburse EPA for its costs in response to those letters.

In May 1997, EPA met with several PRPs and is currently pursuing the option of having a PRP perform removal activities associated with the landfill.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI/FS report, the Proposed Plan and supporting documentation were made available to the public in the administrative record file at the Docket Room in EPA Region II, 290 Broadway, New York, New York and the information repositories at the Mary Jacobs Memorial Library (64 Washington Street, Rocky Hill, New Jersey) and the Franklin Public Library (485 DeMott Lane, Somerset, New Jersey). The notice of availability for the above-referenced documents was published in the *Home News and Tribune* on May 1, 1997. The public comment period which related to these documents was initially held from May 1, 1997 to May 30, 1997.

On May 20, 1997, EPA conducted a public meeting at the Franklin Township Municipal Building. The purpose of this meeting was to inform local officials and interested citizens about the Superfund process, to review planned remedial activities at the site, to discuss and receive comments on the Proposed Plan, and to respond to questions from area residents and other interested parties. Based upon a request by the community at the public meeting, the public comment period was extended to June 30, 1997.

Responses to the comments received at the public meeting and in writing during the public comment period are included in the Responsiveness Summary, which is appended to this Record of Decision (see Appendix V).

SCOPE AND ROLE OF OPERABLE UNIT

This is the first and only operable unit at this Site. The primary objectives of the selected remedy are to capture and treat the bulk of groundwater contamination found on the property, to limit potential future off-site migration of contamination, and to protect potential users of groundwater through extension of (and connection to) municipal water service.

Many residents in the vicinity of the Site, as well as the residents on the Site depend on groundwater as a potable water source. Although most residents on Laurel Avenue have installed household carbon treatment units, there remains the potential for contaminated groundwater to migrate to other residential wells. Exposure to the contaminated groundwater could pose a threat to residents who currently utilize groundwater as their potable water supply or residents who will utilize groundwater in the future. Therefore, action is necessary to restrict migration of contaminants and to protect nearby groundwater users.

Under a separate removal action, EPA is planning to remove and dispose of highly contaminated source materials found in the on-site landfill. Aside from this action, EPA believes that exposure to Site soils, surface water, and sediment does not pose a significant risk. Therefore, EPA has determined that no further action is considered necessary for soils, surface water and sediment.

SUMMARY OF SITE CHARACTERISTICS

RI field work commenced in October 1992. The purpose of the RI was to accomplish the following: identify the nature and extent of contaminant source areas; define contamination of groundwater, soils, surface water and sediment; characterize Site hydrogeology; and determine the risk to human health and the environment posed by the Site. The work was conducted by Malcolm Pirnie, Inc., under contract to EPA.

The results of the RI can be summarized as follows.

Hydrogeology & Groundwater Contamination

The geology of the Site is characterized by unconsolidated material (e.g., sand) underlain by fractured bedrock. The region surrounding the Site is underlain by sedimentary and igneous rocks of the late Triassic-early Jurassic Age Newark Supergroup and late Cretaceous and Quaternary age sediments. Bedrock in the region consists of sedimentary units of the upper Lockatong Formation and lower Passaic Formation of late Triassic age and intrusive igneous diabase of early Jurassic age. The Site itself is underlain by unconsolidated overburden deposits ranging in thickness from approximately 15 feet to approximately 84 feet. These deposits vary in composition from clayey silt to sand. Below the overburden is a thick unit of red siltstone interpreted as the red beds of the Lockatong Formation. An apparent graben structure (i.e., an area that has subsided between two geologic faults) occurs along the center of the Site in a north-south orientation.

As described above, the Site is relatively flat with the highest elevation occurring near its center. From the center, the surface topography slopes downward to the north toward Dirty Brook, and downward to the south toward the unnamed brook. Storm water drainage generally follows the surface topography, as there are no storm sewers to redirect the flow. The two ponds at the north end of the property receive overland stormwater flow from portions of the property, and discharge into Dirty Brook. Both the Dirty and unnamed brooks discharge to the Delaware and Raritan Canal.

Groundwater in the area is classified by the State as Class II-A, which indicates that groundwater is suitable for potable water supply at current levels of water quality and conventional treatment. Groundwater occurs both in the sandy overburden and in the underlying fractured bedrock aquifer. Regionally, groundwater flow is to the southwest towards the Delaware and Raritan Canal and the Millstone River.

On the Site, the depth to groundwater ranges from approximately 4 to 56 feet below ground surface. As described below, groundwater in both the overburden and the fractured bedrock is contaminated with volatile organic compounds, or VOCs (e.g., chloroform, tetrachloroethene and trichloroethene) and inorganics (e.g., lead, copper and chromium), although semivolatile organic compounds, or SVOCs (e.g., 1,2-dichlorobenzene), pesticides (e.g., 4,4'-DDE) and PCBs were likewise detected. Groundwater in the overburden flows west, northwest and southwest away from the landfill and buried waste disposal areas. The general flow direction is apparently influenced by the pumping of the Higgins' residential well except to the south of the waste disposal areas (Figure 2). Groundwater flow in the bedrock is affected by bedrock fractures; however, in the shallow bedrock flow is likewise influenced by the Higgins' residential well (Figure 3).

The Higgins' residential well has been in operation since 1993, is at least 300 feet deep, and pumps approximately 4 to 5 gallons per minute. Prior to 1993, the Higgins utilized a different water supply well which would have had a different effect on the hydrology (since it was set in a different location on the property). The current residential well does not pump at a constant rate over a constant period of time. Its pumping is dependent upon the various and changing needs of the Higgins' household and the Hasty Acres Riding Club. Therefore, its level of influence on the hydrology underlying the Site varies over time.

EPA collected groundwater samples from eighteen monitoring wells installed on the Site. Of the 65 chemical constituents detected in groundwater underlying the Site, 34 of the chemicals were detected in concentrations that exceed the New Jersey groundwater quality standards. The most significant exceedances occur for VOCs, where 17 of the 21 VOCs detected exceed the standards. For example, chlorobenzene was detected at a level of 3,100 parts per billion (ppb), while the standard is 4 ppb; trichloroethene was found at 2,200 ppb, and the standard is 1 ppb. Other exceedances occur for 1,2-dichlorobenzene and 1,4-dichlorobenzene, which are SVOCs. These chemicals were respectively found at levels of 1,800 ppb and 89 ppb, while the respective standards are 600 ppb and 75 ppb. Other exceedances occurred for three pesticides and eleven metals (e.g., arsenic was found at 35.5. ppb while the standard is 8 ppb; lead was detected at 115 ppb while the standard is 10 ppb). Table 1 provides a summary of the groundwater data collected from on-site monitoring wells.

Chemicals detected in the groundwater beneath the Higgins' property were also detected in neighboring residential wells(see Figure 4 for residential sampling locations), some present above Federal and State s. For example, Table 2 provides the results of residential sampling performed on August 10, 1993.

Concentrations of VOCs as high as 26 ppb carbon tetrachloride, 200 ppb tetrachloroethylene and 22 ppb 1,1,2-trichloroethane were found in the samples. The VOCs and SVOCs detected in the groundwater are similar to those chemical constituents detected at the drum/container disposal areas and therefore are likely to have been derived from the drum/container disposal source area.

In summary, 1) Contaminants found in groundwater underlying the Site have also been found in wells on other residential properties. The pattern of contamination, along with the natural regional shallow groundwater flow regime suggests that the source of these contaminants is the buried waste area on the Site; 2) Water level data obtained from the on-site overburden and bedrock monitoring wells during the RI field work indicate that the current Higgins' supply well influences groundwater flow on the Higgins' property. Therefore, it is likely that only a limited migration of organic and inorganic contaminants has occurred since the operation of this Higgins' well (1993); and 3) EPA's past and planned removal actions have removed and will continue to remove the source of contamination to the groundwater (the buried waste and associated contaminated soil).

__Indoor Riding Ring Surface Soil__

Seven surface soil samples (six samples plus one duplicate sample) were collected at six locations in the indoor riding ring (see Table 3). Of the samples collected, VOCs were detected in all seven samples. For example, acetone was found to vary from 6 to 9 ppb, while tetrachloroethene varied from 5 to 22 ppb. SVOCs were detected in all samples except one, with diethylphthalate being detected at 1,100 ppb and total polycyclic aromatic hydrocarbons being found at levels ranging from 1.0 to 2.9 ppm. PCBs were found to vary from 0.18 to 7.5 ppm, while metals were detected in all the samples. Examples of metals which were found include: chromium (ranging from 5 to 12 parts per million, or ppm); arsenic (ranging from 1.3 to 1.5 ppm); and copper (ranging from 18 to 33 ppm).

As described below, the results of the Risk Assessment indicate that the potential contaminant exposure to indoor surface soils is less than or within EPA's acceptable risk range.

Outdoor Soil

Surface Soil

Outdoor surface soil samples were collected at 52 locations (see Figures 5 and 6) in four main areas. Twenty samples were collected in the area of the landfill, eleven samples (10 samples plus one duplicate sample) were collected in the area of the transfer station, eight samples were collected in the area of the vehicle maintenance building, and fifteen samples (including one duplicate sample) were collected from open field areas of the Site. A summary of the analytical results can be found in Table 4.

In general, VOCs were found in approximately 15 percent of the samples, with acetone exhibiting the highest VOC concentration at 0.16 ppm. SVOCs were found in approximately 94 percent of the samples, with total polycyclic aromatic hydrocarbons detected at levels as high as 301.6 ppm. Pesticides were found in approximately 67 percent of the samples (with 4,4'-DDD having the highest concentration at 0.33 ppm), while PCBs were found in approximately 72 percent of the samples with the highest concentration at 22 ppm.

The concentrations of the contaminants in outdoor surface soils are generally low and may have been distributed across the Site by mechanical means (e.g., wind, tractor) rather than direct deposition (e.g., dumping of waste as in the fields used for waste burial). As explained in the risk assessment section, below, the results of the risk assessment indicate that the risk from exposure to outdoor surface soils is less than or within EPA's acceptable risk range. However, because of one elevated and anomalous detection of lead, 13 additional soil samples in the transfer station area were taken in the fall of 1996. The highest concentration of lead detected in the thirteen samples was 69.2 ppm, well below the Federal screening level (and State Soil Cleanup Criteria) of 400 ppm. Arsenic was also deemed problematic in this area by NJDEP because of one detection of 33.8 ppm during the RI sampling event, which is above the State's criterion of 20 ppm. The highest concentration of arsenic found in the fall 1996 sampling event was 3.9 ppm, well below the State's criterion.

Subsurface Soil

Numerous chemical constituents were detected in the subsurface soils at the various sampling locations (see Table 5). Overall, it appears that the metals are ubiquitous, as virtually every subsurface sample detected the same metal constituents in the same relative range of concentrations. For example, aluminum was found to vary from 1,230 to 78,000 ppm, while iron ranged from 6,090 to 57,500 ppm. The subsurface borings in the landfill had the highest detection of VOCs and SVOCs. For example, acetone was detected at 0.54 ppm; 1,1,1-trichloroethane was found at 58 ppm; the vinyl chloride level was determined to be 0.27 ppm; carbazole was present at 0.21 ppm; and 4-methylphenol was found at 18 ppm. Few VOCs or SVOCs were detected in the location with the underground storage tank (UST) and in the monitoring well borings. As an example, acetone was detected at 0.095 ppm, while methylene chloride was found at only 0.004 ppm.

It should be noted that subsequent to the RI, the landfill was found to contain significant amounts of hazardous substances mixed with solid waste. As indicated previously, the landfill contents and any underlying contaminated soil will be excavated and disposed of through a separate removal activity.

Surface Water

Twelve surface water samples were collected. The samples were taken from Dirty Brook, the unnamed brook, the on-site ponds, and from the Delaware and Raritan Canal (see Table 6). The majority of the chemical constituents detected in the surface waters were metals. For example, aluminum was detected at 8,200 ppb; arsenic was present at 5.2 ppb; beryllium was found at 0.55 ppb; chromium was present at 25.6 ppb; copper was detected at 22 ppb; and lead and manganese were found at 15.4 ppb and 1,830 ppb, respectively. In addition, VOCs (e.g., trichloroethene at 1 ppb), SVOCs (e.g., bis (2-ethylhexyl)phthalate at 3 ppb) and a pesticide (e.g., gamma chlordane at 0.02 ppb) were found in surface water.

Sediments

Thirteen sediment samples were collected from Dirty Brook, the unnamed brook, the on-site ponds, and from the Delaware and Raritan Canal. Table 7 provides a summary of the analytical data. VOCs (such as acetone at 0.044 ppm and methylene chloride at 0.004 ppm), SVOCs (e.g., 2-butanone at 0.012 ppm and bis (2-ethylhexyl)phthalate at 0.055 ppm) and pesticides (such as aldrin at 0.0059 ppm and gamma-chlordane at 0.0098 ppm) were detected. The majority of the chemicals detected were metals. Examples of metals found in sediments include aluminum at 31,600 ppm, arsenic at 9.6 ppm, beryllium at 1.2 ppm, chromium at 164 ppm, copper at 122 ppm, lead at 39.8 ppm, manganese at 1,130 ppm and zinc at 106 ppm. This is consistent with the range of metals detected elsewhere on the Site.

SUMMARY OF SITE RISKS

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future Site conditions. The baseline risk assessment estimates the human health and ecological risk which could result from the contamination at the Site if no remedial action were taken.

Human Health Risk Assessment

To perform a Human Health Risk Assessment, the reasonable maximum human exposure is evaluated. A four-step process is then utilized for assessing site-related human health risks for a reasonable maximum exposure scenario: *Hazard Identification*-- identifies the contaminants of concern at the Site based on several factors such as toxicity, frequency of occurrence, and concentration. *Exposure Assessment*-- estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well-water) by which humans are potentially exposed. *Toxicity Assessment*-- determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). *Risk Characterization*-- summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-a-million excess cancer risk) assessment of site-related risks.

The baseline risk assessment began with selecting contaminants of concern which would be representative of Site risks (see Table 8). The evaluation identified numerous contaminants of concern in the various media (outdoor surface soil, indoor surface soil, outdoor subsurface soil, air, surface water, sediment, and groundwater). For example, contaminants of concern selected for groundwater included: acetone; benzene; carbon tetrachloride; chlorobenzene; 1,2-dichloroethane; toluene; 1,1,2-tetrachloroethane; xylenes; vinyl chloride; several pesticides; manganese; mercury; arsenic; chromium; lead; and nickel. Several of the contaminants of concern listed above are known or suspected of causing cancer in animals and/or humans. The baseline risk assessment then evaluated the health effects which could result from exposure to contamination as a result of various exposure pathways including: 1) ingestion of chemicals in soil; 2) dermal contact with chemicals in soil; 3) inhalation of volatile chemicals released from soil; 4) inhalation of chemicals sorbed to respirable particulates released from soil; 5) dermal contact with chemicals in groundwater; 6) ingestion of chemicals in groundwater; 7) inhalation of chemicals in groundwater volatilized to air; 8) dermal contact with chemicals in surface water; 9)ingestion of chemicals in surface water; 10) dermal contact with chemicals in sediment; 11) ingestion of chemicals in sediment.

In the exposure assessment, the potential for human exposure to the chemicals of concern, in terms of the type, magnitude, frequency, and duration of exposure, is estimated. The assessment is made for potentially exposed populations at or near the property considering both the current situation and potential future conditions. Since residential and commercial activities take place on the property currently, all of the exposure scenarios evaluated are regarded as "current" scenarios that will continue in the future. Please see Table 9 for a listing of exposure pathways.

Six potential receptors were identified: 1) stable employees; 2) garage employees; 3) clients or visitors of the Hasty Acres Riding Club; 4) landscape or utility workers that may occasionally work on the property; 5) residents (both on-site and neighboring residents); and 6) trespassers. Adult and child age groups are included in client/visitor and resident populations. Exposure intakes (doses) were calculated for each receptor for all pathways considered.

Potential carcinogenic risks are evaluated using the cancer slope factors developed by EPA for the contaminants of concern. Cancer slope factors (Sfs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals (see Table 10). Sfs, 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 a conservative estimate of the risks calculated from the SF. Use of this approach makes the underestimation of the risk highly unlikely.

For known or suspected carcinogens, EPA considers excess upper-bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has not greater than approximately a one in ten thousand to one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under the specific exposure conditions at a site.

The risk characterization showed that cancer risks associated with the groundwater pathways exceed EPA's acceptable risk range for both adults and children. For example, the estimated cancer risk associated with ingestion of groundwater is $3x10^{-3}$ (i.e., three in a thousand) for an adult resident, $1x10^{-3}$ (i.e., one in a thousand) for a child resident, $6x10^{-4}$ (i,e, six in ten thousand) for garage employees and $9x10^{-4}$ (i.e., nine in ten thousand) for stable employees. The total cancer risk posed by groundwater, from all pathways considered, is $5x10^{-3}$ (i.e., five in a thousand) for adults and $2x10^{-3}$ (i.e., two in a thousand) for child residents. Tetrachloroethene, vinyl chloride, chloroform, 1,1-dichloroethene, 1,1,2,2-tetrachloroethane, arsenic, beryllium and PCBs are the predominant contributors to the estimated cancer risk. As indicated previously, eight of the eleven residences have whole-house point source filter units which, if properly maintained, prevent the ingestion of VOCs and further mitigate the potential for human exposure via inhalation of VOCs through household use. Three residents do not have such units, but analysis of their water did not indicate a health risk.

The other receptors/exposure routes, which include exposure to soils, sediment and surface water, have total estimated cancer risks within or below EPA's acceptable risk range.

Noncarcinogenic 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 (see Table 11). RfDs, which are expressed in units of milligrams per kilogram per day (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 to the RfD to derive the hazard quotient for the contaminant in the particular medium (i.e., the hazard quotient equals the chronic daily intake divided by the RfD). The HI is obtained by adding the hazard quotients for all compounds within a particular medium that impacts particular receptor population. An HI greater than 1.0 indicates that the potential exists for noncarcinogenic 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.

For chronic health effects (non-carcinogenic), the hazard indices for the stable employee, garage employee, adult and child residents, and adult and child neighboring residents exceeded the EPA risk criterion predominantly due to ingestion and dermal contact with groundwater. For example, the HI for adult residents exposed to groundwater was estimated to be 90, and the HI for child residents exposed to groundwater was estimated to be 200.

Adult and child clients/visitors had HIs of less than one for all exposure routes indicating that adverse non-carcinogenic effects are not likely (e.g., exposure to indoor ring and outdoor surface soils).

Exposure to soils, sediments, and surface water was determined not to pose a significant threat to human health. A summary of the calculated hazard indices and cancer risks are provided in Table 12.

In summary, the Human Health Risk Assessment concluded that exposure to groundwater, if not addressed by the selected remedy or one of the other active measures considered, may present a current or potential threat to public health or welfare, as groundwater is used for drinking purposes on and in the vicinity of the Site.

Ecological Risk Assessment

As part of the Ecological Risk Assessment, a qualitative and/or semi-quantitative appraisal of the actual or potential effects of a hazardous waste site on plants and animals, constitutes an ecological risk assessment. A four-step process is utilized for assessing site-related ecological risks: *Problem Formulation* - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. *Exposure Assessment* - a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. *Ecological Effects Assessment* - literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. *Risk Characterization* - measurement or estimation of both current and future adverse effects.

The environmental evaluation (see Table 13) focused on how the contaminants would affect the Site's natural resources. Natural resources include existing flora and fauna at the Site, surface water, wetlands and sensitive species or habitats. Minor wetlands systems have developed on the Site, and two constructed farm ponds are located in the northern portion of the Site. Federally listed threatened or endangered species were found not to be likely to inhabit the Site. However, the Higgins' property does provide habitat for a variety of wildlife species. The current use of the property as an equestrian center and grazing area for horses limits wildlife use somewhat to smaller species of birds and mammals which thrive in open pasture with available cover limited to hedgerows. Several species of waterfowl are also known to utilize the ponds.

As explained below, contaminants detected in surface water, sediment and surface soils at the Site present a potential risk to those species which utilize the property on a long-term basis. Of particular concern are: aluminum (surface water); dieldrin and DDT (sediment) and; lead (surface soil).

The chemicals of concern selected for the environmental risk assessment include: polyaromatic hydrocarbons (PAHs); several pesticides; aluminum; antimony; cadmium; chromium; copper; iron; lead; manganese; mercury; nickel; selenium; silver; thallium; and zinc. The following ecological exposure pathways were evaluated: 1) Fish and wildlife ingesting aquatic and hydrophytic vegetation can be exposed to contaminants which have been taken up from sediments and water; 2) Direct contact with water and sediments can occur during feeding and nesting activities of waterfowl and on a constant basis for fish and other aquatic organisms inhabiting open water areas of the wetlands; and
3) Terrestrial wildlife (including horses) may also be exposed to contaminants via ingestion of surface soil, water and vegetation.

Specifically with regard to horses, it appears that antimony, lead, PCBs and zinc present a possible concern to horses ingesting soil from the property. Aluminum in the surface water also presents a possible concern. However, it should be noted that the effects of aluminum on the development of laboratory animals are controversial. Some studies have reported effects, while others have not.

The risk assessment concluded that there is the possibility of toxic effects on wildlife species and horses. These effects would be predominantly due to metals and pesticides, However, these potential effects are considered to have minimal ecological significance for the following reasons: 1) The presence of elevated levels of pesticides is probably due to previous agricultural land use at the property; 2) The impact on wetlands is negligible due to their small size and low functional value; 3) No threatened or endangered species or significant habitat are affected by contamination, since none are known to occur on the property; 4) No apparent effects from contamination were observed ; 5) Habitat is limited on the property due its relatively small size and its active use by humans and grazing by horses; and 6) Although the horses are allowed to graze in the fields, most of their diet is composed of commercial feed and hay.

Uncertainties

The procedures and estimates used to assess risks, 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. 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 baseline risk assessment provides upper bound estimates of the risks to populations near the Site, and it is highly unlikely to underestimate those actual risks related to the Site.

More specific information concerning public health risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the RI report.

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.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and risk-based levels established in the risk assessment. The potential exposure routes and risks associated with contaminated groundwater at the Site were evaluated in the risk assessment.

The following remedial action objectives were established for the Higgins Disposal Site:

(1) To capture and treat the contaminated groundwater at the Site for the purposes of restoring the aquifer to the most stringent Federal and State s (MCLs) and promulgated State groundwater quality standards;

(2) To control the migration of the contaminated groundwater for the purpose of limiting future off-site migration; and

(3) To minimize the potential for direct exposure of the populace to the contaminated groundwater.

As stated previously, groundwater flow and contaminant transport in the fractured bedrock aquifer system is extremely complicated. Defining the precise location of fractures conveying contaminants which have already migrated off of the property and removing all contaminants from bedrock fractures might not be feasible. Therefore, the groundwater remediation goal is to capture and treat the bulk of the contamination on the property to restore the aquifer to s and to limit future contaminant migration off of the property to the extent practicable, given the complicated nature of Site geology.

Numerical values for Federal and State MCLs and State groundwater quality standards can be found in Table 14.

It should be noted that some surface soil samples exceeded State of New Jersey Soil Cleanup Criteria for PCBs and arsenic. There was one exceedance (7.5 ppm) of the PCB standard (.49 ppm) out of seven data points in the indoor riding ring and there were two exceedances (26.3 ppm and 32.2 ppm) of the arsenic standard (20 ppm) out of 8 samples in the maintenance building area. However, EPA re-sampled the soil in the maintenance building area in the fall of 1996 which indicated no exceedances of the arsenic standard. Even based on the samples with the exceedances, the risk assessment illustrated that the risk from ingestion/inhalation of these surface soils was within EPA's acceptable risk range. Therefore, EPA recommends no further action for the soils. From NJDEP's perspective, however, the soil exceedances from the first sampling event during the RI, must be addressed by remediation or by institutional controls such as a Declaration of Environmental Restriction (DER).

DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that a remedial action must be protective of human health and the environment, cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment which permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

EPA's FS Report evaluated, in detail, five remedial alternatives for addressing the threat to the drinking water supply located in the vicinity of the Site. Cost and construction time, among other criteria, were evaluated for each remedial alternative. The time to implement a remedial alternative reflects the estimated time required to construct the remedy. The estimates do not include the time to negotiate with potentially responsible parties, prepare design documents, or procure contracts.

The remedial alternatives are:

Alternative 1: No Action

Estimated Capital Cost:$0
Estimated Annual O & M Cost (Years 1 - 5): $102,600
Estimated Annual O&M Cost (Years 6 - 30):$43,200
Estimated Total Present Worth Value:$723,503
Estimated Implementation Period: None

The Superfund program requires that the "no-action" alternative be considered as a baseline for comparison with other alternatives.

The no-action alternative does not provide treatment or containment of contaminated groundwater. Under this alternative, contaminated groundwater could potentially migrate off of the Site, possibly reaching human and ecological receptors (i.e., residents using well water). Long-term monitoring would be conducted, including tap water sampling and sampling of groundwater to monitor contaminant concentrations remaining on the property and migrating off of the property. It should be noted that the annual O&M costs are more expensive in the first five years since monitoring well sampling would be performed quarterly during that time frame, and then annually thereafter.

Since this alternative may result in hazardous substances remaining at the Site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that it continues to provide adequate protection of human health and the environment.

Alternative 2: Limited Action: Utilization of Existing Supply Well and Carbon Filtration System

Option 2A: Maintain Residential Carbon Treatment Systems

Estimated Capital Cost: $6,300
Estimated Annual O&M Cost (Years 1 - 5): $106,100
Estimated Annual O&M Cost (Years 6 - 30):$46,700
Estimated Total Present Worth Value:$769,205
Estimated Implementation Period: 3 months

Option 2B: Connect Residences to Public Water

Estimated Capital Cost: $381,750
Estimated Annual O & M Cost (Years 1 - 5): $85,640
Estimated Annual O & M Cost(Years 6 - 30): $26,240
Estimated Total Present Worth Value:$914,321
Estimated Implementation Period: 18 months

Alternative 2 involves utilizing the Higgins' existing water supply well for groundwater extraction; it would be pumped at the usual rate for their domestic and business uses, approximately 4 - 5 gallons per minute (gpm) during various staggered time intervals (i.e., pumping would be dependent on the needs of the residents and businesses on the Site). The existing carbon filtration systems would be maintained for groundwater treatment. Groundwater on the property would be monitored utilizing the bedrock monitoring wells and the Higgins' water supply well would be monitored via tap water sampling.

Under this alternative, one of two options would be implemented to provide a potable water supply for the eleven Laurel Avenue residences described earlier. Option 2A consists of maintaining the existing carbon filtration systems at the residences (which are probably either carbon or Culligan units) and installing treatment systems at the three residences which do not currently have treatment systems. This option would also include annual monitoring of the tap water. It should be noted that the party implementing this remedy (i.e., either the Government or the PRPs) would be responsible for the expenses associated with these activities. Option 2B consists of connecting the Laurel Avenue residences to public water. Tap water sampling would not be necessary in this case. Under this option, costs for public water would be the responsibility of the residents.

Since this alternative may result in hazardous substances remaining at the Site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that it continues to provide adequate protection of human health and the environment.

Alternative 3: Groundwater Extraction System/Treatment at Higgins' Farm

Option 3A: Maintain Residential Carbon Treatment Systems

Estimated Capital Cost: $1,400,200
Estimated Annual O&M Cost (Years 1 - 5): $204,100
Estimated Annual O&M Cost (Years 6 - 30):$144,700
Estimated Total Present Worth Value:$3,270,000
Estimated Implementation Period: 20 months

Option 3B: Connect Residences (including Higgins) to Public Water

Estimated Capital Cost: $1,763,400
Estimated Annual O&M Cost (Years 1 - 5): $177,200
Estimated Annual O&M Cost (Years 6 - 30):$117,800
Estimated Total Present Worth Value:$3,330,000
Estimated Implementation Period: 20 months

Alternative 3 involves the installation of new extraction wells and piping the groundwater to the Higgins Farm Site for treatment and disposal. As previously discussed, the Higgins Farm Site is another Superfund site, located in close proximity to the Higgins Disposal Site. Both of these sites are owned by Clifford and Lizbeth Higgins. Furthermore, the two sites have similar groundwater contamination. A 100 gpm waste water treatment plant (WWTP) is currently under construction at that Site and is expected to be operational by the end of 1997.

Approximately 10 gpm would be conveyed to the Higgins Farm WWTP. A pump station and pipeline would be constructed to convey the extracted water. The pipeline would be located within existing pipeline easements situated between the Higgins Farm and Higgins Disposal Sites. It is estimated that approximately 14,000 linear feet of pipeline would be necessary. Currently, the following treatment systems are available at the Higgins Farm WWTP: flow equalization, precipitation/clarification), filtration, air stripping, ion exchange and pH adjustment. If necessary, the Higgins Farm WWTP would be enhanced with additional granular activated carbon contactors. This may be necessary because the concentrations of SVOCs are higher at the Higgins Disposal Site than at the Higgins Farm Site, and the treated groundwater would be discharged to an on-site pond, which then discharges to Carters Brook. Since the discharge is to a surface water body, it would be necessary to achieve discharge levels established in accordance with the National Pollutant Discharge Elimination System, under the Clean Water Act.

As in Alternatives 1 and 2, groundwater on the property would be monitored utilizing the bedrock monitoring wells. Under this alternative, one of two options would be implemented to address the potable water supply for the Higgins and Laurel Avenue residences. Option 3A consists of maintaining the existing carbon filtration systems at the Higgins' and the Laurel Avenue residences (residences without systems would be supplied with the systems). The Higgins would be assured of a water supply (in case their well were to go dry due to the pumping of the extraction wells) by diverting water from the new extraction wells to their water storage tank. This option would also include monitoring of the tap water.

Option 3B consists of connecting the Higgins' and the Laurel Avenue residences to public water. No tap water sampling would be necessary in this case.

It should be noted that costs and implementation times for both options have been revised from the information presented in the spring 1997 Proposed Plan. The revised costs reflect the installation of the pipeline in the current easement locations, and also reflect the additional O&M costs that would be spent at the Higgins Farm WWTP associated with treating the additional 10 gpm flow (such as additional chemicals used in the treatment process and additional sludge disposal). Overall, these additional costs represent an increase of approximately 1.1 million dollars in the present worth of Options 3A and 3B.

It is anticipated that implementation of the groundwater extraction and conveyance system would occur once the landfill is addressed through the planned removal activities. Removal of this source of groundwater contamination will allow the remedy to be optimally designed, based on actual residual contaminant levels in the groundwater. However, connection of the Higgins and the Laurel Avenue residents to public water is expected to occur in as expeditiously as practicable.

Since this alternative may result in hazardous substances remaining at the Site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that it continues to provide adequate protection of human health and the environment.

Alternative 4: Groundwater Extraction System/On-Site Treatment & Disposal

Option 4A: Maintain Residential Carbon Treatment Systems

Estimated Capital Cost: $1,118,175
Estimated Annual O&M Cost (Years 1 - 5): $307,300
Estimated Annual O&M Cost (Years 6 - 30):$247,900
Estimated Total Present Worth Value:$4,146,146
Estimated Implementation Period: 4 years

Option 4B: Connect Residences to Public Water

Estimated Capital Cost: $1,493,625
Estimated Annual O&M Cost (Years 1 - 5): $282,200
Estimated Annual O&M Cost (Years 6 - 30):$222,800
Estimated Total Present Worth Value:$4,239,026
Estimated Implementation Period: 4 years

Alternative 4 mainly differs from Alternative 3 in that a new WWTP would be built on the Higgins Disposal property as opposed to building a pipeline from the Higgins Disposal property to the Higgins Farm property. This new WWTP would include flow equalization, precipitation/clarification, filtration, air stripping, carbon adsorption, ion exchange, and pH adjustment. Since the treated groundwater would be discharged to a surface water body (i.e., the Dirty Brook), it would be necessary to achieve discharge levels established in accordance with the National Pollutant Discharge Elimination System, under the Clean Water Act. Therefore, the treatment system would be designed to meet the anti-degradation criteria for Dirty Brook; for each chemical, the most stringent value between the New Jersey Ambient Surface Water Quality Criteria (AWQC) and the Federal AWQC.

Under Options A and B, the Higgins would be supplied with the treated water from the new WWTP. Groundwater on the property would be monitored utilizing the bedrock monitoring wells. No tap water sampling at the Higgins' household would be necessary since their water supply, coming from the new WWTP, would already be monitored as part of the WWTP's operation and maintenance program. Option 4A also consists of maintaining the existing carbon filtration systems (and installing three new systems at the residences currently lacking them) at the neighboring Laurel Avenue residences. Annual tap water monitoring at these residences would be required.

Under Option 4B, the other Laurel Avenue residences would be hooked up to public water. No tap water sampling would be necessary in this case.

It is anticipated that implementation of the groundwater extraction and treatment system would occur once the landfill is addressed through the planned removal activities. Removal of this source of groundwater contamination will allow the remedy to be optimally designed, based on actual residual contaminant levels in the groundwater. However, connection of the Higgins and the Laurel Avenue residents to public water is expected to occur as expeditiously as practicable.

Since this alternative may result in hazardous substances remaining at the Site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that it continues to provide adequate protection of human health and the environment.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting a remedy, EPA considered the factors set out in CERCLA §121, 42 U.S.C. §9621, by conducting a detailed analysis of the viable remedial alternatives pursuant to the NCP, 40 CFR §300.430(e)(9) and EPA's OSWER Directive 9355.3-01. The detailed analysis consisted of an assessment of the individual alternatives against each of nine evaluation criteria and a comparative analysis focusing upon the relative performance of each alternative against those criteria.

The following "threshold" criteria are the most important and must be satisfied by any alternative in order to be eligible for selection:

1. *Overall protection of human health and the environment* addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. *Compliance with ARARs* addresses whether or not a remedy would meet all of the applicable (legally enforceable), or relevant and appropriate (pertaining to situations sufficiently similar to those encountered at a Superfund site such that their use is well suited to the site) requirements of federal and state environmental statutes and requirements or provide grounds for invoking a waiver.

The following "primary balancing" criteria are used to make comparisons and to identify the major trade-offs between alternatives:

3. *Long-term effectiveness and permanence* refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

4. *Reduction of toxicity, mobility, or volume through treatment* refers to a remedial technology's expected ability to reduce the toxicity, mobility, or volume of hazardous substances, pollutants or contaminants at the site.

5. *Short-term effectiveness* addresses 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 periods until cleanup goals are achieved.

6. *Implementability* refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed.

7. *Cost* includes estimated capital and operation and maintenance costs, and the present-worth costs.

The following "modifying" criteria are considered fully after the formal public comment period on the Proposed Plan is complete:

8. *State acceptance* indicates whether, based on its review of the RI/FS reports and the Proposed Plan, the State supports, opposes, and/or has identified any reservations with the selected alternative.

9. *Community acceptance* refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports. Factors of community acceptance to be discussed include support, reservation, and opposition by the community.

A comparative analysis of the remedial alternatives based upon the evaluation criteria noted above follows.

Overall Protection of Human Health and the Environment

Alternative 1, the no-action alternative, would not protect human health or the environment because there would not be any immediate reduction in risk or in the toxicity, mobility, or volume of the contaminants. Natural attenuation to reduce the contaminant concentrations to Federal and State s would take many years and the bedrock contamination might never achieve the remedial requirements. The volume of groundwater contaminated would also increase with time, due to the continued migration of contaminants. In addition, surface water would continue to receive discharges of contaminated groundwater from the aquifer. Although most residents have tap water treatment systems, the maintenance of the systems cannot be guaranteed under the no-action alternative. Therefore, there could be human exposure to contaminated groundwater, presenting an unacceptable risk.

Alternative 2, limited action, affords some protection of human health since an alternative potable water supply would be ensured by either providing city water to the residents or by maintaining the tap water treatment systems. However, because the extraction system utilized in this alternative is the Higgins' supply well, which only pumps according to the needs of the Higgins' household and the Hasty Acres Riding Club, the full or necessary amount of contaminated groundwater will not be extracted from the aquifer (as in Alternative 1). Therefore, contaminated water will likely continue to migrate into other portions of the aquifer system and increase the volume of contaminated groundwater. In Alternative 2, there would be minimal reduction in risk and in the toxicity, mobility, or volume of the contaminants. Natural attenuation to reduce the contaminant concentrations to Federal and State s would take many years and the bedrock contamination might never achieve the remedial requirements. Surface water would also continue to receive discharges of contaminated groundwater from the aquifer.

Conversely, Alternatives 3 and 4 provide protection of human health and the environment by actively and continuously controlling contaminant migration, as well as by providing a potable water supply (as in Alternative 2).

Compliance with ARARs

Federal and State drinking water standards (maximum contaminant levels, or MCLs) and the promulgated State groundwater quality standards are chemical-specific ARARs for the Site (see Table 14). Federal MCLs were selected as the remedial requirement for groundwater remediation except when more stringent State MCLs and groundwater quality standards exist, in which case the State requirement was selected. Alternatives 1 and 2 are not expected to meet chemical-specific ARARs in groundwater as neither involves active, continuous remediation methods. The limited pumping of the Higgins' well and natural flushing of groundwater may eventually result in achievement of ARARs in groundwater. The time frame is unknown, but would be expected to take many years. The active extraction system required under Alternatives 3 and 4 would provide the best possible remediation system for the groundwater contaminant plume. The groundwater extraction scheme in Alternatives 3 and 4 would create a capture zone far more extensive than utilizing the Higgins' water supply well. The system under Alternatives 3 and 4 would be designed to create a capture zone encompassing the entire Site. It would allow less contamination to migrate off-site and extract a greater volume of contamination. It must be emphasized that this groundwater contamination problem exists in a fractured bedrock aquifer and extraction of contaminated groundwater from such aquifers is often difficult. Additionally, removal of contaminants to achieve the MCLs in such situations is also difficult. However, highly fractured zones were encountered during RI work and the hydrologic modeling and aquifer tests performed during the RI indicate that properly placed extraction wells would create a larger capture zone than currently exists due to the Higgins' water supply well and such a system would be able to achieve significant decreases in contaminant levels over time. The time frame for Alternatives 3 and 4 to achieve compliance with chemical-specific ARARs in the underlying bedrock aquifer is undetermined. Removal of the landfill, which is a continuing source of groundwater contamination, is critical for achieving ARARs and remedial action objectives. However, because Alternatives 3 and 4 are aggressive, active approaches to attaining ARARs in the aquifer, utilizing more wells and extracting a greater volume of contaminated water, greater decreases in contaminant levels can be expected in significantly less time compared to Alternatives 1 and 2.

As discussed above, Alternatives 3 and 4 include surface water discharge of treated groundwater. The preliminary discharge criteria for Alternative 3 were developed for the Higgins Farm WWTP (see Table 15). Like that WWTP, the discharge criteria for a new WWTP under Alternative 4 would be based on prevention of degradation of the receiving water body. The selected discharge requirements are generally the Federal Ambient Water Quality Criteria (FAWQC) under the Clean Water Act. However, for those compounds for which the laboratory analytical detection limit (MDL) is greater than the FAWQC, compliance with the FAWQC will be shown through measurements meeting the lowest MDL available through EPA contract laboratory program. In addition, for certain compounds, an anti-degradation based value may be applicable. This is due to a Clean Water Act requirement to minimize degradation of existing water quality (i.e., the discharge limit should not be higher than the ambient concentration in the stream). The discharge from the groundwater treatment system will be designed to meet the FAWQC and the anti-degradation limit.

Alternatives 3 and 4 are expected to achieve other ARARs including the Resource Conservation and Recovery Act (RCRA) requirements for treatment facilities, the Department of Transportation (DOT) requirements for off-site transportation of any residual materials, and the New Jersey Solid and Hazardous Waste Regulations and the Occupational Safety and Health Act (OSHA). In addition, the operation of the treatment system in Alternatives 3 and 4 will comply with Federal and State air standards.

Long-Term Effectiveness and Permanence

Alternatives 1 and 2 would not remove or contain contaminants in the groundwater in a continuous or active manner. Contaminants would likely continue to migrate and increase the volume of contaminated groundwater. The no action and limited action alternatives are not considered to be effective over the long-term because contaminated groundwater, other than that captured via the Higgins' supply well, remains on-site and is likely to continue to migrate off of the Higgins' property. These alternatives will require long-term monitoring and sampling.

Although some contamination may remain in fractures at the end of the remediation time period, Alternatives 3 and 4 are expected to be generally effective in providing cleanup of the aquifer.

Options A and B under Alternatives 2, 3, 4 provide a potable water supply for the residents. Option B, provision of a waterline and hookups to the public water system, is a more permanent remedy whereas Option A requires long-term maintenance of carbon filters to ensure potable, drinkable water. Therefore, Option B provides greater long-term effectiveness and permanence than Option A.

Since all of the alternatives may result in hazardous substances remaining at the Site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that it continues to provide adequate protection of human health and the environment.

Reduction in Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 and 2 would not provide for any active, continuous mechanisms for the total containment, removal, treatment, or disposal of contaminated groundwater. Alternatives 1 and 2 rely on the limited pumping and extraction of groundwater dependent upon the water usage needs of the Higgins' household and the Hasty Acres Riding Club to promote reduction in mobility or volume. Because of the carbon filter on the Higgins' supply well, there would also be some reduction in toxicity. However, due to the limited effect of the Higgins' well, contaminants would continue to migrate to off-site areas as well as into deeper fractures of the bedrock resulting in an increase in the volume of contaminated groundwater.

Alternatives 3 and 4 are expected to more effectively reduce the toxicity, mobility and volume of contaminants in the groundwater through treatment. Due to the nature of fractured bedrock, some contamination may remain in the interconnecting fractures of the bedrock and may continue to migrate. However, the amount would be significantly less than under Alternatives 1 and 2.

Short-Term Effectiveness

Alternatives 1 and 2 provide limited protectiveness in the short-term. However, since Alternative 1 only requires sampling and Alternative 2 only requires sampling and maintenance, they could essentially be implemented immediately. However, under these two alternatives, groundwater may continue to migrate off of the Higgins' property which continues to present a risk to those residents utilizing the aquifer for potable water.

The time required to implement Alternative 3 is estimated to be 20 months. During this time, the risks are estimated to be the same as for Alternative 1. Upon system startup, this alternative will immediately begin to further limit groundwater contaminant migration. However, due to the nature of the fractured bedrock and the difficulty in remediating contaminated groundwater within these fractures, specific time frames for remediation of the groundwater cannot be determined.

The time required to implement Alternative 4 is approximately four years since building a waste water treatment plant is more complex than building a pipeline and making minor modifications to an existing waste water treatment plant. During this time, the risks are estimated to be the same as for Alternatives 1, 2, and 3. Upon system startup, this alternative will also immediately begin to limit groundwater contaminants from migrating. However, as with Alternative 3, the nature of the fractured bedrock and the difficulty in remediating the contaminated groundwater within these fractures renders it difficult to specify a time frame for remediation of the groundwater.

It is anticipated that implementation of the groundwater extraction and conveyance and treatment components of Alternatives 3 and 4 would occur once the landfill is addressed through the planned removal activities. Removal of this source of groundwater contamination will allow the remedy to be optimally designed, based on actual residual contaminant levels in the groundwater. However, connection of the Higgins and the Laurel Avenue residents to public water is expected to occur as expeditiously as practicable.

Implementability

Minimal effort would be required to perform the sampling under Alternatives 1 and 2. The wells to be used for sampling already exist. The pipeline, pump station, and potential treatment plant modifications proposed under Alternative 3 involve standard construction practices and based upon discussions with the designers of the Higgins Farm WWTP, capacity for contaminated groundwater from Higgins Disposal will be available. However, Alternative 3 will also involve coordination with local authorities as well as private property owners since access to easements would be required for both the installation and operation and maintenance of the pipeline. Alternative 4 involves standard construction practices and would be technically easily implementable, although space to construct such a facility at the Higgins property is limited.

The extraction wells proposed under Alternatives 3 and 4 can be designed and installed relatively easily. The effectiveness of the groundwater pumping will be dependent upon the placement of the extraction wells in productive fracture zones. Information obtained during the RI indicates some very productive zones. However, it must be noted that it may not be possible to pump all of the contaminated groundwater from the fractured bedrock. If necessary, further remedial measures, such as installing additional wells can be easily implemented.

Maintenance of the carbon filters under option A of Alternatives 2, 3, and 4 is also easy to implement. Installation of the public water pipeline extension and connections (option B) is also a simple engineering task, but would require coordination with local officials.

Cost

The present-worth costs are calculated using a discount rate of 8 percent. The estimated capital, annual O&M, and present-worth costs for each of the alternatives are summarized below.

Alternative	Capital Cost	Operation and Maintenance Cost	Present-Worth Cost
1	$0	$102,600 (Years 1-5) $43,200 (Years 6-30)	$723,503
2A	$6,300	$106,100 (Years 1-5) $46,700 (Years 6-30)	$769,205
2B	$381,750	$85,640 (Years 1-5) $26,240 (Years 6-30)	$914,321
3A	$1,400,200	$204,100 (Years 1-5) $144,700 (Years 6-30)	$3,270,000
3B	$1,763,400	$177,200 (Years 1-5) $117,800 (Years 6-30)	$3,330,000
4A	$1,118,175	$307,300 (Years 1-5) $247,900 (Years 6-30)	$4,146,146
4B	$1,493,625	$282,200 (Years 1-5) $222,800 (Years 6-30)	$4,239,026

For purposes of this analysis, calculations were based upon the assumption that the alternatives will have a 30-year useful life.

State Acceptance

The State of New Jersey does not concur with EPA's position of no further action for the soils. The State of New Jersey does concur with EPA's selected remedy provided that EPA remediates any hazardous substances that could contribute to exceedances of the NJDEP groundwater standards (i.e., the landfill).

Community Acceptance

EPA solicited input from the community on the remedial alternatives proposed for the Higgins Disposal Site. While the community was supportive of that portion of the remedy consisting of extension of existing public water, the community expressed concerns with regard to the groundwater extraction and conveyance system. The attached Responsiveness Summary addresses the comments received during the public comment period.

SELECTED REMEDY

Based upon consideration of the results of the RI/FS, the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, EPA has determined that Alternative 3B is the appropriate remedy for the Site, because it best satisfies the requirements of CERCLA §121, 42 U.S.C. §9621, and the NCP's nine evaluation criteria for remedial alternatives, 40 CFR §300.430(e)(9). This remedy is comprised of the following components:

- Remediation of contaminated groundwater to Federal and State Maximum Contaminant Levels and also to groundwater quality standards promulgated by the State of New Jersey.
- Installation of on-site wells for the extraction of the contaminated groundwater.
- Conveyance of the extracted groundwater via a pipeline to the Higgins Farm Superfund Site for treatment, with discharge to surface water.
- If necessary, the on-site groundwater treatment system at the Higgins Farm Site will be enhanced through the addition of granular activated carbon.

- Connection of the ten neighboring residents on Laurel Avenue who use private well water to a public water supply. Public water would also be provided to the Higgins family. This would be accomplished through the extension of the existing Elizabethtown Water Company pipeline.

- Implementation of an environmental monitoring program to ensure the overall effectiveness of the remedy.

- Five-year reviews of the Site pursuant to CERCLA.

The selection of this remedy is based on the comparative analysis of the alternatives discussed above and provides the best balance of tradeoffs with respect to the nine evaluation criteria.

It is anticipated that implementation of the groundwater extraction and conveyance system will occur once the landfill is addressed through the planned removal activities. Removal of this source of groundwater contamination will allow the remedy to be optimally designed, based on actual residual contaminant levels in the groundwater. However, connection of the Higgins and the Laurel Avenue residents to public water is expected to occur in as expeditiously as practicable.

STATUTORY DETERMINATIONS

As was previously noted, CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that a remedial action must be protective of human health and the environment, cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, or contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a degree of cleanup that satisfies ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

For the reasons discussed below, EPA has determined that the selected remedy meets the requirements of CERCLA §121, 42 U.S.C. §9621.

Protection of Human Health and the Environment

The selected remedy protects human health and the environment in terms of both the extraction and treatment systems. By controlling contaminant migration on and off of the Site and supplying potable water from the public water system, exposures would be prevented at the Site and neighboring Laurel Avenue receptors. However, it should be recognized that the contamination is in a fractured bedrock system, and the possibility exists that some of the contamination that has already migrated into the deep fractures may not be able to be extracted and may continue to migrate. However, the extraction system would be designed to contain the plume of contamination and actively extract the greatest amount of contaminated water possible.

In addition, the effluent from the groundwater treatment system at the Higgins Farm Site would meet surface water discharge requirements that are considered to be protective of human health and the environment.

Furthermore, by providing a permanent, alternative source of potable water through extension of the existing water line, the selected remedy protects human health through elimination of residential exposure to contaminated groundwater.

Compliance with ARARs

The selected remedy will be designed to achieve compliance with the chemical-specific ARARs for the discharge to surface water at the Higgins Farm Site, and would be designed to attempt to meet ARARs for remediation of all of the contaminated groundwater. It is possible, however, that due to the nature of the fractured bedrock, all groundwater standards may not be achieved (i.e., contaminated groundwater that has already migrated into deep fracture zones). However, for contaminated groundwater in the overburden (i.e., the unconsolidated deposits above the bedrock) and in a substantial part of the fractured bedrock, this alternative is expected to achieve ARARs.

The selected remedy will also be designed to meet other chemical-specific, action-specific and location-specific ARARs, as discussed under **Summary of Comparative Analysis of Alternatives**, above, and as provided in Table 16.

Cost-Effectiveness

The selected remedy is cost-effective as it has been determined to provide the greatest overall long-term and short-term effectiveness in proportion to its present worth cost, $3.3 million. Alternative 4, which would require construction of a new WWTP, would cost approximately $900,000 more than the selected remedy. While the selected remedy is more expensive than the no action and limited action alternatives, the selected remedy achieves far greater protection of human health and the environment. Furthermore, while the selected remedy is more expensive than Alternative 3A, it provides a permanent potable water supply rather than relying on long-term maintenance of carbon filters.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and alternative treatment technologies can be utilized in a cost-effective manner for the Higgins Disposal Site. Furthermore, the selected remedy provides the best balance of tradeoffs with respect to the nine evaluation criteria.

Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for treatment as a principal element. The selected remedy utilizes treatment to reduce levels of contamination in groundwater to achieve ARARs, to the extent practicable.

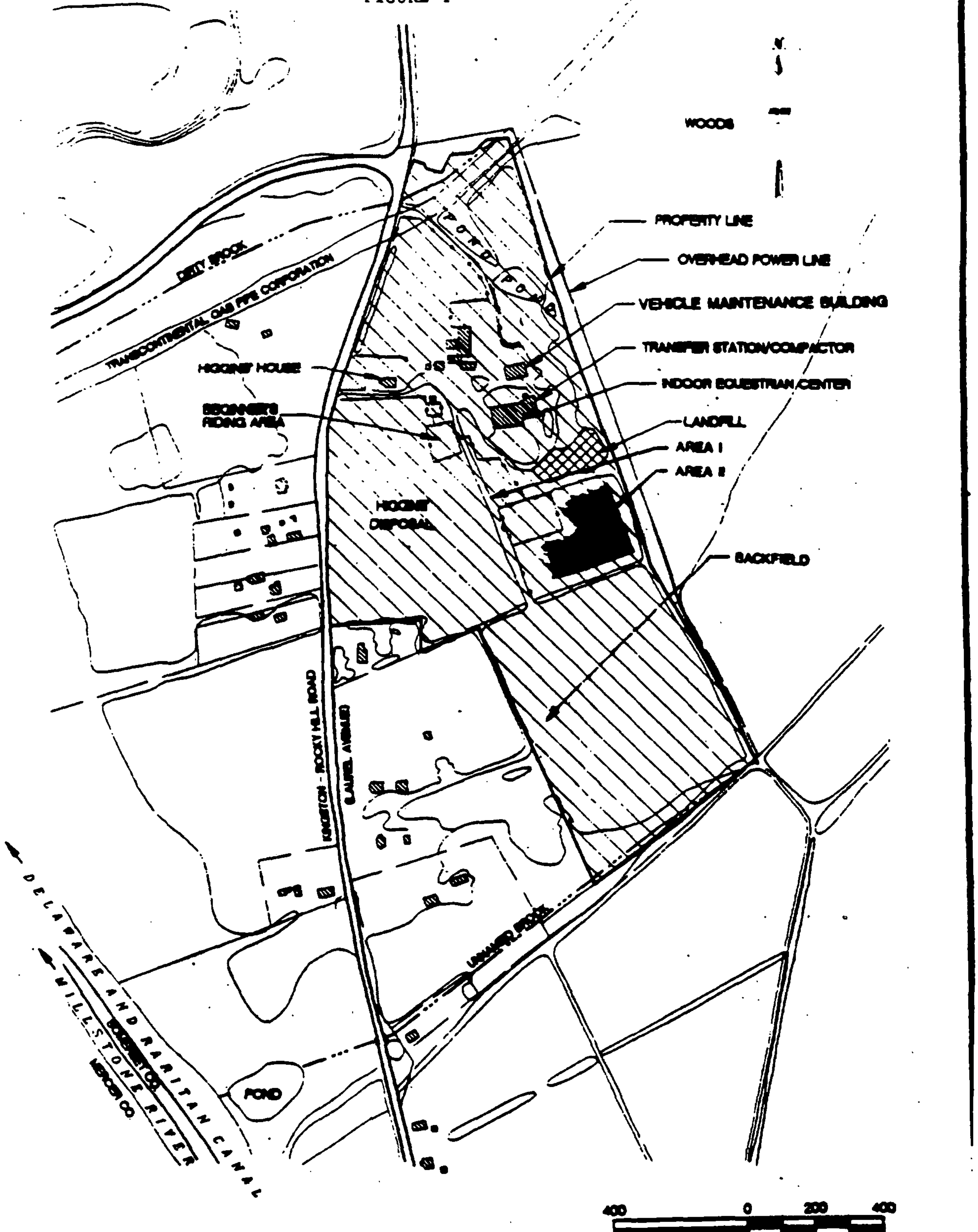
DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the Site was released to the public in May 1997. This Plan identified Alternative 3B as the preferred alternative to address the groundwater contamination at the Higgins Disposal Site. Upon review of all comments submitted, EPA revised the costs associated with Alternatives 3A and 3B. As previously described, the present worth of Alternative 3A increased from $2,181,322 to $3,270,000, while the present worth of Alternative 3B increased from $2,241,712 to $3,330,000. However, it should be noted that the overall intent of the selected remedy did not change from the Proposed Plan.

APPENDIX I

FIGURES

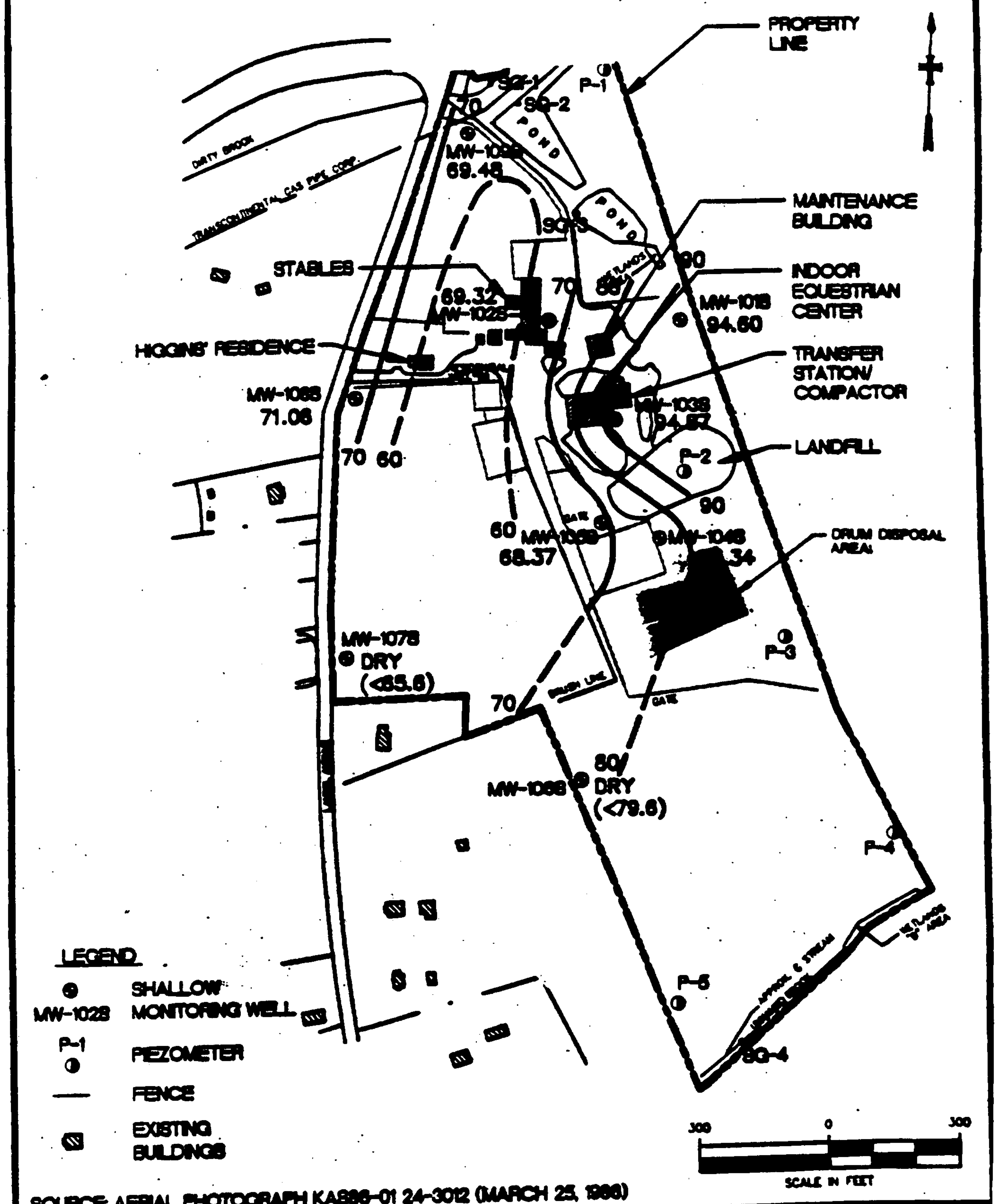
FIGURE 1



SOURCE: AERIAL PHOTOGRAPH KAS86-01 24-3012 (MARCH 28, 1986)

MALCOLM PIRNIE	HIGGINS DISPOSAL KINGSTON, NEW JERSEY **HIGGINS DISPOSAL PLAN**	MALCOLM PIRNIE, INC.

FIGURE 2

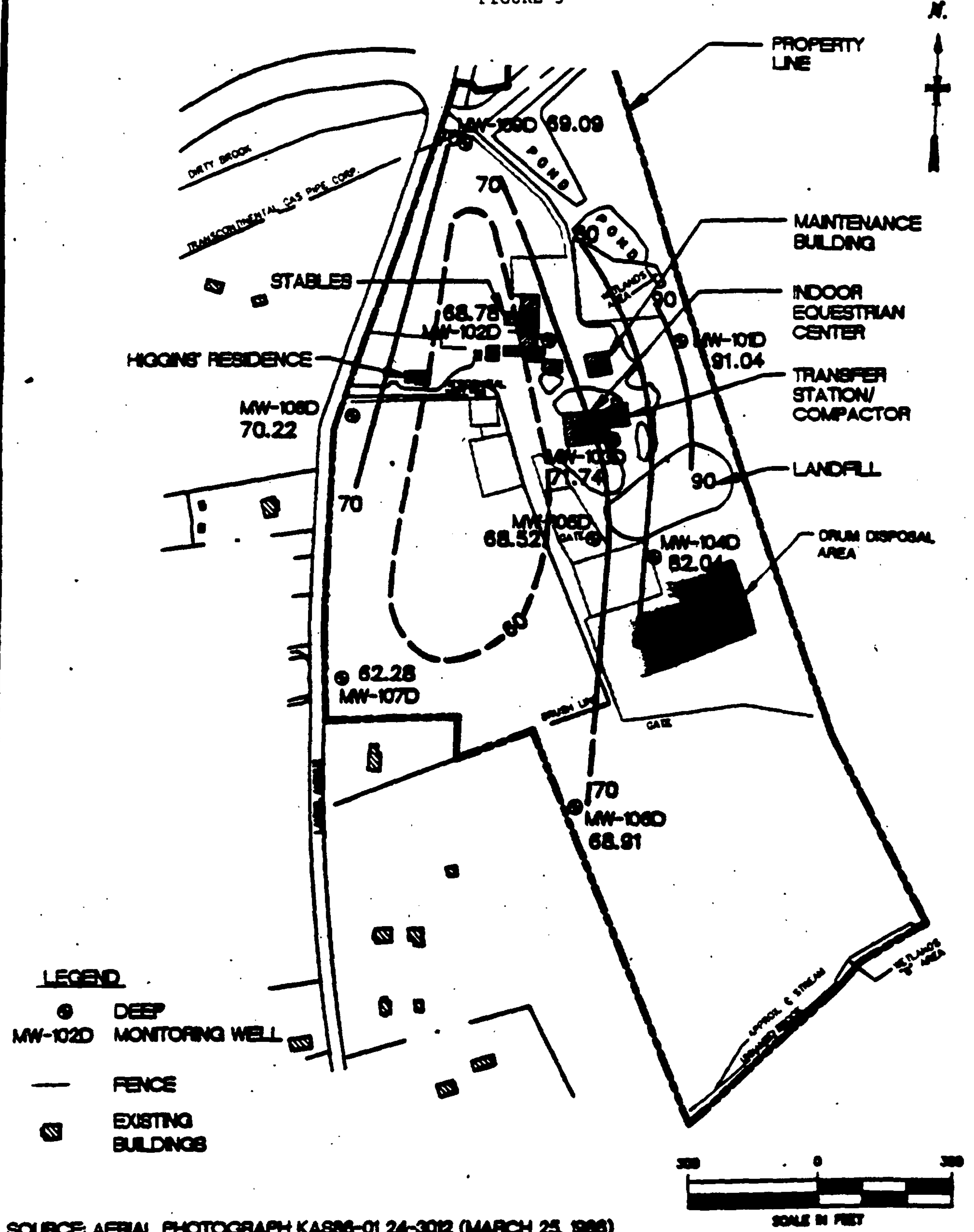


MALCOLM PIRNIE, INC.

MALCOLM PIRNIE

HIGGINS DISPOSAL
KINGSTON, NEW JERSEY
POTENTIOMETRIC CONTOUR MAP - SHALLOW WELLS
PRE-TEST STATIC CONDITIONS - APRIL 6, 1995

FIGURE 3



MALCOLM PIRNIE

HIGGINS DISPOSAL
KINGSTON, NEW JERSEY
POTENTIOMETRIC CONTOUR MAP - DEEP WELLS
PRE-TEST STATIC CONDITIONS - APRIL 6, 1995

MALCOLM PIRNIE, INC.

FIGURE 4

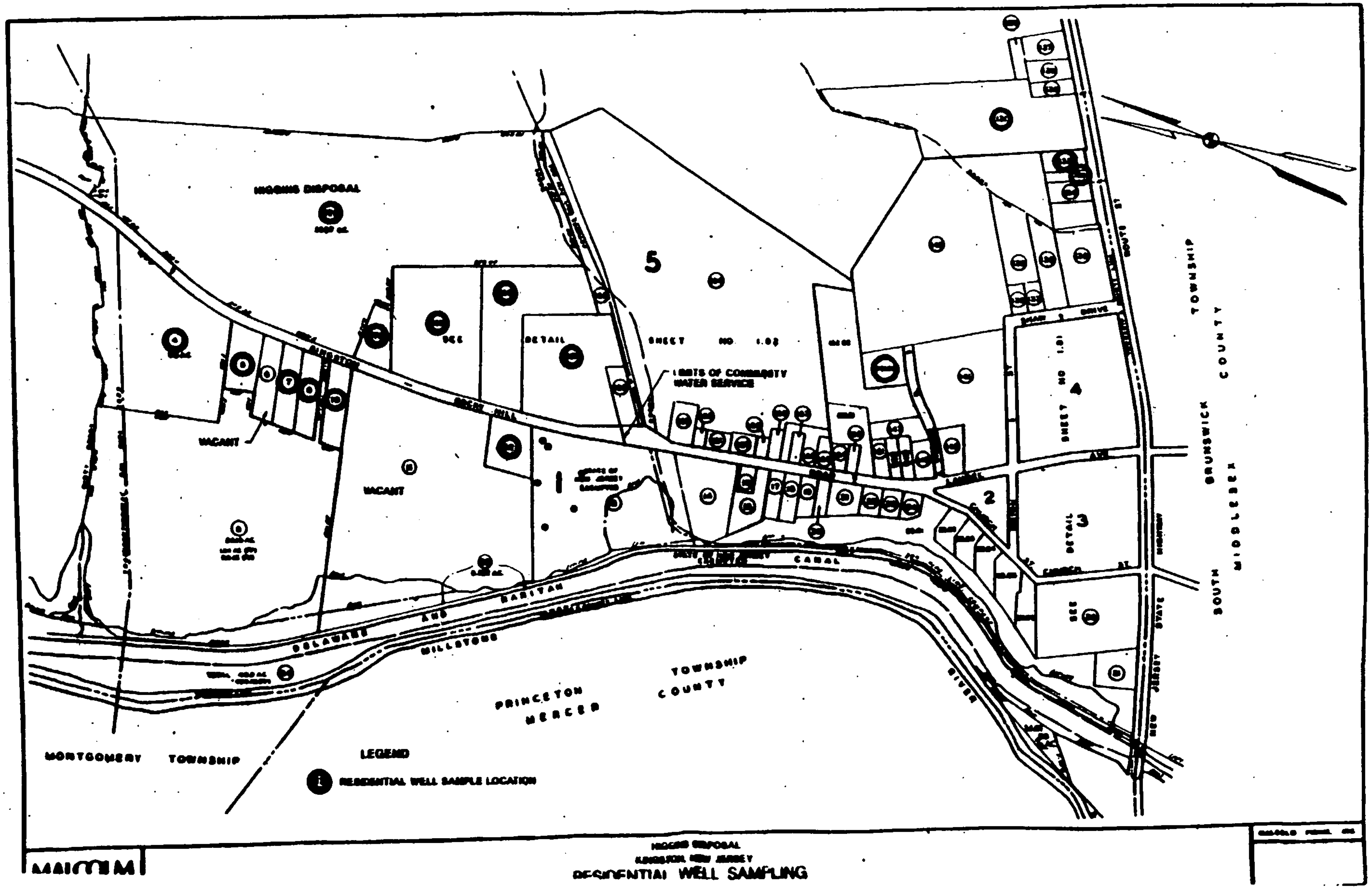
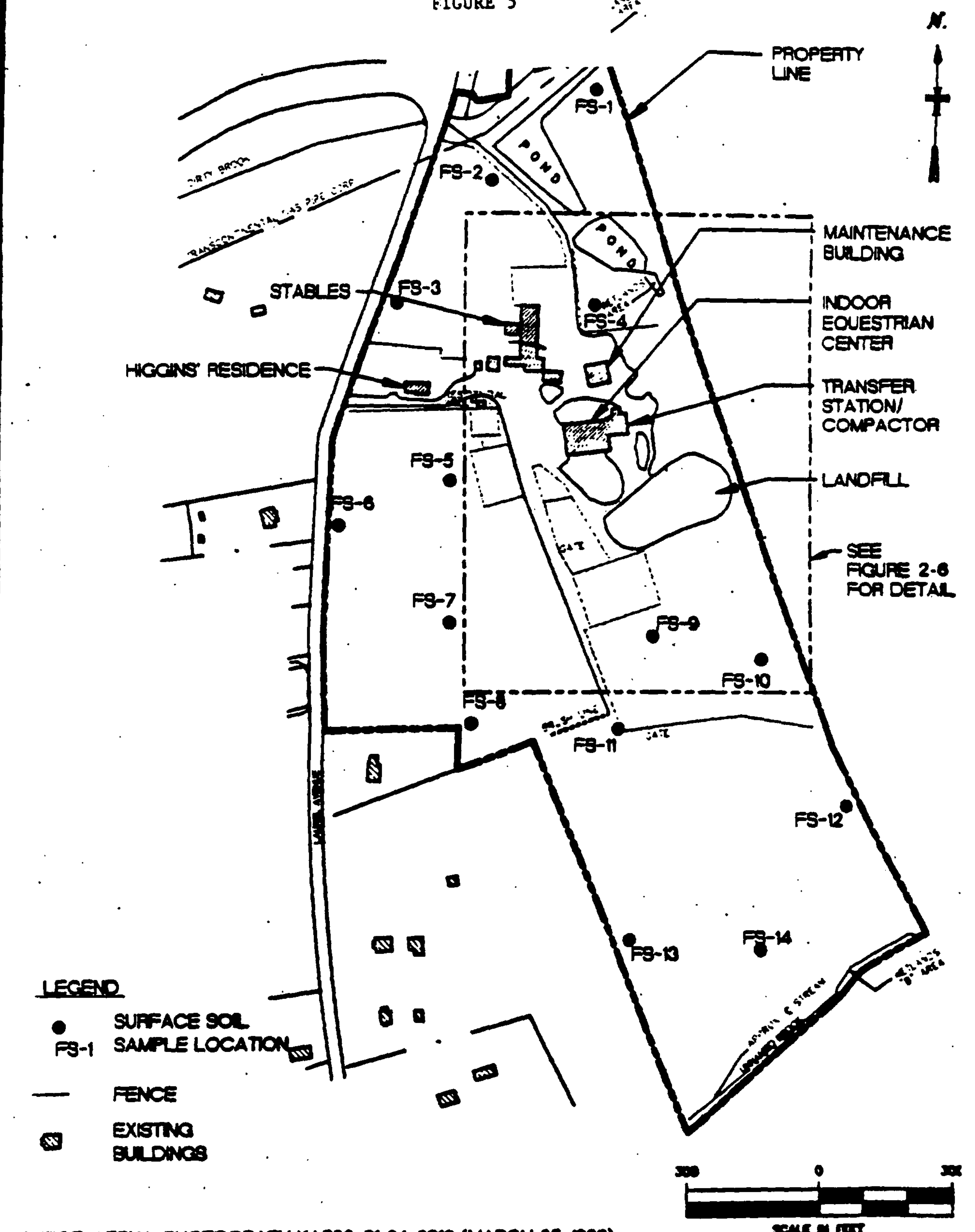

HIGGINS DISPOSAL
5
4
3
2
VACANT
VACANT
LIMITS OF COMMUNITY
WATER SERVICE
DELAWARE AND RARITAN CANAL
MILLSTONE RIVER
PRINCETON TOWNSHIP
MERCER COUNTY
MONTGOMERY TOWNSHIP
SOUTH BRUNSWICK TOWNSHIP
MIDDLESEX COUNTY
LEGEND
RESIDENTIAL WELL SAMPLE LOCATION
HIGGINS DISPOSAL
RESIDENTIAL WELL SAMPLING
MALCOLM

FIGURE 5



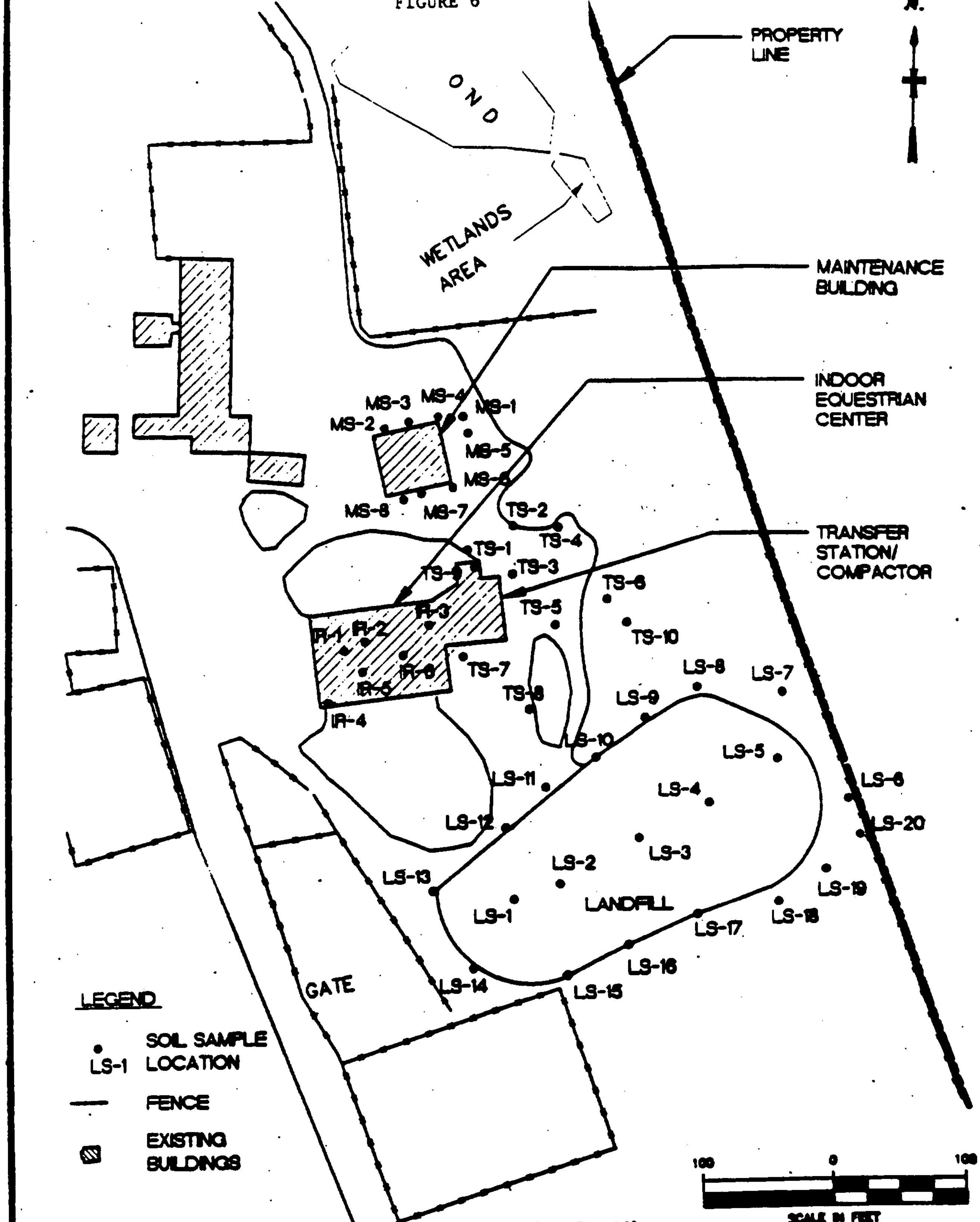
SOURCE: AERIAL PHOTOGRAPH KAS86-01 24-3012 (MARCH 25, 1986)

MALCOLM PIRNIE

HIGGINS DISPOSAL
KINGSTON, NEW JERSEY
SURFACE SOIL SAMPLING LOCATIONS

MALCOLM PIRNIE, INC

FIGURE 6



SOURCE: AERIAL PHOTOGRAPH KAS86-01 24-3012 (MARCH 25, 1986)

MALCOLM PIRNIE	HIGGINS DISPOSAL KINGSTON, NEW JERSEY SURFACE SOIL SAMPLING LOCATIONS	MALCOLM PIRNIE, INC.

<u>APPENDIX II</u>

TABLES

TABLE 1

SUMMARY OF GROUNDWATER DATA
HIGGINS DISPOSAL

CHEMICAL	ROUND 1 Frequency of Detection	ROUND 1 Range of Concentrations (µg/l)	ROUND 2 Frequency of Detection	ROUND 2 Range of Concentrations (µg/l)	SUMMARY Frequency of Detection	SUMMARY Percent Occurence	BACKGROUND* Frequency of Detection	BACKGROUND* Range of Concentrations (µg/l)	NJ GW Quality Standard (µg/l)
VOLATILE ORGANICS									
Acetone	4 / 14	17 - 40	1 / 15	5	5 / 29	17%	0 / 4	NDa	700
Benzene	3 / 14	6 - 910	2 / 15	35 - 800	5 / 29	17%	0 / 4	ND	1
Carbon Disulfide	2 / 14	4 - 25	2 / 15	2 - 3	4 / 29	14%	1 / 4	7	2
Carbon Tetrachloride	5 / 14	46 - 160	5 / 15	37 - 150	10 / 29	34%	0 / 4	ND	
Chlorobenzene	3 / 14	15 - 3100	3 / 15	16 - 2500	6 / 29	21%	0 / 4	ND	4
Chloroform	8 / 14	10 - 1700	13 / 15	1 - 1600	21 / 29	72%	0 / 4	ND	6
1,1-Dichloroethane	7 / 14	4 - 69	8 / 15	1 - 37	15 / 29	52%	0 / 4	ND	70
1,2-Dichloroethane	6 / 14	9 - 1400	8 / 15	1 - 1200	14 / 29	48%	0 / 4	ND	2
1,1-Dichloroethene	5 / 14	8 - 190	7 / 15	1 - 52	12 / 29	41%	0 / 4	ND	2
1,2-Dichloroethene (total)	7 / 14	11 - 770	8 / 15	2 - 660	15 / 29	52%	0 / 4	ND	10c
1,2-Dichloropropane	0 / 14	ND	1 / 15	1	1 / 29	3%	0 / 4	ND	1
Ethylbenzene	0 / 14	ND	0 / 15	ND	0 / 29	0%	1 / 4	4	700
Methylene Chloride	2 / 14	4 - 330	1 / 15	240	3 / 29	10%	0 / 4	ND	2
1,1,2,2-Tetrachloroethane	6 / 14	4 - 460	5 / 15	11 - 420	11 / 29	38%	0 / 4	ND	2
Tetrachloroethene	9 / 14	11 - 560	10 / 15	2 - 490	19 / 29	66%	0 / 4	ND	1
Toluene	3 / 14	5 - 41	2 / 15	11 - 43	5 / 29	17%	0 / 4	ND	1,000
1,1,1-Trichloroethane	6 / 14	15 - 560	5 / 15	42 - 190	11 / 29	38%	0 / 4	ND	30
1,1,2-Trichloroethane	7 / 14	7 - 81	8 / 15	6 - 83	15 / 29	52%	0 / 4	ND	3
Trichloroethene	9 / 14	6 - 2200	10 / 15	1 - 1500	19 / 29	66%	1 / 4	4	1
Vinyl Chloride	1 / 14	68	2 / 15	9 - 53	3 / 29	10%	0 / 4	ND	5
Xylenes (Total)	2 / 14	13 - 53	1 / 15	45	3 / 29	10%	0 / 4	ND	40
SEMI-VOLATILE ORGANICS									
bis(2-Ethylhexyl)phthalate	0 / 13	ND	1 / 14	6	1 / 27	4%	0 / 4	ND	30
2-Chlorophenol	1 / 13	39	0 / 14	ND	1 / 27	4%	0 / 4	ND	40
1,3-Dichlorobenzene	2 / 13	1 - 4	0 / 14	ND	2 / 27	7%	0 / 4	ND	600
1,4-Dichlorobenzene	2 / 13	6 - 41	1 / 14	89	3 / 27	11%	0 / 4	ND	75
1,2-Dichlorobenzene	3 / 13	3 - 920	2 / 14	420 - 1800	5 / 27	19%	0 / 4	ND	600
Diethylphthalate	2 / 13	2 - 5	0 / 14	ND	2 / 27	7%	0 / 4	ND	5,000
2-Methylnaphthalene	1 / 13	7	0 / 14	ND	1 / 27	4%	0 / 4	ND	
Naphthalene	1 / 13	19	1 / 14	44	2 / 27	7%	0 / 4	ND	30*
Phenol	1 / 13	55	0 / 14	ND	1 / 27	4%	0 / 4	ND	4,000
1,2,4-Trichlorobenzene	1 / 13	3	0 / 14	ND	1 / 27	4%	0 / 4	ND	9

* Interim specific criteria

TABLE 1 (Continued)

SUMMARY OF GROUNDWATER DATA
HIGGINS DISPOSAL

CHEMICAL	ROUND 1 Frequency of Detection	ROUND 1 Range of Concentrations (µg/l)	ROUND 2 Frequency of Detection	ROUND 2 Range of Concentrations (µg/l)	SUMMARY Frequency of Detection	SUMMARY Percent Occurence	BACKGROUND* Frequency of Detection	BACKGROUND* Range of Concentrations (µg/l)	NJ GW Quality Standard (µg/l)
PESTICIDES/PCBs									
Aldrin	0 / 12	ND	1 / 14	0.1	1 / 26	4%	0 / 3	ND	0.04
alpha-BHC	0 / 13	ND	2 / 14	0.025 - 0.097	2 / 27	7%	0 / 4	ND	0.02
beta-BHC	0 / 13	ND	2 / 14	0.03 - 0.041	2 / 27	7%	0 / 4	ND	0.2
delta-BHC	1 / 13	0.04	1 / 14	0.033	2 / 27	7%	0 / 4	ND	
gamma-BHC (Lindane)	0 / 13	ND	1 / 14	0.034	1 / 27	4%	0 / 4	ND	0.2
alpha-Chlordane	1 / 12	0.02	1 / 13	0.064	2 / 25	8%	1 / 4	0.02	0.5
gamma-Chlordane	0 / 13	ND	2 / 14	0.086 - 0.11	2 / 27	7%	0 / 4	ND	0.5
4,4'-DDE	0 / 13	ND	2 / 14	0.069 - 0.21	2 / 27	7%	0 / 4	ND	0.1
4,4'-DDD	0 / 13	ND	1 / 14	0.089	1 / 27	4%	0 / 4	ND	0.1
4,4'-DDT	0 / 13	ND	1 / 14	0.013	1 / 27	4%	0 / 4	ND	0.1
Endosulfan I	0 / 13	ND	1 / 14	0.053	1 / 27	4%	0 / 4	ND	0.4
Heptachlor	0 / 13	ND	1 / 14	0.06	1 / 27	4%	0 / 4	ND	0.4
Heptachlor epoxide	0 / 13	ND	1 / 14	0.042	1 / 27	4%	0 / 4	ND	0.2
PCBs	1 / 13	0.57	0 / 14	ND	1 / 27	4%	1 / 4	3.1	0.5
INORGANICS									
Aluminum	13 / 13	130 - 69300	0 / 0	ND	13 / 13	100%	2 / 4	979 - 99200	200
Antimony	0 / 13	ND	4 / 14	11.9 - 15.1	4 / 27	15%	1 / 4	11.4	20
Arsenic	5 / 13	2.8 - 13.4	9 / 14	2.3 - 35.5	14 / 27	52%	3 / 4	2.5 - 8.5	8
Barium	13 / 13	31.2 - 953	14 / 14	27.1 - 1090	27 / 27	100%	4 / 4	313 - 552	20
Beryllium	5 / 13	1.8 - 11.2	10 / 14	0.87 - 13.1	15 / 27	56%	2 / 4	1.9 - 6.4	0.008
Cadmium	0 / 13	ND	4 / 14	1.4 - 3.1	4 / 27	15%	3 / 4	1.1 - 8.3	4
Calcium	13 / 13	9920 - 77500	14 / 14	9070 - 93000	27 / 27	100%	4 / 4	22000 - 42100	
Chromium	11 / 13	6.9 - 286	14 / 14	5.4 - 1690	25 / 27	93%	4 / 4	14 - 4740	100
Cobalt	5 / 13	8.8 - 103	8 / 14	2.5 - 85.1	13 / 27	48%	2 / 4	20.1 - 91.4	
Copper	11 / 13	8 - 128	12 / 14	5 - 177	23 / 27	85%	3 / 4	6.5 - 114	1,000
Iron	13 / 13	197 - 56000	2 / 2	49000 - 165000	15 / 15	100%	2 / 4	139 - 126000	300
Lead	9 / 13	1.5 - 54.1	14 / 14	3.9 - 115	23 / 27	85%	3 / 4	4 - 50.8	10
Magnesium	13 / 13	2260 - 57000	14 / 14	4650 - 65400	27 / 27	100%	4 / 4	10400 - 51700	
Manganese	13 / 13	16.3 - 7870	14 / 14	46.4 - 10300	27 / 27	100%	4 / 4	199 - 1060	50
Mercury	2 / 8	0.28 - 7.4	2 / 14	0.26 - 0.27	4 / 22	18%	1 / 3	0.28	2
Nickel	9 / 13	13.4 - 255	14 / 14	5.5 - 341	23 / 27	85%	3 / 4	15.7 - 527	100
Potassium	13 / 13	2620 - 23600	14 / 14	1410 - 20000	27 / 27	100%	4 / 4	4720 - 15700	
Selenium	1 / 13	0.75	3 / 14	3.3 - 4.5	4 / 27	15%	0 / 4	ND	50

TABLE 1 (Continued)

SUMMARY OF GROUNDWATER DATA
HIGGINS DISPOSAL

CHEMICAL	ROUND 1 Frequency of Detection	ROUND 1 Range of Concentrations (µg/l)	ROUND 2 Frequency of Detection	ROUND 2 Range of Concentrations (µg/l)	SUMMARY Frequency of Detection	SUMMARY Percent Occurence	BACKGROUND* Frequency of Detection	BACKGROUND* Range of Concentrations (µg/l)	NJ GW Quality Standard (µg/l)
Silver	0 / 13	ND	1 / 14	4.2	1 / 27	4%	0 / 4	ND	
Sodium	13 / 13	10900 - 66400	13 / 14	8830 - 132000	26 / 27	96%	4 / 4	20100 - 30100	50,000
Vanadium	9 / 13	4 - 137	11 / 14	5.2 - 262	20 / 27	74%	3 / 4	8.3 - 265	
Zinc	12 / 13	8.4 - 337	3 / 3	7.3 - 19.6	15 / 16	94%	2 / 4	4.9 - 390	5,000

Notes:

* Background samples from MW-109

Round 1 wells did not include MW-108S and MW-107S

Round 2 wells did not include MW-108S

USEPA SDWA=USEPA Safe Drinking Water Act

MCL - Maximum Contaminant Level

pMCL - Proposed Maximum Contaminant Level

sMCL - Secondary Maximum Contaminant Level

psMCL - Proposed Secondary Maximum Contaminant Level

NJ SDWA=NJ Safe Drinking Water Act(N.J.A.C 7:10-5.1, 7:10-16)

NJ GWQC=NJ Groundwater Quality Criteria(N.J.A.C. 7:9-6)

(a) ND=Not Detected

(b) as total Trihalomethanes

(c) as cis-1,2-Dichloroethene

TABLE 2

RESIDENTIAL WELL SAMPLING RESULTS

Location	Chemicals Detected	Concentration (ppb)
81 (Unfiltered Sample)	Chloroform	2
	Calcium	7000
	Chromium	10
	Copper	207
	Sodium	7000
85 (Unfiltered Sample)	Chloroform	1.7
	Calcium	10000
	Copper	28
	Sodium	8000
	Lead	3.8
	Zinc	501
95 (Unfiltered Sample)	1,1-Dichloroethylene	0.3
	1,1-Dichloroethane	0.7
	Cis 1,2-Dichloroethylene	1.7
	Chloroform	36.0
	1,1,1-Trichloroethane	1.2
	Carbon tetrachloride	11.0
	Trichloroethylene	10.0
	1,2-Dichloroethane	0.4
	Tetrachloroethylene	9.9
	1,1,2,2-Tetrachloroethane	2.2
	1,1,2-Trichloroethane	2.9
	Calcium	24000
	Copper	169
	Iron	133
	Magnesium	11000
	Sodium	19000
	Lead	3.8

TABLE 2 (Continued)

Location	Chemicals Detected	Concentration (ppb)
102 (Filtered Sample)	Chloroform	2.7
	Carbon tetrachloride	0.6
	1,1,2-Trichloroethane	0.9
	Calcium	10000
	Chromium	12
	Copper	95
	Sodium	10000
	Zinc	138
104 (Unfiltered Sample)	Chloroform	0.3
	Tetrachloroethylene	2.7
	Calcium	8000
	Chromium	22
	Copper	84
	Sodium	8000
	Lead	3.5
	Zinc	219
110 (Unfiltered Sample)	Calcium	10000
	Copper	152
	Iron	258
	Magnesium	5000
	Manganese	43
	Sodium	10000
	Lead	10.9
	Zinc	84

TABLE 2 (Continued)

Location	Chemicals Detected	Concentration (ppb)
82 (Unfiltered Sample)	1,1-Dichloroethylene	29
	1,1-Dichloroethane	10
	Trans 1,2-Dichloroethylene	12
	Cis 1,2-Dichloroethylene	37
	1,1,1-Trichloroethane	98
	Carbon Tetrachloride	26
	1,2-Dichloropropane	0.3
	1,2-Dichloroethane	3.3
	1,1,2,2-Tetrachloroethane	76
	Chloroform	200
	Trichloroethylene	230
	Tetrachloroethylene	200
	1,1,2-Trichloroethane	22
	Trichlorotrifluoroethane	12
	Diisopropylether	20
	Calcium	25000
	Copper	141
	Iron	232
	Potassium	11000
	Magnesium	11000
	Sodium	20000
	Lead	5.5
121 Higgins' Property (Filtered Sample)	1,1-Dichloroethane	0.5
	Cis 1,2-Dichloroethylene	1.0
	Chloroform	30
	1,1,1-Trichloroethane	0.2
	Carbon tetrachloride	0.9
	Trichloroethylene	1.1
	1,2-Dichloroethane	0.6
	Tetrachloroethylene	0.4
	1,1,2,2-Tetrachloroethane	3.6
	1,1,2-Trichloroethane	1.5
	Calcium	43000
	Copper	91
	Magnesium	17000
	Sodium	16000
	Zinc	2880

TABLE 2 (Continued)

Location	Chemicals Detected	Concentration (ppb)
122 (Unfiltered Sample)	Chloroform	0.6
	Calcium	13000
	Magnesium	9000
	Sodium	8000
	Zinc	189
87 (Unfiltered Sample)	1,1-Dichloroethylene	2.8
	1,1-Dichloroethane	0.9
	Trans 1,2-Dichloroethylene	0.6
	Cis 1,2-Dichloroethylene	1.9
	Chloroform	96
	1,1,1-Trichloroethane	5.6
	Carbon tetrachloride	1.1
	Trichloroethylene	1.2
	1,2-Dichloroethane	0.7
	1,1,2-Trichloroethane	0.9
	Calcium	13000
	Copper	42
	Sodium	7000
	Lead	5.2

TABLE 3

SUMMARY OF INDOOR SURFACE SOIL SAMPLES
HIGGINS DISPOSAL

CHEMICAL	Frequency	Range of Concentrations (mg/kg)
VOLATILE ORGANICS		
Acetone	2 / 6	0.006 - 0.009
Chloroform	4 / 6	0.001 - 0.002
1,1,2,2-Tetrachloroethane	1 / 6	0.003
Tetrachloroethene	4 / 6	0.005 - 0.022
Toluene	1 / 6	0.001
SEMI-VOLATILE ORGANICS		
Diethylphthalate	1 / 6	1.1
tPAHs (total)	3 / 6	1 - 2.9
PESTICIDES		
Aldrin	3 / 5	0.013 - 0.034
alpha-BHC	4 / 6	0.0019 - 0.0064
delta-BHC	1 / 2	0.0021
4,4'-DDE	1 / 5	0.016
Dieldrin	2 / 5	0.021 - 0.029
Endosulfan sulfate	1 / 3	0.0012
Heptachlor	1 / 6	0.00061
Heptachlor epoxide	2 / 6	0.027 - 0.037
PCBs (total)	3 / 9	0.18 - 7.5
INORGANICS		
Aluminum	6 / 6	3320 - 5860
Arsenic	2 / 6	1.3 - 1.5
Barium	4 / 6	26 - 30
Cadmium	6 / 6	0.6 - 1.3
Calcium	6 / 6	2490 - 5740
Chromium	6 / 6	5 - 12
Copper	6 / 6	18 - 33
Iron	6 / 6	5360 - 8520
Lead	6 / 6	15 - 73
Magnesium	6 / 6	787 - 1550
Manganese	6 / 6	76 - 131
Mercury	1 / 6	0.4
Nickel	4 / 6	5 - 6
Potassium	5 / 6	699 - 1100
Sodium	4 / 6	572 - 761
Vanadium	6 / 6	11 - 17
Zinc	6 / 6	84 - 245

NA: Not Available
tPAHs total Polycyclic Aromatic Hydrocarbons
PCBs Polychlorinated Biphenyls mixture

TABLE 4

SUMMARY OF OUTDOOR SURFACE SOILS DATA
HIGGINS DISPOSAL

CHEMICAL	LANDFILL AREA Frequency	LANDFILL AREA Range of Concentrations (mg/kg)	TRANSFER STATION Frequency	TRANSFER STATION Range of Concentrations (mg/kg)	MAINTENANCE GARAGE Frequency	MAINTENANCE GARAGE Range of Concentrations (mg/kg)	FIELD/PASTURE AREAS Frequency	FIELD/PASTURE AREAS Range of Concentrations (mg/kg)	OUTDOOR SS SUMMARY * Frequency	OUTDOOR SS SUMMARY * Percent Occurrence
VOLATILE ORGANICS										
Acetone	2 / 20	0.009 - 0.16	5 / 10	0.014 - 0.043	0 / 8	ND	0 / 10	ND	7 / 48	15%
2-Butanone	1 / 20	0.024	2 / 10	0.014 - 0.042	0 / 8	ND	0 / 10	ND	3 / 48	6%
Carbon Disulfide	0 / 20	ND	1 / 10	0.22	0 / 8	ND	0 / 10	ND	1 / 48	2%
Carbon Tetrachloride	1 / 20	0.007	0 / 10	ND	0 / 8	ND	0 / 10	ND	1 / 48	2%
Chloroform	1 / 20	0.01	0 / 10	ND	0 / 8	ND	0 / 10	ND	1 / 48	2%
1,2-Dichloroethene (total)	0 / 20	ND	1 / 10	0.076	0 / 8	ND	0 / 10	ND	1 / 48	2%
1,1,2,2-Tetrachloroethane	0 / 20	ND	1 / 10	0.069	0 / 8	ND	0 / 10	ND	1 / 48	2%
Tetrachloroethene	3 / 20	0.008 - 0.036	1 / 10	0.1	0 / 8	ND	0 / 10	ND	4 / 48	8%
1,1,2-Trichloroethane	1 / 20	0.015	1 / 10	0.044	0 / 8	ND	0 / 10	ND	2 / 48	4%
Trichloroethene	0 / 20	ND	1 / 10	0.009	0 / 8	ND	0 / 10	ND	1 / 48	2%
Xylenes (total)	0 / 20	ND	1 / 10	0.009	0 / 8	ND	0 / 10	ND	1 / 48	2%
SEMI-VOLATILE ORGANICS										
bis(2-Ethylhexyl)phthalate	9 / 20	0.039 - 2.2	6 / 10	0.05 - 2.4	6 / 8	0.13 - 2	5 / 10	0.038 - 0.17	26 / 48	54%
Butylbenzylphthalate	4 / 20	0.053 - 2.4	2 / 10	0.077 - 0.081	1 / 8	0.085	0 / 10	ND	7 / 48	15%
Carbazole	6 / 20	0.024 - 4.4	4 / 10	0.045 - 1.9	2 / 8	0.039 - 0.052	0 / 10	ND	12 / 48	25%
Diethylphthalate	1 / 20	0.035	0 / 10	ND	0 / 8	ND	0 / 10	ND	1 / 48	2%
Dimethylphthalate	0 / 20	ND	0 / 10	ND	1 / 8	0.066	0 / 10	ND	1 / 48	2%
Di-n-butylphthalate	1 / 20	0.048	1 / 10	0.037	0 / 8	ND	0 / 10	ND	2 / 48	4%
Di-n-octylphthalate	1 / 20	0.81	0 / 10	ND	0 / 8	ND	0 / 10	ND	1 / 48	2%
4-Methylphenol	1 / 20	0.06	0 / 10	ND	0 / 8	ND	0 / 10	ND	1 / 48	2%
N-nitrosodiphenylamine	1 / 20	0.029	0 / 10	ND	0 / 8	ND	0 / 10	ND	1 / 48	2%
cPAHs (total)	19 / 20	0.079 - 125.6	10 / 10	0.575 - 105.11	6 / 8	0.249 - 2.75	4 / 10	0.057 - 0.325	39 / 48	81%
PAHs (total)	20 / 20	0.119 - 301.6	10 / 10	0.337 - 50.4	7 / 8	0.572 - 5.889	8 / 10	0.019 - 0.601	45 / 48	94%
PESTICIDES/PCBs										
Aldrin	0 / 20	ND	1 / 8	0.038	0 / 8	ND	0 / 10	ND	1 / 46	2%
delta-BHC	1 / 14	0.00051	1 / 4	0.0041	2 / 5	0.0027 - 0.003	1 / 10	0.00023	5 / 33	15%
alpha-Chlordane	0 / 16	ND	1 / 5	0.0084	1 / 5	0.028	0 / 9	ND	2 / 35	6%
gamma-Chlordane	0 / 14	ND	0 / 1	ND	0 / 4	ND	1 / 4	0.00041	1 / 23	4%
4,4'-DDD	3 / 11	0.026 - 0.33	3 / 7	0.016 - 0.027	0 / 7	ND	0 / 10	ND	6 / 35	17%
4,4'-DDE	10 / 11	0.0053 - 0.24	5 / 7	0.0023 - 0.024	5 / 6	0.0046 - 0.22	2 / 9	0.0063 - 0.11	22 / 33	67%
4,4'-DDT	5 / 8	0.0029 - 0.12	0 / 2	ND	3 / 3	0.028 - 0.25	0 / 3	ND	8 / 16	50%
Dieldrin	3 / 14	0.00017 - 0.00089	3 / 4	0.0025 - 0.004	4 / 6	0.00017 - 0.17	1 / 10	0.00056	11 / 34	32%
Endosulfan I	0 / 10	ND	0 / 9	ND	0 / 7	ND	1 / 10	0.001	1 / 36	3%
Endosulfan II	8 / 16	0.00022 - 0.058	2 / 7	0.0019 - 0.0043	5 / 5	0.00055 - 0.04	3 / 10	0.0005 - 0.00069	18 / 38	47%
Endosulfan sulfate	2 / 18	0.0021 - 0.017	1 / 9	0.00037 - 0.00052	3 / 7	0.0013 - 0.0018	0 / 7	ND	6 / 41	15%

TBLSEC4.XLS

TABLE 4 (Continued)

SUMMARY OF OUTDOOR SURFACE SOILS DATA
HIGGINS DISPOSAL

CHEMICAL	LANDFILL AREA Frequency	LANDFILL AREA Range of Concentrations (mg/kg)	TRANSFER STATION Frequency	TRANSFER STATION Range of Concentrations (mg/kg)	MAINTENANCE GARAGE Frequency	MAINTENANCE GARAGE Range of Concentrations (mg/kg)	FIELD/PASTURE AREAS Frequency	FIELD/PASTURE AREAS Range of Concentrations (mg/kg)	OUTDOOR SS SUMMARY * Frequency	OUTDOOR SS SUMMARY * Percent Occurrence
Endrin	1 / 13	0.014	3 / 4	0.001 - 0.015	5 / 6	0.0002 - 0.01	1 / 8	0.00038	10 / 31	32%
Endrin aldehyde	1 / 13	0.0041	1 / 6	0.01	1 / 8	0.0007	0 / 10	ND	3 / 37	8%
Heptachlor	1 / 14	0.07	1 / 9	0.0028	1 / 8	0.0077	0 / 10	ND	3 / 41	7%
Heptachlor epoxide	0 / 17	ND	0 / 3	ND	0 / 5	ND	1 / 10	0.00054	1 / 35	3%
Methoxychlor	0 / 11	ND	0 / 5	ND	0 / 7	ND	1 / 10	0.0016	1 / 33	3%
PCBs (total)	19 / 20	0.095 - 22	9 / 10	0.13 - 1.7	8 / 8	0.021 - 0.86	22 / 43	0.04 - 2.8	58 / 81	72%
INORGANICS										
Aluminum	20 / 20	4600 - 37400	10 / 10	8220 - 38800	8 / 8	6750 - 18800	10 / 10	9490 - 17000	48 / 48	100%
Antimony	0 / 20	ND	2 / 10	10.1 - 13.3	0 / 8	ND	0 / 10	ND	2 / 48	4%
Arsenic	20 / 20	1.6 - 27.3	10 / 10	3.3 - 33.8	8 / 8	4 - 32.2	10 / 10	3.6 - 6	48 / 48	100%
Barium	20 / 20	44.3 - 874	10 / 10	55.5 - 181	8 / 8	28.5 - 207	10 / 10	50.2 - 193	48 / 48	100%
Beryllium	20 / 20	0.2 - 1.5	10 / 10	0.22 - 1	8 / 8	0.33 - 2.3	10 / 10	0.42 - 0.96	48 / 48	100%
Cadmium	5 / 20	0.49 - 3	4 / 10	1.1 - 1.2	6 / 8	0.42 - 6.4	0 / 10	ND	15 / 48	31%
Calcium	20 / 20	782 - 25800	10 / 10	2170 - 45200	8 / 8	2470 - 64100	10 / 10	950 - 2440	48 / 48	100%
Chromium	20 / 20	7.3 - 41.8	10 / 10	15.7 - 42.8	8 / 8	16.4 - 57.7	10 / 10	11.6 - 21.7	48 / 48	100%
Cobalt	20 / 20	2.1 - 51.5	10 / 10	4.8 - 22.6	8 / 8	3.2 - 14.3	10 / 10	4.8 - 11.6	48 / 48	100%
Copper	20 / 20	16.9 - 177	10 / 10	19.1 - 391	8 / 8	4.9 - 487	10 / 10	11.6 - 36.2	48 / 48	100%
Iron	20 / 20	7950 - 45200	10 / 10	11200 - 35100	8 / 8	16000 - 45500	10 / 10	12200 - 20200	48 / 48	100%
Lead	20 / 20	17.3 - 228	10 / 10	33.9 - 81500	8 / 8	15.6 - 1460	10 / 10	19.9 - 36.5	48 / 48	100%
Magnesium	20 / 20	540 - 14700	10 / 10	2100 - 15600	8 / 8	555 - 21300	10 / 10	862 - 2300	48 / 48	100%
Manganese	5 / 5	262 - 561	10 / 10	182 - 1580	8 / 8	71.4 - 814	10 / 10	145 - 599	33 / 33	100%
Mercury	19 / 20	0.09 - 43.1	10 / 10	0.15 - 2	8 / 8	0.05 - 1.1	9 / 10	0.07 - 0.3	46 / 48	96%
Nickel	20 / 20	4.8 - 38.4	10 / 10	8.9 - 125	8 / 8	5 - 29.2	10 / 10	6.7 - 14.1	48 / 48	100%
Potassium	20 / 20	307 - 4220	10 / 10	792 - 2500	8 / 8	574 - 1690	10 / 10	330 - 1210	48 / 48	100%
Selenium	1 / 19	2.3	0 / 10	ND	1 / 8	1.2	2 / 9	0.81 - 1.7	4 / 46	9%
Silver	10 / 20	1 - 5.4	4 / 10	1.4 - 2.6	8 / 8	2 - 7.9	8 / 10	0.87 - 2.7	30 / 48	63%
Sodium	20 / 20	99.3 - 6710	10 / 10	110 - 4680	8 / 8	58.2 - 924	10 / 10	73.8 - 347	48 / 48	100%
Thallium	0 / 20	ND	0 / 10	ND	4 / 8	0.35 - 0.47	0 / 10	ND	4 / 48	8%
Vanadium	20 / 20	13.7 - 80.4	10 / 10	20 - 87.5	8 / 8	23.4 - 86	10 / 10	19.1 - 36.1	48 / 48	100%
Zinc	20 / 20	39.6 - 307	10 / 10	79.3 - 731	8 / 8	24.3 - 642	10 / 10	36.8 - 65.8	48 / 48	100%

ND: Not Detected

NA: Not Available

* Outdoor Surface Soil Summary

cPAHs carcinogenic Polycyclic Aromatic Hydrocarbons

tPAHs total Polycyclic Aromatic Hydrocarbons

PCBs Polychlorinated Biphenyl mixture

TABLE 5

SUMMARY OF OUTDOOR SUBSURFACE SOIL DATA
HIGGINS DISPOSAL

CHEMICAL	LANDFILL BORINGS AND TEST PIT SAMPLES		UST AREA		MONITORING WELL BORINGS		OUTDOOR SB SUMMARY *	
	Frequency of Detection	Range of Concentrations (mg/kg)	Frequency of Detection	Range of Concentrations (mg/kg)	Frequency of Detection	Range of Concentrations (mg/kg)	Frequency of Detection	Percent Occurrence
VOLATILE ORGANICS								
Acetone	4 / 19	0.042 - 0.54	3 / 4	0.047 - 0.095	3 / 7	0.054 - 0.26	10 / 30	33%
Benzene	2 / 17	0.005 - 0.52	0 / 4	ND	0 / 7	ND	2 / 28	7%
2-Butanone	3 / 18	0.004 - 0.006	1 / 4	0.008	3 / 7	0.008 - 0.17	7 / 29	24%
Carbon Tetrachloride	0 / 17	ND	0 / 4	ND	1 / 7	0.001	1 / 28	4%
Chlorobenzene	3 / 17	0.002 - 0.011	0 / 4	ND	0 / 7	ND	3 / 28	11%
Chloroform	4 / 19	0.002 - 0.45	0 / 4	ND	2 / 7	0.001 - 0.002	6 / 30	20%
1,1-Dichloroethane	1 / 19	0.46	0 / 4	ND	0 / 7	ND	1 / 30	3%
1,2-Dichloroethene (total)	3 / 19	0.001 - 0.22	0 / 4	ND	0 / 7	ND	3 / 30	10%
Ethylbenzene	3 / 17	0.4 - 1.5	0 / 4	ND	0 / 7	ND	3 / 28	11%
Methylene Chloride	5 / 19	0.008 - 0.73	2 / 4	0.003 - 0.004	0 / 7	ND	7 / 30	23%
Tetrachloroethene	10 / 18	0.002 - 30	1 / 4	0.018	1 / 7	0.002	12 / 29	41%
Toluene	5 / 17	0.001 - 1.0	0 / 4	ND	0 / 7	ND	5 / 28	18%
1,1,1-Trichloroethane	4 / 18	0.049 - 58	0 / 4	ND	0 / 7	ND	4 / 29	14%
Trichloroethene	4 / 17	0.002 - 3.1	0 / 4	ND	0 / 7	ND	4 / 28	14%
Vinyl chloride	1 / 19	0.27	0 / 4	ND	0 / 7	ND	1 / 30	3%
Xylenes (Total)	3 / 17	0.015 - 7.9	0 / 4	ND	0 / 7	ND	3 / 28	11%
SEMI-VOLATILE ORGANICS								
bis(2-Ethylhexyl)phthalate	3 / 18	0.029 - 0.056	0 / 4	ND	0 / 6	ND	3 / 28	11%
Carbazole	1 / 18	0.21	0 / 4	ND	0 / 6	ND	1 / 28	4%
2,4-Dimethylphenol	1 / 18	12	0 / 4	ND	0 / 7	ND	1 / 29	3%
Di-n-butylphthalate	1 / 18	0.150	0 / 4	ND	1 / 7	0.085	2 / 29	7%
2-Methylphenol	1 / 18	5.6	0 / 4	ND	0 / 7	ND	1 / 29	3%
4-Methylphenol	1 / 18	18	0 / 4	ND	0 / 7	ND	1 / 29	3%
Pentachlorophenol	1 / 18	3.4	0 / 4	ND	0 / 7	ND	1 / 29	3%
Phenol	1 / 18	3.7	0 / 4	ND	0 / 7	ND	1 / 29	3%
cPAHs	4 / 18	0.089 - 3.55	2 / 4	0.31 - 2.060	1 / 7	0.028	7 / 29	24%
PAHs	7 / 18	0.052 - 51.2	2 / 4	1.07 - 3.924	3 / 7	0.067 - 0.308	12 / 29	41%

TABLE 5 (Continued)

SUMMARY OF OUTDOOR SUBSURFACE SOIL DATA
HIGGINS DISPOSAL

CHEMICAL	LANDFILL BORINGS AND TEST PIT SAMPLES Frequency of Detection	LANDFILL BORINGS AND TEST PIT SAMPLES Range of Concentrations (mg/kg)	UST AREA Frequency of Detection	UST AREA Range of Concentrations (mg/kg)	MONITORING WELL BORINGS Frequency of Detection	MONITORING WELL BORINGS Range of Concentrations (mg/kg)	OUTDOOR SB SUMMARY * Frequency of Detection	OUTDOOR SB SUMMARY * Percent Occurrence
PESTICIDES/PCBs								
Aldrin	2 / 19	0.00014 - 0.00031	0 / 2	ND	0 / 7	ND	2 / 28	7%
alpha-BHC	1 / 18	0.00011	1 / 4	0.0011	0 / 7	ND	2 / 29	7%
beta-BHC	0 / 19	ND	1 / 4	0.0029	0 / 7	ND	1 / 30	3%
gamma-BHC (Lindane)	1 / 17	0.00019	1 / 2	0.00012	0 / 7	ND	2 / 26	8%
alpha-Chlordane	2 / 15	0.0028 - 0.022	3 / 4	0.0013 - 0.02	0 / 6	ND	5 / 25	20%
gamma-Chlordane	2 / 18	0.0022 - 0.018	0 / 2	ND	0 / 7	ND	2 / 27	7%
4,4'-DDE	3 / 19	0.0017 - 0.015	1 / 4	0.00856	0 / 7	ND	4 / 30	13%
4,4'-DDT	4 / 18	0.018 - 0.078	3 / 3	0.00026 - 0.01	0 / 6	ND	7 / 27	26%
Dieldrin	6 / 16	0.00016 - 0.0016	3 / 4	0.00023 - 0.042	0 / 7	ND	9 / 27	33%
Endrin	1 / 19	0.00057	0 / 4	ND	0 / 7	ND	1 / 30	3%
Endrin aldehyde	2 / 18	0.0027 - 0.045	0 / 4	ND	0 / 7	ND	2 / 29	7%
Endrin ketone	1 / 19	0.0064	1 / 3	0.0046	0 / 7	ND	2 / 29	7%
Endrin sulfate	1 / 19	0.06	0 / 4	ND	0 / 7	ND	1 / 30	3%
Heptachlor	0 / 17	ND	1 / 4	0.00022	0 / 7	ND	1 / 28	4%
Methoxychlor	5 / 19	0.0028 - 0.012	0 / 4	ND	0 / 7	ND	5 / 30	17%
PCBs (total)	7 / 19	0.027 - 3.4	1 / 4	2.6	0 / 7	ND	8 / 30	27%
INORGANICS								
Aluminum	19 / 19	1230 - 78800	4 / 4	19600 - 37300	7 / 7	5260 - 49400	30 / 30	100%
Arsenic	18 / 19	1.5 - 8	4 / 4	3.4 - 4.7	6 / 6	2.2 - 8.3	28 / 29	97%
Barium	18 / 19	21.4 - 124	4 / 4	50.1 - 69.6	6 / 7	41.7 - 646	28 / 30	93%
Beryllium	11 / 19	0.45 - 2.7	4 / 4	0.98 - 1.8	6 / 7	0.43 - 4.4	21 / 30	70%
Cadmium	11 / 19	0.5 - 2.7	0 / 4	ND	2 / 7	0.9 - 1.9	13 / 30	43%
Calcium	17 / 19	361 - 18800	4 / 4	843 - 13500	5 / 7	102 - 3820	26 / 30	87%
Chromium	16 / 17	7 - 59.8	4 / 4	24 - 38.1	6 / 6	6.5 - 87.6	26 / 27	96%
Cobalt	16 / 19	4.2 - 43.5	4 / 4	8.1 - 17.4	7 / 7	12 - 53.6	27 / 30	90%
Copper	19 / 19	5 - 174	4 / 4	9.9 - 35.3	6 / 7	2.9 - 60.7	29 / 30	97%
Iron	19 / 19	6090 - 39000	4 / 4	17300 - 25200	7 / 7	11100 - 57500	30 / 30	100%
Lead	16 / 16	2 - 85	4 / 4	4.9 - 82.3	7 / 7	0.6 - 15.2	27 / 27	100%
Magnesium	16 / 19	622 - 15200	4 / 4	2170 - 7830	6 / 7	661 - 33800	26 / 30	87%

TABLE 5 (Continued)

SUMMARY OF OUTDOOR SUBSURFACE SOIL DATA
HIGGINS DISPOSAL

CHEMICAL	LANDFILL BORINGS AND TEST PIT SAMPLES Frequency of Detection	Range of Concentrations (mg/kg)	UST AREA Frequency of Detection	Range of Concentrations (mg/kg)	MONITORING WELL BORINGS Frequency of Detection	Range of Concentrations (mg/kg)	OUTDOOR SB SUMMARY * Frequency of Detection	Percent Occurence
Manganese	19 / 19	21 - 795	4 / 4	256 - 494	7 / 7	216 - 2210	30 / 30	100%
Mercury	3 / 19	0.11 - 0.4	1 / 4	0.19	0 / 7	ND	4 / 30	13%
Nickel	18 / 19	6 - 57.5	4 / 4	16.8 - 33.8	7 / 7	8 - 53.4	29 / 30	97%
Potassium	11 / 19	453 - 2510	4 / 4	775 - 1060	6 / 7	416 - 11800	21 / 30	70%
Selenium	13 / 19	0.7 - 2.9	0 / 4	ND	0 / 6	ND	13 / 29	45%
Silver	8 / 19	1 - 6.7	4 / 4	1.6 - 3.7	1 / 7	2.2	13 / 30	43%
Sodium	11 / 19	102 - 4730	4 / 4	212 - 367	5 / 7	35.3 - 210	20 / 30	67%
Thallium	5 / 19	0.46 - 1.3	2 / 4	0.56 - 0.64	2 / 7	1.3 - 1.7	9 / 30	30%
Vanadium	18 / 19	14 - 113	4 / 4	37.7 - 56.4	7 / 7	23 - 195	29 / 30	97%
Zinc	16 / 16	15.6 - 321	2 / 2	27 - 70	6 / 6	19 - 81	24 / 24	100%

ND: Non Detected
NA: Not Available

* Based on the total Frequency of Detection for landfill boring samples, test pit samples, UST area boring samples, and monitoring well boring samples
** Background samples include WB-101s and WB-109s.
*** NJDEPE, 1993. Division of Science and Research

cPAHs carcinogenic Polycyclic Aromatic Hydrocarbons
tPAHs total Polycyclic Aromatic Hydrocarbons
PCBs Polychlorinated Biphenyls mixture

TABLE 6

SUMMARY OF SURFACE WATER DATA
HIGGINS DISPOSAL

CHEMICAL	DIRTY BROOK (upstream)		DIRTY BROOK (opposite pond outfall)		NORTH POND		SOUTH POND		UNNAMED BROOK	
	Frequency of Detection	Range of Concentrations (mg/l)	Frequency of Detection	Range of Concentrations (mg/l)	Frequency of Detection	Range of Concentrations (mg/l)	Frequency of Detection	Range of Concentrations (mg/l)	Frequency of Detection	Range of Concentrations (mg/l)
VOLATILE ORGANICS										
Trichloroethene	0 / 1	ND	0 / 2	ND	0 / 2	ND	1 / 2	0.001	0 / 2	ND
SEMI-VOLATILE ORGANICS										
bis(2-Ethylhexyl)phthalate	0 / 1	ND	0 / 2	ND	1 / 2	0.003	0 / 2	ND	0 / 2	ND
PESTICIDES										
gamma-Chlordane	0 / 1	ND	1 / 2	0.00002	0 / 2	ND	0 / 2	ND	0 / 2	ND
INORGANICS										
Aluminum	NA	NA	1 / 1	1.59	1 / 1	0.369	1 / 1	0.268	1 / 1	8.2
Arsenic	0 / 1	ND	0 / 2	ND	1 / 2	0.0026	0 / 2	ND	1 / 2	0.0052
Barium	1 / 1	0.0285	2 / 2	0.0355-0.0427	2 / 2	0.0214-0.0409	2 / 2	0.0231-0.0267	2 / 2	0.0551-0.138
Beryllium	1 / 1	0.00045	0 / 2	ND	1 / 2	0.00055	0 / 2	ND	0 / 2	ND
Cadmium	0 / 1	ND	0 / 2	ND	0 / 2	ND	1 / 2	0.0011	1 / 2	0.0014
Calcium	1 / 1	17.9	2 / 2	16.7-25.6	2 / 2	15.3-20.8	2 / 2	15-17.5	2 / 2	17.6-26.7
Chromium	1 / 1	0.0086	1 / 2	0.0144	1 / 2	0.0178	1 / 2	0.0031	2 / 2	0.0028-0.0256
Cobalt	1 / 1	0.0023	1 / 2	0.0035	1 / 2	0.0052	0 / 2	ND	1 / 2	0.0106
Copper	1 / 1	0.0123	1 / 2	0.0154	1 / 2	0.022	1 / 2	0.007	2 / 2	0.0041-0.0129
Iron	1 / 1	3.89	2 / 2	6.46-9.3	2 / 2	0.639-8.1	2 / 2	0.732-1.94	2 / 2	2.05-17.8
Lead	1 / 1	0.0055	2 / 2	0.0018-0.0063	1 / 2	0.0084	2 / 2	0.0022-0.01	2 / 2	0.0041-0.0154
Magnesium	1 / 1	5.89	2 / 2	6.12-9.82	2 / 2	6.48-7.25	2 / 2	7.85-8.5	2 / 2	6.26-9.51
Manganese	NA	NA	1 / 1	1.83	1 / 1	0.0317	1 / 1	0.358	1 / 1	1.76
Nickel	0 / 1	ND	1 / 2	0.0087	1 / 2	0.0097	0 / 2	ND	0 / 1	ND
Potassium	1 / 1	2.62	2 / 2	2.72-2.9	2 / 2	2.43-3.09	2 / 2	3.07-3.19	2 / 2	2.02-2.65
Selenium	0 / 1	ND	1 / 2	0.0024	0 / 2	ND	0 / 2	ND	0 / 2	ND
Sodium	1 / 1	8.9	2 / 2	6.65-9.74	2 / 2	5.64-9.46	2 / 2	8.1-10.8	2 / 2	7.17-9.65
Vanadium	1 / 1	0.0098	1 / 2	0.0176	1 / 2	0.0222	1 / 2	0.0035	2 / 2	0.0032-0.0269
Zinc	NA	NA	1 / 1	0.0307	0 / 1	ND	0 / 1	ND	1 / 1	0.0821

ND: Not Detected NA: Not Analyzed

TABLE 7

SUMMARY OF SEDIMENT DATA
HIGGINS DISPOSAL

CHEMICAL	DIRTY BROOK (upstream) Frequency of Detection	DIRTY BROOK (upstream) Range of Concentrations (mg/kg)	DIRTY BROOK (opposite pond outfall) Frequency of Detection	DIRTY BROOK (opposite pond outfall) Range of Concentrations (mg/kg)	NORTH POND Frequency of Detection	NORTH POND Range of Concentrations (mg/kg)	SOUTH POND Frequency of Detection	SOUTH POND Range of Concentrations (mg/kg)	UNNAMED BROOK Frequency of Detection	UNNAMED BROOK Range of Concentrations (mg/kg)
VOLATILE ORGANICS										
Acetone	0 / 2	ND	0 / 2	ND	0 / 2	ND	1 / 2	0.044	1 / 2	0.016
2-Butanone	0 / 2	ND	0 / 2	ND	0 / 2	ND	0 / 2	ND	1 / 2	0.012
Methylene chloride	0 / 2	ND	1 / 2	0.004	1 / 2	0.013	0 / 2	ND	0 / 2	ND
SEMI-VOLATILE ORGANICS										
bis(2-Ethylhexyl)phthalate	0 / 2	ND	0 / 2	ND	1 / 2	0.22	1 / 2	0.055	0 / 2	ND
nPAHs	2 / 2	0.368-0.657	2 / 2	0.412-0.999	2 / 2	0.046-0.095	2 / 2	0.314-0.687	2 / 2	0.626-1.79
cPAHs	2 / 2	0.227-0.439	2 / 2	0.132-0.427	0 / 2	ND	2 / 2	0.064-0.297	2 / 2	1.21-3.81
PESTICIDES/PCBs										
Aldrin	0 / 2	ND	0 / 2	ND	0 / 2	ND	1 / 2	0.0059	1 / 2	0.0024
alpha-Chlordane	1 / 2	0.0088	1 / 2	0.0029	2 / 2	0.0036-0.006	1 / 2	0.0088	1 / 2	0.0022
gamma-Chlordane	1 / 2	0.0098	0 / 2	ND	0 / 2	ND	1 / 2	0.0019	0 / 2	ND
4,4'-DDD	0 / 2	ND	0 / 2	ND	0 / 2	ND	1 / 2	0.0023	1 / 2	0.011
4,4'-DDE	0 / 2	ND	0 / 2	ND	1 / 2	0.0032	1 / 2	0.0071	2 / 2	0.017-0.031
4,4'-DDT	0 / 2	ND	0 / 2	ND	0 / 2	ND	0 / 1	ND	1 / 2	0.0073
Dieldrin	0 / 2	ND	0 / 1	ND	0 / 1	ND	1 / 1	0.0028	2 / 2	0.015-0.019
Endosulfan I	0 / 2	ND	0 / 2	ND	0 / 2	ND	0 / 2	ND	1 / 2	0.0036
Endrin	0 / 2	ND	1 / 2	0.007	0 / 2	ND	0 / 1	ND	1 / 2	0.0084
Endrin aldehyde	0 / 2	ND	0 / 2	ND	0 / 2	ND	1 / 2	0.0057	0 / 2	ND
Heptachlor	1 / 2	0.0019	0 / 2	ND	0 / 2	ND	0 / 1	ND	0 / 2	ND
PCBs	0 / 2	ND	1 / 2	0.131	2 / 2	0.17-0.32	2 / 2	0.46-0.92	1 / 2	0.184

TABLE 7 (Continued)

SUMMARY OF SEDIMENT DATA
HIGGINS DISPOSAL

CHEMICAL	DIRTY BROOK (upstream)		DIRTY BROOK (opposite pond outfall)		NORTH POND		SOUTH POND		UNNAMED BROOK	
	Frequency of Detection	Range of Concentrations (mg/kg)	Frequency of Detection	Range of Concentrations (mg/kg)	Frequency of Detection	Range of Concentrations (mg/kg)	Frequency of Detection	Range of Concentrations (mg/kg)	Frequency of Detection	Range of Concentrations (mg/kg)
INORGANICS										
Aluminum	2 / 2	9300-12700	2 / 2	6050-31600	2 / 2	7990-9620	2 / 2	7810-10100	2 / 2	10900-15500
Arsenic	2 / 2	2.7 - 3.5	2 / 2	3-8.6	2 / 2	2.8-5.4	2 / 2	3.4-4.7	2 / 2	9.5-9.6
Barium	2 / 2	50.2-52.8	2 / 2	35.6-117	2 / 2	54.9-64.7	2 / 2	62-66.8	2 / 2	108-115
Beryllium	2 / 2	0.44-0.52	2 / 2	0.35-0.78	2 / 2	0.98-1	2 / 2	0.47-0.78	2 / 2	1.1-1.2
Cadmium	0 / 2	ND	1 / 2	1.4	1 / 2	1.3	0 / 2	ND	0 / 2	ND
Calcium	2 / 2	4070-4740	2 / 2	2530-5520	2 / 2	1350-1610	2 / 2	1720-3170	2 / 2	5070-5350
Chromium	2 / 2	49.8-54.3	2 / 2	38.1-164	2 / 2	23.3-25.8	2 / 2	17-20.1	2 / 2	26.1-33.3
Cobalt	2 / 2	18.4-20	2 / 2	12.5-32.8	2 / 2	10.2-11.6	2 / 2	7-8.5	2 / 2	13.3-14.2
Copper	2 / 2	52.3-61.7	2 / 2	33.3-122	2 / 2	20.2-63.2	2 / 2	21.5-30.5	2 / 2	31.2-34.1
Iron	2 / 2	21800-23000	2 / 2	20800-53000	2 / 2	20300-23300	2 / 2	15400-16300	2 / 2	23700-23800
Lead	2 / 2	11.7-12.1	2 / 2	9.6-15.9	2 / 2	14.5-23.7	2 / 2	26.2-31.9	2 / 2	8.7-39.8
Magnesium	2 / 2	7500-7590	2 / 2	4550-11700	2 / 2	2560-2710	2 / 2	1770-2460	2 / 2	5170-5490
Manganese	2 / 2	445-497	2 / 2	266-777	2 / 2	158-420	2 / 2	315-359	2 / 2	776-1130
Mercury	0 / 2	ND	0 / 2	ND	1 / 2	0.18	2 / 2	0.06-0.29	0 / 2	ND
Nickel	1 / 1	37	1 / 1	64	1 / 1	14.2	1 / 1	12.3	1 / 1	21.3
Potassium	2 / 2	1090-1290	2 / 2	783-1220	2 / 2	497-758	2 / 2	412-542	2 / 2	1480-1650
Selenium	1 / 2	0.76	1 / 2	0.46	1 / 2	0.87	1 / 2	0.6	1 / 2	0.82
Silver	0 / 2	ND	2 / 2	0.85-2.1	0 / 2	ND	0 / 2	ND	0 / 2	ND
Sodium	2 / 2	202-387	2 / 2	141-481	2 / 2	72-156	2 / 2	139-463	2 / 2	143-279
Thallium	0 / 2	ND	0 / 2	ND	1 / 2	1	1 / 2	0.48	1 / 2	0.82
Vanadium	2 / 2	43.6-54.1	2 / 2	30.1-116	2 / 2	40.5-41.3	2 / 2	29.2-34.7	2 / 2	44-49.8
Zinc	2 / 2	54.2-61.7	2 / 2	36.8-86.8	2 / 2	41.1-84.6	2 / 2	70.7-89.4	2 / 2	86.8-106
OTHER										
Cyanide	0 / 2	ND	0 / 2	ND	0 / 2	ND	1 / 2	7	0 / 2	ND

ND: Not Detected

TABLE 8

CHEMICALS OF POTENTIAL CONCERN
HIGGINS DISPOSAL

Chemical	Outdoor Surface Soils	Indoor Surface Soils	Outdoor Subsurface Soils	Outdoor Surface and Subsurface Soils	Indoor Air [1]	Outdoor Air [1]	Surface Water	Sediment	Ground Water
VOLATILE ORGANICS									
Acetone	X	X	X	X	X	X	ND	X	X
Benzene	ND	ND	X	·	ND	X	ND	ND	X
2-Butanone	X	ND	X	X	ND	X	ND	X	ND
Carbon Disulfide	·	ND	ND	ND	ND	·	ND	ND	X
Carbon Tetrachloride	·	ND	·	·	ND	·	ND	ND	X
Chlorobenzene	ND	ND	X	·	ND	ND	ND	ND	X
Chloroform	·	X	X	X	X	X	ND	ND	X
1,1-Dichloroethane	ND	ND	·	·	ND	ND	ND	ND	X
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	X
1,1-Dichloroethene	ND	ND	ND	·	ND	ND	ND	ND	X
1,2-Dichloroethene (total)	·	ND	X	·	ND	X	ND	ND	X
Ethylbenzene	ND	ND	X	·	ND	X	ND	ND	·
Hexachlorobutadiene	ND	ND	ND	·	ND	X	ND	ND	ND
Methylene chloride	ND	ND	X	X	ND	X	ND	X	X
1,1,2,2-Tetrachloroethane	·	X	ND	·	X	X	ND	ND	X
Tetrachloroethene	X	X	X	X	X	X	ND	ND	X
Toluene	ND	X	X	X	X	X	ND	ND	X
1,1,1-Trichloroethane	ND	ND	X	·	ND	X	ND	ND	X
1,1,2-Trichloroethane	·	ND	ND	·	ND	X	ND	ND	X
Trichloroethene	·	ND	X	X	ND	X	X	ND	X
Vinyl chloride	ND	ND	·	·	ND	X	ND	ND	X
Xylenes (total)	·	ND	X	·	ND	X	ND	ND	X

TABLE 8 (Continued)

CHEMICALS OF POTENTIAL CONCERN
HIGGINS DISPOSAL

Chemical	Outdoor Surface Soils	Indoor Surface Soils	Outdoor Subsurface Soils	Outdoor Surface and Subsurface Soils	Indoor Air [1]	Outdoor Air [1]	Surface Water	Sediment	Ground Water
SEMI-VOLATILE ORGANICS									
bis(2-Ethylhexyl)phthalate	X	ND	X	X	ND	X	X	X	X
Butylbenzylphthalate	X	ND	ND	X	ND	X	ND	ND	ND
Carbazole	X	ND	-	X	ND	X	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	-	ND	X	ND	ND	X
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	X
1,4-Dichlorobenzene	ND	ND	ND	-	ND	X	ND	ND	X
Diethylphthalate	ND	X	ND	ND	X	ND	ND	ND	X
cPAHs (total)	X	ND	X	X	ND	X	ND	X	ND
tPAHs (total)	X	X	X	X	X	X	ND	X	X
PESTICIDES/PCBs									
Aldrin	-	X	X	-	X	-	ND	X	X
alpha-BHC	ND	X	-	-	X	ND	ND	ND	X
beta-BHC	ND	ND	-	-	ND	ND	ND	ND	X
delta-BHC	X	X	ND	-	X	X	ND	ND	X
alpha-Chlordane	-	ND	X	X	ND	-	ND	X	X
gamma-Chlordane	-	ND	X	X	ND	-	X	X	X
4,4'-DDD	X	ND	ND	X	ND	X	ND	X	-
4,4'-DDE	X	X	X	X	X	X	ND	X	X
4,4'-DDT	X	ND	X	X	ND	X	ND	X	-
Dieldrin	X	X	X	X	X	X	ND	X	ND
Endosulfan II	X	ND	ND	X	ND	X	ND	ND	ND
Endosulfan sulfate	X	X	-	X	X	X	ND	ND	ND
Endrin	X	ND	-	X	ND	X	ND	X	ND
Heptachlor	-	X	-	-	X	-	ND	-	-
Heptachlor epoxide	-	X	ND	-	X	-	ND	ND	-
Methoxychlor	-	ND	X	X	ND	-	ND	ND	ND
PCBs (total)	X	X	X	X	X	X	ND	X	X

TABLE 8 (Continued)

CHEMICALS OF POTENTIAL CONCERN
HIGGINS DISPOSAL

Chemical	Outdoor Surface Soils	Indoor Surface Soils	Outdoor Subsurface Soils	Outdoor Surface and Subsurface Soils	Indoor Air [1]	Outdoor Air [1]	Surface Water	Sediment	Ground Water
INORGANICS									
Antimony	•	ND	ND	•	ND	•	ND	ND	X
Arsenic	•	•	•	•	•	•	X	X	X
Beryllium	•	ND	X	•	ND	•	X	X	X
Cadmium	X	X	•	•	X	X	X	X	•
Chromium	•	•	•	•	•	•	X	X	X
Lead	X	•	X	X	•	X	X	X	X
Manganese	•	•	•	•	•	•	X	X	X
Mercury	X	X	X	X	X	X	ND	X	X
Nickel	•	•	•	•	•	•	X	X	X
Selenium	•	ND	•	•	ND	•	X	X	X
Silver	•	ND	X	X	ND	•	ND	X	•
Thallium	X	ND	X	•	ND	X	ND	X	ND
Vanadium	•	•	•	X	•	•	•	•	•

NOTES:

1	Based on soil and/or soil gas analyses		
•	Detected, but not selected as a chemical of potential concern	cPAHs	Carcinogenic polycyclic aromatic hydrocarbons
X	Selected chemical of potential concern	tPAHs	Total polycyclic aromatic hydrocarbons
ND	Not Detected	PCBs	Polychlorinated biphenyls mixture
	Not Analyzed		

TABLE 9

SUMMARY OF COMPLETE EXPOSURE PATHWAYS
HIGGINS DISPOSAL

Potentially Exposed Population	Exposure Route, Medium, and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Stable Employees	Ingestion of and dermal contact with chemicals in surface soil from the field/pasture areas.	Yes	Stable employees may come into contact with contaminated soil in the vicinity of their work areas during daily activities.
Maintenance Garage Employees	Ingestion of and dermal contact with chemicals in surface soil from the landfill, maintenance garage, and transfer station areas.	Yes	Maintenance garage employees may come into contact with contaminated soil in the vicinity of their work areas during daily activities.
Stable and Maintenance Garage Employees	Inhalation of volatile chemicals released from the landfill, transfer station, and UST areas.	Yes	Employees may inhale volatile chemicals released from contaminated soil.
Stable and Maintenance Garage Employees	Inhalation of chemicals on respirable particulates released from outdoor surface soil.	Yes	Employees may inhale contaminated respirable particulates dispersed in air from mechanical and/or wind erosion of surface soil.
Stable Employees	Ingestion of, dermal contact with, and inhalation of chemicals in surface soil from the indoor riding area.	Yes	Stable employees may be exposed to contaminated soil during daily activities in the indoor riding area.
Stable and Maintenance Garage Employees	Ingestion of and dermal contact with chemicals in subsurface soil.	No	The nature of the workers' responsibilities would not routinely cause exposure to contaminated subsurface soil.
Stable and Maintenance Garage Employees	Ingestion of, and dermal contact with chemicals in ground water.	Yes	Employees may be exposed to chemicals in ground water during daily activities.
Stable and Maintenance Garage Employees	Ingestion of and dermal contact with chemicals in surface water and sediment.	No	The nature of the workers' responsibilities would not routinely cause exposure to contaminated surface water and sediment.
Tractor Operators	Inhalation of chemicals on respirable particulates released from outdoor surface soil.	Yes	Tractor or other heavy equipment operators may inhale contaminated respirable particulates made airborne by mechanical erosion.

TABLE 9 (Continued)

SUMMARY OF COMPLETE EXPOSURE PATHWAYS
HIGGINS DISPOSAL

Potentially Exposed Population	Exposure Route, Medium, and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Clients/Visitors	Ingestion of and dermal contact with chemicals in surface soil from the field/pasture areas.	Yes	Regular clients and visitors may be exposed to contaminated surface soil in these areas.
Clients/Visitors	Inhalation of volatile chemicals released from the landfill, transfer station and UST areas.	Yes	Regular clients and visitors may inhale volatile chemicals released from contaminated soil.
Clients/Visitors	Inhalation of chemicals on respirable particulates released from outdoor surface soil.	Yes	Regular clients and visitors may be exposed to contaminated respirable particulates dispersed in air from mechanical and/or wind erosion of surface soil.
Clients/Visitors	Ingestion of, dermal contact with, and inhalation of chemicals in surface soil from the indoor riding area.	Yes	Regular clients and visitors may be exposed to contaminated soil while using the indoor riding area.
Clients/Visitors	Ingestion of and dermal contact with chemicals in subsurface soil.	No	Regular clients and visitors would not be exposed to contaminated subsurface soil.
Clients/Visitors	Ingestion of and dermal contact with chemicals in ground water.	No	Regular clients and visitors are unlikely to routinely come in contact with contaminated ground water during site visits.
Clients/Visitors	Ingestion of and dermal contact with chemicals in surface water and sediment.	No	Swimming in the two on-site ponds is not permitted.
Trespassers	Ingestion of and dermal contact with chemicals in surface soil; inhalation of volatile chemicals released from the landfill, transfer station, and UST areas; inhalation of chemicals on respirable particulates released from surface soil.	Yes	Contaminated media may be encountered by trespassers.
Trespassers	Ingestion of and dermal contact with chemicals in surface water and sediment.	Yes	Anecdotal evidence suggests that trespassers have used the on-site ponds as swimming holes.

TABLE 9 (Continued)

SUMMARY OF COMPLETE EXPOSURE PATHWAYS
HIGGINS DISPOSAL

Potentially Exposed Population	Exposure Route, Medium, and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Residents	Ingestion of and dermal contact with chemicals in soil.	Yes	Current and future residents may be exposed to contaminated surface and subsurface soils.
Residents	Ingestion of, dermal contact with, and inhalation of chemicals in ground water.	Yes	Current and future residents may be exposed to contaminated ground water.
Neighboring Residents	Inhalation of volatile chemicals released from the landfill, transfer station and UST areas; inhalation of chemicals on respirable particulates released from surface soil.	Yes	Volatile chemicals and contaminated respirable particulates may be transported to residential areas.
Neighboring Residents	Ingestion of, dermal contact with, and inhalation of chemicals in ground water.	Yes	Neighboring residents with private wells may be exposed to contaminated ground water.
Recreationists	Ingestion of dermal contact with chemicals in surface water and sediment.	Yes	Surface water and sediment may be encountered by Recreationists in Dirty Brook and the unnamed brook.
Landscape/Utility Workers	Ingestion of and dermal contact with chemicals in surface and subsurface soils.	Yes	Contaminated soils may be encountered throughout the site during excavation activities.
Landscape/Utility Workers	Dermal contact with and inhalation of chemicals in ground water.	No	Depth to groundwater is greater than 6 feet, thus workers would not routinely come into contact with contaminated ground water during excavation activities.

TABLE 10

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)⁻¹	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
VOLATILES					
Acetone	–	D	–	–	IRIS
Benzene	2.9E-02	A	Leukemia	Inhalation	IRIS
2-Butanone	–	D	–	–	IRIS
Carbon disulfide	–	–	–	–	IRIS;HEAST
Carbon tetrachloride	1.3E-01	B2	Liver	Subcutaneous injection/ gavage	IRIS
Chlorobenzene	NA	D	–	–	IRIS
Chloroform	6.1E-03	B2	Kidney	Oral	IRIS
1,1-Dichloroethane	–	C	Hemangiosarcoma	Gavage	IRIS; HEAST
1,2-Dichloroethane	9.1E-02	B2	Circulatory system	Gavage	IRIS; HEAST
1,1-Dichloroethene	6.0E-01	C	Kidney adenocarcinoma	Oral	IRIS
cis-1,2-Dichloroethene	–	D	–	–	IRIS
trans-1,2-Dichloroethene	–	–	–	–	IRIS; HEAST
Ethylbenzene	–	D	–	–	IRIS
Hexachlorobutadiene	7.80E-02	C	Kidney	Oral, diet	IRIS
Methylene Chloride	7.5E-03	B2	Hepatocellular adrenomas and carcinomas	Inhalation	IRIS
1,1,2,2-Tetrachloroethane	2.0E-01	C	Hepatocellular carcinoma	Gavage	IRIS
Tetrachloroethene	5.2E-02	B2	--	--	ECAO

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TABLE 10 (Continued)

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)⁻¹	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
Toluene	--	D	--	--	IRIS
1,1,1-Trichloroethane	--	D	--	--	IRIS;HEAST
1,1,2-Trichloroethane	5.7E-02	C	Hepatocellular carcinoma	Gavage	IRIS
Trichloroethene	1.1E-02	B2	--	--	ECAO
Vinyl chloride	1.9E+00	A	Lung	Diet	HEAST
Xylenes	--	D	--	--	IRIS
SEMI-VOLATILES					
Acenaphthene	--	--	--	--	IRIS; HEAST
Acenaphthylene	--	D	--	--	IRIS
Anthracene	--	D	--	--	IRIS
Benzo(a)anthracene	--	B2	--	--	IRIS; HEAST
Benzo(b)fluoranthene	--	B2	--	--	IRIS; HEAST
Benzo(k)fluoranthene	--	B2	--	--	IRIS; HEAST
Benzo[g,h,i]perylene	--	D	--	--	IRIS
Benzo[a]pyrene	7.3E+00	B2	Forestomach	Oral, diet	IRIS
bis(2-ethylhexyl)phthalate	1.4E-02	B2	Hepatocellular carcinoma and adenoma	Oral, diet	IRIS
Butylbenzyl phthalate	--	C	--	--	IRIS, HEAST
Carbazole	2.0E-02	B2	Liver	Oral, diet	HEAST
Chrysene	--	B2	--	--	IRIS, HEAST

TABLE 10 (Continued)
TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)⁻¹	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
Dibenz[a,h]anthracene	--	B2	--	--	IRIS; HEAST
Dibenzofuran	--	D	--	--	IRIS
1,2 Dichlorobenzene	--	D	-	-	IRIS
1,3 Dichlorobenzene	--	--	--	--	IRIS; HEAST
1,4-Dichlorobenzene	2.4E-02	B2	Liver	Gavage	HEAST
Diethyl phthalate	--	D	--	--	IRIS
Fluoranthene	--	D	--	--	IRIS
Fluorene	--	D	--	--	IRIS
Indeno[1,2,3-cd]pyrene	--	B2	--	--	IRIS; HEAST
2-Methylnaphthalene	--	D	--	--	ECAO
Naphthalene	--	D	--	--	IRIS
Phenanthrene	--	D	--	--	IRIS
Pyrene	--	D	--	--	IRIS
PESTICIDES/PCBs					
Aldrin	1.7E+01	B2	Liver	Oral,diet	IRIS
alpha-BHC	6.3E+00	B2	Liver	Oral, diet	IRIS
beta-BHC	1.8E+00	C	Hepatic nodules and hepatic carcinomas	Oral, diet	IRIS
delta-BHC	--	D	--	--	IRIS
Chlordane(alpha,gamma)	1.3E+00	B2	Liver	Oral,diet	IRIS
4,4'-DDD	2.4E-01	B2	Lung, liver, thyroid	Oral	IRIS

TABLE 10 (Continued)

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)⁻¹	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
4,4'-DDE	3.4E-01	B2	Liver, thyroid	Oral	IRIS
4,4'-DDT	3.4E-01	B2	Liver	Oral, diet	IRIS
Dieldrin	1.6E+1	B2	Liver, hepatocellular carcinomas	Oral, diet	IRIS
Endosulfan II	--	--	--	--	IRIS; HEAST
Endosulfan sulfate	--	--	--	--	IRIS, HEAST
Endrin	--	D	--	--	IRIS, HEAST
Heptachlor	4.5E+00	B2	Liver	Oral, diet	IRIS
Heptachlor epoxide	9.1E+00	B2	Liver		
Methoxychlor	--	D	--	--	IRIS
Polychlorinated biphenyls	7.7E+00	B2	Liver	Oral	IRIS
INORGANICS					
Antimony	--	--	--	--	IRIS; HEAST
Arsenic	1.75E+00	A	Skin	Oral	IRIS
Beryllium	4.3E+00	B2	Gross tumors, all sites combined	Oral	IRIS
Cadmium	--	B1	--	--	IRIS; HEAST
Chromium (III)	Pending	--	--	--	IRIS, HEAST
Lead	--	B2	--	--	IRIS, HEAST
Manganese	--	D	--	--	IRIS, HEAST
Mercury	--	D	--	--	IRIS, HEAST

TABLE 10 (Continued)

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)⁻¹	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
Nickel	--	--	--	--	IRIS; HEAST
Selenium	--	D	--	--	IRIS
Silver	--	D	--	--	IRIS
Thallium	--	--	--	--	IRIS; HEAST
Vanadium	--	--	--	--	IRIS; HEAST

TABLE 10 (Continued)

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)[1]	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
VOLATILE ORGANICS					
Acetone	--	D	--	--	IRIS
Benzene	2.9E-02	A	Leukemia	Inhalation	IRIS
2-Butanone	--	D	--	--	IRIS
Carbon Disulfide	--	--	--	--	IRIS; HEAST
Carbon Tetrachloride	5.3E-02	B2	Liver	Subcutaneous injection/ gavage	HEAST
Chlorobenzene	--	D	--	--	IRIS
Chloroform	8.1E-02	B2	Heptacellular carcinoma	Oral	IRIS; HEAST
1,1-Dichloroethane	--	C	--	--	HEAST
1,2-Dichloroethane	9.1E-02	B2	Circulatory system	Gavage	HEAST
1,1-Dichloroethene	1.2E+0	C	Kidney	Inhalation	IRIS, HEAST
cis-1,2-Dichloroethene	--	D	--	--	IRIS
trans-1,2-Dichloroethene	--	--	--	--	IRIS; HEAST
Hexachlorobutadiene	7.80E-02	C	Kidney	Oral	IRIS
Ethylbenzene	--	D	--	--	IRIS
Methylene chloride	1.6E-03	B2	Combined adenomas and carcinomas	Inhalation	IRIS
1,1,2,2-Tetrachloroethane	2.0E-01	C	Liver	Gavage	HEAST
Tetrachloroethene	2.0E-03	B2	Leukemia, Liver	--	ECAO
Toluene	--	D	--	--	IRIS

TABLE 10 (Continued)

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)[1]	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
1,1,1-Trichloroethane	--	D	--	--	IRIS;HEAST
1,1,2-Trichloroethane		C	Liver	Gavage	HEAST
Trichloroethene	6.0E-03	B2	--	--	ECAO
Vinyl Chloride	2.9E-01	A	Liver	--	HEAST
Xylenes	--	D	--	--	IRIS
SEMI-VOLATILES					
Acenaphthene	--	--	--	--	IRIS; HEAST
Acenaphthylene	--	D	--	--	IRIS; HEAST
Anthracene	--	D	--	--	IRIS; HEAST
Benzo(a)anthracene	--	B2	--	--	IRIS; HEAST
Benzo(b)fluoranthene	--	B2	--	--	IRIS, HEAST
Benzo(k)fluoranthene	--	B2	--	--	IRIS; HEAST
Benzo[g,h,i]perylene	--	D	--	--	IRIS
Benzo[a]pyrene	6.1E+00	B2	Respiratory tract	Inhalation	HEAST
bis(2-Ethylhexyl)phthalate	--	B2	--	--	IRIS
Butylbenzl phthalate	--	C	--	--	IRIS, HEAST
Carbazole	--	B2	--	--	IRIS; HEAST
Chrysene	--	B2	--	--	IRIS; HEAST
Dibenz[a,h]anthracene	--	B2	--	--	IRIS, HEAST
Dibenzofuran	--	D	--	--	IRIS
1,2-Dichlorobenzene	--	D	--	--	IRIS

TABLE 10 (Continued)

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)⁻¹	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
1,3-Dichlorobenzene	--	--	--	--	IRIS; HEAST
1,4-Dichlorobenzene	--	B2	--	--	IRIS; HEAST
Diethylphthalate	--	D	--	--	IRIS
Fluoranthene	--	D	--	--	IRIS
Fluorene	--	D	--	--	IRIS
Indeno[1,2,3-cd]pyrene	--	B2	--	--	IRIS; HEAST
2-Methylnaphthalene	--	--	--	--	IRIS; HEAST
Naphthalene	--	D	--	--	IRIS
Phenanthrene	--	D	--	--	IRIS
Pyrene	--	D	--	--	IRIS
PESTICIDES/PCBs					
Aldrin	--	B2	Liver	Oral,diet	IRIS;HEAST
alpha-BHC	6.3E+00	B2	Liver	Oral, diet	IRIS, HEAST
beta-BHC	1.86E+00	C	Liver	Oral, diet	IRIS,HEAST
delta-BHC	--	D	--	--	IRIS, HEAST
Chlordane(alpha,gamma)	1.3E+00	B2	Liver	Oral,diet	IRIS,HEAST
4,4'-DDD	--	B2	--	--	IRIS; HEAST
4,4'-DDE	--	B2	--	--	IRIS; HEAST
4,4'-DDT	3.4E-01	B2	Liver	Oral	IRIS
Dieldrin	1.61E+01	B2	Liver, hepatocellular carcinomas	Oral, diet	IRIS
Endosulfan II	--	--	--	--	IRIS; HEAST

TABLE 10 (Continued)

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Slope Factor (SF) (mg/kg-day)[1]	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source
Endosulfan sulfate	--	--	--	--	IRIS, HEAST
Endrin	--	D	--	--	IRIS
Heptachlor	4.6E+00	B2	Liver	Oral, diet	IRIS
Methoxychlor	--	D	--	--	IRIS
Polychlorinated biphenyls	--	B2	--	--	IRIS; HEAST
INORGANICS					
Antimony	--	--	--	--	IRIS; HEAST
Arsenic	5.0E+01	A	Respiratory	Inhalation	IRIS; HEAST
Beryllium	8.4E+00	B2	Lung tumors	Inhalation	IRIS; HEAST
Cadmium	6.1E+00	B1	Respiratory	Inhalation	IRIS; HEAST
Chromium (III)	--	--	--	--	IRIS; HEAST
Lead	--	B2	--	--	IRIS; HEAST
Manganese	--	D	--	--	IRIS; HEAST
Mercury	--	D	--	--	IRIS
Nickel (soluble salts)	--	--	--	--	IRIS; HEAST
Selenium	--	D	--	--	IRIS
Silver	--	D	--	--	IRIS
Thallium	--	--	--	--	IRIS; HEAST
Vanadium	--	--	--	--	IRIS; HEAST

TABLE 10 (Continued)

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Slope Factor (SF) $(mg/kg\text{-}day)^{-1}$	Weight-of-Evidence Classification	Type of Cancer	SF Basis	SF Source

Notes:

-- = Not Available
A = Human Carcinogen
B2 = Probable Human Carcinogen
C = Possible Human Carcinogen
D = Not classifiable as to human carcinogenicity
IRIS = Integrated Risk Information System (USEPA data base) (USEPA, 1995).
HEAST = Health Effects Assessment Summary Tables (USEPA, 1994).
ECAO = Environmental Criteria and Assessment Office (USEPA, 1995).

TABLE 11

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
VOLATILES							
Acetone	1.0E-01	Low	Increased liver and kidney weights and nephrotoxicity	Oral	IRIS	1000	1
Benzene	3.0E-04	Medium	Hematological and immunological effects	Gavage	ECAO	3000	--
2-Butanone	6.0E-01	Low	Decreased fetal birth weight	Diet	IRIS	3000	1
Carbon disulfide	1.0E-01	Medium	Fetal toxicity/malformations	Inhalation	IRIS	100	1
Carbon tetrachloride	7.0E-04	Medium	Liver effects	Gavage	IRIS	1000	1
Chlorobenzene	2.0E-02	Medium	Histopathologic liver changes	Oral (capsules)	IRIS	1000 for H,A,S	1
Chloroform	1.0E-02	Medium to Low	Fatty cyst formation in liver	Oral	IRIS	1000	1
1,1-Dichloroethane	1.0E-01	--	None observed	Inhalation	HEAST	1000	--
1,2-Dichloroethane	3.1E-01	Low	Developmental & reproductive toxicity	Gavage	ECAO	1000 for H,A,S	--
1,1-Dichloroethene	9.0E-03	Medium	Liver effects, Hepatic lesions	Oral	IRIS, HEAST	1000	1
1,2-Dichloroethene (cis & trans)	9.0E-03	--	Liver lesions	Oral	HEAST	1000	

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
cis-1,2-Dichloroethene	1.0E-02	--	Decreased hemoglobin and hematocrit	Gavage	HEAST	3000	--
trans-1,2-Dichloroethene	2.0E-02	Low	Increased serum alkaline phosphatase	Water	IRIS	1000 for H,A,S	1
Ethylbenzene	1.0E-01	Low	Liver and kidney toxicity	Oral	IRIS	1000 for H,A,S	1
Hexachlorobutadiene	2E-04	--	Renal tubules	Oral, diet	HEAST	1000	--
Methylene chloride	6.0E-02	Medium	Liver toxicity	Oral	IRIS	100 for H,A	1
1,1,2,2-Tetrachloroethane	--	--	--	--	IRIS; HEAST	--	--
Tetrachloroethene	1.0E-02	Medium	Hepatotoxicity, weight gain	Gavage	IRIS	1000 for H,A,S	1
Toluene	2.0E-01	Medium	Changes in liver and kidney weights	Gavage	IRIS	1000 for H,A,S	1
1,1,1-Trichloroethane	--	--	--	--	IRIS;HEAST	--	--
1,1,2-Trichloroethane	4.0E-03		Clinical chemistry alterations	--	ECAO	1000	1
Trichloroethene	6E-03	Low	Liver and Kidney	Oral; diet	IRIS; HEAST	3000	--
Vinyl chloride	--	--	--	--	IRIS; HEAST	--	--
Xylenes (total)	2.0E+00	Medium	Hyperactivity, decreased body	Gavage	IRIS	100	1

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
SEMI-VOLATILES							
Acenaphthene	6.0E-02	Low	Hepatotoxicity	Oral	IRIS	3000 for H,A,S	1
Acenaphthylene	--	--	--	--	IRIS; HEAST	--	--
Anthracene	3.0E-01	Low	Subchronic toxicity	Gavage	IRIS	3000 for H,A,S	1
Benzo(a)anthracene	--	--	--	--	IRIS; HEAST	--	--
Benzo(a)pyrene	--	--	--	--	IRIS; HEAST	--	--
Benzo(b)fluoranthene	--	--	--	--	IRIS; HEAST	--	--
Benzo(k)fluoranthene	--	--	--	--	IRIS; HEAST	--	--
Benzo(g,h,i)perylene	--	--	--	--	IRIS, HEAST	--	--
bis(2-ethylhexyl)phthalate	2.0E-02	Medium	Increased liver weight	Oral	IRIS	1000 for H,A,S	1
Butylbenzyl phthalate	2.0E-01	Low	Increased liver weight	Diet	IRIS	1000 for H,A,S	1
Carbazole	--	--	--	--	IRIS; HEAST	--	--
Chrysene	--	--	--	--	IRIS; HEAST	--	--

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
Dibenz(a,h)anthracene	--	--	--	--	IRIS; HEAST	--	--
Dibenzofuran	4E-03	Low	Kidney, spleen	Oral	ECAO	3000	1
1,2-Dichlorobenzene	9.0E-02	Low	Liver effects	Oral	IRIS; HEAST	1000	1
1,3-Dichlorobenzene	--	--	--	--	IRIS; HEAST	--	--
1,4-Dichlorobenzene	--	--	--	--	IRIS;HEAST	--	--
Diethyl phthalate	8.0E-01	Low	Decreased growth rate, food consumption and organ weight	Diet	IRIS	1000	1
Fluoranthene	4.0E-02	Low	Nephropathy hematological and liver effects	Gavage	IRIS	3000 for H,A,S	1
Fluorene	4.0E-02	Low	Decreased erythrocyte count and hemoglobin	Gavage	IRIS	3000 for H,A,S	1
Ideno(1,2,3-cd)pyrene	--	--	--	--	IRIS; HEAST	--	--
2-Methylnaphthalene	--	--	--	--	IRIS; HEAST	--	--
Naphthalene	4E-02	--	--	Gavage	ECAO	1000	--
Phenanthrene	--	--	--	--	IRIS; HEAST	--	--
Pyrene	3.0E-02	Low	Kidney effects	Oral	IRIS	3000 for H,A,S	1

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
PESTICIDES							
Polychlorinated Biphenyls	2E-05	--	Immune System toxicity	--	HEAST	300	--
Aldrin	3.00E-05	Medium	Liver	Oral,diet	IRIS	1000	1
alpha-BHC	--	--	--	--	IRIS, HEAST	--	--
beta-BHC	--	--	--	--	IRIS, HEAST	--	--
delta-BHC	--	--	--	--	iris, heast	--	--
Chlordane(alpha,gamma)	6.00E-05	Low	Liver	Oral,diet	IRIS	1000	1
4,4'-DDD	3E-03	Low	Low body weight	Oral, diet	ECAO	10,000	--
4,4'-DDE	7E-04	Low	Mild liver and hepatic lesions	Oral, diet	ECAO	10,000	--
4,4'-DDT	5E-4	Medium	Liver lesions	Diet	IRIS	100	1
Dieldrin	5E-05	Medium	Liver, hepatic lesions	Oral, diet	IRIS	100	1
Endosulfan II	2E-4	--	Kidney Effects	Oral	HEAST	1000	--
Endosulfan sulfate	--	--	--	--	IRIS	--	--
Endrin	3E-04	Medium	Mild histological effects	Oral, diet	IRIS	100	1

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
Heptachlor	5E-04	Low	Liver	Oral, diet	IRIS, HEAST	300	1
Heptachlor epoxide	1.3E-05	Low	increased Liver weight	Oral,diet	IRIS;HEAST	1000	1
Methoxychlor	5E-3	Low	Ecessive Loss of Litters	Oral	IRIS	1000	1
INORGANICS							
Antimony	4.0E-04	Low	Longevity, blood glucose, and cholesterol	Oral	IRIS	1000	1
Arsenic	3.0E-04	Medium	Hyperpigmentation, keratosis and possible vascular complications	Oral	IRIS	3	1
Beryllium	5.0E-03	Low	No adverse effects	Oral	IRIS	100	1
Cadmium	5.0E-04 (water) 1.0E-03 (food)	High	Significant proteinuria	Oral	IRIS	10	1
Chromium III	1.0E+00	Low	No adverse effects observed	Oral	IRIS	100	10
Lead	--	--	--	--	IRIS; HEAST	--	--
Manganese	1.4E-01 (food) 5.0E-03 (water)	--	CNS effects	Oral	IRIS	1	1
Mercury	3.0E-04	--	Kidney effects	Oral	HEAST	1000	--

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS
HIGGINS DISPOSAL

ORAL EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
Nickel(soluble salts)	2.0E-02	Medium	Decreased body and organ weights	Oral	IRIS	300	1
Selenium	5.0E-03	High	Clinical selenosis	Epidemiology study	IRIS	3	1
Silver	5.0E-03	Low	Argyria	Oral	IRIS	3	1
Thallium	--	--	--	--	IRIS; HEAST	--	--
Vanadium	7.0E-03	--	--	Oral	HEAST	100	--

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NON-CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
VOLATILES							
Acetone	--	--	--	--	IRIS; HEAST	--	--
Benzene	pending	--	--	--	IRIS	--	--
2-Butanone	2.9E-01	Low	Decreased fetal birth	Inhalation	IRIS	1000	3
Carbon disulfide	2.9E-03	--	Fetal toxicity	Inhalation	HEAST	1000	--
Carbon tetrachloride	--	--	--	--	IRIS; HEAST	--	--
Chlorobenzene	5.0E-03	--	Liver and kidney effects	Inhalation	HEAST	10,000	--
Chloroform	--	--	--	--	IRIS; HEAST	--	--
1,1-Dichloroethane	1.0E-01	--	Kidney damage	Inhalation	HEAST	1000	--
1,2-Dichloroethane	1.0E-02	Low	Gastrointestinal tract, liver and kidney damage	--	ECAO	1000	--
1,1-Dichloroethene	--	--	--	--	IRIS, HEAST	--	--
cis-1,2-Dichloroethene	--	--	--	--	IRIS; HEAST	--	--
trans-1,2-Dichloroethene	--	--	--	--	IRIS, HEAST	--	--
Ethylbenzene	2.9E-01	Low	Developmental toxicity	Inhalation	IRIS	300	1
Hexachlorobutadiene							
Methylene chloride	--	--	--	--	IRIS, HEAST	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	IRIS, HEAST	--	--
Tetrachloroethene	--	--	--	--	IRIS, HEAST	--	--
Toluene	1.1E-01	Medium	Neurological effects	Inhalation	IRIS	300	1
1,1,1-Trichloroethane	--	--	--	--	IRIS,HEAST	--	--

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NON-CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
1,1,2-Trichloroethane	--	--	--	--	HEAST	--	--
Trichloroethene	--	--	--	--	IRIS; HEAST	--	--
Vinyl chloride	--	--	--	--	IRIS; HEAST	--	--
Xylenes (total)	--	--	--	--	IRIS; HEAST	--	--
SEMI-VOLATILES							
Acenaphthene	--	--	--	--	IRIS; HEAST	--	--
Acenaphthylene	--	--	--	--	IRIS; HEAST	--	--
Anthracene	--	--	--	--	IRIS; HEAST	--	--
Benzo(a)anthracene	--	--	--	--	IRIS; HEAST	--	--
Benzo(a)pyrene	--	--	--	--	IRIS; HEAST	--	--
Benzo(b)fluoranthene	--	--	--	--	IRIS; HEAST	--	--
Benzo(k)fluoranthene	--	--	--	--	IRIS; HEAST	--	--
Benzo(g,h,i)pyrene	--	--	--	--	IRIS; HEAST	--	--
bis(2-ethylhexyl)phthlate	--	--	--	--	IRIS; HEAST	--	--
Butylbenzyl phthalate	--	--	--	--	IRIS; HEAST	--	--
Carbazole	--	--	--	--	IRIS; HEAST	--	--
Chrysene	--	--	--	--	IRIS; HEAST	--	--
Dibenz(a,h)anthracene	--	--	--	--	IRIS; HEAST	--	--
Dibenzofuran	--	--	--	--	IRIS; HEAST	--	--
1,2-Dichlorobenzene	4.0E-02	--	Decreased body weight gain	Inhalation	HEAST	1000	--
1,3-Dichlorobenzene	--	--	--	--	IRIS; HEAST	--	--

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NON-CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
1,4-Dichlorobenzene	2.3E-1	--	Multigeneration liver	Inhalation	HEAST	100	--
Dietylphthalate	--	--	--	--	IRIS; HEAST	--	--
Fluoranthene	--	--	--	--	IRIS; HEAST	--	--
Fluorene	--	--	--	--	IRIS; HEAST	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	IRIS; HEAST	--	--
2-Methylnaphthalene	--	--	--	--	IRIS; HEAST	--	--
Naphthalene	--	--	--	--	IRIS; HEAST	--	--
Phenanthrene	--	--	--	--	IRIS; HEAST	--	--
Pyrene	--	--	--	--	IRIS; HEAST	--	--
PESTICIDES/PCBs							
Polychlorinated biphenyls	--	--	--	--	IRIS; HEAST	--	--
Aldrin	--	--	Liver,diet	Oral	IRIS	--	--
alpha-BHC	--	--	--	--	IRIS, HEAST	--	--
beta-BHC	--	--	--	--	IRIS, HEAST	--	--
delta-BHC	--	--	--	--	IRIS, HEAST	--	--
Chlordane(alpha,gamma)	--	--	Liver	Oraldiet	IRIS,HEAST	--	--
4,4'-DDD	--	--	--	--	IRIS, HEAST	--	--
4,4'-DDE	--	--	--	--	IRIS; HEAST	--	--
4,4'-DDT	--	--	--	--	IRIS; HEAST	--	--
Dieldrin	--	--	--	--	IRIS, HEAST	--	--
Endosulfan II	--	--	--	--	IRIS, HEAST	--	--

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NON-CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor
Endosulfan sulfate	--	--	--	--	--	--	--
Endrin	--	--	--	--	IRIS, HEAST	--	--
Heptachlor	--	--	--	--	IRIS, HEAST	--	--
Heptachlor epoxide	--	--	--	--	IRIS;HEAST	--	--
Methoxychlor	--	--	--	--	IRIS; HEAST	--	--
INORGANICS							
Antimony	--	--	--	--	IRIS; HEAST	--	--
Arsenic	--	--	--	--	IRIS; HEAST	--	--
Beryllium	--	--	--	--	IRIS; HEAST	--	--
Cadmium	--	--	--	--	IRIS; HEAST	--	--
Chromium III	--	--	--	--	IRIS; HEAST	--	--
Lead	--	--	--	--	IRIS; HEAST	--	--
Manganese	1.4E-05	Medium	Increased prevalence of respiratory symptoms and psychomotor disturbances.	Inhalation	IRIS	300	3
Mercury	8.6E-05	--	Neurotoxicity	Inhalation	HEAST	30	--
Nickel	pending	--	--	--	IRIS; HEAST	--	--
Selenium	--	--	--	--	IRIS; HEAST	--	--
Silver	--	--	--	--	IRIS, HEAST	--	--
Thallium	--	--	--	--	IRIS, HEAST	--	--
Vanadium	--	--	--	--	IRIS, HEAST	--	--

TABLE 11 (Continued)

TOXICITY VALUES: POTENTIAL NON-CARCINOGENIC EFFECTS
HIGGINS DISPOSAL

INHALATION EXPOSURE

Chemical	Chronic RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Basis	RfD Source	Uncertainty Factor	Modifying Factor

Notes:

-- = Not Available
HEAST = Health Effects Assessment Summary Tables (USEPA, 1994).
IRIS = Integrated Risk Information System (USEPA, 1994).
ECAO = Environmentsal Criteria and Assessment Office (USEPA, 1994).
UF = Uncertainty Factor, to account for inter- and intraspecies extrapolation and extrapolation from subchronic to chronic exposures.
MF = Modifying Factor, to account for uncertainty in the test program.
H = Variation in Human Sensitivity
A = Animal to Human Extrapolation
S = Extrapolation from Lowest Observed Adverse Effect Level (LOAEL) to No Observed Adverse Effect Level (NOAEL)

TABLE 12

SUMMARY OF HAZARD INDICES AND CANCER RISKS
HIGGINS DISPOSAL

EXPOSURE POPULATION AND PATHWAY	HAZARD INDEX	CANCER RISK
TRACTOR OPERATOR		
Inhalation of Respirable Particulates from Outdoor Surface Soils	4E-06	1E-08
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**4E-06**	**1E-08**
STABLE EMPLOYEE		
Ingestion of Outdoor Surface Soils	6E-02	4E-06
Dermal Contact with Outdoor Surface Soils	3E-01	5E-06
Inhalation of Volatilized Chemicals	5E-03	5E-05
Ingestion of Ground Water	4E+01	9E-04
Dermal Contact with Ground Water	8E+00	3E-04
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**5E+01**	**1E-03**
STABLE EMPLOYEE		
Ingestion of Indoor Surface Soils	5E-01	3E-05
Dermal Contact with Indoor Surface Soils	8E-01	4E-05
Inhalation of Volatilized Chemicals from Indoor Surface Soils	5E-10	3E-13
Inhalation of Respirable Particulates from Indoor Surface Soils	1E-05	9E-09
Ingestion of Ground Water	4E+01	9E-04
Dermal Contact with Ground Water	8E+00	3E-04
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**5E+01**	**1E-03**
GARAGE EMPLOYEE		
Ingestion of Outdoor Surface Soils	2E-01	6E-05
Dermal Contact with Outdoor Surface Soils	2E-01	1E-05
Inhalation of Volatilized Chemicals	4E-03	3E-05
Ingestion of Ground Water	3E+01	6E-04
Dermal Contact with Ground Water	6E+00	2E-04
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**3E+01**	**9E-04**
ADULT CLIENT/VISITOR		
Ingestion of Outdoor Surface Soils	2E-02	3E-07
Dermal Contact with Outdoor Surface Soils	3E-02	4E-07
Inhalation of Volatilized Chemicals	5E-04	9E-07
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**4E-02**	**2E-06**
ADULT CLIENT/VISITOR		
Ingestion of Indoor Surface Soils	1E-01	2E-06
Dermal Contact with Indoor Surface Soils	2E-01	3E-06
Inhalation of Volatilized Chemicals from Indoor Surface Soils	2E-10	4E-14
Inhalation of Respirable Particulates from Indoor Surface Soils	8E-07	2E-10
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**4E-01**	**6E-06**
CHILD CLIENT/VISITOR		
Ingestion of Outdoor Surface Soils	4E-02	7E-07
Dermal Contact with Outdoor Surface Soils	3E-02	5E-07
Inhalation of Volatilized Chemicals	2E-03	3E-06
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**7E-02**	**4E-06**
CHILD CLIENT/VISITOR		
Ingestion of Indoor Surface Soils	3E-01	5E-06
Dermal Contact with Indoor Surface Soils	3E-01	4E-06
Inhalation of Volatilized Chemicals from Indoor Surface Soils	7E-10	1E-13
Inhalation of Respirable Particulates from Indoor Surface Soils	3E-06	6E-10
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**6E-01**	**9E-06**

TABLE 12 (Continued)

SUMMARY OF HAZARD INDICES AND CANCER RISKS
HIGGINS DISPOSAL

EXPOSURE POPULATION AND PATHWAY	HAZARD INDEX	CANCER RISK
ADOLESCENT TRESPASSER		
Ingestion of Outdoor Surface Soils	5E-02	5E-06
Dermal Contact with Outdoor Surface Soils	5E-02	8E-07
Inhalation of Volatilized Chemicals	5E-04	9E-07
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**1E-01**	**6E-06**
ADOLESCENT TRESPASSER		
Ingestion of Surface Water	4E-03	3E-08
Dermal Contact with Surface Water	4E-02	4E-07
Ingestion of Sediment	3E-03	8E-08
Dermal Contact with Sediment	4E-03	6E-08
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**5E-02**	**5E-07**
LANDSCAPE/UTILITY WORKER		
Ingestion of Outdoor Surface Soils	3E-02	4E-07
Dermal Contact with Outdoor Surface Soils	9E-03	2E-08
Inhalation of Volatilized Chemicals	6E-04	1E-07
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**4E-02**	**5E-07**
LANDSCAPE/UTILITY WORKER		
Ingestion of Subsurface Soils	1E+00	9E-08
Dermal Contact with Subsurface Soils	2E-03	4E-09
Inhalation of Volatilized Chemicals	6E-04	1E-07
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**1E+00**	**2E-07**
ADULT RESIDENT		
Ingestion of All Surface and Subsurface Soils	9E-02	6E-05 *
Dermal Contact with All Surface and Subsurface Soils	1E-01	9E-06 *
Ingestion of Ground Water	8E+01	3E-03 *
Dermal Contact with Ground Water	1E+01	6E-04 *
Inhalation of Volatile Chemicals in Ground Water	4E-01	2E-03 *
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**9E+01**	**5E-03**
CHILD RESIDENT		
Ingestion of All Surface and Subsurface Soils	9E-01	4E-05
Dermal Contact with All Surface and Subsurface Soils	2E-01	3E-06
Ingestion of Ground Water	2E+02	1E-03
Dermal Contact with Ground Water	2E+01	2E-04
Inhalation of Volatile Chemicals in Ground Water	2E+00	1E-03
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**2E+02**	**2E-03**
ADULT NEIGHBORING RESIDENT		
Inhalation of Volatilized Chemicals	6E-03	1E-04 *
Ingestion of Ground Water	8E+01	3E-03 *
Dermal Contact with Ground Water	1E+01	6E-04 *
Inhalation of Volatile Chemicals in Ground Water	4E-01	2E-03 *
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**9E+01**	**5E-03**
CHILD NEIGHBORING RESIDENT		
Inhalation of Volatilized Chemicals	3E-02	6E-05
Ingestion of Ground Water	2E+02	1E-03
Dermal Contact with Ground Water	2E+01	2E-04
Inhalation of Volatile Chemicals in Ground Water	2E+00	1E-03
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**2E+02**	**2E-03**

TABLE 12 (Continued)

SUMMARY OF HAZARD INDICES AND CANCER RISKS
HIGGINS DISPOSAL

EXPOSURE POPULATION AND PATHWAY	HAZARD INDEX	CANCER RISK
RECREATIONALIST (Dirty Brook)		
Dermal Contact with Surface Water	6E-04	[illegible]E-09
Ingestion of Sediment	5E-03	2E-07
Dermal Contact with Sediment	3E-03	3E-08
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**9E-03**	**3E-07**
RECREATIONALIST (Unnamed Brook)		
Dermal Contact with Surface Water	1E-01	1E-08
Ingestion of Sediment	7E-03	4E-07
Dermal Contact with Sediment	3E-03	4E-08
TOTAL PATHWAY HAZARD INDEX/CANCER RISK:	**1E-01**	**4E-07**

* Adult Resident Cancer Risks are 30 year exposures,
24 years adult exposure plus 6 years child exposure

TABLE 13

SUMMARY OF ENVIRONMENTAL EVALUATION
HIGGINS DISPOSAL

Compound of Potential Concern	Existing Condition	Potential Risk Level Based on Hazard Quotients	Comments
Aldrin	Exceeds EqP Sediment Guideline Value.	Possible concern in sediment.	Compound known to bioaccumulate, but exceeded sediment criterion in only one sample
Aluminum	Exceeds NJ and USEPA AWQC. Exceeds sediment background and oral toxicity data.	Probable concern to wildlife in surface water and sediment. Possible concern to horses in surface water.	Ubiquitous compound; not expected to biomagnify in food chains; risk likely to be lower than HQs suggest.
Antimony	Exceeds surface soil background and oral toxicity data.	Probable concern to wildlife in surface soils. Possible concern to horses in surface soils.	Only detected in 2/48 surface soil samples; risk likely to be lower than HQ suggests
Cadmium	Exceeds NJ and USEPA AWQC. Exceeds surface soil background and oral toxicity data.	Possible concern in surface water. No concern in surface soils.	Only slight exceedance of AWQC.
Chlordane	Exceeds NJ and USEPA AWQC.	Possible concern in surface water.	Only detected in one surface water sample
Chromium	Exceeds NJ AWQC. Exceeds sediment background and NOAA ER-L and ER-M.	Possible concern in surface water and sediment.	Did not exceed USEPA AWQC. Only 1 exceedance in 9 sediment samples.
Copper	Exceeds NJ and USEPA AWQC. Exceeds sediment background and NOAA ER-L Exceeds surface soil background and oral toxicity data.	Possible concern in surface water, sediment and surface soils.	Background unfiltered surface water sample also exceeded criteria, filtered samples did not exceed criteria. Only 2 exceedances in 9 sediment samples. Only 3/48 surface soil samples exceed general surface soil background levels
Dieldrin	Exceeds EqP Sediment Guideline Value and NOAA ER-L and ER-M.	Probable concern in sediment.	Risk likely, based on frequency of detection and number of exceedances.

TABLE 13 (Continued)

SUMMARY OF ENVIRONMENTAL EVALUATION
HIGGINS DISPOSAL

Compound of Potential Concern	Existing Condition	Potential Risk Level Based on Hazard Quotients	Comments
DDE, DDD, DDT	Exceeds EqP Sediment Guideline Value and NOAA ER-L and ER-M. Exceeds surface soil background and oral toxicity data.	DDE and DDD: Possible concern in sediment. DDT: Probable concern in sediment. DDE, DDD and DDT: No concern in surface soil.	Compounds known to bioaccumulate. Risk likely in sediment.
Endosulfan	Exceeds EqP Sediment Guideline Value.	Possible concern in sediment.	Only detected in 2/9 sediment samples.
Endrin	Exceeds NOAA ER-L.	Probable concern in sediment.	Only detected in 2/9 sediment samples. EqP Guideline Value and ER-M not exceeded.
Iron	Exceeds NJ and USEPA AWQC.	Possible concern in surface water.	Unfiltered background sample also exceeded criterion.
Lead	Exceeds NJ and USEPA AWQC. Exceeds NOAA ER-L and sediment background. Exceeds oral toxicity data and surface soil background.	Possible concern in surface water and sediment. Probable concern to wildlife in surface soil. Possible concern to horses in surface soil.	Unfiltered background sample also exceeded criterion. Only 2 exceedances in 9 sediment samples; compound is considered ubiquitous. Surface soil concentrations exceeded U.S. soil background in only 5 of 48 samples.
Manganese	Exceeds Aquatic Toxicity value for fresh water.	Possible concern in surface water.	Only 3/13 samples exceeded toxicity value.
Mercury	Exceeds NOAA ER-L and sediment background. Exceeds surface soil background and oral toxicity data.	Possible concern in sediment and surface soils.	Compound known to bioaccumulate and biomagnify. Risk likely based on number of exceedances and frequency of detection.
Nickel	Exceeds NOAA ER-L and sediment background.	Possible concern in sediment.	Background sample also exceeded ER-L.

TABLE 13 (Continued)

SUMMARY OF ENVIRONMENTAL EVALUATION
HIGGINS DISPOSAL

Compound of Potential Concern	Existing Condition	Potential Risk Level Based on Hazard Quotients	Comments
PCBs	Exceeds EqP Sediment Guideline Value and NOAA ER-L and ER-M. Exceeds surface soil background and oral toxicity data.	Possible concern in sediment. Possible concern to wildlife and horses in surface soils.	Risk likely in sediment and surface soils due to frequency of detection and number of exceedances.
PAHs	Exceeds NOAA ER-L. Exceeds surface soil background and/or oral toxicity data.	Possible concern in sediment. No concern in surface soils.	Low number of exceedances in sediment per compound. Chrysene detected in only 1/9 sediment samples.
Selenium	Exceeds surface soil background.	No concern in surface soils.	Low frequency of detection; compound detected below oral toxicity data
Silver	Exceeds NJ and USEPA AWQC. Exceeds NOAA ER-L and sediment background.	Probable concern in surface water. Possible concern in sediment.	Only detected in one surface water sample. Only 1 exceedance in 9 sediment samples. Risk likely to be lower than HQ suggests
Thallium	Exceeds surface soil background.	No concern in surface soils.	Low frequency of detection.
Zinc	Exceeds surface soil background and oral toxicity data.	Possible concern to wildlife and horses in surface soils.	All samples below general surface soil background levels; risk likely to be less than HQ suggests.

Notes:

EqP = Equilibrium Partitioning Method for deriving Sediment Guideline Values
AWQC = Ambient Water Quality Critera
NOAA ER-L = National Oceanic and Atmospheric Administration's Effects Range - Low
NOAA ER-M = National Oceanic and Atmospheric Administration's Effects Range - Median
HQ = Hazard Quotient

TABLE 14

Ground Water and Surface Water ARARs - Higgins Disposal

Volatile Organic Compounds (ug/l)	Max. Conc. Detected in Ground Water	NJ Surface Water Criteria (1)	Federal Surface Water Criteria (2)	NJ GW Standards (3)	NJ Drinking Water MCLs (4)	Federal Drinking Water MCLs (5)
Acetone	40			700		
Benzene	910	0.15	1.2	1	1.000	5
Carbon Disulfide	25					
Carbon Tetrachloride	160	0.363	0 25	2	2	5
Chlorobenzene	3,100	22	680	4	50	
Chloroform	1,700	5.67	5.7	6		--
1,2-Dichloroethene (total) -as cis	770		11,600	10	70	70
1,1-Dichloroethane	69			70	50	
1,2-Dichloroethane	1,400	0.291	0.38	2	2	5
1,1-Dichloroethene	190	4.81	0 0570	2	2	7
Methylene Chloride	330	2.49		2	3	
1,1,2,2-Tetrachlroethane	460	1.72		2	1	
Tetrachloroethene	560	0.388		1	1	5
Toluene	41	7,440	6,800	1,000		1,000
1,1,1-Trichlroethane	560	127	3,100	30	30	200
1,1,2-Trichlroethane	83	13.5	0,6	3	3	5
Trichlorethene	2,200	1,09	2,70	1,00	1	5
Vinyl Chloride	68	0.083	2	5	2	2
Xylenes (total)	53			40.	1,000	10

Semi-Volatile Organic Compounds (ug/l)	Max. Conc. Detected in Ground Water	NJ Surface Water Criteria (1)	Federal Surface Water Criteria (2)	NJ GW Standards (3)	NJ Drinking Water MCLs (4)	Federal Drinking Water MCLs (5)
Bis (2-ethylhexyl) phthalate	6	1.76	1.8	30		
2-Chlorophenol	39	122		40		
1,2-Dichlorobenzene	1,800	2,520	2,700	600	600	600
1,3-Dichlorobenzene	4	2,620	400	600	600	75
1,4'-Dichlorobenzene	89	343	400	75		
Diethyl phthalate	5	21,200	23,000	5,000		
2-Methylnapthalene	7					
Napthalene	44				300	
Phenol	55	20,900		4,000		
1,2,4-Trichlorobenzene	3	30.6		9	8	70

Notes:

(1) N.J.A.C. 7:9-4
(2) EPA 440/5-86-001
(3) N.J.A.C. 7:9-6
(4) N.J.A.C. 7:10-16
(5) 40 CFR 141
(6) Blank - No ARAR

TABLE 14 (Continued)

Ground Water and Surface Water ARARs - Higgins Disposal

Inorganics (ug/l)	Max. Conc. Detected in Ground Water	NJ Surface Water Criteria [1]	Federal Surface Water Criteria [2]	NJ GW Standards (3)	NJ Drinking Water MCLs [4]	Federal Drinking Water MCLs [5]
Aluminum	69,300		87	200		
Antimony	15.1	12.2	14	20		6
Arsenic	35.5	0.0170	13	8		50
Barium	1,090	2,000		2,000		2,000
Beryllium	13.1		0.0077	20		4
Cadmium	3.1	10	0.025	4		5
Calcium	93,000					
Chromium	1,690	160	11	100		100
Cobalt	103					
Copper	177		2.32	1,000		
Iron	165,000		300	300		
Lead	115	5	0.28	10		
Magnesium	65,400					
Manganese	10,300		50	50		
Nickel	341	516	31.45	100		
Potassium	23,600					
Selenium	4.5	10		50		50
Silver	4.2	164				
Sodium	132,000			50,000		
Vanadium	262					
Zinc	337			5,000		

Notes:
(1) N.J.A.C. 7:9-4
(2) EPA 440/5-86-001
(3) N.J.A.C. 7:9-6
(4) N.J.A.C. 7:10-16
(5) 40 CFR 141
(6) Blank = No ARAR

TABLE 14 (Continued)

Ground Water and Surface Water ARARs - Higgins Disposal

Pesticide/PCBs	Max. Conc. Detected in Ground Water	NJ Surface Water Criteria [1]	Federal Surface Water Criteria [2]	NJ GW Standards [3]	NJ Drinking Water MCLs [4]	Federal Drinking Water MCLs [5]
Aldrin	0.1	0.000135	1.3	0.04		
alpha-BHC	0.097	0.00391	0.34	0.02		
beta-BHC	0.041	0.137	0.34	0.20		
delta-BHC	0.04		0.34			
gamma-BHC (Lindane)	0.034	2.0	0.16	0.20		0.2
alpha-Chlordane	0.064	0.000277	0.004	0.50		2
gamma-Chlordane	0.11	0.000277	0.004	0.50		2
4,4'-DDE	0.21	0.000588	14	0.10		
4,4'-DDD	0.089	0.000832		0.01		
4,4'-DDT	0.013	0.000588		0.01		
Endosulfan I	0.053	0.056	0.0087	0.40		
Heptachlor	0.06	0.000208	0.0036	0.40		0.4
Heptachlor epoxide	0.042	0.000103		0.20		0.2
PCBs	0.57	0.000244	0.014	0.50	0.50	0.5

Notes:
(1) N.J.A.C. 7:9-4
(2) EPA 440/5-86-001
(3) N.J.A.C. 7:9-6
(4) N.J.A.C. 7:10-16
(5) 40 CFR 141
(6) Blank = No ARAR

TABLE 15

CHEMICAL-SPECIFIC ARARs & TBCs FOR DISCHARGE TO SURFACE WATER

Compound	Maximum Concentration Detected in Ground Water (µg/l)	Maximum Concentration Detected in Surface Water (µg/l)	NJ SWQ[a] (µg/l) (TBC)	NJPDES[b] (µg/l) Aquatic[f] (ARAR)	NJPDES[b] (µg/l) Potable[g] (ARAR)	FAWQC[c] (µg/l) (ARAR)	Method Detection Limit[d] (µg/l) (MDL)	Anti-Degradation Goal[e] (µg/l)
Volatile Organics								
Acetone	5.2	—	—	—	—	—	1.0	ND (1.0)
Benzene	1,200.0	—	—	5,300	—	1.2	1.0	ND (1.0)
Bromobenzene	1.4	—	—	—	—	—	1.0	ND (1.0)
Carbon Disulfide	2.1	5.0	—	—	—	—	1.0	5.0
Carbon Tetrachloride	3.3	1.4	—	35,200	—	0.25	1.0	1.4
Chlorobenzene	1,100.0	—	—	250	488	680.0	1.0	ND (1.0)
Chloroform	33.0	—	—	28,900	—	5.7	1.0	ND (1.0)
2-Chlorotoluene	3.5	—	—	—	—	—	1.0	ND (1.0)
4-Chlorotoluene	2.5	—	—	—	—	—	1.0	ND (1.0)
Cis-1,2-Dichloroethene	76.0	—	—	11,600	—	—	1.0	ND (1.0)
1,1-Dichloroethane	3.0	—	—	—	—	—	1.0	ND (1.0)
1,2-Dichloroethane	320.0	—	—	20,000	—	0.38	1.0	ND (1.0)
1,1-Dichloroethene	10.0	—	—	11,600	—	0.057	1.0	ND (1.0)
1,2-Dichloropropane	0.56	—	—	5,700	—	0.52	1.0	ND (1.0)
1,1-Dichloropropene	4.3	—	—	244	87	—	1.0	ND (1.0)
Ethylbenzene	1.0	—	—	32,000	1,400	3,100.0	1.0	ND (1.0)
Trans-1,2-Dichloroethene	13.0	—	—	11,600	—	700.0	1.0	ND (1.0)
1,1,2,2-Tetrachloroethane	7.5	—	—	2,400	—	0.17	1.0	ND (1.0)
Tetrachloroethene	270.0	—	—	840	—	0.8	1.0	ND (1.0)
Toluene	1.9	1.3	—	17,500	14,300	6,800.0	1.0	1.3
1,1,1,2-Tetrachloroethane	1.4	—	—	9,320	—	—	1.0	ND (1.0)
1,1,1-Trichloroethane	4.3	—	—	18,000	18,400	3,100.0	1.0	ND (1.0)
1,1,2-Trichloroethane	1,100.0	—	—	9,400	—	0.6	1.0	ND (1.0)
Trichloroethene	220.0	—	—	45,000	—	2.7	1.0	ND (1.0)
Trichlorofluoromethane	3.8	—	—	11,000	—	—	1.0	ND (1.0)
Vinyl chloride	86.0	—	—	—	—	2.0	1.0	ND (1.0)
Xylenes (total)	13.8	—	—	—	—	—	1.0	ND (1.0)
Semivolatile Organics								
Bis(2-chloroethyl)ether	2.0	—	—	—	—	0.031	5.0	ND (5.0)
Bis(2-ethylhexyl)phthalate	10.0	—	—	3	—	1.8	5.0	ND (5.0)
2-Chlorophenol	6.0	—	—	4,380	—	—	5.0	ND (5.0)

Source: Higgins Farm ROD (9/92)

TABLE 15 (Continued)

CHEMICAL-SPECIFIC ARARs & TBCs FOR DISCHARGE TO SURFACE WATER

Compound	Maximum Concentration Detected in Ground Water (µg/l)	Maximum Concentration Detected in Surface Water (µg/l)	NJ SWQ[a] (µg/l) (TBC)	NJPDES[b] (µg/l)		FAWQC[c] (µg/l) (ARAR)	Method Detection Limit[d] (µg/l) (MDL)	Anti-Degradation Goal[e] (µg/l)
				Aquatic[f] (ARAR)	Potable[g] (ARAR)			
1,2-Dichlorobenzene	48.0	—	—	763	400	2,700.0	10.0	ND (10.0)
1,3-Dichlorobenzene	5.0	—	—	763	400	400.0	10.0	ND (10.0)
1,4-Dichlorobenzene	20.0	—	—	763	400	400.0	10.0	ND (10.0)
Di-n-butylphthalate	0.9	—	—	3	34,000	—	5.0	ND (5.0)
Di-n-octylphthalate	ND	1.0	—	3	—	—	5.0	ND (5.0)
Diethyl phthalate	1.0	42.0	—	3	350,000	23,000.0	5.0	42.0
Hexachlorobutadiene	5.3	—	—	9.3	—	0.44	1.0	ND (1.0)
Isopropylbenzene	4.6	—	—	—	—	—	1.0	ND (1.0)
Naphthalene	0.38	—	—	620	—	—	1.0	ND (1.0)
N-Butylbenzene	5.0	—	—	—	—	—	1.0	ND (1.0)
N-Propylbenzene	4.5	—	—	—	—	—	1.0	ND (1.0)
P-Isopropyltoluene	5.0	—	—	—	—	—	1.0	ND (1.0)
Phenol	9.0	—	—	2,560	3,500	—	5.0	ND (5.0)
Sec-Butylbenzene	4.9	—	—	—	—	—	1.0	ND (1.0)
Tert-Butylbenzene	4.9	—	—	—	—	—	1.0	ND (1.0)
1,2,3-Trichlorobenzene	1.4	—	—	250	—	—	1.0	ND (1.0)
1,2,4-Trichlorobenzene	1.7	—	—	250	—	—	10.0	ND (10.0)
1,2,4-Trimethylbenzene	3.2	—	—	—	—	—	1.0	ND (1.0)
1,3,5-Trimethylbenzene	3.9	—	—	—	—	—	1.0	ND (1.0)
Inorganic Compounds								
Aluminum	304,000.0	2,310.0	—	—	—	87.0[h,i]	100.0	2,310.0
Antimony	28.5	—	—	1,600	146	14.0	5.0	ND (5.0)
Barium	1,890.0	27.5	1,000	—	—	—	20.0	27.5
Beryllium	23.7	—	—	5.3	—	0.0077[k]	1.0	ND (1.0)
Cadmium	4.1	—	10	0.012	10	0.29[j]	1.0	ND (1.0)
Chromium	403.0	—	50	0.29	50	11.0	10.0	ND (10.0)
Cobalt	826.0	5.2	—	—	—	—	10.0	ND (10.0)
Copper	8,750.0	6.4	—	5.6	—	2.32[j]	10.0	ND (10.0)
Iron	433,000.0	4,950	—	—	—	300.0[h]	100.0	4,950
Lead	81.4	12.0	50	.79	50	0.28[j]	0.3	12.0
Magnesium	27,200.0	3,780	—	—	—	—	5,000.0	ND (5,000.0)
Manganese	24,800.0	325	—	—	—	50.0[h]	10.0	325

Source: Higgins Farm ROD (9/92)

TABLE 15 (Continued)
CHEMICAL-SPECIFIC ARARs & TBCs
FOR DISCHARGE TO SURFACE WATER

Compound	Maximum Concentration Detected in Ground Water (µg/l)	Maximum Concentration Detected in Surface Water (µg/l)	NJ SWQ[a] (µg/l) (TBC)	NJPDES[b] (µg/l)		FAWQC[c] (µg/l) (ARAR)	Method Detection Limit[d] (µg/l) (MDL)	Anti-Degradation Goal[e] (µg/l)
				Aquatic[f] (ARAR)	Potable[g] (ARAR)			
Nickel	224.0	—	—	56	13.4	31.45[j]	20.0	ND (20.0)
Vanadium	1,490.0	14.4	—	—	—	—	10.0	14.4
Zinc	811.0	292	—	47	—	—	20.0	292

Note:

The following conventional parameter limits must also be considered:

Parameter	Maximum Detected In Ground Water	Maximum Detected In Surface Water	Limit	Rationale
BOD	—	2.1 ppm	25 ppm	NJAC 7:9-5.1.
COD	—	15 ppm	31 ppm	Assume BOD:COD ratio is 0.8.
TDS	—	74 ppm	95 ppm	133% of natural background concentration. NJAC 7:9-4.
pH	8.4	6.9	6.5-8.5	NJAC 7:9-4.
TSS	25,900 ppm	—	40 ppm	NJAC 7:9-4.
Whole effluent toxicity	—	—	L_c = 100	No observed effects using 100% effluent. NJAC 7:9-4.

Treatability testing will determine the ability of a treatment system to meet these limits.

[a]New Jersey Surface Water Quality Standards NJAC 7:9-4 for FW2-NT Waters.
[b]New Jersey Pollutant Discharge Elimination System Regulations NJAC 7:14A, Appendix F, Values for Determination of NJPDES Permit Toxic Effluent Limitations.
[c]Federal Ambient Water Quality Criteria. Quality Criteria for Water. May 1, 1987. EPA 440/5-86-001.
From "Toxics Rule".
[d]MDLs are best available Contract Laboratory Program analytical method detection limit. [From Superfund Analytical Methods for Low Concentration Water for Organics Analysis (6/91) and Superfund Analytical Methods for Low Concentration Water for Inorganics Analysis (10/91)].
[e]Anti-degradation goal is based on the maximum concentration detected in surface water. If contaminant was not detected in surface water or if detected below the method detection limit, the MDL is the anti-degradation goal.
[f]Maximum Values for Protection of Aquatic Life.
[g]Maximum Values for Protection of Potable Water Supplies.
[h]Federal Ambient Water Quality Criteria; non-priority pollutants.
[i]pH dependent criterion. Value given based on a pH of 6.5 to 9.0.
[j]Hardness dependent criterion. Value given based on an assumed total hardness of 15 mg/l.

— Value not available.
ND = Not Detected

Source: Higgins Farm ROD (9/92)

TABLE 16
ARARs

Requirement	Source
NJ Groundwater Quality Standards	N.J.A.C. 7:9-6
Federal Safe Drinking Water Act Regulations	40 CFR 141
NJ Safe Drinking Water Act Regulations	N.J.A.C. 7:10
NJ Surface Water Quality Standards	N.J.A.C. 7:9-4
Federal Ambient Water Quality Criteria	33 U.S.C. 1251 et seq. 40 CFR 122-125
NJ Pollutant Discharge Elimination System Regulations	N.J.A.C. 7:14A
NJ Air Pollution Control Act	N.J.A.C. 7:27
NJ Flood Hazard Control Act	N.J.S.A. 58:16A-50
NJ Soil Erosion and Sediment Control Act	N.J.S.A. 4:34-1
Federal Resource Conservation and Recovery Act	42 USC 6901 et seq.
New Jersey Solid and Hazardous Waste Regulations	N.J.A.C. 7:26
National Historic Preservation Act Regulations	36 CFR Part 800
Executive Order 11990	40 CFR Part 6, Subpart A
Farmlands Protection Policy Act of 1981, as amended	7 USC 4201 et seq.
Federal Department of Transportation Regulations	49 CFR 171-179 Subtitle C
New Jersey Water Supply Management Act	N.J.S.A. 58A
New Jersey Endangered Species Act	N.J.S.A. 23:2A-2
U.S. Fish and Wildlife Coordination Act Regulations	40 CFR Part 302
New Jersey Well Drilling Licensing Act	N.J.S.A. 58:4
New Jersey State Register of Historic Places	N.J.S.A. 13:1B-15.128
State Freshwater Wetlands Regulations	N.J.A.C. 7:7A
Federal Wetlands Regulations	40 CFR Part 230
Occupational Safety and Health Administration Regulations	29 CFR 1910
Clean Air Act Regulations	40 CFR Part 50

APPENDIX III

ADMINISTRATIVE RECORD INDEX

HIGGINS DISPOSAL SERVICES
ADMINISTRATIVE RECORD FILE
INDEX OF DOCUMENTS

1.0 SITE IDENTIFICATION

1.2 Notification/Site Inspection Reports

p. 100001-100022 Report: Potential Hazardous Waste Site: Site Inspection Report, Higgins Disposal, prepared by Marge Kostenowczyk of NUS Corporation, April 15, 1983.

3.0 REMEDIAL INVESTIGATION

3.1 Sampling and Analysis Plans

p. 300001-300277 Report: Field Sampling Plan for Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., December 1992.

p. 300278-300427 Report: Quality Assurance Project Plan for Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., December 1992.

3.2 Sampling and Analysis Data/Chain of Custody Forms

p. 300428-300493 Report: Quick Turnaround Method Data Spreadsheet, prepared by EA Laboratories, March 17, 1993.

p. 300494-300495 Addendum: Table 6-1 Addendum Analytical Procedure Sample Container Preservation and Holding Time Requirements Higgins Disposal Site, prepared by Malcolm Pirnie, Inc.

3.3 Work Plans

p. 300496-300639 Report: Health And Safety Plan for Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., December, 1992.

p. 300640-300843 Report: Work Plan for Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., December 1992.

10.0 PUBLIC PARTICIPATION

10.2 Community Relations Plans

p. 1000001- 1000031 Report: Community Relations Plan for Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., December 1992.

HIGGINS DISPOSAL SITE
ADMINISTRATIVE RECORD FILE UPDATE
INDEX OF DOCUMENTS

1.0 SITE IDENTIFICATION

1.1 Background - RCRA and Other Information

P. 100023-100078 Report: Potential Hazardous Waste Site, Preliminary Assessment, Kingston Residences, prepared by Mr. Barry L. Kellems, Malcolm Pirnie, Inc., May 12, 1986.

P. 100079-100085 Report: Field Sampling Episode Report, Higgins Disposal Service Inc., 121 Laurel Avenue, Kingston, Somerset County, New Jersey, June 26, 1986, prepared by New Jersey Department of Environmental Protection (NJDEP), Division of Hazardous Waste Management, Bureau of Site Assessment, July 8, 1986.

P. 100086-100086 Preliminary Assessment Review Form, Kingston Residences, prepared by Mr. James Ippolito, July 17, 1986.

P. 100087-100094 Letter to Mr. John Carlano, Health Officer, Franklin Township Health Department, from Mr. Steven Nieswand, Chief, NJDEP, Bureau of Safe Drinking Water, re: attached summary of the results of analysis of water samples collected on April 26, 1986, from 10 potable wells in Franklin Township (Somerset County), August 7, 1986. (Attachment: Summary, Potable Water Sample Analysis Results for Ten Non-Public Wells, Franklin Township (Somerset County), August 6, 1986.)

P. 100095-100102 Letter to Mr. John Carlano, Health Officer, Franklin Township Health Department, from Mr. Barker Hamill, Acting Chief, Bureau of Safe Drinking Water, NJDEP, re: attached summary of the results of analysis of water samples collected on August 12, 1986, from nine potable wells in Franklin Township (Somerset County), November 25, 1986. (Attachment: Summary Potable Water Sample Analyses Data From Nine Non-Public Wells in Franklin Township, Somerset County, November 25, 1986.)

P. 100103- 100114 Memorandum to Mr. Al Pleva, HSMS I, Bureau of Site Assessment, NJDEP, from Kathleen M. Grimes, Research Scientist III, Quality Assurance Section, NJDEP, re: Quality Assurance Review Summary of Higgins Disposal Sampling June 26, 1986: ETC Numbers M7174-M7183, January 2, 1987. (Attachments: 1. Evaluation of Analytical Data Report Package for New Jersey Dept. of Environmental Protection, Division of Hazardous Site Mitigation, CN 028, Trenton, NJ 08625, Review of the Higgins Disposal for the PA/SI and HRS, January 2, 1987; 2. Memorandum to Mr. David J. Shotwell, Chief, Bureau of Field Operations, Division of Hazardous Waste Management, NJDEP, from Ms. Nancy E. Spence, Chief; Mr. Floyd A. Genicola, Environmental Scientist I, NJDEP; Dr. Kenneth Lin, Research Scientist II, Quality Assurance Section, NJDEP, re: Quality Assurance Review of Higgins Farm Site Total Dioxin and Total Furan Data Packages, March 16, 1987; and 3. Memorandum to Ms. Carol Graubert, Technical Coordinator, Bureau of Site Assessment, NJDEP, from Mr. Thomas A. Jackson, Office of Quality Assurance, NJDEP, re: Quality Assurance Review - Higgins Farm/S-R Analytical Incorporated Samples SR12821-1 through SR12821-11 - June 1986.)

P. 100115- 100137 Transmittal form (with attachments) to Linda Comerci, Northern N.J. Compliance, U.S. EPA, Region II, from Chris Mallery, Northern Bureau of Regional Enforcement, NJDEP, re: Higgins/Laurel Ave., Franklin Township, Somerset County, forwarding the following attachments: 1. Directive to Mr. Higgins; 2. Letter to Health Dept.; 3. 1982 Administrative Order to Higgins; 4. Malcolm Pirnie Report; and 5. Maps, April 13, 1987.

P. 100138- 100140 Letter to Ms. Carol Garubart, Bureau of Planning and Assessment, NJDEP, from Mr. Randall Vieser, Elizabethtown Water Company, re: two copies of the well log for Grover Avenue Well, November 18, 1987. (Attachment: Compliance Evaluation Inspection Public Community Water Supply, February 4, 1987.)

P. 100141- 100152 Site Inspection Review Form, Kingston Residences, prepared by Ms. Joyce Harney, March 9, 1989. (Attachment: HRS Cover Sheet and Groundwater Route Work Sheets, July 11, 1988.)

P. 100153- 100193 Letter to Mr. Perry Katz, Chief, New Jersey Compliance Section, U.S. EPA, Region II, from Ms. Melinda Dower, Chief, Bureau of Federal Case Management, NJDEP, re: letter of June 19, 1989, Higgins Disposal Service, July 18, 1989. (Attachment: Ground Water Analysis - Monitoring Well Report, April 10, 1989.)

P. 100194- 100223 Monitoring Results - Tracking Form, Higgins Disposal Service, Inc., NJPDES NO. NJ0067270, Sampling Period: 12/88 - 2/89, undated. (Attachment: Monitoring Well Report, April 10, 1989.)

P. 100224- 100326 Dredge Spoil Site (D & R Canal, Laurel Avenue Stockpile Site) package containing Maps and Ground Water Analysis - Volatile Organics Reports and Monitoring Well Report.

1.2 Notification/Site Inspection Reports

P. 100327- 100341 Memorandum (with attachment) submitted by Ms. Carol Graubart, Environmental Specialist, NJDEP, re: attached Site Inspection Report, Higgins Disposal Service, 121 Laurel Avenue, Kingston, Somerset County, Site Inspection, conducted by NJDEP representatives on June 26, 1986.

1.3 Preliminary Assessment Reports

P. 100342- 100362 Potential Hazardous Waste Site, Executive Summary, prepared by Ms. Marge Kostenowczyk, NUS Corporation, April 15, 1983. (Attachment: Report: Potential Hazardous Waste Site, Site Inspection Report, Part I - Site Location and Inspection Information, prepared by Ms. Marge Kostenowczyk, NUS Corporation, February 22, 1983.

1.4 Site Investigation Report

P. 100363- 100405 HRS Cover Sheet & Package, prepared by Mr. Kenneth Kloo, November 18, 1986.

P. 100406- 100427 HRS Cover Sheet & Package, prepared by Mr. Kenneth Kloo, November 18, 1886.

P. 100428- 100456 HRS Cover Sheet & Package, prepared by Mr. Kenneth Kloo, November 18, 1986.

P. 100457- 100473 Report: Site Inspection Report, Kingston Residences, Laurel Avenue, Franklin Township, Somerset County, New Jersey, prepared by Mr. Robert Raisch, NJDEP, March 25, 1988.

P.	100474-100477	Report: Kingston Residences, Laurel Avenue, Franklin Township, Somerset, N.J., EPA ID # NJD981490436, prepared by Robert Raisch, HSMS III, NJDEP, June 1988.
P.	100478-100525	Kingston Residences Attachments (Maps 1 - 7 & other attachments A - J), undated.
P.	100526-100721	Higgins Disposal Service, 121 Laurel Avenue, Kingston, Somerset County, New Jersey, References A through Y, undated.

2.0 REMOVAL RESPONSE

2.2 Sampling and Analysis Data/Chain of Custody Forms

P.	200001-200191	Memorandum to Mr. George Prince, EPA/ERT Work Assignment Manager, from Mr. Charles McCusker, REAC Task Leader, Roy F. Weston, Inc., re: Higgins Disposal - Soil Sampling, Work Assignment # 2-442 - Trip Report, November 9, 1990.
P.	200192-200264	Report: Soil and Sediment Sampling, Higgins Disposal, Franklin Township, New Jersey, prepared by Roy F. Weston, Inc./REAC, prepared for U.S. EPA/ERT, December 1990.
P.	200265-200385	Report: Final Report, Geophysical Survey to Locate Buried Hazardous Waste Containers, Higgins Disposal Site, Franklin Township, New Jersey, September 1993, prepared by Roy F. Weston, Inc./REAC, prepared for U.S. EPA/ERT, September 17, 1993.
P.	200386-200565	Ensco Waste Material Data Sheets, No. 408939 through 408944, prepared by Mr. Michael Ferriola, On-Scene Coordinator, U.S. EPA, Region II, October 21, 1994. (Attachment: Attachment E: Haz-Scan Drum Inventory, prepared by Mr. Michael Ferriola, OSC, U.S. EPA, Region II, November 11, 1994.)
P.	200566-200571	Uniform Hazardous Waste Manifest, State of New Jersey, Manifest No. 1, Facility: Ensco Environmental Services of GA, Inc., Transporter: Nappi Trucking Co., Generator: U.S. EPA, Region II/Higgins Disposal, Mr. Michael Ferriola, On-

Scene Coordinator, U.S. EPA, Region II, November 11, 1994.

P. 200572- 200578 Uniform Hazardous Waste Manifest, State of New Jersey, Manifest No. 2, Facility: Ensco Environmental Services of GA, Inc., Transporter: Nappi Trucking Co., Generator: U.S. EPA, Region II/Higgins Disposal, Mr. Michael Ferriola, On-Scene Coordinator, U.S. EPA, Region II, November 11, 1994.

P. 200579- 200604 Uniform Hazardous Waste Manifest, State of Arkansas, Facility: Ensco, Inc., Transporter: Haz Mat Environmental Group, Generator: U.S. EPA, Region II/Higgins Disposal, Mr. Michael Ferriola, On-Scene Coordinator, U.S. EPA, Region II, November 15, 1994. (Attachments: 1. Letter to Mr. Richard Jakucs, from Wastex Industries, Inc., Re: analytical results obtained for Sample I.D. AB37776, October, 25, 1994; 2. Letter to Mr. Richard Jakucs, from Wastex Industries, Inc., re: analytical results obtained for Sample I.D. AB37777, October 25, 1994; and 3. Letter to Mr. Richard Jakucs, from Wastex Industries, Inc., re: analytical results obtained for Sample I.D. AB37778, October, 25, 1994.

P. 200605- 200656 Data Package: Removal Data & Manifests prepared by Accredited Laboratories, prepared for Westinghouse Remediation, December 22, 1994.

P. 200657- 200810 Report: Preliminary Trip Report, Soil Sampling at the Higgins Disposal Site, Franklin TWP., New Jersey, April 1995, prepared by Roy F. Weston, Inc./REAC, prepared for U.S. EPA/ERT, April 7, 1995.

P. 200811- 200905 Report: Preliminary Trip Report, Soil Sampling and Radiation Survey, Higgins Disposal Site, Franklin TWP., New Jersey, April 1995, prepared by Roy F. Weston, Inc./REAC, prepared for U.S. EPA/ERT, April 24, 1995.

P. 200906- 201150 Report: Final Trip Report, Soil Sampling and Radiation Survey, Higgins Disposal Site, Franklin TWP., New Jersey, May 1995, prepared by Roy F. Weston, Inc./REAC, prepared for U.S. EPA/ERT, May 4, 1995.

P. 201151- 201513 Report: Trip Report, Soil Sampling, Higgins Disposal Site, Kingston, New Jersey, February

1996, prepared by Roy F. Weston, Inc./REAC, prepared for U.S. EPA/ERT, February 29, 1996.

2.7 Correspondence

P. 201514- 201515 Memorandum to Mr. Richard Salkie, Associate Director for Removal and Emergency Preparedness Program, ERRD, U.S. EPA, Region II, from Mr. John Frisco, Deputy Director for New Jersey Programs, ERRD, U.S. EPA, re: Request for a Removal Action at the Higgins Disposal Service Site, Franklin Township, Somerset County, New Jersey, March 31, 1993.

P. 201516- 201524 Memorandum to Mr. George Prince, U.S. EPA/ERT Work Assignment Manager, from Mr. Stewart K. Sandberg, Project Manager, REAC Cincinnati, re: Preliminary Results of Field Work at the Higgins Disposal Site, W.A. # 4-905, July 21, 1993.

3.0 Remedial Investigation

3.1 Sampling and Analysis Plans

P. 300844- 300857 Plan: Sampling and Analysis Plan III, Higgins Disposal Site, Kingston, Somerset County, New Jersey, prepared by Roy F. Weston, Inc., prepared by Roy F. Weston, Inc., prepared for U.S. EPA, Region II, October 13, 1992.

P. 300858- 300884 Plan: Sampling QA/QC Work Plan, Higgins Disposal, Higgins Disposal Contaminated Soil Pile, prepared by U.S. EPA, Region II, TAT and Roy F. Weston, Inc., prepared for U.S. EPA, Region II, December 20, 1994.

3.3 Work Plans

P. 300885- 300908 Plan: Work Plan for Drum Excavation, Higgins Disposal Site, Kingston, Somerset County, New Jersey, prepared by Westinghouse Remediation Services, Inc., prepared for U.S. EPA, Region II, February 11, 1994.

3.4 Remedial Investigation

P. 300909- 301006 Report: 6.91-Mile Milltown "E" Loop of the Liberty Pipeline Upstream Facilities Temporary Row Expansion and Work Space Areas, Phase I Historical and Archaeological Survey, prepared by The

Cultural Resource Group, Louis Berger & Associates, Inc., prepared for Transcontinental Gas Pipe Line Corporation, March 1992.

P. 301007- 301064 Report: Final Wetland Delineation Report, Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., prepared for U.S. EPA, June 1996.

P. 301065- 301149 Report: Final Stage 1A Archaeological Survey, Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., prepared for U.S. EPA, July 1996.

P. 301150- 301539 Report: Final Remedial Investigation Report, Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., prepared for U.S. EPA, August 1996.

P. 301540- 302005 Report: Final Remedial Investigation Report, Volume II, Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., prepared for U.S. EPA, August 1996.

4.0 FEASIBILITY STUDY

4.3 Feasibility Study Report

P. 400001- 400137 Report: Final Feasibility Study Report, Higgins Disposal Services, Town of Kingston, Somerset County, New Jersey, prepared by Malcolm Pirnie, Inc., prepared for U.S. EPA, August 1996.

10.0 PUBLIC PARTICIPATION

10.2 Community Relations Plans

P. 10.00032 10.00062 Glossary of Environmental Terms and Acronym List, prepared by U.S. EPA, Office of Communications and Public Affairs, December 1989.

APPENDIX IV

STATE LETTER

State of New Jersey
Department of Environmental Protection

Christine Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

?? 2 9 1997

Ms. Jeanne M. Fox
Regional Administrator
USEPA - Region II
290 Broadway - Floor 19
New York, NY 10007 - 1866

Re: Higgins Disposal Superfund Site: Record of Decision (ROD)

Dear Ms. Fox:

The New Jersey Department of Environmental Protection (NJDEP) has evaluated the components of the selected remedy for the Higgins Disposal Superfund Site and concurs with the following ground water components of the remedy. NJDEP does not concur with EPA's position of no further action for the soils at the site.

The major components of the selected ground water remedy that NJDEP concurs with include the following:

- Remediation of contaminated ground water to Federal and State Maximum Contaminant Levels and also to ground water quality standards promulgated by the State of New Jersoy.
- Installation of on-site wells for the extraction of the contaminated ground water.
- Conveyance of the extracted ground water via a pipeline to the Higgins Farm Superfund Site for treatment, with discharge to surface water.
- If necessary, the on-site ground water treatment system at the Higgins Farm Site will be enhanced through the addition of granular activated carbon.
- Connection of the ten neighboring residents on Laurel Avenue who use private well water to a public water supply. Public water would also be provided to the Higgins family. This would be accomplished through the extension of the existing Elizabethtown Water Company pipeline.
- Implementation of an environmental monitoring program to ensure the overall effectiveness of the remedy.
- Five-year reviews of the Site pursuant to CERCLA.

NJDEP concurs that the selected remedy for ground water is protective of human health and the environment, complies with requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective.

NJDEP does not concur with EPA's conclusion of no further action for soils because there are levels of PCB's, PAH's and some metals in the soils that exceed our soil cleanup guidelines for a residential setting. Although these levels may not require an active remediation, EPA has failed to recognize the need to implement a Declaration of Environmental Restriction (DER) at a minimum as warranted by NJSA 58:10-B.

The State of New Jersey appreciates the opportunity to participate in the decision making process of the Superfund program.

Sincerely,

Richard J. Gimello
Assistant Commissioner

APPENDIX V

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
HIGGINS DISPOSAL SUPERFUND SITE
FRANKLIN TOWNSHIP, NEW JERSEY

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

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

II. Background: This section briefly describes community relations activities for the Higgins Disposal Site.

III. Public Meeting Comments and EPA Responses: This section provides a summary of commenters' major issues and concerns, and expressly acknowledges and responds to all significant comments raised at the public meeting.

IV. Response to Written/Internet Comments: This section provides a summary of, and responses to, comments received in writing and through the Internet during the public comment period.

V. Written/Internet Comments: This section provides copies of all of the written/Internet comments received. In addition, a copy of the transcript of the public meeting is likewise included.

I. OVERVIEW

At the initiation of the public comment period on May 1, 1997, EPA presented its preferred alternative for the Higgins Disposal Site located in Franklin Township, New Jersey. The selected remedy includes extraction of contaminated groundwater with conveyance of this groundwater via a pipeline to the Higgins Farm treatment plant. In addition, neighboring residents including the Higgins' will be connected to public water through extension of the existing Elizabethtown Water Company's pipeline. Furthermore, environmental monitoring will be performed in order to evaluate the effectiveness of the groundwater extraction system.

II. BACKGROUND

The Remedial Investigation and Feasibility Study (RI/FS) and the Proposed Plan for the Site were made available at the EPA Superfund Document Center at EPA's Region II office in New York City, at the Mary Jacobs Memorial Library in Rocky Hill, New Jersey and at the Franklin Public Library in Somerset, New Jersey. The notice of availability for these documents was published in the Home News and Tribune on May 1, 1997. The public was given the opportunity to comment on the preferred alternative during the public comment period which began on May 1 and concluded on June 30, 1997. In addition, a public meeting was held on May 20, 1997 at the Franklin Township Municipal Building. At this meeting, representatives from EPA answered questions concerning the Site and the remedial alternatives under consideration. It should be noted that the public comment period originally was to have ended on May 30, 1997. However, in response to a request made during the public meeting, the comment period was extended to June 30, 1997. Responses to comments received during the comment period, including the public meeting, are provided in this Responsiveness Summary.

III. PUBLIC MEETING COMMENTS AND EPA RESPONSES

The questions and comments raised during the public meeting can be grouped into the following categories:

A. EPA's Preferred Alternative (Alternative 3B)

B. Issues Regarding the State-Owned Laurel Avenue Site

C. Other Issues and Comments

Questions or comments are summarized in bold, followed by EPA's response.

A. EPA's Preferred Alternative (Alternative 3B)

1. **Members of the audience asked for specific details of the proposed pipeline that will convey groundwater from the Higgins Disposal Site to the Higgins Farm Site. Questions concerned the composition of the pipeline, the effects of blasting from the nearby quarry, the location of the pipeline and whether the pipeline pumping system will operate on suction or pressure.**

   EPA Response: Specific details of the pipeline material, the effects of blasting and the pumping system will be evaluated in the detailed design of the remedy. The pipeline will be designed to withstand the blasting associated with quarry operations, and to shut down in the event of a pipeline failure.

   With regard to the pipeline location, EPA acknowledges that the location proposed in the Feasibility Study must be revised based on current locations of the easements. The Feasibility Study proposed a conceptual pipeline alignment, within both the Transcontinental Gas Pipeline Corporation and the Sun Pipeline Company easements, which crossed through Trap Rock property. However, information provided during the public comment period indicates that these easements have been relocated outside of the active mining zone to the edge of Trap Rock property. Using easement information provided to EPA during the public comment period, the Agency has recalculated the costs for implementing the selected remedy (which are provided in Appendix VI). While the present worth of the remedy has been recalculated to be approximately $3.3 million dollars (as compared to the original present worth calculation of approximately $2.2 million dollars), the remedy nevertheless provides the best balance of trade-offs among alternatives with respect to EPA's evaluation criteria.

2. **The attorney representing the owners of the Site commented that there is insufficient information to select a remedy. Areas in which the attorney noted uncertainties include the hydraulic characteristics at the Site and surrounding area, the relationship between on-site groundwater and regional groundwater flow, the pipeline location and the groundwater model.**

EPA Response: EPA disagrees with the majority of these comments, in that the Agency believes sufficient information has been gathered to make a sound decision with regard to the selection of a remedy.

The results of EPA's investigatory activities (which were performed in accordance with established technical procedures) reveal that chemicals detected in the groundwater beneath the Site were also detected in neighboring residential wells. Additionally, the pattern of contamination along with the groundwater flow regime suggests that the source of these contaminants is the buried waste on the Site. In addition, operation of the on-site production well is known to influence groundwater flow underneath the Site.

Based on the information collected during EPA's investigation, a groundwater model was used to develop a conceptual design which would be sufficient for remedy selection purposes. This conceptual design (i.e., pumping groundwater from a known area of contamination) has been successfully implemented at other Superfund sites in New Jersey in which contamination exists in fractured bedrock. It should be noted that the conceptual design will, by necessity, be refined during the detailed design of the remedy. During the detailed design, actual well location(s) and extraction rate(s) will be determined.

With regard to the proposed pipeline route, information obtained during the public comment period was used to determine a revised location and re-estimate costs. However, the preferred alternative with the revised pipeline location still provides the best balance of trade-offs among alternatives with respect to EPA's evaluation criteria.

3. **Members of the audience expressed concerns with the placement of the pipeline near the quarry and near residential property. Furthermore, concerns were raised regarding possible pipeline failure, and what entity would be responsible in the event of such an occurrence. In addition, the attorney representing the owners of the Site requested that EPA investigate the possibility of conveying the extracted groundwater to a publicly-owned treatment works (POTW).**

EPA Response: As discussed above, EPA has determined that Alternative 3B provides the best balance of trade-offs among alternatives with respect to EPA's evaluation criteria. Responsibility in the event of pipeline failure will depend on the circumstances of the accident. If the failure were the result of either a design, construction or operation and maintenance error, then the party responsible for these activities (whether it be the Government or potentially responsible parties) may be held responsible. Conversely, if the accident were the result of activities performed by an outside party, then that party may be held responsible for the pipeline failure.

With regard to the possibility of conveying groundwater to a POTW, EPA has met with representatives of the Stony Brook Regional Sewage Authority. At this meeting, EPA was informed that the Authority would consider a request by the Agency to accept groundwater from the Site. However, during the meeting, the participants agreed that some form of pretreatment of the groundwater would probably be necessary. In addition, the method by which the groundwater would be conveyed to the POTW was likewise discussed. The Authority indicated construction of a pipeline to the nearest sewer system, which is located outside of Franklin Township, would require the approval of the municipalities that own the sewer system. As an alternative to construction of a pipeline, the Authority indicated that trucking the wastewater to the POTW would be more implementable, since municipal collection systems would not be used. Under this scenario, truckloads of the pretreated groundwater would need to be routinely sampled for priority pollutants (such as volatile organics, semi-volatile organics, pesticides, PCBs and metals).

EPA has calculated the cost of conveying pretreated groundwater by trucks to the POTW. The cost analysis assumes that a 30,000 gallon holding tank would need to be erected on the Site, and that approximately 14,000 gallons of groundwater would need to be trucked each day, six days a week (on the seventh day, the groundwater would be stored in the holding tank). The groundwater would be pretreated using carbon canisters, and sampling of the pretreated groundwater would need to be performed on a monthly basis for at least the first year of operation. The cost information, which is provided in Appendix VI, indicates that the present worth of this alternative is approximately 4.7 million dollars, as compared to approximately 3.3 million dollars for the preferred alternative of piping groundwater to the Higgins Farm Site. The costs of conveying groundwater to the POTW, combined with the aforementioned difficulties associated with implementing such an alternative, renders this suggestion impractical.

4. **Members of the audience expressed concerns with regard to linking both the Higgins Farm and Higgins Disposal Sites by the pipeline. Questions arose as to whether the cleanup at Higgins Farm would be delayed by treatment of groundwater from Higgins Disposal, and if Higgins Farm would still be considered a Superfund site if that Site was cleaned up, yet groundwater was still being conveyed to it from Higgins Disposal. Additionally, a member of the audience asked if the treatment system at Higgins Farm could operate with only the 10 gallon per minute flow from Higgins Disposal.**

   EPA Response: EPA does not anticipate the cleanup of Higgins Farm to be delayed by the addition of the 10 gallon per minute flow from Higgins Disposal. Since contamination at both sites occurs within fractured bedrock, specific time frames for cleanup of these sites is difficult to determine. However, it is expected that the Higgins Farm Site could be deleted from EPA's National Priorities List once it is cleaned up, even if the treatment plant was still receiving groundwater from Higgins Disposal. In the event that the Higgins Farm Site were to be cleaned up prior to Higgins Disposal Site, the treatment system may require some modification in order to treat groundwater at the lower flow rate.

5. **A member of the audience expressed concern that by allowing groundwater to be conveyed to the Higgins Farm treatment system from the Higgins Disposal Site, then the possibility exists that the treatment system will be used to treat water from other sites.**

   EPA Response: EPA will not bring wastewater from other Superfund sites to the Higgins Farm treatment system. Since both sites are owned by the same party (i.e., Clifford and Lizbeth Higgins), are in close proximity to each other and exhibit similar groundwater contamination, the preferred alternative can be readily implemented. It should be remembered that the Higgins Farm treatment system was designed to treat specific classes of contaminants. Treatment of groundwater other than the groundwater from Higgins Farm or Higgins Disposal could possibly require extensive modifications of the treatment system, which may be cost-prohibitive. In any event, no such action is contemplated by EPA.

6. **A member of the audience asked where the groundwater extraction wells would be located. A member of the audience also asked whether the extraction system would draw in contamination from locations off of the Site.**

EPA Response: The specific locations of the groundwater extraction wells will be determined during the detailed design of the remedy. It is currently anticipated that the extraction system would be placed on the Site, near the location of the source of groundwater contamination. With regard to the potential of drawing in contamination from off-site locations, EPA does not anticipate this situation to occur, since the extraction system will be operating at a low pumping rate (only enough to capture contaminated groundwater at the Site). However, it should be noted that in order to determine the effectiveness of the extraction system, a groundwater monitoring system will be developed and implemented as part of the remedy.

7. **A member of the audience asked how the air emissions at the Higgins farm treatment plant would be affected by the additional groundwater from Higgins Disposal.**

   EPA Response: The Higgins Farm treatment system is designed to treat 100 gallons per minute of contaminated groundwater. It is expected that the 10 gallons per minute flow from the Higgins Disposal Site will not adversely impact the air quality in the vicinity of the Site. Any such air emissions would have to comply with Federal and State requirements.

8. **A member of the audience asked how contracting for the remedy would occur.**

   EPA Response: If the remedy is implemented by the Government, then contracts would be awarded competitively, in accordance with Federal and EPA acquisition regulations.

9. **A member of the audience inquired as to the course of action that will be taken if the remedy is not successful. Another member of the audience asked if the public will be able to review performance data for the remedy.**

   EPA Response: When the remedy is implemented, monitoring will be performed to determine the remedy's effectiveness. Once this data is determined to be valid, it will be sent to the information repositories (i.e., the Mary Jacobs Memorial Library, the Franklin Public Library and EPA's Superfund Document Center) and made available for public review . In addition, EPA will perform a formal review of the remedy every five years. The purpose of this review is to ensure that the selected remedy is performing as expected. Depending on the effectiveness of the remedy, it is possible that other alternatives could be considered in the event that the remedy was found to be ineffective. However, it must be stressed that EPA anticipates that the selected remedy will, in fact, be effective.

10. **A member of the audience asked if the parties holding the easements necessary for location of the pipeline have consented to access.**

EPA Response: EPA has contacted these parties with regard to access for installation of the pipeline. However, to date, access has not been secured. Access to these easements will be secured by the entities responsible for implementing the remedy, whether it is the Government or the potentially responsible parties (also called "PRPs").

11. **Members of the audience commented on EPA's proposal to connect residents to public water. While the audience was supportive of EPA's proposal, they asked if it was possible to shorten the time frame to implement this portion of the remedy. A member of the audience also recommended that EPA should connect residents to public water and not address the remaining groundwater contamination.**

EPA Response: EPA will ensure that connection of the residents to public water be made a priority, and that the time frame for implementation of this portion of the selected remedy is not dependent upon implementation of the groundwater extraction and conveyance system. With regard to the recommendation that the groundwater extraction and conveyance system not be implemented, EPA is mandated by law to address contamination that poses a threat to human health and the environment. As described in the March 8, 1990 Federal Register (Vol. 55, No. 46, Page 8732), EPA's Superfund program uses EPA's Groundwater Protection Strategy as guidance when determining the appropriate remediation for contaminated groundwater at Superfund sites. The goal of EPA's Superfund approach is to return usable groundwaters to their beneficial uses within a time frame that is reasonable given the particular circumstances of the site.

Through its investigation, the Agency has documented that there are unacceptable risks to human health resulting from groundwater contamination. Therefore, EPA is compelled to implement measures to address this contamination.

12. **A member of the audience asked if the remedy could be delayed until performance of the Higgins Farm treatment plant is ascertained.**

EPA Response: Since start-up activities of the Higgins Farm treatment system have commenced, EPA anticipates that the performance of the system will be known prior to implementation of the remedy. Therefore, at this time, it is not necessary to delay the remedy based on performance of the Higgins Farm treatment system.

13. **A member of the audience inquired as to the time frames for remediation through implementation of Alternative 3B versus continued use of the on-site production well.**

As stated previously, time frames for cleanup of contaminated groundwater in fractured bedrock are difficult to predict. Nevertheless, it is expected that the preferred alternative of continuous extraction of the groundwater beyond the current condition of intermittent pumping will reduce the time frame for cleanup of the groundwater.

B. Issues Regarding the State-Owned Laurel Avenue Site

1. **Members of the audience had numerous questions concerning the State-owned Property on Laurel Avenue, which may be a potential source of groundwater contamination. These questions include the following:**

- **Is water withdrawn from this property for use?**
- **Can this property and Higgins Disposal be addressed at the same time?**
- **Where is the contaminated groundwater migrating?**
- **What is the status of the investigation of the property?**
- **Can the property be placed on EPA's NPL?**
- **Is there information on this property in the information repositories for the Higgins Disposal Site?**

EPA Response: Based on available information, water is not withdrawn from the Laurel Avenue Site for use. Since the New Jersey Department of Environmental Protection has responsibility for this Site, EPA has provided the information that it has collected to the State and has also advised the State that the property may be a source of contamination.

Due to the fact that the property is currently not listed on EPA's NPL, Federal remedial funding cannot be used to clean up the property. However, EPA is currently evaluating the existing information to determine whether a preliminary assessment and a site inspection is appropriate for the property. At the present time, EPA has not evaluated the direction of contaminant migration from this property. Furthermore, since the property is not listed on the NPL, it cannot be remediated by the remedial action selected for the Higgins Disposal Site. In order for a site to be placed on the NPL, it must be evaluated, or ranked. If the site were to exceed the minimum ranking criteria, then it could be placed on the NPL.

With regard to the public availability of information about this property, information which EPA obtains concerning this property will be provided to the information repositories for public review.

C. Other Issues and Comments

1. **A member of the audience asked if a community working group had been established for the Site.**

   EPA Response: While such a group has not been established for this Site, EPA can organize a Community Advisory Group, should there be sufficient public interest.

2. **A member of the audience asked when will the selection of the alternative be made, and whether that will happen before or after the close of the comment period. Another member of the audience asked if the public will be able to comment on the final location of the pipeline. A third member of the audience asked if the PRPs will be allowed to present their own remedy.**

   EPA Response: Selection of a remedy is made after the close of the public comment period, and all comments have been evaluated. During design and construction of the remedy, EPA can provide updates to the public, in the form of presentations and fact sheets. Information of selection of a final pipeline location will be provided to the public. While it is possible that EPA will ask the PRPs to perform the remedy, the Agency will not agree to these parties presenting a remedy to the public which differs from the selected remedy.

3. **A member of the audience asked if there would be additional public participation should EPA not select Alternative 3B (i.e., the preferred alternative).**

   EPA Response: The Agency is not required to solicit public comment if one of the other remedies described in the Proposed Plan is chosen. However, if the Agency were to select an alternative not described in the Proposed Plan, then the public would be afforded an additional opportunity to comment.

4. **A member of the audience asked if residential property values are considered in the remedy selection process.**

   EPA Response: Residential property values are not directly considered in the selection of a remedy. However, comments from residents who are concerned about their property values and who prefer a specific remedy are considered in the selection process.

5. **A request for an extension of the public comment period was made during the public comment period.**

EPA Response: As described previously in the ROD, EPA extended the public comment period to June 30,1997.

6. **A resident inquired as to whether the Proposed Plan needed to be reissued, since it contained inaccurate information pertaining to costs associated with the preferred alternative.**

EPA Response: Although EPA has slightly revised the costs of the preferred alternative based upon the information obtained during the public comment period, the preferred alternative still represents the best balance of trade-offs among alternatives with respect to the evaluating criteria (including cost). Therefore, reissuance of the Proposed Plan is not necessary.

7. **Several questions were raised pertaining to the size and location of the on-site treatment plant associated with Alternative 4.**

EPA Response: The Feasibility Study provides an estimated size of 70 feet by 30 feet. It should be noted that a more accurate specification of the size of the treatment plant would be developed during a detailed design. In addition, the final location of the treatment plant would likewise be determined during the detailed design after consultation with the property owners.

8. **A member of the audience asked if the residential carbon filters have been effective in preventing exposure to contamination in the groundwater.**

EPA Response: Based on the results of EPA sampling, the carbon filters have been found to be effective.

9. **A member of the audience asked if the effects of blasting at the quarry have an effect on the area hydrogeology and in the existing wells.**

EPA Response: Since blasting at the quarry occurs at random intervals, it would be difficult to evaluate the effect of blasting on the hydrogeology of the area. However, it must be recognized that the existing water supply well on the Site continues to be productive in spite of the blasting.

10. **A member of the audience asked for information pertaining to the source of the public water.**

EPA Response: Public water is provided by the Elizabethtown Water Company. Elizabethtown Water Company primarily obtains this water from the Raritan River. However, water can be obtained from the Delaware and Raritan Canal.

11. **A member of the audience asked if there is a plan for the Department of Health to monitor the residents to see if there are effects from the Site.**
EPA Response: The Agency for Toxic Substances and Disease Registry (ATSDR) is the agency that would oversee any public health monitoring and epidemiologic studies. In addition, ATSDR performs public health surveys at Superfund Sites. Individuals with specific health concerns as they pertain to the Site should contact ATSDR at 290 Broadway, 18th Floor, New York, New York 10007-1866.

12. **A member of the audience commented that there were area residents who did not receive the Proposed Plan. Recommendations were made by the audience to update the mailing list for the Site.**

EPA Response: Efforts are made to ensure that the mailing list is current and as complete as possible. However, mailing lists can become outdated. The situation is exacerbated by the fact that instances occur in which people attend public meetings yet do not provide the Agency with their names and addresses. Several suggestions made during the public meeting to keep the mailing list current (such as contacting the Board of Adjustments and the Board of Elections) are appropriate and will be used to update the mailing list.

IV. RESPONSE TO WRITTEN/INTERNET COMMENTS

Questions and comments received during the public comment period, in writing and through the Internet, can be grouped into the following categories:

A. Non-PRP Comments Concerning EPA's Preferred Alternative (3B)

B. PRP Comments Concerning EPA's Preferred Alternative

As before, questions or comments are summarized in bold, followed by EPA's response.

A. **Non-PRP Comments Concerning EPA's Preferred Alternative (3B)**

1. **Several commenters recommended that EPA investigate conveyance of groundwater to a nearby POTW.**

   EPA Response: This issue was raised at the May 20, 1997 public meeting, and is discussed in III.A.3, above.

2. **A commenter urged the Agency to immediately connect the Laurel Avenue residents to public water. Another commenter wrote that the Residents should decide themselves whether they should have public water.**

   EPA Response: As discussed in III.A.11, EPA will ensure that connection of resident to public water is made a priority and is not delayed by implementation of the groundwater extraction and conveyance system. While the Agency will extend the existing water main to affected residents, it should be noted that individual residents will be given the opportunity to decline connection to the water main.

3. **A resident living in the vicinity of Higgins Farm asked how the air emissions at the Higgins farm treatment plant would be effected by the additional groundwater from Higgins Disposal.**

   EPA Response: This issue was raised at the May 20, 1997 public meeting, and is discussed in III.A.7, above.

4. **Several commenters suggested trucking the extracted groundwater to Higgins Farm, instead of using a pipeline.**

   EPA Response: Upon receiving this comment, EPA calculated the cost of conveying the extracted groundwater by trucks to the Higgins Farm treatment plant. The cost information, which is provided in Appendix VI, indicates that the present worth of this alternative is approximately 4.2 million dollars (as opposed to the present worth of EPA's preferred alternative, which is approximately 3.3 million dollars). The increase in cost of trucking over the cost of the Alternative 3B, combined with the increased truck traffic at Higgins Farm, makes implementation of a trucking alternative impractical.

5. **One commenter asked what the responsibilities would be of entities other than EPA (such as the NJDEP or the PRPs) if EPA transfers the project to these entities prior to completion of cleanup. The commenter further asked if the public would be notified of this transfer.**

EPA Response: Currently, EPA has the responsibility of implementing the cleanup activities at the Site. Should activities in the future be implemented by other parties, these entities would be legally required to implement the remedy selected in this ROD. Since it is EPA's intention to periodically update the public on the status of the cleanup, the public will be informed as to whether parties other than EPA become responsible for implementing cleanup activities.

6. **A commenter asked how people who did not attend the public meeting will be notified of errors in the preferred alternative.**

EPA Response: As discussed in III.C.6 above, EPA believes that any errors in the preferred alternative that was presented in the Proposed Plan do not change the fact that Alternative 3B represents the best balance of trade-offs with respect to the Agency's evaluation criteria. Therefore, there is not a need to reissue the Proposed Plan or to provide additional public notification beyond the issuance of this ROD.

7. **A commenter recommended that, as a precaution in the event of a pipeline leak, a pumping system operating on suction be used to convey groundwater from the Higgins Disposal Site to the Higgins Farm Site.**

EPA Response: As described in III.A.1, above, the details of the piping system will be determined during the detailed design. Furthermore, the system will have sufficient controls to evaluate whether leakage occurs in the pipeline system and to minimize any leakage that may occur.

8. **Several commenters expressed concern for the integrity of the pipeline due to the blasting that occurs at the quarry.**

EPA Response: As explained in III.A.I, the pipeline will be designed to withstand the effects of blasting that occurs at the quarry.

9. **A representative of the quarry commented that since his company installed the existing water line on Laurel Avenue, then it should be reimbursed for any use of it.**

EPA Response: The issue of reimbursement is between the company operating the quarry and the water company. It should be noted that the company operating the quarry would not receive reimbursement from EPA.

10. **A commenter asked where in the treatment system at Higgins Farm would carbon contactors be installed.**

EPA Response: It is anticipated that carbon contactors would be installed as a finishing step following the existing treatment system at Higgins Farm.

11. **Several commenters indicated preferences for alternatives other than 3B. One commenter suggested that no action be taken. Another indicated that the existing production well on the Site is treating groundwater and that the public is not at risk. A third expressed a preference of Alternative 2B over Alternative 3B, while a fourth commenter preferred the construction of a small treatment plant on the Site.**

EPA Response: The Agency believes that additional cleanup activities beyond the current intermittent pumping of the on-site production well is necessary to protect human health and the environment. As described in the Proposed Plan, the four alternatives presented to the public were compared to each other using EPA's evaluation criteria. With regard to the comment concerning the construction of a "small" treatment plant on the Site, it must be noted that the size of the plant described in the Feasibility Study was determined based on the need for treatment processes that would treat the groundwater to levels that would render the groundwater suitable for discharge to surface water. Additionally, in lieu of installing a pipeline, the Agency also considered trucking the extracted groundwater to the Higgins Farm Site or to a POTW. Based on all of the information to date, Alternative 3 B is considered by EPA to be the most cost-effective protective remedy to address groundwater contamination at the Site.

12. **One commenter informed EPA of the existence of benzene-contaminated groundwater at the Six Mile Run Reservoir Site, and that the State of New Jersey has leased an 80 acre portion of this site to Clifford Higgins since 1966. Furthermore, the commenter inquired as to whether testing of this property should be performed as an element of activities associated with the Higgins Disposal Site.**

EPA Response: EPA will be contacting the commenter to obtain additional information about the groundwater contamination at the Six Mile Run Reservoir Site. This information will be used by EPA to determine whether a preliminary assessment and a site inspection is necessary. It is not anticipated that this work will be performed as an element of activities associated with the Higgins Disposal Site.

13. **One commenter was concerned about the decrease in property values due to the installation of the pipeline.**

    EPA Response: As described in III.C.4 above, EPA does not directly consider property values in the selection of a remedy. Since the pipeline would be located largely within pre-existing easements, property values are not expected to be negatively influenced by implementation of the remedy.

14. **A commenter asked if the State-owned house at 82 Laurel Avenue could be able to tie into the proposed water line extension. This commenter also inquired as to the logistics for tie-in, and whether the water line would be sized sufficiently for installation of fire hydrants.**

    EPA Response: The house at 82 Laurel Avenue would be allowed to tie into the water line extension. Logistical and technical issues (such as the size of the water line) would be resolved during the design of the water line extension.

15. **One commenter asked if the additional groundwater from Higgins Disposal will delay cleanup of the Higgins Farm Site.**

    EPA Response: This issue was raised at the May 20, 1997 public meeting, and is discussed in III.A.4, above.

16. **A commenter discussed the possibility of delaying the remedy until performance of cleanup at the Higgins Farm Site can be ascertained.**

    EPA Response: This issue was raised at the May 20, 1997 public meeting, and is discussed in III.A.12, above.

17. **A commenter inquired as to when EPA would determine that the cleanup was ineffective, and if the Agency consider other alternatives at that point.**

EPA Response: This issue was raised at the May 20, 1997 public meeting, and is discussed in III.A.9, above. Effectiveness will be periodically evaluated during implementation of the remedy. Depending on the effectiveness of the remedy, it is possible that other alternatives could be considered in the event that the remedy was found to be ineffective. However, it must be stressed that EPA anticipates that the selected remedy will, in fact, be effective.

18. **An individual commented that the EPA should require the installation of filters for those residences on Laurel Avenue which do not have these systems.**

EPA Response: As described in the Proposed Plan, the analysis of the water from these residences did not indicate a health risk. Therefore, it is not necessary to require the installation of filtration units.

19. **A commenter inquired as to the direction of flow for the receiving water for the Higgins Farm treatment plant discharge, and if testing of the discharged water will occur.**

EPA Response: The treatment plant at Higgins Farm discharges to a pond, which then discharges through an unnamed tributary to Carters Brook. Prior to discharge, the effluent is monitored for a variety of organic, inorganic and conventional pollutants in accordance with the requirements of the Clean Water Act.

20. **A commenter asked if EPA had performed an investigation to determine if wastes were improperly disposed at areas other than the Higgins Farm and Higgins Disposal Sites.**

EPA Response: EPA has conducted and continues to conduct an investigation to determine the identities of PRPs at both Sites. Due to the lack of detailed business records, it is difficult to determine the extent of off-site disposal.

21. **The representative of the quarry commented that EPA, in its groundwater model, assumes that the quarry uses a large quantity of groundwater for its mining activities. This person further states that the quarry does not use groundwater as part of its operations, and that any assumption by EPA that the quarry influences groundwater flow is incorrect.**

EPA Response: The use of groundwater in the quarry's process was never inferred from the model. The idea that the quarry itself may create a groundwater sink, however, was incorporated into the model. This was due to several observations from the groundwater modeling effort. The main observation is that the amount of drawdown necessary to create the groundwater potentiometric heads that were actually observed in the field can not be recreated solely by pumping from the residential wells.

The amount of water removed from north of the Site to create the observed drawdown was approximately 35,000 gallons per day. When this amount of water is compared to the size of the quarry, it does not indicate a prolific aquifer. However, it does not preclude the quarry from being a stress on the aquifer. When 35,000 gallons per day is spread over the available seepage faces of the quarry, it is possible that the seepage would not even be observable. Whether or not the quarry uses water in their operations, the quarry still represents a sink in the aquifer system and does not change the results of the modeling.

22. **The representative of the quarry commented that the quarry is situated in the vicinity of the Lockatong Formation, to which the NJDEP has assigned a permeability rating of "poor". The commenter recommends that EPA should reexamine the groundwater modeling calculations to determine if the model's assumptions are consistent with this type of formation.**

EPA Response: As indicated in IV.A.21 above, the 35,000 gallons per day removed from north of the Site, compared to the size of the quarry, does not indicate a prolific aquifer. Consequently, EPA believes that the groundwater modeling assumptions are consistent with the geologic characteristics of the area.

23. **The representative of the quarry inquired as to whether EPA factored into its groundwater model the usages represented by the supply wells "outlined on Page 1-10 of the Plan".**

EPA Response: The Agency assumes that the "plan" which is referenced to is actually the Feasibility Study. As described in IV.A.21 above, the model is based on conditions observed during actual groundwater monitoring. Therefore, observable stresses (and, consequently, the sources of those stresses) on the aquifer have been factored into the groundwater model.

B. PRP Comments Concerning EPA's Preferred Alternative

The questions and comments can be grouped into the following categories:

I. Comments by a Specific PRP

II. Comments by the Attorney Representing the Owners of the Site

As before, questions or comments are summarized in bold, followed by the Agency's response

I. Comments by a Specific PRP

One of the PRPs for the Site provided numerous written comments on the Proposed Plan, hydrogeologic investigations/RI, risk assessment, FS and groundwater model. Although these comments have been summarized below, the complete set of comments will be placed in the administrative record/information repositories. Please note, however, that EPA's responses that are provided below represent responses to all of the PRP's comments.

A. Proposed Plan Comments

1. **Selection of a groundwater remedy is premature, since Removal actions have not yet been completed. The commenter further notes that the role of natural attenuation needs to be understood.**

   EPA Response: EPA disagrees. Groundwater at the Site is contaminated at levels which are above health-based standards, and there is currently a risk to human health from drinking contaminated groundwater. The types of contaminants and general migration pathways have been determined, and the available data indicates that the contamination can be extracted from the aquifer. The complex site hydrogeology has been investigated and characterized in accordance with accepted scientific and engineering practices. While it is believed that upon removal of the final source area there will be no additional contamination of the aquifer by the Site, the removal activities will have no effect on the contamination currently present in the groundwater.

With regard to natural attenuation, the data collected through the groundwater monitoring effort do not suggest that natural attenuation mechanisms are effective at preventing risks to human health. From the 1950's through 1985, the owner operated a landfill and waste transfer station at the Site. The present contaminant levels in the groundwater, which exceed health-based levels, are not expected to degrade any faster than the contaminants which presumably first entered the groundwater 4 decades ago.

While EPA disagrees that selection of a remedy is untimely, the Agency does believe that implementation of the groundwater extraction and conveyance system should be deferred until the removal action is completed. Once the removal action is completed, additional data can be collected for the purpose of optimizing the detailed design of this system.

2. **EPA has not developed a conceptual model of the Site, and the proposed remedy is based upon an incomplete understanding of Site conditions.**

EPA Response: EPA disagrees. A conceptual model was established for this Site and is documented, in great detail, in the RI Report. EPA actually prepared its first conceptual site model in 1990. EPA collected a broad breadth of information of the Site (such as data collected previously be the NJDEP and the State/local health departments) as well as reviewing the available published technical literature on the geology and biology within the region of the Site. This first conceptual Site model is detailed in the work plan for the RI/FS. EPA subsequently improved its understanding of the Site through the RI, collecting data on the groundwater, soils, surface water, sediment and air. EPA investigated the adjacent quarry and contacted State geologists (who are experts on the area's structural geology) to gain a better understanding of the local and regional geology and hydrogeology.

Upon completion of the RI, the conceptual Site model was completed since the sources of contamination were identified, the types of contaminants present and the affected media were defined, the routes of migration of the contaminants were defined and the human and environmental receptors were identified.

EPA anticipated that the hydrogeology of this Site would be extremely complex. Therefore, the Agency installed 18 on-site monitoring wells, prepared soil boring logs from the wells, performed geophysical work to help define bedrock fractures and joints, collected soil samples and ran tests to determine the characteristics of the soil, ran aquifer pumping tests, collected two rounds of groundwater sampling and water level measurements, sampled on-site surface water bodies and monitored off-site wells. In addition, discussions with experts on bedrock geology in the local area and utilization of published literature on the geology and hydrology of the area all served to derive EPA's model of the site hydrogeologic system. EPA used the best available scientific techniques to define the hydrogeologic system and predict contaminant transport in the bedrock environment.

EPA expects the proposed extraction wells to yield sufficient amounts of groundwater to make the remedy viable. The majority of monitoring wells which EPA installed yielded sufficient volumes of water for sampling while a few did not, revealing the heterogeneity of the hydrogeologic system. EPA conducted an aquifer test on the better yielding monitoring wells to gain a better understanding of the hydrology of the aquifer and to gain information on possible pumping rates for extraction purposes. It must be stressed that actual, current extraction of groundwater from an on-site well and the pumping test performed by EPA demonstrate that groundwater can be efficiently extracted from the Site in order to remediate groundwater contamination.

3. **EPA's presumptive response strategy requires a more thorough characterization of site conditions coordinated with response actions. Furthermore, other remedial processes such as enhanced in-situ treatment or natural attenuation, should have been evaluated in the FS.**

EPA Response: EPA's RI/FS work was completed before completion of the Agency's guidance on groundwater presumptive remedies. Although EPA was working proactively to eliminate sources of contamination through its removal authority, the Agency did not make a determination to utilize a presumptive remedy for groundwater, or to implement an interim action. During the course of the RI/FS, EPA found that the on-site production well was serving in a manner similar to an interim action, in that a portion of the contaminated groundwater was being contained.

Although Alternative 1 was not identified as such, it should be noted that this alternative described a monitored natural attenuation remedial action. Furthermore, EPA screened out in-situ and containment technologies during the FS screening phase because of the type of the complex, fractured bedrock geologic environment, and the uncertainties associated with such an environment. Therefore, the Agency believes that it developed an appropriate set of remedial alternatives as mandated by the NCP.

4. **EPA's Proposed Plan does not evaluate the factors limiting restoration potential.**

EPA Response: EPA did evaluate the factors limiting restoration potential and was extremely forthright to the public in its report about the limitations. Page 16 of EPA's Proposed Plan states:

> "It must be emphasized that this ground water contamination problem exists in a fractured bedrock aquifer and extraction of contaminated ground water from such aquifers is often difficult. Additionally, removal of contaminants to achieve the MCLs in such situations is also difficult. However, highly fractured zones were encountered during RI work and the hydrologic modeling and aquifer tests performed during the RI indicate that properly placed extraction wells would create a larger capture zone than currently exists due to the Higgins' water supply well and such a system would be able to achieve significant decreases in contaminant levels over time. The time frame for Alternatives 3 and 4 to achieve compliance with chemical-specific ARARs in the underlying bedrock aquifer are undetermined. However, because Alternatives 3 and 4 are aggressive, active approaches to attaining ARARs in the aquifer, utilizing more wells and extracting a greater volume of contaminated water, greater decreases in contaminant levels can be expected in significantly less time compared to Alternatives 1 and 2."

It is EPA's position that the Agency adequately evaluated the factors limiting restoration potential.

5. **Implementation results of the groundwater pumping system at the Higgins farm Site should be considered.**

EPA Response: This comment was raised at the May 20, 1997 public meeting, and is discussed in III.A.12, above. However, the Agency must also respond to the PRP's written statement that "very low well yields were observed upon startup" at the Higgins Farm treatment plant. Since the PRP has not reviewed information pertaining to start-up, and since the PRP toured the Higgins Farm treatment facility only during the initial phases of start-up, it cannot with accuracy make this statement. As previously indicated, once performance data is determined to be representative of Site and operating conditions, it will be made available for public review through transmittal to the information repositories.

6. **Comments to (and public perception of) EPA's preferred remedy for groundwater contamination confirm that sufficient data do not exist to permit identification of a final remedy for groundwater.**

EPA Response: EPA believes that it has adequately addressed public comments on the preferred remedy during the May 20, 1997 public meeting and in this Responsiveness Summary. As detailed in these responses, EPA maintains that there is sufficient information for the selection of a groundwater remedy.

B: Technical Comments on the Hydrogeologic Investigation/RI

1. The RI does not adequately characterize the site geology and hydrogeology.

EPA Response: Extensive soil borings, soil sampling, sediment sampling, groundwater sampling and other investigative activities were performed as documented in the RI Report. The field work was conducted and the data collected in accordance with EPA's work plan. The work conducted and the data collected is sufficient to characterize the site for the purposes of the RI.

The PRP's written comment of whether or not the prominent structure crossing the Site is truly a graben is academic. Whether it is a graben or a series of normal faults, a structural feature is present which exerts an influence on the preferential movement of groundwater.

As stated in the RI report, the regional direction of groundwater flow is to the southwest toward the Delaware & Raritan Canal and the Millstone River. Localized flow within the Site is affected by fracture orientation. Data from previous investigations was used in the evaluation of groundwater flow. However, the monitoring wells used in the previous investigations were improperly constructed, with well screens crossing both the overburden and bedrock zones. Therefore, the water level data from these wells is not representative of either formation.

Information on the construction of the on-site production wells is not available. However, according to the Higgins', this well is much deeper than the old well, and as such will create a steeper cone of depression and greater gradients to influence groundwater flow toward the well. This is consistent with groundwater contour maps generated for the Site. A true "static" groundwater table condition could not be achieved because the production well could not be turned off. The option of turning off the well was explored; however, this was not feasible since there is a need to water the horses boarded there, and there was not a practical alternative water supply source.

The limited water level drawdown effect observed when pumping monitoring well 105D is as expected. Well 105D was designed as a monitoring well, not as a test pumping well. Even though it is a bedrock well, it was fitted with a screen to keep the well open following a collapse of the borehole walls. It is also a shallow well, less than 100 feet deep, which limits the available drawdown, the sustainable pumping rate and the radius of influence. Furthermore, the pumping test conducted on monitoring well 105D was of short duration, and is not reflective of the long-term effect seen in the newer on-site production well. This newer production well has a definite influence on local groundwater flow patterns as evidenced by the water level data collected and the groundwater contour maps developed for the RI.

2. **The RI does not adequately characterize the distribution or movement of contaminants in groundwater.**

EPA Response: The regional groundwater flow direction is to the southeast, toward the homeowner wells. Although the influence of the on-site production well, the fracture orientation and geological structures will affect the localized flow conditions, the groundwater contamination has clearly migrated toward the homeowners. The contamination of homeowner wells may have occurred from Site sources prior to the installation of the newer on-site production well. It should be noted that the occurrence and movement of contaminants north of the landfill within the Site are a product of the localized, rather than regional, conditions.

As described previously, static conditions cannot be evaluated since the on-site production well is needed to water the horses. Furthermore, since (as described above) there were deficiencies in the previous investigations, comparison of current groundwater data to prior investigations will not provide additional useful information.

In summary, EPA strongly believes that a conceptual model for groundwater flow has already been developed and is described in the RI Report.

3. **The RI does not discuss the effectiveness of pumping in addressing groundwater contaminants.**

EPA Response: It should be noted that the effectiveness of groundwater pumping is described in the FS Report. Although the PRP predicts that pumping will not be effective in influencing groundwater movement, the PRP essentially recognizes in its comments that the on-site production well is influencing groundwater. The performance of this well, which was not intended or designed to capture the contaminant plume, indicates that a groundwater recovery system is feasible. A series of properly designed and located recovery wells will be even more effective in capturing the plume and controlling groundwater movement. As stated above, monitoring well 105D was never intended, nor was it designed, to be a recovery well. Rather, it is a standard monitoring well which, when used for pumping, displays the expected low efficiency.

C. **Technical Comments On the Risk Assessment**

1. **A conceptual model is needed for groundwater to understand the relationship between chemical of concern (COC) sources, constituent transport, potential exposure points, and potential receptors.**

   EPA Response: A conceptual model for groundwater has already been developed. Since groundwater from off-site residential wells is impacted and the on-site production well has the greatest influence on the flow characteristics of groundwater underlying the Site, groundwater exposure was evaluated to examine the following scenarios in the absence of remedial action and natural attenuation and degradation processes:

   - the possibility of residual (i.e., following removal of the likely sources) contamination reaching the on-site production well; and

   - the possibility of residual contamination reaching private, off-site wells should operation of the on-site production well cease

   The intent of this evaluation was to indicate whether the groundwater pathway posed sufficient risk to warrant evaluation in the FS.

2. **Many of the potential risks estimated for groundwater exposures are excessive, reflecting unrealistic assumptions and inappropriate models.**

   EPA Response: The Agency's risk assessment guidance was followed in the preparation of the risk assessment for this Site. This guidance included the 1989 EPA document entitled Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A). Interim Final. In addition, the 1991 document entitled Risk Assessment Guidance for Superfund. Volume I: Human Health. Supplemental Guidance "Standard Default Exposure Factors" was likewise used. The exposure pathway analysis, exposure models and exposure parameters and assumptions were established by EPA in consultation with the Agency's consultant and the NJDEP.

3. **Exposure concentrations for COC's should be adjusted to account for COC's detected in Quality Assurance/Quality Control (QA/QC) samples.**

   EPA Response: Per EPA 's previously-cited Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A). Interim Final, during data validation, chemicals regarded as common laboratory contaminants were retained in the groundwater data sets only if detected in concentrations greater than ten times that in corresponding blanks. Acetone was selected as a chemical of potential concern based on frequency of detection. Although detected infrequently, bis(2-ethylhexyl)phthalate was selected as a chemical of potential concern based on detection at a concentration equal to Federal and State MCLs. It must be stressed that neither of these chemicals posed unacceptable risks.

4. **Risk associated with exposure to background conditions should be separated from site-related risks.**

EPA Response: Per EPA guidance, comparison of average concentrations in groundwater from the monitoring wells to average concentrations in groundwater in monitoring well MW-109 selected as representative of background was used as a criterion to select inorganic chemicals of potential concern. While the detection of pesticides in groundwater may be related to past farming practices, they nonetheless contribute to potential exposures and risks from potable use of the groundwater. Although data from MW-109 were included in the data set to compute the 95% UCL concentrations to best characterize average chemical concentrations underlying the Site, the pesticide chemicals of concern were not detected in groundwater from MW-109.

It should be noted that two Superfund guidance documents (Risk Assessment Guidance for Superfund [RAGS], 1989, and Guidance for Data Useability in Risk Assessment, 1992) address background issues in detail. Both documents discuss statistical methods for evaluating site versus background concentrations, but nowhere is it stated, or implied, that if site-related concentrations are significantly greater than background, that an additional step should be taken to discount the exposure contributed from background.

5. **Exposure concentrations for certain COCs appear to be elevated by the presence of COCs sorbed to particulate.**

EPA Response: The concentrations represent the total values for the contaminants of concern. These values include both dissolved and suspended contamination because the samples were unfiltered. The use of unfiltered groundwater data is consistent with EPA's risk assessment guidance.

6. **COC concentrations used to evaluate groundwater exposures should reflect conditions at current exposure points and predictive analysis for future conditions.**

EPA Response: As discussed previously, the approach for performing the groundwater evaluation was based on the fact that groundwater from private, off-site wells is impacted. The exposure point concentrations are not based solely on data from monitoring wells with locations biased to source areas. The overall approach for deriving exposure point concentrations was to use data from the entire monitoring well network. over depth (i.e., data from overburden and bedrock wells combined and over time) to compute average chemical concentrations representative of groundwater underlying the Site.

The PRP's written comments indicate that the use of on-site monitoring well data to estimate current risks from groundwater exposures misrepresents actual exposure conditions. The PRP cites the following passage from RAGS,1989: "it is most appropriate to use groundwater sampling data as estimates of exposure concentrations when the sampling points correspond to exposure points, such as samples from a drinking water tap." However, the section (6.5.2) from RAGS that contains the aforementioned quote also states: "most of the time, data from monitoring wells will be used to estimate chemical concentrations at the exposure point."

Additionally, the PRP also states in its comments that the use of current on-site monitoring well data to estimate future risks from groundwater exposures is also expected to misrepresent future exposure conditions. Once again, the PRP cites RAGS, 1989: "groundwater monitoring data are often of limited use for evaluating long-term exposure concentrations because they are generally representative of current site conditions and not long-term trends." This same section (6.5.2) of RAGS also discusses the complexities inherent in modeling exposure concentrations in groundwater. The final paragraph in section 6.5.2 states: "if groundwater modeling is not used, current concentrations can be used to represent future concentrations in groundwater assuming steady-state conditions. This assumption should be noted in the exposure assessment chapter and in the uncertainties and conclusions of the risk assessment."

The PRP further comments that the Risk Assessment fails to address the effectiveness of the existing point-of-use wellhead treatment systems or the interim Well Restriction Area designated by NJDEP in 1986 (which serves as an institutional control to prevent potential exposures) on future exposure to affected groundwater. Note, however, that EPA, in a response to comments on the National Continency Plan (Federal Register, 3/8/90 Page 8709), states: "one specific objective of the baseline risk assessment is to provide an analysis of baseline risk (i.e., the risks that exist if no remediation or institutional controls are applied to the site)."

D. Technical Comments on the Feasibility Study

1. **The PRP commented that**

- **Alternative 2 should be considered a viable alternative;**

- **If the 10 gallons per minute flow of groundwater were to be treated on-site, a less complicated and costly treatment system may be appropriate:**

- **Other appropriate remedies could be considered for the Site, including natural attenuation and other existing or newly identified alternatives.**

EPA's Response: These comments have already been addressed in various locations of this Responsiveness Summary. Please see Sections IV.A. and IV.B.I.A for the applicable responses.

E. Technical Comments on the Groundwater Modeling

1. **The PRP comments that the modeling is not sufficient to provide the technical basis for the selection of the preferred alternative, or to comment on the feasibility of groundwater extraction and treatment.**

EPA Response: As clearly stated in Appendix A of the FS Report, the groundwater modeling effort was conducted to provide an order of magnitude assessment of the different remedial alternatives and was not intended as a design tool. The input of the model was based on pumping tests, slug tests and observed heads from the remedial investigation, as well as several assumptions about regional groundwater flow. The parameters of most importance, hydraulic conductivity, anisotropy and aquifer thickness were based on field observations where available. EPA recognizes the inherent limitations of such a model and discusses these limitations at length in the appendix. Even when the limitations and assumptions are considered, the results of the modeling show that a reasonable number of appropriately placed extraction wells can capture the groundwater contamination. The exact number, placement and pumping rate of such wells is not a conclusion which can be drawn from the modeling effort and should be based on testing and additional modeling during the detailed design.

With regard to the influence of the nearby quarry, this issue has been discussed elsewhere in this Responsiveness Summary.

II. Comments by the Attorney Representing the Owners of the Site

The attorney representing the Site's owners provided numerous written comments, most of which have been addressed elsewhere in this Responsiveness Summary through responses to similar comment raised by other parties. Provided below are response to those comments which EPA believes have not yet been addressed.

1. **Many relevant facts and conclusions that should have been made readily available to the public for review and comment and included in the Proposed Plan were only included in the RI/FS, and were not provided for consideration and comment by the public.**

   EPA Response: Page 3 of the Proposed Plan clearly states that the RI/FS, Proposed Plan and supporting documentation were available for public review. During the public comment period. EPA placed the RI/FS in three locations for public comment. These locations include the Mary Jacobs Memorial Library in Rocky Hill, New Jersey; the Franklin Public Library in Somerset, New Jersey; and EPA's Superfund Document Center in New York, New York. Therefore, the public has had the opportunity to review and comment on all of the relevant facts and conclusions which support EPA's selection of a remedy for this Site.

2. **How can the Agency propose a groundwater remedy without having current groundwater data?**

   EPA Response: EPA believes that the groundwater data collected during the RI (the most recent sampling event being May of 1994) is sufficient for the purposes of remedy selection. The Agency anticipates that additional groundwater monitoring data will be collected for the purpose of optimizing the design of the groundwater extraction system.

3. **What human exposure to contaminated groundwater at or from the property will exist if the residences on Laurel Avenue are connected to a public water supply system?**

   EPA Response: EPA is charged with the responsibility of preventing risks to human health and the environment. As described in the March 8, 1990 Federal Register (Vol. 55, No. 46, Page 8732), EPA's Superfund program uses EPA's Groundwater Protection Strategy as guidance when determining the appropriate remediation for contaminated groundwater at Superfund sites. The goal of EPA's Superfund approach is to return usable groundwaters to their beneficial uses within a timeframe that is reaonable given the particular circumstances of the site. While connection of the residences on Laurel Avenue will eliminate the risk to these receptors (and the next removal action will presumably remove the remaining source of groundwater contamination), residual contamination present in the groundwater will continue to pose a potential threat to receptors, especially if there are current or future residents who choose not to connect to the water line. Therefore, EPA maintains that active remediation of the groundwater is an appropriate action for this Site.

4. **Does the start-up testing being performed at the Higgins Farm treatment plant indicate whether the quantity or quality of the groundwater from the Higgins Disposal Site can be treated?**

EPA Response: The start-up testing data that has been collected to date is being evaluated by EPA to determine the performance of the treatment system with respect to contamination at Higgins Farm. As described in the Proposed Plan and the FS Report, it is expected that the Higgins Farm treatment plant will be able to treat the relatively small flow from Higgins Disposal, with the possibility that carbon contactors may need to be added to the treatment system.

APPENDIX VI

ADDITIONAL COST INFORMATION

TABLE B-1
COST ANALYSIS
Higgins Disposal

CAPITAL COSTS

	Cost Component	Alternative 1	Alternative 2		Alternative 3		Alternative 4		Alternative "5" - truck to H Farm		Alternative "6" - truck to STP	
			Existing Laurel Avenue Treatment Systems	Alternative Water Supply for Laurel Avenue	Existing Treatment Systems	Alternative Water Supply to Higgins and Laurel Avenue	Existing Treatment Systems/Provide Water for Higgins	Alternative Water Supply to Higgins and Laurel Avenue	Existing Treatment Systems	Alternative Water Supply to Higgins and Laurel Avenue	Existing Treatment Systems	Alternative Water Supply to Higgins and Laurel Avenue
Higgins Disposal Site	Extraction System	$ -	$ -	$ -	$ 41,250	$ 41,250	$ 41,250	$ 41,250	$ 41,250	$ 41,250	$ 41,250	$ 41,250
	Treatment System	$ -	$ -	$ -	$ -	$ -	$ 700,000	$ 700,000	$ -	$ -	$ -	$ -
	Pump Station	$ -	$ -	$ -	$ 60,000	$ 60,000	$ -	$ -				
	Pipeline	$ -	$ -	$ -	$ 693,000	$ 693,000	$ -	$ -				
	Securing Easements	$ -	$ -	$ -	$ 70,000	$ 70,000	$ -	$ -				
	Sampling Manhole	$ -	$ -	$ -	$ 5,000	$ 5,000	$ -	$ -	$ 5,000	$ 5,000	$ 5,000	$ 5,000
	Holding Tank	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,000	$ 50,000	$ 50,000	$ 50,000
	Tanker	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 145,000	$ 145,000	$ 145,000	$ 145,000
	Carbon	$ -	$ -	$ -	$ -	$ -	$ -	$ -			$ 50,000	$ 50,000
	Sampling STP 1st year	$ -	$ -	$ -	$ -	$ -	$ -	$ -			$ 47,000	$ 47,000
	Sampling STP years 2-5	$ -	$ -	$ -	$ -	$ -	$ -	$ -			$ 64,000	$ 64,000
	Modifications to Higgins' Farm	$ -	$ -	$ -	$ 50,000	$ 50,000	$ -	$ -	$ 50,000	$ 50,000	$ 50,000	$ 50,000
Options	Modification to Holding Tank/Automation	$ -	$ -	$ -	$ 10,000	$ -	$ -	$ -	$ 10,000	$ -		$ -
	Water Main Extension	$ -	$ -	$ 235,000	$ -	$ 235,000	$ -	$ 235,000	$ -	$ 235,000	$ -	$ 235,000
	City Water Connection Fee	$ -	$ -	$ 1,000	$ -	$ 1,000		$ 1,000	$ -	$ 1,000	$ -	$ 1,000
	Household Connections	$ -	$ -	$ 18,500	$ -	$ 20,350	$ -	$ 18,500	$ -	$ 20,350	$ -	$ 20,350
	Carbon System Installation	$ -	$ 4,200	$ -	$ 4,200	$ -	$ 4,200	$ -	$ 4,200	$ -	$ 4,200	$ -
	Subtotal	$ -	$ 4,200	$ 254,500	$ 933,450	$ 1,175,600	$ 745,450	$ 995,750	$ 305,450	$ 547,600	$ 456,450	$ 708,600
	Contingency (50%)	$ -	$ 2,100	$ 127,250	$ 466,725	$ 587,800	$ 372,725	$ 497,875	$ 152,725	$ 273,800	$ 228,225	$ 354,300
	TOTAL	$ -	$ 6,300	$ 381,800	$ 1,400,200	$ 1,763,400	$ 1,118,200	$ 1,493,600	$ 458,200	$ 821,400	$ 684,700	$ 1,062,900

ANNUAL OPERATION AND MAINTENANCE COSTS (Yrs 1-5)

Cost Component	Alternative 1	Alt. 2 Existing	Alt. 2 Alternative	Alt. 3 Existing	Alt. 3 Alternative	Alt. 4 Existing	Alt. 4 Alternative	Alt. 5 Existing	Alt. 5 Alternative	Alt. 6 Existing	Alt. 6 Alternative
Groundwater Monitoring	$ 79,200	$ 79,200	$ 79,200	$ 79,200	$ 79,200	$ 79,200	$ 79,200	$ 79,200	$ 79,200	$ 79,200	$ 79,200
Carbon Replacement	$ -	$ -	$ -	$ 5,000	$ 5,000	$ -	$ -	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Tap Water Monitoring	$ 23,400	$ 23,400	$ 6,120	$ 23,400	$ -	$ 21,900	$ -	$ 23,400	$ -	$ 23,400	$ -
Electrical Consumption	$ -	$ -	$ -	$ 5,000	$ 5,000	$ 10,000	$ 10,000	$ 5,000	$ 5,000		
Farm Plant Discharge Sampling	$ -	$ -	$ -	$ 18,000	$ 18,000	$ -	$ -	$ 18,000	$ 18,000		
Carbon Replacement	$ -	$ 3,500	$ 320	$ 3,500	$ -	$ 3,200	$ -	$ 3,500	$ -		$ -
Licensed Operator	$ -	$ -	$ -	$ 10,000	$ 10,000	$ 95,000	$ 95,000	$ 10,000	$ 10,000	$ -	$ -
Treatment System Maintenance	$ -	$ -	$ -	$ 20,000	$ 20,000	$ 40,000	$ 40,000	$ 20,000	$ 20,000	$ -	$ -
Chemicals	$ -	$ -	$ -	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ -	$ -
O & M User Fee	$ -	$ -	$ -			$ -	$ -			$ 105,100	$ 105,100
Sludge Removal	$ -	$ -	$ -	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000		
O&M Tanker	$ -	$ -	$ -					$ 15,000	$ 15,000	$ 15,000	$ 15,000
Trucking	$ -	$ -	$ -					$ 146,000	$ 146,000	$ 146,000	$ 146,000
Treatment System Discharge Sampling	$ -	$ -	$ -	$ -	$ -	$ 18,000	$ 18,000	$ -	$ -	$ -	$ -
TOTAL	$ 102,600	$ 106,100	$ 85,600	$ 204,100	$ 177,200	$ 307,300	$ 282,200	$ 345,100	$ 330,200	$ 373,700	$ 350,300

TABLE B-1
COST ANALYSIS
Higgins Disposal

ANNUAL OPERATION AND MAINTENANCE COSTS (Yrs 6-30)

Cost Component	Alternative 1	Alternative 2		Alternative 3		Alternative 4		Alternative "5"		Alternative "6"	
		Existing Laurel Avenue Treatment Systems	Alternative Water Supply for Laurel Avenue	Existing Treatment Systems	Alternative Water Supply to Higgins and Laurel Avenue	Existing Treatment Systems/Provide Water for Higgins	Alternative Water Supply to Higgins and Laurel Avenue	Existing Treatment Systems	Alternative Water Supply to Higgins and Laurel Avenue	Existing Treatment Systems	Alternative Water Supply to Higgins and Laurel Avenue
Groundwater Monitoring	$ 19,800	$ 19,800	$ 19,800	$ 19,800	$ 19,800	$ 19,800	$ 19,800	$ 19,800	$ 19,800	$ 19,800	$ 19,800
Carbon Replacement	$ -	$ -	$ -	$ 5,000	$ 5,000	$ -	$ -	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Tap Water Monitoring	$ 23,400	$ 23,400	$ 6,120	$ 23,400	$ -	$ 21,900	$ -	$ 23,400	$ -	$ 23,400	$ -
Electrical Consumption	$ -	$ -	$ -	$ 5,000	$ 5,000	$ 10,000	$ 10,000	$ 5,000	$ 5,000		
Farm Plant Discharge Sampling	$ -	$ -	$ -	$ 18,000	$ 18,000	$ -	$ -	$ 18,000	$ 18,000		
Carbon Replacement	$ -	$ 3,500	$ 320	$ 3,500	$ -	$ 3,200	$ -	$ 3,500	$ -		$ -
Licensed Operator	$ -	$ -	$ -	$ 10,000	$ 10,000	$ 95,000	$ 95,000	$ 10,000	$ 10,000	$ -	$ -
Treatment System Maintenance	$ -	$ -	$ -	$ 20,000	$ 20,000	$ 40,000	$ 40,000	$ 20,000	$ 20,000	$ -	$ -
Chemicals	$ -	$ -	$ -	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ -	$ -
O & M User Fee	$ -	$ -	$ -			$ -	$ -			$ 105,100	$ 105,100
Sludge Removal	$ -	$ -	$ -	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000		
O&M Tanker	$ -	$ -	$ -					$ 15,000	$ 15,000	$ 15,000	$ 15,000
Trucking	$ -	$ -	$ -					$ 146,000	$ 146,000	$ 146,000	$ 146,000
Sampling STP	$ -	$ -	$ -					-	-	$ 16,000	$ 16,000
Treatment System Discharge Sampling	$ -	$ -	$ -	$ -	$ -	$ 18,000	$ 18,000	$ -	$ -	$ -	$ -
TOTAL	$ 43,200	$ 46,700	$ 26,300	$ 144,700	$ 117,800	$ 247,900	$ 232,800	$ 305,700	$ 270,800	$ 330,300	$ 306,900

PRESENT WORTH ANALYSIS

Annual Interest 8.0%
Compounding Period (years) 30

Capital Costs	$ -	$ 6,300	$ 381,800	$ 1,400,200	$ 1,763,400	$ 1,118,200	$ 1,493,600	$ 458,200	$ 821,400	$ 684,700	$ 1,062,900
Present Worth of O/M Costs (yrs 1-5)	$ 409,652	$ 423,627	$ 341,776	$ 814,912	$ 707,508	$ 1,226,960	$ 1,126,743	$ 1,457,738	$ 1,350,335	$ 1,492,076	$ 1,398,646
Present Worth of O/M Costs (yrs 6-30)	$ 313,851	$ 339,279	$ 190,345	$ 1,051,256	$ 855,826	$ 1,801,012	$ 1,618,658	$ 2,220,933	$ 2,025,502	$ 2,399,654	$ 2,229,631
TOTAL Present Worth	$ 724,000	$ 769,000	$ 914,000	$ 3,270,000	$ 3,330,000	$ 4,150,000	$ 4,240,000	$ 4,140,000	$ 4,200,000	$ 4,580,000	$ 4,690,000
	1	2		3		4		"5"		"6"	

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY SG DATE 7/31/97 SHEET NO. 1 OF 2

CHKD. BY [illegible] DATE 8-4-97 JOB NO. 0001210 - 102

SUBJECT HIGGINS DISPOSAL FS- COSTS

PIPELINE TO HIGGINS FARM

- ASSUME EASEMENTS ARE 10' WIDE
  SUN PIPELINE = 10,900 LF
  TRANSCONTINENTAL = 1,600 LF
  HIGGINS = 400 LF / TOTAL = 12,900 → 14,000 LF

(TO ACCOUNT FOR CHANGES, IRREGULARITIES → SAY)

- ASSUME EASEMENTS COST $5/LF

$5/LF x 14,000 LF = $70,000 ✓

- TRENCH: ASSUME NO ROCK EXCAVATION
  3' WIDE
  5' DEEP
  CRUSHED STONE TO SPRING LINE

EXCAVATION: 5' x 3' x 14,000' x CY/27 ft³ x $20/cy = $156,000 ✓

PVC PIPE: 14,000 LF x $25/LF = $350,000 ✓

CRUSHED STONE:
6" BELOW PIPE + 2" PIPE x
3' WIDE x 14,000 LF x CY/27 ft³ x
$30/cy = $31,100 —

FILTER FABRIC:
AROUND PERIMETER OF STONE
(1' + 1' + 3' + 3') = 8'
8' x 14,000 LF x $0.20/SF = $22,400 —

RECYCLED PAPER

PIPELINE TO HIGGINS FARM (CONT.)

BACKFILL INCL COMPACTION
5' – 8" (PIPE + STONE) = 4' 2"
4.4' × 14,000 LF × 3' × CY/27 ft³

× $10/CY = $ 67,410

DISPOSAL OF UNUSEABLE BACKFILL
STONE = 3' × 14,000' × 8" × CY/27 ft³

× $ 50/CY = $ 51,850

REPLACEMENT SEEDING:
SAY 20' CORRIDOR × 14,000 LF
× $ 0.05/SF = $ 14,000

TOTAL = $ 763,000
PIPELINE

$693,000 pipeline
$ 70,000 easements

[illegible]

HAUL H2O TO HIGGINS FARM TREATMENT SYSTEM

- ASSUME 10 gpm from EXTRACTION WELLS
  10 gpm × 60 min/hr · 24 hr/d = 14,400 gpd

- ABOVE GROUND STORAGE TANK
  30,000 gal Capacity = $22,917
  Shipping = $2,000
  assume Exterior Coating = $3,000
  Saddles - 5 @ $573/each = $2865

  $30,782

  Construction (concrete pads) = $15,300
  assume 50% of Capital

  $46,082

  Say $50,000 ✓

- LEASE HAULER

  Say $950/day for transporting 2-3 5000 gallon LOADS

  OPERATE 6 DAYS/WEEK = $296,400/yr ✓

Quotes FROM:
AQUATEX - ALLEN CAMPIONE (609) 567-8280
TANKER = $65-75,000 HAULER $750/day
TRACTOR = $50-$70,000

MILLER ENVIRONMENTAL - KEN HAYMAN (516) 369-4900
HAULER — 5000 gal 2-3X PER DAY
$872/day (8-hr day) ⇒ avg = $950/day
$1134/day (... ...)

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
BY SG DATE 7/31/97 SHEET NO. 2 OF 2
CHKD. BY [illegible] DATE 8-4-97 JOB NO. 8001210102
SUBJECT HIGGINS DISPOSAL FS - COSTS

- PURCHASE HAULER
  - TANKER = $75,000
  - TRACTOR = $70,000
  - → $145,000 Capital
  - Maintenance of TANKER & TRACTOR = $15,000/yr (SAY 10% OF CAPITAL)
  - LABOR
    - BASED ON $70/hr for 6 DAYS A WEEK = $145,600/yr (say $146,000/yr)
  - → O&M

∴ cheaper to purchase & maintain hauler

- ~~User Fees at Higgins Farm~~
  ~~$20 - $/1000 gal (EPA)~~
  ~~avg = $29/1000 gal~~
  ~~(14,400 gpd)(365 days/yr)($29/1000 gal) = $152,400~~

[initials] 8/4/97

- ~~Sludge Disposal~~
  $20,000/yr - use same # as for onsite treat Alt. 4

RECYCLED PAPER

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
BY SG DATE 8/1/97 SHEET NO. 1 OF 2
CHKD. BY [illegible] DATE 8-4-97 JOB NO. 800121010?
SUBJECT HIGGINS DISPOSAL FS - COSTS

HAUL H_2O TO STONY BROOK SEWAGE AUTHORITY

- ASSUME 10 gpm from EXTRACTION WELLS
  10 gpm = 14,400 gpd

- ABOVE GROUND STORAGE TANK

30,000 gallon =	$22,917
SHIPPING =	$2,000
EXTERIOR COATING =	$3,000
SADDLES - 5 @ $573/each =	$2,865
	$30,782
CONSTRUCTION (CONCRETE PADS) = ASSUME 50% OF CAPITAL	$15,391
	$46,173
	SAY $50,000 ✓

- SCHEDULE OF SAMPLING
  FULL PRIORITY POLLUTANT LIST

EPA 624 - VOLATILES + LIBRARY SEARCH =	$280
EPA 625 - BNAs + LS =	$555
EPA 608 - PESTICIDES/PCBS =	$240
SW-846 METALS =	$216
EPA 335.4 CN⁻ =	$55
EPA 420.2 PHENOLICS =	$55
EPA 625 DIOXIN =	$170
	$1571/Sample

1st yr - 1x month = $22,092/yr
Thereafter = Quarterly = $7564/yr
} ~~see add'l page 1A [illegible]~~

$300/Sample

$1871/Sample

SAY $2000

L.C. Gail $60/hr x 5 hr. =

RECYCLED PAPER

Sampling Costs

Lab 1st yr $22,692

Say $23,000

Labor ($2,000/month)(12 mos) = $24,000

Total 1st yr = $47,000

Sampling - Annual Costs after 1st year

Lab - Quarterly $7564/yr

Say $8000/yr

Labor ($2000/event)(4 events) = $8,000/yr

$16,000/yr

Years 2-5: ($16,000/yr)(4 years) = $64,000

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
BY SG DATE 8/1/97 SHEET NO. 2 OF 2
CHKD. BY SJF DATE 8-4-97 JOB NO. 8001210-102
SUBJECT HIGGINS DISPOSAL FS - COSTS

- USERS FEE @ STONY BROOK SEWAGE AUTHORITY
  = $20/1000 gal

$14,400 \text{ gpd} \times \frac{365 \text{ d}}{\text{yr}} \times \frac{\$20}{1000 \text{ gal}} =$ $105,120/yr

- HAULER
  $950/day for transporting 2-3 5000 gallon loads

Operate 6 days/week = $296,400/yr

SJF use purchase costs from SG previous calculations

- PRE-TREATMENT W/ CARBON

CARBON CANISTERS

- FULLY AUTOMATED =	$ 20,000
- CONC. SLAB =	$ 1,111
- BACKFILL =	$ 675
- MISC. SITE WORK =	$ 2000
- FREEZE PROTECTION =	$ 4500
- EFFLUENT PUMP =	$ 5000
- ELECTRICAL =	$ 5000
- MECHANICAL =	$ 5000
- INSTRUMENTATION =	$ 5000
	$48,286

say $50,000

RECYCLED PAPER

ROD FACT SHEET

SITE

Name: Higgins Disposal Site
Location: Franklin Township, Somerset County, New Jersey
EPA Region: 2
HRS Score (date): 35.73 (11/86)
Site ID #: NJD053102232

ROD

Date Signed: September 30, 1997
Remedies: 1)Groundwater extraction, conveyance via a pipeline to the Higgins Farm Superfund Site for treatment and discharge to surface water. 2)Connection of residents to public water supply.

Operating Unit Number: OU-1
Capital cost: $1,763,400 (in 1997 dollars)
Construction Completion: by September 2001.
O & M: $177,200/yr (in 1997 dollars)
Present worth: $3,330,000 (8.0% over 30 years)

LEAD

Remedial/Enforcement: Remedial
EPA/State/PRP: EPA
Primary contact: James S. Haklar (212) 637-4414
Secondary contact: Lisa Jackson (212) 637-4380
Main PRP(s): Site owners Clifford and Lizbeth Higgins, and generators including FMC Corporation, Princeton Gamma-Tech and EG&G Princeton Applied Research Corporation.
PRP Contact: No contact designated.

WASTE

Type: Volatile organics, semi-volatile organics, pesticides, metals
Medium: Groundwater
Origin: Contamination due to on-site disposal of wastes containing hazardous substances.
Est. quantity: Not applicable.