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Superfund Record of Decision:

Sullivan's Ledge, MA

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Sullivan's Ledge site is a 12-acre disposal area in an urban area of New Bedford, Massachusetts. The site is bordered by a country club and marsh area to the north and small businesses to the east and west. The site was operated originally as a granite quarry and includes four 150 ft deep quarry pits. Between the 1930s and 1970s, the quarry and adjacent areas were used for disposal of hazardous materials and other industrial wastes. Site investigations conducted in 1986 and 1988 revealed high concentrations of PCBs in soil and sediment, and VOCs and inorganics in on-and offsite ground and surface water. Surface runoff and ground water from the disposal area discharge into the adjacent stream which drains into the country club golf course and the Middle Marsh Wetlands area. In addition, a small portion of the site lies within the stream's 100-year floodplain. EPA concluded that the sources of contamination are onsite soils, PCB-contaminated sediments washed offsite and found in an adjacent stream and wetland areas, and wastes disposed of in the former quarry pits. This ROD addresses source control and management of migration; a subsequent ROD will address the Middle Marsh area. The primary contaminants of concern affecting the soil, sediment, ground water, and surface water are VOCs including benzene and TCE; organics including PCBs and PAHs; and metal including lead.
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision - Sullivan's Ledge, MA
First Remedial Action
Contaminated Media: soil, sediments, gw
Key Contaminants: VOCs (benzene, TCE), organics, (PCB, PAHs), metals (lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 79
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(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

16. Abstract (Continued)

The selected remedial action for this site includes excavation/dredging of 24,200 yd3 of soil and 1,900 yd3 of sediment with onsite treatment using solidification, followed by onsite disposal; construction of an 11-acre impermeable cap; air monitoring; diversion and lining of the stream adjacent to site; active ground water pumping and passive underdrain collection with treatment using oxidation/filtration and UV/ozonation with offsite disposal of contaminated residuals (ground water disposal will be determined after further studies); wetlands restoration/enhancement; sediment, ground water, and surface water monitoring; institutional controls including ground water use and access restrictions. The estimated present worth cost is $10,100,000; O&M costs were included in the present worth cost but were not provided.

ROD DECISION SUMMARY

SULLIVAN'S LEDGE SUPERFUND SITE

NEW BEDFORD, MASSACHUSETTS

JUNE 28, 1989

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION I

Sullivan's Ledge Site

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ROD DECISION SUMMARY

I. SITE NAME, LOCATION AND DESCRIPTION

SITE NAME: Sullivan's Ledge
SITE LOCATION: New Bedford, Massachusetts
SITE DESCRIPTION: Sullivan's Ledge, a 12-acre disposal area, is located on Hathaway Road in an urban area of the City of New Bedford, Bristol County, in Southeastern Massachusetts. The disposal area is roughly bounded on the north by Hathaway Road, on the south by I-State 195/Route 140 Interchange and on the east and west by commercial development (see Figure 1). Immediately north of Hathaway Road is the Whaling City Country Club, which covers about 250 acres. Throughout this Record of Decision (ROD) the disposal area is referred to as Sullivan's Ledge (SL) or the Site.

The study area includes the Sullivan's Ledge disposal area and the country club because contamination migrates from the site via an unnamed stream to the country club, and contaminated groundwater also discharges from seeps along Hathaway Road. Surface water bodies in the study area include the unnamed stream, golf course water hazards, Middle Marsh and the Apponagansett Swamp. The unnamed stream follows a well-defined channel starting adjacent to the eastern border of the site, continuing northward across the golf course, bisecting Middle Marsh and eventually draining into the golf course water hazards. Surface runoff, overburden groundwater and shallow bedrock groundwater from the disposal area discharge to the unnamed stream. Estimates of flood potential presented by the unnamed stream were presented in the Phase I RI. The 100-year floodplain for the site is delineated in Figure 2. This figure shows that only a small portion of the disposal area, at the northeastern corner, lies within the 100 year floodplain.

The 12-acre Sullivan's Ledge disposal area is a former granite quarry. Four granite quarry pits with estimated depths up to 150 feet have been identified from historical literature and field investigations. After quarrying operations ceased, the land was acquired by the City of New Bedford. Between the 1930's and the 1970's the quarry pits and adjacent areas were used for disposal of hazardous materials and other industrial waste.

A more complete description of the site can be found in the "Phase I Remedial Investigation Report; June 1987" in Chapter 1 of Volume I.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Response History

The United States Environmental Protection Agency (EPA) conducted an air monitoring program of the Greater New Bedford Area in 1982 and installed groundwater monitoring wells around the Sullivan's Ledge site in 1983. Based, in part, on the results of these studies, the site was included on the National Priorities list in September 1984. The Phase I and Phase II Remedial Investigations, performed by EPA, were completed in September 1987 and January 1989, respectively. The Feasibility Study was also completed in January 1989.

In September 1984, EPA issued the owner of the site, the City of New Bedford, an Administrative Order under Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). In compliance with this Order, the City of New Bedford in 1984 secured the disposal area by installing a perimeter fence and posted signs warning against unauthorized trespassing of the site.

A more detailed description of the site history can be found in the "Phase I Remedial Investigation Report; June 1987" in Chapter 1 of Volume I.

B. Enforcement History

In September 1984 an Administrative Order was issued to the City of New Bedford to conduct the activities as outlined in the preceding Response History section.

On November 29, 1988, EPA notified approximately 15 parties who either owned or operated the facility, generated wastes that were shipped to the facility, or transported wastes to the facility, of their potential liability with respect to the Site.

The PRPs have been active in the remedy selection process for this site. Technical comments presented by the PRPs during the public comment period were summarized in writing, and the summary and written responses were included in the Responsiveness Summary in Appendix A.

Special notice has not been issued in this case to date.

III. COMMUNITY RELATIONS

The Sullivan's Ledge site was originally included as part of the New Bedford Harbor site, known as the Greater New Bedford Superfund site. The level of community concern about the Greater New Bedford site was quite high during the fall of 1984, when an open house was held by EPA to explain cleanup options for PCB "hot spots," and a public hearing was held to obtain comments from citizens and local agencies and organizations. About that same time, the EPA and the Massachusetts Department of Public Health announced the start of a three-year health study in the greater New Bedford area that included testing individuals to determine the level of PCBs in their bloodstream. EPA provided funding for the study.

Other public meetings held to discuss findings or information about the New Bedford sites occurred in January and October of 1985. At the October 1985 meeting, the EPA announced the decision to separate the Sullivan's Ledge site from the Greater New Bedford Superfund site and include the Sullivan's Ledge site on the National Priorities List (NPL). The decision to create a separate site was based on the following considerations:

1. The severity of the problem and the environmental complexity of the Sullivan's Ledge site.

2. Environmental diversity between harbor areas (aquatic) and the Sullivan's Ledge site (primarily wetlands and uplands).

3. Difference in the range of contaminants found.

4. Possible differences in potentially responsible parties (PRPs) at the sites.

5. Degree to which separate management would facilitate activities at the sites.

Throughout the site's more recent history, community involvement has been moderate. EPA has kept city government officials and other interested parties informed through informational meetings, fact sheets, press releases and public meetings.

In September 1986, EPA finalized a community relations plan which outlined a program to address community concerns and keep citizens informed about and involved in activities during remedial activities. On July 20, 1988, EPA held an informational meeting to present the results of the Remedial Investigation and to answer questions from the public.

An administrative record was prepared and made available to the public on February 6, 1989. On that same date, EPA held an informational meeting to discuss the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan. From February 6 to March 27, 1989, the Agency held a forty-nine day public comment period to accept public comment on the alternatives presented in the Feasibility Study and the Proposed Plan and on other documents available to the public. On February 21, 1989, the Agency held a public hearing to accept oral comments. A transcript of this hearing and the comments and the Agency's response to comments are included in the attached responsiveness summary.

IV. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedy was developed by combining components of different source control alternatives and a management of migration alternative to obtain a comprehensive approach for site remediation of all portions of the site except for Middle Marsh. In summary, the remedy consists of nine components:

1. Site preparation;
2. Excavation, solidification and on-site disposal of contaminated soils;
3. Excavation, dewatering, solidification and on-site disposal of contaminated sediments;
4. Construction of an impermeable cap over an 11-acre area;
5. Diversion and lining of a portion of the unnamed stream;
6. Collection and treatment of contaminated groundwater;
7. Wetlands restoration/enhancement;
8. Long-term environmental monitoring; and
9. Institutional controls, including restrictions on groundwater use.

The U.S. Department of Interior (DOI) and the Massachusetts Department of Environmental Quality Engineering (MA DEQE) have raised concerns that, if the PCB-contaminated sediments in Middle Marsh are not excavated, they may continue to pose a long-term threat to a variety of aquatic and terrestrial organisms that inhabit the Middle Marsh area. In view of these concerns, EPA has determined that additional studies including biological studies are needed before a final remedial action decision on Middle Marsh is given. Therefore, this Record of Decision will not incorporate a remedial action decision on Middle Marsh. Instead, this portion of the study area will be studied as a separate operable unit and the decision on the appropriate remedial action for Middle Marsh will be made in a separate ROD.

V. SITE CHARACTERISTICS

The significant findings of the Remedial Investigation are summarized below:

A. General

Field Investigations were conducted in 1986 and 1988. The results of the investigations revealed high concentrations of polychlorinated biphenyls (PCBs) in surface soil, subsurface soils and sediments. In addition, the results indicated the presence of volatile organic compounds (VOCs) and inorganics in groundwater sampled from a network of wells both on- and off-site.[1]

Based on the results of the two RIs, EPA has concluded that the sources of contamination at the Sullivan's Ledge site are on-site soils, PCB-contaminated sediments that have washed off of the 12-acre site into the unnamed stream and wetland areas, and wastes disposed of in the former quarry pits. EPA has further determined that surface water and overburden and bedrock groundwater both on- and off-site are significantly contaminated from wastes contained within the pits.

Surface water and groundwater represent the major migration pathways for volatile organic contaminants. Erosion of soils from the site into the unnamed stream is the most significant pathway for movement of PCBs and PAHs. Airborne transport is of little consequence at the site.

In general, a marked pattern of decreasing contamination (both in terms of numbers of contaminants and their respective concentrations) is evident with increasing distance from the site. The pattern is typified, with few exceptions, by the drop in concentrations of volatile organics in both groundwater and surface waters north of the site. Surface soil contamination exhibits a similar pattern with respect to contaminants found in this medium. Sediments, however, exhibit a comparatively undiminished loading of PCBs throughout the golf course area. This is apparently a function of the manner in which PCBs are distributed in the environment; primarily as adsorbed materials to soils, so that their distribution mirrors that of sediment deposition along and from the stream.

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[1]Except where otherwise noted, "on-site" is used throughout this ROD to describe the 12-acre disposal area and "off-site" refers to areas outside the 12-acre disposal area.

B. Hydrogeology

Hydrogeologic investigations were conducted as part of the Phase I and Phase II RIs to characterize groundwater flow and contaminant transport. Based on the geological and geophysical evidence presented in the reports, the following conclusions are made:

1. The shallow bedrock is highly fractured and the fracture planes vary both in frequency and orientation. This means that the shallow bedrock exhibits the properties of a porous medium, with groundwater flowing in the direction of the hydraulic gradient. Contaminant migration in the shallow bedrock groundwater would be expected to follow the shallow groundwater flow paths and form contaminant plumes.

2. The deep bedrock contains fewer fractures than the shallow bedrock; these discrete fracture planes follow a regional north/northwest lineament trend. Contaminant migration in these deeper fractures is controlled by the orientation of these fractures. The potential exists for contamination to migrate relatively long distances along these specific fractures. However, given the significant depths (>200 feet) and unpredictability of the fracture orientations, the exact locations of all deep bedrock fractures are technically infeasible to determine. Furthermore, the possibility of locating all pockets of contamination within these fractures is highly unlikely.

On a regional scale, groundwater flow in the overburden, shallow bedrock and deep bedrock is to the north. On a local scale, groundwater flow in the overburden and shallow bedrock is influenced by surface features (i.e. the unnamed stream). Flow in the deep bedrock locally is controlled by the distribution and orientation of fractures. Local groundwater flow at the site is from the southwest corner to the northeast corner (see Figure 3). Flow from the southwest corner of the site enters the quarry pits and discharges out of the pits. Part of this flow discharges into the overburden and the unnamed stream. The remainder of the flow discharges into the bedrock. Components of groundwater flow in the bedrock discharges to surface water bodies north of the quarry pits. A more detailed discussion of groundwater flow is presented in Chapter 4 of the Phase II RI.

C. Soil

Most of the Sullivan's Ledge Site is covered by a layer of fill which overlies the bedrock and quarry pits. The thickness of the fill generally increases to the south and east across the property with the maximum observed thickness of 22.4 feet of fill (exclusive of the quarry pit areas) found in the southwest corner of the site. The fill is found throughout the site property, except in the northwest corner of the site where bedrock outcrops were observed, and the southeast corner of the site, where glacial till and swamp deposits were found. Field observations indicated that fill material on the site is largely derived from local glacial deposits (silt, sand, gravel and rock fragments), with rubber tires, wood, scrap metal, and metal objects mixed in.

The RI reports identified areas of soil contamination. Organic contamination at the site was detected at all sampling depths within the unsaturated layer. Soil samples generally contained low total concentrations of volatile organic compounds. Unsaturated site soils are primarily contaminated with polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) and lead. Although contamination has occurred throughout most of the site, the soils along the eastern and southern boundaries contain the highest concentrations of PCBs and PAHs. The highest lead concentration, greater than 10 times the mean value, was detected in unsaturated soils along the southern boundary of the site. Maximum measured soil concentrations of PCBs, PAHs and lead are 2,400 ppm, 88.5 ppm and 4,600 ppm, respectively.

D. Sediments

Soils have eroded from the site into the unnamed stream and have been transported from the site. As a result, the sediments in the unnamed stream, Middle Marsh, four golf course water hazards, and a portion of the Apponagansett Swamp are contaminated with PCBs from the Sullivan's Ledge site. Contaminants detected in sediments include inorganics and organics, primarily PCBs and PAHs.

Significant levels of PCBs in sediments were found within the study area, as described below:

Location	Maximum PCB concentration (mg/kg)
Unnamed stream	90
Middle Marsh	60
Golf course water hazards	18
Apponagansett Swamp (south)	19
Apponagansett Swamp (north)	18

The sediments in the stream also contained maximum concentrations of aluminum and iron of 40,000 mg/kg and 374,000 mg/kg, respectively. Numerous PAHs were also frequently detected in the unnamed stream, with average concentrations less than 1 mg/kg for each compound.

E. Quarry Pits

Based on historical documentation and data from the field investigations, four quarry pits estimated to be as deep as 150 feet have been identified. The quarries are located in fractured bedrock. Based on historical documents, the contents of the pits may include rubber tires, scrap metal, automobiles, transformers, capacitors and miscellaneous rubble. Technical difficulties with drilling in quarries which have been filled with debris and solid waste prevented direct sampling of the contents of the quarries. However, groundwater sampling was conducted immediately adjacent to the quarry pits in order to characterize the liquid contents of the pits.

F. Groundwater

Volatile organic compounds (VOCs) were the predominant groundwater contaminants identified in the Phase I and Phase II RIs. VOCs were identified in overburden groundwater, shallow bedrock groundwater (i.e. less than 100 feet), and deep bedrock groundwater:

1. Overburden groundwater

Volatile organic contaminants detected in groundwater samples from overburden monitoring wells include: benzene, 1,2-dichloroethene, trichloroethene, ethylbenzene, chlorobenzene and vinyl chloride. Total VOCs measured during the RIs ranged from not detected to 8.2 ppm. VOCs in overburden groundwater were greatest in the vicinity of the northernmost quarry pit.

The overburden groundwater contaminant plume is oriented in the same northeastern to northern direction as the projected groundwater flow direction. Figure 4 is a VOC contaminant plume map for the overburden aquifer. As illustrated in the figure, the overburden contaminant plume extends from the site, with the highest contamination around the northernmost pit, to the southern edge of Middle Marsh.

2. Shallow bedrock groundwater

The shallow bedrock plume is similar in configuration and location to the overburden plume. However, VOC contamination in groundwater increases with depth. The VOCs detected in shallow bedrock groundwater were similar to the VOCs detected in the overburden aquifer, but were detected at increased frequency and concentration. The following specific VOCs were detected:

Compound	Range of Detected Concentrations (ug/l)
Benzene	5 - 1200
1,2-Dichloroethene	13 - 51,000
Trichloroethene	5 - 4000
Vinyl chloride	36 - 6900

Total VOCs detected in on-site and off-site monitoring wells during the Phase II RI ranged from not detected, in MW-11, an upgradient well, to 54,000 ug/l in GCA-1 located at the northeast corner of the site.

3. Deep bedrock groundwater

The deep bedrock groundwater system extends from 100 to 300 feet below ground surface. Information gained by the geophysical survey combined with information obtained during the actual borehole drilling indicated that at these depths, bedrock is more uniform with fewer fractures. Contaminant transport at these depths would occur primarily along specific fractures.

During the Phase II RI, four Westbay multilevel sampler wells (ECJ-1,2,3,4) were installed to investigate the deep bedrock system with respect to groundwater flow direction and extent of contamination. With the exception of ECJ-2, each Westbay well was sampled at six different zones.

Average total VOCs in each of the four Westbay wells were detected as follows:

Total VOCs (ppm)

Zone	ECJ-1	ECJ-2	ECJ-3(upgradient)	ECJ-4
1	9.4	21.7	not detected	not detected
2	50.2	30.6	0.02	not detected
3	94.6	38.8	0.01	0.01
4	90.1	23.3	0.01	0.01
5	56.0	27.3	0.01	153
6	9.3		0.02	0.01

It is of particular significance that during one round of sampling of zone 5 of ECJ-4, trichloroethene was detected at an elevated concentration of 270 ppm, at greater than 200 feet below the ground surface and over 1,000 feet from the site. At this concentration, trichloroethene was detected at approximately 25 percent of its solubility, suggesting that dense non-aqueous phase liquids (DNAPLs) may exist in the quarry pits or in on- or off-site deep bedrock fractures.

Contaminants in the deep bedrock were consistent with those found in the overburden and shallow bedrock. Trichloroethene, 1,2 - dichloroethene and vinyl chloride account for 90 percent of the contamination found in the deep bedrock. In general the largest number and concentrations of contaminants were found near the quarry pits. With depth the distribution of contaminants were controlled by their physical properties (i.e. density) and the presence and orientation of fractures. Chapter Five of the Phase II RI presents a more detailed discussion of the distribution of contamination.

G. <u>Surface Water</u>

Surface waters throughout the study area are affected by contaminants associated with the site. Contaminants from the site enter the unnamed stream as dissolved constituents from overland runoff and from groundwater seeps. The following observations support this suggestion:

1. Seeps to the unnamed stream were observed at the south end of the site, along the stream's length and at the northeast end of the site.

2. Surface water was contaminated at the south end of the site with volatile organic compounds.

3. At a seep discharge at the north end of the site, surface water was also contaminated with many of the same chemicals and concentrations as surface waters at the south end of the site.

4. Surface water contaminants detected at the south and north ends of the site were similar to those in groundwater in their respective vicinities.

Table 8-1 of the Phase I RI lists the major surface water organic and inorganic contaminants and their concentrations ranges and provides an indication of their prevalence in surface waters, based on Phase I sampling. As indicated by the table, benzene, chlorobenzene, trichloroethene, trans-1,2-dichloroethene, vinyl chloride, aluminum, barium, copper, iron and lead are the primary surface water contaminants.

Thirteen surface water stations were sampled during the Phase II field investigation. In general, VOCs were detected during this field investigation at decreased frequency and concentration in comparison to Phase I results. VOCs detected in groundwater seeps include trichloroethene, chlorobenzene, benzene, xylenes and 1,2-dichloroethene at maximum concentrations of 9, 43, 45, 68 and 675 ppb, respectively. Of the five surface water stations sampled for semi-volatile organic compounds (SVOCs), two stations contained measurable SVOCs. Station SW-8 (seep location) contained low levels of naphthalene (16 ppb) and n-nitrosodiphenylamine (16 ppb). As in the case of organic contaminants, inorganic contaminant concentrations are significantly higher at seep locations. Seeps SW-6, SW-8 and SW-9 show elevated concentrations of iron. Aluminum contamination was also noted at seeps SW-6 and SW-9. In addition, the Phase II data indicated detectable in-stream concentrations of lead, silver, zinc and barium. Figures 5-8, 5-9 and 5-16 of the Phase II RI depict the surface water and seep sampling results for both inorganics and organics.

H. Biota Investigation

In October 1987, a biological investigation was conducted for the unnamed stream, Middle Marsh, and Apponagansett Swamp, habitats potentially impacted by wastes emanating from the Sullivan's Ledge site. The investigation included aquatic biota sampling at predetermined stations (see Figure 5-17 RI); collection of water quality parameters; and characterization of aquatic and terrestrial habitats. The objective of the investigation was to qualitatively assess general conditions of aquatic ecosystems (stream, marsh, and swamp), such as obvious stress (i.e., absence of certain organisms), presence of indicator species, and indications of pathological stress.

1. Aquatic Habitats

Aquatic habitats located on or associated with the Sullivan's Ledge site include: the unnamed stream (Stations B1 through B7); forested wetlands known as Middle Marsh in the interior of the golf course (Stations B8 through B10); a series of shallow ponds (water hazards) between Middle Marsh and the Conrail line (Station B11); and the Apponagansett Swamp, a forested wetlands north of the golf course (Stations B12 through B16). Aquatic invertebrates collected and species identified at sampling locations in these areas are listed in Table 5-2 (RI).

Three reference stations were established upstream from the groundwater seeps (B1, B2, and B3). At those stations, typically four to five aquatic species were identified per site with 23 to 26 organisms collected. Groundwater seeps are located immediately downstream of Station B3 and immediately upstream of Station B5. Fewer organisms were collected and fewer species were identified at these sites compared to the reference stations. Only two to 12 total organisms were collected, and one to four different species were identified at each station. Thus, Stations B4 through B8 were impacted by the seeps. Stations B12, B14, B15 (Apponagansett Swamp) yielded the highest number of organisms collected and species identified. The organisms (collected from stations B12 to B15) were representative of those typically found in a wetland system. The highest number of organisms found in the Apponagansett Swamp may be attributable to the type of forested wetland which typically supports a more diverse and dense assemblage of aquatic organisms.

2. Terrestrial Habitats

Three types of habitats for terrestrial organisms were identified. These habitats are referred to as old field, forested palustrine wetland, and mowed grassland (see Figure 5-17 RI). Old field communities are those areas that were once cleared and now are in the process of reverting to woodland. Most of the habitats found on-site have been identified as old field communities. Palustrine forested wetlands are the types found off-site in the middle of the golf course and north of the Conrail rail line. Palustrine wetlands are non-tidal wetlands dominated by emergent mosses, lichens, persistent emergents, shrubs, or trees. Mowed grassland areas are the cultivated fairways of the Whaling City Country Club.

A complete discussion of site characteristics can be found in Chapters 4 through 7 of the Phase I RI and Chapters 4 and 5 of the Phase II RI.

VI. Summary of Site Risks

A Risk Assessment (RA) of the site was performed to estimate the probability and magnitude or potential adverse human health and environmental effects from exposure to contaminants found at the site.

Fifty-nine contaminants of concern, listed in Table 1, were selected for evaluation in the RA. These contaminants constitute a representative subset of the more than 80 contaminants identified on-site in the RI. The 59 contaminants were selected based on their relative toxicity, concentration, and mobility and persistence in the environment.

Potential human health risks associated with exposure to the contaminants of concern in surface soils, sediments, air, surface water and groundwater were estimated quantitatively through the development of several hypothetical exposure scenarios. Incremental lifetime carcinogenic risks were estimated and the potential for noncarcinogenic adverse health effects were evaluated for the various exposure scenarios. For carcinogenic compounds, risks are estimated by multiplying the estimated exposure dose by the cancer potency factor of each contaminant. The product of these two values is an estimate of the incremental cancer risk. For noncarcinogenic compounds, a Hazard Index (HI) value was estimated. This value is a ratio between the estimated exposure dose and the reference dose (Rfd) which represents the amount of toxicant that is unlikely to cause adverse health effects. Generally, if the HI is less than one, the predicted exposure dose is not expected to cause harmful human health effects. If the HI exceeds one, the potential to cause noncarcinogenic human health effects increases.

Exposure scenarios were developed to reflect the potential for exposure to hazardous substances based on the characteristic uses and location of the site. A factor of special note that is reflected in the Risk Assessment is that portions of the study area are part of a golf course. Additionally, the Risk Assessment took into account the facts that access to the site is restricted and the land is zoned for commercial development. The Risk Assessment also considered the proposed future use of the site as a soccer field.

Direct contact with surface soil was judged as the most likely exposure route to result in potential health hazards under present site conditions. Although on-site groundwater is not currently used for drinking water, the risks associated with its consumption were evaluated because it is classified as a potential source for drinking water. Inhalation of on-site airborne contaminants was also evaluated quantitatively. Other potential public health and environmental risks associated with direct contact with contaminated surface water and sediments on-site and off-site were also discussed in the RA.

A. Direct Contact with Surface Soil

Human health risks were calculated for an adult assuming occasional site visits and inadvertent contact with contaminated soil. Similar calculations were made for an older child (i.e., 8 to 18 years old) who may play or loiter occasionally on the site. The risks were assessed assuming both mean contaminant concentrations and maximum concentrations. A range of probable absorption rates for different chemicals (i.e., VOCs, SVOCs, PCBs, and inorganics) was used to estimate body dose. Calculated incremental carcinogenic risks were determined to be greater for risks associated with exposure to contaminated soil for a child than for an adult. The incremental lifetime carcinogenic risks for an older child coming in contact with surface soil on-site ranged from 5×10^{-6} using site-wide average contaminant concentrations to 5×10^{-5} using site-wide maximum contaminant concentrations. PCBs and total PAHs contributed the majority of the total risk.

The Risk Assessment further specified carcinogenic risks to an older child and an adult from exposure to off-site surface soils. For an older child coming in contact with surface soil off-site, incremental lifetime carcinogenic risks ranged from 8×10^{-9} to 1×10^{-8}. In comparison, for an adult coming in contact with surface soil off-site, incremental lifetime carcinogenic risks ranged from 3×10^{-7} to 5×10^{-7}, reflecting the greater frequency of exposure assumed for the adult. PCBs contributed the major portion of the total risk using both average contaminant concentrations and maximum contaminant concentrations.

Noncarcinogenic risk estimates were also specified in the Risk Assessment. Hazard indices (HIs) calculated for exposure to contaminated soil are all less than one with the exception of incidental ingestion of on-site soils by children. A HI greater than one is attributed to only one chemical. This HI of 3.7 is attributed to the maximum concentration of lead detected in an on-site shallow soil sample.

B. Ingestion of Groundwater

Estimated lifetime carcinogenic and noncarcinogenic risks for exposure to groundwater were greatest for ingestion scenarios. Groundwater on-site is not currently used for drinking water, but does represent a potential future source. According to criteria established by EPA Groundwater Protection Strategy guidelines, the aquifer underlying the site is classified as Class IIB aquifer, (i.e., a potential source for future use). Under the Massachusetts DEQE classification system, the aquifer is considered Class I, based on the same potential use. Therefore, the incremental lifetime carcinogenic risk and the noncarcinogenic health risks associated with the ingestion of contaminated groundwater were assessed.

The total incremental carcinogenic risk if a person were to drink the groundwater found under the site for a lifetime containing contaminants of concern at the mean and maximum concentrations, based on the Phase II sampling, was estimated at 1.7×10^{-2} and 5.4×10^{-1}, respectively. Benzene, trichloroethene, vinyl chloride and PCBs contributed over 99 percent of the total cancer risk.

For these same conditions, the total estimated exposure dose exceeds a HI of one. Therefore, there is also an increased potential to cause adverse noncarcinogenic human health effects.

The hazard indices associated with ingestion for a lifetime of groundwater containing contaminants of concern at the mean and maximum concentrations, based on Phase II sampling, were estimated at 63 and 304, respectively. In both cases, 1,2-dichloroethene is the only contaminant with an estimated exposure dose greater than the respective reference dose.

C. Exposure to Sediments

The public health risk assessment performed for the Phase I and Phase II RIs examined risk associated with exposure to contaminated sediments in the unnamed stream and water hazards including direct contact with or incidental ingestion of sediments for a child and for an adult golfer. The highest incremental carcinogenic risk was 1.7×10^{-5}, based on direct contact by an older child with the maximum concentrations of contaminants in the unnamed stream.

The risk assessment also evaluated potential impacts to environmental receptors exposed to contaminated sediments. For the small mammals, rodents and aquatic organisms that inhabit the area, the potential exists for exposure to site associated contaminants through the skin, by ingestion or through the food chain. Of greatest concern is exposure to PCBs because they are difficult to eliminate from the body and may affect the animals and other organisms.

Two approaches were used to evaluate the environmental risk posed by the contaminated sediments.

The first approach was to determine levels of PCBs and total organic carbon (TOC) at various sampling locations, and then to compare those values to the Interim Sediment Quality Criteria (SQC), which vary depending on the TOC value. The sediment quality criteria are numbers which predict the relationship between contaminant levels in sediments and the Ambient Water Quality Criteria (AWQC) which protects wildlife that consume aquatic organisms.[2] There are three levels of SQCs. The upper level represents a 97.5% probability that PCB levels in interstitial water (the water between sediment particles) will exceed AWQCs. The mean level represents a 50% probability of the same event, and the lower level represents a 2.5% probability. Generally, the greater the probability of PCB levels exceeding AWQCs, the greater the risk to wildlife that consume aquatic

[2]For PCBs, the ambient water quality criterion for the protection of aquatic life to allow safe consumption of aquatic organisms by wildlife is 0.014 ug/l.

organisms.[3]

At Sullivan's Ledge, PCBs in sediments exceeded the mean SQC value of 20 ugPCBs/gTOC in all portions of the unnamed stream and in most portions of the water hazards. Furthermore, sediment PCB levels were greater than the upper SQC value in most portions of the unnamed stream and its tributary, and in some portions of the water hazards. In one location, the maximum level was 500 times greater than the upper SQC value.

Based on the comparisons between the SQCs for PCBs and measured PCB levels in sediments, EPA has determined that a potential exists for significant risk to wildlife through consumption of aquatic organisms exposed to PCB-contaminated sediments within the unnamed stream, its tributaries and portions of water hazards 1 and 2.

The second approach was used to assess risks to the aquatic organisms in contact with the PCB-contaminated sediments. The PCB tissue concentrations of these aquatic organisms are projected to be equal to or, in some cases, in excess of those concentrations in the sediment. Assuming a sediment:tissue Bioconcentration Factor (BCF) of 1, the range of PCB tissue concentrations in aquatic organisms are estimated at less than 1.0 to 118 ppm in the unnamed stream and less than 1.0 to 18.0 ppm in the water hazards. PCB tissue concentrations higher than 0.4 ppm in freshwater fish have been associated with reproductive impairment. Therefore, based on assumed tissue levels in aquatic organisms in the unnamed stream and water hazards (1 and 2), aquatic organisms in these areas may be at risk of reproductive impairment or other adverse effects.

The results of the biota investigation, as described in Section V.H, further indicate that the contaminants from the site impact the aquatic biota in the unnamed stream. Reduced numbers and species of organisms were observed from below the seep areas to the Middle Marsh area.

Due, in part, to the presence of orange floc attributable to iron precipitates, both the water and sediments within the unnamed stream and water hazards are aesthetically unappealing, in violation of Massachusetts water quality standards.

D. Exposure to Surface Water/Seeps

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[3]The derivation of upper, mean and lower value SQCs are further discussed in Appendix E of the Feasibility Study.

The public health risk assessment, based on the Phase I sampling results, evaluated the potential risks associated with direct contact exposure to surface water. Various surface water exposure scenarios were developed to evaluate the potential carcinogenic risks and noncarcinogenic health effects. Based on these scenarios, exposure to surface water is not expected to cause non-carcinogenic human health effects. The lifetime incremental carcinogenic risks ranged from $5x10^{-13}$ to $4x10^{-7}$. The maximum incremental carcinogenic risk ($4x10^{-7}$) was derived from a child's direct contact exposure to groundwater seeps. Exposure to n-nitrosodiphenylamine accounted for the majority of this risk.

Concentrations of chemicals of concern detected in surface water were compared to their respective ambient water quality criteria (AWQC) to evaluate potential risk to aquatic organisms. The following results were noted:

1. The mean or maximum detected concentrations in surface water of 10 chemicals exceeded their respective freshwater chronic AWQC during the Phase I field investigation (see Table 6-18 RI). Mean concentrations of bis(2-ethylhexyl) phthalate (BEHP) at 8.13 ug/l; mercury at 1.56 ug/l; copper at 10.44 ug/l; silver at 8.9 ug/l; and lead at 26.8 ug/l exceeded chronic criteria of 3.0, 0.012, 6.5, 0.12, and 1.3 ug/l, respectively.

2. Maximum concentrations of two chemicals exceeded chronic criteria while their mean concentrations did not. The maximum detected concentration of nickel of 82.0 ug/l exceeded the criteria of 56.0 ug/l, and the maximum concentration of chlorobenzene of 53 ug/l was in excess of the 50 ug/l criteria level.

3. PCBs and pentachlorophenol were detected in surface waters only once during Phase I sampling. A PCB concentration of 1.7 ug/l (see Table 6-18 RI) at SW-207 exceeded the final residue value criterion of 0.014 ug/l for PCBs in freshwater. The 8 ug/l pentachlorophenol concentration (see Table 6-18 RI) found at SW-301 exceeded the chronic criteria of 3.2 ug/l.

4. During Phase II field investigations, mean concentrations of BEHP, cyanide, lead, and silver at 251, 48.2, 11.0 and 6.38 ug/l, respectively, exceed their respective chronic water quality criteria (see Table 6-18 RI). Maximum detected concentrations of zinc also exceeded its respective criteria.

Based on comparisons between contaminant concentrations detected in surface water and their respective water quality criteria, as described above, a potential risk exists for aquatic organisms due to exposure to contaminants in surface water of the unnamed stream.

Risk to aquatic organisms due to PCB exposure in water cannot be accurately evaluated by comparing detected concentrations of PCBs to the respective water quality criteria. The detection limit for PCBs was 1.0 ug/l (during both investigations), and the criteria concentration is 0.014 ug/l. However, PCB exposure via water for aquatic organisms is likely in the unnamed stream and water hazards because of high levels of PCBs detected in area sediments. Adverse effects to aquatic organisms can occur as a result of exposure to the 1.7 ug/l concentration detected at SD-614 during Phase I. It is of particular concern that PCB concentrations (Aroclor-1254) of 1.2 and 1.5 ug/l are associated with measurable effects to growth, reproduction, survival, and/or metabolic upset in some aquatic organisms.

A complete discussion of site risks can be found in Chapter 8 of the Phase I RI and Chapter 6 of the Phase II RI.

VII. DOCUMENTATION OF SIGNIFICANT CHANGES

EPA adopted a proposed plan (preferred alternative) for remediation of the site in January 1989. Components of the preferred alternative included:

1. Site preparation;
2. Excavation, solidification and on-site disposal of contaminated soils;
3. Excavation, dewatering, solidification and on-site disposal of contaminated sediments from the unnamed stream and golf course water hazards;
4. Construction of an impermeable cap;
5. Diversion and lining of a portion of the unnamed stream;
6. Collection and treatment of groundwater from on-site overburden and shallow bedrock;
7. Wetlands restoration/enhancement;
8. Long-term environmental monitoring; and
9. Institutional controls, including restrictions on groundwater use.

EPA has made two significant changes to the proposed plan. First, the proposed plan outlined the evaluation of wetland remediation options for Middle Marsh. Three remedial action options were described ranging from no action to excavation and treatment of sediments from 9.5 acres of Middle Marsh. Based, in part, on the significant adverse short-term environmental impacts associated with the excavation and disruption of the forested wetlands, the preferred alternative, as described in the proposed plan, included the no action option for Middle Marsh. However, since issuing the proposed plan, EPA has re-evaluated options relating to Middle Marsh and has determined that additional studies are needed. In addition, the U.S. Department of Interior (DOI) and the Massachusetts Department of Environmental Quality Engineering (MA DEQE) have raised concerns that, if a portion of the PCB-contaminated sediments are not excavated, they may continue to pose a long-term threat to a variety of aquatic and terrestrial organisms that inhabit the Middle Marsh area. In view of these concerns, EPA has determined that additional studies, including biological testing, are needed before a final remedial action decision on Middle Marsh is given. Therefore, this Record of Decision will not incorporate a remedial action decision on Middle Marsh. Instead, this portion of the study area will be studied as an operable unit and the decision on the appropriate remedial action for Middle Marsh will be made in a separate ROD.

Because the decision on remedial action in Middle Marsh has not been included in this ROD but will be addressed in a subsequent ROD, EPA has re-evaluated the eight site alternatives to determine to what extent factors relating to Middle Marsh were used to screen site alternatives. EPA has determined that components of the site alternatives associated with Middle Marsh were not the determining factors in screening out site alternatives and in choosing SA-5 as the selected remedy. Therefore, the site alternatives, as described in the proposed plan will not be changed by deleting components relating to Middle Marsh (i.e. cost). However, analysis of site alternatives, as discussed in this ROD, will not focus on components or issues resulting from proposed remedial action in Middle Marsh.

Second, EPA has determined that locations other than the site's disposal area may require remediation due to soil contamination. Therefore, a sampling program will be implemented to determine the extent of soil contamination in the unsaturated layer in off-site areas immediately north of Hathaway Road and east of the existing fence along the eastern boundary of the site. EPA has estimated that the additional volume of soils that will be excavated from these areas will be minor in comparison to the total 24,000 cubic yards estimated in the Feasibility Study. Therefore, costs associated with the excavation, disposal and/or treatment of soils from outside the site's disposal area are projected to be minimal in comparison to the total estimated cost of the remedy. In the unlikely event that projected costs are substantially greater than expected, the public will be notified and the ROD will be amended.

VIII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

Prior to the passage of the Superfund Amendments and Reauthorization Act of 1986 (SARA), actions taken in response to releases of hazardous substances were conducted in accordance with CERCLA as enacted in 1980 and the revised National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, dated November 20, 1985. Until the NCP is revised to reflect SARA, the procedures and standards for responding to releases of hazardous substances, pollutants and contaminants shall be in accordance with Section 121 of CERCLA and to the maximum extent practicable, the current NCP.

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with applicable or relevant and appropriate environmental standards established under federal and state environmental laws unless a statutory waiver is granted; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a statutory preference for remedies that permanently and significantly reduce the volume, toxicity or mobility of hazardous wastes over remedies that do not achieve such results through treatment. Response alternatives were developed to be consistent with these Congressional mandates.

A number of potential exposure pathways were analyzed for risk and threats to public health and the environment in the SL Risk Assessment. Guidelines in the Superfund Public Health Evaluation Manual (EPA, 1986) regarding development of design goals and risk analyses for remedial alternatives were used to assist EPA in the development of response actions. As a result of these assessments, remedial response objectives were developed to mitigate existing and future threats to public health and the environment. These response objectives are:

1. Prevent or mitigate the continued release of hazardous substances to the unnamed stream, Middle Marsh, and Apponagansett Swamp;
2. Reduce risks to human health associated with direct contact with and incidental ingestion of contaminants in the surface and subsurface soils;
3. Reduce risks to animal and aquatic life associated with the contaminated surface soils and sediments;

4. Reduce the volume, toxicity, or mobility of the

hazardous contaminants;

5. Maintain air quality at protective levels for on-site workers and nearby residents during site remediation;
6. Reduce further migration of groundwater contamination from the quarry pits in the upper 150 feet of the bedrock groundwater flow system;
7. Significantly reduce the mass of contaminants in groundwater located in and immediately adjacent to the quarry pits;
8. Provide flushing of groundwater through the pits to encourage continued removal of contaminants at the site; and
9. Minimize the threat posed to the environment from contaminant migration in the groundwater and surface water.

B. Technology and Alternative Development and Screening

CERCLA, the NCP, and EPA guidance documents including, "Guidance on Feasibility Studies Under CERCLA" dated March 1988, and the "Interim Guidance on Superfund Selection of Remedy" [EPA Office of Solid Waste and Emergency Response (OSWER)], Directive No. 9355.0-19 (December 24, 1986) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements and guidance documents, a range of alternatives were developed for the site involving treatment that would reduce the mobility, toxicity, or volume of the hazardous substances as their principal element. In addition to the range of treatment alternatives, a containment option involving little or no treatment and a no-action alternative were developed in accordance with Section 121 of CERCLA.

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. In addition to these factors and the other statutory directives of Section 121, the evaluation and selection process was guided by the EPA document "Additional Interim Guidance for FY '87 Records of Decision" dated July 24, 1987. This document provides direction on the consideration of SARA cleanup standards and sets forth nine factors that EPA should consider in its evaluation and selection of remedial actions.

The nine factors are:

1. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).

2. Long-term Effectiveness and Permanence.

3. Reduction of Toxicity, Mobility or Volume.

4. Short-term Effectiveness.

5. Implementability.

6. Community Acceptance.

7. State Acceptance.

8. Cost.

9. Overall Protection of Human Health and the Environment.

Chapter 8 of the Feasibility Study identified, assessed and screened technologies based on engineering feasibility, implementability, effectiveness, and the nature and extent of wastes produced by such technologies. These technologies were combined into source control (SC) and management of migration (MM) alternatives. Chapter 9 in the Feasibility Study presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories required by OSWER Directive No. 9355.0-19. Each alternative was then evaluated and screened in Chapter 9 of the Feasibility Study. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Of the twenty-one source control and six management of migration remedial alternatives screened in Chapter 9, seven source control and three management of migration alternatives were retained for detailed analysis. Table 2 identifies the source control and management of migration alternatives that were retained through the screening process, as well as those that were eliminated from further consideration.

IX. DESCRIPTION/SUMMARY OF THE DETAILED AND COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a narrative summary and brief evaluation of each alternative according to the evaluation criteria described above. A tabular assessment of each site alternative can be found in Table 12-18 of the Feasibility Study.

A. Source Control (SC) Alternatives Analyzed

Source control alternatives were developed to address hazardous substances remaining at or near the area at which they were originally located and not adequately contained to prevent migration into the environment. At the SL site, SC alternatives were developed to address contaminated material inside the quarry pits, on-site contaminated soils and subsoils and PCB-contaminated sediments.

The source control alternatives evaluated in detail for the site include a minimal no action alternative (SC-1); a containment alternative for soils (SC-2); three treatment alternatives for soils: in-situ vitrification (SC-3), solidification (SC-4), on-site incineration (SC-5); and two excavation/treatment alternatives for sediments: on-site incineration (SC-6), and solidification (SC-7). A detailed evaluation of the source control alternatives is presented in Chapter 10 of the Feasibility Study.

B. Management of Migration (MM) Alternatives Analyzed

Management of migration alternatives address contaminants that have migrated into the groundwater from the original source of contamination. At the Sullivan's Ledge Site, contaminants have migrated into the groundwater from the quarry pits in the direction of groundwater flow and within bedrock fractures. In general, the direction of off-site groundwater flow is north, toward the golf course. Contaminants have also migrated into surface water primarily from groundwater seeps and overland runoff. Chapter 11 of the Feasibility Study presents the detailed evaluation of management of migration alternatives including a minimal no action (MM-1); passive groundwater collection/treatment systems (MM-3); and an active groundwater collection/treatment system (MM-5).

C. Site Alternatives (SA) Analyzed

Table 12-1 of the Feasibility Study presents the combinations of SC alternatives with MM alternatives used in the development of site alternatives. Eight site alternatives were developed which range from no-action to treatment as a principal element for the soils, sediments, and groundwater. In developing the site alternatives, each SC alternative was subdivided into specific areas or contamination levels. For example, the site soils were divided into those that exceed the 10^{-4} present risk level, those that exceed the 10^{-5} present risk level, and those that exceed the 10^{-6} present risk level. This breakdown generates a range of soil volumes and areas that could be treated. Similarly, the PCB-contaminated sediment areas were divided into four areas: the unnamed stream, Middle Marsh, water hazards, and the Apponagansett Swamp. Site alternatives were developed by combining alternatives that would logically be used together (e.g., incineration of the soils with incineration of the sediments). In this way, a total of eight logical, feasible site alternatives were developed that address the contamination at the Sullivan's Ledge site with varying degrees of treatment and associated effectiveness, implementability, and costs. The eight site alternatives are as follows:

- SA-1 Minimal No-Action

- SA-2 Containment/Passive Groundwater Collection with Bedrock Trench and Treatment
- SA-3 Containment/Active Groundwater Collection and Treatment
- SA-4 Solidification of 10^{-4} Present Risk Soils, 10^{-5} Present Risk Surface Soils, Unnamed Stream Sediments, Water Hazard Sediments/Containment/Passive Groundwater Collection with Bedrock Trench and Treatment
- SA-5 Solidification of 10^{-5} Present Risk Soils, Unnamed Stream Sediments, Water Hazard Sediments/Containment/Active Groundwater Collection and Treatment/Passive Groundwater Collection with the Overburden Trench and Treatment
- SA-6 In-situ vitrification (ISV) of all Soils to 10^{-6} Present Risk Level/Solidification of all PCB-contaminated Sediments/Passive Groundwater Collection Utilizing the Bedrock Trench and Treatment
- SA-7 Solidification of all Soils to 10^{-6} Present Risk Level/Solidification of all PCB-contaminated Sediments in the Unnamed Stream, Middle Marsh, and Water Hazards/Containment/Active Groundwater Collection and Treatment
- SA-8 On-site Incineration of all Soils to 10^{-6} Present Risk Level/On-site Incineration of all PCB-Contaminated Sediments/Containment/Active Groundwater Collection and Treatment

A description of each site alternative is given below:

1. <u>SA-1</u>
<u>Minimal No Action</u>

This alternative would consist primarily of restricting access to this site. The major items associated with this alternative are as follows:

- perform security visits
- perform semi-annual site visits
- conduct sediment, soil, and surface water sampling to monitor contaminant concentrations and migration
- conduct a groundwater monitoring program quarterly for the first two years and annually thereafter
- conduct educational programs, including public meetings and presentations, to increase public awareness
- perform site review every five years
- establish institutional controls (i.e. deed restrictions) limiting groundwater and land use

This alternative would not be protective because it does not address public health and environmental risks due to exposure to soils, sediments and groundwater. The alternative is not permanent, is ineffective in the short- and long-term and does not attain groundwater and surface water ARARs. As with all alternatives evaluated, including the selected remedy, this alternative does not result in the attainment of maximum contaminant levels (MCLs). Additionally, this alternative does not use treatment as a principal element, and consequently, there would be no reduction in mobility, toxicity or volume of the wastes present on site. Long term monitoring and site use restrictions would be necessary. This alternative is not acceptable to the state. Finally, none of the comments received from the community support a no-action alternative.

Approximate Present Worth Cost:
$1,200,000

2. SA-2
Containment/Passive Collection

Installation of Cap; Diversion and Lining of a Portion of the Unnamed Stream; Passive Groundwater Collection; Groundwater Treatment; and Environmental Monitoring.

Alternative SA-2 is primarily a containment alternative. Under this alternative an impermeable cap would be constructed over 11 acres of the site. A portion of the unnamed stream parallel to the eastern border of the site would be temporarily diverted in order to construct a concrete channel for that segment of the stream. In addition, a passive groundwater collection system would be installed, to intercept contaminated groundwater in the overburden, shallow bedrock and groundwater seeps. The collected groundwater would be treated using a combination of chemical oxidation/filtration for metals removal and UV/ozonation for organics removal.

This alternative would achieve a short term reduction in environmental and public health risks by reducing the direct contact hazards associated with contaminated on-site soils and groundwater seeps and by reducing the potential for PCB-contaminated soils to migrate off-site via the unnamed stream. The passive groundwater collection and treatment system would reduce the toxicity, mobility and volume of groundwater contaminants in collected groundwater. This containment alternative uses readily available materials and is easy to implement.

Capping an 11-acre area of the site would partially reduce the mobility of contaminants in soil. However, the long term reliability of a cap is questionable. If the cap were to fail mobility of contaminants in soil would not be reduced. Instead, soils would migrate off-site via the unnamed steam. Long term maintenance of the cap would be required and the potential exists for future costs and potential significant public health and environmental risks if the cap were to fail.

This alternative would not reduce the toxicity or volume of soil contamination and does not utilize treatment as a principal element. This alternative does not address the full extent of the contaminated deep bedrock groundwater and therefore does not reduce the toxicity, mobility or volume of those contaminants. The contaminated sediments in the unnamed stream and water hazards would not be excavated. Therefore, this alternative also would not reduce the toxicity, mobility or volume of the sediments in the unnamed stream and water hazards.

This alternative is not supported by the state. Some members of the community favor capping to address soil contamination; others favor an active collection system instead of a passive collection system to address groundwater contamination.

Approximate Present Worth Cost:
$5,100,000

3. SA-3
Containment/Active Collection

Installation of a Cap; Diversion and Lining of a Portion of the Unnamed Stream; Active Groundwater Collection; Groundwater Treatment; and Environmental Monitoring.

This alternative is similar to Alternative SA-2 except that an active groundwater collection system consisting of bedrock extraction wells located adjacent to the pits would be implemented, instead of a passive collection system. The treatment system for the collected groundwater would be the same. The benefits and/or limitations of SA-2 are applicable for SA-3 with the exception that the active groundwater collection system, would significantly reduce the toxicity, mobility or volume of contaminants in the on-site bedrock groundwater. Therefore, this alternative does address the more highly contaminated groundwater in the deep on-site bedrock although, as in all site alternatives, this alternative does not address contamination that exists in the deep bedrock fractures off-site. This alternative is not supported by the state.

Approximate Present Worth Cost:
$5,800,000

4. SA-4

Containment/Treatment/Passive Collection

Excavation, Solidification and On-site Disposal of Contaminated Soil; Excavation, Dewatering, Solidification, and On-site Disposal of Contaminated Sediments from the Unnamed Stream and Golf Course Water Hazards; Construction of an Impermeable Cap; Diversion and Lining of a Portion of the Unnamed Stream; Passive Groundwater Collection; Groundwater Treatment; Wetlands Restoration; and Environmental Monitoring.

Under this alternative, the more highly contaminated subsurface soils will be remediated to a 10^{-4} direct contact present risk level, while surface soils will be remediated to a 10^{-5} present risk level. Excavation and solidification of contaminated soil will reduce public health and environmental risks associated with exposure to contaminated soils and will significantly minimize the potential for contaminated soils to migrate off-site via the adjacent surface waters. Construction of an impermeable cap will provide a barrier to reduce exposure to and to minimize further migration of contaminated soil. Both methodologies (solidification, capping) are easily implementable and utilize materials that are readily available. This alternative would also reduce risks posed by PCB-contaminated sediments in the unnamed stream and golf water hazards and by the contaminated groundwater seeps, overburden groundwater and a portion of the bedrock aquifer.

This alternative is not effective in reducing the long term risks associated with the deep on-site bedrock aquifer which contains the greatest concentrations of groundwater contaminants. Therefore, there will be no reduction in the toxicity, mobility or volume of contaminants in the deep bedrock aquifer. The combination of solidification of soils and sediments and capping of the site will significantly reduce mobility of contaminated soils, but will not reduce the toxicity or volume of contaminated soils.

Approximate Present Worth Cost:
$8,300,000

5. SA-5
Containment/Treatment/Active Passive Collection

Excavation, Solidification and On-site Disposal of Contaminated Soil; Excavation, Dewatering, Solidification and On-site Disposal of Contaminated Sediments from the Unnamed Stream and Golf Water Hazards; Construction of an Impermeable Cap; Diversion and Lining of a Portion of the Unnamed Stream; Passive and Active Groundwater Collection; Groundwater Treatment; Wetlands Restoration; and Environmental Monitoring.

This alternative has been chosen as the selected remedy for the site and is described in detail in Section X.

Approximate Present Worth Cost:
$10,100,000

6. SA-6
Treatrent/Passive Collection

In-situ Vitrification of Soils; Solidification of Sediments; Diversion and Lining of a Portion of the Unnamed Stream; Passive Groundwater Collection; Groundwater Treatment; Wetlands Restoration; and Environmental Monitoring.

Alternative SA-6 is primarily a treatment alternative utilizing innovative technologies; in-situ vitrification (ISV) for contaminated soils and solidification for contaminated sediments. Specifically, all soils up to a 10^{-6} present risk level would be vitrified in-situ. PCB-contaminated sediments above lower value SQCs in surface waters would be excavated, solidified and disposed of on-site. Affected wetland areas would be restored to the maximum extent feasible. The passive collection system would also be installed to collect and treat the groundwater seeps, overburden groundwater and shallow bedrock groundwater.

In-situ vitrification would be effective in the long term in permanently reducing the toxicity and mobility of treated soils. Solidification would reduce the mobility of approximately 67,300 cubic yards of contaminated sediments. The passive groundwater collection and treatment system would reduce the toxicity, mobility and volume of groundwater contaminants in collected groundwater. All three treatment technologies (ISV, solidification, groundwater treatment) are considered innovative.

Contractors for the ISV technology are not readily available, and thus this alternative is not easily implementable. Furthermore, the vitrified matrix may restrict future land use of the site (i.e. soccer field). This alternative provides significant reduction of risks from exposure to contaminated soils, sediments and seeps, but does not address, to the maximum extent practicable, the deep on-site bedrock aquifer which contains the greatest concentrations of groundwater contaminants. As with SA-4, this alternative would not reduce the toxicity or volume of contaminated sediments and the toxicity, mobility or volume of contaminants in the deep bedrock aquifer. This alternative has not received state acceptance and none of the comments received during the public comment period support this approach.

Approximate Present Worth Cost:
$51,300,000

7. SA-7

Containment/Treatment/Active Collection

Excavation, Solidification and On-site Disposal of Contaminated Soil; Excavation, Dewatering, Solidification, and On-site Disposal of Contaminated Sediments; Construction of an Impermeable Cap; Diversion and Lining of a Portion of the Unnamed Stream; Active Groundwater Collection; Groundwater Treatment; Wetlands Restoration; and Environmental Monitoring.

This alternative is similar to SA-4 except that a much greater volume of soils (10^{-6} present risk level) and sediments would be treated and an active extraction bedrock collection system would be utilized instead of a passive collection system. Excavation and solidification of a larger volume of contaminated soil would reduce public health and environmental risks associated with exposure to contaminated soils and would significantly minimize the potential for contaminated soils to migrate off-site. Construction of an impermeable cap would provide an additional barrier against soil exposure and migration. Both methodologies (solidification, capping) are easily implementable, and utilize materials that are readily available. This alternative would further reduce risks posed by PCB-contaminated sediments and by contaminated groundwater in the on-site overburden and bedrock aquifers.

As with SA-4, this alternative would not reduce the toxicity or volume of contaminated soils and sediments. This alternative is acceptable to the state. However, no public comment was received favoring treatment of this larger volume of soils and sediments. This alternative is significantly more expensive than the selected alternative.

Approximate Present Worth Cost:
$18,100,000.

8. SA-8
Containment/Treatment/Active Collection

Excavation, Incineration and On-Site Disposal of Soils and Sediments; Construction of an Impermeable Cap; Diversion and Lining of a Portion of the Unnamed Stream; Active Groundwater Collection; Groundwater Treatment; Wetlands Restoration; and Environmental Monitoring.

This alternative has treatment as its principal element for site soils to 10^{-6} present risk level, sediments to lower value SQCs and the on-site bedrock aquifer. On-site incineration would reduce the mobility, toxicity and volume of contaminants in soils and sediments and the active collection/treatment groundwater system would reduce the mobility, toxicity and volume of contaminants in the on-site bedrock aquifer. This alternative utilizes a destruction technology (incineration) which is readily available. Thus, implementation of this alternative would be effective in reducing public health and environmental risks posed by contaminated soils, sediments and groundwater.

Although this alternative would result in a significant reduction of risk, SA-8 as well as all other alternatives, would not be a permanent remedy because of the untreated wastes contained within the pits which will continue to act as a contaminant source. Long-term monitoring and maintenance would still be required. Finally, high lead soil concentrations (maximum 4650 ppm) may result in exceedance of ambient air levels due to excessive lead emissions emitted during incineration.

Approximate Present Worth Cost:
$88,000,000.

X. THE SELECTED REMEDY

The selected remedial action consists of source control and management of migration components listed in Section VII but excludes action on Middle Marsh which will be addressed as an operable unit. A comprehensive approach is necessary in order to achieve the response objectives established for site remediation and the governing legal requirements.

A. Description of the Selected Remedy

After evaluating all of the feasible alternatives, EPA is selecting a nine-component plan to address soil, sediment and groundwater contamination at the SL site:

1. Site Preparation

The site preparation work includes the establishment of security and controlled access to the site, the connection of light and power utilities and the furnishing of sanitary facilities. A chain link fence will be constructed around the perimeter of the site and designated off-site areas expected to include the groundwater treatment facility, areas of excavation, and additional areas defined during remedy design. To the maximum extent feasible, the existing fence will be utilized. Warning signs will be posted at 100 foot intervals along all fences and at the entrance gate.

Areas to be remediated will initially be cleared of vegetation and debris. Most of these materials will be re-disposed of on-site. Cobblestones that will be disposed of off-site will be sampled for residual contamination. If PCBs are detected, the debris will be decontaminated, upon evaluation of the cost effectiveness by the EPA, with an approved physical removal process (i.e. scrub/wash/steam-clean or sand blast/steam-clean). After areas have been cleared, grading will be performed to provide areas for remedial operations, staging and to promote controlled site drainage.

Runoff controls will be developed in accordance with the conceptual design presented in Figure 5, and as discussed in Section 10 of the FS. Components will include drainage ditches on the western and southern site boundaries, a new sedimentation basin and dikes constructed adjacent to the eastern and northern boundaries of the site's disposal area. Erosion and sediment control measures used during the construction period are also considered part of the site preparation work.

2. **Soil Excavation/Treatment**

This component is composed of the following: excavation, grading, solidification, on-site disposal, backfilling, predesign work and implementation monitoring. A processing area will be set up at the site prior to soil excavation. All on-site unsaturated soils contaminated above the soil cleanup levels described in Section X.B.1.a., including soils within the 100-year floodplain, will be excavated (see Figure 6-4 RI). Off-site soils contaminated above target levels described in Section X.B.1.b. will be excavated from areas shown in Figure 6. Bulk debris will then be screened out of the excavated materials. Screened-out debris will be disposed of on-site. All debris disposed of on-site will be contained within waste cells formed out of compacted solidified product or within excavated areas and ultimately covered. All excavated soils contaminated above 50 ppm of PCBs and/or 30 ppm of PAHs will be placed, along with a hardening agent, in a mixing unit for solidification. The solidified material will then be disposed of on-site beneath the proposed landfill cap, above the existing ground surface and outside the 100-year floodplain. Coordination between the implementation of the solidification processes and cap construction will be necessary to avoid extended exposure of solidified material. Excavated areas on-site within the boundaries of the cap may be backfilled with clean fill, excavated off-site soils containing between 10 and 50 ppm of PCBs and/or debris generated during site preparation and excavation. For excavated areas beyond the boundaries of the landfill cap, final restoration will consist of backfilling with clean fill, grading, loaming and seeding.

Unsaturated soils with contaminants above the cleanup levels, as defined in Section X.B.1., will be excavated. On-site, the volume and area of soil to be excavated is shown in Figure 6-4 of the Phase II RI, and is estimated at 24,200 cubic yards. The volume to be excavated off-site will be defined by predesign sampling. The unsaturated zone at the site is defined as that area from the surface elevation to the seasonal low groundwater table.

Predesign work includes off-site sampling, defining the unsaturated zone and solidification treatability studies. Off-site areas to be sampled are shown in Figure 6 and described below:

1. East of the existing fence along the eastern boundary of the site, from the southern boundary of the site to the Hathaway Road culverts. This area includes the east and west banks of the portion of the unnamed stream along the eastern border of the site.
2. Just north of Hathaway Road and south of the intermittent tributary to the unnamed stream within the golf course.

The sampling program will determine the nature and extent of PCB contamination in surface and subsurface soils in the unsaturated layer in the above referenced areas. Based on the sampling data, areas with soil contaminants in excess of 10 ppm of PCBs and of 50 ppm of PCBs will be defined. The seasonal low groundwater elevation will be defined by implementing a monitoring program that will evaluate the fluctuation of the water table. This program will monitor the fluctuation for all four seasons, but with particular focus on the summer months. Bench-scale testing of the solidification process using representative soil and sediment samples will be performed to evaluate solidifying agents and mixtures. EPA is specifically requesting that treatability tests include the mixing of lime with soils. Testing to determine appropriate and optimal use of hardening agents will consist of leachability tests. EP toxicity tests will also be performed to determine whether certain soils will be RCRA - characteristic waste after solidification.

An air monitoring program will be implemented during the performance of the on-site and off-site soil excavation and treatment component of the remedy to determine risks to on-site workers and nearby residents. Air sampling stations will be located at representative points throughout the site and at the perimeter of the site. Samples will be analyzed, at a minimum, for VOCs, PCB in vapor phase and PCB particulates. To limit potential air emissions the following methods may be implemented: enclosure of the work areas: emission suppression techniques (ie. foam, water spray); and containment of excavated soils.

EPA anticipates that some amount of off-site wetlands areas will be impacted by soil excavation. For those areas, steps will be taken as described in component 7, to minimize potential destruction or loss of wetlands or adverse impacts to organisms.

Upon completion of the excavation of on-site and off-site soils, samples will be collected and evaluated against the cleanup levels for soils (see Section X.B.1). These samples will be used to evaluate the success of excavation.

3. Sediment Treatment

The sediment component is composed of: preparation work, excavation/dredging, dewatering, transportation, solidification and disposal. Initial preparation work will include construction of roadways and, where needed, clearing of trees and shrubs. Cleared materials will be disposed of on-site. Initially, sediments from the designated areas shown in Figure 6 will be excavated to a depth of one foot. Dewatering of excavated sediments will be performed (i.e. filter presses) to reduce sediment moisture content. Effluent from the dewatering operation will be treated to comply with state water quality standards, as discussed in Section X.B.3.c. Presently, the EPA expects that activated carbon or the on-site treatment plant will be used to comply with these standards. Treated effluent will be discharged to the unnamed stream. After the dewatering process, the dewatered sediments will be solidified and disposed of on-site above the existing groundwater surface, as described in the preceding section.

An estimated 1,900 cubic yards of sediments in excess of the sediment cleanup levels, as described in Section X.B.2., will be excavated or dredged and transported to the site's landfill area. Areas to be excavated are shown in Figure 6 and described below:

a. Unnamed stream and tributaries from areas south, east and north of the site to the golf course water hazards
b. The first water hazard north of the unnamed stream and a portion of the next water hazard.

EPA shall determine when excavation activities will be performed upon evaluating weather conditions, stream flow, scheduling constraints, and the impacts of construction activities on the golf course. Excavated areas will be isolated by means of erosion and sedimentation control devices (i.e. sedimentation basin) and diversion structures to limit the resuspension of contaminated sediments. Methods such as sedimentation basins and/or silt curtains will also minimize the amount of contaminated sediments moving downstream during dredging. During excavation of PCB-contaminated sediments, downstream monitoring of surface water will be conducted to ensure that transport is not occurring as a result of the excavation.

An air monitoring program will be performed during the implementation of this component to monitor risks to on-site workers and nearby residents, as described in the soil treatment component of the remedy. Mitigative measures, such as those discussed in the preceding section, shall be taken during excavation, transport and treatment to control emissions.

For wetlands areas affected by sediment excavation, steps will be taken as described in component 7, to minimize potential destruction or loss of wetlands or adverse impacts to organisms.

After the initial excavation of sediments, sediment sampling of the excavated areas will be performed to ensure compliance with the sediment target level. Sediment samples will be analyzed for PCBs and TOC. These samples will be used to evaluate the success of excavation/dredging. Based on the sampling results as well as field judgement, additional excavation at one foot depth intervals shall be performed in any area where sediment contaminant levels are equal to or greater than the sediment target level.

4. **Construction of an Impermeable Cap**

The purposes of the impermeable cap are to reduce human and animal exposure to the solidified soils and sediments, to reduce exposure to untreated contaminated soils and wastes within the pits, and to reduce the amount of precipitation that could filter through the waste and carry contaminants into the groundwater and away from the capped area.

This component is composed of the following: grading, backfilling, capping, predesign work and implementation requirements.

As described under the site preparation component, the first step in constructing the cap will be to remove the trees and brush from the site's surface area. Excavated areas will be backfilled and the site regraded prior to on-site disposal of the solidified soils and sediments. The layers of the cap will then be constructed on top of the solidified soil and sediment layer.

The detailed design of the cap will be finalized during the design phase of the remedy to meet the performance standards set forth in the Massachusetts Hazardous Waste Regulations, including the requirement that the clay layer have an average permeability of 10^{-7} cm/sec. Based on the conceptual design described in Section 10 of the Feasibility Study, the cap will consist of four layers (see Figure 7). The base of the cap will consist of a two-foot clay layer of an average permeability of 10^{-7} cm/sec. To protect the clay layer from the effects of frost, an 18-inch buffer layer of soil will be installed above the clay layer. A permeable drainage layer, consisting of 12 inches of sandy soil will then be placed above the buffer layer. Water that passes through the upper layers of the cap will drain off to the sides of the cap, over the buffer and clay layers. This water will be collected in drains around the edge of the cap, and discharged to the unnamed stream. Above the drainage layer, a 2-foot vegetative layer will be installed consisting of 18 inches of sandy soil and 6 inches of topsoil. Grass will be planted in the topsoil.

The cap will be constructed over a projected 11-acre area extending over the total surface area of the site with the exception of the area within the 100-year flood plain (see Figure 8). As discussed under the second and third components of the selected remedy, the cap will be constructed over the contaminated surface soils and sediments that will be solidified and placed on-site. The cap will also cover unsolidified soils within the 11-acre area that may contain contaminants below the cleanup target level.

Predesign studies will consist of permeability testing of clay mixtures to determine the optimal clay mixture for compliance with the design requirements of a 10^{-7} cm/sec permeability. Both lab and field patch tests will be performed to check compliance with requirements.

Implementation requirements will include erosion and sediment control measures, as discussed in component 1 (site preparation) of the selected remedy. Erosion which may occur during the vegetation establishment will be controlled by applying hay bales or erosion control fabrics. Site regrading of the northeastern corner of the site, within the 100-year flood plain of the unnamed stream, will be limited to backfilling areas where soils have been removed for treatment. Construction activities will be performed to minimize disturbance of contaminated soils. Furthermore, fugitive dust will be controlled during construction activities by water sprays or dust control chemicals.

5. **Diversion and Lining of the Unnamed Stream**

This component of the selected remedy is limited to the portion of the unnamed stream parallel to the eastern boundary of the site. This component consists of the following: limited clearing of areas adjacent to the unnamed stream portion, temporary diversion of surface waters, excavation of sediments, concrete lining of the stream portion, rediversion of surface waters.

Initially, only those areas necessary for implementation and construction of this component will be cleared of shrubs and trees. Cleared material will be disposed of on-site within excavated areas. Surface waters of the portion of the stream to be lined with concrete will be temporarily diverted until the concrete channel is constructed and the surface waters can be redirected back through the new channel. The whole length of the unnamed stream and its tributaries up to the first and second water hazards will be excavated to remove the contaminated sediments (see Figure 6). Next, the portion of the unnamed stream parallel to the eastern border of the site will be lined with concrete to form a concrete channel. The concrete channel will prevent the waters of the unnamed stream from being pulled into the extraction wells described in the next component. The concrete channel will be constructed with a series of baffled sections to reduce stream velocities and maximize sediment deposition. After completion of the concrete lining, the unnamed stream will be directed back to the new channel.

Figure 5 shows the portion of the unnamed stream which will be excavated, diverted and lined. This portion of the stream is approximately 750 feet in length from the culverts at the southern boundary of the site up to the culverts at Hathaway Road.

The method of stream diversion will be finalized during design of the selected remedy. In view of the need to mitigate wetland impacts, EPA has determined that the diversion method of digging a temporary trench on the east or west bank of the unnamed stream will be re-evaluated during remedial design. If deemed feasible, the portion of the unnamed stream to be contained within the concrete channel will be diverted and/or pumped through a temporary pipe located in close proximity to the existing streambed.

The stream diversion structure and ancillary activities will be performed to mitigate adverse impacts to the wetlands, as described in component 7 of the selected remedy.

6. **Collection and Treatment of On-site Groundwater**

With this component of the preferred alternative, EPA will combine two phases of groundwater collection: active groundwater collection and passive groundwater collection.

A. Active Groundwater Collection

This component is composed of the following: predesign pump tests; extraction wells; hydrofracturing or blasting (to increase hydraulic connection with the pits); groundwater pumping; groundwater treatment and groundwater monitoring. Approximately 6 deep bedrock extraction wells at least six inches in diameter will be installed to depths as great as 200 feet. The cumulative pumping rate is expected to be 30 to 60 gallons per minute. A conceptual location map is presented in Figure 11-7(FS). The specific number, depth, pumping rates and location of the extraction wells will be defined during design as directed by predesign investigations. The wells will be located as close as possible to the quarry pits so they are hydraulically connected to the pits. Hydrofracturing or blasting may be performed on individual boreholes to supplement the hydraulic connection between the boreholes and the pits. During design the extent of hydrofracturing or blasting will be defined as directed by predesign investigations. Treatment of the extracted ground water is discussed in Section X.A.6.C.

Predesign work includes pump tests, groundwater sampling and subsurface exploration to define pit boundaries. Pump tests will be performed to determine well yields. This information will be used to evaluate the extent to which hydrofracturing or blasting will be used and to define the safe yields for individual wells. Consideration of extracted groundwater disposal and impacts of surrounding wetlands (ie. dewatering) will be incorporated into pump test design. In addition, as part of the predesign program associated with the pump tests, subsurface investigations to refine the present delineation of the quarry pits will occur to assist in locating extraction wells.

Groundwater monitoring of the overburden, shallow and deep bedrock will occur during the implementation of the active groundwater collection system. Chemical concentrations and water elevations will be monitored to evaluate the efficiency of the extraction system. The frequency of monitoring will be finalized during design; however, it is expected that monitoring wells will be sampled on a quarterly schedule. The specifics of this monitoring program will be defined during design but, at a minimum, will include the multilevel Westbay Systems installed during the Remedial Investigation. In addition, pumping rates of each well and the treatment and extraction system influent and effluent concentrations will be monitored with the objective of defining the mass of contaminants extracted over the life of the system.

Once the clean up targets, as defined in Section X.B.3.a., have been satisfied, the extraction wells will be shut down and a monitoring program will be implemented to confirm the results. This program will, at a minimum, consist of three years of quarterly monitoring of groundwater quality. Monitoring wells to be sampled will be identified in the overburden and deep and shallow bedrock. These wells will be wells that had been historically monitored during the operation of the extraction system. Additional specifics of this monitoring program will be defined in the remedial design. The results of this monitoring will be reviewed by the EPA to evaluate the success of the extraction system and determine if and when it should be reimplemented. The monitoring results from this program ultimately serve two purposes: first to evaluate the success of the remedy and second to help define the extent of the institutional controls.

B. Passive Groundwater Collection

This component of the remedy is composed of the following: excavation; installation of the underdrain pipe; and water treatment and monitoring. The excavation depth for the underdrain installation will extend to the top of the bedrock surface. The underdrain itself will be composed of a 12-inch slotted pipe wrapped in geotextile fabric and backfilled in graded stone (see Figure 11-2A FS). The expected flow rate for the underdrain pipe is approximately 35 gallons per minute. Specifics of the underdrain will be defined in the remedy design and modified depending on predesign data. The location of the underdrain will also be defined in the remedial design, but presently it is expected to be located just beyond the cap boundaries as shown in Figure 11-3 (FS). Treatment of the extracted water is discussed below in Section X.A.6.C.

Predesign work is the same for the passive system as it is for the active system. Of specific note are the pump tests performed in conjunction with the active groundwater system.

These results will define the impact of the active system on overburden flow and help define expected flow rates for the passive system.

Installation of the passive system will be impacted by the implementation of the cap and the active ground water extraction system. Since the underdrain is to be installed at the boundary of the cap, the time of its installation will depend upon that of the cap. Consideration of the appropriate implementation sequence of these components of the remedy will be given in the remedy design.

Monitoring of the flowrate and sampling and analysis of the water collected by the passive system will occur before and after treatment, at a minimum on a quarterly basis, with the objectives of defining the mass of contaminants removed by the system and compliance with the effluent limitations and groundwater target levels. Additional specifics of monitoring frequency and sampling parameters will be defined during remedial design.

Once the clean up target levels as specified in Section X.B.3.b., have been satisfied for two years, treatment of collected groundwater within the passive system will not be required; instead, monitoring will be implemented. The results of this monitoring will be reviewed by the EPA to determine if and when the passive collection system should be reimplemented.

C. Groundwater Treatment

The proposed groundwater treatment for both the active and passive collection systems consists of the following: bench-scale and pilot studies; oxidation/filtration for metals removal; ultraviolet (UV)/ozonation for organics removal and groundwater monitoring.

Chemical oxidants (i.e., potassium permanganate), combined with aeration and followed by filtration, will remove metals. Solids produced during the oxidation step will be concentrated and dewatered prior to disposal. If these solids are hazardous, they will be disposed of in a RCRA landfill. All hazardous wastes transported off-site will be done in accordance with RCRA and DOT regulations.

EPA has selected UV photolysis/ozonation as the water treatment component for organics. This is because UV/ozonation is an innovative treatment technology that destroys organic compounds in water through a combination of UV light and a mixture of ozone and hydrogen peroxide. A unit attached to the reactor collects any residual ozone and converts it to oxygen. UV/ozonation is a destruction technology and, therefore, will not require disposal of waste residuals. Treated groundwater will be discharged to the unnamed stream or, if deemed feasible, to the New Bedford secondary treatment plant.

UV/ozonation is an innovative technology which has been proven to be effective in the destruction of organic contaminants in groundwater. However, it will be necessary to conduct bench-scale treatability studies to determine the implementability of this technology on site-specific contaminants. If UV/ozonation, based on the results of the treatability studies, is not determined to be implementable or effective or is determined to be significantly more costly than other effective treatments, then EPA will select air-stripping with GAC and vapor phase carbon as the treatment technology for removal of organics in groundwater.

Since the levels of groundwater contaminants at the site are relatively high, and because UV/ozonation is an innovative treatment, pilot testing of UV/ozonation (if selected) will be required to determine the implementability of the groundwater treatment system on a full-scale level. The pilot study will yield information on the percent reduction of organic and inorganic compounds in groundwater and the volume and types of residuals and byproducts produced by the operation of the treatment system.

Monitoring of the flow rate and chemical analysis of groundwater entering and leaving the full-scale treatment plant will be evaluated during the operation of the treatment system to ensure that response objectives and effluent limitations are achieved.

The period of operation of the treatment plant will be determined by the achievement of the completion requirements specified for the active and passive systems. During the operation of the treatment plant, regardless of what technology is chosen, the effluent will have to comply with the effluent limitations, as described in Section X.B.3.c.

7. **Wetlands Restoration/Enhancement**

EPA has determined that there are no practicable alternatives to the soil excavation, sediment excavation and stream diversion and lining components of the selected remedy, that would achieve site goals but would have less adverse impacts on the aquatic ecsoystem. The contaminants in the soils and sediments would continue to pose unacceptable human health and/or environmental risks if excavation of the soils and sediments greater than the target levels were not performed.

Excavation of contaminated sediments and soils, lining of the stream and any ancillary activities will result in unavoidable impacts and disturbance to wetland resource areas. Such impacts may include the destruction of vegetation and the loss of certain plant and aquatic organisms. Impacts to the fauna and flora will be mitigated as discussed below.

During implementation of the remedy, steps will be taken to minimize the destruction, loss and degradation of wetlands, including the use of sedimentation basins. A wetland restoration program will be implemented upon completion of the remedial activities in wetland areas adversely impacted by remedial action and ancillary activities. In particular, the unnamed stream portions north of Hathaway Road will be restored to reasonably similar hydrological and botanical conditions existing prior to excavation. The concrete channel which will line the unnamed stream along the eastern boundary of the site will be constructed with a series of baffled sections to reduce stream velocities and maximize sediment deposition. Any additional wetland areas impacted by dredging and/or associated activities, including wooded areas to the north and east of the site, will be restored and/or enhanced, to the maximum extent feasible.

The restoration program will be developed during design of the selected remedy. This program will identify the factors which are key to a successful restoration of the altered wetlands. Factors may include, but not necessarily be limited to, replacing and regrading hydric soils, provisions for hydraulic control and provisions for vegetative reestablishment, including transplanting, seeding or some combination thereof.

The restoration program will include monitoring requirements to determine the success of the restoration. Periodic maintenance (i.e. planting) may also be necessary to ensure final restoration of the designated wetland areas.

8. Long-term Environmental Monitoring and Five-Year Reviews

For the reasons discussed in Section X.B.3., EPA considers it technically impracticable to clean the contaminated deep bedrock groundwater both on- and off-site to drinking water standards. Accordingly, a groundwater monitoring program focusing on deep bedrock groundwater and off-site overburden and bedrock groundwater will be implemented. The groundwater monitoring program will be designed for the following purposes:

a. to document the changes in contaminant concentrations

over time;
b. to evaluate the success of remedial action; and
c. to help define the extent of institutional controls.

Because wastes in the pits would be left untreated, although capped, groundwater monitoring of wells adjacent to the pits will also be performed to determine changes in contaminant loadings and/or distribution.

The details of the on-site and off-site overburden and bedrock groundwater monitoring program will be developed during remedial design. The monitoring program will be tailored to site specific hydrogeologic conditions and contaminants. Wells will be sampled on a routine basis to evaluate dispersion of the contaminant plume and the distribution of contaminant migration. A list of a representative subset of approximately 50 existing monitoring wells to be monitored periodically will be generated. The frequency of monitoring will be finalized during design; however, it is expected that monitoring wells will be sampled and analyzed on a quarterly basis to improve the existing data base and establish contaminant concentrations. The proposed groundwater monitoring program will include sampling of the four existing multi-level bedrock wells (ECJ-1,2,3,4) during every sampling round. Five to eight zones will be sampled in each of the multi-level monitoring wells. Maintenance requirements will include replacement of the multi-level monitoring wells. During design, the condition and usefulness of existing wells will be checked and compared with future data needs. Recommendations on the installation of additional multi-level, overburden and/or bedrock monitoring wells will be specified during remedial design if deemed necessary to adequately monitor over a long term the nature and extent of groundwater contamination. Initially, all samples will be analyzed, at a minimum, for VOCs, SVOCs, PCBs and metals. Specific parameters may be added or deleted depending on sampling results and observed trends.

Environmental monitoring will also include sampling of sediments in the unnamed stream to indirectly check the integrity of the cap and solidified material in preventing mobility and transport of PCBs and PAHs. At a minimum, sediment samples will be initially monitored for PCBs, SVOCs, and total organic carbon.

All monitoring data will be formally reviewed and evaluated during the operation of remedial action to ensure that appropriate remedial response objectives are achieved. Monitoring frequency and chemical parameters may be added or deleted based on review of monitoring data. Five-year reviews will be initiated to ensure that human health and the environment are being protected by the remedial action being implemented. Future remedial action, including source control measures, will be considered if the environmental monitoring program determines that unacceptable risks to human health and/or the environment are posed by exposure to site contaminants.

9. **Institutional Controls**

Because the bedrock groundwater cannot be cleaned to drinking water standards and because wastes will remain in the pits, institutional controls will be necessary to achieve long term protectiveness. Institutional controls at this site will be designed: (i) to ensure that groundwater in the zone of contamination will not be used as a drinking water source; and (ii) to ensure that any use of the site will not interfere with the effectiveness of the cap in reducing exposure to contaminants. EPA will work with state and local officials to enact ordinances and zoning restrictions to prevent the use of groundwater for drinking water and to place deed restrictions regulating land use at the site. The effectiveness of the institutional controls will be re-evaluated during the 5-year reviews described above.

B. **Target Levels**

Based on results of the Phase I and Phase II risk assessments, target levels were developed for the following media: soils, sediments, groundwater.

1. **Soil Target Levels**

a. **Soils within the Disposal Site**

Soil target levels for soils located within the 12-acre disposal area were derived for PCB and PAH compounds. The target levels for PCBs are based on total Aroclors, while PAHs are based on total carcinogenic PAHs (these include benzo(a)anthracene, benzo(b) fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(ah)anthracene, and indeno (1,2,3-cd)pyrene.

Soil target levels for PCBs and PAHs are based on risks associated with direct contact to, and incidental ingestion of, indicator compounds detected in surface soils and test pit soils. The assumptions used to calculate soil target levels reflect the site zoning designation and current and future uses of the site. The current zoning for the site is commercial and access to the disposal area is restricted. The immediate surrounding area is not densely populated and the population is not expected to significantly increase. Two future land use scenarios for this land have been proposed: a parking lot or a soccer field.

Based on current land use at the site, target levels for PCBs and PAHs were estimated. Exposure parameters considered in the target level calculations were as follows:

- exposure by an older child (8 to 18 years)
- 45-kg body weight
- 12 exposures per year (twice per month from May through October)
- 10-year exposure duration
- 4 grams of soil contacted (represents arms, hands, and lower legs)
- relative absorption factors for PCBs and PAHs of 7 percent (dermal)
- ingestion of 0.1 grams of soil per exposure
- relative absorption factor for PCBs and PAHs of 50 percent (oral)

Because one of the possible future uses for this disposal area is a soccer field, target levels for PCBs and PAHs were also estimated to be protective against exposure conditions for this land use. It is assumed that concurrent exposure through direct contact and ingestion of soil occurs per exposure event. Exposure parameters considered for these calculations include the following:

- exposure by an older child (8 to 18 years)
- 45-kg body weight
- 48 exposures per year (twice per week from May through October)
- 10-year exposure duration
- 4 grams of soil contacted (represents arms, hands, and lower legs)
- relative absorption factors for PCBs and PAHs of 7 percent (dermal)
- ingestion of 0.1 grams of soil per exposure
- relative absorption factor for PCBs and PAHs of 50 percent (oral)

The disposal area soil remediation component of the selected remedial action entails excavation and treatment of soils contaminated with total PCBs at concentrations of 50 ppm or greater, and total carcinogenic PAHs at concentrations of 30 ppm or greater, located in the unsaturated zone. These clean-up levels correspond to a 10^{-5} risk level under current site use conditions and a 10^{-4} risk level under future site use conditions (soccer field) which falls within the target risk range of 10^{-4} to 10^{-7} considered for remediation at superfund sites. The potential risk will be further substantially reduced by the construction of an impermeable cap above the treated soils thus minimizing direct exposure to the contaminants. During the excavation and treatment of soil, air quality will be monitored to ensure that site specific ambient action levels are not exceeded.

It is important to recognize the inherent uncertainties in estimating the health-based soil cleanup levels. Uncertainties are associated with the value of each exposure parameter, the toxicological data base and the overall set of exposure assumptions. Despite these uncertainties, EPA believes that the assumptions used to estimate the cleanup levels are reasonable, and that it is necessary to use this approach, in order to ensure that the cleanup goals will be adequately protective of public health.

b. Soils outside the Disposal Area

Results of the off-site soil sampling program will be analyzed to identify contaminant levels in unsaturated soils for areas specified in Section X.A.2.

Incremental carcinogenic risks associated with exposure to contaminated surface soil in areas outside the disposal site have been estimated within the range of 10^{-5} to 10^{-9}. In particular, incremental carcinogenic risks for adults associated with dermal contact with soil outside the disposal area containing contaminants of concern at the mean and maximum concentrations were estimated at 2.7×10^{-7} and 4.9×10^{-7}, respectively. However, results of a limited number of soil sampling within the golf course were used in the calculations of these risks. EPA has determined that additional soil sampling is needed in areas immediately north and east of the site's disposal area. Therefore, a soil cleanup level for soils outside the disposal area has been established because the additional sampling may show greater contaminant levels than levels indicated in the RIs and because corresponding estimated risk values may be greater than a 10^{-5} risk.

Unsaturated soils in areas outside the 12-acre disposal area with PCB concentrations equal to or greater than 10 ppm will be excavated, transported to and disposed of within the site's disposal area. Unsaturated soils with PCB concentrations equal to or greater than 50 ppm will be solidified prior to disposal within the site's landfill area, consistent with the cleanup level for soils within the site's restricted disposal area, as described in the preceding section.

The soil cleanup level of 10 ppm of PCBs for soils outside the site's disposal area is based on a 10^{-5} incremental cancer risk associated with direct contact with contaminated soil. The cleanup level of 10 ppm is more stringent than the soil cleanup level of 50 ppm for soils within the 12-acre disposal area because soils outside the disposal area are located in nonrestricted areas resulting in greater frequency of exposure with these contaminated soils. In addition, soils outside the disposal area will not be covered with an impermeable cap which will cover the majority of the site's disposal area thus further minimizing exposure to the soils underlying the cap.

Excavated off-site areas will be backfilled with clean fill.

2. Sediment Target Levels

The sediment target level for the unnamed stream, its tributaries and the golf course water hazards is the interim mean sediment quality criteria (SQC) value of 20 micrograms of PCBs per gram of carbon (ug/gC). This value for PCBs has been derived by the EPA Criteria and Standards Division to protect uses of aquatic life, specifically the consumption of aquatic life by wildlife. The mean sediment quality criteria (20 ug PCBs/gC) was chosen as the cleanup level because:

a. For total organic carbon (TOC) of 10 gC/kg sediment, typically found in stream sediments, it represents the detection limit for analyzing PCBs in sediments.

b. After remediation, the resulting PCB concentrations in stream sediments represent levels which, with approximately 50% certainty, will result in interstitial water concentrations equal to or lower than the PCB ambient water quality criterion (final residue value of 0.014 ug/l).

c. Based on TOC sediment values between 10 gC/kg sediment and 20 gC/kg sediment, calculated SQCs from between 0.2 ppm PCBs and 0.4 ppm PCBs, respectively, compare favorably with the toxicological literature which documents examples of sublethal toxic effects in aquatic organisms at PCB tissue levels and hence sediment concentrations of less than 1 ppm and as low as 0.1 ppm PCBs.

The following table lists projected mean SQCs in ppm of PCBs.

TOC (gC/kg sediment)	Mean SQC Levels in ppm of PCBs
2 gC/kg sediment	0.04 ppm PCBs
5 gC/kg sediment	0.1 ppm PCBs
8 gC/kg sediment	0.16 ppm PCBs
10 gC/kg sediment	0.2 ppm PCBs
15 gC/kg sediment	0.3 ppm PCBs
20 gC/kg sediment	0.4 ppm PCBs

EPA considered two additional factors: the detection limit for analyzing PCBs in sediments and background levels. The Contract Lab Protocol (CLP) detection limit for the analysis of PCBs in sediments is 0.16 ppm. The background PCB level at this site has been estimated at approximately 0.14 ppm. Therefore, EPA has determined that the sediment target levels in ppm of PCBs for sediments with TOC values less than or equal to 10 gC/kg sediment will be 0.2 ppm of PCBs. Where TOC values are greater than 10gC/kg sediment, the calculated mean SQC will be the target level. Therefore, target levels are as follows:

TOC (gC/kg sediment)	Final Sediment Target Levels in ppm PCBs
2-10 gC/Kg sediment	0.2 ppm PCBs
15 gC/Kg sediment	0.3 ppm PCBs
20 gC/Kg sediment	0.4 ppm PCBs

3. Groundwater Target Levels

EPA has determined that contaminants from the quarry pits have contaminated on- and off-site groundwater and surface water in the unnamed stream. In particular, high levels of VOCs detected in groundwater located in bedrock fractures indicate that pockets of highly-contaminated liquid waste may exist within the pits and along bedrock fractures. For this site, EPA considers it technically impracticable from an engineering perspective to clean up the contaminated deep bedrock groundwater to Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act, and Massachusetts Drinking Water Standards. The basis for this determination of technical impracticability is discussed in Section XI.B.

Instead of MCLs, EPA has determined that the cleanup goals for groundwater at this site are the significant reduction of contaminant mass in the aquifer and the protection of local surface water bodies. A two-part plan for cleanup of on-site contaminated groundwater and seeps is presented. It involves an active extraction system to collect contaminated groundwater located in and adjacent to the pits and a passive collection system to collect seeps and contaminated overburden groundwater.

A groundwater treatment system would be operated to treat collected groundwater.

a. Active Collection System Cleanup Levels (In the Aquifer)

The cleanup goal for the active collection system is the significant reduction in the mass of bedrock contamination.

EPA will evaluate achievement of this cleanup goal by using two criteria : (1) a concentration range of 1 to 10 ppm of total volatile organic compounds (VOCs): and/or (2) an asymptotic curve using groundwater monitoring data indicating that significant concentration reductions are no longer being achieved. The groundwater monitoring data curve will be asymptotic when the rate of change in contaminant levels approaches zero, with no statistically significant deviation.

These two criteria will be evaluated together to determine when a significant reduction of contaminants has occurred. Given the complexities of the Sullivan's Ledge system, EPA will modify the range of 1 to 10 ppm of total VOCs if necessary upon review of actual full-scale treatment performance data. Monitoring data will be reviewed to assess the practicability of achieving or exceeding 1 to 10 ppm of total VOCs. This data will be evaluated against the asymptotic curve standard by comparing contaminant concentrations against time at a number of monitoring wells. If new monitoring data indicates that either achieving the 1 to 10 ppm VOC concentrations is impracticable, or that achieving groundwater concentrations lower than 1 to 10 ppm is practicable, then the ROD will be amended. The asymptotic curve must be demonstrated for one year (four consecutive quarters), at a minimum, during the operation of the pumps before the pumps can be shut off. After the shutdown of the active pumping system, monitoring data will be evaluated on a quarterly basis for a minimum of three years. If monitoring data shows an increase in contaminant levels over time, such that the asymptotic condition is significantly changed, active pumping will be resumed.

b. Passive Collection System Cleanup Levels (Influent Concentrations)

The management of migration objective of the passive collection system is to prevent degradation of the unnamed stream by collecting seeps and contaminated groundwater. Cleanup levels for the passive system will be based on Ambient Water Quality Standards (AWQS) and the designated uses of the receiving waters. EPA has selected AWQSs as cleanup levels because they are appropriate standards for the protection of aquatic life in the unnamed stream. EPA anticipates that either ambient water quality criteria for specific pollutants or bioassays will be used to determine compliance with Massachusetts water quality standards. Compliance with these cleanup levels will be measured at the influent to the treatment plant. Collected leachate and groundwater will be monitored before and after entering the groundwater treatment plant.

c. Effluent Concentration for Treatment Plant

Massachusetts ambient water quality standards (AWQSs) will also be used to set effluent limitations so that the discharge to the unnamed stream will not result in violations of the state's water quality standards. These standards include minimum criteria as well as narrative standards including "surface waters shall be free of toxic pollutants in toxic amounts." EPA anticipates that either ambient water quality criteria for specific pollutants or whole effluent toxicity limits will be specified as effluent limitations for the treatment plant's effluent. Based on the specific limits set for the effluent, appropriate monitoring requirements will also be specified, including bioassays. Specific effluent limits which comply with water quality standards and monitoring requirements will be determined during remedial design and will be based in part on the evaluation of predesign and pilot results. If at some point in the future it is determined to be more cost-effective to discharge to the New Bedford POTW, then the effluent limitations, as discussed above, will be amended to reflect pretreatment requirements.

C. Rationale for Selection

The choice of the selected alternative is based on the criteria listed in the evaluation of alternatives section of this document. In accordance with Section 121 of CERCLA, to be considered as a candidate for selection in the ROD, the alternative must be protective of human health and the environment and able to attain ARARs unless a waiver is granted. At the Sullivan's Ledge site, attainment of groundwater ARARs is technically impracticable from an engineering perspective, and a waiver from compliance with those ARARs is justified. In assessing the alternatives at this site, EPA focused on other evaluation criteria, including short term effectiveness, long term effectiveness, implementability, use of treatment to permanently reduce the mobility, toxicity, and volume of contaminants, and cost. EPA also considered nontechnical factors that affect the implementability of a remedy, such as state and community acceptance. Based upon this assessment, taking into account the statutory preferences of CERCLA, EPA selected the remedial approach for this site.

Alternative SA-5 represents the best combination of elements addressing contaminated soils, sediments and groundwater. The selected alternative is protective, effective in the long term and the short term, reduces the toxicity, mobility and volume of the contaminants, is implementable, has state and community acceptance and is cost-effective.

Most of the on-site soils are contaminated with PCBs, with approximately 24,000 cubic yards in excess of 50 ppm of PCBs. The clean-up level for sediments within the adjacent unnamed stream is less than 1 ppm. Therefore, for this site it is critical to ensure that on-site soils will not erode off-site into the unnamed stream. EPA has determined that solidification of the more highly contaminated soils and disposal under a cap is necessary to ensure that in the long term contaminated soils will not mobilize and erode off-site into the unnamed stream and is consistent with the preference for treatment as a principal element. Solidification also provides an added measure of security against possible future costs and remedial action necessary to protect human health and the environment if the cap were to fail. Excavation of contaminated sediments within the unnamed stream and water hazards is necessary to reduce the unacceptable environmental risk posed by such contaminated sediments for aquatic organisms and organisms at higher trophic levels. Solidification and on-site disposal for excavated sediments is the most cost-effective alternative considering the long term effectiveness and the significant reduction of mobility similar to other sediment treatment alternatives but at less cost, and the need to convert dewatered sediments into a suitable filler for disposal under a cap. As previously discussed, EPA has determined that it is technically impracticable, from an engineering perspective, to clean the contaminated groundwater to comply with drinking water standards. However, EPA has further determined that an active pumping collection system, located in close proximity to the pits, is required to significantly reduce the level of groundwater contaminants located in the on-site bedrock aquifer. In addition, because of unacceptable environmental risks due to contaminated groundwater and seeps discharging into the unnamed stream, a passive groundwater collection system is necessary for the short and long term during downtimes and upon successful completion of the active pumping system.

Other alternatives were considered less acceptable for the following reasons. Because Alternative SA-1, the no-action alternative, did not address risks from exposure pathways, it is not protective and was rejected from further consideration. All other alternatives included an element to reduce risks from exposure to contaminated soils. However, capping alone (Alternatives SA-2, SA-3) was not selected because it does not utilize treatment to reduce the toxicity, mobility, or volume of wastes, does not provide protection if the cap should fail and the long term effectiveness is less certain. Alternatives involving in-situ vitrification and incineration for soils (Alternatives SA-6 and SA-8) were rejected, even though the treatments would permanently destroy PCBs, because of implementability problems and substantially greater cost than solidification. Solidification was selected because it will reduce the mobility of PCBs and PAHs and will provide an extra measure of protection and long term effectiveness when used with a cap. Alternatives which did not address contaminated sediments (Alternatives SA-2, SA-3) were rejected because they do not reduce risks to aquatic and terrestrial organisms from exposure to contaminated sediments. Alternatives which did not utilize an active collection and treatment system to address groundwater contamination (Alternatives SA-2, SA-4, SA-6) were rejected because they are ineffective in the long term, do not significantly reduce the toxicity, mobility and volume of contaminants in the groundwater, and are not acceptable to the state. Alternatives which utilized an active collection and treatment system, but did not include a passive collection and treatment system (Alternatives SA-3, SA-7, SA-8), were rejected because they are not protective of the environment in the long term. Because it is technically impracticable to extract all pockets of contaminants located in the quarry pits and bedrock fractures, and an indeterminate amount of contaminants will therefore remain in the groundwater after the active collection and treatment system has been turned off, the passive collection system will be necessary to reduce environmental risks from exposure to groundwater seeps and/or further contamination of the unnamed stream and sediments.

XI. Statutory Determinations

A. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this site will permanently reduce the risks posed to human health and the environment by exposure to contaminated soils, sediments, surface water and groundwater.

The soil cleanup levels to be attained by this remedy will reduce the risks from direct contact to and incidental ingestion of contaminated soils to a level protective of human health. In addition to solidification, construction of an impermeable cap over most of the surface area of the site will provide an additional barrier against exposure to contaminated soils by both human and environmental receptors. The combination of solidification and capping will also significantly reduce the potential for contaminated soils to migrate off-site via the unnamed stream. Periodic site visits and maintenance will be performed to ensure the integrity of the cap, and its effectiveness in preventing exposure to contaminated soils and wastes within the pits. Similarly, institutional controls will be implemented to regulate land use of the site, including activities which may compromise the integrity of the cap.

Treatment of the PCB-contaminated sediments in the unnamed stream and golf course water hazards will permanently and significantly reduce the risks to benthic organisms and organisms at higher trophic levels associated with contact with such sediments and subsequent bioaccumulation.

Risks from exposure to contaminated on-site overburden and bedrock groundwater and groundwater seeps will be permanently reduced. EPA has determined that it is technically impracticable to clean up the contaminated groundwater to drinking water standards, both on-site and immediately off the disposal site. However, attainment of groundwater cleanup goals, as measured by achievement of 1-10 ppm of total volatiles and/or an asymptotic curve using groundwater monitoring data, will result in a significant reduction of on-site groundwater contaminants. Groundwater within the zone of contamination is not currently used for drinking water sources. Institutional controls will be implemented to ensure that in the future, drinking water wells will not be drilled on- and off-site within the zone of groundwater contamination.

B. The Selected Remedy Attains ARARs

The remedy will meet or attain applicable or relevant and appropriate federal and state requirements that apply to the site, with the exception of requirements relating to groundwater, as discussed below. Federal environmental laws and regulations which are applicable or relevant and appropriate to the selected remedial action at the Sullivan's Ledge Site are:

Resource Conservation and Recovery Act (RCRA)
Toxic Substances Control Act (TSCA)
Clean Water Act (CWA)
Clean Air Act (CAA)
Occupational Safety and Health Administration (OSHA)
Safe Drinking Water Act (SDWA)
Department of Transportation Regulations

State environmental regulations which are applicable or relevant and appropriate to the selected remedial action at the site are:

Dept. of Environmental Quality Engineering (DEQE) Regulations
- Hazardous Waste Regulations
- Wetlands Protection Regulations
- Certification for Dredging and Filling in Waters
- Drinking Water Regulations
- Air Quality Standards
- Air Pollution Control Regulations

Massachusetts Division of Water Pollution Control (MDWPC) Regulations
- Surface Water Quality Standards
- Groundwater Quality Standards
- Supp. Requirements for Hazardous Waste Management Facilities

Table 3 provides a synopsis of the applicable or appropriate requirements for the selected remedy. A discussion of how the selected remedy meets those requirements follows.

Groundwater

Safe Drinking Water Act
Massachusetts DEQE Drinking Water Regulations
Massachusetts MDWPC Groundwater Quality Standards

The groundwater at Sullivan's Ledge, both on-site and immediately off-site, is not currently used as a drinking water source, but is a potential drinking water source. Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act and Massachusetts Drinking Water Standards, which regulate public drinking water supplies, are not applicable. However, because the groundwater could potentially be used as drinking water source, MCLs are relevant and appropriate. Minimum Groundwater Criteria established under the Massachusetts Groundwater Quality Standards are relevant and appropriate.

In this Record of Decision, EPA is waiving compliance with certain ARARs relating to groundwater. The waiver covers both federal and state ARARs. Specifically, the Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act, Massachusetts Drinking Water Standards and Massachusetts Groundwater Quality Standards are waived. EPA has determined that compliance with the requirements of these ARARs is technically impracticable from an engineering perspective. Accordingly, EPA is waiving these requirements pursuant to Section 121(d)(4)(C) of CERCLA, 42 U.S.C. § 9622(d)(4)(C).

The determination of technical impracticability is based primarily on the nature of the wastes and contaminants within the pits and along the bedrock fractures, and the geology of the site. EPA has concluded that the quarry pits and bedrock fractures contain dense non-aqueous phase liquids (DNAPLs), as a result of direct dumping of liquid wastes into the pits at depths approaching 150 feet into bedrock. The bedrock fractures are irregular both in length and orientation and as such cannot be accurately located, especially at such depths. In addition, DNAPLs will distribute along bedrock fractures under the influence of gravity, not just in the direction of flow, resulting in the inability to predict their locations even along a specific fracture. Therefore, the pockets of highly contaminated wastes located within the pits and along fractures cannot be cleaned up by conventional excavation and pumping methods as it is technically not possible to locate and extract all the contaminated pockets. The excavation of the quarry pits would also require an operation which is logistically infeasible to implement considering decontamination, staging and disposal constraints for the liquid wastes and solid objects within the pits. Even if the remedy did include excavation of the quarry pits, some contaminants would certainly remain in the pits and along the bedrock fractures.

Groundwater will be treated to the target levels discussed in Section X.B.3. The groundwater treatment facility will be located outside of the 100-year floodplain on the golf course, immediately adjacent to the disposal site. The location of the facility attains the siting requirements of MDWPC Supplemental Requirements for Hazardous Waste Management Facilities. There are no suitable areas on site for constructing the treatment facility, because quarry pits underlie much of the site and because construction of the facility may harm the cap. The proposed location is within the areal extent of contamination, and is considered to be part of the site for the purposes of Section 121(e) of CERCLA. Therefore, no permit is required. Discharges from the treatment facility into the unnamed stream or to the New Bedford sewer will attain ARARs, as described below.

Soils and Sediments

The applicable or relevant and appropriate requirements for the excavation, solidification and capping of the contaminated soils and sediments are regulations promulgated pursuant to TSCA, RCRA and DEQE Hazardous Waste Management Regulations.

Toxic Substances Control Act

The PCB Disposal Requirements promulgated under TSCA are applicable to the site because the selected remedy involves disposal of soils and sediments contaminated with PCBs in excess of 50 ppm. Under the Disposal Requirements, soils contaminated with PCBs may be disposed of in an incinerator, chemical waste landfill, or may be disposed of by an alternate method which is a destruction technology and achieves an equivalent level of performance to incineration. 40 C.F.R. §§ 761.60(a)(4), 761.60(e). In this case, placement of solidified soils and sediments on the top of the ground surface of the existing landfill and construction of an impermeable cap over 11 acres of the site will satisfy the requirements of a chemical waste landfill. The passive groundwater collection system will collect leachate and monitoring of groundwater wells will be instituted, as required by the chemical waste landfill regulations.

The Regional Administrator is exercising the waiver authority contained within the TSCA regulations at 40 C.F.R. § 761.75(c)(4), and is waiving certain requirements of the chemical waste landfill. The provisions to be waived require construction of chemical waste landfills in certain low permeable clay conditions [40 C.F.R. § 761.75(b)(1)], the use of a synthetic membrane liner [§ 761.75(b)(2)], and that the bottom of the landfill be 50 feet above the historic high water table [§ 761.75(b)(3)].

The Regional Administrator hereby determines that, for the following reasons, the requirements of 40 C.F.R. §§ 761.75(b)(1),(2) and (3) are not necessary to protect against an unreasonable risk of injury to health or the environment from PCBs in this case.

Low permeability clay conditions for the underlying substrate are not necessary at this site to prevent migration of PCBs. Soils and sediments over 50 ppm will be solidified and placed on top of the existing ground surface and clean fill. Solidification of soils with PCBs over 50 ppm and an impermeable cap will effectively encapsulate PCBs and prevent future migration. The requirement of a synthetic membrane liner is waived because there will be no hydraulic connection between the solidified mass and the groundwater or surface water. Although the water table at Sullivan's Ledge is five to ten feet below the ground surface, infiltration of PCBs to the groundwater will be prevented by binding the PCBs in a solidified mass and placing them under an impermeable cap. Also, installation of the active collection system and the cap may further lower the groundwater level. Surface erosion of PCBs in soils and transport of the soils into the unnamed stream will essentially be prevented by the combination of solidification and placement under an impermeable cap. The hydrologic requirement that the landfill must be fifty feet above the historic high water table is waived because it is extremely unlikely that the solidified soils and sediments will ever come in contact with the groundwater. The solidified materials will be placed on the ground surface, five to ten feet above the water table, and will not be located in a floodplain, shoreland or groundwater recharge area. These factors ensure that at this site there will not an unreasonable risk of injury to health and the environment if the above requirements are waived.

Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act

The Commonwealth of Massachusetts has been authorized by EPA to administer and enforce RCRA programs in lieu of the federal authority. Compliance with Massachusetts RCRA regulations is discussed below. However, federal regulations promulgated under the Hazardous and Solid Waste Amendments to RCRA (HSWA) are potentially applicable.

The applicability of HSWA regulations depends on whether the wastes are hazardous, as defined under RCRA.[4] In this case, certain compounds which may exhibit characteristics of hazardous waste, such as barium and lead, are present in some limited areas of the soils. However, HSWA regulations will not be applicable to those soils, because the Agency expects that after the soils are solidified, they will no longer exhibit any characteristics of hazardous wastes. Accordingly, HWSA land disposal restrictions will not be applicable because placement of the solidified soils on the land will not constitute disposal of a hazardous waste.[5]

The minimum technology standards for landfills promulgated pursuant to HSWA are not applicable, because the Sullivan's Ledge site is an existing landfill, rather than a new landfill, a lateral expansion, or a replacement landfill. Furthermore, the double liners required under these standards are not relevant and appropriate to this site. Because contaminants exist deep within the quarry pits and in the bedrock fractures, it is technically infeasible to build double liners that would prevent contaminants from coming into contact with groundwater. Accordingly, bottom double liners would not serve the purpose of isolating contaminants from the groundwater. Leachate collection requirements are relevant and appropriate, with the exception of the length of operation requirement. The passive groundwater collection system will collect leachate until Massachusetts water quality standards are achieved.

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[4] The agency has determined that none of the wastes in the soils and sediments at Sullivan's Ledge are listed hazardous wastes under RCRA because the specific processes creating the wastes are unknown. The mere presence of a hazardous constituent in a waste is not sufficent to consider the waste a RCRA listed waste.

[5] HSWA land disposal restrictions (LDR) would be applicable to the disposal of those portions of the soils contaminated with RCRA hazardous waste if they also contain certain restricted wastes. Under LDR, if soils contaminated with a RCRA hazardous waste (such as lead) also contain halogenated organic compounds such as PCBs in excess of 1,000 ppm, they must be incinerated prior to land disposal. At Sullivan's Ledge, it appears that the soils with high lead content do not also contain PCBs greater than 1000 ppm. Even if that were the case, incineration would not be appropriate because of the high lead content, and EPA would invoke a variance from the treatment standard pursuant to 40 CFR § 268.44, allowing treatment of the lead- and PCB-contaminated soils by solidification.

Massachusetts DEQE Hazardous Waste Regulations

Massachusetts' DEQE Hazardous Waste Regulations are relevant and appropriate to this site, because the wastes to be managed are either hazardous wastes or are similar to hazardous wastes.[4]

The placement of contaminated soils and sediments under a cap will occur outside the 100-year floodplain, in accordance with location standards in the Massachusetts Hazardous Waste Regulations. Massachusetts closure and post-closure requirements requiring, among other things, that a cap attain a certain low permeability standard and act to minimize migration of liquids through the landfill in the long term will be attained. In addition, the substantive elements of the contingency plan, emergency procedures, preparedness and safety requirements will be satisfied.

The portion of the DEQE landfill regulations requiring a double liner is not appropriate to the site and will not be attained. Large volumes of wastes will be left in the quarry pits underlying the solidified material, because of the impracticability of excavation, as described above. Thus, placement of a double liner over the wastes in the quarry pits would be ineffective in containing the wastes. Leachate collection requirements are relevant and appropriate, with the exception of length of operation requirements. The passive system will collect leachate and will operate until water quality standards are achieved.

The groundwater monitoring program will comply with the groundwater protection regulations under the DEQE regulations, with the possible exception of semi-annual monitoring. As currently conceived, the remedy calls for groundwater monitoring quarterly during the first three years, and the frequency thereafter will be finalized during remedial design. Semi-annual monitoring requirements may not be appropriate to this site,

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[4] Massachusetts Hazardous Waste Regulations are not applicable, because the remedial action implementing this Record of Decision will be initiated or ordered by DEQE as well as EPA. In such circumstances, no license pursuant to the Massachusetts hazardous waste statute and DEQE hazardous waste regulations is required. 310 C.M.R. 30.801(11). Accordingly, DEQE does not require strict compliance with all hazardous waste regulations for such remedial actions, but only requires compliance with the relevant and appropriate substantive sections of those regulations.

where the primary purpose of groundwater monitoring is not to check the effectiveness of the cap, but to assess the effectiveness of the groundwater extraction and treatment program.

Surface Water

Clean Water Act

Some regulations under the Clean Water Act are applicable to the discharge of treated waters to the surface waters of the unnamed stream. No permit is required under the NPDES program for this discharge, because the effluent from the treatment facility will be discharged directly into the unnamed stream at a point considered part of the CERCLA site. EPA has selected a treatment method combining chemical oxidation/filtration for metals removal and UV/ozonation for organics removal which will be capable of achieving state water quality standards. Pilot testing of the treatment system will be conducted as part of the remedial action.

If the City of New Bedford builds a secondary treatment plant (POTW) at some point in the future, EPA may discharge groundwater collected by the passive system indirectly to the POTW through the sewer. In that case, EPA would comply with pretreatment requirements of the Clean Water Act. These regulations contain general prohibitions against interfering with the operation of a POTW and against pass-through of pollutants, and specific prohibitions against introducing pollutants that will create a fire or explosion hazard, or cause corrosive structural damage to the POTW, among other things.

Massachusetts Surface Water Quality Standards

Massachusetts water quality standards for discharge to surface waters are applicable to discharges to the unnamed stream. The unnamed stream is classified as Class B, for the uses and protection of propagation of fish, aquatic life and wildlife, and for primary and secondary contact recreation. Massachusetts standards state that water shall be free from pollutants that exceed the recommended limits, that are in concentrations injurious or toxic to humans, or that exceed site-specific safe exposure levels determined by bioassay using sensitive species. At Sullivan's Ledge, these standards will be attained by using either ambient water quality standards or whole effluent toxicity limits. Bioassay tests may also be performed to determine site-specific safe exposure levels. Because the effluent from the treatment facility will be discharged directly into the unnamed stream at a point considered part of the site, no permit is required.

Floodplains and Wetlands ARARs

Regulations under Section 404 of the Clean Water Act are applicable, because channelization and lining of the unnamed stream and construction of roads in the wetlands will involve a discharge of dredged or fill material. The Agency has determined that in this case there is no other practicable alternative which would address PCB contamination in sediments but which would also have a less adverse impact on the aquatic ecosystem. The selected remedy will comply with the substantive requirements of Section 404 to minimize adverse impacts to the aquatic ecosystem, by creating sedimentation basins, by erecting baffles in the lined part of the stream, and by restoring the stream and wetlands.

In addition, the policies expressed in Executive Orders regarding wetlands and floodplains were taken into account in the selected remedy. The remedy will include steps to minimize the destruction, loss, or degradation of wetlands in accordance with Executive Order 11990, and will include steps to reduce the risk of floodplain loss in accordance with Executive Order 11988.

DEQE Wetlands Protection Regulations concerning dredging, filling, altering or polluting inland wetlands are applicable to the dredging of the unnamed stream and water hazards. The remedial action will comply with the performance standards of the regulations regarding banks, vegetated wetlands, and lands under water, and a one-for-one replication of any hydraulic capacity which is lost as the result of this part of the remedial action.

Because the stream and water hazards are within the areal extent of contamination, they are considered part of the site, and no permits will be necessary.

Air

Standards for particulate matter under the Clean Air Act and DEQE Air Quality and Air Pollution regulations are applicable and will be attained during construction phases.

OSHA/Right to Know

OSHA standards for general industries and health and safety standards will be attained. Informational requirements under the Massachusetts right to know regulations will be attained during implementation of the remedy.

Department of Transportation Regulations

Any hazardous wastes transported for off-site disposal, including any solids extracted during the groundwater treatment program, will be transported in accordance with Department of Transportation regulations.

C. The Selected Remedial Action is Cost Effective

Of those remedial alternatives that are protective and attain all technically practicable ARARs, EPA's selected remedy is cost-effective. As discussed in the FS, solidification is the most cost effective treatment alternative for soils and sediments, based on the treatment of equivalent volumes. In particular, the cost of on-site incineration is $13,500,000 (present worth) for treatment of soils with PCBs in concentrations equal to or greater than 50 ppm. This is $9,000,000 more than the cost of solidification for treatment of the same volume of soils. Although solidification is not a destruction technology, solidification and capping, in combination with a long-term maintenance program and institutional controls, will adequately protect human health and the environment over the short- and long-term. Because the site must be capped in any event to contain the wastes within the quarry pits, solidification of soils and sediments represents the most cost-effective treatment means of achieving the response objectives outlined in Section VIII A.

Present worth costs were estimated in the FS for four groundwater treatment technologies for the active collection system: air stripping with granular activated carbon (GAC), air stripping with GAC and vapor phase carbon, GAC alone and UV/ozonation. Of the four referenced treatment systems, UV/ozonation has the lowest cost estimate in present worth terms. Although GAC is a commonly used treatment for removal of VOCs, vinyl chloride, one of the contaminants of concern in the groundwater at the site, quickly exhausts the adsorptive capacity of GAC. UV/ozonation is a technology which has been proven to be effective in the destruction of organic contaminants in groundwater, including vinyl chloride. Therefore, the selection of UV/ozonation as a groundwater treatment system is the most cost-effective both in terms of its destruction efficiency and estimated cost.

Implementation of the active groundwater collection system will be required until the time that the levels which the Agency considers technically practicable, as described in Section X.B.3.a., are achieved. The combination of an active and passive groundwater collection system is cost-effective because it reduces the length of time of the operation of the active collection system. If no passive system were in place, it would be necessary to operate the active system until water quality standards were achieved in order to prevent degradation of the unnamed stream. Construction of the passive system represents a minimal portion of the total cost of the remedy.

D. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

EPA has determined that the solidification, capping, and groundwater treatment components of the selected remedy utilize permanent solutions to the maximum extent practicable.

In this case, it is technically impracticable from an engineering perspective to excavate all the wastes contained within the quarry pits and deep bedrock fractures, and therefore technically impracticable to eliminate permanently the source of groundwater contamination. All the source alternatives which EPA evaluated for complete and permanent remediation of wastes contained within the quarry pits were screened out in Chapter 9 of the FS, because of problems with their effectiveness, implementability and cost.

The determination that it is technically impracticable to excavate wastes in the quarry pits and bedrock fractures is based primarily on the nature of the wastes present and the geology of the site. The evidence indicates that the quarry pits and the bedrock fractures contain pockets of highly contaminated liquids. These pockets cannot be cleaned up by conventional excavation and pumping methods, as it is technically not possible to locate and extract all contaminated liquids. The excavation of the quarry pits would also require an operation which is logistically impracticable to implement, considering decontamination, staging and disposal of wastes and objects in the pits. Significant short term hazards may result from excavating large bulky objects such as cars and timbers which are significantly contaminated by the liquid wastes.

The remedy also uses alternate technologies. Solidification of soil and sediment is designated as an innovative treatment, as is UV/ozonation.

E. The Selected Remedy Satisfies the Preference for Treatment as a Principal Element

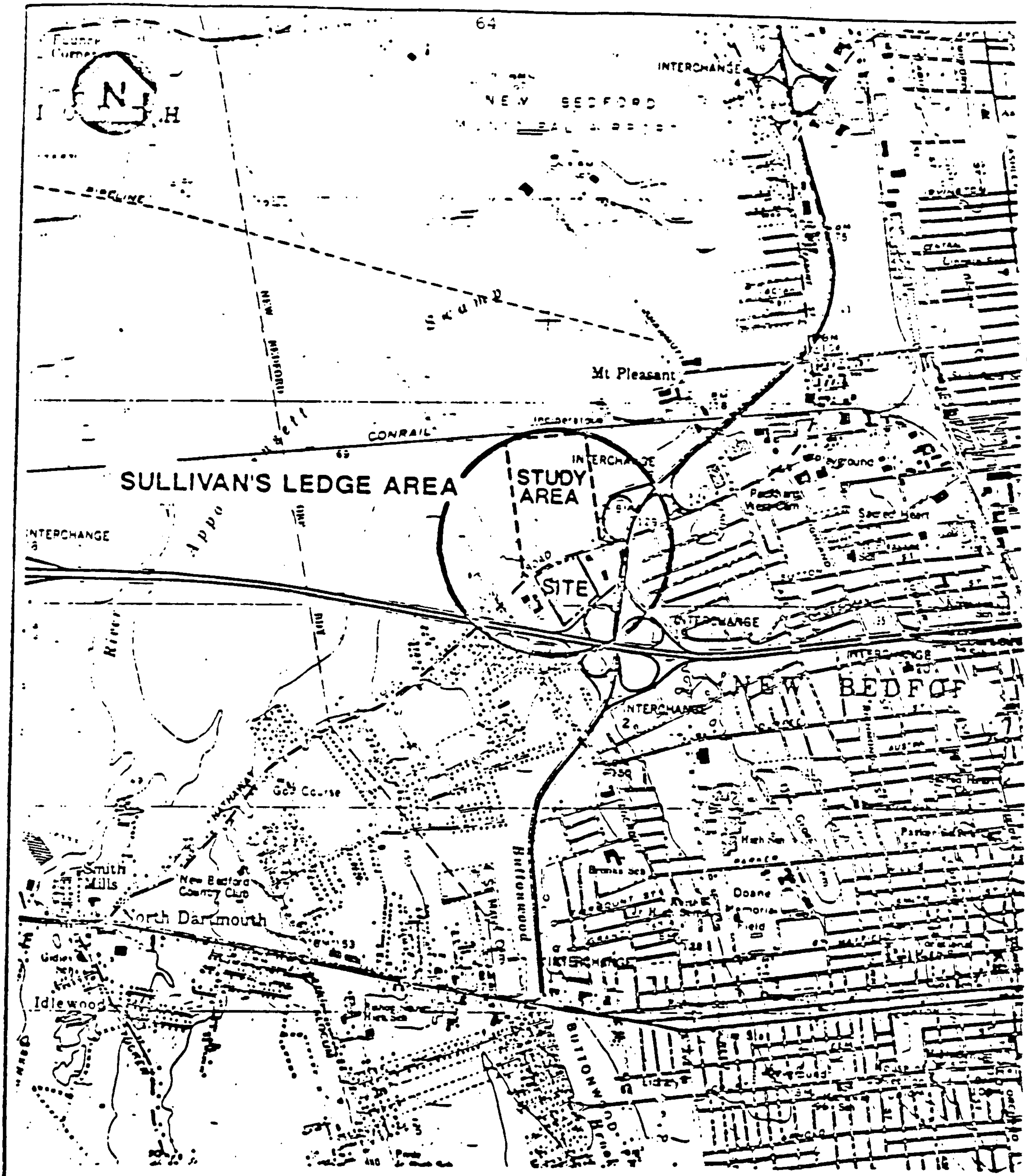
The selected remedy satisfies the statutory preference for treatment as a principal element by specifying excavation and solidification of contaminated soils and sediments equal to or above human health-based and environmental risk-based target levels. Solidification of contaminated soils and sediments is a form of treatment which significantly reduces the mobility of PCBs. Although not as permanent as destruction technologies, solidification provides more long term protection than capping alone.

The groundwater treatment system also utilizes treatment. As described in preceding sections, EPA has determined that it is technically impracticable, from an engineering perspective, to excavate and treat all the solid and liquid wastes within the quarry pits. However, since the liquid wastes within the pits constitute the primary threat to human health and the environment, the remedy specifies a groundwater extraction and treatment system located in close proximity to the pits in order to significantly reduce the mass of contaminants in groundwater. The groundwater treatment system of chemical precipitation followed by UV/ozonation will permanently destroy organic contaminants and remove metal contaminants from collected groundwater.

XII. STATE ROLE

The Massachusetts Department of Environmental Quality Engineering (MA DEQE) has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the Remedial Investigations and the Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental laws and regulations. MA DEQE concurs with the selected remedy for the Sullivan's Ledge Site. A copy of the declaration of concurrence is attached as Appendix C.

Because the City of New Bedford, a political subdivision of the Commonwealth of Massachusetts, operated the site at the time of disposal of hazardous substances, the state is responsible for a minimum of 50 percent of the sums expended in response to releases at the site, in accordance with Section 104(c)(3) of CERCLA. In the case of the selected remedy, the Commonwealth's minimum share is estimated at approximately $5,050,000.



BASE MAP SOURCE: USGS QUADRANGLE, 7.5 MINUTE SERIES
NEW BEDFORD NORTH, MA.

SCALE: 1" = 2083'

FIGURE 1
SITE LOCATION MAP
SULLIVAN'S LEDGE SITE
NEW BEDFORD, MASSACHUSETTS

5180-03

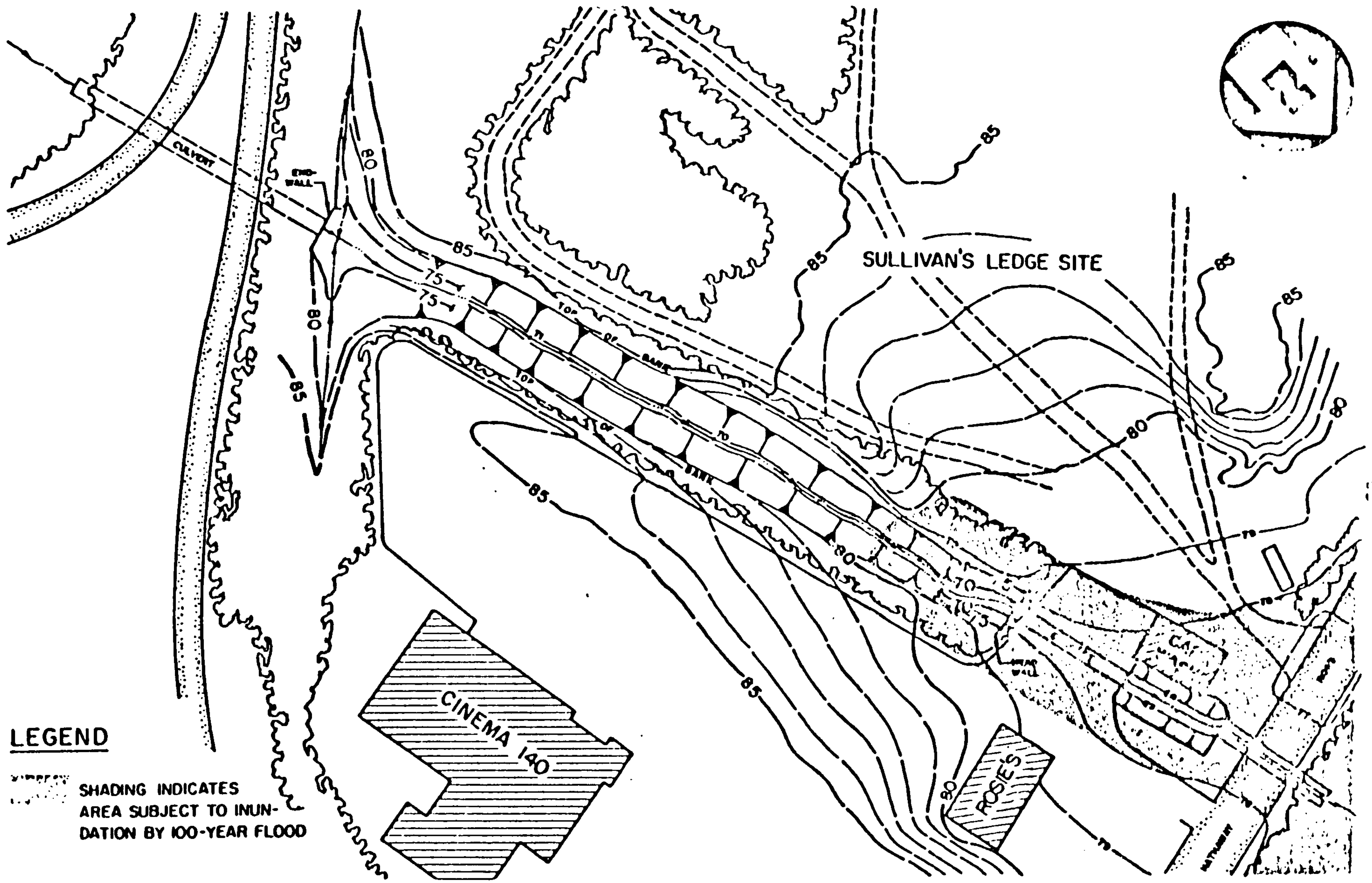
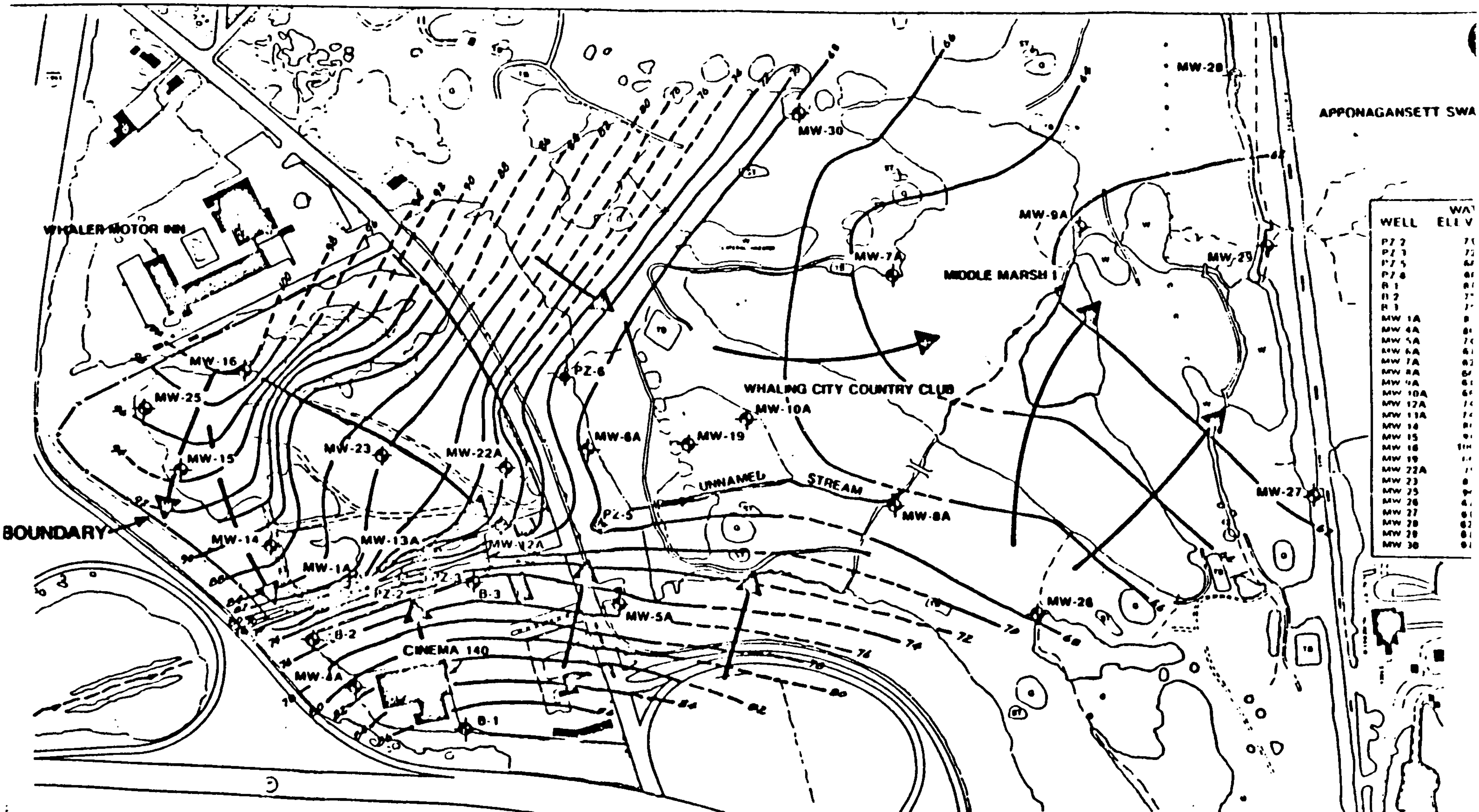


FIGURE 2

FLOOD STAGE MAP (100-YEAR FLOOD)
SULLIVAN'S LEDGE SITE, NEW BEDFORD, MA
SCALE 1" = 100'

Delineation of 100-year Flood Plan



URS ARE BASED UPON GROUNDWATER MEASUREMENTS ON OR ABOUT FEBRUARY 26, 1984. INTERPRETATIONS ASED ON AVAILABLE DATA, HOWEVER ACTUAL TIONS MAY VARY FROM THOSE INDICATED ABOVE

LEGEND

- BUILDING
- CONTROL POINT
- DRAINAGE
- FOOT BRIDGE
- GREEN
- POSS DRAINAGE
- SPOT ELEVATION
- GROUNDWATER SURFACE CONTOUR (DASHED WHERE INFERRED)
- INTERPRETIVE GROUNDWATER FLOW DIRECTION
- SAND TRAP
- TEE BOX
- TREES
- UNIMPROVED ROAD
- UTILITY POLE
- POND/IMPOUNDMENT
- PIEZOMETER LOCATION
- MONITORING WELL LOCATION

2 300 FEET

FIGURE

INTERPRETIVE GROUNDWATER SURFACE CONTOURS IN OVERBURDEN
SULLIVAN'S LEDGE SITE
NEW BEDFORD MASSACHUSETTS

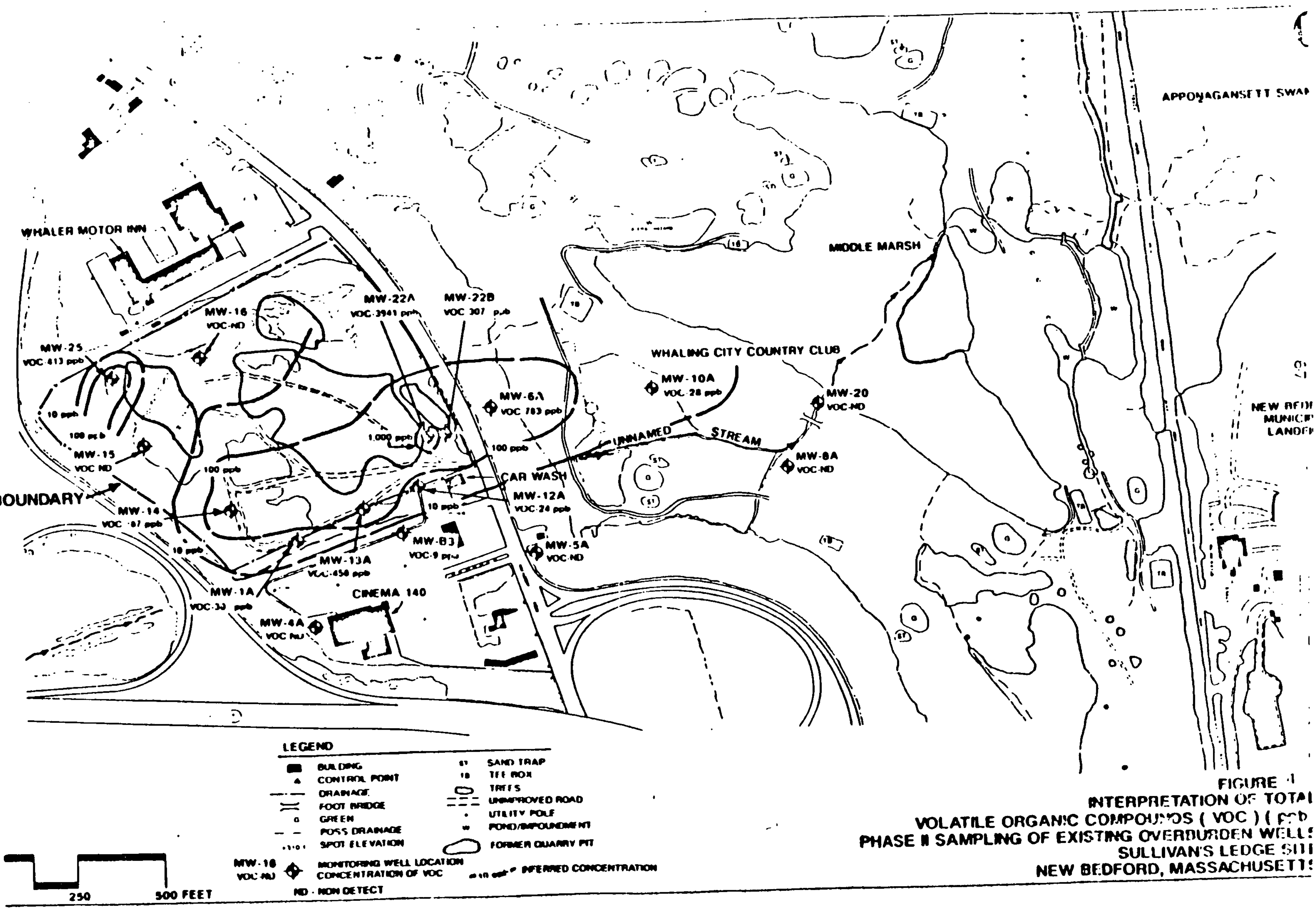


FIGURE 4
INTERPRETATION OF TOTAL
VOLATILE ORGANIC COMPOUNDS (VOC) (ppb)
PHASE II SAMPLING OF EXISTING OVERBURDEN WELLS
SULLIVAN'S LEDGE SITE
NEW BEDFORD, MASSACHUSETTS

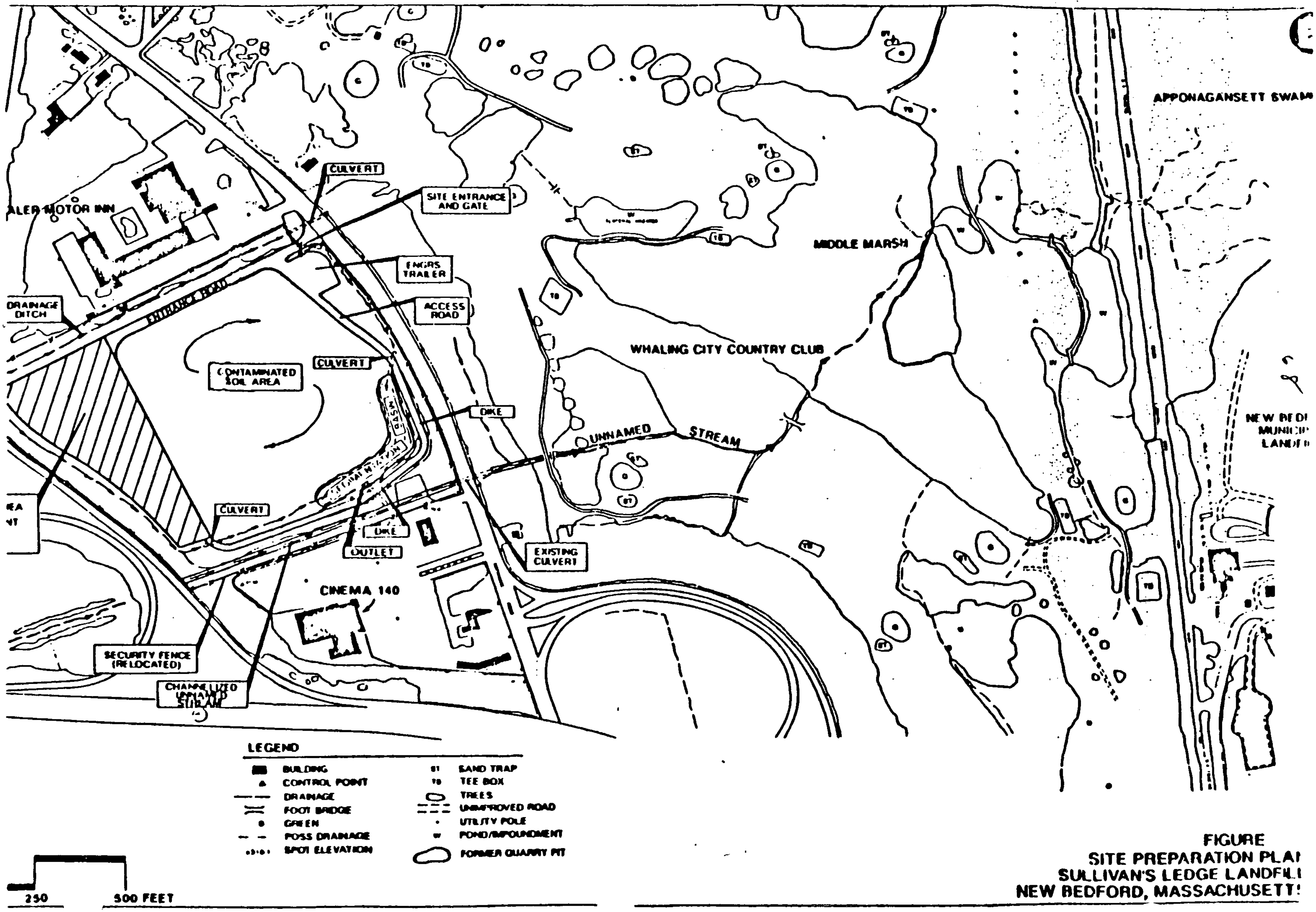


FIGURE
SITE PREPARATION PLAI
SULLIVAN'S LEDGE LANDFILI
NEW BEDFORD, MASSACHUSETT!

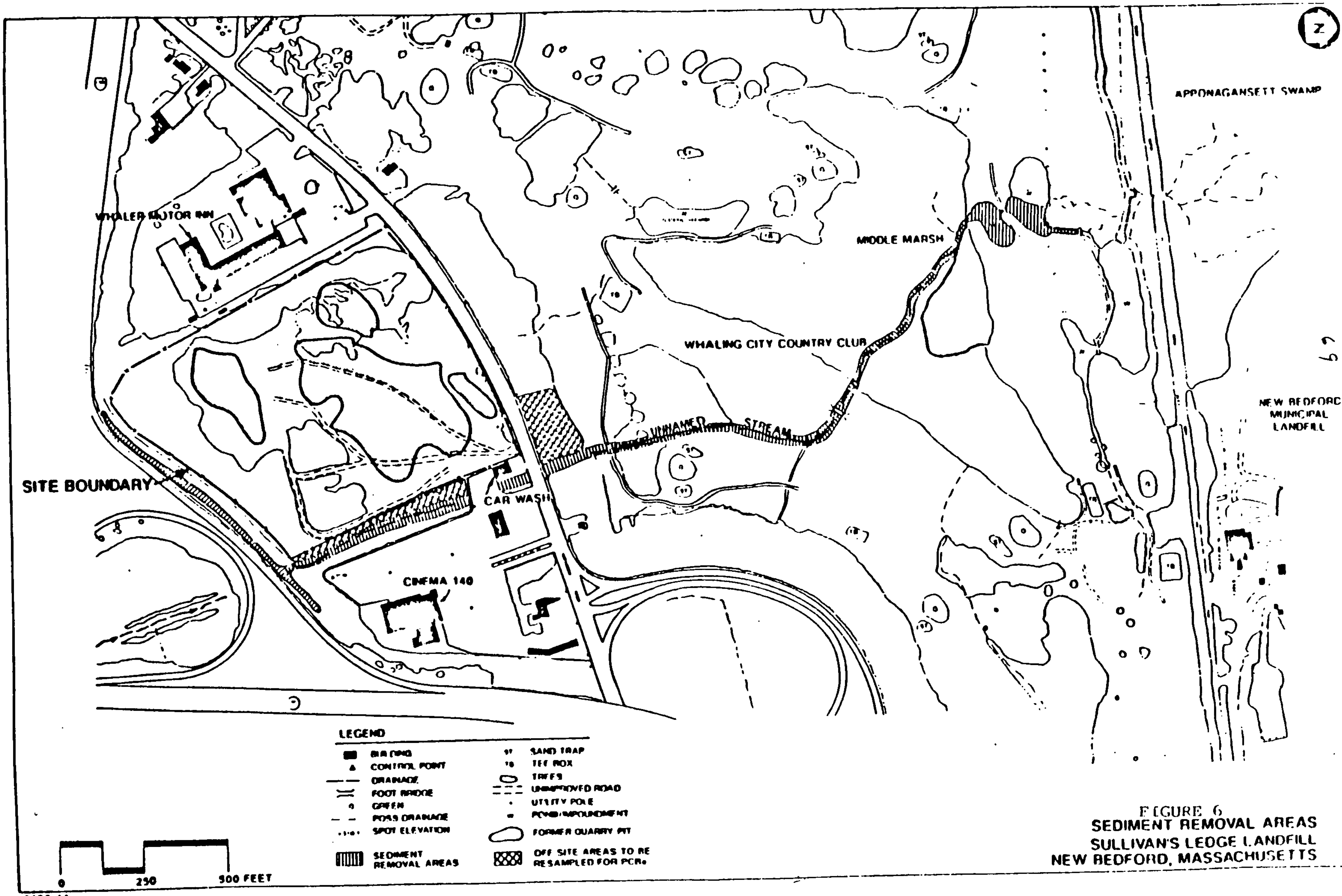


FIGURE 6
SEDIMENT REMOVAL AREAS
SULLIVAN'S LEDGE LANDFILL
NEW BEDFORD, MASSACHUSETTS

5180-11

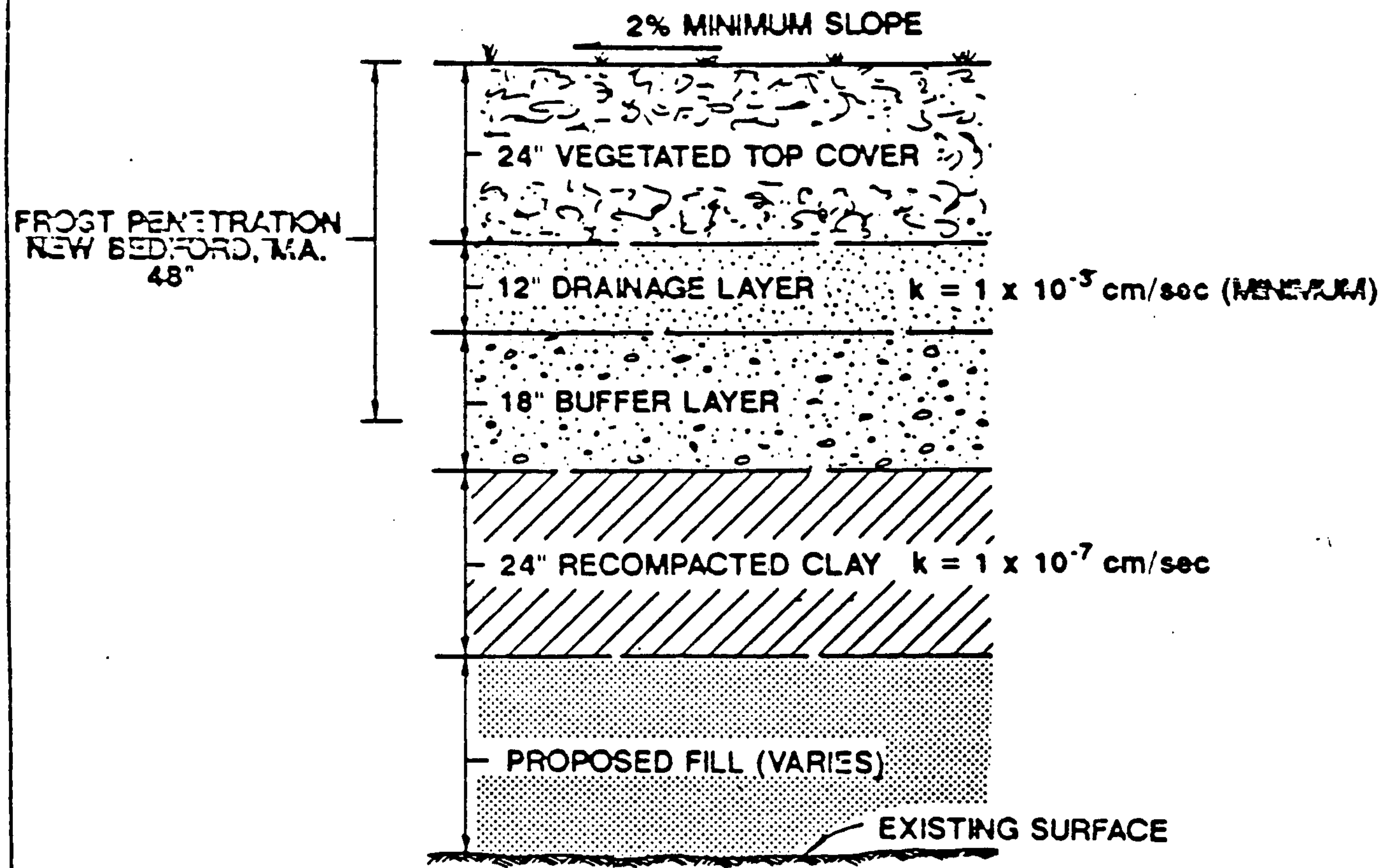


FIGURE 7
PROPOSED CAP DESIGN

SULLIVAN'S LEDGE SITE
NEW BEDFORD, MASSACHUSETTS

5780-11

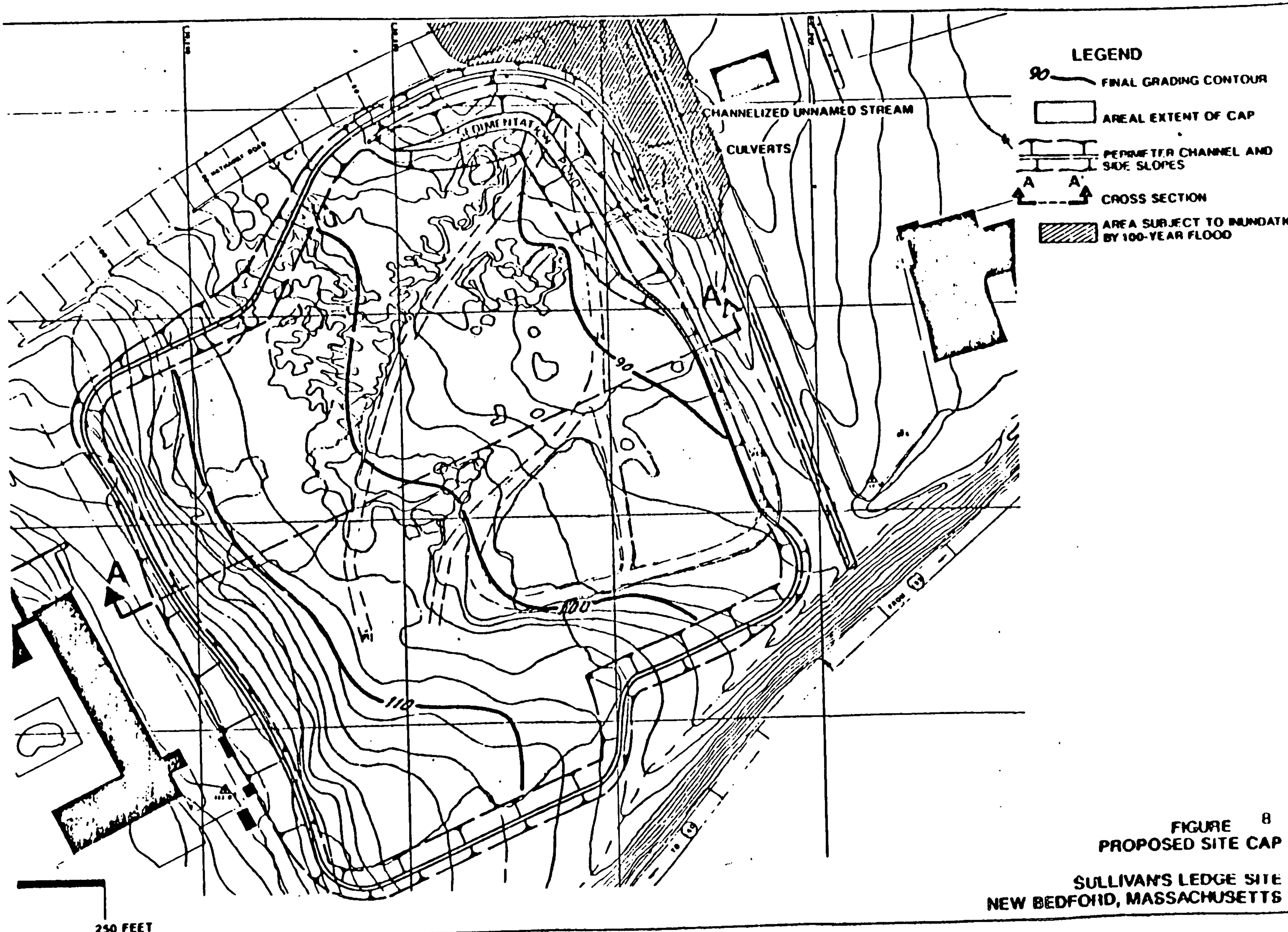


FIGURE 8
PROPOSED SITE CAP

SULLIVAN'S LEDGE SITE
NEW BEDFORD, MASSACHUSETTS

TABLE 1

INDICATOR COMPOUNDS
SULLIVAN'S LEDGE SITE
NEW BEDFORD, MASSACHUSETTS

VOLATILE ORGANICS

2-butanone
4-methyl-2-pentanone
benzene
toluene
xylenes
ethylbenzene
chlorobenzene
1,2-dichloroethane
trans-1,2-dichloroethene
trichloroethene
vinyl chloride
chloroform
methylene chloride
styrene

SEMI-VOLATILE ORGANICS

Acid Extractables

Pentachlorophenol

Base/Neutral Extractables

bis(2-ethylhexyl)phthalate
polycyclic aromatic hydrocarbons (PAHs)
- acenapthane
- acenapthylene
- anthracene
- benzo(a)anthracene
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- benzo(g,h,i)perylene
- benzo(a)pyrene
- chrysene
- dibenzo(a,h)anthracene
- fluoranthene
- fluorene
- ideno(1,2,3-cd)pyrene
- phenanthrene
- pyrene
- naphthalene
- 2-methylnaphthalene
- 2-chloronaphthalene

1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
1,2,4-trichlorobenzene
n-nitrosodimethylamine
n-nitrosodiphenylamine
bis(2-chloroethyl)ether
dibenzofuran

Table 1 continued

INDICATOR COMPOUNDS
SULLIVAN'S LEDGE SITE
PAGE TWO

PESTICIDES/PCBs

PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260

INORGANICS

barium
copper
iron
lead
manganese
mercury
nickel
silver
sodium
zinc

TABLE 2

SUMMARY OF SOURCE CONTROL ALTERNATIVES SCREENING
SULLIVAN'S LEDGE SITE
NEW BEDFORD, MASSACHUSETTS

ALTERNATIVE DEVELOPMENT (SECTION 9.1)		ALTERNATIVE(S) ELIMINATED DURING COMPATIBILITY (SECTION 9.2)	ALTERNATIVES ELIMINATED DURING SCREENING OF (SECTION 9.3)	ALTERNATIVES REMAINING FOR DETAILED EVALUATION
SC-Soils-1	No Action	SC-Soils-1*		SC-1*
SC-Soils-2	Containment			SC-Soils-2
SC-Soils-3	In-situ Vitrification			SC-Soils-3
SC-Soils-4	Off-site RCRA Landfill	SC-Soils-4		
SC-Soils-5	On-site Incineration			SC-Soils-5
SC-Soils-6	Off-site Incineration		SC-Soils-6	
SC-Soils-7	KPEG/Thermal Aeration		SC-Soils-7	
SC-Soils-8	Solidification/on-site Disposal			SC-Soils-8
SC-Pits-1	No Action	SC-Pits-1*		
SC-Pits-2	Containment		SC-Pits-2	
SC-Pits-3	In-situ Biological		SC-Pits-3	
SC-Pits-4	Off-site RCRA Landfill		SC-Pits-4	
SC-Pits-5	Solidification/Off-site Landfill		SC-Pits-5	
SC-Pits-6	On-site Incineration		SC-Pits-6	
SC-Pits-7	Off-site Incineration		SC-Pits-7	
SC-Sed-1	No Action	SC-Sed-1*		
SC-Sed-2	Containment		SC-Sed-2	
SC-Sed-3	In-situ Biological		SC-Sed-3	
SC-Sed-4	Excavation/On-site Disposal		SC-Sed-4	
SC-Sed-5	Solidification/On-site Disposal			SC-Sed-5
SC-Sed-6	On-site Incineration			SC-Sed-6

*Note: SC-Soils-1, SC-Pits-1, SC-Sed-1, Combined to SC-1

TABLE 2 continued

SUMMARY OF MANAGEMENT OF MIGRATION ALTERNATIVES SCREENING
SULLIVAN'S LEDGE SITE
NEW BEDFORD, MASSACHUSETTS

ALTERNATIVE DEVELOPMENT (SECTION 9.1)		ALTERNATIVE ELIMINATED DURING COMPATIBILITY (SECTION 9.2)	ALTERNATIVES ELIMINATED DURING SCREENING OF (SECTION 9.3)	ALTERNATIVES REMAINING FOR DETAILED EVALUATION
MM-1	No Action			MM-1
MM-2	Containment	MM-2		
MM-3	Passive Collection			MM-3
MM-4	Groundwater Diversion		MM-4	
MM-5	Active Collection - Overburden and Bedrock Groundwater			MM-5
MM-6	Action Collection - Deep Bedrock Fracture Groundwater		MM-6	

Table 3 - ARARs

REQUIREMENT	REQUIREMENT SYNOPSIS/CONSIDERATION
Safe Drinking Water Act Regulations, 40 CFR Part 141, Subpart B	Establishes MCLs for public drinking water supplies. These relevant and appropriate regulations will be waived because of technical impracticability.
TSCA PCB Disposal Requirements, 40 CFR §§ 761.60	Disposal of soils and sediments with PCBs over 50 ppm, must be by incinerator or equivalent alternative method, or chemical waste landfill. Remedy will result in chemical waste landfill containing existing wastes which have been previously landfilled on site and solidified soils and sediments. Some requirements of chemical waste landfill which are not necessary to protect against risk of injury to health or environment will be waived under the waiver provisions of the TSCA regulations.
RCRA Land Disposal Regulations, 40 CFR § 268 Subpart C	These regulations are not applicable because solidified soils are not expected to contain characteristic or listed hazardous waste.
RCRA Minimum Technology Regulations, 40 CFR § 264.300	These regulations establish standards for new or replacement landfills, or lateral expansions of landfills, including double liner and leachate collection. Not applicable because remedy does not involve creation of new or replacement landfill, or lateral expansion of landfill. Double liners are not relevant and appropriate because it is technically infeasible to construct a double liner separating wastes in quarry pits from the groundwater. Remedy will comply with leachate collection requirements, except inappropriate length of operation requirements.

Surface Water Discharge Regulations, 40 CFR §§ 122, promulgated pursuant to Clean Water Act	Applicable to discharge of groundwater treatment system effluent. If effluent is discharged to surface waters, regulations will be attained through compliance with state water quality standards, and monitoring of discharge.
Pretreatment Regulations for Indirect Discharges to POTWs, 40 CFR Part 403	These regulations control the discharge of pollutants into POTWs, including specific and general prohibitions. If groundwater from passive collection system is discharged to sewer after New Bedford secondary treatment plant becomes operational, these regulations will be applicable, and the remedy will comply through pretreatment.
Discharge of Dredged and Fill Materials Regulations, 40 CFR §§ 230, promulgated under Section 404 of Clean Water Act	This regulation applies to the use of fill material in stream and wetlands. Remedy will comply because there is no practicable alternative having a less adverse impact on aquatic organisms, and steps will be taken to minimize adverse impacts, such as sedimentation basins, baffles and stream and wetlands restoration.
National Ambient Air Quality Standards (NAAQS), 40 CFR § 50.6, promulgated pursuant to Clean Air Act	These applicable regulations set primary and secondary 24-hour concentrations for emissions of particulate matter. Fugitive dust from excavation, treatment, solidification and disposal will be maintained below these standards, by dust suppressants if necessary.
OSHA Worker Safety Regulations, 29 CFR Part 1910	These applicable regulations contain safety and health standards that will be met during all remedial activities, including construction of the cap and installation of groundwater wells.
Department of Transportation Regulations for Transport of Hazardous Materials, 49 CFR Parts 107, 171.1-172.558	Requirements for transporting hazardous materials off-site will be met.

Massachusetts DEQE Drinking Water Regulations, 310 CMR 22	Establishes maximum contaminant levels for public drinking water supplies. Attainment of this relevant and appropriate regulation will be waived because of technical impracticability.
Massachusetts MDWPC Groundwater Standards, 314 CMR 6	Establishes minimum groundwater criteria. Attainment of this relevant and appropriate regulation will be waived because of technical impracticability.
Massachusetts DEQE Hazardous Waste Closure and Post Closure Regulations, 310 CMR §§ 30.580 and 30.590	The closure and post closure regulations are relevant and appropriate. The cap will be constructed and maintained and monitoring will be performed in compliance with these requirements.
Massachusetts DEQE Hazardous Waste Location Regulations, 310 CMR 30.700	The cap will be constructed outside the 100-year floodplain in accordance with these relevant and appropriate regulations.
Massachusetts DEQE Hazardous Waste Groundwater Protection Regulations, 310 CMR 30.660	The groundwater monitoring requirements are relevant and appropriate. Semi-annual monitoring for specified indicators of hazardous constituents are required to verify the effectiveness of closure. The remedy will comply with the substantive requirements, except that monitoring will be quarterly for the first three years and the frequency will be reevaluated thereafter.
Massachusetts DEQE Hazardous Waste Landfill Regulations, 310 CMR 30.620	Landfill requirements include double liners, leachate collection systems, and technical requirements for cap. Double liner requirements are not appropriate to this site, since groundwater below landfill will remain contaminated. Other requirements are relevant and appropriate and will be attained, except that leachate collection may be terminated prior to 30 years after closure, if target levels for the passive system have been achieved.
Massachusetts MDWPC Supplemental	RCRA facilities subject to surface water discharge requirements must also comply

Requirements for Hazardous Waste Management Facilities, 314 CMR 8	with DEQE regulations regarding location, technical standards for landfills, closure and post-closure, and management standards.
Massachusetts MDWPC Surface Water Quality Standards, 314 CMR 4	Surface waters must be free from pollutants which are present in toxic amounts, which exceed recommended limits for most sensitive use, or which exceed safe exposure levels. These applicable standards will be attained during remedial design and operation of the treatment system.
Massachusetts DEQE Wetlands Protection Regulations, 314 CMR 10	This applicable regulation sets performance standards for dredging banks, vegetated wetlands, and lands under water. The remedy and mitigative measures will attain these standards.
Massachusetts DEQE Ambient Air Quality Standards, 310 CMR 6, and DEQE Air Pollution Control Regulations, 310 CMR 7	This applicable regulation sets primary and secondary standards for emissions of particulate matter. These standards will be met during implementation.
Massachusetts Right to Know Regulations	Informational requirements of these regulations will be attained during implementation.

<u>Standards to be Considered</u>

Executive Orders 11990 and 11988	These executive orders regarding protection of floodplains and wetlands were considered in the evaluation and development of remedial alternatives . The soil and sediment excavation and stream lining will be conducted in such a manner to avoid or minimize adverse impacts.
Interim Sediment Quality Criteria	Interim sediment quality criteria were considered in establishing target levels for cleanup of sediments.