FORMER HUDSON MANUFACTURED GAS PLANT SITE - WATER STREET

Hudson (C), Columbia County, New York
NYSDEC Site No. 4-11-005

PROPOSED REMEDIAL ACTION PLAN
Operable Unit No. 1

January 2001

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

and

Emergency & Remedial Response Division
United States Environmental Protection Agency

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (NYSDEC) in consultation with the New York State Department of Health, is jointly proposing with the US Environmental Protection Agency (EPA), a remedy to address the potential threat to human health and significant threat to the environment created by the presence of hazardous waste and hazardous substances at Operable Unit 1 (OU #1) of the Former Hudson Manufactured Gas Plant (MGP) Site, a NYSDEC class 2 inactive hazardous waste disposal site. As more fully described in Sections 3 and 4 of this document, this site is the location of a former coal gasification plant whose operation has resulted in the on-site disposal of hazardous waste and hazardous substances consisting of coal tar and its various constituents. Consequently, soil, groundwater and Hudson river embayment #1 sediments at the site are contaminated with benzene, toluene, ethylbenzene and xylene (BTEX) and polycyclic aromatic hydrocarbons (PAHs) including non aqueous phase liquids (NAPL). Some of these contaminants were released or have migrated from the site to embayment #1 (see Figure 2) of the Hudson River, where floating product has been observed. These operations resulted in the following potential threat to the public health and significant threat to the environment:

- Soil contaminated by NAPL including BTEX and inorganics above Standards, Criteria, and Guidance values (SCGs)/Applicable or Relevant and Appropriate Requirements (ARARs).

- Groundwater contamination resulting from migration of NAPL and other contaminants from the subsurface soil.

- Sediment impacts resulting from migration of contaminants from the site and direct discharge of MGP byproducts including coal tar to an embayment of the Hudson River.

These contaminants have caused significant environmental damage to the embayment resulting in significant acute or chronic adverse effects to fish, shellfish, crustacea and wildlife, and have the potential to adversely affect human health.

In order to eliminate or mitigate the potential threat to the public health and significant threat to the environment that the hazardous waste and hazardous substances disposed at the Former Hudson MGP site have caused, the following remedy is proposed:

- Excavation and removal of approximately 10,000 cubic yards of contaminated soil and coal tar from former gas holders and other locations determined to be source areas, including pipes and bedding materials adjacent to embayment #1 (see Figures 3 and 4).

- Removal of the top 10 feet of contaminated sediments from embayment #1 (see Figure 4). If impacted materials are visually observed beyond the proposed depth of excavation, these materials would be removed, to the extent feasible.

- Replacement of sediment to pre-removal contours, with the upper 3 feet restored with materials similar to the native materials removed, to provide a suitable habitat for benthic invertebrate colonization. The upper 3 feet sediment stratum will be sampled to verify and ensure that the replaced sediments have a total PAH value of less that 4 parts per million (ppm).

- Installation of collection wells (if determined necessary) in the areas of the former gas holders for the recovery of any residual DNAPL that may not be removed by excavation.

- Deed restrictions to ensure non-residential use of the property, prevent use of groundwater and provide notification to future site construction workers regarding possible MGP residuals in the subsurface. In addition, a long-term monitoring plan would be implemented.

The proposed remedy, discussed in detail in Section 7 of this document, is intended to attain the remediation goals selected for this site in Section 6 of this Proposed Remedial Action Plan (PRAP), in conformity with applicable SCGs/ARARs.

This PRAP identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The NYSDEC will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The NYSDEC is issuing this PRAP as a component of the citizen participation plan developed pursuant to the New York State Environmental Conservation Law and 6 NYCRR Part 375. EPA is issuing this document jointly with the NYSDEC as part of its public participation responsibilities under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan.

For EPA, this document describes the response actions considered for the site and identifies the preferred response action with the rationale for this preference. EPA's

preferred response action is formally referred to as a removal action.

This document is a summary of the information that can be found in greater detail in the Site Investigation Summary Report {comparable to a Remedial Investigation (RI)} and the Engineering Evaluation/Cost Analysis (EE/CA) {comparable to the standard Feasibility Study (FS)} and other relevant reports and documents, available at the document repositories.

To better understand the site and the investigations conducted, the public is encouraged to review the project documents at the following repositories:

Mr. F. Reese
Hudson Public Library
400 State Street
Hudson, New York 12534
Phone #: (518) 828-1792
Hours of Operation: Tues, Wed, Thurs, 9am - 6 pm, Sat 9am -1 pm.

Mr. Eric Hamilton
NYSDEC, Region 4 Headquarters
1150 Westcott Road
Schenectady, NY 12306-2014
(518) 357-2373
Hours of Operations: 9am - 4pm

U.S. EPA Region II Removal Records Center
2890 Woodbridge Avenue, Bldg 205
Edison, New Jersey 08837
(732) 906-6877
Hours of Operation: Mon - Fri, 8:30am - 4:30pm

The NYSDEC and EPA seek input from the community on all PRAPs. A public comment period has been set from February 1, 2001 to March 2, 2001 to provide an opportunity for public participation in the remedy selection process for this site. A public meeting is scheduled for February 13, 2001 at the City Hall in the City of Hudson beginning at 7PM.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments can be submitted on the PRAP.

The NYSDEC and EPA may modify the preferred alternative or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and responses provided in the Responsiveness Summary section of the Record of Decision (by the NYSDEC) or in an Action Memorandum (by the EPA). The Record of Decision is the NYSDEC's final selection of the remedy for this site. Written comments may be sent to:

Amen M. Omorogbe, P.E.
Project Manager
NYSDEC
Division of Environmental Remediation
Bureau of Western Remedial Action
50 Wolf Road
Albany, NY 12233-7010

Phone #: (518) 457-4343

Information regarding EPA activities at the site may be obtained from:

James S. Haklar, Ph.D., P.E.
On-Scene Coordinator
U.S. EPA Region II
2890 Woodbridge Avenue, Bldg 209
Edison, NJ 08837

Phone #: (732) 321-6730

SECTION 2: SITE LOCATION AND DESCRIPTION

The site is located on Water Street on the east bank of the Hudson River in the City of Hudson, Columbia County, New York (see Figure 1). The site consists of approximately two acres of land on two lots identified as lots 15 and 16.2 on Figure 2, which are divided by Water Street. The former coal gasification plant was located on the eastern parcel. The site is bounded on the north by a vacant lot, formerly an inactive oil storage facility (Best Oil Terminal), on the east by CSX Transportation, Inc rail lines; on the south by a CSX maintenance yard and on the west by the Hudson River. The former manufactured gas plant (MGP) was operated on the eastern half of the site from approximately 1853 to 1949. This portion of the site, and the former plant building are currently used by SBD Warehouse/Dunn Builders Supply as a warehouse for lumber and building supplies.

Operable Unit No. 1, which is the subject of this PRAP, consists of the former MGP site (lots 15 and 16.2), including embayment #1of the Hudson River. An Operable Unit represents a portion of the site which can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. The remaining operable unit for this site is Operable Unit 2, which includes Hudson River and embayment #2 sediments, which are potentially impacted by migration of on-site contaminants resulting from the operation of the former MGP.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The MGP was a facility where gas for lighting and heating homes and businesses was manufactured. The gas was produced either by a process which heated coal, or from a combination of coal, oil and water called the "carburetted water-gas" process. A coal gasification plant was operated on the eastern portion of the former Hudson MGP site from approximately 1853 to 1949.

On-site disposal of MGP by-products, including coal tar, from the operation of the plant has resulted in the contamination of soil and groundwater, as well as the adjacent embayment #1 of the Hudson River. These media were impacted through the combination of leaks from storage and processing facilities, including gas holders, and from direct discharge to embayment #1.

3.2: Remedial History

In July 1986, the Department was notified regarding an oil spill and sheens in embayment #1 on the east bank of the Hudson River, adjacent to the site. In response, the NYSDEC Oil Spill Program excavated and stockpiled approximately 2,000 cubic yards (cy) of impacted soil from the riverbank, embayment #1 and from a former 20,000 cubic-foot brick-

lined gas holder foundation located east of Water Street.

The Department subsequently requested that the EPA conduct a CERCLA removal action at the site in 1993, which lead to the Niagara Mohawk Power Corporation (NMPC) entering into a consent order with EPA in 1995. Under this consent order, NMPC removed and disposed of the stockpiled material and deployed, and maintains oil absorbent booms near embayment #1. The consent order also required NMPC to conduct a site investigation and evaluate cleanup alternatives for the site. The Department listed the site on the Registry of Inactive Hazardous Waste Sites, as a class 2 site, in 1998. A remedial investigation for a second operable unit (OU 2), to address potential Hudson River sediment impact is currently being performed by NMPC.

SECTION 4: SITE CONTAMINATION

To evaluate the contamination present at the site and to evaluate alternatives to address the significant threat to human health and the environment posed by the presence of hazardous waste and hazardous substances, NMPC recently conducted a Remedial Investigation/Feasibility Study (RI/FS) the results of which can be found in the January 2001 EE/CA report.

4.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site.

The RI was conducted in four phases. The first phase was conducted in fall of 1995, the second phase between August and September of 1996, the third phase was conducted during the summer of 1997 while the forth phase was conducted during the summer of 1999. A report entitled Site Investigation Summary Report, Hudson (Water Street) Site, Hudson, New York, dated January 2001 has been prepared which describes the field activities and findings of the RI in detail.

The RI included the following activities:

- Installation of soil borings for collection and analysis of soil samples.
- Installation of sediment borings for sediment samples collection and analysis.
- Installation of monitoring wells for collection and analysis of groundwater samples.
- Installation of test pits for evaluation of physical properties of the soils.

To determine which media (soil, groundwater, sediment) are contaminated at levels of concern, the RI analytical data was compared to Federal ARARs and State SCGs. A detail explanation of these ARARs/SCGs can be found in the January 2001 EE/CA. Groundwater, drinking water and surface water SCGs identified for the former Hudson MGP site are based on NYSDEC Ambient Water Quality Standards and Guidance Values and Part V of New York State Sanitary Code. For soils, NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 provides soil cleanup guidelines

for the protection of groundwater, background conditions, and health-based exposure scenarios. In addition, for soils and sediments, site specific background concentration levels can be considered for certain classes of contaminants. Guidance values for evaluating contamination in sediments are provided by the NYSDEC "Technical Guidance for Screening Contaminated Sediments" (January 1999).

Based on the RI results, in comparison to SCGs/ARARs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized below. More complete information can be found in the Site Investigation Summary Report and the EE/CA.

Chemical concentrations are reported in parts per billion (ppb) and parts per million (ppm). For comparison purposes, where applicable, SCGs are provided for each medium.

4.1.1: Site Geology and Hydrogeology

Site investigations identified the site geology as consisting of both fill and native materials. Bedrock has been characterized as a gray weathered shale and identified at a depth varying from approximately 13.5 to 72 feet below sea-level. On top of the bed rock is a gray clay deposit, up to approximately 15 feet thick. Overlying this unit is a deposit of clay/silt. The upper unit consists of coarse grained porous fill materials consisting of sands and gravel with varying fractions of debris.

4.1.2: Nature of Contamination

As described in the aforementioned reports, many soil, groundwater and sediment samples were collected at the site to characterize the nature and extent of contamination. The main categories of contaminants which exceed their SCGs/ARARs are polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) and inorganics (metals).

The PAHs present at the site include both carcinogenic (cPAHs) and non-carcinogenic compounds. The cPAH contaminants of concern are chrysene, dibenzo(a,h)anthracene, benzo(b)fluoranthene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, and Indeno(1,2,3-cd)pyrene. The VOC contaminants of concern include benzene, toluene, ethylbenzene and xylene (BTEX). Inorganic compounds present at the site include but are not limited to, arsenic, chromium, mercury and zinc.

4.1.3: Extent of Contamination

Table 1 summarizes the extent of contamination for the contaminants of concern in soil, groundwater and embayment sediments and compares the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

Soil

Subsurface Soil

The soil at the former Hudson MGP site is contaminated with the various chemical constituents related to the gas manufacturing processes that took place at the site. Certain

areas of the site including the former gas holders contain coal tar and non aqueous phase liquids (NAPL) and are considered the source areas. Coal tar is associated with high concentrations of PAHs and BTEX and is the source of the NAPLs.

Individual PAHs (including cPAHs) were observed in the subsurface soil at concentrations ranging from less than one to over 270 ppm and VOCs constituents were detected at concentrations ranging from non detect to 1,300 ppm. NAPL was observed in the areas where former MGP subsurface structures were located in the eastern portion of the site. The NAPL was observed in the gray clay/fill unit generally occurring at a depth of up to 20 feet below the ground surface (bgs). There is no evidence that the NAPL has penetrated through the gray clay unit.

Inorganic constituents of concern at the site in subsurface soil include arsenic, chromium, lead and cyanide, with concentrations ranging from non detect to 1,340 ppm (for zinc).

Surface Soil

Surface soil contaminant concentrations were generally low, below levels of concern, with the exception of a location in the southern portion of the site, near the south side of the SBD Warehouse, that exhibit levels of individual carcinogenic PAHs above levels of concern. Concentration of individual cPAHs ranged from non detect to 5.6 ppm for chrysene while concentrations of inorganic constituents ranged from one to 1,370 ppm for lead.

Groundwater

Shallow groundwater at this site is recharged by precipitation, which forms a localized groundwater mound that is generally centered in the eastern portion of the site, in the area of the former gas holders. With the exception of the location of the former gas holders, no floating oil products or DNAPLs have been observed in site groundwater.

MGP byproducts including BTEX and PAHs have been detected in some monitoring wells at relatively low concentrations. These byproducts were generally detected at the same locations where NAPLs were observed, near the former gas holders. VOCs were detected at concentrations ranging from non detect to 340 ppb while individual PAHs were detected at concentrations ranging from not detected to over 2,000 ppb. There is no indication of off-site groundwater impacts based on downgradient monitoring well results.

Sediments

MGP related contaminants have been detected in the sediments at Hudson River embayment #1, which is adjacent to the site and is believed to be the location of discharges from the plant during operation. Coal tar and NAPL have been observed in the sediment at embayment #1. VOCs were also detected in the sediment of embayment #1 at concentrations ranging from 0.006 to over 500 ppm. Concentrations of individual PAHs ranged from not detect to over 2,000 ppm with total PAHs of over 6,000 ppm. Inorganics were detected at concentrations ranging from not detect for some constituents to approximately 59 ppm (for chromium).

4.2: Summary of Human Exposure Pathways and Human Health Assessment:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the health risks can be found in Section 3 of the Site Investigation report dated January 2001.

An exposure pathway is the manner by which an individual may come in contact with a contaminant. The five elements of an exposure pathway are 1) the source of contamination; 2) the environmental media and transport mechanisms; 3) the point of exposure; 4) the route of exposure; and 5) the receptor population. These elements of an exposure pathway may be based on past, present, or future events.

Potential pathways which are known to or may exist at the site include:

- Oral, dermal, and inhalation exposure to surface soil by commercial workers and recreational users.

- Oral, dermal, and inhalation exposure to subsurface soil by on-site construction workers.

Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one-in-ten-thousand excess cancer risk"; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants. For non-cancer health effects, a "hazard index" (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a non-cancer HI is that a threshold level (measured as an HI of less than 1) exists below which non-cancer health effects are not expected to occur. The estimated cancer risks for the receptors identified previously are within or below the EPA target range of 10^{-6} to 10^{-4}. In addition, the hazard indices are less than 1.

4.3: Summary of Environmental Exposure Pathways

This section summarizes the types of environmental exposures and ecological risks which may be presented by the site. The Fish and Wildlife Impact Assessment included in the Site Investigation Report, dated January 2000 presents a more detailed discussion of the potential impacts from the site to fish and wildlife resources. The following pathways for environmental exposure and/or ecological risks have been identified:

Analytical results from sediment samples obtained from the adjacent Hudson river embayment #1 indicate that the embayment and possibly the Hudson River has been, and continues to be, impacted by contamination resulting from the operation of the former Hudson MGP site. Both site soil and groundwater have been impacted due to operation of the former MGP. The criteria-specific analysis which compares the concentrations measured in the site data with numeric criteria provides an assessment of potential impact to sediment dwelling communities.

As discussed previously, impact to the Hudson River will be addressed under Operable Unit 2.

SECTION 5: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

As indicated previously, in July 1993, after having discovered an oil sheen at the Hudson River embayment #1, the NYSDEC requested the EPA conduct a CERCLA Removal Action at the site which lead to NMPC entering into a consent order with USEPA in 1995.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10 and through EPA's removal process. The overall remedial goal is to meet all SCGs/ARARs and be protective of human health and the environment. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste and hazardous substances disposed at the site through the proper application of scientific and engineering principles.

The goals selected for this site are:

- Eliminate, to the extent practicable, human exposures to the contaminants present at the site.
- Eliminate to the extent practicable, the migration of contaminants from on-site soils and source areas, to the site groundwater and the sediments in the embayment #1.
- Eliminate, to the extent practicable, the exposure of fish and wildlife to contaminants within the embayment #1 and restore embayment sediments.
- Eliminate to the extent practicable, off-site migration of contaminants of potential concern within the site groundwater.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost effective, comply with other statutory laws and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the former Hudson MGP site were identified, screened and evaluated in the report entitled EE/CA dated January 2000.

A summary of the detailed analysis follows. As presented below, the time to implement reflects only the time required to perform the remedy, and does not include the time required to design the remedy, procure contracts for design and construction or to negotiate with responsible parties for implementation of the remedy.

7.1: Description of Remedial Alternatives

The potential remedies for Operable Unit 1 are intended to address the contaminated soils, groundwater and sediments in embayment #1.

The cost to implement all Alternatives has been estimated using a discount rate of 5% for the initial investment over a 30 year period for site monitoring and maintenance.

Alternative 1: *No Action*

The No Action alternative (which, for this site, is actually a limited action) is developed to be used as a basis for comparison with other alternatives. It would require continued monitoring of existing monitoring wells and surface water within embayment #1. Deed restrictions would be instituted to restrict use of the site to non-residential use and minimize exposure to impacted subsurface soils. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

The cost to implement Alternative 1, based upon 30 years of operation and maintenance (O&M) has been estimated as follows:

Present Worth:	*$1,190,000*
Capital Cost:	*$ 22,000*
Annual O&M:	*$ 76,560*

Time to Implement: 3 months

Alternative 2: *Site Cover, In-situ treatment of sediment in embayment #1 and covering with rip rap.*

Under Alternative 2, a limited amount of contaminated surface materials would be removed while providing an asphalt cover. The sediment would be treated in-place with a solidification/stabilization agent and 2 feet of rip rap cover would be placed in embayment #1.

The components of Alternative 2 would include the following:

- Excavation and removal of the top six-inch layer of surface soil.
- Placement of a six-inch layer of fill material.
- Placement of a four-inch layer of asphalt cover to reduce infiltration.
- In-place solidification/stabilization (s/s) of the top 3 feet of sediment in embayment #1.
- Placement of 2 feet of rip rap cover over the treated sediment.
- Institutional Controls
- Long-term monitoring.

The cost to implement Alternative 2 has been estimated as follows:

Present Worth:	*$2,500,000*
Capital Cost:	*$1,500,000*
Annual O&M:	*$ 66,000*

Time to Implement: 12 to 18 months

Alternative 3: *Soil and Sediment removal and disposal.*

Under Alternative 3, source areas, where contaminant levels are the highest would be removed. Site investigations indicate that the majority of the source contamination in the subsurface soil is located within and around the areas of former plant subsurface structures including former gas holders. Areas adjacent to embayment #1 also contain source materials.

The major components of Alternative 3 would include:

- Excavation and removal of approximately 10,000 cubic yards (cy) of contaminated soils.
- Installation of DNAPL collection wells if determined necessary.
- Excavation and removal of the top 10 feet of contaminated sediments in embayment #1.
- Replacement of sediment with clean material to original contours and restoration of the upper 3 feet of sediment with materials similar to the native materials removed, to provide suitable habitat for benthic organisms. The upper 3 feet of sediment will be sampled to determine that the replaced sediments have a total PAH value of less that 4 parts per million (ppm).
- Institutional Controls
- Long-term monitoring.

The cost to implement Alternative 3 has been estimated as follows:

Present Worth:	*$22,400,000*
Capital Cost:	*$21,847,000*
Annual O&M:	*$ 36,000*

Time to Implement: 18 to 24 months

7.2 Evaluation of Remedial Alternatives

The criteria used to compare the potential remedial alternatives are defined in the regulation that directs the remediation of inactive hazardous waste sites in New York State (6 NYCRR Part 375). For each of the criteria, a brief description is provided, followed by an evaluation of the alternatives against that criterion. A detailed discussion of the evaluation criteria and comparative analysis is included in the EE/CA.

The first two evaluation criteria are termed threshold criteria and must be satisfied in order for an alternative to be considered for selection.

1. Compliance with SCGs/ARARs. This criterion addresses whether or not an alternative would meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes and requirements or provide grounds for invoking a waiver.

Alternative 1 (Limited Action) would not bring the site into compliance with SCGs/ARARs for soils, groundwater and sediments. The No Action alternative would not address continuous impact to site groundwater from

the contaminated materials in the soils, nor would it address contamination in embayment #1.

Alternative 2 would not address the major contaminant sources located below the proposed depth of excavation and therefore would not meet site SCGs/ARARs. Alternative 2 would leave source materials within the embayment #1 sediments with the potential for continuous impact to fish and other benthic organisms.

Alternative 3 also would not bring the site into total compliance with all SCGs/ARARs. While the bulk of the contaminants would be removed by excavating materials from the source areas, residual soil contaminant concentrations above SCGs/ARARs would remain at certain subsurface locations on site. There is however no known potential exposure pathways from residual contaminants that would be left in place at depth. The concentrations of contaminants in groundwater are expected to decrease through natural attenuation mechanisms with a potential to achieve SCGs/ARARs due to source material removal. While the majority of the impacted sediments would be removed from embayment #1, contaminants within the embayment would persist in excess of applicable standards. However, the depth of the material to cap the residual contaminants in place would mitigate continuous impact of the contaminants to benthic organisms.

2. Protection of Human Health and the Environment. This criterion assesses whether the alternatives are protective of human health and the environment. The evaluation focuses on how each alternative achieves adequate protection and describes how the alternative will reduce, control, or eliminate risks at the site through the use of treatment, engineering, or institutional controls.

Alternative 1 would not provide overall protection of human health and the environment. Contaminants within the former gas holders and other source areas would persist and continue to impact the environment. Floating products and other MGP related contaminants in the embayment #1 sediments would remain and continue to impact benthic organisms. Future users of the embayment would potentially be exposed to contaminants at the site.

Alternative 2 would provide protection to human health due to the proposed installation of an asphalt cover over the impacted soil areas. The installation of the asphalt cover would also lessen the migration of contaminants from subsurface soil to groundwater, thereby providing some protection to the environment. However, source area contamination would remain within the gas holders and other source areas (including the area adjacent to embayment #1) with the potential for migration of contaminants to the environment and embayment.

Alternative 3 would provide protection to both human health and the environment. The excavation and off-site treatment/disposal of impacted materials would result in the improvement of groundwater quality. Removal and disposal of the impacted sediments in embayment #1 would minimize exposure pathways and provide protection to future human users and the current and future benthic organisms.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. This criterion examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation period until the cleanup objectives have been met. The following factors are considered: potential for short-term risks to the affected community as a result of the alternative; potential impacts on workers, and the effectiveness and reliability of protective measures that would be taken; potential adverse environmental impacts of the alternative, and the effectiveness and reliability of protective measures that would be taken; and time until protection is achieved.

Alternative 1 would not result in additional short-term impacts to the workers, community and the environment since there is no additional action proposed under this Alternative.

Alternative 2 would have some short-term impacts upon the workers and the community due to limited work required to install an asphalt cover. Solidification/stabilization (s/s) of sediments would be expected to result in some resuspension of sediments within the embayment #1 and oil sheens on surface waters may result.

Alternative 3 may have short-term impacts on workers and the community requiring mitigating controls. Workers would be required to comply with all safety standards and regulations to prevent or minimize exposure to contaminants. Air monitoring would be performed during remedy implementation. If necessary, additional engineering controls such as dust control would be implemented to provide protection to the community and construction workers.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the controls intended to limit the risk, and 3) the reliability of these controls.

Alternative 1 would not provide any in long-term effectiveness and permanence as there would be no remedial action associated with this alternative. Current impacts to human health and the environment would continue to persist.

Alternative 2 would not provide any long-term effectiveness and permanence as source area contamination in subsurface soil would be left in place. The effectiveness and reliability of the solidification/stabilization process in the long-term and its ability to limit the risks of residual contaminants is not well documented.

Alternative 3 would provide the best long-term effectiveness and permanence by the treatment/disposal of the excavated contaminated soils and sediments. The excavation and removal of contaminated materials under Alternative 3 would remove the bulk of the waste present at the site and reduce the exposure pathway to potential future site users. Under this alternative, residual concentrations of contaminants would not pose a threat to any individual, except to

construction workers, and then only if they dig below the replaced materials and conduct work in violation of a site health and safety plan. The technologies proposed for Alternative 3 are proven and used routinely as reliable measures to control MGP-related contaminants.

5. Reduction of Toxicity, Mobility or Volume. This criterion evaluates the anticipated performance of specific treatment technologies. This evaluation addresses the statutory preference for selecting alternatives that employ treatment technologies to permanently and significantly reduce toxicity, mobility, or volume of wastes. Factors that are considered, as appropriate, include: the treatment or recycling processes the alternatives employ and the materials they would treat; the amount of hazardous materials to be destroyed or treated; the degree of reduction expected in toxicity, mobility, or volume; the degree to which the treatment would be irreversible; the type and quantity of residuals that would remain after treatment; and whether the alternative would satisfy the preference for treatment.

Alternative 1 does not incorporate a technology to reduce the toxicity, mobility or volume of the contamination.

Alternative 2 does not involve treatment of soils, sediment nor groundwater, therefore, the toxicity and volume of the contaminants would not be reduced. However, the alternative would provide reduction of mobility for both soils and sediment due to the installation of an asphalt cover over the site and solidification/stabilization of the sediment in embayment #1.

Alternative 3 would provide significant reduction in the toxicity, mobility and volume of contaminants at the site. Approximately 10,000 cubic yards of contaminated soils and approximately 5,000 cubic yards of impacted sediments in embayment #1 would be excavated for off-site treatment and/or disposal.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, etc.

Alternative 1 would be easily implemented since there are no active remedial activities involved.

Alternative 2 would be easily implemented for the soils, but would require an increased level of response compared to Alternative 1. Construction of an asphalt cover over the impacted soil area would be technically feasible and easy to implement. The labor, equipment and materials necessary to construct the cover are readily available.
In-situ solidification/stabilization of sediment in embayment #1 may not be technically feasible due to difficulties in mixing solidification/stabilization agents in-situ and containing suspended sediments during mixing (as well as the resulting increase in volume of sediments).

Alternative 3 could be implemented but would require a greater level of effort than Alternatives 1 and 2. Excavation and removal of impacted soils and sediments including installation of sheet pile to separate the river from embayment #1 are technically feasible remedial construction activities. Permits (or permit equivalencies) would be required to accomplish this alternative, for activities such as dredging and filling in navigable waters and for coastal zone erosion management. The labor, equipment and materials necessary to accomplish this remedy are readily available.

7. Cost. Capital and operation and maintenance costs are estimated for each alternative and compared on a present worth basis. Although cost is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the remaining criteria, cost effectiveness can be used as the basis for the final decision. The costs for each alternative are presented in Table 2. This table illustrates that, in terms of both capital cost and present worth, Alternative 3 is the most costly alternative while Alternative 1 is the least costly.

This final criterion is considered a modifying criterion and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. **Community Acceptance** - Concerns of the community regarding the supporting documentation and the Proposed Remedial Action Plan will be considered by the NYSDEC and EPA after the close of the public comment period. A "Responsiveness Summary" will be prepared that describes public comments received and the manner in which the NYSDEC and EPA will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

Based upon the evaluation of the various alternatives presented in Section 7, the NYSDEC and EPA are proposing Alternative 3 as the remedy for this site. Alternative 3 includes contaminated soil and sediment removal and disposal.

Alternative 3 would eliminate or mitigate, through the proper application of scientific and engineering principles, all significant threats to public health and the environment presented by the hazardous waste and hazardous substances disposed at the site. The remedy would essentially eliminate the threat of exposure to site related contamination.

This selection is based on the evaluation of the three alternatives developed for this site, which demonstrates the advantages discussed below, that Alternative 3 has over the other evaluated plans in meeting the remedial action objectives.

Alternative 1 would fail to meet remedial action objectives as it does not include any actions to address contamination in the soils and the sediments in embayment #1. Alternative 2, which includes capping over the contaminated soil and in-situ solidification/stabilization of sediments in embayment #1 would also not meet remedial action objectives. Contaminated soil would continue to pose a significant threat to the environment as source area contaminants would be left in place untreated. Although Alternative 2 is proposing in-situ mixing of solidification/stabilization agents with the top 3 feet of impacted sediments, the effectiveness of this technology to provide adequate controls to limit the risks of residual contaminants to benthic organisms and the environment is questionable in this application. In addition, solidification/stabilization of the sediment would not allow reestablishment of the benthic community. Based on the foregoing, Alternatives 1 and 2 would be removed from further consideration.

Alternative 3 would meet remediation goals and provide the most protection to human health and the environment. Alternative 3 would remove the most significant sources of contamination from both soils and sediments leaving only residual contaminants in the environment. Alternative 3 would eliminate or minimize exposure pathways by the excavation of contaminated soils of up to 20 feet below ground surface and placement of 6 inches of gravel over the backfilled excavated areas. In addition, the removal of the top 10 feet of contaminated sediments in embayment #1 and replacement with similar clean materials would result in a profound positive effect on the environment and provide a suitable habitat for benthic invertebrate colonization.

Although Alternative 3 would be the most costly alternative evaluated, it would provide the greatest long-term effectiveness and reduction of the toxicity, mobility and volume of contaminants.

The estimated present worth cost to implement the remedy is $22,000,000. The cost to construct the remedy is estimated to be $21,560,000 and the estimated average annual operation and maintenance cost for a period of 30 years is $36,000.

The elements of the proposed remedy are as follows:

1. A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program. Any uncertainties identified during the RI/FS including whether there is off site impact beyond the site boundaries, specifically in the area east of the site would be resolved.

2. Excavation and removal of approximately 10,000 cubic yards (cy) of contaminated soils from the site as shown on Figures 3 and 4.

3. Off-site treatment and/or disposal of the contaminated soils excavated.

4. Backfill of excavated soil areas with select clean fill materials to within 6 inches of the original ground surface and placement of 6 inches of gravel on the backfilled areas.

5. Installation of collection wells (if determined necessary) in the areas of the former gas holders for the recovery of any residual DNAPL that may not be removed by excavation.

6. Temporary placement of sheet piling to facilitate sediment removal and excavation and removal of the top 10 feet of sediments from embayment #1. The volume of contaminated sediments removed would be approximately 5,000 cubic yards. It should be noted that additional embayment materials would be removed if determined necessary based on visual observation of mobile NAPL.

7. Replacement of sediment to pre-removal contours, with the upper 3 feet restored with materials similar to the native materials removed, to provide a suitable habitat for benthic invertebrate colonization. The upper 3 feet sediment stratum will be sampled to verify and ensure that the replaced sediments have a total PAH value of less that 4 parts per million (ppm). Embayment restorations would meet all substantive regulatory requirements including 6 NYCRR Part 608, Use and Protection of Waters.

8. Since the remedy results in some untreated hazardous waste and hazardous substances remaining at the site, deed restrictions and a long term monitoring program would be instituted. The site would be restricted to allow only non-residential uses as well as notice to future site workers

regarding possible MGP residuals. The remedy would include implementation of groundwater and, if necessary, a DNAPL monitoring program to monitor the effectiveness of the proposed remedy. The effectiveness of the remedy would be evaluated at the end of a five-year monitoring period.

Table 1
Nature and Extent of Contamination

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCG	SCGs (ppb)
Groundwater	Volatile Organic Compounds (VOCs)	Benzene Ethylbenzene Toluene Xylene	ND to 140 ND to 10 ND to 17 ND to 340	9 of 35 4 of 35 3 of 35 10 of 35	5 5 5 5
	PAHs	Naphthalene	ND to 2,000	12 of 35	10
MEDIA	**CLASS**	**CONTAMINANT OF CONCERN**	**CONCENTRATION RANGE (ppm)**	**FREQUENCY of EXCEEDING**	**SCGs (ppm)**
Subsurface Soil	VOCs	Benzene	ND to 1,000	42 of 147	0.06
		Toluene	ND to 1,300	7 of 147	1.5
		Ethylbenzene	ND to 500	26 of 138	5.5
		Xylene	ND to 830	38 of 139	1.2
	cPAHs	Chrysene	ND to 250	62 of 114	0.4
		Dibenzo(a,h)anthracene	ND to 7.8	7 of 114	0.014
		Indeno(1,2,3-cd)pyrene	ND to 79	29 of 115	3.2
		Benzo(b)fluoranthene	ND to 140	47 of 115	1.1
		Benzo(a)pyrene	ND to 250	48 of 115	0.061
		Benzo(a)anthracene	ND to 270	52 of 115	0.224
		Benzo (k)fluoranthene	ND to 160	75 of 115	1.1
	Inorganics	Arsenic	ND to 28	19 of 75	7.5
		Chromium	ND to 79	69 of 75	10
		Mercury	ND to 3.1	28 of 75	0.1
		Zinc	ND to 1,340	74 of 75	20
Surface Soil	cPAHs	Chrysene	0.33 to 5.60	24 of 39	0.4
		Dibenzo(a,h) anthracene	0.33 to 2.5	11 of 36	0.014
	Inorganics	Arsenic	1.0 to 25	19 of 32	7.5
		Chromium	5 to 39	27 of 32	10
		Lead	7 to 1,370	2 of 32	500

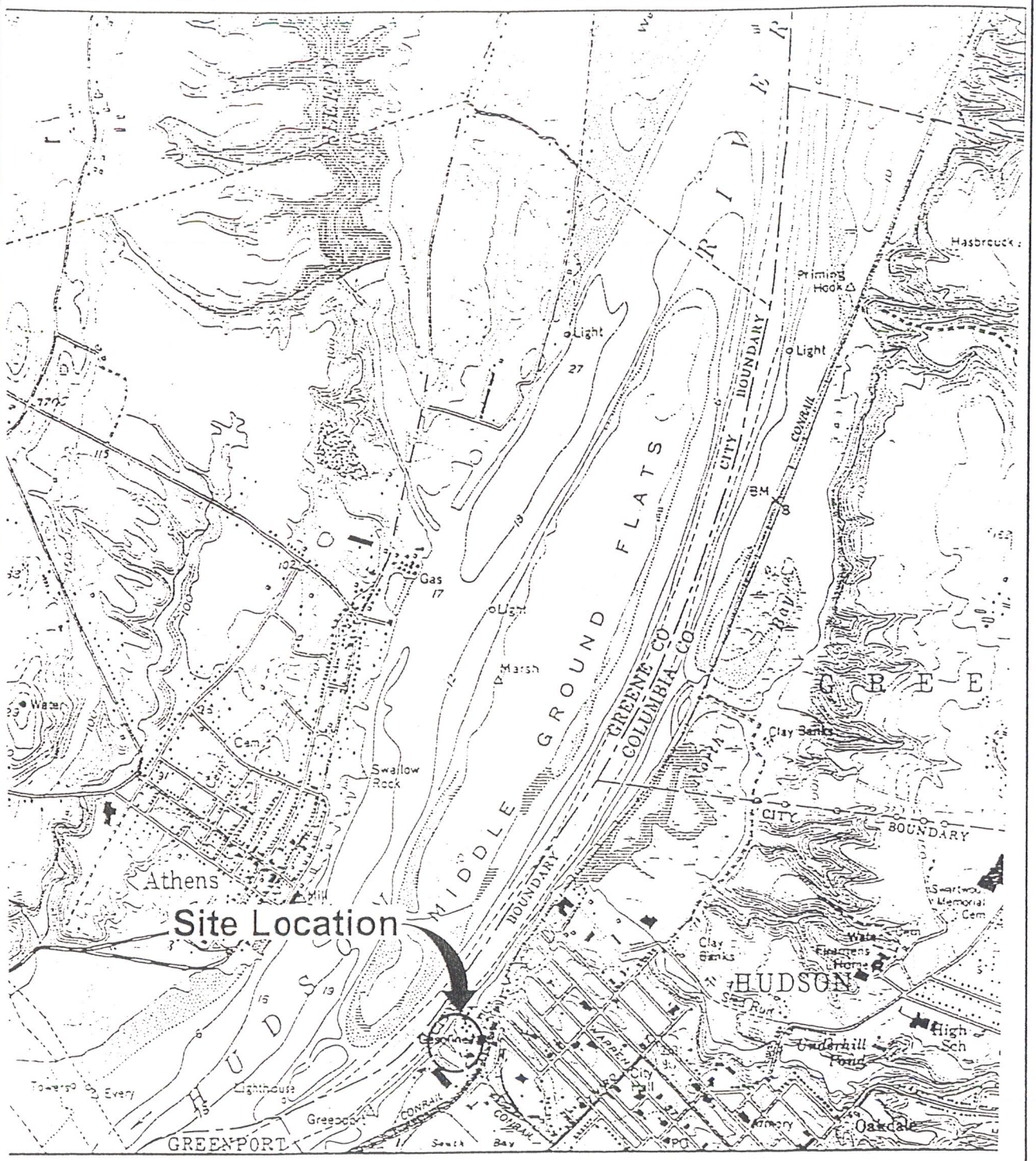
Table 1 (cont'd)
Nature and Extent of Contamination

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (mg/kg sediment)	FREQUENCY of EXCEEDING SCGs	SCGs ug/g of organic carbon
Sediment	Volatile Organic Compounds (VOCs)	Benzene	ND to 310	10 of 39	28
		Ethylbenzene	ND to 200	12 of 39	24
		Toluene	ND to 410	9 of 39	49
		Xylene	ND to 511	14 of 39	92
	PAHs	Naphthalene	ND to 2,000	17 of 39	30
		total PAHs	ND to 6,600	39 of 39	4a
	Inorganics	Chromium	14 to 59	2 of 5	26a

Note: a - mg/kg sediment

Table 2
Remedial Alternative Costs (Rounded)

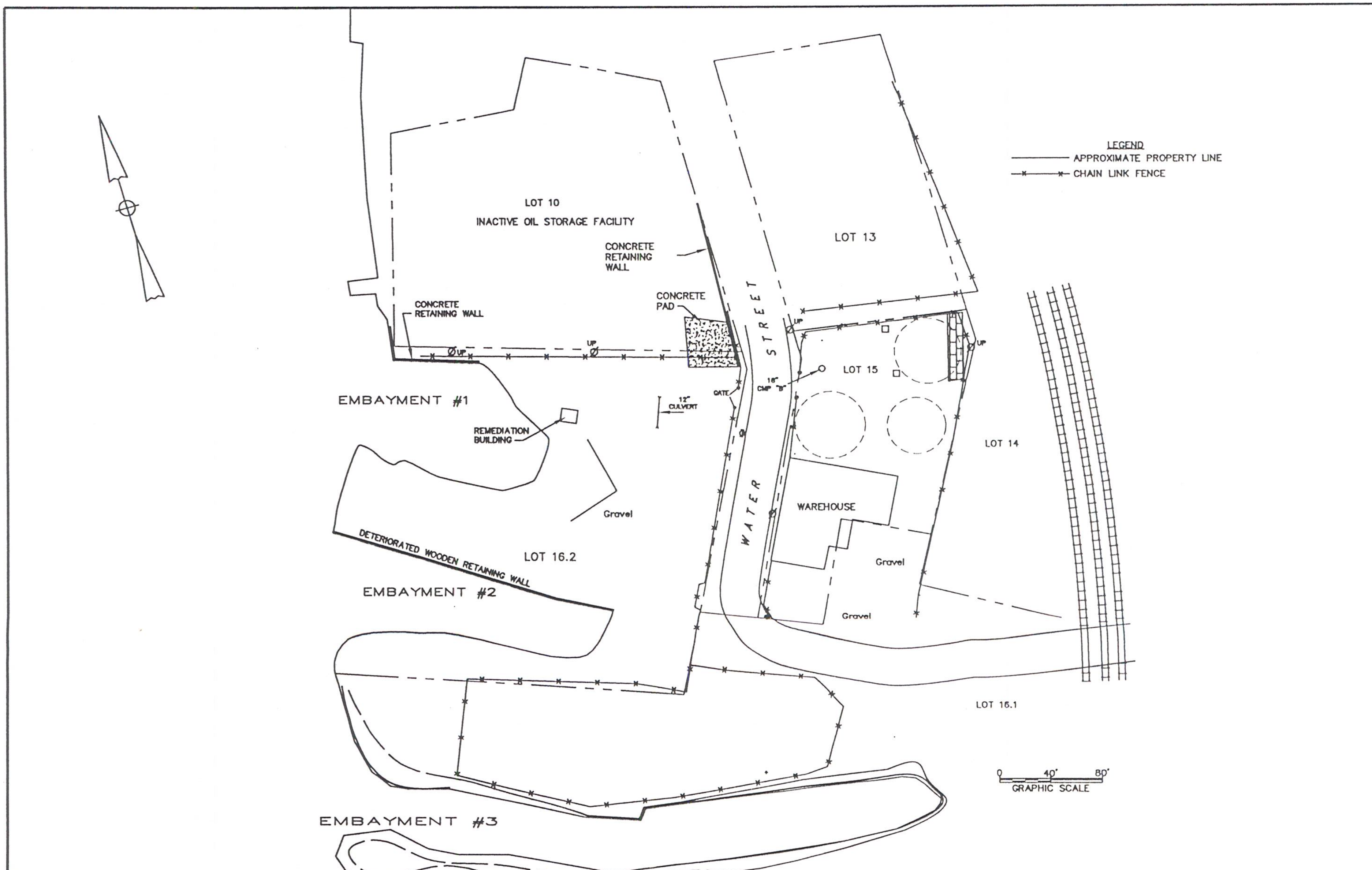
Remedial Alternative	Capital Cost	Annual O&M Cost	Total Present Worth
Alternative 1, No Action	$22,000	$76,500	$1,190,000
Alternative 2, Site Cover, In-situ treatment of sediment in embayment #1 and covering with rip rap.	$1,500,000	$66,000	$2,500,000
Alternative 3, Soil and Sediment removal and disposal.	$21,847,000	$36,000	$22,400,000



FORMER HUDSON MANUFACTURED GAS PLANT SITE
HUDSON (C), COLUMBIA COUNTY, NEW YORK, SITE NO. 4-11-005

SITE LOCATION MAP

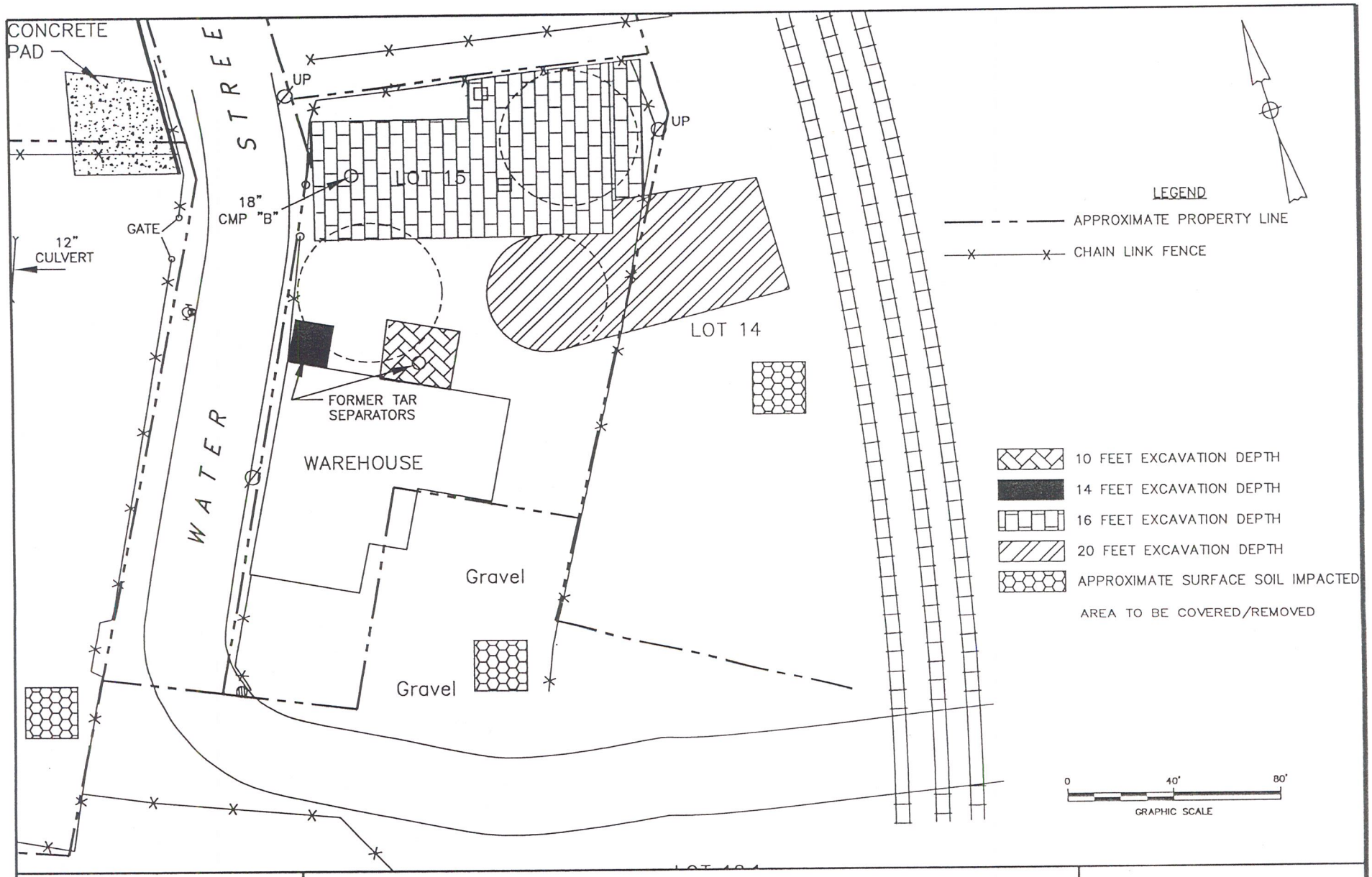
FIGURE 1



FORMER HUDSON MANUFACTURED GAS PLANT SITE
HUDSON (C), COLUMBIA COUNTY, NEW YORK. SITE NO. 4-11-005

SITE PLAN

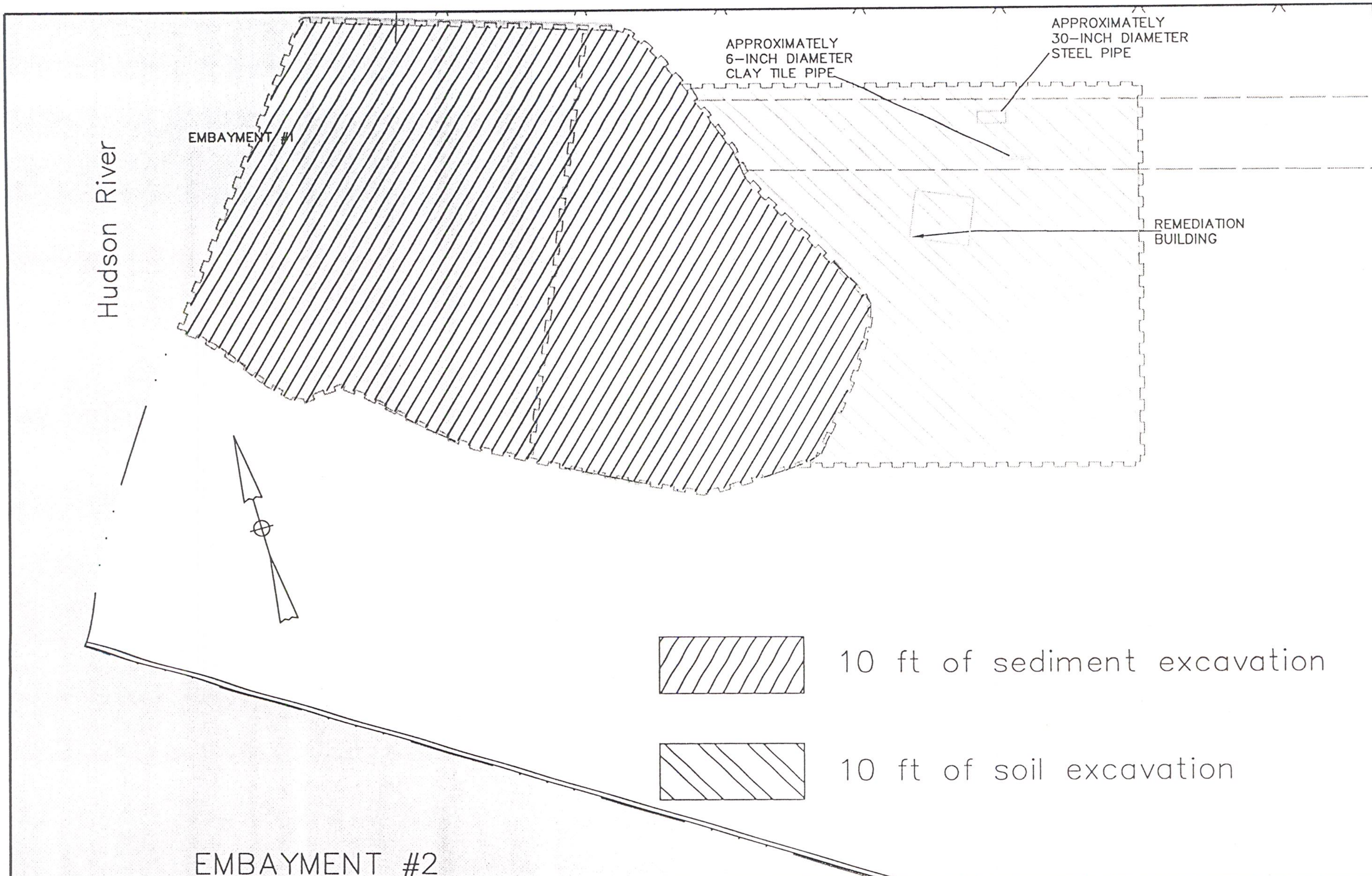
FIGURE 2



FORMER HUDSON MANUFACTURED GAS PLANT SITE
HUDSON (C), COLUMBIA COUNTY, NEW YORK, SITE NO. 4-11-005

SOIL REMOVAL AREAS

FIGURE 3



FORMER HUDSON MANUFACTURED GAS PLANT SITE
HUDSON (C), COLUMBIA COUNTY, NEW YORK, SITE NO. 4-11-005

SEDIMENT AND EAST BANK SOIL REMOVAL AREAS

FIGURE 4