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Alexander B. Grannis
Commissioner

October 31, 2007

Mr. John Ruspantini
New York State Electric and Gas Corporation
Corporate Drive - Kirkwook Industrial Park
P.O. Box 5224
Binghamton, New York 13902

Re: NYSEG Dansville MGP
50 Ossian Street, Dansville, New York 14437
Site No. 8-26-012 Operable Unit 1 (OU1)
Operable Unit - 1Feasibility Study (FS)

Dear Mr. Ruspantini,

The New York State Department of Environmental Conservation (Department) has received the Draft Feasibility Study (FS) dated August 2006 and a Draft Feasibility Study Report Addendum for Operable Unit 1 dated March 2007 from NYSEG's consultant, Ish Inc. for the above referenced site (the Site). These documents, collectively referred to as the Operable Unit - 1 Feasibility Study, provide an acceptable basis for the Department to develop a Proposed Remedial Action Plan (PRAP).

The next step is to file copies of the Operable Unit-1 Feasibility Study with the established repositories. Please provide three copies of these documents to my office for distribution.

Please feel free to contact me at 518-402-9662 to discuss any aspect of this site. Thank you for your work on these documents.

Sincerely,

Charles Post
Project Manager

ec: G. Heitzman, NYSDEC
M. Forucci, NYSDOH

FINAL FEASIBILITY STUDY REPORT
FOR OPERABLE UNIT 1

AND

FINAL FEASIBILITY STUDY REPORT ADDENDUM
FOR OPERABLE UNIT 1

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

October 2007

Prepared for:

New York State Electric & Gas Corporation
Kirkwood Industrial Park
Binghamton, New York 13902

Prepared by:

Ish Inc.
804 Salem Woods Drive, Suite 201B
Raleigh, NC 27615

FINAL FEASIBILITY STUDY REPORT
FOR OPERABLE UNIT 1

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FINAL FEASIBILITY STUDY REPORT
FOR OPERABLE UNIT 1
NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

This report presents the Feasibility Study conducted for Operable Unit 1 at the NYSEG Former MGP Site in Dansville, New York, and includes the development and evaluation of remedial alternatives performed consistent with NYSDEC guidance. Remedial Investigation and Risk Assessment activities conducted prior to the preparation of this report provide the basis for the evaluation.

PROFESSIONAL ENGINEER CERTIFICATION

I, William J. Zeli, a Professional Engineer registered in the State of New York, certify that the evaluation referenced above has been conducted consistent with proper engineering practices and that, to the best of my knowledge and belief, this report accurately presents the findings of the evaluation.

William J. Zeli, P.E.
New York License No. 080787
MTR Engineering, Inc.

11/2/07
Date

UNAUTHORIZED
ALTERATION
OF THIS ITEM
IS UNLAWFUL

EXECUTIVE SUMMARY

Introduction

This Feasibility Study Report was prepared on behalf of NYSEG (New York State Electric & Gas Corporation) to evaluate remedial alternatives for Operable Unit 1 at the Dansville former MGP site located at 50 Ossian Street in Dansville, New York. The Dansville former MGP site includes two operable units, with OU1 consisting of the on-site area owned by NYSEG, and OU2 consisting of the off-site area not owned by NYSEG. Evaluation of remedial alternatives for OU2 will be presented in a separate FS Report, although active remediation of OU1 is expected to provide remedial benefits regarding groundwater conditions within OU2.

This FS Report presents an evaluation of potential remedial alternatives for OU1 to address the remedial action objectives that were established through discussions with NYSDEC, NYSEG and Ish Inc. staff. The alternatives evaluation was conducted in accordance with appropriate regulatory guidance. Remedial Investigation and Risk Assessment activities completed for the site provide the basis for this evaluation.

Site Description

Land use in the vicinity of the site includes a mix of residential, commercial-industrial and agricultural properties. Properties located adjacent to the site include one commercial property to the north on Battle Street and one commercial property to the southeast on Ossian Street that was formerly used for a dry cleaning operation (Pappas Cleaners). The OU1 area encompasses approximately 2-1/4 acres and a building on the site is currently being used by NYSEG as an operational service center.

None of the former plant structures, except for the former electricity generation building now used as the service center, are observable at the ground surface. Former plant structures are present in the subsurface and have been identified during remedial investigation activities. Most of the site surface is covered by the service center building or pavement. The south central part of the site is covered with grass, and the pole storage and northeastern areas of the site are covered with gravel. Except for the U-shaped driveway in the south central portion, the site is fenced and access is restricted to authorized individuals.

Site Background

Gas manufacturing operations at the Dansville site began in 1861 and continued for approximately 70 years, ceasing in January 1930. Electricity was also produced on-site from 1895 to 1925. NYSEG acquired the property through a merger with New York Central Electric Company in 1937. The gas manufacturing process and feed fuels were changed several times during the operational life of the MGP. Management of wastes included the use of an in-ground tar storage vessel. Rail cars were likely used to transport wastes from the site for refining or burning as fuel. Also, purifier wastes were stored along the west side of the gas house for periodic removal.

Investigations were conducted at the site by TRC Environmental Consultants between 1986 and 1991. In addition, groundwater monitoring occurred between 1991 and 2002. Based on those findings, a Supplemental Remedial Investigation (SRI) Work Plan was developed and implemented by Ish Inc. in 2004-2006 to complete the site characterization and delineate the MGP-related impacts. The SRI was also intended to provide data to support the evaluation of potential remedial alternatives.

Geology and Hydrogeology

The unconsolidated sediments at OU1 consist of Quaternary glacial lacustrine deposits overlain by a thin layer of alluvial sediments and fill material. The thickness of the fill material is generally less than 10 feet, thinning out to less than 5 feet in the northeast portion of the site and the southern yard. The fill material is dry and consists of medium to coarse-grained sands, trace amounts of silt, some gravel, brick and other debris. The top of the alluvium occurs at depths of 5 to 11 feet below ground surface (bgs) and the bottom of this layer extends to depths of 10 to 17 feet bgs. The alluvium consists of brown, wet gravel and medium to coarse-grained sands, cobbles and trace amount of silt, with underlying interbedded, brown, fine sand and silts in some areas. The top of the silty clay unit acts as a continuous confining layer beneath the thin shallow aquifer. The unit consists of gray stiff silty clay with some layers of interbedded fine sand and silt. The top of the confining layer was generally encountered approximately 14 to 16 feet bgs, with undulations throughout the OU1 area. On the northwest portion of the site, there is a general westerly component to the confining layer contour consistent with the groundwater flow direction in the shallow aquifer.

Shallow groundwater at the NYSEG Dansville site occurs within a thin zone above the top of the silty clay-confining layer and flows generally to the northwest, with a horizontal hydraulic gradient estimated at 0.011 feet/feet. Depth to the groundwater table has historically been measured from approximately 9 to 13 feet bgs within this zone. Deep groundwater has been monitored on-site using wells screened within sand lenses present within the confining layer. Groundwater elevations are higher in the deep wells than the wells screened in the shallow zone, indicating an upward vertical gradient. The groundwater flow direction in the deep zone is generally to the west, with a horizontal hydraulic gradient estimated to range from approximately 0.009 to 0.012 feet/feet. Some variations to this general flow direction have been observed, and are attributable to the relatively low hydraulic conductivity of the formation.

Subsurface Structures and Soil Impacts

Test pits were advanced during the SRI to locate former structures in the subsurface and determine the associated degree of impacts. The former tar storage vessel was not located, and may have been removed during a paving project in 1988. The concrete slab of a former aboveground gas holder was uncovered east of the service center building approximately two feet below the pavement with a diameter of about 40 feet. The slab surface was stained but no NAPL was observed. A brick-walled holder remnant was present just south of the service center building with a diameter of approximately 45 feet. The holder contained soil and debris, and water with NAPL globules and sheens. Soil borings within the holder footprint indicate a wooden and brick bottom between 8.5 and 9 feet bgs.

VOC detections in surface soil samples collected during the SRI were limited to very low concentrations of two constituents. SVOC constituents detected in surface soils included several polynuclear aromatic hydrocarbons (PAHs). Overall, actual direct contact exposures to surface soil at the site are likely to be infrequent and, given the concentrations, such exposures are unlikely to be significant. As a result, surface soils are not a concern for OU1.

Visual observations of sheens or NAPL in the subsurface were generally limited to the locations of former MGP structures and the gravel and sand interval located immediately above the confining layer. The visual impacts generally occurred approximately between 12 to 16 feet bgs and do not extend into the confining layer. The greatest NAPL impacts were encountered east of the service center building in the area near the former aboveground gas holder. Lesser impacts, primarily small NAPL globules or sheens, were observed in the other impacted portions of the site within the saturated portion of the sandy gravel layer. The NAPL occurrences are generally consistent with the flow of groundwater and contour of the confining layer. Because an accumulation of NAPL has not occurred in any wells or piezometers at the site, it appears that the NAPL is no longer migrating in the subsurface.

Analytical results for subsurface and saturated zone soil samples confirmed the general understanding of the nature and extent of impacts based on the visual NAPL observations. The occurrence of soils exceeding the NYSDEC recommended soil cleanup objective of 500 mg/Kg for total SVOCs is generally consistent with the locations of subsurface structures associated with the former MGP. The results also confirm that VOCs, specifically BTEX, and SVOCs, specifically PAHs, are the constituents of concern.

Impacts to Groundwater

Groundwater in the saturated gravel and sand layer above the confining unit has been impacted by VOCs and SVOCs. The VOCs include BTEX as well as several solvents and chlorinated compounds. The solvents and chlorinated VOCs detected in groundwater are not associated with former MGP operations, and appear to have been released and migrated from a former dry cleaning facility (Pappas Cleaners) immediately upgradient from the site. The MGP-related groundwater impacts are consistent with NAPL observations and the groundwater flow direction at the site, which is to the northwest. The extent of groundwater standard or guidance value exceedances for MGP-related constituents covers much of the OU1 area and extends off-site in some areas of OU2.

Although shallow groundwater at OU1 is impacted, the groundwater table is several feet deeper than typical utility excavations. In addition, the thin saturated zone neither serves as a usable water supply nor does the groundwater discharge to any nearby surface water. Drinking water is supplied in the area by the local water authority and NYSEG does not intend to use shallow groundwater within OU1. Deep groundwater quality at the site has not been impacted by the former MGP due to the presence of a competent confining layer below the shallow impacted groundwater zone.

Risk Evaluation

The SRI Report included a fish and wildlife impact assessment and a qualitative human health risk assessment (HHRA) for OU1. The site does not provide habitat for wildlife resources. The qualitative HHRA evaluated the following potential on-site receptors and exposure pathways:

- Indoor workers (inhalation of intrusive vapors);
- Outdoor workers (direct contact with surface soil);
- Utility worker (direct contact with surface soil and subsurface soil);
- Construction workers (direct contact with surface soil and subsurface soil); and
- Visitors (direct contact with surface soil).

The potential for direct contact with impacted surface soils was determined to be insignificant. There are two areas of the site where possible direct contact exposures to MGP-related constituents in unsaturated subsurface soil may occur. However, NYSEG maintains a policy that ensures properly trained excavation personnel are used, health and safety precautions are followed, and soil is managed appropriately during excavations at the site. By following these procedures, the potential for direct contact exposure to subsurface soil during excavations is minimized.

Subsequent to the SRI, a Soil Vapor Intrusion (SVI) Study to assess the potential for intrusive vapors in the NYSEG service center was completed and a draft report was submitted to NYSDEC in May 2006. Comparison of the measured indoor air results to their respective OSHA TWA standards indicates that OSHA standards were not exceeded. A sub-slab depressurization system will be installed in the service center to mitigate measured indoor air concentrations of chlorinated compounds from an upgradient non-MGP source (i.e., Pappas Cleaners).

Remedial Goals And Remedial Action Objectives

The selected remedy will eliminate or mitigate all significant threats to public health and the environment associated with the former MGP operations. The following Remedial Action Objectives (RAOs) have been established for OU1 as a result of discussions between NYSDEC, NYSEG and Ish Inc. personnel:

Coal Tar NAPL:

- Remediate, to the extent practicable, areas containing coal tar NAPL.
- Control, to the extent practicable, further off-site migration of coal tar NAPL.
- Eliminate, to the extent practicable, human exposure to coal tar NAPL.

Groundwater:

- Minimize potential risks to human health from exposure to groundwater containing site-related MGP constituents at levels above current NYS groundwater quality standards.
- Restore, to the extent practicable, groundwater quality in the shallow sand and gravel aquifer, where impacted from site-related MGP constituents, to the current NYS groundwater quality standards.

Subsurface Soil:

- Minimize potential risks to human health from exposure to subsurface soil containing site-related MGP constituents.

Development Of Remedial Alternatives

Potentially applicable remedial technologies were identified based on the experience of NYSEG and Ish Inc. at similar former MGP sites. Based on a preliminary screening, several potentially applicable technology components were identified and then combined to develop a set of remedial alternatives that are appropriate for the detailed evaluation phase for OU-1. Phone conversations and communications with NYSDEC representatives occurred as the alternatives were being developed so that potential regulatory concerns and inputs could be considered prior to conducting the detailed analysis.

Except for no action (Alternative 1), all other remedial alternatives (Alternatives 2 through 7) include excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in vadose (unsaturated) zone soils, along with institutional controls and groundwater monitoring. An excavation depth of 10 feet within a surficial area of approximately 17,000 square feet has been assumed for evaluation purposes, with a total excavation mass of approximately 10,000 tons. The planned extent of soil excavation would be finalized during remedial design phase. Excavated soil that is MGP-impacted would be transported to a suitable off-site facility for low temperature thermal desorption (LTTD) treatment or another acceptable treatment method. Debris would be transported to a local landfill for disposal. Clean soil from an off-site source would be used as backfill material, along with unimpacted earthen material from the site that would be reused to backfill the deeper portions of the excavated areas.

The remedial alternatives include the following:

Alternative 1 – No action (with institutional controls and groundwater monitoring)

The no action alternative provides a baseline for comparison with the other alternatives, and is included in the evaluation for consistency with NYSDEC guidance. No active remediation would be carried out under this alternative. Institutional controls that limit land and groundwater uses would be placed on the NYSEG property, along with groundwater monitoring for a maximum period of 30 years.

Alternative 2 – Excavation of subsurface structures and visual NAPL in vadose zone soils, free-phase NAPL removal using collection trench, institutional controls and groundwater monitoring

One component of this alternative would involve excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in vadose zone soils, along with institutional controls and groundwater monitoring. It appears that the bulk of the NAPL present within the saturated zone is no longer migrating laterally in the subsurface. However, Alternative 2 includes the installation of a trench along the downgradient boundary as a second component to collect and remove potentially mobile free-phase NAPL. Details associated with the trench would be determined during the remedial design phase. For evaluation purposes, installation of a gravel trench was assumed with 15 monitoring/recovery points to periodically remove the NAPL, if it accumulates in the trench.

The third component under this alternative is to control potential exposures by instituting land and groundwater use restrictions and adopting a soil management plan.

The presence of NAPL within the saturated zone and an upgradient source of dissolved phase chlorinated constituents would continue to impact groundwater quality in OU-1. Alternative 2 assumes that NAPL monitoring and removal would occur over a ten-year period and groundwater monitoring would continue for a period of 15 years.

Alternative 3 – Excavation of subsurface structures and visual NAPL in vadose zone soils, downgradient containment using physical barrier with limited total fluids extraction and disposal, institutional controls and groundwater monitoring

One component of this alternative (as in Alternative 2) would involve excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in vadose zone soils, along with institutional controls and groundwater monitoring. Although it appears that the bulk of the NAPL is no longer migrating laterally in the subsurface, Alternative 3 includes downgradient containment at the property boundary as a second remedial component. For evaluation purposes, a containment system consisting of a physical barrier installed using the slurry wall method to a depth of 20 feet has been assumed, with limited total fluids extraction and disposal using a series of 15 extraction points installed upgradient of the physical barrier. The extraction points would remove any NAPL that may accumulate and maintain hydraulic control at the downgradient boundary to the extent necessary. Monthly total fluids extraction using mobile high vacuum equipment (e.g., vacuum truck) with off-site disposal of the recovered fluids has been assumed for evaluation purposes lasting for a 15-year period. The method for fluids extraction and disposal would be evaluated further during remedial design.

The third component of this alternative will control potential exposures by instituting land and groundwater use restrictions and adopting a soil management plan.

Groundwater clean-up goals would not be achieved due to NAPL that would remain within the saturated zone, as well as an upgradient source of dissolved phase constituents. Groundwater monitoring is projected over a period of 15 years.

Alternative 4 – Excavation of subsurface structures and visual NAPL in vadose zone soils, full containment using physical barrier around impacted OU1 area with maintenance of cap/cover, institutional controls and groundwater monitoring

One component of this alternative (as in Alternatives 2 and 3) would involve excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in vadose zone soils, along with institutional controls and groundwater monitoring. A second component of Alternative 4 involves full isolation/containment by installing a physical barrier around the impacted OU1 area to greatly reduce or eliminate groundwater movement through the coal tar-impacted subsurface layer within the saturated zone. For evaluation purposes, installation of a physical barrier using the slurry wall method to a depth of 20 feet has been assumed. Other barrier types may be viable, and the type, location and depth of the barrier would be finalized during remedial design. The physical barrier would prevent impacted groundwater from the upgradient source from continuing to impact groundwater within OU1. However, the altered groundwater flow could result in dissolved phase constituents from the upgradient off-site source migrating to other areas that are currently not impacted. Therefore, implementation of this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property.

A third component of the Alternative 4 involves instituting land and groundwater use restrictions and adopting a soil management plan that would control potential human exposures. A fourth component is maintaining the existing surface cap/cover to limit potential soil exposures beyond the excavation areas and to maintain hydraulic control within OU1 by minimizing infiltration.

Drinking water-based groundwater clean-up goals would not be achieved under this alternative due to the presence of NAPL that would be contained within the saturated zone. This alternative assumes that groundwater monitoring would occur for a period of 15 years.

Alternative 5 – Excavation of subsurface structures and visual NAPL in vadose and saturated zone soils to the confining layer, institutional controls and groundwater monitoring

The first component of this alternative consists of excavation of subsurface structures (same as Alternatives 2, 3 and 4) and visual NAPL to a depth of 16 feet both in the unsaturated and saturated zones, within a surficial area of approximately 23,000 square feet used for evaluation purposes. The extent of soil excavation would be finalized during the remedial design phase should this option be selected for implementation. The 20,500 ton total excavated quantity estimate includes an anticipated significant amount of unimpacted material within the vadose zone. Because the excavation would extend into the saturated zone where significant groundwater inflow is anticipated, this alternative includes the installation of a slurry wall around the excavation areas as a hydraulic control to support the excavation. Other methods of hydraulic control may be viable, and the method would be evaluated further during the design phase. Left in place, a physical barrier for hydraulic control would also prevent impacted groundwater from the upgradient source from re-impacting the excavated portion of the saturated zone. However, it could also alter groundwater flow patterns such that impacted groundwater from the former Pappas Cleaners property may migrate to previously unimpacted areas. Therefore, implementation would require coordination with any planned remedial actions for the Pappas Cleaners property.

Other components of this alternative include addressing any remaining soil impacts by instituting land use restrictions, adopting a soil management plan, and maintaining the surface cover for infiltration control.

Drinking water-based groundwater clean-up goals may not be achieved due to residual NAPL that may remain beyond the excavation areas, and because of the presence of an unrelated upgradient source of dissolved phase constituents (i.e., chlorinated solvents from the former Pappas Cleaners facility). Therefore, a groundwater use restriction is included along groundwater monitoring for a period of 10 years.

Alternative 6 – Excavation of subsurface structures and visual NAPL in vadose zone soils, *in-situ* treatment of the saturated zone following excavation, institutional controls and groundwater monitoring

One component of this alternative (as in Alternatives 2, 3 and 4) involves excavation of the former MGP subsurface structures and associated areas with visual NAPL impacts in vadose (unsaturated) zone soils, along with institutional controls and groundwater monitoring. Following excavation of the structures and vadose zone material, *in-situ* treatment would be carried out as a second component of Alternative 6. *In-situ* treatment of on-site groundwater would reduce dissolved phase constituent concentrations and mitigate the potential for off-site migration. The target treatment interval would start below the depth of the excavation (or below the water table in areas located beyond the extent of the excavation) and extend to the confining layer. A depth to the confining layer of 16 feet has been assumed for evaluation purposes, along with a total *in-situ* treatment area of approximately 23,000 square feet. Potentially applicable *in-situ* treatment technologies include *in-situ* stabilization (ISS) and *in-situ* chemical oxidation (ISCO). For evaluation purposes, *in-situ* treatment via ISS has been assumed. Because the proposed ISS area is mostly within the area proposed for vadose zone excavation, the need to address excess material from within the treated areas would be minimized. The significantly reduced permeability within the ISS treatment zone will change groundwater flow such that impacted groundwater from the former Pappas Cleaners property may migrate to previously unimpacted areas. Therefore, implementation would require coordination with any planned remedial actions at the former Pappas Cleaners property.

As a third component, institution of land use restrictions and adoption of a soil management plan would address any residual soil impacts, along with maintenance of the existing surface cover for infiltration control.

Drinking water-based groundwater clean-up goals may not be achieved due to residual NAPL that may remain beyond the excavation and treatment areas, and because of the upgradient source of dissolved phase constituents. Therefore, a groundwater use restriction is included to assure continued protection of human health on-site. Alternative 6 includes groundwater monitoring for a period of 10 years.

Alternative 7 – Complete excavation of subsurface structures and areas with NAPL impacts within the vadose and saturated zones on-site, groundwater use restriction and groundwater monitoring

Excavation of subsurface structures and NAPL impacted soil would extend to the confining layer. An excavation depth of 16 feet within a surficial area of approximately 72,000 square feet has been assumed for evaluation purposes. The existing service center on the property is within the proposed excavation area of this alternative. Therefore, demolition and replacement of the building would be necessary. The 64,000 ton total excavated mass estimate for Alternative 7 includes an anticipated significant quantity of unimpacted material within the vadose zone. This alternative includes the installation of a slurry wall around the excavation area, as a hydraulic control to support the excavation activities within the saturated zone. Other methods of hydraulic control may be viable, and the method employed would be evaluated further during remedial design. Left in place, a physical barrier installed to support the excavation would also prevent impacted groundwater from the upgradient source from re-impacting the saturated zone within OU1. However, impacted groundwater from the former Pappas Cleaners property would likely migrate to previously unimpacted areas. Therefore, coordination with any planned remedial actions at the former Pappas Cleaners property would be required.

Because impacted soils would be fully addressed, the institutional controls associated with Alternative 7 involve a limited groundwater use restriction. No restrictions on future land use would be required. Drinking water-based groundwater clean-up goals may be achievable with this alternative for the MGP-related constituents. However, unless the upgradient source on the former Pappas Cleaners property is addressed, groundwater within the saturated zone of OU1 would be re-impacted. Should future groundwater monitoring indicate that drinking water-based goals have been achieved, the deed restriction would be removed by NYSEG. Groundwater monitoring with Alternative 7 is assumed to continue for a period of 5 years.

<u>Detailed Evaluation of Remedial Alternatives</u>

In accordance with regulatory guidance, the remedial alternatives were evaluated in detail using the following criteria:

- Overall protection of public health and the environment;
- Compliance with standards, criteria and guidance (SCGs);
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility or volume with treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

Each alternative was first evaluated independently. The ability of each alternative to achieve the RAOs was considered in evaluating overall protection of public health and the environment. Compliance with SCGs includes consideration of the actions involved as well as groundwater and soil quality.

Comparative Analysis and Recommended Remedy

A comparative analysis of the remedial alternatives using the same criteria was also completed. Table ES-1 presents a graphical summary of the overall acceptability of each alternative regarding the evaluation criteria.

Alternative 1 (no action) does not adequately address the RAOs and is not protective of public health or the environment. Although Alternative 7 would be highly effective in permanently removing the MGP-related impacts, the substantially higher costs, implementation challenges and demolition and reconstruction of NYSEG service center building make site-wide excavation a non-preferred remedial alternative. Alternative 3 requires extraction and disposal of fluids over an extended period of time and does not remove NAPL from the saturated zone, which makes Alternative 3 less acceptable in comparison to other alternatives. Each of the remaining four alternatives considered in the FS (Alternatives 2, 4, 5 and 6) incorporate excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in the vadose zone, institutional controls and groundwater monitoring as additional technology components. The differences between the four alternatives relate to the manner in which saturated zone impacts are addressed.

Containment approaches, using NAPL collection at the downgradient boundary (Alternative 2) or full isolation/containment around the impacted OU1 area (Alternative 4), are more effective in addressing residual NAPL present beyond the extent of the area where saturated zone excavation or stabilization is implemented (Alternatives 5 or 6). Also, addressing NAPL at the downgradient boundary (Alternative 2) is much less contingent upon the nature of any actions that may be taken to address impacts associated with the former Pappas Cleaners property. Full containment (Alternative 4), as well as solidification of the saturated zone within OU1 as with Alternative 6, could result in previously unimpacted areas being impacted by migration of chlorinated compounds from the releases at the former Pappas Cleaners property. Although higher initial costs are involved, the saturated zone excavation work under Alternative 5 addresses the coal tar NAPL in the saturated zone more effectively than the containment or ISS alternatives. However, the benefits could be negated by re-impacting of groundwater quality within OU1 due to constituent migration from the off-site source material.

Given the criteria evaluated in this FS, with additional consideration given to the RAOs, Alternative 5 appears to be the most effective alternative overall to address the OU1 impacts at the NYSEG Dansville former MGP site. In addition to the excavation of former MGP structures and associated areas with significant NAPL impacts in vadose zone soils, institutional controls and groundwater monitoring components, Alternative 5 includes removal of coal tar NAPL in the saturated zone. This remedy addresses the RAOs established for OU1 at the site by incorporating the following components:

- A significant mass of coal tar NAPL is remediated by excavation of NAPL-containing soils associated with the former MGP structures in the vadose zone and also in the saturated zone to the confining layer;
- Off-site migration of coal tar NAPL is controlled by removing the coal tar NAPL source material within the saturated zone of OU1;

- Human exposure to coal tar NAPL is eliminated by the soil excavation; exposure to the remaining coal tar NAPL outside the excavation footprint (chiefly 12-16 feet bgs) will be controlled through use of institutional controls;
- Potential risks to human health from exposure to groundwater containing MGP constituents are minimized by the use of institutional controls and groundwater monitoring;
- Restoration of groundwater in the shallow sand and gravel aquifer with MGP-related impacts is addressed via excavation of material that would continue to act as a source of groundwater impacts; and
- Potential risks to human health from exposure to subsurface soil containing MGP constituents are minimized by the soil excavation and use of institutional controls.

In addition, installation of a slurry wall around the excavation area eliminates the recontamination potential from the upgradient source of chlorinated compounds.

TABLE ES-1

FEASIBILITY STUDY EVALUATION SUMMARY

NYSEG Dansville Former MGP Site
Dansville, New York

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Overall Protection of Public Health and the Environment	⊗	○	○	○	◍	◍	●
Compliance with SCGs	⊗	◍	◍	◍	◍	◍	●
Long-Term Effectiveness and Permanence	⊗	○	○	◍	◍	◍	●
Reduction of Toxicity, Mobility or Volume with Treatment	⊗	○	◍	◍	◍	◍	●
Short-Term Effectiveness	●	◍	⊗	○	○	○	○
Implementability	●	◍	○	○	○	○	⊗
Cost	●	◍	○	◍	○	◍	⊗
Overall Summary	⊗	◍	○	◍	●	●	○

Legend:
- ⊗ - least acceptable
- ○ - fair to moderate acceptability
- ◍ - moderate to good acceptability
- ● - most acceptable

Alternatives:

1) No action (with institutional controls and groundwater monitoring)
2) Excavation of subsurface structures and heavy visual NAPL in vadose zone soils, free-phase NAPL removal using collection trench, institutional controls and groundwater monitoring
3) Excavation of subsurface structures and heavy visual NAPL in vadose zone soils, downgradient containment using physical barrier with limited total fluids extraction and disposal, institutional controls and groundwater monitoring
4) Excavation of subsurface structures and heavy visual NAPL in vadose zone soils, containment using physical barrier around impacted OU1 area with maintenance of cap/cover, institutional controls and groundwater monitoring
5) Excavation of subsurface structures and heavy visual NAPL in vadose and saturated zone soils, institutional controls and groundwater monitoring
6) Excavation of subsurface structures and heavy visual NAPL in vadose zone soils, *in situ* treatment of the saturated zone following excavation, institutional controls and groundwater monitoring
7) Excavation of subsurface structures and areas with NAPL impacts within the vadose and saturated zones, groundwater use restriction and groundwater monitoring

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1.0 INTRODUCTION

1.1 Purpose

This Feasibility Study Report (FS Report) was prepared on behalf of NYSEG (New York State Electric & Gas Corporation) to address Operable Unit 1 (OU1) at the Dansville former manufactured gas plant (MGP) site located at 50 Ossian Street in the village of Dansville, New York. This work was performed in compliance with an Order on Consent between NYSEG and the New York State Department of Environmental Conservation (NYSDEC).

The Dansville former MGP site was divided into two operable units for administrative reasons. One unit (OU1) consists of the on-site area defined as the current property owned by NYSEG, and the second unit (OU2) consists of the off-site area defined as the properties not owned by NYSEG. OU2 will be addressed separately from this FS Report, although active remediation of OU1 is expected to provide benefits regarding NAPL migration and groundwater conditions within OU2.

This FS Report presents an evaluation of potential remedial alternatives for OU1. The alternatives evaluation was conducted in accordance with appropriate regulatory guidance, including Technical Guidance for Site Investigation and Remediation (NYSDEC, December 2002). Remedial Investigation and Risk Assessment activities for the site were conducted prior to preparation of this report, and provide the basis for this evaluation.

1.2 Site Description

Dansville is located on the western end of the Finger Lake Region, at the southern end of a long linear valley in the Canaseraga Creek drainage area. Average annual precipitation is approximately 29 inches (TRC, December 1988). Land use in the vicinity of the site includes a mix of residential, commercial-industrial and agricultural properties. Immediately surrounding the site, land use is primarily residential with one commercial property to the north on Battle Street and one commercial property to the southeast on Ossian Street that was used for a dry cleaning operation (TRC, August 1986).

Sewers are located along the two streets bordering the site (Battle and Ossian Streets), and all other streets surrounding the site area reportedly include sewers that connect to the central sewer system. There are no drinking water supply wells located within a one-mile radius of the site. Dansville drinking water is supplied by a surface impoundment and well field that are located two miles and three miles, respectively, upgradient from the site (TRC, May 1991).

The OU1 area encompasses approximately 2-1/4 acres and is currently used by NYSEG as an operational service center. A general site map is provided as Figure 1-1. A service center building is located on the site and utility equipment (utility poles, transformers, wires, piping, etc.) is stored on-site along with utility vehicles. Individuals report for work at the site, park their vehicles and pick up equipment, and use utility vehicles to drive to off-site work locations. Some individuals are present in the NYSEG building at various times during the workday.

None of the former plant structures, except for the former electricity generation building, now used as the NYSEG service center, are observable at the ground surface. Former plant structures have been identified in the subsurface during previous site investigation activities. Locations where former MGP structures are believed to remain in the subsurface are identified on Figure 1-1. Most of the site surface is now covered by the service center building or pavement. The building has a slab on grade foundation and does not have a basement. The south central part of the site, which is encompassed by the U-shaped driveway along Ossian Street, is covered with grass. The pole storage area and the northeastern part of the site are covered with gravel. The U-shaped driveway in the south central part of the site, including the grass-covered area, has unrestricted access. The remainder of the site is fenced and access is restricted to authorized individuals (Ish Inc., January 2006).

1.3 Site Background

Gas operations at the NYSEG Dansville site began in 1861 and continued for approximately 70 years, ceasing in January 1930. Electricity was also produced on-site from 1895 to 1925. NYSEG acquired the property through its merger with New York Central Electric Company in 1937 (seven years after gas manufacturing operations ceased).

During its operational history, there was at least one period (1921 to 1926) when gas manufacturing operations were shut down following the introduction of natural gas to the Dansville area. The gas manufacturing process and the feed fuels were changed several times during the operational life of the MGP. Oil, coal and coke were used at various times as feed fuels. Blue gas and carbureted water gas were manufactured at the plant. Gas production generally increased during the operating life of the plant. Management of wastes generated at the site included the use of an in-ground tar storage vessel. Rail cars were likely used to transport wastes away from the site for refining or for burning as boiler fuel. Also, purifier wastes were stored in burlap bags along the west side of the gas house for periodic removal.

Photographs of the site from 1930 show at least two gas holders were present. Additionally, site maps and photos from circa 1930 show a former canal that was subsequently filled and now exists on the west side of the site as a weed-choked ditch paralleling the south side of Battle Street. Historical pictures from circa 1933 show a small substation on the property. A 1938 aerial photograph shows that the gas holders were no longer present.

In the years after MGP operations ceased, the gas house was used as a meter department and was later removed in 1958. Also, the former electricity generation building was renovated, enlarged and used as the regional service center for NYSEG. At some point after plant closure, soil was spread over the south end of the property for a lawn. A limited site remediation was completed by excavation and off-site disposal of excavated material in 1988, when approximately 1,500 yards of impacted soils were removed from the site for a paving project. The excavation may have advanced into the large gas holder to the east of the service center building.

Historical industrial/commercial operations in the vicinity of the site include a former dry cleaning facility (Pappas Cleaners) located southeast and upgradient from OU1.

2.0 SUMMARY OF INFORMATION FROM THE SRI REPORT

Previous investigation activities at the site were summarized in the Task 1 through 4 reports completed by TRC Environmental Consultants between 1986 and 1991. In addition, groundwater samples were collected and analyzed between 1991 and 2002. Based on the previous findings by TRC, a Supplemental Remedial Investigation (SRI) Work Plan was developed (Ish Inc., November 2003).

The SRI was conducted at the NYSEG Dansville site in 2004 and 2005 to complete the characterization of the site and the surrounding area, as necessary, such that the nature and extent of MGP-related impacts were delineated. The SRI was also intended to provide data to support the evaluation of potential remedial alternatives and lay the foundation for future remedial design. Locations of soil borings, test pits and monitoring wells installed during the assessment activities for OU1 are indicated on Figure 2-1. The findings of the site characterization activities for OU1 are presented in the Final Supplemental Remedial Investigation Report for Operable Unit 1 (Ish Inc., January 2006). A summary of the findings, based on the SRI Report, is provided below.

2.1 Geology and Hydrogeology

2.1.1 Site Geology

The unconsolidated sediments at the OU1 area consist of Quaternary glacial lacustrine deposits overlain by a thin layer of alluvial sediments and fill material. The depth and composition of the overburden fill material varies across the site. The thickness of the fill material is generally less than 10 feet, thinning out to less than 5 feet in the northeast portion of the site and the southern yard. The fill material is dry and consists of medium to coarse-grain sands, trace amounts of silt, some gravel, brick, and other debris. Within the former gas holder to the south of the service center building, the fill material consists of demolition debris, concrete, gravel, sand, some ash-like material and wood.

The top of the alluvium occurs at depths of 5 to 11 feet below ground surface (bgs) and the bottom of this layer extends to depths of 10 to 17 feet bgs. The alluvium consists of two units, with the upper unit consisting of brown, wet gravel and medium to coarse-grained sands, cobbles and trace amount of silt. A second, less consistent unit is present beneath the upper unit in some areas and consists of interbedded, brown, fine sand and silt.

The lacustrine deposit was first encountered at depths ranging from 11.5 to 18 feet bgs and extends to depths of 87.5 feet as determined at MW03D. The unit consists of gray stiff silty clay with some layers of interbedded fine sand and silt. The silt layers found within the silty clay unit are often varved, confirming their glacial origin. In the lacustrine deposit, a few fine sand lenses ranging in thickness from 1 to 16.5 feet and some coarse sands and gravel were observed.

The top of the silty clay unit acts as a continuous confining layer beneath the thin shallow aquifer. The top of the silty clay layer was generally encountered between approximately 14 and 16 feet bgs. Based on contours of the silty clay surface developed for the SRI Report, there is a low area in the southern portion of the site, as well as undulations throughout the OU1 area. On the northwestern portion of the site, there is a general westerly component to the contour consistent with the groundwater flow direction in the shallow unconfined aquifer.

Two geologic cross-sections for OU1 were presented in the SRI Report based on previously gathered information and the results of soil borings from the SRI work. The cross-sections run east to west in the northern portion of the site and north to south through the central portion of the site. An additional cross-section that runs northwest to southeast across the site is presented as Figure 2-2.

2.1.2 Site Hydrogeology

Shallow groundwater at the NYSEG Dansville site occurs within a thin zone above the top of the silty clay-confining layer. Depth to the groundwater table has historically been measured from approximately 9 to 13 feet bgs within this zone. Shallow groundwater at OU1 flows generally to the northwest, with a horizontal hydraulic gradient estimated at 0.011 feet/feet. The hydraulic conductivity of the shallow zone has been estimated at 0.48 feet per day, although qualitative observations at well MW03S and general characteristics of a sand and gravel zone suggest that the hydraulic conductivity may be significantly underestimated based on the limited available data. Assuming an effective porosity of 0.35, the linear shallow groundwater velocity would be approximately 5.5 feet per year based on the suspected low conductivity estimate.

Deep groundwater has been monitored on-site using wells that are screened within sand lenses present within the confining layer. Screen intervals for the deep monitoring wells exist between 63 and 87 feet bgs. Groundwater elevations are higher in the deep groundwater wells than within the wells screened in the shallow zone, indicating an upward vertical gradient. The groundwater flow direction in the deep zone is generally to the west. Some variations to this general flow direction have been observed, and are attributable to the relatively low hydraulic conductivity associated with the formation being monitored. The horizontal hydraulic gradient within the deep groundwater zone has been estimated to range from approximately 0.009 to 0.012 feet/feet. The hydraulic conductivity of the deep zone has been estimated to range between 0.10 and 0.71 feet per day. Assuming an effective porosity of 0.35, the linear deep groundwater velocity would be approximately 1 to 10 feet per year based on the gradient and conductivity estimates.

2.2 Nature and Extent of Impacts

Characterization of the nature and extent of environmental impacts for OU1 was completed during the SRI. The constituents analyzed included volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals and total cyanide. In addition, polychlorinated biphenyls (PCBs) were analyzed in surface soil samples. Results were compared to recommended soil cleanup objectives (RSCOs) provided in NYSDEC guidance (NYSDEC, January 1994).

2.2.1 Impacts to Surface Soil

VOC detections in surface soil samples collected during the SRI were limited to very low (well below RSCOs) concentrations of two constituents. SVOC constituents detected in surface soils included several polynuclear aromatic hydrocarbons (PAHs). Two surface soil samples had low levels of total cyanide, and low levels of PCBs were detected below the RSCO of 1 mg/kg in two surface soil samples. Several metals were detected in surface soil samples, but the concentrations were generally within the range of background concentrations found in soils in the eastern United States.

Overall, actual direct contact exposures to surface soil at the site are likely to be infrequent and, given the concentrations, such exposures are unlikely to be significant. As a result, surface soils are not a concern for OU1.

2.2.2 Subsurface Structures

Test pits were advanced during the SRI to locate former structures in the subsurface and determine the degree of impacts associated with them. Five test pits were excavated to locate the former tar storage vessel in the pole yard area. No subsurface tar storage structure was found. The tar storage vessel may be present beyond the extent of the test pit locations. However, it is also plausible that the vessel was removed during the paving project in 1988.

Three test pits were excavated to locate points along the perimeter of the former large gas holder to the east of the service center building. The concrete slab of a former aboveground gas holder was uncovered approximately two feet below the pavement with a diameter of about 40 feet. The slab surface was stained but no non-aqueous phase liquid (NAPL) was observed. Soil boring SB09 was installed through the slab of the former gas holder to the east of the service center building, and a significant amount of NAPL was observed in the saturated gravel and sand layer at this location.

Three test pits were excavated to locate points along the wall of the subsurface gas holder just south of the service center building. A brick-walled holder remnant was present with a diameter of approximately 45 feet. The holder contained soil and debris, and water with NAPL globules and sheens. Subsequent soil borings within the holder footprint indicated a wooden and brick bottom between 8.5 and 9 feet bgs. Sheens were noted in the fill material near the bottom of the holder foundation.

During the SRI, several test pits were excavated on the southern lawn of the site to investigate the possibility that other structures existed. Three test pits were excavated in the area of the former relief holder shown in some historical photographs from 1930. No remaining evidence of this former structure was found to a depth of approximately 4 feet bgs. In addition, three test pits were excavated in the area where TRC previously indicated that a gas holder had been located, based on a brick wall being observed at 1.5 feet bgs. These three test pits were excavated to 3.5 feet bgs and no subsurface remnants of structures were found. Because TRC found this potential holder remnant at only one location and could not confirm the presence of the wall at another point, it is likely that some other structure was encountered and another gas holder did not exist in this area.

2.2.3 Impacts to Subsurface and Saturated Zone Soils

Visual observations of sheens or NAPL in the subsurface were generally limited to the locations of former MGP structures and the gravel and sand groundwater-bearing interval located immediately above the silty clay-confining layer. The visual impacts generally occurred in approximately 12 to 16 feet bgs. Visual NAPL impacts do not extend into the confining layer.

The NAPL observed at OU1 was generally reddish-brown in color. Figure 2-3 depicts the occurrence of NAPL within the subsurface across the site. The greatest NAPL impacts were encountered east of the service center building in the area near the former aboveground gas holder. Lesser impacts, primarily small NAPL globules or sheens, were observed in the other impacted portions of the site within the saturated portion of the sandy gravel layer. NAPL impacts were not observed east of the pavement edge in the northeast portion of the site.

Cross-sectional representations of the site geology with NAPL impacts plotted were provided in the SRI Report (Ish Inc., January 2006). Observations of NAPL are also noted on the cross-section provided as Figure 2-2 in this report. The NAPL occurrences are generally consistent with the flow of groundwater from the former MGP structures and the contour of the confining layer. The cross-sections show that NAPL impacts have not migrated vertically into the confining silty clay layer. Because an accumulation of NAPL has not been observed in any monitoring wells or piezometers at the site, it appears that the bulk of the NAPL is no longer migrating laterally in the subsurface.

Analytical results for subsurface and saturated zone soil samples submitted for analyses confirmed the general understanding of the nature and extent of impacts based on the visual NAPL observations. The occurrence of soils exceeding the NYSDEC recommended soil cleanup objective of 500 mg/Kg for total SVOCs is generally consistent with the locations of subsurface structures associated with the former MGP. As described in detail in the SRI Report, the results also confirm that VOCs, specifically benzene, toluene, ethylbenzene and xylenes (BTEX), and SVOCs, specifically PAHs, are the constituents of concern for OU1 at the NYSEG Dansville site.

2.2.4 Impacts to Groundwater

The SRI Report (Ish Inc., January 2006) documents the occurrence of constituents of concern in groundwater within OU1. Groundwater in the saturated gravel and sand layer above the silty clay-confining unit has been impacted by VOCs and SVOCs. The VOCs include BTEX as well as several solvents and chlorinated compounds not associated with MGP operations. The SVOCs include PAHs and biphenyl. Metals and total cyanide are not a concern in groundwater at the site.

The solvents and chlorinated VOCs detected in groundwater are not associated with former MGP operations, and appear to have been released and migrated from a former dry cleaning facility (Pappas Cleaners) immediately upgradient from the site. The MGP-related groundwater impacts are consistent with NAPL observations and the groundwater flow direction at the site, which is to the northwest. The extent of NYSDEC Class GA groundwater standard or guidance value exceedances for MGP-related constituents covers much of the OU1 area and extends off-site in some areas (OU2). The extent of the off-site groundwater plume will be characterized in a separate report for the off-site OU2 area.

Although the shallow zone groundwater at OU1 is impacted, the groundwater table is several feet deeper than typical utility excavations. In addition, this thin saturated zone groundwater neither serves as a usable water supply nor does the groundwater discharge to any nearby surface water body. Drinking water is supplied in the area by the local water authority and NYSEG does not intend to use shallow groundwater within OU1 as a source of drinking water.

Deep groundwater quality at the site was determined by analyzing samples from the deep wells, which have screen intervals ranging from 63 to 87 bgs. As documented in the SRI Report, deep groundwater quality has not been impacted by the former MGP due to the presence of a competent confining layer below the shallow impacted zone.

2.3 Risk Evaluation

The SRI Report (Ish Inc., January 2006) included a fish and wildlife impact assessment and a qualitative human health risk assessment (HHRA) for OU1.

The site is an operational service center for NYSEG and the surface is mostly covered by the building, pavement or gravel. There is no wildlife present at the site except for some transient species that visit the site occasionally. The site does not provide habitat for wildlife resources.

The qualitative HHRA evaluated potential on-site receptors and exposure pathways. The on-site receptors and potential exposure pathways included:

- Indoor workers (inhalation of intrusive vapors);
- Outdoor workers (direct contact with surface soil);
- Utility worker (direct contact with surface soil and subsurface soil);
- Construction workers (direct contact with surface soil and subsurface soil); and
- Visitors (direct contact with surface soil).

The potential for direct contact with impacted surface soils was determined to be insignificant. There are two areas of the site where possible direct contact exposures to MGP-related constituents in unsaturated subsurface soil are likely to occur. The first area is the south central part of the site that includes the below ground gas holder foundation. The second area is within and around the former aboveground gas holder foundation (slab) to the east of the service center building. NYSEG has a policy that requires environmental compliance personnel within the company be contacted before excavations occur on the site. This policy ensures that properly trained excavation personnel are used, health and safety precautions are followed, and soil is managed appropriately. By following these procedures, the potential for direct contact exposures to subsurface soil during excavations are minimized.

Several factors mitigate the vapor intrusion pathway at the site. The building has a slab on grade foundation, and there is about 10 feet of unsaturated soil between the water table and the floor of the building. If vapors originate primarily from groundwater, the constituents in the vapor phase must migrate through the unsaturated soil zone where attenuation will occur prior to reaching the building. Also, because vehicles drive into portions of the building, the building must be well ventilated to prevent exhaust fumes from accumulating. Although these factors suggested that the potential for inhalation of intrusive vapors is not significant, the vapor intrusion pathway was examined further as a follow up to the SRI.

A work plan for a soil vapor intrusion (SVI) assessment in the OU1 area where the NYSEG service center building is situated, entitled Supplemental Remedial Investigation – Soil Vapor Intrusion Evaluation (Ish Inc., December 2005), was approved by NYSDEC in December 2005. An initial site survey was completed in February 2006, and samples were collected in March 2006. A draft report presenting the results of the SVI evaluation was submitted to NYSDEC for review in May 2006 (Ish Inc., May 2006).

The objective of the SVI evaluation was to determine the potential presence of indoor air impacts in the NYSEG Service Center building resulting from subsurface MGP residues in the OU1 land area. Two indoor air and two sub-slab samples were collected from two locations in the NYSEG service center building. Two additional subsurface soil gas samples were collected just outside the footprint of the service center building and one ambient air (outdoor air) sample was collected to the southeast of the service center building. All samples were collected on March 9, 2006 using summa canisters and 8-hour flow controllers and submitted for laboratory analyses.

Only one constituent (chloromethane) was detected in the outdoor air sample. Constituents detected in the soil gas samples collected outside the building, the vapor samples collected from the sub-slab beneath the building, and the indoor air samples were consistent with constituents detected in groundwater (chlorinated and aromatic VOCs). The aromatic VOCs are typically found in MGP residuals as well as in petroleum products, such as gasoline, which is stored inside the building. The chlorinated VOCs and their degradation products appear to originate from the former Pappas Cleaners facility, located upgradient and immediately south and east of OU1. Comparison of the measured indoor air results to their respective OSHA TWA standards indicates that no OSHA standards were exceeded. A sub-slab depressurization system will be installed in the building to mitigate intrusion of the non-MGP related chlorinated compounds.

3.0 REMEDIAL GOALS AND REMEDIAL ACTION OBJECTIVES

The selected remedy will eliminate or mitigate all significant threats to public health and the environment associated with the former MGP operations. On March 2, 2006, discussions with NYSDEC and NYSEG led to establishment of the following Remedial Action Objectives (RAOs) for OU1 at the NYSEG former MGP site in Dansville, New York:

Coal Tar NAPL

- Remediate, to the extent practicable, areas containing coal tar NAPL.
- Control, to the extent practicable, further off-site migration of coal tar NAPL.
- Eliminate, to the extent practicable, human exposure to coal tar NAPL.

Groundwater

- Minimize potential risks to human health from exposure to groundwater containing site-related MGP constituents at levels above current NYS groundwater quality standards.
- Restore, to the extent practicable, groundwater quality in the shallow sand and gravel aquifer, where impacted from site-related MGP constituents, to the current NYS groundwater quality standards.

Subsurface Soil

- Minimize potential risks to human health from exposure to subsurface soil containing site-related MGP constituents.

The approximate areal extent of MGP-related vadose zone soil, saturated zone soil and groundwater impacts are identified on Figure 3-1. With the exception of locations of the former MGP structures, NAPL occurrences within OU1 are primarily limited to the saturated gravel and sand interval above the silty clay-confining layer at depths of approximately 12 to 16 feet bgs. Impacted groundwater occurs within the same interval, with vertical migration halted by the silty clay-confining layer that is generally encountered between approximately 14 and 16 feet bgs. Depth to groundwater generally ranges from approximately 9 to 13 feet bgs within this zone.

4.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

4.1 Preliminary Screening

Potentially applicable remedial technologies have been identified based on the experience of NYSEG and the Ish Inc. team at similar former MGP sites.

Remediation Technologies for Unsaturated Soils
Technologies for addressing unsaturated zone soils within the areas of interest are identified in Table 4-1. Eight general technologies are included. As noted in the table, technologies may be combined to develop alternatives for the evaluation to identify a preferred alternative for Dansville OU1.

As summarized in Table 4-1, four soil technologies have been eliminated from further consideration. *In-situ* stabilization (ISS) and *in-situ* chemical oxidation (ISCO) are not appropriate to address impacts within the unsaturated zone at the site, but will be considered further to address NAPL and groundwater impacts within the saturated zone. *In-situ* biological treatment was eliminated because it is not effective for addressing the subsurface structures and associated heavy NAPL impacts within the vadose zone. Excavation with on-site thermal desorption treatment and backfill is not feasible at the NYSEG Dansville site because of implementation concerns due to the site being located in a residential area.

Institutional controls and maintenance of a surface cover were eliminated as stand-alone remediation technologies, but are retained for consideration as components of other alternatives. The primary soil technologies retained for further evaluation include no action and excavation with off-site treatment and disposal. No action is being retained as a baseline for comparison with other alternatives. Excavation with off-site treatment and disposal of the subsurface structures and associated heavy NAPL impacts within the unsaturated zone will be a component of all alternatives except no action.

NAPL and Groundwater Remediation Technologies
Technologies for addressing NAPL and groundwater within the areas of interest at the site are identified in Table 4-2. Eleven general technologies are included. As noted in the table, component technologies may be combined to develop alternatives for the evaluation.

As summarized in Table 4-2, two technologies have been completely eliminated from further consideration. *In-situ* biological treatment was eliminated because of its limited effectiveness in heavily impacted areas, and because of the significant dissolved phase concentrations attributable to the adjacent off-site source. Site-wide groundwater extraction and treatment technology was eliminated due to its limited effectiveness, implementation constraints, and presence of the upgradient off-site source area that could result in increased impacts if application of the technology were attempted.

Hydraulic containment was eliminated as a stand-alone technology, but was retained as a component with installation of a partial downgradient physical barrier. NAPL collection was eliminated as a stand-alone technology, primarily because free phase, mobile NAPL is minimal or not present at the site, but has been retained as a potential component of other alternatives. Institutional controls and groundwater monitoring were also eliminated as stand-alone technologies, but retained as components of other alternatives.

The primary NAPL and groundwater technologies retained for further evaluation include no action, source removal via excavation, *in-situ* treatment (using either ISS or ISCO technology), or physical containment (using either full containment or a partial downgradient barrier). No action is being retained as a baseline for comparison with other alternatives. Source removal within the saturated zone via excavation will be considered further along with the necessary hydraulic controls for implementation. *In-situ* treatment within the saturated zone, following excavation of sources and structures within the vadose zone, will be considered further. Physical containment alternatives, including full containment around the impacted area of OU1 and a partial downgradient barrier with limited hydraulic controls, will also be retained for the alternatives evaluation.

4.2 Identification of Alternatives

Based on the preliminary screening of potentially applicable remedial technologies, components have been identified and combined to develop a set of remedial alternatives that are appropriate for the detailed evaluation phase of the FS for OU1 at the NYSEG Dansville site.

The remedial alternatives (seven in total) are identified in Table 4-3. Communications with NYSDEC representatives have occurred as these alternatives were developed so that potential regulatory inputs and concerns could be addressed prior to conducting the detailed analysis. The remedial alternatives are described further in Section 5.0 of this FS, and are also evaluated in detail using the criteria specified by NYSDEC.

5.0 EVALUATION OF REMEDIAL ALTERNATIVES

The remedial alternatives identified in Section 4.0 are described in further detail in this section. In accordance with regulatory guidance entitled Technical Guidance for Site Investigation and Remediation (NYSDEC, December 2002), the remedial alternatives are also evaluated in this section using the following criteria:

- Overall protection of public health and the environment;
- Compliance with standards, criteria and guidance (SCGs);
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility or volume with treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

Each alternative is first evaluated independently. The ability of each alternative to achieve the RAOs identified in Section 3.0 is considered in evaluating overall protection of public health and the environment. Compliance with SCGs includes consideration of the actions involved as well as groundwater and soil quality. Potentially applicable SCGs are identified in Section 7 and Appendix 7A of the DER-10 guidance document (NYSDEC, December 2002).

A summary of the alternatives evaluation is presented in Table 5-1. Cost estimates for each alternative, developed for comparative purposes, are presented in Table 5-2. A comparative analysis using the same criteria follows in Section 6.0.

5.1 Alternative 1 – No Action (With Institutional Controls and Groundwater Monitoring)

The no action alternative provides a baseline for comparison with the other alternatives, and is included in the evaluation for consistency with NYSDEC guidance (NYSDEC, January 2002). No active remediation would be implemented under this alternative. Institutional controls that limit land and groundwater uses and routine groundwater monitoring have been included as components of this remedial alternative.

The no action alternative would not impact current or expected future land uses at the site. Soil and groundwater quality would not be effected other than through natural attenuation. The surface cover currently in place limits potential human exposures to surface/subsurface soils, although maintenance of the cover would not be assured. Exposure to impacted groundwater does not currently exist. A groundwater use restriction would assure on-site exposure does not occur. Drinking water-based groundwater clean-up goals would not be addressed with this alternative. Institutional controls would assure continued protection of human health on-site. Potential exposure to impacted soil would be controlled by land use restrictions and a soil management plan.

Groundwater monitoring is included with the no action alternative for evaluation purposes. The estimated monitoring costs are based on analyses of groundwater samples collected on a quarterly basis for a maximum period of 30 years. The well network and monitoring program would be finalized prior to implementation. As part of the monitoring events, groundwater level measurements would be obtained to evaluate groundwater flow directions and assure that an appropriate monitoring well network is maintained.

Overall Protection of Public Health and the Environment

The current surface cover provides protection from direct exposure to impacted soil. However, long-term maintenance of the cover is not included for implementation in this alternative, which may increase the potential for future exposure. There is no current or anticipated future use of groundwater within the impacted area. However, the presence of coal tar NAPL within the saturated zone under this alternative poses a continued threat to the subsurface environment.

RAOs that involve exposure controls are addressed. Active remediation of NAPL or groundwater would not occur, nor would any active measure be exercised to control potential NAPL migration to downgradient locations in OU2. Alternative 1 reduces the potential for human exposure through the use of institutional controls. The no action alternative is low in acceptability because it is not adequately protective of public health or the environment. Furthermore, the potential for human exposure to contaminants can be reduced by active remedial actions.

Compliance With SCGs

Actions under Alternative 1 would be limited to institutional controls (land and groundwater use restrictions) and groundwater monitoring. Compliance with SCGs associated with these actions would primarily involve proper management of purge water for monitoring well sampling, which is achievable.

Remediation of soils exceeding the NYSDEC recommended soil cleanup objective of 500 mg/Kg for total SVOCs would not occur. The objective of restoring groundwater quality to NYS standards site-wide would not be achieved with this alternative. The overall acceptability of this alternative is low regarding this criterion.

Long-Term Effectiveness and Permanence

Because maintenance of the surface cover would not be assured, this alternative is unreliable in assuring the long-term effectiveness and protection from potential exposures to impacted soil. There is no current or anticipated future use of groundwater within the impacted area. Therefore, a groundwater use restriction and monitoring may be adequate to provide long-term protection from potential exposures to impacted groundwater.

Risks related to the continued presence of coal tar NAPL in the subsurface would persist, and long-term impacts to groundwater quality associated with the off-site source would continue unless the source is addressed. This alternative is low in acceptability regarding this criterion.

Reduction of Toxicity, Mobility or Volume with Treatment

No active treatment of soil or groundwater would occur with Alternative 1. Significant reductions in contaminants through natural attenuation are not expected to occur without removal of source material. Constituent mobility would not significantly change.

NAPL within the saturated zone would remain as a continued source of dissolved phase constituents that will continue to migrate with groundwater flow and maintain the current groundwater plume. Acceptability regarding this criterion is low because the toxicity, mobility or volume of constituents would not be reduced.

Short-Term Effectiveness

The no action alternative would not have any adverse short-term effects on the community or remediation workers. Short-term environmental impacts beyond the current extent of constituent occurrence are not expected. Alternative 1 is highly effective in the short-term, although groundwater monitoring would occur for a projected period of 30 years.

Implementability

This alternative would not impact current or expected future land uses, other than the need to maintain the existing monitoring well network. Institutional controls such as use restrictions are commonly adopted. Therefore, this alternative is readily implementable, although it may not be acceptable to regulatory agencies.

Cost

The initial cost to implement Alternative 1 is estimated at $9,500, to cover preparation of the land and groundwater use restrictions. Annual costs for groundwater monitoring, including management and reporting, are estimated at $62,000.

Assuming monitoring activities occur over a 30-year period, the estimated total present worth cost is approximately $962,600. Table 5-2 provides the detailed cost estimate for Alternative 1. This alternative is considered very good in acceptability regarding this cost criterion.

5.2 Alternative 2 – Excavation of Subsurface Structures and Visual NAPL in Vadose Zone Soils, Free-Phase NAPL Removal Using Collection Trench, Institutional Controls and Groundwater Monitoring

This alternative would involve four remedial components – (1) excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in the vadose (unsaturated) zone soils, (2) installation of a collection trench to capture any mobile, free-phase NAPL at the downgradient property boundary, (3) institutional controls and (4) groundwater monitoring.

The general areas for the excavation and location of the NAPL collection trench utilized for evaluation purposes are identified on Figure 5-1. The planned extent of soil excavation would be finalized during remedial design phase based on available analytical data and visual observations of coal tar/NAPL occurrence as noted on boring logs. Depth to groundwater varies across the site, and generally occurs between approximately 9 to 13 feet bgs. An excavation depth of 10 feet within a surficial area of approximately 17,000 square feet has been assumed for evaluation purposes. The 10,000 tons total excavated mass estimate for Alternative 2 includes an allowance for limited additional excavations within the saturated zone (without the use of hydraulic controls) to address significant NAPL occurrences observed below the water table during field implementation of the remedy. As depicted on Figure 5-1, removal of a small southern portion of the NYSEG service center building may be necessary for complete access to one of the former gas holder locations. This issue would be evaluated further during the remedial design phase.

Excavated soil that is impacted by MGP residuals would be transported to a suitable off-site facility for low temperature thermal desorption (LTTD) treatment or another acceptable treatment method. Debris would be transported to a local landfill for disposal. Approved waste profiles will be in place with any treatment or disposal facility utilized to assure that the material meets their acceptance criteria. Clean soil from an off-site source would be used as backfill material, along with unimpacted material that would be reused within the deeper portions of the excavated areas.

Based on the data obtained during remedial investigations of the site, it appears that the bulk of the NAPL present within the saturated zone is no longer migrating in the subsurface. However, as a precautionary measure, Alternative 2 includes the installation of a trench along the downgradient boundary of OU1 to collect and remove potentially mobile free-phase NAPL should it be migrating off-site. Details associated with the trench, including the location, length, method of installation, materials of construction and NAPL removal method would be determined during the design phase if this alternative is chosen for implementation. For the FS evaluation purposes, installation of a gravel trench within the saturated zone at the location depicted on Figure 5-1 has been assumed. Waste material would be managed similar to material from the excavated areas. Monitoring/recovery points located within the trench (15 assumed) would be used to determine if mobile NAPL is accumulating within the trench, and to periodically remove the NAPL when sufficient accumulation occurs. For costing purposes, bimonthly monitoring, monthly NAPL removal, and annual disposal of six drums of NAPL has been assumed for a ten-year duration.

The surface cover currently in place limits potential soil exposures, and maintenance of the cover would continue with this alternative to address soils beyond the excavation areas. Potential soil exposures would also be controlled by land use restrictions and a soil management plan for intrusive activities. To assure that the integrity of the cap/cover is adequate, the budgetary estimate of this alternative includes initial costs for improvements to the existing cover as well as routine maintenance and soil management plan-related costs. Groundwater would be addressed via removal of material from the unsaturated zone that acts as a source of groundwater impacts. Exposure to impacted groundwater does not currently exist, and institutional controls involving a groundwater use restriction would assure continued protection of human health on-site. Drinking water-based groundwater clean-up goals would not be achieved on-site with this alternative due to the presence of NAPL within the saturated zone and migration of non-MGP dissolved phase constituents from an upgradient source.

Groundwater monitoring would be implemented similar to Alternative 1. This sampling and analyses would be conducted until remedial objectives are met. The cost estimate for this alternative assumes that quarterly groundwater monitoring would continue for a period of 15 years. The well network and monitoring program would be finalized during remedial design activities. During the monitoring events, groundwater level measurements would be obtained to evaluate groundwater flow directions and assure that an appropriate monitoring well network is maintained.

Overall Protection of Public Health and the Environment

Excavation of subsurface structures and impacted soil within the unsaturated zone, along with maintenance of a surface cover, would eliminate the potential for direct exposure to impacted soil. The presence of coal tar NAPL within the saturated zone on-site would remain as an ongoing environmental impact. However, potential off-site NAPL migration would be addressed by the collection trench at the downgradient boundary, and there is no current or anticipated future use of groundwater within the impacted area.

Alternative 2 further reduces the potential for human exposure through the use of institutional controls and groundwater monitoring. Although there would be limited potential for exposure during future excavation of the subsurface soils, routine procedures are available to assure adequate worker protection. Therefore, RAOs that involve exposure controls are addressed. Active remediation of NAPL or impacted groundwater within the saturated zone would not occur, although the potential for further off-site migration of NAPL would be controlled. This alternative should provide adequate protection of public health and the environment for the MGP-related impacts.

Compliance With SCGs

Actions under Alternative 2 would include excavation, installation of a collection trench with NAPL monitoring and removal, institutional controls and groundwater monitoring. Compliance with SCGs associated with these actions would include proper management of excavated material, purge water and NAPL, which are expected to be achievable.

Soils in the vadose zone exceeding the NYSDEC recommended soil cleanup objective of 500 mg/Kg for total SVOCs would be addressed via excavation. The excavation component of this alternative would also reduce the mass of material that is a source of groundwater impacts. Drinking water-based groundwater quality standards would likely not be met within the impacted area, however, due to the continued presence of coal tar NAPL within the saturated zone and migration of dissolved phase chlorinated constituents from an upgradient source. Therefore, this alternative is considered moderate in overall acceptability regarding this criterion.

Long-Term Effectiveness and Permanence

Excavation of impacted soil provides a permanent solution. The surface cover should be maintainable over the long-term, which combined with institutional controls provides additional protective measures for potential soil exposures.

The collection trench would provide a protective measure to address potentially mobile, free-phase NAPL. Material acting as a source of groundwater impacts would be partially removed. There is no current or anticipated future use of groundwater within the impacted area. However, residual risks related to the continued presence of coal tar NAPL in the subsurface would persist with Alternative 2, along with long-term impacts to groundwater quality associated with the upgradient off-site source unless the source is addressed by the responsible parties. The institutional controls and groundwater monitoring should be adequate to provide long-term protection from potential exposure to impacted groundwater.

Reduction of Toxicity, Mobility or Volume with Treatment

Direct reduction of toxicity, mobility and volume of contaminants at the site would occur via physical removal of subsurface structures and impacted material including NAPL from the vadose zone. Post-remediation reductions through natural attenuation of groundwater would be monitored.

The potential extraction of free-phase NAPL in the saturated zone would be addressed through installation of the collection trench and subsequent monitoring and removal of NAPL, should accumulation within the trench occur. Residual NAPL within the saturated zone would remain as a source of dissolved phase constituents that may migrate with groundwater flow. The acceptability of Alternative 2 regarding this criterion is moderate.

Short-Term Effectiveness

Implementation of institutional controls, periodic NAPL monitoring and removal (if present), routine surface cover maintenance and groundwater monitoring would not have any adverse short-term effects on the community or remediation workers. The vadose zone excavation and collection trench installation components would have limited short-term effects. However, routine procedures are available to mitigate the potential risks and assure adequate protection, and these procedures could be implemented within a reasonable timeframe.

The excavation and NAPL removal components of this alternative address source material, and further assure that potential exposure to impacted soil or groundwater will not occur. Environmental impacts beyond the current extent of MGP constituent occurrence are not expected. Alternative 2 would have good short-term effectiveness, although NAPL monitoring/removal and groundwater monitoring are assumed to continue for projected periods of 10 and 15 years, respectively.

Implementability

Institutional controls such as land use restrictions are commonly adopted and considered readily implementable. The excavation work under Alternative 2 is considered technically implementable, although logistical, underground structure and existing utility issues must be further addressed. Installation of the collection trench should be implementable, although temporary dewatering and underground utility issues will need to be addressed in the design and implementation phases. Administrative constraints on implementation are not anticipated.

Following the excavation and collection trench installation work, this alternative would not impact current or expected future land use other than the need to maintain access to the NAPL monitoring/recovery points and the groundwater monitoring well network. NAPL monitoring and removal (should accumulation occur) and groundwater monitoring are considered routine tasks that are readily implementable. Overall, Alternative 2 is considered implementable.

Cost

The initial cost to implement Alternative 2 is estimated at $3,002,400, to cover excavation costs, installation of the NAPL collection trench, and institutional controls. Annual costs for groundwater monitoring, cap/cover maintenance with periodic soil management, and NAPL monitoring and removal are estimated at $113,900. If NAPL monitoring and removal are not needed, the estimated annual costs would be reduced to $90,700.

Assuming the monitoring, maintenance and NAPL removal activities occur over a 10-year period, with additional groundwater monitoring and cap/cover maintenance for five years (15-year period total), the estimated total present worth cost is approximately $4,123,000. Table 5-2 provides the detailed cost estimate for Alternative 2. From a cost perspective, the acceptability of this alternative is considered good.

5.3 Alternative 3 – Excavation of Subsurface Structures and Visual NAPL in Vadose Zone Soils, Downgradient Containment Using Physical Barrier With Limited Total Fluids Extraction and Disposal, Institutional Controls and Groundwater Monitoring

Alternative 3 would involve excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in vadose (unsaturated) zone soils, downgradient containment at the property boundary using a physical barrier with limited total fluids extraction and disposal, institutional controls and groundwater monitoring. This alternative is similar to Alternative 2, except for the method to address NAPL within the saturated zone at the downgradient boundary.

The extent of the excavation areas and location of the containment system used for evaluation purposes are depicted on Figure 5-2. Similar to Alternative 2, an excavation depth of 10 feet within a surficial area of approximately 17,000 square feet has been assumed. The 10,000 ton total excavated mass estimate allows for limited additional excavations within the saturated zone. The planned extent of soil excavation would be finalized during remedial design, along with further evaluation of access to the former gas holder locations. Excavated soil that is MGP residuals-impacted would be transported to an off-site facility for LTTD or another acceptable treatment method. Debris would be transported to a local landfill for disposal. Approved waste profiles will be in place with any facility utilized to assure the material meets their acceptance criteria. Clean soil from an off-site source would be used as backfill material, along with unimpacted material from the excavations that would be reused within the lower portions of the excavated areas.

Although it appears that the bulk of the NAPL within the saturated zone is no longer migrating in the subsurface, downgradient containment at the property boundary is included with Alternative 3 as a precautionary measure. For evaluation purposes, installation of a containment system using a physical barrier with limited total fluids extraction at the location depicted on Figure 5-2 and off-site disposal have been assumed. Waste material generated during installation of the containment system would be managed similar to material from the vadose zone excavated areas.

A physical barrier installed using the slurry wall method to a depth of 20 feet was utilized for cost estimating purposes. Slurry wall installations generally involve excavating a narrow vertical trench. Where possible, the depth is extended to bedrock or a low permeability confining layer. During excavation, the trench is filled with slurry consisting of a bentonite, cement and water mixture. Maintaining the trench full of slurry prevents caving or sloughing of the trench walls. The excavation equipment used depends on the depth, with backhoe-type equipment generally most efficient for depths less than 70 feet. After excavation, the slurry-filled trench is backfilled with a soil/bentonite/cement/water mixture to create a low permeability barrier. Other barrier types (*in-situ* stabilization barrier, sheet piling, jet grout wall, GundWall system, etc.) may be viable. The type, location and depth of the barrier would be finalized during design.

A series of extraction points (15 assumed) would be installed upgradient of the physical barrier to remove any NAPL that may accumulate and to maintain hydraulic control at the downgradient boundary to the extent necessary. Periodic total fluids extraction using mobile high vacuum equipment (e.g., vacuum truck) with off-site disposal of the recovered fluids has been assumed for evaluation purposes. The method for fluids extraction and disposal would be evaluated further during the remedial design phase. For costing purposes, monthly total fluids extraction and disposal of approximately 3,000 gallons have been assumed over a 15-year period.

Maintenance of the existing surface cover is included in this alternative to limit potential soil exposures beyond the excavation areas. Land use restrictions and a soil management plan for intrusive activities would also address any remaining soil impacts. To assure that the integrity of the cap/cover is adequate, initial costs for improvements as well as routine maintenance and soil management related costs are included in the budgetary estimate of this alternative. Exposure to impacted groundwater does not currently exist, and a groundwater use restriction would assure continued protection of human health on-site. Groundwater quality would be addressed via removal of unsaturated zone material that acts as a source of impacts. Drinking water-based groundwater clean-up goals would not be achieved with Alternative 3 due to the NAPL that would still remain within the saturated zone, as well as migration of dissolved phase non-MGP chlorinated compounds from an upgradient source.

Groundwater monitoring would be implemented with Alternative 3 until remedial objectives are met. For cost estimating purposes, quarterly groundwater monitoring for a period of 15 years has been assumed. The monitoring well network and monitoring program would be finalized during remedial design activities. Groundwater level measurements would be obtained during the monitoring events to evaluate groundwater flow directions and assure that an appropriate well network is maintained.

Overall Protection of Public Health and the Environment

The potential for direct exposure to impacted soil would be eliminated by excavation of subsurface structures and impacted soil within the unsaturated zone, along with maintenance of a surface cover. The presence of coal tar NAPL within the saturated zone on-site would pose a continued threat of environmental impacts. However, potential NAPL migration would be addressed by the containment system. There is no current or anticipated future use of groundwater within the impacted area, and periodic extraction and disposal of groundwater at the barrier would mitigate dissolved phase migration of constituents.

The potential for human exposure would be further reduced by the use of institutional controls and groundwater monitoring. The limited potential for exposure during future subsurface soil excavation could be controlled using routine procedures. Therefore, RAOs that involve exposure controls are addressed. Active remediation of NAPL or impacted groundwater within the saturated zone would not occur, although potential NAPL migration off-site would be controlled and the containment system would also mitigate dissolved phase migration. This alternative would provide adequate protection of public health and the environment for the MGP-related impacts.

Compliance With SCGs

Actions under Alternative 3 would include excavation, installation of a physical barrier and extraction points with periodic total fluids extraction, institutional controls and groundwater monitoring. Compliance with SCGs associated with these actions would include proper management of excavated material, material generated during installation of the barrier, extracted fluids and purge water, which is expected to be achievable.

Soils in the vadose zone exceeding the 500 mg/Kg soil cleanup objective for total SVOCs would be addressed via excavation. The excavation component would also reduce the mass of material in the vadose zone acting as a source of groundwater impacts. Because coal tar NAPL within the saturated zone and migration of dissolved phase chlorinated compounds from an upgradient source would remain, drinking water-based groundwater quality standards would likely not be met. Therefore, this alternative is considered moderate in overall acceptability regarding this criterion.

Long-Term Effectiveness and Permanence

Excavation of impacted soil provides a permanent long-term solution to potential impacted soil exposures. The surface cover should be maintainable in the long-term, which combined with institutional controls provides additional protective measures for potential soil exposures.

Material acting as a source of groundwater impacts would be partially removed. Residual risks related to the continuing presence of coal tar NAPL in the saturated zone would be addressed through containment, although long-term operation and maintenance of the system would be necessary. Unless the source is addressed, groundwater quality impacts associated with the off-site source will continue to affect OU1. Because groundwater within the impacted area is not currently used or anticipated for future use, the groundwater use restriction and monitoring should provide adequate long-term protection. Overall, Alternative 3 is considered moderate in acceptability regarding this criterion.

Reduction of Toxicity, Mobility or Volume with Treatment

Direct reduction in toxicity, mobility and volume of contaminants would occur via physical removal of subsurface structures and impacted material from the vadose zone. Post-remediation reductions through natural attenuation of groundwater would be monitored.

The mobility of impacted groundwater and potentially free-phase NAPL in the saturated zone would be addressed through installation and operation of a downgradient containment system. However, immobile NAPL in the saturated zone would remain. The acceptability of Alternative 3 regarding this criterion is moderate to good.

Short-Term Effectiveness

Implementation of institutional controls, routine surface cover maintenance and groundwater monitoring would not have any adverse short-term effects on the community or remediation workers. The excavation and downgradient barrier installation components would have some short-term effects. However, routine procedures are available to mitigate the potential risks and assure adequate protection, and these measures could be implemented within a reasonable timeframe.

The excavation component of Alternative 3 addresses source material in the vadose zone, and further assures that potential exposure to impacted soil will not occur. The containment system would assure that environmental impacts due to continued constituent migration from OU1 do not occur. However, total fluids extraction at the barrier and disposal would need to continue for a projected duration of 15 years. Because remedial operations, in addition to routine monitoring and maintenance activities, would be necessary for a significant period of time, this alternative is fair to low in acceptability regarding short-term effectiveness.

Implementability

Institutional controls such as land use restrictions are commonly adopted and considered readily implementable. The vadose zone excavation work is considered technically implementable, although logistical, underground structure and existing utility issues must be properly addressed. Installation of the containment system should be implementable, although underground utility issues and management of waste material will need to be addressed in design and implementation phases. Administrative constraints on implementation are not anticipated.

Following the excavation and containment system installation work, this alternative would involve the need to maintain access to the extraction points and the groundwater monitoring well network. Maintaining access to the extraction points could limit future land uses. Removal of fluids from the extraction points should be implementable using mobile high vacuum equipment that is generally available. The requirement for long-term extraction and disposal of fluids may pose some constraints in the future, however. Maintenance of the monitoring well network and groundwater monitoring are routine tasks that are readily implementable.

Overall, Alternative 3 has implementability issues primarily associated with the need to maintain access to the extraction points and for long-term disposal of fluids extracted for hydraulic control purposes.

Cost

The initial cost to implement Alternative 3 is estimated at $2,914,500, to cover vadose zone excavation costs, installation of the downgradient containment system, and institutional controls. Annual costs for groundwater monitoring, cap/cover maintenance with periodic soil management, and monthly total fluids extraction and disposal are estimated at $142,900.

Assuming the monitoring, maintenance and extraction activities occur over a 15-year period, the estimated total present worth cost is approximately $4, 397,800. Table 5-2 provides the detailed cost estimate for this alternative. The initial costs for Alternative 3 are relatively low, while the long-term costs are relatively high due primarily to the need for extraction and disposal of fluids from the containment system.

5.4 Alternative 4 – Excavation of Subsurface Structures and Visual NAPL in Vadose Zone Soils, Containment Using Physical Barrier Around Impacted OU1 Area With Maintenance of Cap/Cover, Institutional Controls and Groundwater Monitoring

Alternative 4 would involve excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in vadose (unsaturated) zone soils, full containment around the impacted OU1 area using a physical barrier with maintenance of a surface cap/cover, institutional controls and groundwater monitoring.

The extent of the excavation areas and location of the physical barrier used for evaluation purposes are depicted on Figure 5-3. Similar to Alternatives 2 and 3, a 10-foot excavation depth within a surficial area of approximately 17,000 square feet has been assumed. The 10,000 ton total excavated mass estimate allows for limited additional excavations within the saturated zone. The planned soil excavation extent would be finalized during the remedial design phase, along with further evaluation of access at the former gas holder locations. Excavated soil impacted by MGP residuals would be transported off-site to a LTTD or other acceptable treatment facility. Debris would be transported to a local landfill for disposal. Approved waste profiles will be in place with any facility utilized to assure the material meets their acceptance criteria. Clean soil from an off-site source would be used as backfill material, along with unimpacted excavated material that would be reused within the lower portions of the excavated areas.

The full isolation/containment approach of Alternative 4 involves installation of a physical barrier around the impacted OU1 area to greatly reduce or eliminate groundwater movement through the coal tar NAPL containing area within the saturated zone. Containment of on-site groundwater would mitigate the potential for continued off-site migration of dissolved phase constituents. Although the bulk of the NAPL within the saturated zone does not appear to be migrating in the subsurface, containment at the property boundary would also address potentially mobile free-phase NAPL within the saturated zone as a precaution.

For evaluation purposes, installation of a physical barrier using the slurry wall method to a depth of 20 feet at the location depicted on Figure 5-3 has been assumed. Slurry wall installations are described in the presentation of Alternative 3. Other barrier types may be viable, and the type, location and depth of the barrier would be finalized during remedial design phase should this alternative be chosen for implementation. Waste material generated during installation of the containment system would be managed similar to material from the excavated areas. The physical barrier would prevent migration of impacted groundwater from the non-MGP upgradient source (i.e., the former Pappas Cleaners facility) from continuing to impact groundwater within OU1. However, the groundwater flow pattern would be altered such that non-MGP dissolved phase constituents from the off-site source may migrate to previously unimpacted areas. Therefore, implementation of this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property.

Maintenance of the existing surface cap/cover would occur with Alternative 4 to limit potential soil exposures beyond the excavation areas and to maintain hydraulic control within the isolated area of OU1 by minimizing infiltration. Land use restrictions and a soil management plan for intrusive activities would also address any remaining soil impacts. The budgetary estimate of this alternative includes costs for initial improvements as well as routine maintenance for the cap/cover, and periodic soil management related costs. Exposure to impacted groundwater does not currently exist, and a groundwater use restriction would assure continued protection of human health on-site. Groundwater would be addressed via removal of unsaturated zone material that acts as a source of impacts. Drinking water-based groundwater clean-up goals would not be achieved with Alternative 4 due to the presence of NAPL that would remain within the saturated zone.

Groundwater monitoring would be implemented with Alternative 4 until remedial objectives are met. For cost estimating purposes, quarterly monitoring for a period of 15 years has been assumed. The monitoring program would be finalized during remedial design activities. Groundwater level measurements obtained during the monitoring events would be used to evaluate groundwater flow directions and assure that an appropriate monitoring well network is maintained.

Overall Protection of Public Health and the Environment

As with Alternatives 2 and 3, the potential for direct exposure to impacted soil would be eliminated by excavation of subsurface structures and impacted soil within the unsaturated zone, along with maintenance of a surface cover and land use restrictions. Although coal tar would remain within the saturated zone, full containment around OU1 would control potential off-site NAPL migration and the migration of groundwater impacted by MGP constituents.

Groundwater is not currently used within the impacted area, and the use of institutional controls and groundwater monitoring would further reduce the potential for human exposure. Potential worker exposures during subsurface soil excavation could be controlled with routine procedures. Therefore, RAOs that involve exposure controls are addressed. Although active remediation of NAPL in the saturated zone would not occur, the full isolation provided by the containment barrier for the source material addresses the associated potential for continued environmental impacts in a cost-effective manner. This alternative provides adequate protection of public health and the environment for the MGP constituents.

Compliance With SCGs

Actions under Alternative 4 would include excavation, installation of a physical barrier around the impacted OU1 area, maintenance of a surface cap/cover, institutional controls and groundwater monitoring. Compliance with SCGs associated with these actions would include proper management of excavated material, material generated during installation of the physical barrier and purge water, which are expected to be achievable.

Soils in the vadose zone exceeding the 500 mg/Kg soil cleanup objective for total SVOCs would be addressed via excavation, and the mass of material acting as a source of groundwater impacts would be reduced. Coal tar NAPL within the saturated zone would remain, however. Therefore, drinking water-based groundwater quality standards would not be met within OU1. Also, the upgradient portion of the barrier may cause groundwater impacted by the non-MGP off-site source to flow to previously unimpacted areas. This alternative is considered moderate in overall acceptability regarding this criterion.

Long-Term Effectiveness and Permanence

Excavation provides a permanent long-term solution to potential impacted soil exposures. Maintenance of the surface cover should be achievable in the long-term to provide additional protective measures, along with institutional controls, for potential soil exposures.

Material acting as a source of groundwater impacts would be partially removed. Residual risks related to the continuing presence of coal tar NAPL in the saturated zone would be addressed through full containment around the impacted area of OU1. The full barrier would also mitigate groundwater quality impacts to OU1 associated with the upgradient off-site source, although it may impact groundwater in other areas if not addressed.

Groundwater is not currently used and future use is not expected. Therefore, a groundwater use restriction and monitoring should provide adequate long-term protection. Overall, Alternative 4 is good in acceptability regarding this criterion.

Reduction of Toxicity, Mobility or Volume with Treatment

Direct reduction in toxicity, mobility and volume of contaminants would occur via physical removal of subsurface structures and impacted material from the vadose zone. Post-remediation reductions through natural attenuation of groundwater would be monitored.

The mobility of constituents within the saturated zone of OU1 would be addressed site-wide through installation of a full physical barrier that would mitigate the potential migration of NAPL and dissolved phase constituents with groundwater flow. However, NAPL within the saturated zone would remain. The acceptability of Alternative 4 regarding this criterion is good.

Short-Term Effectiveness

Implementation of institutional controls, routine surface cover maintenance and groundwater monitoring would not have any adverse short-term effects on the community or remediation workers. The excavation and barrier installation components would have some short-term effects. In particular, impacts on utilities located along and across the property boundary would need to be addressed in design phase and properly managed during implementation.

The excavation component of Alternative 4 addresses source material, and further assures that potential exposure to impacted soil would not occur. The barrier around OU1 would assure that environmental impacts due to continued constituent migration do not occur. This alternative includes groundwater monitoring as an additional protective measure for a projected duration of 15 years. Because the on-site excavation and installation of the full barrier would address source material within the impacted area on-site and these measures could be implemented within a reasonable timeframe, this alternative would have good short-term effectiveness.

Implementability

Institutional controls such as land use restrictions are commonly adopted and considered readily implementable. The excavation work is considered technically implementable, although logistical, underground structure and existing utility issues must be addressed further. Installation of the full barrier around OU1 should be implementable, although waste material management and underground utility issues would need to be addressed in the design and implementation phases. Administrative constraints on implementation are not anticipated.

Following the excavation and barrier installation work, this alternative would not impact current or expected future land uses other than the need to maintain access to the monitoring well network. Groundwater monitoring is a routine task that is readily implementable. Overall, Alternative 4 is considered implementable.

Cost

The initial cost to implement Alternative 4 is estimated at $3,448,700, to cover excavation costs, installation of the physical barrier around OU1, and institutional controls. Annual costs for groundwater monitoring, cap/cover maintenance and periodic soil management are estimated at $83,700.

Assuming monitoring and maintenance activities occur over a 15-year period, the estimated total present worth cost is approximately $4,317,500. Table 5-2 provides the detailed cost estimate for Alternative 4. This alternative is considered moderate in acceptability regarding this criterion.

5.5 Alternative 5 – Excavation of Subsurface Structures and Visual NAPL in Vadose and Saturated Zone Soils, Institutional Controls and Groundwater Monitoring

Alternative 5 would involve excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts within the vadose zone (as in Alternatives 2, 3 and 4) and additionally in the saturated zone to the confining layer, along with institutional controls and groundwater monitoring.

The general areas for the excavation activities used for evaluation purposes are identified on Figure 5-4. Depth to the confining layer varies across the site, and was generally encountered approximately 14 to 16 feet bgs during RI activities. An excavation depth of 16 feet within a surface area of approximately 23,000 square feet has been assumed for evaluation purposes. The planned extent of soil excavation would be finalized during the remedial design phase should this alternative be chosen for implementation, along with further evaluation of access at the former gas holder locations. The 20,500 ton total excavated mass estimate for Alternative 5 includes an anticipated significant volume of unimpacted material within the vadose zone, particularly where the excavation area to reach saturated zone impacts extends beyond the planned vadose zone excavation area of Alternatives 2 through 4. Excavated soil that is MGP residuals-impacted would be transported off-site to a LTTD or other acceptable treatment facility. Debris would be transported to a local landfill for disposal. Approved waste profiles will be in place with any facility utilized to assure the material meets their acceptance criteria. Clean soil from an off-site source would be used as backfill material, along with unimpacted material that would be reused within the lower portions of the excavated areas.

Because the excavation would extend into the saturated zone, where a significant amount of groundwater inflow is anticipated, this alternative includes the installation of hydraulic controls to support the excavation activities. For evaluation purposes, installation of a slurry wall around the excavation areas at the location depicted on Figure 5-4 has been assumed. Slurry wall installations are described in the presentation of Alternative 3. Other methods of hydraulic control (sheet piling, wellpoint extraction system, etc.) may be viable, and the method employed would be evaluated further during the remedial design phase. Any waste material generated during installation of the hydraulic controls would be managed similar to material from the excavated areas.

Left in place, a physical barrier for hydraulic control to support the saturated zone excavation would also prevent impacted groundwater from the non-MGP upgradient source of chlorinated compounds (i.e., the former Pappas Cleaners facility) from re-impacting the excavated portion of the saturated zone. However, it would alter groundwater flow patterns such that impacted groundwater from the former Pappas Cleaners property may migrate to previously unimpacted areas. Therefore, depending on the method utilized, removal or modification of the controls following excavation may be necessary and implementation of this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property.

The surface cover currently in place limits potential soil exposures, and maintenance of the cover would continue with Alternative 5 to address soils beyond the excavation areas. Any remaining soil impacts would also be addressed by land use restrictions and a soil management plan for intrusive activities. The budgetary estimate includes initial costs for improvements to the existing cover as well as routine maintenance and soil management related costs. Groundwater quality would be significantly improved via removal of material from the vadose and saturated zones that acts as a source of groundwater impacts. However, drinking water-based groundwater clean-up goals may not be achieved with Alternative 5 due to residual coal tar NAPL that may remain beyond the excavation areas, and because of migration of dissolved phase constituents from the upgradient source. Therefore, this alternative includes a groundwater use restriction to assure continued protection of human health on-site.

Groundwater monitoring would be implemented with Alternative 5 until remedial objectives are met, similar to the other alternatives. The cost estimate assumes that quarterly monitoring would continue for a period of 10 years. The reduced monitoring duration of this alternative is based on the excavation of additional source material within the saturated zone. Groundwater level measurements obtained during the monitoring events would be used to evaluate groundwater flow directions and assure that an appropriate monitoring well network is maintained. The monitoring program would be finalized during remedial design activities.

Overall Protection of Public Health and the Environment

Through the excavation of former MGP structures and impacted vadose zone soil, maintenance of a surface cover and land use restrictions, this alternative would eliminate the potential for direct exposure to impacted soil. The excavation of coal tar NAPL within the saturated zone would directly address the source of potentially mobile NAPL and dissolved phase constituents that pose a threat of continued environmental impacts.

Use of impacted groundwater does not currently exist. Institutional controls and groundwater monitoring would further reduce the potential for human exposure. The saturated zone excavation would remediate NAPL, control potential NAPL migration and provide for restoration of groundwater quality although re-contamination from the off-site non-MGP source could occur. Potential worker exposures during subsurface soil excavation could be controlled. Therefore, each of the RAOs is addressed and Alternative 5 provides adequate protection of public health and the environment by addressing impacted soil and saturated zone source areas.

Compliance With SCGs

Actions under Alternative 5 would include excavation within the vadose and saturated zones with installation of hydraulic controls to support the excavation activities, along with institutional controls and groundwater monitoring. Compliance with SCGs would involve proper management of excavated material, including material generated during installation of the physical barrier, and water extracted from the excavation areas during implementation. Compliance should be achieved, although requirements associated with the excavation dewatering may impose some constraints. Management of purge water generated during groundwater monitoring activities consistent with requirements is achievable.

Soils in the vadose and saturated zones exceeding the total SVOCs soil cleanup objective of 500 mg/Kg would be addressed. The mass of coal tar NAPL acting as a source of groundwater impacts would be eliminated from both the unsaturated and saturated zones within the excavated area. However, depending on the degree of residual NAPL that may remain beyond the excavation areas and the status of migration of the upgradient source of non-MGP dissolved phase constituents, drinking water-based groundwater quality standards may not be met throughout the entire OU1 area.

Unless removed or modified, a physical barrier installed for hydraulic control purposes could result in impacted groundwater from the former Pappas Cleaners property to migrate to previously unimpacted areas. Therefore, this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property. This alternative is considered good in overall acceptability regarding this criterion.

Long-Term Effectiveness and Permanence

Excavation of material with significant NAPL impacts within both the unsaturated and saturated zones provides an effective and permanent long-term solution to potential impacted soil exposures and the sources of groundwater impacts within the excavation area. Long-term maintenance of a surface cover should be achievable to provide additional protective measures, along with institutional controls, for potential soil exposures beyond the excavation areas.

The permanence of the saturated zone remediation and resulting improvements to groundwater quality may be limited by the presence of the former Pappas Cleaners property upgradient of OU1. Unless the off-site non-MGP source is addressed, groundwater within OU1 could be re-impacted following the excavation. The use restriction and groundwater monitoring would provide additional protection from potential exposure to impacted groundwater. Overall, Alternative 5 is good in acceptability regarding this criterion.

Reduction of Toxicity, Mobility or Volume with Treatment

Direct reduction of toxicity, mobility and volume of contaminants on the site would occur via physical removal of subsurface structures and impacted material from the vadose and the saturated zones. Post-remediation groundwater concentrations and natural attenuation would be monitored. Overall, the acceptability of Alternative 5 regarding this criterion is good because the mass of constituents in both the unsaturated and saturated zones would be permanently reduced.

Short-Term Effectiveness

Implementation of institutional controls, routine surface cover maintenance and groundwater monitoring would not have any adverse short-term effects on the community or remediation workers. The excavation and installation of the associated barrier for hydraulic control purposes would have some short-term effects, such as increased potential for exposure to constituents in the excavated soil. However, routine procedures are available to mitigate the potential risks and assure adequate protection during the construction activities.

The excavation of source material within the vadose and saturated zones further assures that potential exposure to impacted soil will not occur, and also reduces the potential for environmental impacts beyond the current extent of constituent occurrence. Installation of the hydraulic control measures and handling of wet material excavated from the saturated zone could affect the overall timeframe for implementation. Alternative 5 includes groundwater monitoring as an additional protective measure for a projected duration of 10 years. Overall, this alternative would have moderate to good short-term effectiveness.

Implementability

The vadose zone and subsurface structure excavation work associated with Alternative 5 is considered technically implementable, although logistical, underground structure and existing utility issues must be addressed further. Some concerns exist regarding the technical implementability of saturated zone excavation work due to the depth and anticipated dewatering requirements. Installation of a slurry wall or similar hydraulic control measure around the excavation area is anticipated. Dewatering of the saturated zone suitably for excavation purposes may involve administrative constraints that would need to be addressed in the design phase.

Institutional controls such as land use restrictions are commonly adopted and considered readily implementable. Following the excavation work, this alternative would not impact current or expected future land use other than the need to maintain access to the monitoring well network. Groundwater monitoring is a routine task that is readily implementable.

Overall, Alternative 5 has some potential implementability issues due to the technical and administrative requirements involved with the saturated zone excavation work.

Cost

The initial cost to implement Alternative 5 is estimated at $4,794,700, to cover excavation costs with hydraulic controls for the saturated zone and institutional controls. Annual costs for groundwater monitoring, cap/cover maintenance and periodic soil management are estimated at $78,400.

Assuming monitoring and maintenance activities occur over a 10-year period, the estimated total present worth cost is approximately $5,400,100. Table 5-2 provides the detailed cost estimate for this alternative. The initial costs are considered relatively high, although long-term costs after implementation would be relatively low due to the reduced monitoring period.

5.6 Alternative 6 – Excavation of Subsurface Structures and Visual NAPL in Vadose Zone Soils, *In-Situ* Treatment of the Saturated Zone Following Excavation, Institutional Controls and Groundwater Monitoring

Alternative 6 would involve excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in vadose (unsaturated) zone soils, *in-situ* treatment within the saturated zone following vadose zone excavation, institutional controls and groundwater monitoring.

The extent of the excavation and *in-situ* treatment areas used for evaluation purposes are depicted on Figure 5-5. Similar to Alternatives 2 through 4, a 10-foot depth within a surficial area of approximately 17,000 square feet has been assumed for the excavation. The 10,000 ton total excavated mass estimate allows for limited additional excavations to remove significant NAPL occurrences below the water table that may be encountered and are readily removable. The remaining saturated zone impacts would be addressed via *in-situ* treatment. The planned soil excavation extent would be finalized during the design phase, along with further evaluation of access to the former gas holder locations. MGP residuals-impacted soil would be transported off-site to a LTTD or other acceptable treatment facility. Debris would be transported to a local landfill for disposal. Approved waste profiles would be in place with any facility utilized for treatment or disposal. Clean soil from an off-site source would be used as backfill, along with unimpacted material that would be reused within the lower portions of the excavated areas.

Following excavation of the structures and vadose zone material, *in-situ* treatment of contaminants in the saturated zone would be carried out. *In-situ* treatment of on-site groundwater would reduce dissolved phase constituent concentrations and mitigate the potential for off-site migration. The target treatment interval would be below the depth of the excavation to the confining layer, and below the water table to the confining layer within the planned treatment areas located beyond the extent of the excavation. A depth to the confining layer of 16 feet has been assumed for evaluation purposes, along with a total *in-situ* treatment area of approximately 23,000 square feet as depicted on Figure 5-5.

The potentially applicable *in-situ* treatment technologies identified in Section 4.0 include *in-situ* stabilization/solidification (ISS) and *in-situ* chemical oxidation (ISCO). ISS technology generally involves the mixing of impacted soil and/or NAPL-containing material with grouting reagents to solidify the material and immobilize constituents of interest, reducing leaching and the migration of constituents in groundwater as well as migration of NAPL. The ISS process alters the chemical composition and physical characteristics of the impacted material and NAPL contained in the subsurface, and reduces the potential for infiltration or groundwater contact with the immobilized constituents. A large-diameter auger is typically moved through the targeted treatment interval, while reagents prepared at an on-site batch plant are mixed with the soil material in the treatment interval. Treatment proceeds in columns, with the auger retracted after completion and repositioned to overlap the previously treated column, and the process is repeated. On the other hand, ISCO treatment involves the chemical destruction of constituents, which, if effective, results in a permanent solution. Treatment is achieved through the installation of injectors screened within the target treatment zone, and the injection of reagents that chemically catalyze and oxidize the organic constituents of interest. The application of ISCO technology within an area of NAPL occurrence must be carefully managed.

For cost estimating and evaluation purposes, *in-situ* treatment via ISS has been assumed for Alternative 6. The ISS process results in an increase in the bulk density and volume of the treated/solidified material.

Because the proposed ISS area is mostly within the area proposed for vadose zone excavation, the need to address excess material from within the treated areas would be minimized. The significantly reduced permeability within the ISS treatment zone may alter groundwater flow patterns such that non-MGP impacted groundwater from the former Pappas Cleaners property may migrate to previously unimpacted areas. Therefore, implementation of this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property.

Maintenance of the existing surface cover would occur with Alternative 6 to limit potential soil exposures beyond the excavation areas. Land use restrictions and a soil management plan for intrusive activities would also address any remaining soil impact issues. The budgetary estimate of this alternative includes initial costs for improvements to the existing cover as well as routine maintenance and soil management related costs. Groundwater quality would be significantly improved via removal of material from the vadose zone and treatment of material within the saturated zone that act as a source of groundwater impacts. However, drinking water-based groundwater clean-up goals may not be immediately achieved with Alternative 6 due to residual NAPL beyond the excavation and treatment areas, and because of the migration of non-MGP dissolved phase chlorinated compounds from an upgradient source. Therefore, this alternative includes a groundwater use restriction to assure continued protection of human health on-site.

Alternative 6 includes groundwater monitoring until remedial objectives are met, similar to the other alternatives. For cost estimating purposes, quarterly monitoring for a period of 10 years has been assumed. The reduced monitoring duration of this alternative is based on the treatment of additional source material within the saturated zone. Groundwater level measurements would be obtained during the monitoring events to evaluate groundwater flow directions and assure that an appropriate well network is maintained. The monitoring program would be finalized during remedial design activities.

<u>Overall Protection of Public Health and the Environment</u>
Excavation of the MGP structures and impacted vadose zone soil, combined with maintenance of a surface cover and land use restriction, would eliminate the potential for direct exposure to impacted soil. *In-situ* treatment of the saturated zone within the area of significant coal tar NAPL would directly address the source of potentially mobile NAPL and dissolved phase constituents that pose a threat of continued environmental impacts.

Potential worker exposures during excavation activities would be controlled. Use of impacted groundwater does not currently exist, and institutional controls and groundwater monitoring would further reduce the potential for human exposure. Although NAPL constituents would remain in the solidified material, ISS within the saturated zone would essentially eliminate potential migration of NAPL and the dissolved phase constituents. Therefore, each of the RAOs is addressed. Alternative 6 provides adequate protection by addressing impacted soil and sources of MGP constituents within the saturated zone.

<u>Compliance With SCGs</u>
Actions under Alternative 6 would include excavation, *in-situ* treatment within the saturated zone, institutional controls and groundwater monitoring. Compliance with SCGs associated with these actions would include proper management of excavated material and purge water, which is expected to be

achievable. Compliance with requirements for the safe and proper application of ISS technology would also be necessary during implementation of Alternative 6, which should be achievable.

Soils exceeding the total SVOCs soil cleanup objective of 500 mg/Kg would be addressed via excavation in the vadose zone and ISS in the saturated zone. Material acting as a source of groundwater impacts would be physically removed or solidified in-place to reduce or eliminate its potential to affect groundwater quality. Similar to Alternative 5, the degree of residual NAPL beyond the excavation areas and the status of the upgradient source of chlorinated compounds would affect the ability of this alternative to achieve drinking water-based groundwater quality standards throughout the entire OU1 area.

Because of the significant permeability reduction within the area treated via ISS, groundwater flow would be altered. Therefore, non-MGP impacted groundwater from the former Pappas Cleaners property could migrate to previously unimpacted areas and this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property. This alternative is considered good in overall acceptability regarding this criterion.

Long-Term Effectiveness and Permanence

Excavation of MGP-impacted material in the unsaturated zone provides a permanent long-term solution to potential exposures to impacted soil. Maintenance of a surface cover should be achievable in the long-term to provide additional protective measures, along with institutional controls, for potential soil exposures beyond the excavation areas.

Material within the saturated zone acting as a source of MGP-related groundwater impacts would be addressed via *in-situ* stabilization. Residual risks would be primarily related to the continued presence of coal tar NAPL constituents (although immobilized via solidification) within the saturated zone, and residual NAPL that may remain beyond the stabilization area. Also, as with the other alternatives, the off-site non-MGP source could cause continuing groundwater impacts outside of the stabilized/solidified areas.

Combined with the excavation and *in-situ* stabilization, deed restrictions and groundwater monitoring would provide additional long-term protection to address the limited residual risks. Alternative 6 is considered good in overall acceptability regarding this criterion.

Reduction of Toxicity, Mobility or Volume with Treatment

Direct reduction of toxicity, mobility and volume of contaminants would occur via physical removal of subsurface structures and impacted material from the vadose zone, and stabilization/solidification of impacted material within the saturated zone using *in-situ* technology. Future additional reductions through natural attenuation would be monitored. The acceptability of Alternative 6 is good regarding this criterion because the mass of constituents in both the unsaturated and saturated zones would be permanently removed or reduced in mobility and toxicity.

Short-Term Effectiveness

Implementation of institutional controls, routine surface cover maintenance and groundwater monitoring would not have any adverse short-term effects on the community or remediation workers. The excavation component would have some short-term effects. However, routine procedures are available to mitigate the potential risks and assure adequate protection. Application of *in-situ* stabilization/solidification technology would also have some limited short-term effects such as increased potential for worker exposure to constituents that would need appropriate management.

The excavation and *in-situ* treatment components of this alternative further assure that potential exposure to impacted soil will not occur, and also reduce the potential for environmental impacts beyond the current extent of constituent occurrence. Impacts on the environment during implementation of this alternative are considered acceptable. Alternative 6 includes groundwater monitoring as an additional protective measure for a projected duration of 10 years. Overall, this alternative would have good short-term effectiveness.

Implementability

The excavation work is considered technically implementable, although logistical, underground structure and existing utility issues must be addressed further. ISS would involve technical considerations and administrative requirements that would need to be addressed during the design phase for safe and proper implementation.

Institutional controls are common measures that are considered readily implementable. Following the excavation and *in-situ* treatment work, current or expected future land use should not be adversely impacted. The monitoring well network would need to be maintained, groundwater monitoring would be conducted, and the solidified area may need to be taken into consideration with any potential future construction work involving subsurface structures or foundations.

Alternative 6 is considered implementable, although technical issues and administrative requirements would need to be addressed in the design phase.

Cost

The initial cost to implement Alternative 6 is estimated at $3,848,200, to cover excavation costs, *in-situ* treatment within the saturated zone following excavation, and institutional controls. Annual costs for groundwater monitoring, cap/cover maintenance and periodic soil management are estimated at $78,400.

Assuming monitoring and maintenance activities occur over a 10-year period, the estimated total present worth cost is approximately $4,453,600. Table 5-2 provides the detailed cost estimate for Alternative 6. Although the initial costs are considered moderate to high, the long-term costs after implementation would be relatively low due to the reduced monitoring period.

5.7 Alternative 7 – Excavation of Subsurface Structures and Areas With NAPL Impacts Within the Vadose and Saturated Zones, Groundwater Use Restriction and Groundwater Monitoring

Alternative 7 would involve excavation of the former MGP subsurface structures and areas with NAPL within the vadose and saturated zones to the maximum extent practicable on-site, along with institutional controls and groundwater monitoring.

The general area for the excavation activities used for evaluation purposes is identified on Figure 5-6. The depth of the excavation would extend to the confining layer. An excavation depth of 16 feet within a surface area of approximately 72,000 square feet has been assumed for evaluation purposes. As depicted on Figure 5-6, the existing NYSEG service center building is within the proposed excavation area of this alternative. Therefore, the budgetary estimate includes demolition and replacement costs for the building. The planned extent of soil excavation would be finalized during remedial design phase. Excavated soil that is MGP-impacted would be transported off-site to a LTTD or other acceptable treatment facility. Debris would be transported to a local landfill for disposal. Approved waste profiles will be in place with any facility utilized to assure the material meets their acceptance criteria. Clean soil from an off-site source would be used as backfill material, along with unimpacted material that would be reused within the deeper portions of the excavated areas. The 64,000 ton total excavated mass estimate for Alternative 7 includes an anticipated significant volume of unimpacted material within the vadose zone.

Because the excavation would extend into the saturated zone, where a significant amount of groundwater inflow is anticipated, this alternative includes the installation of hydraulic controls to support the excavation activities. Installation of a slurry wall around the excavation area at the location depicted on Figure 5-6 has been defined for evaluation purposes. Other methods of hydraulic control may be viable, and the method employed would be evaluated further during the remedial design phase. Any waste material generated during installation of the hydraulic controls would be managed similar to material from the excavated areas.

Left in place, a physical barrier installed to support the saturated zone excavation would also prevent impacted groundwater from the upgradient non-MGP source from re-contaminating the saturated zone within OU1. However, groundwater flow patterns would be altered such that non-MGP impacted groundwater from the former Pappas Cleaners property may migrate to previously unimpacted downgradient areas. Therefore, depending on the method utilized, removal or modification of the controls following excavation may be necessary. Implementation of this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property.

Because impacted soils and NAPL in the subsurface in OU1 would be fully addressed, the institutional controls associated with Alternative 7 are limited to a groundwater use restriction. No restrictions on future land use would be required. Drinking water-based groundwater clean-up goals may be achievable with this alternative for the MGP-related constituents. However, unless the upgradient non-MGP source on the former Pappas Cleaners property is addressed, groundwater within the saturated zone of OU1 would be re-contaminated. Should future groundwater monitoring indicate that drinking water-based goals have been achieved, the deed restriction would be removed by NYSEG.

Groundwater monitoring would be implemented with Alternative 7 until remedial objectives are met, similar to the other alternatives. The cost estimate assumes that quarterly monitoring would continue for a period of 5 years. This alternative involves a significantly reduced monitoring duration based on the extent of the proposed excavation and removal of source material to the extent practicable. Groundwater level measurements would be used to evaluate groundwater flow directions and assure that an appropriate monitoring well network is maintained. The monitoring program would be finalized during remedial design.

Overall Protection of Public Health and the Environment

Alternative 7 is highly protective of public health and the environment based on impacted material from both the vadose and saturated zones being removed. Following the excavation activities, the potential for exposure to impacted soil would be eliminated, and MGP-related sources of impact to groundwater in OU1 would be significantly reduced or eliminated.

Each of the RAOs would be addressed to the maximum extent practicable, including restoration of groundwater quality impacted by MGP constituents. However, unless modified or removed, controls installed to support the saturated zone excavation would alter groundwater flow such that non-MGP impacted groundwater from the former Pappas Cleaners property may migrate to previously unimpacted downgradient areas. Alternatively, impacted groundwater from the upgradient non-MGP source could re-impact the saturated zone. Therefore, achievement of drinking water-based goals for groundwater site-wide may not be technically practicable.

Compliance With SCGs

Actions under Alternative 7 would include excavation within the vadose and saturated zones with installation of hydraulic controls to support the excavation activities, along with institutional controls and groundwater monitoring.

Compliance with SCGs would involve proper management of excavated material, including material generated during installation of the physical barrier, and water extracted from the excavation areas during implementation. Compliance should be achievable, although measures to assure proper implementation would be critical due to the significant extent of the planned excavation. Also, requirements associated with the excavation dewatering may impose some constraints. Management of purge water generated during groundwater monitoring activities consistent with requirements is achievable.

Soils in the vadose and saturated zones exceeding the total SVOCs soil cleanup objective of 500 mg/Kg would be addressed. Material acting as a source of MGP-related groundwater impacts would be significantly reduced or eliminated, including coal tar NAPL within the saturated zone. Drinking water-based groundwater quality standards for the MGP constituents could be achieved throughout the entire OU1 area. However, depending on the status of the upgradient dissolved phase chlorinated compounds source and the final disposition of the physical barrier installed for hydraulic control purposes during excavation, groundwater within OU1 could be re-impacted by the chlorinated compounds following remediation. Also, left in place, the physical barrier should prevent groundwater from being re-impacted although it could lead to non-MGP impacted groundwater from the former Pappas Cleaners property migrating to previously unimpacted downgradient areas. Assuming coordination with any planned remedial actions at the former Pappas Cleaners property will occur, this alternative is highly acceptable regarding this criterion.

Long-Term Effectiveness and Permanence

Excavation of NAPL-impacted material in both the unsaturated and saturated zones to the extent practicable provides the most effective and permanent long-term solution to potential impacted soil exposures and the sources of groundwater impacts within the excavation area.

The permanence of the saturated zone remediation and resulting improvements to groundwater quality may be limited by the presence of the former Pappas Cleaners property upgradient of OU1. As with the other alternatives, the off-site non-MGP source could cause continuing groundwater impacts following the remediation of OU1. The groundwater use restriction and monitoring would provide additional protection from potential exposure to impacted groundwater.

Reduction of Toxicity, Mobility or Volume with Treatment

Direct reduction in toxicity, mobility and volume of contaminants from the site would occur to the maximum extent practicable via physical removal of NAPL-impacted material within the vadose and the saturated zones. Because NAPL within the saturated zone would be addressed, that source of MGP-related groundwater impacts and the associated potential for constituent mobility with groundwater flow would be significantly reduced or eliminated.

Short-Term Effectiveness

Implementation of a groundwater use restriction and groundwater monitoring would not have any adverse short-term effects on the community or remediation workers. The excavation and installation of the associated barrier for hydraulic control purposes during excavation would have some short-term effects. In particular, impacts on utilities would need to be addressed in the design phase and appropriately managed during implementation. Procedures are available to mitigate the potential risks and assure adequate protection during the excavation activities. These procedures for implementation of the alternative would be critical for Alternative 7 due to the significant extent of the planned excavation.

The excavation of impacted material within the vadose and saturated zones further assures that potential exposure to impacted soil will not occur, and also reduces or eliminates the potential for MGP-related environmental impacts. Impacts on the environment during implementation will need appropriate management, particularly during the saturated zone excavation activities. Installation of the hydraulic control measures and handling of the significant mass of wet material excavated from the saturated zone would prolong the overall timeframe for implementation. Alternative 7 includes groundwater monitoring as an additional protective measure for a projected duration of 5 years. Overall, this alternative would have good short-term effectiveness.

Implementability

The vadose zone and subsurface structure excavation work associated with Alternative 7 is considered technically implementable, although logistical, underground structure and existing utility issues must be addressed further. Significant technical implementability concerns exist regarding the saturated zone excavation work due to the planned extent, depth and anticipated dewatering requirements. Installation of a slurry wall or similar hydraulic control around the excavation area is anticipated.

Administrative constraints on implementation for dewatering of the saturated zone suitably for excavation purposes would need to be addressed in the design phase. The need to demolish/reconstruct the existing service center building and temporarily relocate NYSEG crews and equipment would also need to be addressed.

Placing a restriction on future groundwater use and groundwater monitoring are considered readily implementable. Following the excavation work, this alternative would not impact current or expected future land uses other than the need to maintain access to the monitoring well network.

Overall, Alternative 7 has significant implementability issues due to the technical and administrative requirements involved with the saturated zone excavation work and the presence of the existing NYSEG service center building.

Cost

The initial cost to implement Alternative 7 is estimated at $13,735,900, to cover excavation costs with hydraulic controls for the saturated zone, and preparation of a groundwater use restriction. Annual costs for groundwater monitoring, including management and reporting, are estimated at $62,000.

Assuming monitoring activities occur over a 5-year period, the estimated total present worth cost is approximately $14,004,300. Table 5-2 provides the detailed cost estimate for this alternative. Although effective where implementable, excavation represents a relatively high cost approach to remediation of saturated zone impacts.

6.0 COMPARATIVE ANALYSIS

Each remedial alternative for the NYSEG Dansville MGP site OU1 was evaluated using the seven evaluation criteria in Section 5.0. This section presents a comparative analysis of the alternatives using the same seven criteria. The comparative analysis is summarized in Table 6-1.

6.1 Overall Protection of Public Health and the Environment

The no action alternative is the least protective of public health and the environment. The current surface cover provides protection from direct exposure to impacted soil, although long-term maintenance of the cover is not included in this alternative. There is no current or anticipated future use of groundwater within the impacted area. However, the presence of coal tar NAPL within the saturated zone would pose a continued threat of environmental impacts. RAOs that involve exposure controls are addressed. However, active remediation of NAPL or groundwater would not occur, nor would any active measure to address potential NAPL migration thereby not meeting some of the RAOs.

Alternatives 2, 3 and 4 include the excavation of subsurface structures and impacted soil within the unsaturated zone, along with maintenance of a surface cover, which would eliminate the potential for direct exposure to impacted soil. Although there is a limited potential for exposure during excavation of the impacted soils, routine procedures are available to assure adequate protection. The potential for human exposure to impacted soil would be further reduced through the use of institutional controls. There is no current or anticipated future use of groundwater within the impacted area. The potential for human exposure would be further reduced by the use of institutional controls and groundwater monitoring with these alternatives. However, coal tar NAPL remaining within the saturated zone on-site would pose a continued threat of environmental impacts and active remediation of NAPL in the saturated zone and the resulting impacted groundwater would not be carried out.

Alternative 2 addresses potential off-site NAPL migration within the saturated zone with a collection trench at the downgradient boundary. Alternative 3 would address potential NAPL migration and mitigate dissolved phase migration off-site using a barrier system with extraction and disposal of groundwater at the barrier, which may be slightly more protective than Alternative 2. Alternative 4 provides full containment around OU1 to control potential off-site NAPL migration and the migration of groundwater impacted by MGP constituents, which should be comparable to Alternative 3 in overall effectiveness. The RAOs that involve exposure controls are adequately addressed with Alternatives 2, 3 and 4, and they are comparable regarding the remediation of NAPL, control of potential NAPL migration and groundwater restoration objectives.

Alternatives 5 and 6 also involve excavation of subsurface structures and impacted soil within the unsaturated zone, maintenance of a surface soil cover to eliminate the potential for direct exposure to impacted soil, and institutional controls to further reduce the potential for human exposure to impacted soil. Potential exposure to impacted groundwater, which is not currently used or projected for future use, would be addressed by institutional controls and groundwater monitoring. Alternative 5 would involve additional excavation within the saturated zone to remove coal tar NAPL and substantially diminish MGP-related impacts to groundwater quality within OU1. *In situ* stabilization would occur within the saturated zone under Alternative 6 to address coal tar NAPL and its associated impacts to groundwater quality. Alternative 5 and 6 are comparable in the overall protection provided. Because coal tar NAPL within the saturated zone would be actively addressed, they are considered more protective than Alternatives 2, 3 and 4.

Alternative 7 is the most protective of public health and the environment because impacted material from both the vadose and saturated zones in OU1 would be removed to the maximum extent practicable. Following the excavation activities, the potential for exposure to impacted soil would be eliminated, and MGP-related sources of impact to groundwater would be eliminated. A limited groundwater use restriction would provide an additional protective measure for potential human exposure.

Each of the RAOs would be addressed to the maximum extent practicable with Alternative 7, including restoration of groundwater impacted by MGP constituents. However, non-MGP impacted groundwater from the former Pappas Cleaners property could re-contaminate the saturated zone, or hydraulic controls installed to support the saturated zone excavation could alter flows and result in downgradient groundwater impacts to previously unimpacted areas if the installed controls are not modified or removed. Therefore, achievement of drinking water-based goals for groundwater site-wide may not be technically practicable with any alternative unless the off-site non-MGP source located upgradient of OU1 is adequately addressed by the responsible parties.

6.2 Compliance with SCGs

Compliance with action-based SCGs would be achieved with Alternative 1 because no actions would occur. However, soil remediation would not be achieved and impacted groundwater would not be addressed. Therefore, no action is low in overall acceptability regarding this criterion.

All alternatives except no action would involve activities that include excavation of subsurface structures and vadose zone material, institutional controls and groundwater monitoring. The alternatives that combine containment of saturated zone impacts with those activities (Alternatives 2, 3 and 4) involve fewer action-based issues and associated SCGs than the alternatives with active remediation within the saturated zone (Alternatives 5, 6 and 7). Soils in the vadose zone exceeding the 500 mg/Kg soil cleanup objective for total SVOCs would be addressed via excavation with Alternatives 2, 3 and 4, and the mass of material acting as a source of groundwater impacts would be reduced. Coal tar NAPL within the saturated zone would remain, however. Therefore, drinking water-based groundwater quality standards would not be met within OU1. Alternatives 2, 3 and 4 are generally comparable overall regarding compliance with SCGs.

Alternatives 5 and 6 involve active remediation within the saturated zone, which would generally involve more action-based issues and SCGs than the alternatives with containment approaches for saturated zone impacts. Soils in the vadose and saturated zones exceeding the total SVOCs soil cleanup objective of 500 mg/Kg would be removed or treated in-place. The mass of material acting as a source of groundwater impacts would be significantly reduced, including coal tar NAPL within the saturated zone. However, depending on the degree of residual NAPL beyond the excavation areas and the status of migration of dissolved phase constituents from the upgradient source, drinking water-based groundwater quality standards may not be met throughout the entire OU1 area with Alternative 5 or 6. Alternatives 5 and 6 are generally comparable overall regarding compliance with SCGs. Although they involve more action-based issues, they are better at addressing the RSCOs and groundwater quality standards.

Measures to assure proper implementation of Alternative 7 would be critical to compliance with action-based SCGs due to the significant extent of the planned excavation and the associated dewatering requirements. All impacted material exceeding the total SVOCs soil cleanup objective of 500 mg/Kg would be addressed. Material acting as a source of MGP-related groundwater impacts would be significantly reduced or eliminated, including coal tar NAPL within the saturated zone. Drinking water-based groundwater quality standards for the MGP-derived constituents could be achieved throughout the entire OU1 area. However, depending on the status of the upgradient non-MGP dissolved constituents source and the final disposition of the physical barrier installed for hydraulic control purposes, groundwater within OU1 could be re-contaminated following remediation. Assuming coordination with any planned remedial actions at the former Pappas Cleaners property will occur, this alternative may be best regarding compliance with RSCOs and groundwater quality standards.

6.3 Long-Term Effectiveness and Permanence

The surface cover currently in place limits potential soil exposures, and there is no current or anticipated future use of groundwater within the impacted area. However, without being addressed, residual risks related to the continued presence of NAPL in the subsurface would persist, along with the associated impacts to groundwater quality. Each alternative includes groundwater use restrictions and groundwater monitoring as exposure controls to assure adequate protection is maintained.

Because no active remediation would occur under Alternative 1, it is unreliable and the lowest alternative at assuring long-term effectiveness and protection from potential exposures. Alternative 2 includes excavation of impacted soil, which provides a permanent long-term solution to potential exposures to impacted soil. The surface cover should be maintainable long-term, which combined with institutional controls provides additional protective measures for potential soil exposures. Material acting as a source of groundwater impacts would be partially removed, and the collection trench would provide a protective measure to address potentially mobile, free-phase NAPL. The residual risks related to the continued presence of coal tar NAPL in the subsurface would be addressed by the institutional controls and groundwater monitoring to provide long-term protection from potential exposure to groundwater impacted by the former MGP.

Alternative 3 is similar to Alternative 2 regarding long-term effectiveness and permanence. Similar remedial measures would be employed to address soil and potential exposures to impacted soil. The containment system would provide a protective measure to address dissolved phase migration as well as potentially mobile NAPL, although long-term operation and maintenance of the system would be necessary. Unless the source is addressed, groundwater quality impacts associated with the off-site source would continue to affect OU1 with either alternative.

Alternatives 5 and 6 are comparable regarding long-term effectiveness and permanence, although *in-situ* stabilization technology involves less certainty regarding permanence than excavation. All alternatives (except no action) address the former MGP structures and NAPL occurrences within the vadose zone in a similar manner. Alternatives 5 and 6 would address the saturated zone more reliably and actively than the containment approaches of Alternatives 2 and 3. Because of residual NAPL that may remain beyond the excavation or stabilization areas, the full containment approach of Alternative 4 may be comparable to Alternatives 5 and 6.

Excavation of NAPL-impacted material in both the unsaturated and saturated zones to the extent practicable (Alternative 7) provides the most effective and permanent long-term solution to potential impacted soil exposures and the sources of groundwater impacts within the excavation area. The groundwater use restriction and monitoring would provide additional protection from potential exposure to impacted groundwater.

With all alternatives, the off-site, upgradient non-MGP source would likely continue to impact groundwater quality unless it is adequately addressed by the responsible parties. The remedial actions taken under Alternatives 2 and 3 would be least effected by the status of the former Pappas Cleaners property. The permanence of the saturated zone remediation and resulting improvements to groundwater quality with Alternatives 5 and 7 may be limited by the presence of the off-site non-MGP source upgradient of OU1. Unless the former Pappas Cleaners property is addressed, groundwater within OU1 could be re-contaminated following the saturated zone excavation work. The full barrier of Alternative 4 would mitigate groundwater quality impacts to OU1 associated with the off-site source, although it may result in impacts to groundwater in other downgradient areas due to a change in groundwater flow regime. With Alternative 6, the off-site non-MGP source could continue to impact groundwater quality within OU1, or the solidified portion of the saturated zone could result in groundwater impacts to previously unimpacted areas.

6.4 Reduction of Toxicity, Mobility or Volume with Treatment

No direct treatment of soil or groundwater would occur with Alternative 1. Natural attenuation is not expected to be significant without removal of source material, and constituent mobility would not be significantly affected. NAPL within the saturated zone would not be addressed. The “no action” alternative would not reduce the toxicity, mobility or volume of contaminants at the site, and is the least acceptable alternative regarding this criterion.

All alternatives except no action would provide direct reductions via physical removal of subsurface MGP structures and impacted material from the vadose zone, and groundwater would be monitored. With Alternative 2, the potential mobility of free-phase NAPL in the saturated zone would be addressed through installation of a collection trench and subsequent monitoring and removal of NAPL (if accumulation within the trench occurs). NAPL within the saturated zone would remain as a source of dissolved phase constituents that may migrate with groundwater flow. In addition to addressing potentially free-phase NAPL as with Alternative 2, Alternative 3 would address the mobility of impacted groundwater through installation and operation of a downgradient containment system.

Although the approaches differ, Alternatives 4, 5 and 6 are similar in overall effectiveness regarding a reduction in the toxicity, mobility or volume of constituents within the saturated zone. Alternative 6 relies on solidification of NAPL within the saturated zone to immobilize constituents, along with excavation of structures and NAPL in the vadose zone. Alternative 5 provides for physical removal of NAPL from both the vadose and saturated zones. Alternative 4 relies on containment to address constituent mobility, and may be slightly more effective overall depending on the amount and extent of residual NAPL beyond the excavation or *in-situ* treatment areas.

Alternative 7 is the best alternative regarding this criterion. Direct reductions would occur to the maximum extent practicable via physical removal of NAPL-impacted material within the vadose and saturated zones. Because NAPL within the saturated zone would be addressed, that source of MGP-related groundwater impacts and the associated potential for dissolved phase constituent mobility with groundwater flow would be eliminated.

6.5 Short-Term Effectiveness

Exposure to impacted soil or groundwater does not currently exist, and none of the alternatives are expected to result in short-term environmental impacts beyond the current extent of constituent occurrence. Implementation of institutional controls and groundwater monitoring would not have any adverse short-term effects on the community or remediation workers.

The alternatives that include excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in the vadose zone (all except Alternative 1) would have some associated short-term effects during the implementation period. However, routine procedures are available to mitigate the potential risks and assure adequate protection during implementation. The primary differences regarding short-term effectiveness relate primarily to the manner in which saturated zone impacts are addressed.

Because remedial actions would need to continue for a longer period of time, Alternative 3 is considered to be the least effective alternative regarding the short-term criterion. Installation of the hydraulic control measures and handling of the significant volume of wet excavated material would affect the overall timeframe for implementation and result in Alternative 7 requiring the longest duration to complete initial activities, although the subsequent groundwater monitoring period would be relatively limited.

Alternatives 5 and 6 are expected to require similar timeframes for completion of the initial activities, are considered similar overall regarding short-term effectiveness, and should be more effective in the short-term than Alternatives 3 or 7.

Alternative 4, which includes installation of a physical barrier around the perimeter of OU1, may be slightly better in short-term effectiveness than Alternatives 5 and 6, which involve excavation or *in-situ* solidification/stabilization of impacted saturated zone material. Alternative 2, which incorporates installation of a collection trench for potentially mobile NAPL with excavation, is the best alternative overall in the short-term of those that involve active remediation. “No action” (Alternative 1) would not affect the community or remediation workers, and implementation would not cause any adverse environmental effects. Therefore, it is the most effective alternative in the short-term, although the impacted area would not be improved/remediated.

6.6 Implementability

All alternatives include institutional controls and groundwater monitoring. Institutional controls such as land use restrictions, and measures such as groundwater sampling and maintenance of a monitoring well network, are common actions that are considered readily implementable. Except for no action (Alternative 1), all alternatives also include excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in vadose (unsaturated) zone soils. Therefore, implementation issues associated with saturated zone excavation would be common to all alternatives except the no action alternative. Differences regarding implementability relate primarily to the manner in which saturated zone impacts are addressed.

Due to the significant extent of the planned excavation work within the saturated zone and the presence of the existing service center building, Alternative 7 would be the most difficult alternative to implement. Alternative 5 has some concerns with implementation because of the saturated zone excavation, although the surface area of the excavation is much smaller and removal of the service center building is excluded.

Although excavation dewatering issues would be avoided, Alternative 6 (which involves *in-situ* stabilization of the saturated zone following excavation of vadose zone soils) is expected to have more implementation concerns overall compared to alternatives that employ a containment approach to address saturated zone impacts. No action (Alternative 1) would not have the potential implementability constraints of the containment approaches and would be the easiest alternative to implement technically; however, it is unlikely to be acceptable to the regulatory agencies.

Collection trench or barrier installation issues would need to be addressed in the design and implementation phases for Alternatives 2, 3 or 4. However, overall these activities are considered to be implementable. The length of the barrier associated with Alternative 4 is significantly larger than Alternatives 2 and 3, which likely makes implementation more difficult. Removal of fluids from the extraction points, required for Alternative 3, should be implementable using equipment that is generally available. The requirement for long-term extraction and disposal of fluids may pose constraints in the future, however. Therefore, Alternative 2 is expected to have the least amount of constraints overall regarding implementability.

6.7 Cost

Comparative cost estimates for the remedial alternatives are presented in Table 5-2, including the estimated initial cost, annual cost, duration and total present worth cost. The estimates are based on the alternative descriptions and assumptions provided in Section 5.0.

Alternative 7 is the highest cost alternative in terms of both initial and total costs. Although effective where implementable, site-wide excavation of NAPL within the saturated zone represents a relatively high cost approach to remediation. The long-term costs after implementation should be relatively low due to the potential for a significantly reduced monitoring period compared with other alternatives. Alternative 5 is the second highest cost alternative in terms of both initial and total costs. This alternative employs removal of saturated zone NAPL-containing soils to the confining layer to a lesser extent than Alternative 7, making the total present worth cost estimate about $8.6 million lower than Alternative 7. *In-situ* stabilization or treatment of NAPL within the saturated zone (Alternative 6) is also relatively high in initial costs, but with relatively lower subsequent costs compared with containment approaches. The total present worth cost of Alternative 6 is about $1 million less than Alternative 5.

The alternatives that involve unsaturated zone excavation combined with containment to address saturated zone impacts (Alternatives 2, 3 and 4) are lower in initial costs than those involving excavation or treatment of the saturated zone (Alternatives 5, 6 or 7). Post-remediation costs would be higher, however. Alternative 4 involves the most extensive containment system and, therefore, has the highest initial costs compared with Alternatives 2 and 3, which are comparable to each other in initial costs. Alternative 3 has the highest long-term costs of any alternative following remediation due to the need for extraction and disposal of fluids at the barrier for an extended period of time. Total estimated costs for Alternative 3 are the highest for alternatives that do not involve excavation or stabilization within the saturated zone. Total estimated present worth costs for Alternatives 2, 3 and 4 are similar, and comparable to the total present worth costs estimated for Alternative 6 (excavation and *in-situ* stabilization within the saturated zone).

Alternative 1 (no active remediation, with institutional controls and groundwater monitoring) involves minimal initial costs. Although the long-term costs are expected to be the highest of all alternatives, total estimated costs are still the lowest overall. The no action alternative was included in the evaluation to provide a baseline for comparison with the other alternatives.

7.0 RECOMMENDED REMEDY

Based on the findings of the Remedial Investigation and the FS presented in this report, sufficient information exists to select a remedy for OU1 at the NYSEG Dansville former MGP site. The recommendation has been developed based on the RAOs and the seven criteria utilized in the evaluation pursuant to NYSDEC guidance, with consideration given to the constraints associated with the former Pappas Cleaners property where a source of unrelated groundwater impacts is located upgradient of OU1.

Alternative 1 (no action) does not satisfactorily address the RAOs and is not adequately protective of public health or the environment. Although Alternative 7 would be highly effective in permanently removing the MGP-related impacts, the significant costs and implementation concerns make site-wide excavation to the confining layer infeasible.

Alternative 3 achieves the RAOs that involve exposure controls, provides remediation of NAPL within the vadose zone associated with the former MGP structures via excavation, addresses groundwater restoration via removal of unsaturated zone material that acts as a source of impacts, and controls potential NAPL migration off-site with a physical barrier. However, Alternative 3 is not recommended based on the evaluation criteria. In particular, the need for extraction and disposal of fluids at the barrier over an extended period of time result in Alternative 3 being less acceptable in comparison to other alternatives.

Each of the remaining four alternatives considered in the FS (Alternatives 2, 4, 5 and 6) incorporate excavation of the former MGP subsurface structures and associated areas with significant NAPL impacts in the vadose zone, institutional controls and groundwater monitoring as three of the remedial technology components. The differences between the four alternatives relate to the manner in which saturated zone impacts are addressed.

In addition to the excavation, institutional controls and groundwater monitoring as components, Alternative 2 includes collection of potentially mobile NAPL using a collection trench at the downgradient property boundary, with periodic monitoring and removal of NAPL (if accumulation occurs) using wells installed within the trench. Collection at the downgradient boundary of OU1 is potentially more effective in addressing residual NAPL that may be present beyond the extent of the area where saturated zone excavation or stabilization is implemented (Alternatives 5 or 6). Also, NAPL collection at the boundary (as with Alternative 2) is much less contingent upon the nature of any actions that may be taken to address impacts associated with the former Pappas Cleaners property. However, to date there is no empirical evidence of NAPL mobility at the site, which makes Alternative 2 speculative with regard to NAPL extraction and removal.

Full containment (Alternative 4), as well as solidification of the saturated zone within OU1 as with Alternative 6, could result in previously unimpacted groundwater areas being impacted by non-MGP constituent migration from the former Pappas Cleaners property. The primary benefit of the saturated zone excavation work under Alternative 5, which involves higher initial costs for implementation, is that the NAPL in the saturated zone as well as in the unsaturated zone of the excavation footprint would certainly be removed.

Given the criteria evaluated in this FS, with additional consideration given to the RAOs, Alternative 5 appears to be the most effective alternative overall to address the OU1 impacts at the NYSEG Dansville former MGP site. In addition to the excavation of former MGP structures and associated areas with significant NAPL impacts in vadose zone soils, institutional controls and groundwater monitoring components, Alternative 5 includes removal of coal tar NAPL in the saturated zone. This alternative, while more costly than Alternatives 2, 3, 4 and 6, addresses the RAOs established for OU1 by incorporating the following technology components:

- A significant mass of coal tar NAPL is remediated by excavation of NAPL associated with the former MGP structures in the vadose zone and also in the saturated zone to the confining layer;
- Off-site migration of coal tar NAPL is controlled by removing the coal tar source material within the saturated zone of OU1;
- Human exposure to coal tar NAPL is eliminated by the soil excavation; exposure to the remaining coal tar NAPL outside the excavation footprint (chiefly 12-16 feet bgs) will be controlled through use of institutional controls;

- Potential risks to human health from exposure to groundwater containing MGP constituents are minimized by the use of institutional controls and groundwater monitoring;
- Restoration of groundwater in the shallow sand and gravel aquifer with MGP-related impacts is addressed via excavation of material that would continue to act as a source of groundwater impacts; and
- Potential risks to human health from exposure to subsurface soil containing MGP constituents are minimized by the soil excavation and use of institutional controls.

In addition, installation of a slurry wall around the excavation area eliminates the recontamination potential of the remediated area from the upgradient source of chlorinated compounds.

8.0 REFERENCES

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TRC, May 1991. Task 4 Report, New York State Electric & Gas Corporation, Risk Assessment for the Former Coal Gasification Site, Dansville, NY.

TABLES

TABLE 4-1

SCREENING OF POTENTIAL SOIL TECHNOLOGIES

NYSEG Dansville Former MGP Site
Dansville, New York

Technology	Description	Conclusion
No action	No remedial measures taken	**Retain** as a baseline for comparison with other alternatives
Institutional controls	Addresses potential risks by restricting property uses to non-residential and through a Soil Management Plan	**Eliminate** as a stand-alone technology, but include as a component of other alternatives
Surface cover	Maintain a cover (e.g., vegetation, stone, pavement) over impacted areas	**Eliminate** as a stand-alone technology, but include as a component of other alternatives
In-situ stabilization	Reduce mobility of constituents in-place by mixing with a binding agent and solidification	**Eliminate** as a technology to address impacts within the unsaturated zone
In-situ biological treatment	Reduce constituent concentrations in-place by enhancing natural biodegradation	**Eliminate -** not effective at addressing subsurface structures and associated heavy NAPL impacts
In-situ chemical oxidation	Chemical destruction of adsorbed constituents through injection of reagents	**Eliminate** as a technology to address impacts within the unsaturated zone
Excavation, on-site thermal desorption and backfill	Excavate impacted soils, treat on-site via thermal desorption, and reuse treated soil as backfill	**Eliminate -** implementation concerns with on-site thermal desorption due to site setting in residential area
Excavation, off-site treatment and disposal	Excavate impacted soils, transport off-site for treatment and disposal	**Retain** for further evaluation

Notes:
1. Retained technologies may be combined for the alternatives evaluation.

TABLE 4-2

SCREENING OF POTENTIAL NAPL AND GROUNDWATER TECHNOLOGIES

NYSEG Dansville Former MGP Site
Dansville, New York

Technology	Description	Conclusion
No action	No remedial measures taken	**Retain** as a baseline for comparison with other alternatives
Institutional controls	Address risks by restricting groundwater use	**Eliminate** as a stand-alone technology, but include as a component of other alternatives
Natural attenuation monitoring	Groundwater sampling and analyses to evaluate potential migration and natural attenuation of dissolved phase constituents	**Eliminate** as a stand-alone technology, but include as a component of other alternatives
NAPL collection	Use of wells or trenches to collect and remove free phase, mobile NAPL from the subsurface	**Eliminate** as a stand-alone technology, but include as a component of other alternatives
Source removal via excavation	Excavate impacted material within the saturated zone, using hydraulic controls if necessary	**Retain** for further evaluation
In-situ stabilization	Solidification in-place by mixing with a binding agent to immobilize subsurface constituents	**Retain** for further evaluation as an *in-situ* treatment approach
In-situ bioremediation	Enhancement of natural attenuation by addition of oxygen, and nutrients if needed, to increase biodegradation of constituents	**Eliminate** due to limited effectiveness in heavily impacted areas, and presence of significant dissolved phase impacts from off-site source
In-situ chemical oxidation	Chemical destruction of adsorbed and dissolved phase constituents through injection of reagents	**Retain** for further evaluation as an *in-situ* treatment approach
Hydraulic containment	Use of limited groundwater extraction or phytoremediation to provide containment of dissolved phase constituents and mobile NAPL	**Eliminate** as a stand-alone technology, but include as a component with a partial physical barrier
Physical containment	Installation of a physical barrier (e.g., slurry wall) to provide containment of dissolved phase constituents and mobile NAPL	**Retain** for further evaluation of full containment and partial downgradient barrier approaches
Site-wide groundwater extraction and treatment	Installation of a site-wide groundwater extraction system with treatment and discharge	**Eliminate** due to implementability constraints, effectiveness limitations, and presence of upgradient off-site source area

Notes:
1. Retained technologies may be combined for the alternatives evaluation.

TABLE 4-3

POTENTIAL REMEDIAL ALTERNATIVES FOR OU1

NYSEG Dansville Former MGP Site
Dansville, New York

	DESCRIPTION
1	No action alternative consisting of institutional controls and groundwater monitoring with no other active remediation conducted.
2	Excavation of subsurface structures and visual NAPL in vadose zone soils. Design and installation of a free-phase NAPL removal system at the perimeter to the north side of OU-1 using a collection trench. Institutional controls such as AUL and soil management plans to be employed. Groundwater monitoring to be conducted.
3	Excavation of subsurface structures and visual NAPL in vadose zone together with a downgradient containment system to be designed with limited total fluids extraction and disposal. Institutional controls such as AUL and soil management plans to be employed. Groundwater monitoring to be conducted.
4	Excavation of subsurface structures and visual NAPL in the vadose zone. Containment system to be designed around impacted area of OU1 with cap/cover on surface. Institutional controls such as AUL and soil management plans to be employed. Groundwater monitoring to be conducted.
5	Excavation of subsurface structures and visual NAPL in vadose and saturated zones in OU-1. Institutional controls such as AUL and soil management plans to be employed. Groundwater monitoring to be conducted.
6	Excavation of subsurface structures and visual NAPL in vadose zone. In situ treatment (by in situ stabilization (ISS) or in situ chemical oxidation (ISCO) technology) of the saturated zone underneath the structures and visual NAPL areas after removal by the vadose zone excavation activities. Institutional controls such as AUL and soil management plans to be employed. Groundwater monitoring to be conducted.
7	Excavate subsurface structures and areas with NAPL impacts within both the vadose and the saturated zones (to the maximum extent practicable on-site). Institutional controls such as groundwater use restriction. Groundwater monitoring to be conducted.

Notes:
1. Alternatives with excavation involve off-site treatment of excavated material.
2. Alternatives 5 and 7 include hydraulic controls (e.g., slurry wall) for saturated zone excavation.

TABLE 5-1

REMEDIAL ALTERNATIVES EVALUATION

NYSEG Dansville Former MGP Site (OU1)
Dansville, New York

Criteria	**Alternative 1** **No Action (With Institutional Controls and Groundwater Monitoring)**	**Alternative 2** **Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose Zone Soils, Free-Phase NAPL Removal Using Collection Trench, Institutional Controls and Groundwater Monitoring**	**Alternative 3** **Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose Zone Soils, Downgradient Containment Using Physical Barrier With Limited Total Fluids Extraction and Disposal, Institutional Controls and Groundwater Monitoring**
Overall Protection of Public Health and the Environment	• Relies solely on the use of institutional controls and monitoring • Only RAOs that involve exposure controls are addressed	• Should provide adequate protection by eliminating potential for exposure to impacted soil and addressing potential NAPL migration • RAOs involving exposure controls and NAPL containment are addressed • Active remediation of NAPL or impacted groundwater within the saturated zone would not occur	• Provides adequate protection by eliminating potential for exposure to impacted soil and mitigating potential NAPL and impacted groundwater migration • RAOs involving exposure controls and NAPL containment are addressed • Active remediation of NAPL or impacted groundwater within the saturated zone would not occur
Compliance with SCGs	• Activities should comply • Remediation to address soil impacts would not occur • Groundwater restoration to NYSDEC standards site-wide not addressed	• Activities should comply • Soils in vadose zone exceeding RSCO addressed via excavation • Groundwater restoration to NYSDEC standards site-wide would likely not occur due to continued presence of coal tar in saturated zone	• Activities should comply, although requirements for groundwater extraction may have constraints • Soils in vadose zone exceeding RSCO addressed via excavation • Groundwater restoration to NYSDEC standards site-wide would likely not occur due to continued presence of coal tar in saturated zone
Long-Term Effectiveness and Permanence	• Does not provide adequate long-term protection • Residual risks related to presence of coal tar in subsurface would continue	• Should provide adequate long-term protection • Former structures and source material from vadose zone removed • Residual risks related to potentially mobile NAPL addressed by collection trench	• Should provide adequate long-term protection • Former structures and source material from vadose zone removed • Residual risks related to coal tar in subsurface addressed by downgradient barrier
Reduction of Toxicity, Mobility or Volume with Treatment	• No direct treatment or reduction in constituent mobility • Reductions limited to natural attenuation, which would likely be not significant without source removal • Coal tar would remain a source of groundwater impacts	• Direct treatment via physical removal of structures and vadose zone material • Potentially mobile NAPL controlled by collection trench • Coal tar within saturated zone would remain	• Direct treatment via physical removal of structures and vadose zone material • Mobility of impacted groundwater and potentially free phase NAPL controlled by downgradient barrier • Coal tar within saturated zone would remain
Short-Term Effectiveness	• Effective in protecting community and remediation workers • No effect within impacted area	• Short-term impacts to community and remediation workers are considered acceptable • Impacts on environment during implementation are considered acceptable	• Short-term impacts to community and remediation workers are considered acceptable • Impacts on environment during implementation are considered acceptable • Extraction at the barrier and disposal would need to continue for an extended timeframe
Implementability	• Readily implementable without site constraints • May not be acceptable to regulatory agencies	• Considered technically implementable, although logistical issues, existing utilities and water control for the trench installation must be addressed • Administrative constraints on implementation not anticipated • Impacts on land use would be minimal	• Considered technically implementable, although logistical issues and existing utilities must be addressed • Administrative constraints on implementation not anticipated • Requirement for long-term fluids extraction and disposal may pose future constraints
Cost	• Initial costs $9,500 • Annual costs $62,000 • Estimated total present worth costs (30 years) $962,600	• Initial costs $3,002,400 • Annual costs $113,900 (w/ NAPL removal) and $90,700 (w/o NAPL removal) • Estimated total present worth costs (15 years) $4,123,000	• Initial costs $2,914,500 • Annual costs $142,900 • Estimated total present worth costs (15 years) $4,397,800

TABLE 5-1

REMEDIAL ALTERNATIVES EVALUATION

NYSEG Dansville Former MGP Site (OU1)
Dansville, New York

Criteria	Alternative 4 Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose Zone Soils, Containment Using Physical Barrier Around Impacted OU1 Area With Maintenance of Cap/Cover, Institutional Controls and Groundwater Monitoring	Alternative 5 Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose and Saturated Zone Soils, Institutional Controls and Groundwater Monitoring	Alternative 6 Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose Zone Soils, *In Situ* Treatment of the Saturated Zone Following Excavation, Institutional Controls and Groundwater Monitoring
Overall Protection of Public Health and the Environment	• Provides adequate protection by eliminating potential for exposure to impacted soil and containing migration from saturated zone source areas • RAOs involving exposure controls and NAPL containment are addressed • Full containment mitigates potential for environmental impacts off-site from occurrences of NAPL site-wide	• Provides adequate protection by addressing soil and saturated zone source areas • Each of the RAOs is addressed • Saturated zone excavation remediates NAPL and groundwater, and addresses potential NAPL migration	• Provides adequate protection by addressing soil and saturated zone source areas • Each of the RAOs is addressed • *In situ* treatment in saturated zone remediates NAPL and groundwater, and limits potential NAPL migration
Compliance with SCGs	• Activities should comply • Soils in vadose zone exceeding RSCO addressed via excavation • Groundwater restoration to NYSDEC standards site-wide would likely not occur due to continued presence of coal tar in saturated zone	• Activities should comply, although requirements associated with saturated zone excavation and dewatering may have constraints • Soils in vadose and saturated zones exceeding RSCO addressed via excavation • Groundwater restoration to NYSDEC standards site-wide may occur if residual NAPL beyond excavation area is not significant and off-site non-MGP source is addressed	• Activities should comply, although issues associated with ISS in saturated zone would need addressed • Soils exceeding RSCO addressed via excavation in vadose zone and ISS in saturated zone • Groundwater restoration to NYSDEC standards site-wide may occur if residual NAPL beyond excavation area is not significant and off-site non-MGP source is addressed
Long-Term Effectiveness and Permanence	• Provides adequate long-term protection, although interaction with off-site source must be considered • Former structures and source material from vadose zone removed • Residual risks related to coal tar in subsurface addressed through full containment around OU1	• Should provide adequate long-term protection, however remediated portion of saturated zone could be re-impacted if off-site source is not addressed • Former structures and source material from vadose and saturated zones removed • Post-remediation risks would be related to residual impacts beyond excavation area	• Provides adequate long-term protection • Source material from vadose zone removed with former structures, and treated *in situ* within saturated zone • Although immobilized, coal tar would remain in the saturated zone
Reduction of Toxicity, Mobility or Volume with Treatment	• Direct treatment via physical removal of structures and vadose zone material • Mobility of constituents within saturated zone of OU1 fully controlled by physical barrier • Coal tar within saturated zone would remain	• Direct treatment via physical removal of structures and impacted material within vadose and saturated zones • Additional reductions through natural attenuation would be monitored	• Direct treatment via physical removal of structures and vadose zone material • ISS of NAPL in saturated zone would significantly reduce or eliminate constituent mobility • Additional reductions through natural attenuation would be monitored
Short-Term Effectiveness	• Short-term impacts to community and remediation workers would need properly managed, including impacts to existing utilities • Impacts on environment during implementation are considered acceptable • Addresses all MGP-related impacts within a reasonable timeframe	• Short-term impacts to community and remediation workers would need properly managed • Impacts on environment are considered acceptable, with proper measures utilized for saturated zone excavation • Installation of hydraulic controls and wet material handling could affect overall timeframe	• Short-term impacts to community and remediation workers would need properly managed • Impacts on environment during implementation are considered acceptable
Implementability	• Considered technically implementable, although logistical issues and existing utilities must be addressed • Administrative constraints on implementation not anticipated • Impacts on land use would be minimal	• Technical implementability concerns due to depth and dewatering requirements, logistical issues and existing utilities would need addressed in design • Management of excavation water may pose an administrative constraint • Impacts on land use would be minimal	• Considered technically implementable, although logistical issues and existing utilities must be addressed • Administrative constraints not anticipated, although ISS would involve additional issues to address in design • Solidified area may need to be considered during any future work involving subsurface structures or foundations
Cost	• Initial costs $3,448,700 • Annual costs $83,700 • Estimated total present worth costs (15 years) $4,317,500	• Initial costs $4,794,700 • Annual costs $78,400 • Estimated total present worth costs (10 years) $5,400,100	• Initial costs $3,848,200 • Annual costs $78,400 • Estimated total present worth costs (10 years) $4,453,600

TABLE 5-1

REMEDIAL ALTERNATIVES EVALUATION

NYSEG Dansville Former MGP Site (OU1)
Dansville, New York

Criteria	Alternative 7 Excavation of Subsurface Structures and Areas With NAPL Impacts Within the Vadose and Saturated Zones, Groundwater Use Restriction and Groundwater Monitoring
Overall Protection of Public Health and the Environment	• Highly protective based on impacted vadose and saturated zone material being removed • Each of the RAOs is addressed to the maximum extent practicable • All sources of MGP-related constituents would be addressed
Compliance with SCGs	• Activities should comply, although measures to assure proper implementation would be critical due to significant extent of planned activities • Soils in vadose and saturated zones exceeding RSCO addressed via excavation • Restoration to achieve groundwater standards site-wide should occur, although groundwater could be re-impacted if the off-site non-MGP source is not addressed
Long-Term Effectiveness and Permanence	• Provides permanent long-term solution to MGP-related impacts, however off-site non-MGP source could re-impact saturated zone if not addressed • All impacted material and sources of MGP-related groundwater impacts removed
Reduction of Toxicity, Mobility or Volume with Treatment	• Direct treatment to maximum extent practicable via physical removal of structures and impacted material • Potential for MGP-related constituent mobility would be significantly reduced or eliminated
Short-Term Effectiveness	• Short-term impacts to community and remediation workers would need properly managed, including impacts to existing utilities • Impacts on environment are considered acceptable, with proper measures utilized for saturated zone excavation • Installation of hydraulic controls and significant wet material handling would affect overall timeframe
Implementability	• Because of the planned extent, significant technical implementability concerns involving depth, dewatering, logistics and utilities would need addressed in design • Management of excavation water and the need to demolish/reconstruct service center may pose significant administrative constraints • Impacts on land use following excavation and building reconstruction would be minimal
Cost	• Initial costs $13,735,900 • Annual costs $62,000 • Estimated total present worth costs (5 years) $14,004,300

TABLE 5-2

COMPARATIVE COST ESTIMATES FOR REMEDIAL ALTERNATIVES

NYSEG Dansville Former MGP Site (OU1)
Dansville, New York

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Remediation:							
RD/RA work plan/design	0	120,000	130,000	140,000	130,000	130,000	150,000
Preconstruction/permitting	0	70,000	75,000	80,000	70,000	80,000	85,000
Project management	0	90,000	100,000	100,000	95,000	115,000	115,000
Initial cap/cover improvements	0	26,600	25,750	14,000	22,000	27,000	0
Building demolition	0	23,800	23,800	23,800	23,800	23,800	118,000
Physical barrier/slurry wall	0	0	135,000	370,000	250,000	0	350,000
Slurry wall waste management	0	0	48,000	172,800	74,800	0	110,000
NAPL collection trench installation	0	217,400	0	0	0	0	0
Monitor/recovery wells installation	0	0	72,500	0	0	0	0
Collection trench or wells waste management	0	128,000	4,500	0	0	0	0
Manage obstructions and utilities	0	116,600	120,000	159,000	127,000	107,000	235,000
Temporary excavation	0	50,000	50,000	50,000	205,000	200,000	1,280,000
Wet material conditioning	0	0	0	0	102,500	0	320,000
Excavation/off-site LTTD treatment	0	825,000	825,000	825,000	1,465,750	825,000	3,520,000
Excavation/landfill disposal	0	135,000	135,000	135,000	276,750	135,000	576,000
Backfill	0	180,000	180,000	180,000	328,000	167,000	768,000
Oxygen product addition with backfill	0	0	0	0	0	0	0
Water management	0	52,000	0	0	208,000	0	650,000
Monitoring well replacements	0	2,000	2,000	2,000	2,000	2,000	20,000
Site restoration	0	69,500	73,750	132,500	92,500	67,500	190,000
Oversight	0	76,400	89,300	115,100	128,500	122,000	244,600
Air monitoring	0	49,600	62,400	87,000	94,400	93,900	185,300
Disposal characterization	0	18,000	18,000	18,000	34,000	18,000	78,000
Confirmatory sampling	0	18,000	18,000	18,000	23,200	18,000	52,000
In-situ stabilization	0	0	0	0	0	818,000	0
Groundwater system	0	0	0	0	0	0	0
Oxygen product injections	0	0	0	0	0	0	0
Deed restrictions	7,500	10,000	10,000	10,000	10,000	10,000	5,000
Surveying	0	12,500	12,500	17,500	10,000	20,000	15,000
Building reconstruction	0	170,000	170,000	170,000	170,000	170,000	2,300,000
RA Documentation Report	0	42,000	48,000	54,000	52,500	58,000	80,000
Contingency (approx. 20%)	2,000	500,000	486,000	575,000	799,000	641,000	2,289,000
Estimated Cost:	**9,500**	**3,002,400**	**2,914,500**	**3,448,700**	**4,794,700**	**3,848,200**	**13,735,900**

TABLE 5-2

COMPARATIVE COST ESTIMATES FOR REMEDIAL ALTERNATIVES

NYSEG Dansville Former MGP Site (OU1)
Dansville, New York

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Annual Costs							
Groundwater monitoring	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Groundwater system O&M	0	0	43,200	0	0	0	0
Maintain cap/cover and manage soil	0	11,700	11,700	11,700	7,400	7,400	0
Project management and reporting	12,000	24,000	24,000	18,000	18,000	18,000	12,000
NAPL removal	0	19,200	0	0	0	0	0
Contingency (approx. 20%)	10,000	19,000	24,000	14,000	13,000	13,000	10,000
Estimated Annual Cost:	**62,000**	**113,900**	**142,900**	**83,700**	**78,400**	**78,400**	**62,000**
Estimated Cost (post-NAPL removal):	**62,000**	**90,700**	**142,900**	**83,700**	**78,400**	**78,400**	**62,000**
Estimated NAPL Duration (years):	0	10	0	0	0	0	0
Estimated Groundwater Duration (years):	30	15	15	15	10	10	5
Estimated Total Cost:	**1,869,500**	**4,594,900**	**5,058,000**	**4,704,200**	**5,578,700**	**4,632,200**	**14,045,900**
Estimated Present Worth Cost:	**962,595**	**4,122,971**	**4,397,759**	**4,317,481**	**5,400,081**	**4,453,581**	**14,004,329**
Estimated Present Worth Cost (-30%):	**673,817**	**2,886,080**	**3,078,431**	**3,022,237**	**3,780,057**	**3,117,507**	**9,803,030**
Estimated Present Worth Cost (+50%):	**1,443,893**	**6,184,457**	**6,596,639**	**6,476,221**	**8,100,122**	**6,680,372**	**21,006,494**

Alternatives:

1) No action (with institutional controls and groundwater monitoring)
2) Excavation of subsurface structures and heavy visual NAPL in vadose zone soils, free-phase NAPL removal using collection trench, institutional controls and groundwater monitoring
3) Excavation of subsurface structures and heavy visual NAPL in vadose zone soils, downgradient containment using physical barrier with limited total fluids extraction and disposal, institutional controls and groundwater monitoring
4) Excavation of subsurface structures and heavy visual NAPL in vadose zone soils, containment using physical barrier around impacted OU1 area with maintenance of cap/cover, institutional controls and groundwater monitoring
5) Excavation of subsurface structures and heavy visual NAPL in vadose and saturated zone soils, institutional controls and groundwater monitoring
6) Excavation of subsurface structures and heavy visual NAPL in vadose zone soils, *in situ* treatment of the saturated zone following excavation, institutional controls and groundwater monitoring
7) Excavation of subsurface structures and areas with NAPL impacts within the vadose and saturated zones, groundwater use restriction and groundwater monitoring

Assumptions/Notes:

1) Present worth costs are based on 5% interest rate.
2) Alternatives with excavation involve off-site treatment of excavated material.
3) Alternative 4 costs based on containment using slurry wall technology for evaluation purposes.
4) Alternatives 5 and 7 include hydraulic controls (e.g., slurry wall) for saturated zone excavation.
5) Alternative 6 costs based on *in situ* treatment using ISS technology for evaluation purposes.

TABLE 6-1

COMPARATIVE ANALYSIS OF ALTERNATIVES

NYSEG Dansville Former MGP Site
Dansville, New York

Criteria	Alternative 1 No Action (With Institutional Controls and Groundwater Monitoring)	Alternative 2 Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose Zone Soils, Free-Phase NAPL Removal Using Collection Trench, Institutional Controls and Groundwater Monitoring	Alternative 3 Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose Zone Soils, Downgradient Containment Using Physical Barrier With Limited Total Fluids Extraction and Disposal, Institutional Controls and Groundwater Monitoring
Overall Protection of Public Health and the Environment	Least protective (no active remediation)	Should provide adequate protection	May be slightly more protective than Alternative 2 because groundwater would also be controlled
Compliance with SCGs	Limited activities would comply, but soil remediation would not occur and impacted groundwater would not be addressed	Activities should comply; similar to Alternatives 3 and 4 regarding RSCOs and groundwater restoration	More action-based issues than Alternative 2; similar to Alternatives 2 and 4 regarding soil and groundwater quality SCGs
Long-Term Effectiveness and Permanence	Least effective long-term	Should provide adequate long-term protection	Should provide adequate long-term protection; addresses dissolved constituents along with potentially mobile NAPL, but requires long-term operation
Reduction of Toxicity, Mobility or Volume with Treatment	Provides least reduction	Addresses subsurface structures, vadose zone NAPL and potentially mobile NAPL in saturated zone	Better than Alternative 2 because dissolved phase migration is also addressed
Short-Term Effectiveness	Community and remediation workers not effected; no adverse environmental impacts in implementation, although no benefits to impacted area	Impacted area would be improved; short-term community, remediation worker and environmental impacts would occur but are manageable	Least overall short-term effectiveness due to the need for long-term groundwater extraction and disposal
Implementability	Easiest to implement, although likely unacceptable to regulatory agencies	Considered implementable, although excavation and trench installation issues must be addressed	Probably implementable, although excavation and barrier installation issues need addressed and long-term groundwater extraction and disposal would be involved
Cost	Minimal initial costs, and lowest overall costs	Comparable to Alternative 3 as lowest initial cost alternatives, excluding no action, and lower annual costs than Alternative 3; ranks 2nd in total costs overall	Comparable to Alternative 2 as lowest initial cost alternatives, excluding no action, but highest annual costs due to long-term extraction and disposal; 4th in total present worth costs
Overall Summary	Unacceptable based on overall effectiveness	Viable approach that provides adequate protection without relying on coordination with measures for non-MGP off-site source	Approach incorporating containment that requires long-term operation ranks lower overall that other approaches using evaluation criteria

TABLE 6-1

COMPARATIVE ANALYSIS OF ALTERNATIVES

NYSEG Dansville Former MGP Site
Dansville, New York

Criteria	Alternative 4 Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose Zone Soils, Containment Using Physical Barrier Around Impacted OU1 Area With Maintenance of Cap/Cover, Institutional Controls and Groundwater Monitoring	Alternative 5 Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose and Saturated Zone Soils, Institutional Controls and Groundwater Monitoring	Alternative 6 Excavation of Subsurface Structures and Heavy Visual NAPL in Vadose Zone Soils, *In Situ* Treatment of the Saturated Zone Following Excavation, Institutional Controls and Groundwater Monitoring
Overall Protection of Public Health and the Environment	Comparable to Alternative 3 in overall protectiveness	Potentially more protective than alternatives without active remediation of saturated zone, depending on extent of residual NAPL beyond excavation area	Slightly less effective than Alternative 5, because saturated zone NAPL is solidified in place versus removed
Compliance with SCGs	Activities should comply with SCGs; comparable overall to Alternatives 2 and 3 regarding SCGs compliance	More action-based issues than alternatives without saturated zone excavation, but more preferable regarding RSCOs and groundwater restoration although off-site source could negate benefits to groundwater	Comparable overall to Alternative 5 regarding compliance with SCGs
Long-Term Effectiveness and Permanence	Provides long-term protection more reliably than Alternatives 2 and 3 and addresses residual beyond excavation or treatment areas better than Alternatives 5 and 6	Addresses saturated zone NAPL within excavation area more reliably than containment approaches, although groundwater could be re-impacted from off-site source	Comparable overall to Alternative 5, although *in situ* stabilization technology involves less certainty regarding permanence than excavation
Reduction of Toxicity, Mobility or Volume with Treatment	Considered better than Alternatives 2 and 3 because full containment addresses potential migration with more certainty	Comparable to Alternative 4 overall, with more mass removal but less certainty regarding residual material beyond the excavation area	Similar to Alternative 5 overall, considering the combination of mass removal and reduction in constituent mobility
Short-Term Effectiveness	Impacted area would be improved; short-term impacts would occur over longer period than Alternative 2 but are considered manageable	Both vadose and saturated zones would be improved; short-term impacts would occur but are considered acceptable if proper procedures are utilized	Similar overall to Alternative 5 regarding short-term effectiveness
Implementability	Considered implementable, although excavation and barrier installation issues must be addressed	More difficult to implement than alternatives without saturated zone excavation; hydraulic controls and wet material handling would be required	Comparable overall to Alternative 5; dewatering issues are avoided for excavation, but implementation of *in situ* treatment technology is required
Cost	Moderate cost alternative; 4th in initial and 3rd in total present worth costs	Second highest in initial and total overall costs	Relatively higher initial costs, but lower annual costs; ranks 5th in total present worth costs
Overall Summary	Combining full isolation/containment with excavation of former structures and vadose zone soil is a cost-effective approach if properly coordinated with off-site source measures	Excavation of former structures and both vadose and saturated zone soils may be best overall if coordinated with measures to address the non-MGP off-site source	Similar to Alternative 5 overall although less costly; uncertainties with off-site source adversely affect this approach

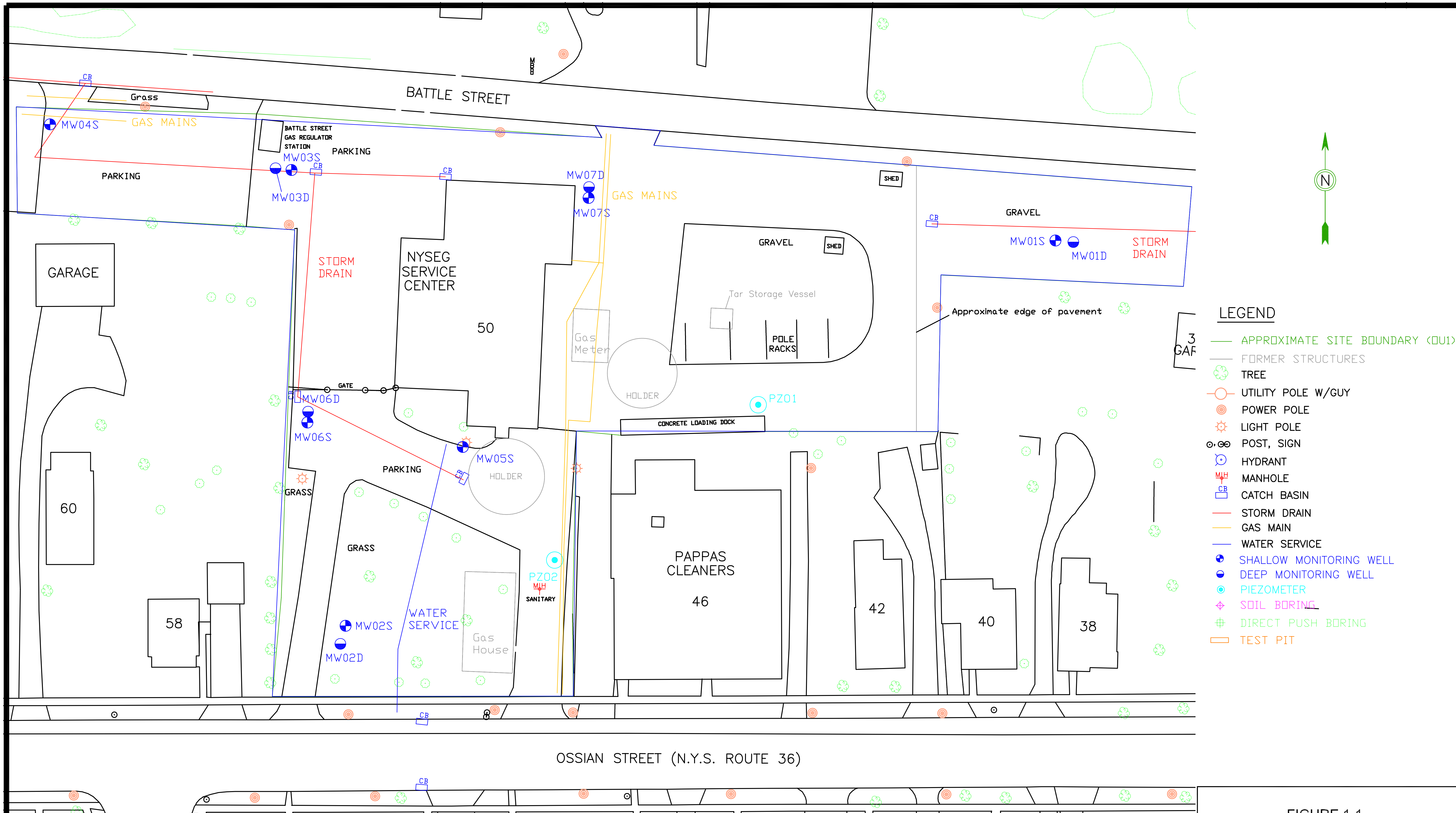
TABLE 6-1

COMPARATIVE ANALYSIS OF ALTERNATIVES

NYSEG Dansville Former MGP Site
Dansville, New York

Criteria	**Alternative 7** **Excavation of Subsurface Structures and Areas With NAPL Impacts Within the Vadose and Saturated Zones, Groundwater Use Restriction and Groundwater Monitoring**
Overall Protection of Public Health and the Environment	Most protective because all NAPL impacts would be removed to the extent practicable
Compliance with SCGs	More action-based issues than Alternative 5 based on similar approach and larger extent; best overall regarding RSCOs and groundwater restoration, assuming groundwater is not re-impacted from off-site source
Long-Term Effectiveness and Permanence	Most effective long-term for MGP-related impacts; off-site non-MGP source could re-pact groundwater if not addressed
Reduction of Toxicity, Mobility or Volume with Treatment	Best alternative regarding this criterion, with removal via excavation to the maximum extent practicable
Short-Term Effectiveness	Short-term impacts to community, remediation workers and environment would occur over longest period and need properly managed
Implementability	Most difficult to implement technically, with significant issues associated with existing building and dewatering requirements
Cost	Highest total costs, although post-remediation costs would be the lowest
Overall Summary	Most protective and effective long-term, but significantly more expensive and difficult to implement making site-wide excavation to the confining layer infeasible

FIGURES



0 25 50 75
Scale Feet
SCALE REFERENCE

Note:
Base map provided by NYSEG surveying department.

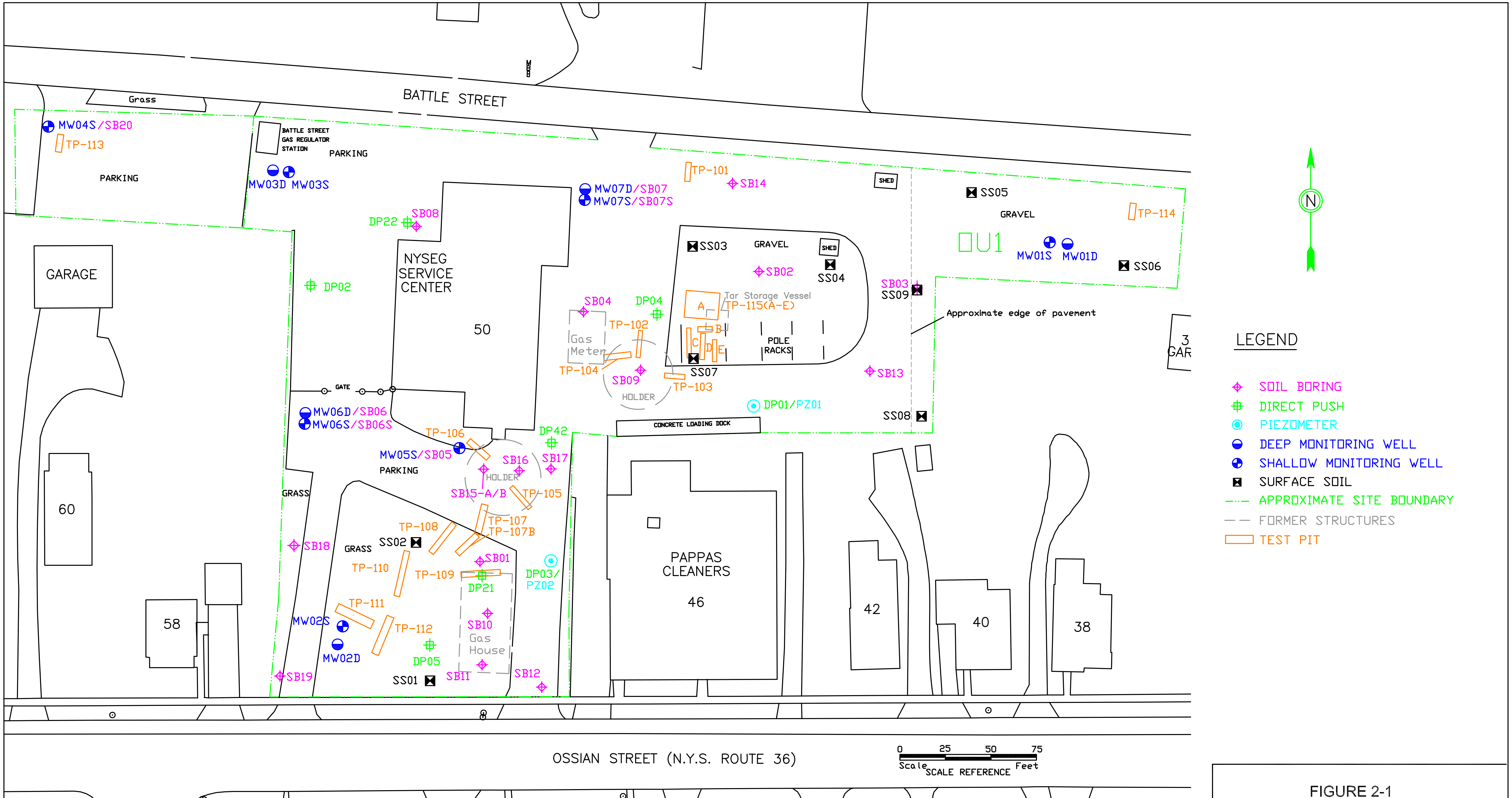
FIGURE 1-1

GENERAL SITE MAP

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 5/12/06 FILE NAME: DANSSITEMAP

ISH INC. / MTR, INC.



Note:
1. This figure was previously presented as Figure A-6 in the supplemental RI Report for OU1 (Ish Inc., January 2006).

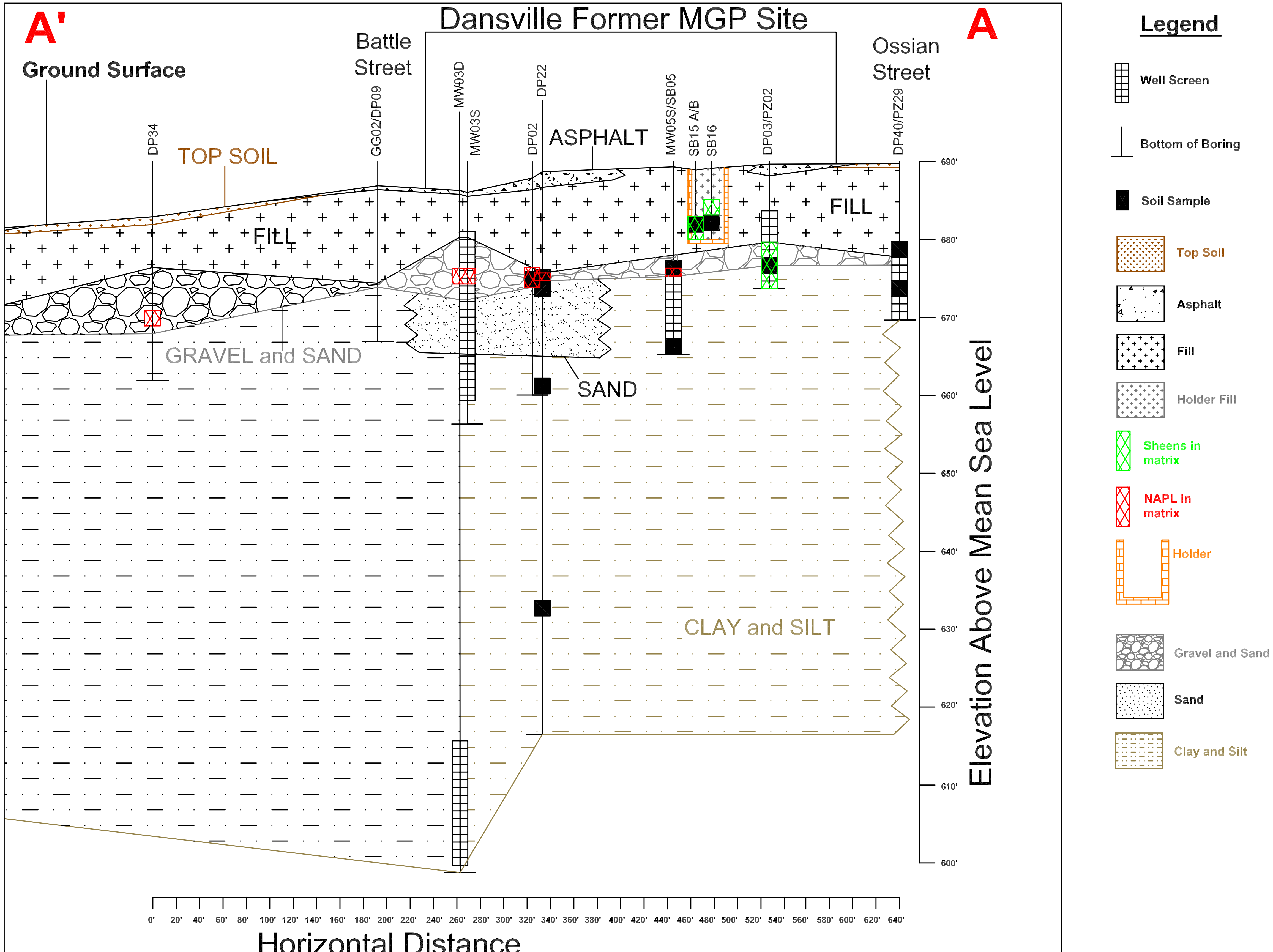
FIGURE 2-1

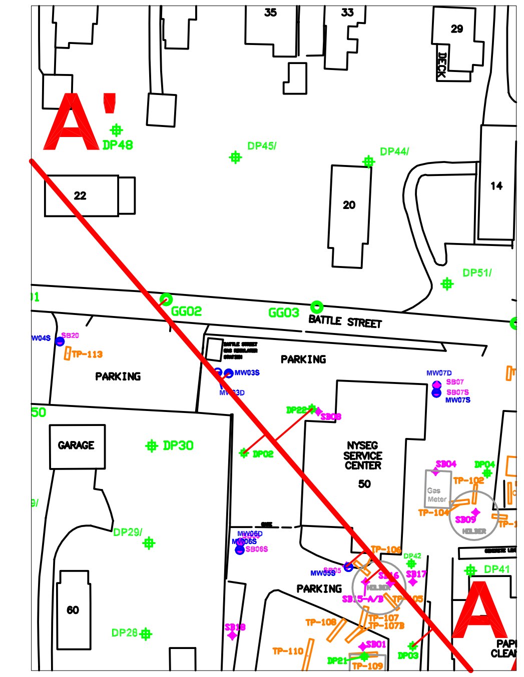
SAMPLING LOCATIONS

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 5/12/06 FILE NAME: DANSFIG2-1

ISH INC. / MTR, INC.





CROSS-SECTION LOCATION

Note:

Observations of NAPL and sheens are from the SRI report except at MWO3S and MWO3D, where observations were made in 1986 by TRC.

FIGURE 2-2	
GEOLOGICAL CROSS-SECTION A - A'	
NYSEG FORMER MGP SITE DANSVILLE, NEW YORK	
DATE: 6/22/06	FILE NAME: 060206JD
ISH INC. / MTR, INC.	

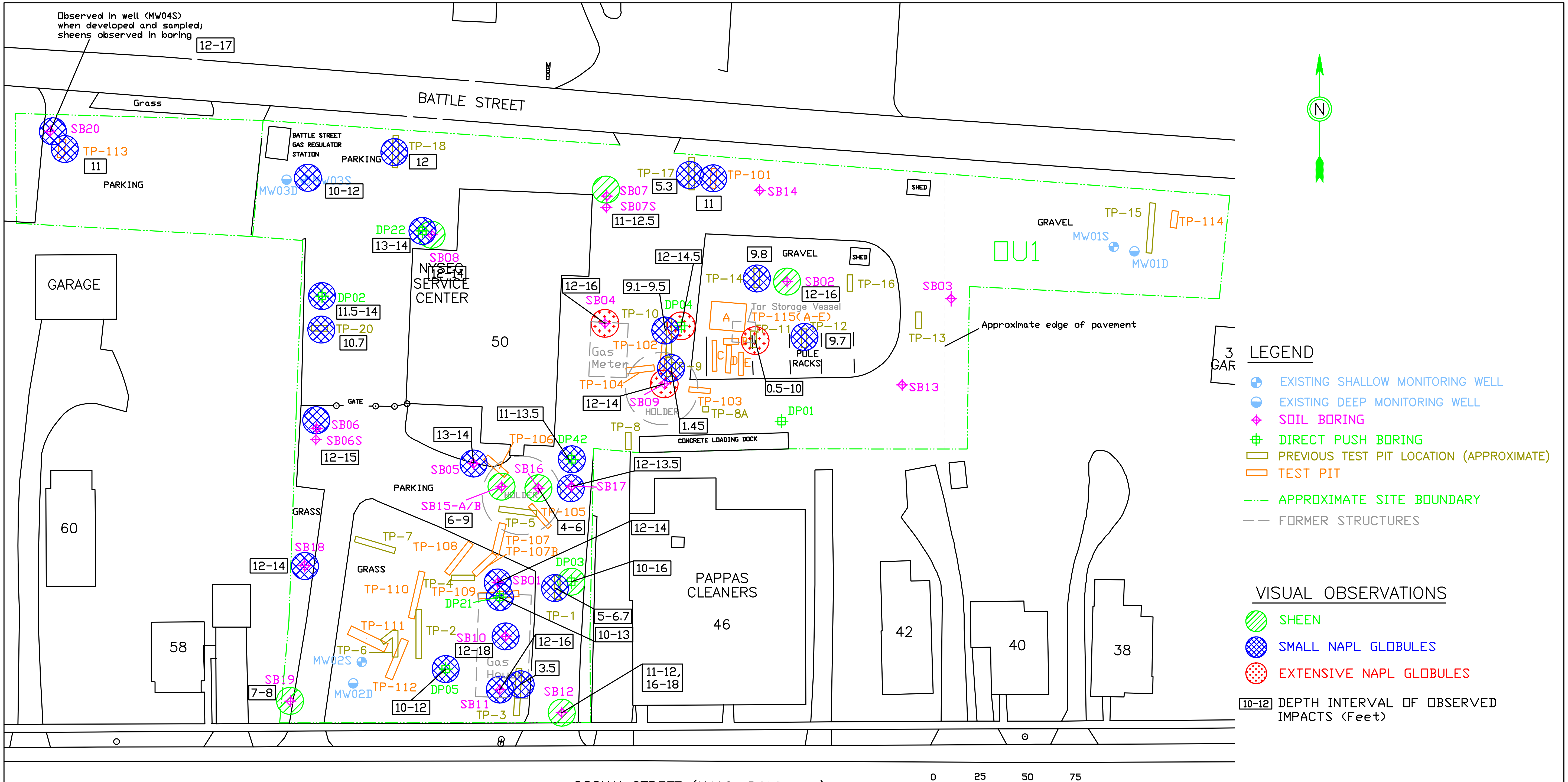


FIGURE 2-3

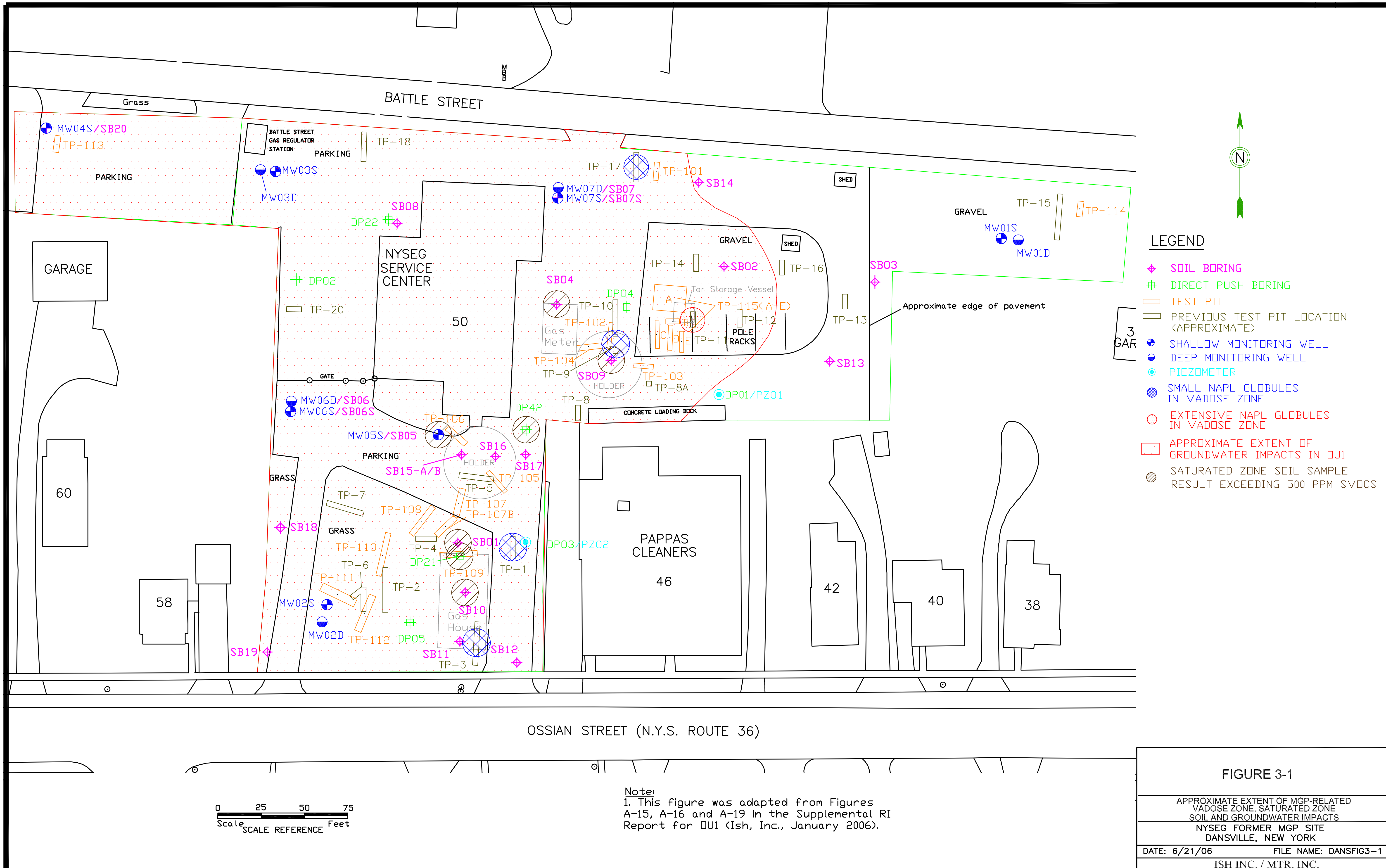
OCCURRENCE OF NAPL WITHIN THE SUBSURFACE

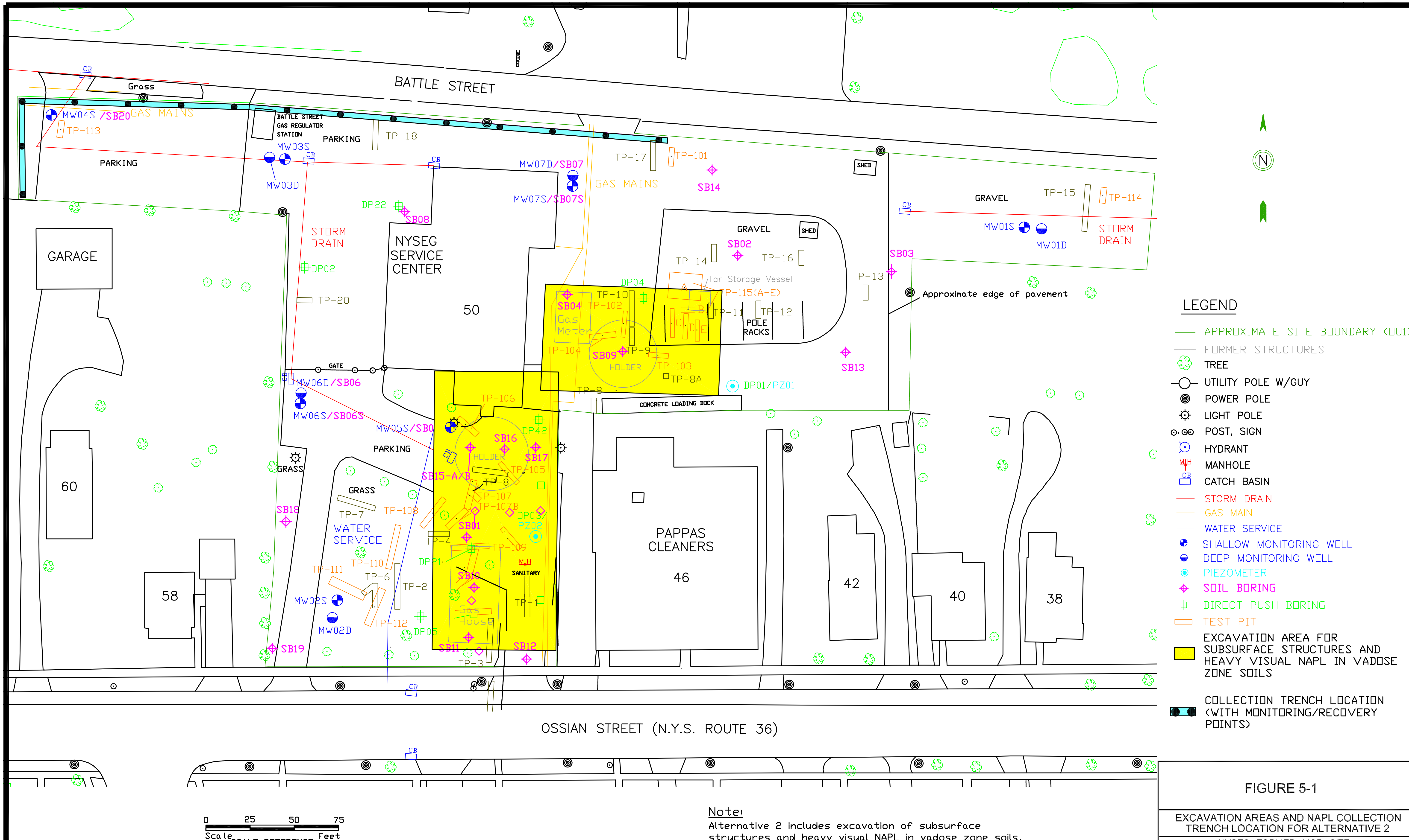
NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 5/12/06 FILE NAME: DANSFIG2-3

ISH INC. / MTR, INC.

Note:
1. This figure was previously presented as Figure A-15 in the Supplemental RI Report for OU1 (Ish Inc., January 2006).


BATTLE STREET
OSSIAN STREET (N.Y.S. ROUTE 36)
NYSEG SERVICE CENTER
50
PAPPAS CLEANERS
46
GARAGE
60
58
42
40
38
PARKING
GRAVEL
GRASS
Grass
BATTLE STREET GAS REGULATOR STATION
POLE RACKS
CONCRETE LOADING DOCK
SHED
GATE
HOLDER
Gas Meter
Gas House
Tar Storage Vessel
Approximate edge of pavement
MW04S/SB20
MW03S
MW03D
MW07D/SB07
MW07S/SB07S
MW06D/SB06
MW06S/SB06S
MW05S/SB05
MW02S
MW02D
MW01S
MW01D
DP01/PZ01
DP03/PZ02
DP02
DP04
DP05
DP21
DP22
DP42
SB01
SB02
SB03
SB04
SB08
SB09
SB10
SB11
SB12
SB13
SB14
SB15-A/B
SB16
SB17
SB18
SB19
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-8A
TP-9
TP-10
TP-11
TP-12
TP-13
TP-14
TP-15
TP-16
TP-17
TP-18
TP-20
TP-101
TP-102
TP-103
TP-104
TP-105
TP-106
TP-107
TP-107B
TP-108
TP-109
TP-110
TP-111
TP-112
TP-113
TP-114
TP-115(A-E)
N
LEGEND
SOIL BORING
DIRECT PUSH BORING
TEST PIT
PREVIOUS TEST PIT LOCATION (APPROXIMATE)
SHALLOW MONITORING WELL
DEEP MONITORING WELL
PIEZOMETER
SMALL NAPL GLOBULES IN VADOSE ZONE
EXTENSIVE NAPL GLOBULES IN VADOSE ZONE
APPROXIMATE EXTENT OF GROUNDWATER IMPACTS IN OU1
SATURATED ZONE SOIL SAMPLE RESULT EXCEEDING 500 PPM SVOCS
0 25 50 75
Scale Feet
SCALE REFERENCE
Note:
1. This figure was adapted from Figures A-15, A-16 and A-19 in the Supplemental RI Report for OU1 (Ish, Inc., January 2006).
FIGURE 3-1
APPROXIMATE EXTENT OF MGP-RELATED VADOSE ZONE, SATURATED ZONE SOIL AND GROUNDWATER IMPACTS
NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK
DATE: 6/21/06
FILE NAME: DANSFIG3-1
ISH INC. / MTR, INC.



Note:
Alternative 2 includes excavation of subsurface structures and heavy visual NAPL in vadose zone soils, free phase NAPL removal using a collection trench, institutional controls and groundwater monitoring.

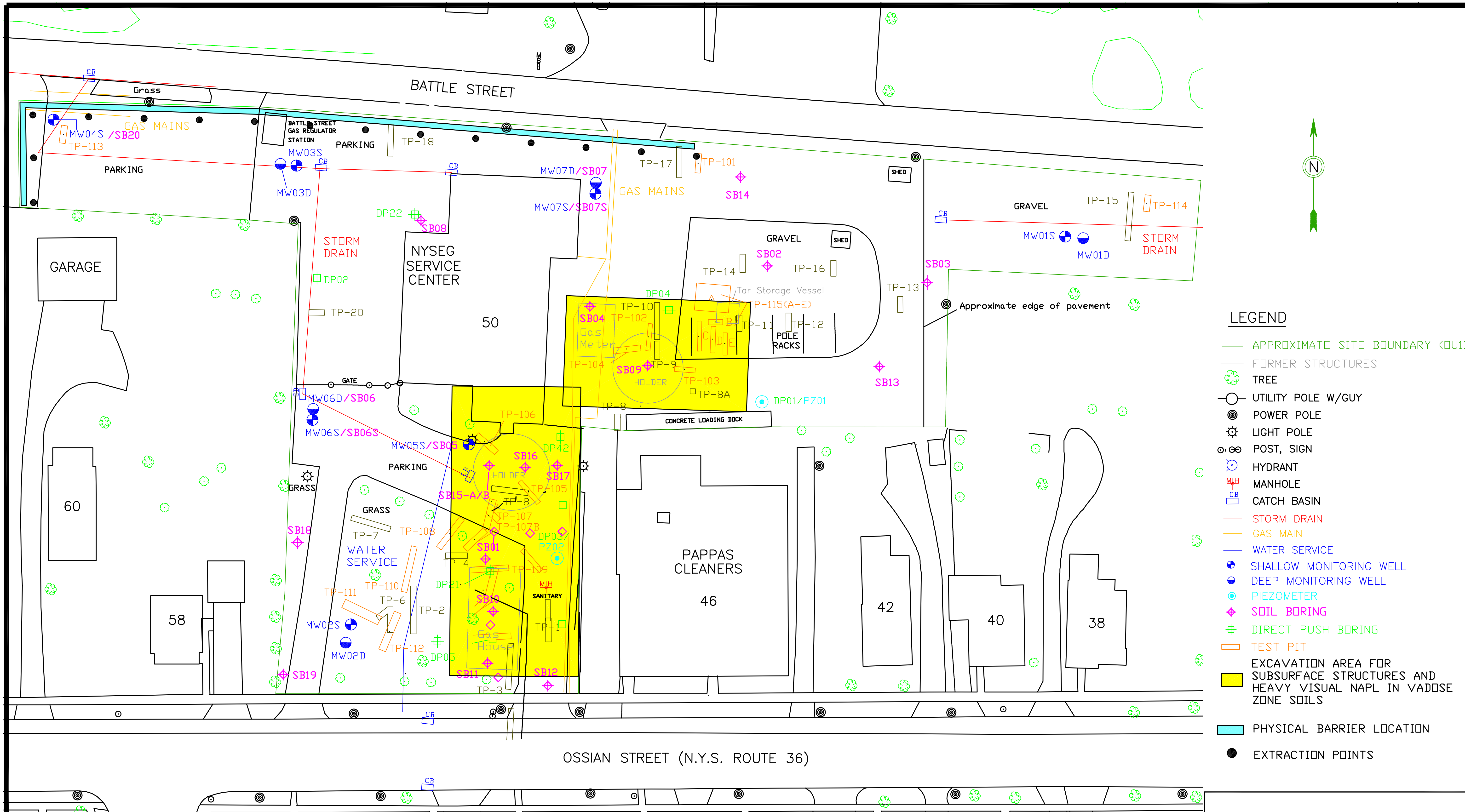
FIGURE 5-1

EXCAVATION AREAS AND NAPL COLLECTION TRENCH LOCATION FOR ALTERNATIVE 2

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 5/18/06 FILE NAME: DANSFIG5-1

ISH INC. / MTR, INC.



0 25 50 75
Scale SCALE REFERENCE Feet

Note:
Alternative 3 includes excavation of subsurface structures and heavy visual NAPL in vadose zone soils, downgradient containment using a physical barrier with limited total fluids extraction and disposal, institutional controls and groundwater monitoring.

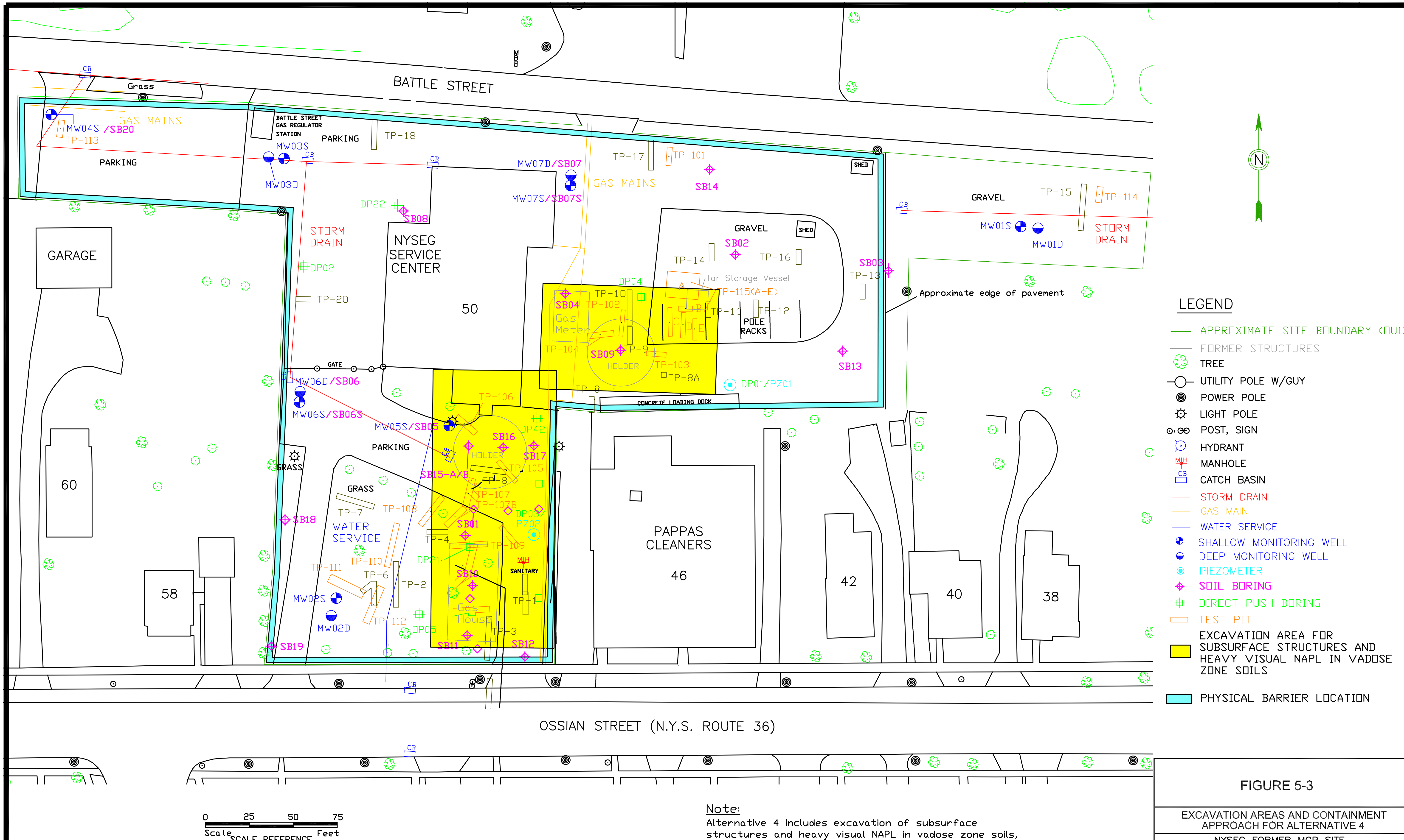
FIGURE 5-2

EXCAVATION AREAS AND CONTAINMENT APPROACH FOR ALTERNATIVE 3

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 5/19/06 FILE NAME: DANSFIG5-2

ISH INC. / MTR, INC.



Note:
Alternative 4 includes excavation of subsurface structures and heavy visual NAPL in vadose zone soils, containment using a physical barrier around impacted OU1 area with maintenance of surface cap/cover, institutional controls and groundwater monitoring.

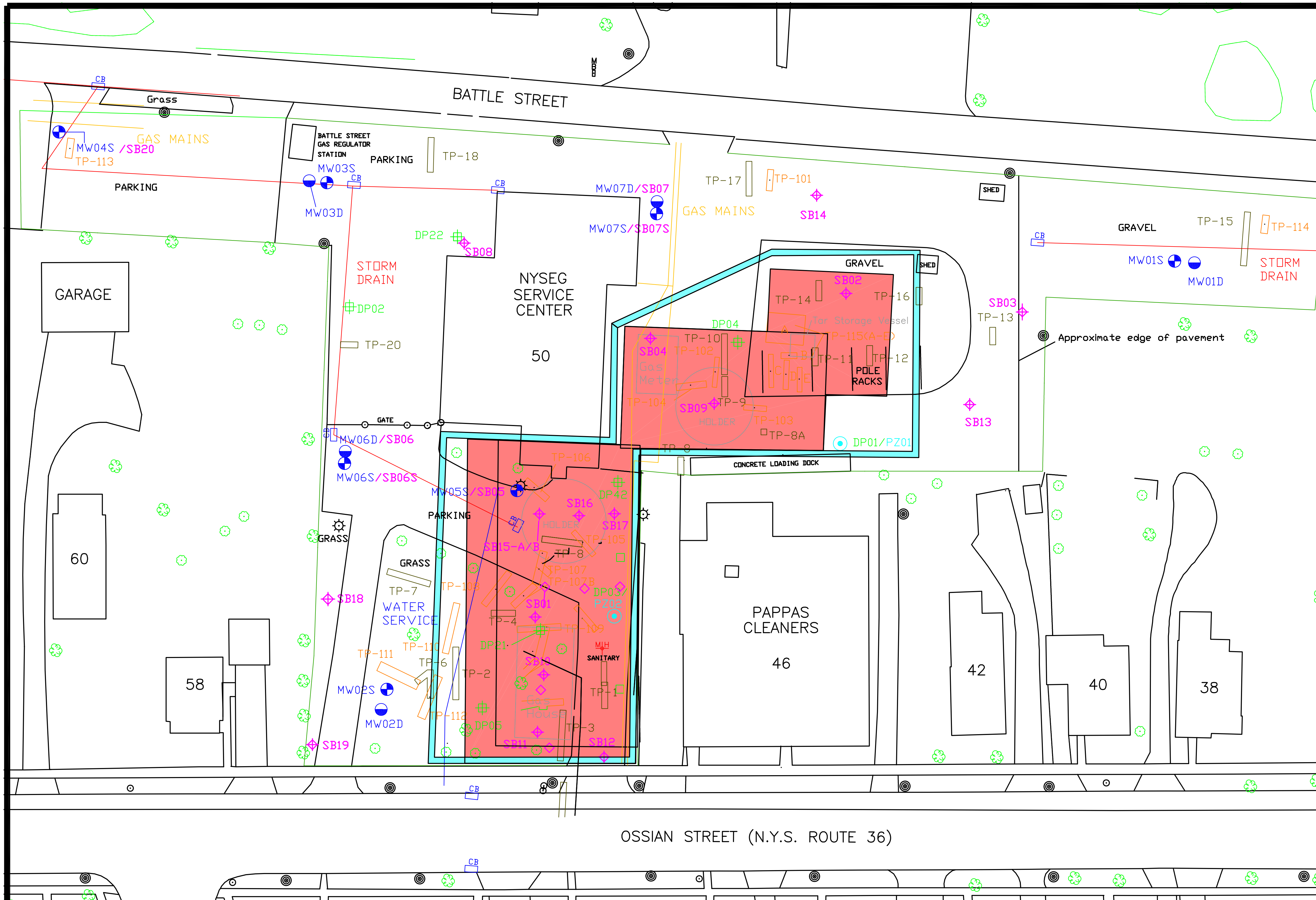
FIGURE 5-3

EXCAVATION AREAS AND CONTAINMENT APPROACH FOR ALTERNATIVE 4

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 5/19/06 FILE NAME: DANSFIG5-3

ISH INC. / MTR, INC.



LEGEND

- APPROXIMATE SITE BOUNDARY (OU1)
- FORMER STRUCTURES
- TREE
- UTILITY POLE W/GUY
- POWER POLE
- LIGHT POLE
- POST, SIGN
- HYDRANT
- MANHOLE
- CATCH BASIN
- STORM DRAIN
- GAS MAIN
- WATER SERVICE
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- PIEZOMETER
- SOIL BORING
- DIRECT PUSH BORING
- TEST PIT
- EXCAVATION AREA FOR SUBSURFACE STRUCTURES AND HEAVY VISUAL NAPL IN VADOSE AND SATURATED ZONE SOILS (TO CONFINING LAYER)
- LOCATION OF HYDRAULIC CONTROL FOR SATURATED ZONE EXCAVATION

0 25 50 75
Scale Feet
SCALE REFERENCE

Note:
Alternative 5 includes excavation of subsurface structures and heavy visual NAPL in vadose and satrurated zone soils, institutional controls and groundwater monitoring.

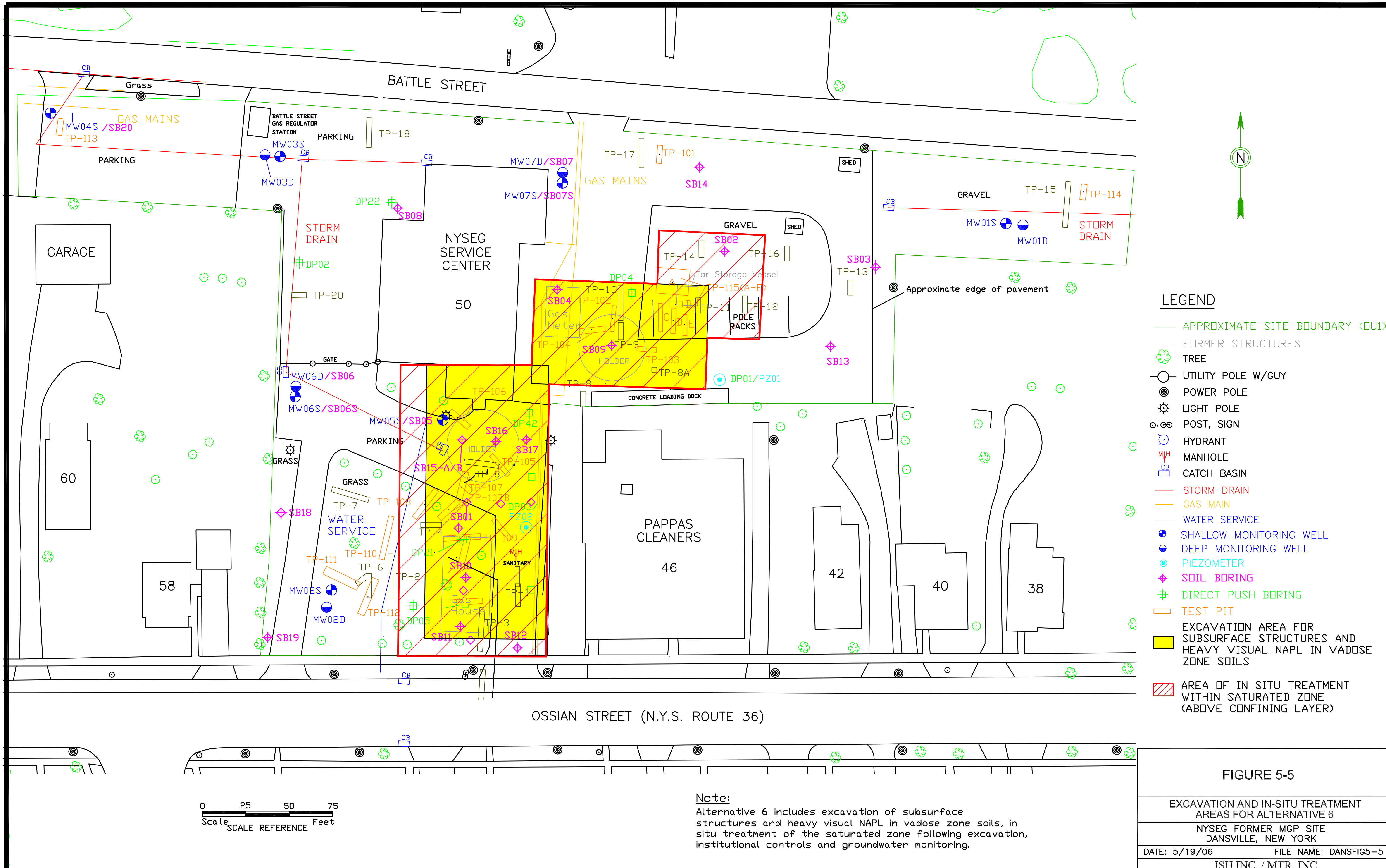
FIGURE 5-4

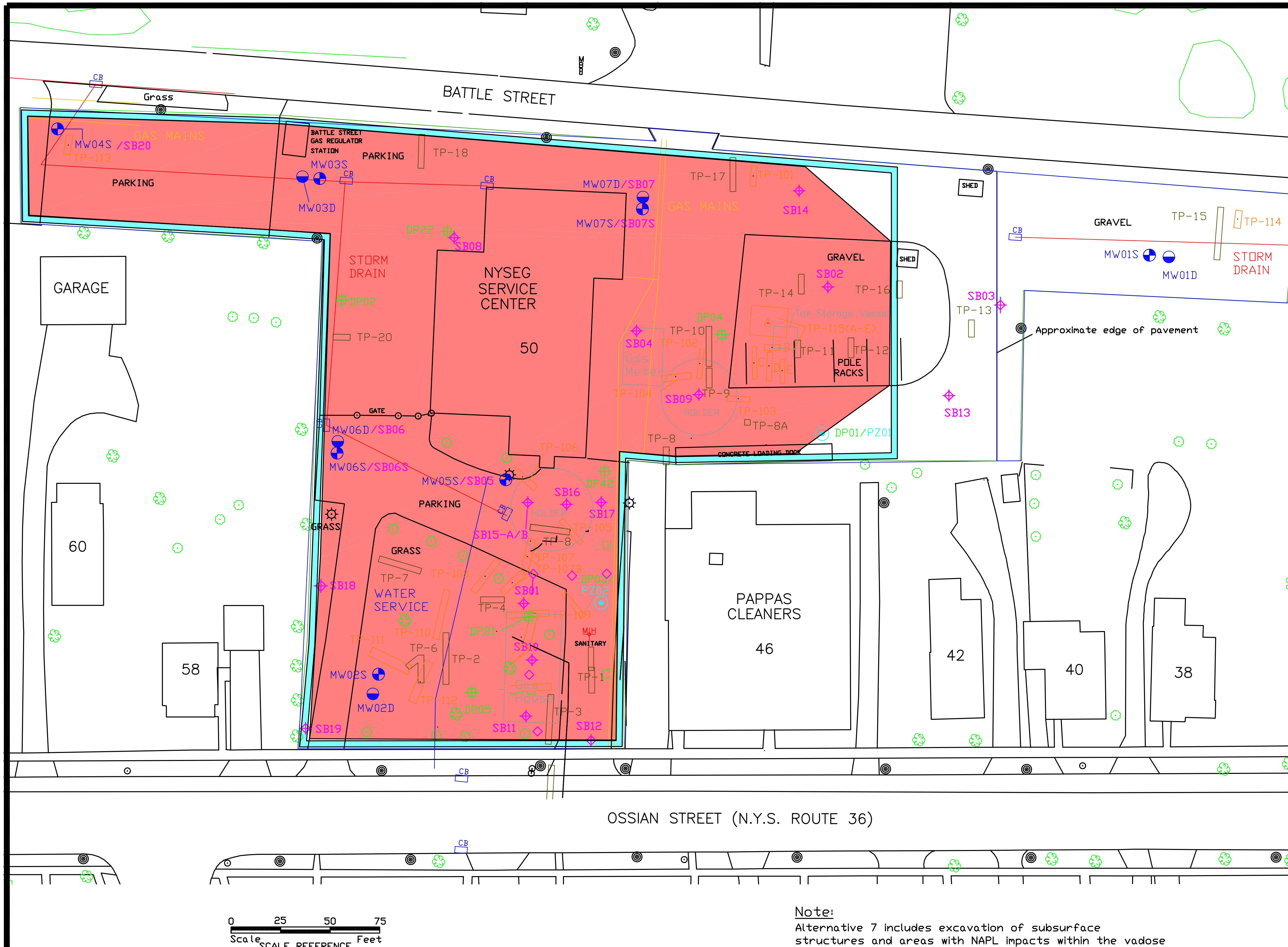
EXCAVATION AREAS FOR ALTERNATIVE 5

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 5/19/06 FILE NAME: DANSFIG5-4

ISH INC. / MTR, INC.


BATTLE STREET
OSSIAN STREET (N.Y.S. ROUTE 36)
Grass
PARKING
BATTLE STREET GAS REGULATOR STATION
GAS MAINS
STORM DRAIN
GARAGE
NYSEG SERVICE CENTER
50
GRAVEL
SHED
Tar Storage Vessel
POLE RACKS
Approximate edge of pavement
CONCRETE LOADING DOCK
HOLDER
Gas Meter
Gas House
SANITARY
GRASS
WATER SERVICE
PAPPAS CLEANERS
46
60
58
42
40
38
MW04S /SB20
TP-113
MW03S
MW03D
MW07D/SB07
MW07S/SB07S
MW01S
MW01D
MW06D/SB06
MW06S/SB06S
MW05S /SB05
MW02S
MW02D
DP01/PZ01
SB01
SB02
SB03
SB04
SB08
SB09
SB10
SB11
SB12
SB13
SB14
SB15-A/B
SB16
SB17
SB18
SB19
DP02
DP04
DP05
DP21
DP22
DP42
TP-13
TP-14
TP-15
TP-16
TP-17
TP-18
TP-20
TP-101
TP-114
N
LEGEND
APPROXIMATE SITE BOUNDARY (OU1)
FORMER STRUCTURES
TREE
UTILITY POLE W/GUY
POWER POLE
LIGHT POLE
POST, SIGN
HYDRANT
MANHOLE
CATCH BASIN
STORM DRAIN
GAS MAIN
WATER SERVICE
SHALLOW MONITORING WELL
DEEP MONITORING WELL
PIEZOMETER
SOIL BORING
DIRECT PUSH BORING
TEST PIT
EXCAVATION AREA FOR SUBSURFACE STRUCTURES AND HEAVY VISUAL NAPL IN VADOSE ZONE SOILS
AREA OF IN SITU TREATMENT WITHIN SATURATED ZONE (ABOVE CONFINING LAYER)
0 25 50 75
Scale Feet
SCALE REFERENCE
Note:
Alternative 6 includes excavation of subsurface structures and heavy visual NAPL in vadose zone soils, in situ treatment of the saturated zone following excavation, institutional controls and groundwater monitoring.
FIGURE 5-5
EXCAVATION AND IN-SITU TREATMENT AREAS FOR ALTERNATIVE 6
NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK
DATE: 5/19/06
FILE NAME: DANSFIG5-5
ISH INC. / MTR, INC.



LEGEND

- APPROXIMATE SITE BOUNDARY (OU1)
- FORMER STRUCTURES
- TREE
- UTILITY POLE W/GUY
- POWER POLE
- LIGHT POLE
- POST, SIGN
- HYDRANT
- MANHOLE
- CATCH BASIN
- STORM DRAIN
- GAS MAIN
- WATER SERVICE
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- PIEZOMETER
- SOIL BORING
- DIRECT PUSH BORING
- TEST PIT
- EXCAVATION AREA FOR SUBSURFACE STRUCTURES, VADOSE ZONE AND SATURATED ZONE SOILS (TO CONFINING LAYER)
- LOCATION OF HYDRAULIC CONTROL FOR SATURATED ZONE EXCAVATION

Note:
Alternative 7 includes excavation of subsurface structures and areas with NAPL impacts within the vadose and saturated zones (to the confining layer), groundwater use restriction, and groundwater monitoring.

FIGURE 5-6

EXCAVATION AREA FOR ALTERNATIVE 7

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 5/19/06 FILE NAME: DANSFIG5-6

ISH INC. / MTR, INC.

FINAL FEASIBILITY STUDY REPORT ADDENDUM
FOR OPERABLE UNIT 1

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

October 2007

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FINAL FEASIBILITY STUDY REPORT ADDENDUM
FOR OPERABLE UNIT 1

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

This Addendum to the Feasibility Study for Operable Unit 1 at the NYSEG Former MGP Site in Dansville, New York presents an evaluation of remedial alternatives as follow-up to NYSDEC review of the Draft Feasibility Study Report (Ish Inc., August 2006) and modification of the OU1 boundary.

PROFESSIONAL ENGINEER CERTIFICATION

I, William J. Zeli, a Professional Engineer registered in the State of New York, certify that the evaluation referenced above has been conducted consistent with proper engineering practices and that, to the best of my knowledge and belief, this report accurately presents the findings of the evaluation.

William J. Zeli

William J. Zeli, P.E.
New York License No. 080787
MTR Engineering, Inc.

11/2/07
Date

STATE OF NEW YORK
WILLIAM J. ZELI
080787
LICENSED PROFESSIONAL ENGINEER

FINAL FEASIBILITY STUDY REPORT ADDENDUM
FOR OPERABLE UNIT 1

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

This Addendum to the Feasibility Study Report (FS Report) for Operable Unit 1 at the former manufactured gas plant (MGP) site at 50 Ossian Street in Dansville, New York has been prepared by Ish Inc. team on behalf of NYSEG (New York State Electric & Gas Corporation).

The New York State Department of Environmental Conservation (NYSDEC) provided comments on the FS Report (Ish Inc., August 2006) in a letter dated December 13, 2006. Following subsequent conference calls and discussions between NYSDEC, NYSEG and Ish Inc. representatives, consensus was reached on moving forward with the FS for OU1 by submitting a FS Report Addendum. Key points of those discussions were summarized in a letter from NYSDEC dated January 25, 2007 and a memorandum from Ish Inc. dated January 31, 2007.

Due to complicating factors caused by an upgradient source (i.e., the former Pappas Cleaners property) of chlorinated volatile organic compounds (VOCs), the remedial action objectives (RAOs) for OU1 have been focused, as suggested by the Department, to address the source of MGP coal tar NAPL or grossly impacted soil. This approach will help to expedite the removal of the source of coal tar NAPL at the site. The areas with source of coal tar NAPL include the former MGP subsurface structures and the adjoining grossly contaminated soil areas. MGP-impacted groundwater (both on-site and off-site) will be addressed in the FS for OU2. The focused RAOs for OU1 are as follows:

- Remediate, to the extent practicable, areas containing sources of coal tar NAPL.
- Control, to the extent practicable, future migration of coal tar NAPL.
- Eliminate, to the extent practicable, human exposure to coal tar NAPL.

Although remediation of groundwater is not a primary RAO for OU1 in this revised approach, some of the alternatives considered herein will have varying effects on improving groundwater quality. As such, the considerations for these effects on groundwater quality have been noted where appropriate.

As a result of discussions and agreements between NYSDEC and NYSEG, the boundary for OU1 has been modified as presented on Figure 1 in this Addendum. As noted on the figure and as agreed upon with NYSDEC, a remedial design investigation will be conducted to refine the delineation of grossly contaminated soil and boundaries of OU1. Appropriate investigative methods will be employed to conduct the remedial design fieldwork, and plans will be provided to NYSDEC for approval prior to implementing the fieldwork.

As summarized in the January 31, 2007 memo from Ish Inc., it was agreed that four alternatives would be retained for presentation in this FS Report Addendum. Some components of alternatives previously presented in the FS Report were modified to reflect the revised remedial action objectives and modified boundary for OU1. The four alternatives are described in detail in the following section, followed by a comparative analysis and recommendation.

IDENTIFICATION OF ALTERNATIVES

Each alternative retained for consideration in this FS Report Addendum is described in this section. Cost estimates for each alternative, developed for comparative purposes, are presented in Table 1.

Alternative 1 – No Action (With Institutional Controls)

The No Action alternative (Alternative 1) provides a baseline for comparison with the other alternatives, and is included in the evaluation for consistency with NYSDEC guidance (NYSDEC, January 2002). No active remediation would be implemented under this alternative. Institutional controls that limit land uses are included as a component of this remedial alternative.

The no action alternative would not impact current or expected future land uses at the site. Soil and groundwater quality would not be affected other than through natural attenuation processes. The surface cover currently in place limits potential human exposure to surface/subsurface soils, although maintenance of the cover would not be assured. Potential exposure to MGP related impacted soil would be controlled by land use restrictions.

The cost to implement Alternative 1 is estimated at $6,000, to cover preparation of the land use restrictions. Because no annual costs would be involved, the estimated total present worth cost is also $6,000. Table 1 provides the cost estimate for Alternative 1.

Alternative 2 – Containment Using Physical Barrier within OU1 Area With Limited Total Fluids Extraction and Disposal, Maintenance of Surface Cap/Cover and Institutional Controls

Alternative 2 would involve perimeter containment using a physical barrier around the OU1 area with limited total fluids extraction and off-site disposal, maintenance of a surface cap/cover, and institutional controls. Also, a limited volume of vadose zone soil in the immediate vicinity of boring SB13 would be removed by excavation and disposed off-site.

The perimeter isolation/containment approach of Alternative 2 involves installation of a physical barrier around OU1 to greatly reduce or eliminate groundwater movement through the grossly contaminated source containing areas within the saturated zone. Containment of groundwater within the source areas would mitigate the potential for continued migration of dissolved phase constituents. Perimeter containment would address potential mobility of free-phase NAPL within the saturated zone in OU1 as a precaution.

The surface area within OU1 as depicted on Figure 2 is approximately 35,000 square feet. For evaluation purposes, installation of a barrier approximately 1,000 feet in length along the perimeter of the OU1 area has been assumed based on the RI data for the site. The proposed physical barrier location is tentative at this time, and would be determined based on information obtained during the remedial design investigation. Because they must remain in service, the underground gas mains that extend through the OU1 area and proposed barrier location would also need to be addressed during the remedial design phase. Options to consider include 1) alternative methods (e.g., jet grouting) for installation of the barrier at crossings with the gas mains, 2) re-routing the gas mains through the western portion of the property, or 3) adjusting the barrier location, particularly the southern area, if justified based on the findings of the remedial design investigation.

For evaluation purposes, installation of a physical barrier using the slurry wall method to a depth of 20 feet has been assumed based on the RI data. Slurry wall installations generally involve excavating a narrow vertical trench. Where possible, the depth is extended to bedrock or a low permeability confining layer. During excavation, the trench is filled with slurry consisting of a bentonite, cement and water mixture. Maintaining the trench full of slurry prevents caving or sloughing of the trench walls. The excavation equipment used depends on the depth, with backhoe-type equipment generally most efficient for depths less than 70 feet. After excavation, the slurry-filled trench is backfilled with a soil/bentonite/cement/water mixture to create a low permeability barrier. Other barrier types (*in-situ* stabilization barrier, sheet piling, jet grout wall, GundWall system, etc.) may be viable. The type, location and depth of the barrier would be finalized during remedial design phase should this alternative be chosen for implementation.

The physical barrier would prevent migration of impacted groundwater from the non-MGP upgradient source (i.e., the former Pappas Cleaners facility) from continuing to impact groundwater within OU1. However, the groundwater flow pattern would be altered such that non-MGP dissolved phase constituents from the upgradient off-site source may migrate to previously unimpacted areas. Therefore, implementation of this alternative would require coordination with planned remedial actions at the former Pappas Cleaners property that NYSDEC has taken the lead for.

Extraction points (13 assumed) would be installed inside of the physical barrier location to remove coal tar NAPL that may accumulate and to maintain hydraulic control, if necessary (see Figure 2). Periodic total fluids extraction using mobile high vacuum equipment (e.g., vacuum truck) with off-site disposal of the recovered fluids has been assumed for evaluation purposes. The method for NAPL or total fluids extraction and disposal would be evaluated further during the remedial design phase. For costing purposes, monthly total fluids extraction and disposal of approximately 4,000 gallons have been assumed over a 20-year period.

The NYSDEC project manager, during phone discussions, pointed out that the near surface soil at sampling location SB13 exceeds TAGM 4046 RSCO values for PAHs. Therefore, NYSEG plans to excavate soils in the vicinity of SB13 in this remediation effort. Vadose zone soil in the immediate vicinity of boring SB13 (see Figure 2) would be excavated and transported off-site to a low temperature thermal desorption (LTTD) or other acceptable treatment facility. If encountered, debris would be transported to a local landfill. Waste material generated during installation of the containment system and extraction wells would be managed in a similar manner. Approved waste profiles will be in place meeting acceptance criteria for the facility to be utilized for off-site disposal of the excavated material. Clean soil from an off-site source would be used as backfill material where needed.

Maintenance of the existing surface cap/cover would occur with Alternative 2 to limit potential exposure to surface/subsurface soil. Land use restrictions and a soil management plan for intrusive activities would also address remaining soil impacts. The budgetary estimate of this alternative includes costs for initial improvement as well as routine maintenance for the cap/cover, and periodic soil management related costs.

The initial cost to implement Alternative 2 is estimated at $1,521,900, to cover installation of the physical barrier and extraction points, limited soil excavation, and institutional controls. Annual costs for operation and maintenance of the extraction system, cap/cover maintenance and periodic soil management are estimated at $64,500. Assuming these activities occur over a 30-year period, the estimated total present worth cost is approximately $2,513,400. Table 1 provides the detailed cost estimate for Alternative 2.

Alternative 3 – Excavation of Subsurface Structures, Grossly Contaminated Soil and Heavy Visual NAPL in Vadose and Saturated Zone Soils, and Institutional Controls

Alternative 3 would involve a source of NAPL excavation within the vadose and saturated zones to the confining layer. This excavation would include the former MGP subsurface structures and adjoining areas with grossly contaminated soil. This alternative also includes land use restrictions as a precautionary measure.

The general areas for the excavation activities used for evaluation purposes are identified on Figure 3. Depth to the confining layer varies across the site, and was generally encountered approximately 14 to 16 feet bgs during RI activities. An excavation depth of 16 feet within a surface area of approximately 23,000 square feet has been assumed for evaluation purposes. In addition, vadose zone soil in the immediate vicinity of boring SB13 would be excavated. The planned extent of soil excavation would be finalized during the remedial design phase should this alternative be chosen for implementation, along with further evaluation of access at the former gas holder locations. The underground gas mains that extend through the excavation areas depicted on Figure 3 would also need to be addressed during design activities. Because the gas lines must remain in service, options to consider include 1) excavating in sequences along the gas mains using structural supports, 2) re-routing the gas mains through the western portion of the property, or 3) adjusting the lateral extent of the excavation areas, particularly the southern area, if justified based on the findings of the remedial design investigation.

The 20,500 ton total excavated mass estimate for Alternative 3 includes an anticipated significant volume of unimpacted material within the vadose zone, particularly where the excavation area to reach saturated zone impacts extends beyond the planned vadose zone excavation area of Alternative 4. Excavated soil that is MGP residuals-impacted would be transported off-site to a LTTD or other acceptable treatment facility. Debris would be transported to a local landfill for disposal. Approved waste profiles will be in place meeting acceptance criteria for the off-site facility to be utilized for disposal. Clean soil from an off-site source would be used as backfill material, along with unimpacted material that would be reused within the lower portions of the excavated areas.

Because the excavation would extend into the saturated zone, where a significant amount of groundwater inflow is anticipated, this alternative includes the installation of hydraulic controls to support the excavation activities. For evaluation purposes, installation of a slurry wall around the excavation areas at the location depicted on Figure 3 has been proposed. The proposed hydraulic control location is tentative at this time, and would be determined based on information obtained during the remedial design investigation. Slurry wall installations are described in the presentation of Alternative 2. Other methods of hydraulic control (sheet piling, wellpoint extraction system, etc.) may be viable, and the method employed would be evaluated further during the remedial design phase. Waste material generated during installation of the hydraulic controls would be managed similar to material from the excavated areas.

Left in place, a physical barrier for hydraulic control to support the saturated zone excavation would also prevent impacted groundwater from the non-MGP upgradient source of chlorinated compounds (i.e., the former Pappas Cleaners facility) from re-impacting the excavated and backfilled portion of the saturated zone. However, it would possibly alter groundwater flow patterns such that impacted groundwater from the former Pappas Cleaners property may migrate to previously unimpacted areas. Therefore, depending on the method utilized, removal or modification of the controls following excavation may be necessary and implementation of this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property by NYSDEC.

Based on the extent of the excavation areas within OU1, maintenance of the current surface cover and a soil management plan for future intrusive activities would not be necessary. Remaining soil impacts would be addressed by land use restrictions as a precautionary measure.

The initial cost to implement Alternative 3 is estimated at $4,845,700, to cover excavation costs with hydraulic controls for the saturated zone and institutional controls. Because no annual costs would be involved, the estimated total present worth cost is also $4,845,700. Table 1 provides the detailed cost estimate for this alternative.

Alternative 4 – Excavation of Subsurface Structures, Grossly Contaminated Soil and Heavy Visual NAPL in Vadose Zone Soils, Containment Using Physical Barrier within OU1 Area, Maintenance of Surface Cap/Cover, and Institutional Controls

Alternative 4 would involve a source of NAPL excavation in the vadose (unsaturated) zone, full containment using a physical barrier within OU1, maintenance of a surface cap/cover, and institutional controls. Vadose zone excavation would include the former MGP subsurface structures and associated areas with grossly contaminated soil.

The extent of the excavation areas and location of the physical barrier used for evaluation purposes are depicted on Figure 4. A 10-foot excavation depth within a surficial area of approximately 17,000 square feet has been assumed. In addition, vadose zone soil in the immediate vicinity of boring SB13 would be excavated. The planned soil excavation extent would be finalized during the remedial design phase, along with further evaluation of access at the former gas holder locations. Similar to Alterative 3, the underground gas mains that extend through the excavation areas depicted on Figure 4 would also need to be addressed during the remedial design phase.

The 10,000 ton total excavated mass estimate allows for limited additional excavation within the saturated zone. Excavated soil impacted by MGP residuals would be transported off-site to a LTTD or other acceptable treatment and disposal facility. Debris would be transported to a local landfill for disposal. Approved waste profiles will be in place meeting acceptance criteria for the off-site facility to be utilized for disposal. Clean soil from an off-site source would be used as backfill material, along with unimpacted excavated material that would be reused within the lower/deeper portions of the excavated areas.

The containment approach associated with Alternative 4 involves installation of a physical barrier within the OU1 area to greatly reduce or eliminate groundwater movement through the coal tar NAPL containing area within the saturated zone. For evaluation purposes, installation of a barrier approximately 1,000 feet in length along the perimeter of the OU1 area has been assumed (see Figure 4). The proposed physical barrier location is tentative at this time, and would be determined based on information obtained during the remedial design investigation. Perimeter containment would address potential mobility of free-phase NAPL within the saturated zone, and mitigate the potential for continued migration of dissolved phase constituents from the source areas.

For evaluation purposes, installation of a physical barrier using the slurry wall method to a depth of 20 feet has been assumed. Slurry wall installations are described in the presentation of Alternative 2. Other barrier types may be viable, and the type, location and depth of the barrier would be finalized during remedial design phase should this alternative be chosen for implementation. Waste material generated during installation of the containment system would be managed similar to material from the excavated areas. The physical barrier would prevent migration of impacted groundwater from the non-MGP upgradient source (i.e., the former Pappas Cleaners facility) from continuing to impact groundwater within OU1. However, the groundwater flow pattern would be altered such that non-MGP dissolved phase constituents from the off-site source may migrate to previously unimpacted areas. Therefore, implementation of this alternative would require coordination with any planned remedial actions at the former Pappas Cleaners property by NYSDEC.

Maintenance of the existing surface cap/cover would occur to limit potential soil exposures beyond the excavation areas and to maintain hydraulic control within the isolated area of OU1 by minimizing infiltration. Land use restrictions and a soil management plan for intrusive activities would also address remaining soil impacts. The budgetary estimate of this alternative includes costs for initial improvements as well as routine maintenance for the cap/cover, and periodic soil management related costs.

The initial cost to implement Alternative 4 is estimated at $3,005,300, to cover excavation costs, installation of the physical barrier around OU1, and institutional controls. Annual costs for cap/cover maintenance and periodic soil management are estimated at $16,500. Assuming these activities occur over a 30-year period, the estimated total present worth cost is approximately $3,258,900. Table 1 provides the detailed cost estimate for Alternative 4.

COMPARATIVE ANALYSIS

Table 2 summarizes a comparative analysis of the four alternatives using the seven criteria identified in regulatory guidance (NYSDEC, December 2002) and also utilized in the FS Report (Ish Inc., August 2006). Each criterion is discussed below, followed by a recommendation based on the overall comparative evaluation.

Overall Protection of Public Health and the Environment

The no action alternative is the least protective of public health and the environment. The presence of coal tar NAPL within OU1 would pose a continued threat of environmental impacts. The RAO that involves human exposure is addressed. However, neither active remediation of coal tar NAPL nor any active measure to control potential NAPL migration would occur. Therefore, these RAOs for OU1 would not be met.

Alternatives 2 and 4 are similar regarding overall protection of public health and the environment. Potential coal tar NAPL migration would be controlled using the containment barrier that is common to each alternative. The potential for human exposure to NAPL would be substantially eliminated with these alternatives by maintenance of a surface cover, and the use of institutional controls. However, coal tar NAPL would remain within the saturated zone of OU1 and would pose a continued threat of environmental impacts. Although there is a limited potential for exposure to the impacted soils during implementation of Alternative 4, routine procedures are available to assure adequate protection of workers and others. Similarly, potential exposure to recovered NAPL during implementation of Alternative 2 can be addressed using routine procedures.

Alternative 3 is the most protective of public health and the environment because impacted material from both the vadose and saturated zones in OU1 would be removed. Measures to control the potential for exposures during implementation would be required, however, to assure adequate protection. Following the excavation activities, the potential for exposure to coal tar NAPL and impacted soil within OU1 would be eliminated, along with MGP-related source of impacts to groundwater. The RAOs would be addressed to the maximum extent practicable with Alternative 3. However, the chlorinated VOC-impacted groundwater from the former Pappas Cleaners property could re-contaminate the saturated zone, or hydraulic controls installed to support the saturated zone excavation could alter flows and result in downgradient groundwater impacts to previously unimpacted areas if the installed controls are not modified or removed. Therefore, the additional protection provided by Alternative 3 for the saturated zone may not be realized if the off-site chlorinated VOC source located upgradient of OU1 is not adequately addressed.

Compliance with SCGs

Compliance with action-based standards, criteria and guidance (SCGs) would be achieved with Alternative 1 because no remedial actions would occur. However, the sources of coal tar NAPL would not be addressed other than by institutional controls. Therefore, the no action alternative is low in overall acceptability regarding this criterion.

Alternatives 2 and 4 include installation of a containment barrier around OU1, maintenance of a surface cap/cover and institutional controls. The difference in these two alternatives involves how coal tar NAPL within the containment barrier is addressed. Installation of extraction points and periodic extraction would occur with Alternative 2, which would involve fewer action-based issues and associated SCGs than the Alternative 4. Active remediation via excavation within the unsaturated zone would occur with Alternative 4, which involves more action-based issues and SCGs than Alternative 2. However, Alternative 4 is better at addressing the RSCOs.

Measures to assure proper implementation of Alternative 3 would be critical to compliance with action-based SCGs due to the extent of the planned excavation and the associated dewatering requirements. Grossly contaminated soil and material with significant visual NAPL content would be addressed, which should significantly reduce or eliminate material acting as a source of MGP-related groundwater impacts. However, depending on the status of the upgradient source of non-MGP dissolved constituents and the final disposition of the barrier installed for hydraulic control purposes, groundwater within OU1 could be re-contaminated following remediation. Assuming that NYSEG can coordinate with NYSDEC for planned remedial actions at the former Pappas Cleaners property, this alternative may be the best regarding compliance with RSCOs and groundwater quality standards.

Long-Term Effectiveness and Permanence

Because no active remediation would occur under Alternative 1, it is unreliable and the lowest alternative at assuring long-term effectiveness and protection from potential exposures. Alternative 2 includes maintenance of the surface cover, and a containment barrier with periodic extraction to address potentially mobile, free-phase NAPL. The residual risks related to the continued presence of coal tar NAPL in the subsurface would also be addressed by the institutional controls.

Alternatives 2 and 4 are similar regarding long-term effectiveness and permanence, with both alternatives relying primarily on containment and exposure controls. However, excavation of the vadose zone impacts within the containment barrier (a component of Alternative 4) is more permanent than relying on long-term extraction. Excavation of NAPL-impacted material in both the unsaturated and saturated zones to the extent practicable (Alternative 3) provides the most effective and permanent long-term solution to address the sources of coal tar NAPL.

With each alternative, the upgradient source of chlorinated VOCs from the former Pappas property would likely continue to impact groundwater quality unless it is adequately addressed by the NYSDEC. The permanence of the saturated zone remediation and resulting improvements to groundwater quality (particularly with Alternative 3) would be limited by re-contamination of chlorinated VOCs following the saturated zone excavation work. The containment barrier of Alternatives 2 and 4 would mitigate saturated zone impacts to OU1 associated with the off-site source, although it may result in chlorinated VOC impacts to groundwater in other downgradient areas due to a potential change in groundwater flow regime.

Reduction of Toxicity, Mobility or Volume with Treatment

No direct or active treatment of sources of coal tar NAPL would occur with Alternative 1. Natural attenuation is not expected to be significant in volume reduction, and dissolved constituent mobility would not be significantly reduced within a reasonable timeframe. The “no action” alternative is the least acceptable regarding this criterion.

Alternative 2 primarily relies on containment to address constituent mobility, with direct treatment limited to removal via periodic extraction and disposal of NAPL or total fluids. Alternative 4 includes excavation of the former MGP subsurface structures and impacted soils in the vadose zone. In comparison to Alternative 2, the excavation component is comparable to long-term extraction and disposal of NAPL or total fluids from within the barrier.

Alternative 3 is the best alternative regarding this criterion. Direct volume reduction of constituents within OU1 would occur via physical removal of NAPL-impacted source material within the vadose and saturated zones. Because NAPL within the saturated zone would be removed, the associated potential for MGP-related groundwater impacts and dissolved phase constituent mobility with groundwater flow would be eliminated.

Short-Term Effectiveness

Implementation of institutional controls would not have any adverse short-term effects on the community or remediation workers. Because remedial actions (i.e., NAPL or total fluids extraction and disposal) would need to continue for an extended period of time, Alternative 2 is considered to be the least effective alternative regarding the short-term criterion.

Alternatives 3 and 4 include excavation of the former MGP subsurface structures and adjoining areas within the vadose zone, which would have some short-term effects during the implementation period. However, routine procedures are available to mitigate the potential risks and assure adequate protection during implementation. Alternative 3 includes extending the excavation into the saturated zone to remove additional MGP-related source material. Handling the significant volume of wet excavated material would likely affect the overall timeframe for implementation of Alternative 3 and would result in the longest duration to complete remedial activities.

Alternative 4, which includes vadose zone excavation and installation of a physical barrier around the perimeter of OU1, is better in short-term effectiveness than Alternative 3 because the physical barrier would contain the saturated zone contamination without the short-term impacts associated with excavation activities within the saturated zone. Implementation of “no action” (Alternative 1) would not affect the community or remediation workers, and implementation would not cause any short-term adverse environmental effects. Therefore, it is the most effective alternative in the short-term, although the impacted areas would not be remediated and would continue to have environmental impacts.

Implementability

Each alternative includes institutional controls, which are common actions that are considered readily implementable.

Because of the planned excavation work within the saturated zone, Alternative 3 would be the most difficult alternative to implement. In addition to sidewall stability and excavation water handling issues, underground utilities would need to be addressed during the remedial design phase and implementation of construction activities. The utility concerns include the gas mains located within the planned excavation area that must remain operational. Because saturated zone excavation dewatering issues would be avoided, Alternative 4 would be easier to implement than Alternative 3. Implementation issues with the underground utilities would be similar with Alternatives 3 and 4.

Perimeter containment barrier installation issues would be similar for Alternatives 2 and 4. Installation of extraction points (component of Alternative 2) would involve fewer implementation issues than excavation (component of Alternative 4), and maintaining the underground utilities would be less involved without the excavation component. Removal of NAPL or total fluids from the extraction points, required for Alternative 2, should be implementable using equipment that is generally available. The requirement for long-term extraction and disposal of fluids may pose constraints in the future, however.

No action (Alternative 1) would not have implementability constraints and would be the easiest alternative to implement technically; however, it is unlikely to be acceptable to the regulatory agencies and the community.

Cost

Comparative cost estimates for the remedial alternatives based on the descriptions and assumptions presented in this FS Report Addendum are provided in Table 1, including the estimated initial cost, annual cost, duration and total present worth cost.

Alternative 3 is the highest cost alternative. Although effective where implementable, excavation of NAPL within the saturated zone represents a relatively high cost approach to remediation. The long-term O&M costs after implementation are minimal, however, compared with other alternatives. Alternative 4 involves unsaturated zone excavation combined with containment to address saturated zone impacts, resulting in lower initial costs than Alternative 3. Post-remediation costs for Alternative 4 would be involved, however, because of the surface cap/cover maintenance and soil management requirements.

Alternative 2 has significantly lower initial costs (approximately $1.5 million less) than Alternative 4. Both alternatives include installation of a containment barrier around OU1 and maintenance of a surface cap/cover. However, the cost to install extraction points within OU1 is significantly less than the cost to excavate the former MGP subsurface structures and associated areas with impacts in the unsaturated zone. Alternative 2 has the highest long-term costs following remediation due to the extraction and disposal of NAPL or total fluids within the barrier for an extended period of time.

Alternative 1 (no active remediation, with institutional controls) involves minimal initial costs and no annual costs. Therefore, the estimated present worth cost is the lowest overall.

RECOMMENDATION

Based on the findings of the Remedial Investigation and information presented in the FS Report (Ish Inc., August 2006) and this FS Report Addendum, sufficient information exists to select a remedy for OU1 at the NYSEG Dansville former MGP site. The recommendation has been developed based on the newly established RAOs focused on the source of NAPL or grossly impacted soils and the seven criteria utilized in the evaluation pursuant to NYSDEC guidance. Consideration has been given to the constraints associated with the former Pappas Cleaners property where a source of unrelated groundwater impacts is located upgradient of OU1. NYSDEC is the lead for assessment and remediation of the Pappas Cleaners property.

Alternative 1 (no action) does not achieve the RAOs and is not adequately protective of public health or the environment. Alternative 2 achieves the RAOs that involve controlling potential human exposure and potential for coal tar migration. However, the coal tar NAPL remediation area is limited and Alternative 2 is not recommended based on the evaluation criteria. In particular, the need for extraction and disposal of NAPL or total fluids within OU1 over an extended period of time results in Alternative 2 being less acceptable in comparison to other alternatives.

In addition to a containment barrier around OU1, maintenance of a surface cap/cover and institutional controls, Alternative 4 includes excavation of the former MGP subsurface structures and adjacent impacted soils in the vadose zone. In comparison to Alternative 2, the benefits of the excavation component are considered slightly better than long-term extraction although initial costs are significantly higher. The primary benefit of the saturated zone excavation work under Alternative 3, which involves higher costs for implementation, is that the coal tar NAPL in both the unsaturated and saturated zones of the excavation footprint would be removed. However, the remediated area within the saturated zone could be re-impacted by non-MGP constituent migration from the former Pappas Cleaners property if the hydraulic controls are not left in place.

Given the evaluation criteria, with additional consideration given to the new RAOs, Alternative 3 appears to be the most effective alternative overall, even though it is the most costly alternative, to address the OU1 impacts at the NYSEG Dansville former MGP site. Alternative 3 involves a source of NAPL excavation in the vadose and saturated zones along with land use restrictions. This excavation includes the former MGP structures and adjoining grossly contaminated soil. This alternative addresses the RAOs established for OU1 by incorporating the following technology components:

- A significant mass of coal tar NAPL is permanently removed by excavation of areas containing sources of NAPL within the vadose zone and also in the saturated zone to the confining layer;
- Potential future migration of coal tar NAPL is controlled, to a practicable extent, by removing the coal tar source material within the saturated zone of OU1; and
- Potential human exposure to coal tar NAPL is eliminated within the excavation areas, and potential exposure to remaining coal tar NAPL outside the excavation footprint (primarily 12 to 16 feet bgs) is controlled through land use restrictions.

ATTACHMENTS

Table 1 Comparative Cost Estimates for Remedial Alternatives
Table 2 Comparative Analysis of Alternatives

Figure 1 General Site Map
Figure 2 Containment Approach for Alternative 2
Figure 3 Excavation Areas for Alternative 3
Figure 4 Excavation Areas and Containment Approach for Alternative 4

TABLE 1

COMPARATIVE COST ESTIMATES FOR REMEDIAL ALTERNATIVES

NYSEG Dansville Former MGP Site (OU1)
Dansville, New York

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Remediation:				
RD investigation	0	35,000	35,000	35,000
RD/RA work plan/design	0	100,000	130,000	110,000
Preconstruction/permitting	0	60,000	70,000	60,000
Project management	0	65,000	80,000	70,000
Initial cap/cover improvements	0	16,000	0	7,500
Building demolition	0	23,800	23,800	23,800
Physical barrier/slurry wall	0	250,000	250,000	250,000
Slurry wall waste management	0	108,800	74,800	74,800
Monitor/extraction wells installation	0	58,500	0	0
Monitor/extraction wells waste management	0	3,900	0	0
Manage obstructions and utilities	0	140,000	169,000	163,000
Temporary excavation	0	0	205,000	50,000
Wet material conditioning	0	0	102,500	0
Excavation/off-site LTTD treatment	0	8,000	1,465,750	825,000
Excavation/landfill disposal	0	0	276,750	135,000
Backfill	0	1,000	328,000	180,000
Water management	0	0	208,000	0
Monitoring well replacements	0	0	4,000	4,000
Site restoration	0	60,000	92,500	77,500
Oversight	0	63,500	128,500	96,000
Air monitoring	0	48,200	94,400	69,200
Disposal characterization	0	2,000	34,000	18,000
Confirmatory sampling	0	1,200	23,200	18,000
Deed restrictions	5,000	7,500	5,000	7,500
Surveying	0	10,000	15,000	12,500
Building reconstruction	0	170,000	170,000	170,000
RA Documentation Report	0	35,500	52,500	47,500
Contingency (approx. 20%)	1,000	254,000	808,000	501,000
Estimated Cost:	**6,000**	**1,521,900**	**4,845,700**	**3,005,300**
Annual Costs				
Extraction system O&M	0	30,000	0	0
Maintain cap/cover and manage soil	0	11,500	0	7,500
Project management and reporting	0	12,000	0	6,000
Contingency (approx. 20%)	0	11,000	0	3,000
Estimated Annual Cost:	**0**	**64,500**	**0**	**16,500**
Estimated Duration (years):	--	30	--	30
Estimated Total Cost:	**6,000**	**3,456,900**	**4,845,700**	**3,500,300**
Estimated Present Worth Cost:	**6,000**	**2,513,426**	**4,845,700**	**3,258,946**
Estimated Present Worth Cost (-30%):	**4,200**	**1,759,398**	**3,391,990**	**2,281,262**
Estimated Present Worth Cost (+50%):	**9,000**	**3,770,139**	**7,268,550**	**4,888,419**

Alternatives:
1) No action (with institutional controls)
2) Containment using a physical barrier within OU1 with limited total fluids extraction and disposal, maintenance of surface cap/cover, and institutional controls
3) Excavation of subsurface structures, grossly contaminated soil and heavy visual NAPL in vadose and saturated zone soils, and institutional controls
4) Excavation of subsurface structures, grossly contaminated soil and heavy visual NAPL in vadose zone soils, containment using a physical barrier within OU1, maintenance of surface cap/cover, and institutional controls

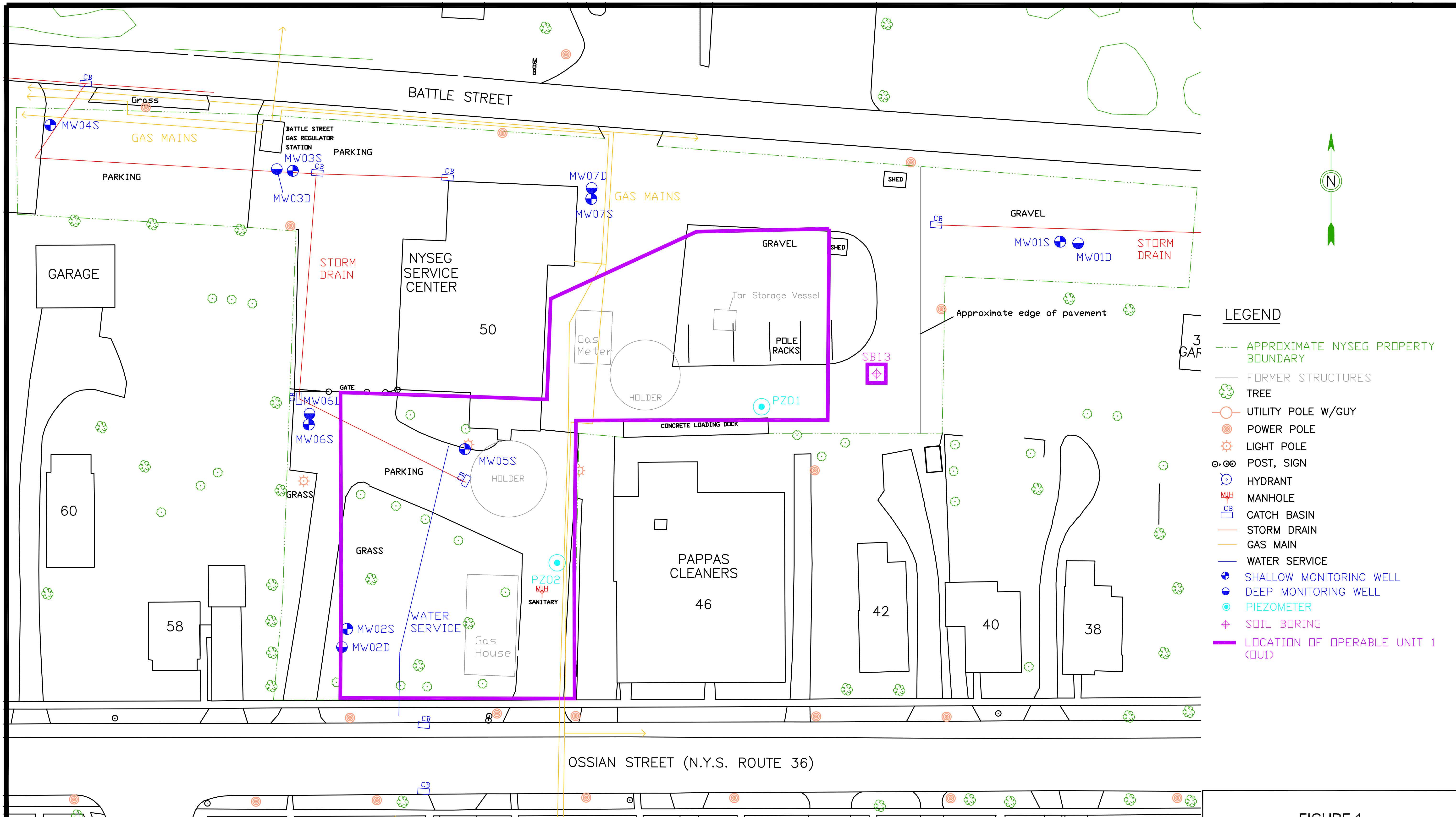
Assumptions/Notes:
1) Present worth costs are based on 5% interest rate.
2) Alternatives with excavation involve off-site treatment of excavated material.
3) Alternative 2 and 4 costs based on containment using slurry wall technology for evaluation purposes.
4) Alternative 3 includes hydraulic controls (e.g., slurry wall) for saturated zone excavation.

TABLE 2

COMPARATIVE ANALYSIS OF ALTERNATIVES

NYSEG Dansville Former MGP Site
Dansville, New York

Criteria	Alternative 1 No Action (With Institutional Controls)	Alternative 2 Containment Using Physical Barrier Within OU1 With Limited Total Fluids Extraction and Disposal, Maintenance of Surface Cap/Cover, and Institutional Controls	Alternative 3 Excavation of Subsurface Structures, Grossly Contaminated Soil and Heavy Visual NAPL in Vadose and Saturated Zone Soils, and Institutional Controls	Alternative 4 Excavation of Subsurface Structures, Grossly Contaminated Soil and Heavy Visual NAPL in Vadose Zone Soils, Containment Using Physical Barrier Within OU1, Maintenance of Surface Cap/Cover, and Institutional Controls
Overall Protection of Public Health and the Environment	Least protective (no active remediation)	Comparable to Alternative 4 in overall protectiveness	Most protective alternative because grossly contaminated material would be removed, treated and disposed off-site to the extent practicable	Comparable to Alternative 2 in overall protectiveness
Compliance with SCGs	Limited activities would comply, but soil remediation would not occur and sources of groundwater impacts would not be addressed	Activities should comply with SCGs; slightly less effective than Alternative 4 regarding RSCOs because no MGP-related source material would be removed	More action-based issues than Alternatives 2 and 4, but more preferable regarding RSCOs and groundwater restoration although upgradient off-site source of chlorinated compounds could negate benefits to on-site groundwater	Activities should comply with SCGs; slightly better than Alternative 2 regarding RSCOs because of removal of MGP-related source material within unsaturated zone
Long-Term Effectiveness and Permanence	Least effective over the long-term	Containment approach should provide adequate long-term protection, although not as reliably as alternatives that include source removal	Most effective long-term for MGP-related impacts; addresses saturated zone more reliably than containment approaches, although groundwater could be re-impacted from upgradient off-site source	Provides adequate long-term protection; comparable to Alternative 2 for the long-term
Reduction of Toxicity, Mobility or Volume with Treatment	Provides least reduction	Slightly less effective than Alternative 4 regarding this criterion; mobility within saturated zone is addressed in similar manner but unsaturated zone source material is not addressed	Best alternative regarding this criterion, with removal of MGP-related source material via excavation to the maximum extent practicable within OU1	Considered better than Alternative 2 because source material within unsaturated zone is removed; mobility within saturated zone is addressed in similar manner as Alternative 2
Short-Term Effectiveness	Community and remediation workers not effected; no adverse environmental impacts in implementation, although no benefits to impacted area	Least overall short-term effectiveness due to long-term extraction and disposal involved	Both vadose and saturated zones would be remediated within OU1; short-term impacts would occur but are considered acceptable if proper procedures are utilized	Impacted area would be improved; short-term impacts would occur but are considered manageable
Implementability	Easiest to implement, although likely unacceptable to regulatory agencies and the community	Considered easier to implement than Alternative 4, although barrier installation and underground utility issues must be addressed and long-term extraction and disposal is involved	Most difficult to implement due to saturated zone excavation; hydraulic controls and wet material handling would be required; utility issues must be addressed in design and implementation	Considered implementable, although barrier installation, excavation and underground utility issues must be addressed during the design phase
Cost	Minimal initial costs, and lowest overall costs	Lowest initial cost alternative, excluding no action, but highest annual costs due to long-term extraction and disposal; second lowest total present worth cost	Highest total costs, although post-excavation O&M costs would be the lowest	Second highest total present worth cost
Overall Summary	Unacceptable based on overall effectiveness in meeting the RAOs	Approach involving containment without source removal and requiring long-term operation ranks lower overall than other approaches using evaluation criteria	Excavation of former structures and both vadose and saturated zone soils may be the best overall if coordinated with NYSDEC who is addressing the upgradient non-MGP off-site source of chlorinated compounds	Combining full isolation/containment with excavation of former structures and vadose zone soil is a cost-effective approach if properly coordinated with NYSDEC for the upgradient off-site source remediation measures



0 25 50 75
Scale Feet
SCALE REFERENCE

Notes:
1) Base map provided by NYSEG surveying department.
2) The boundaries of OU1 are tentative at this time, and will be refined as necessary based on the findings of a remedial design investigation.

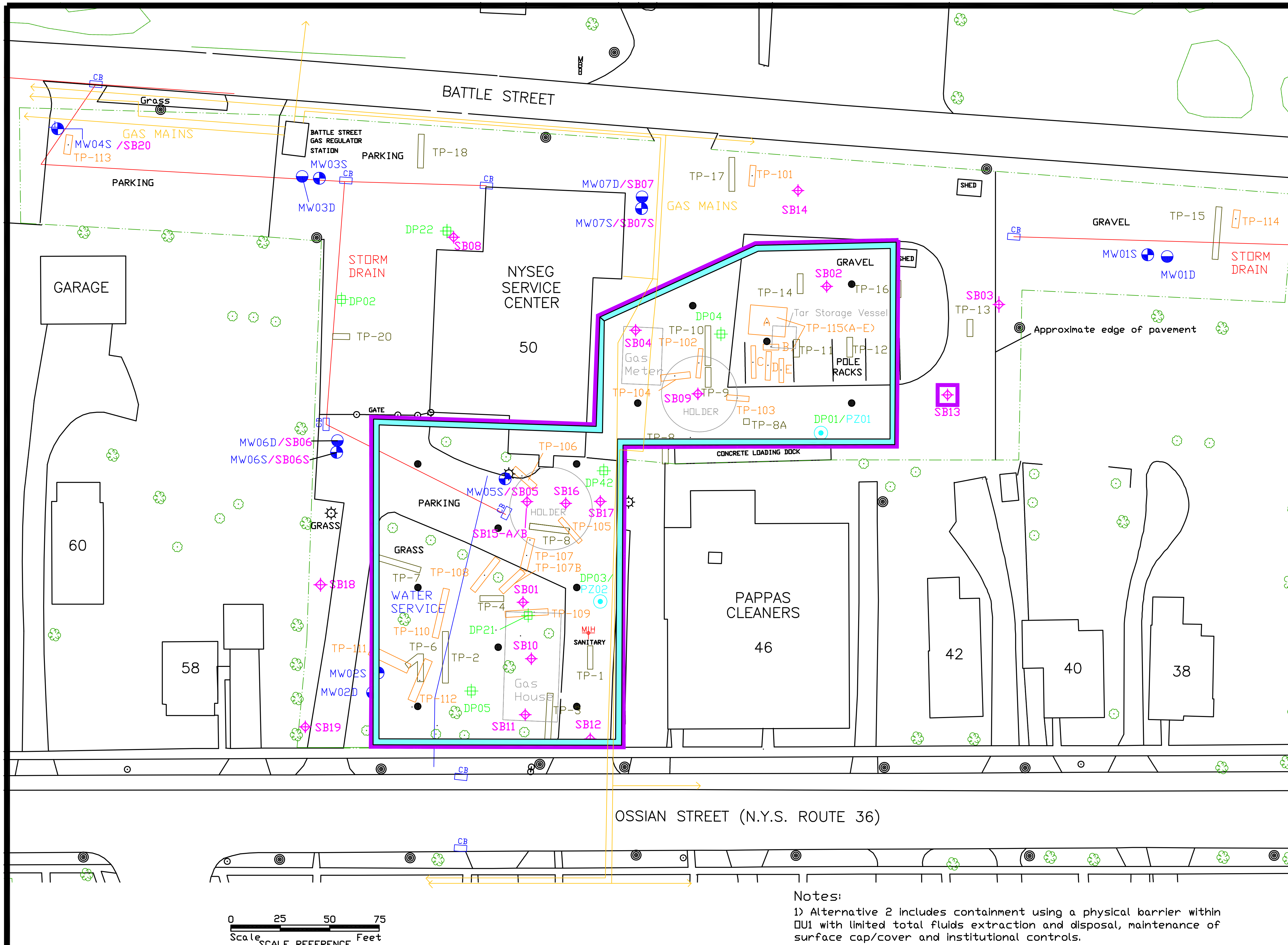
FIGURE 1

GENERAL SITE MAP

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 3/02/07 FILE NAME: DANSFIGURE1

ISH INC. / MTR, INC.



LEGEND

- APPROXIMATE NYSEG PROPERTY BOUNDARY
- FORMER STRUCTURES
- TREE
- UTILITY POLE W/GUY
- POWER POLE
- LIGHT POLE
- POST, SIGN
- HYDRANT
- MANHOLE
- CATCH BASIN
- STORM DRAIN
- GAS MAIN
- WATER SERVICE
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- PIEZOMETER
- SOIL BORING
- DIRECT PUSH BORING
- TEST PIT
- OPERABLE UNIT 1 (OU1)
- TENTATIVE PHYSICAL BARRIER LOCATION (TO BE DETERMINED DURING RD INVESTIGATION)
- EXTRACTION POINT

Notes:

1) Alternative 2 includes containment using a physical barrier within OU1 with limited total fluids extraction and disposal, maintenance of surface cap/cover and institutional controls.

2) The proposed physical barrier location is tentative at this time, and will be determined based on information obtained during remedial design investigation.

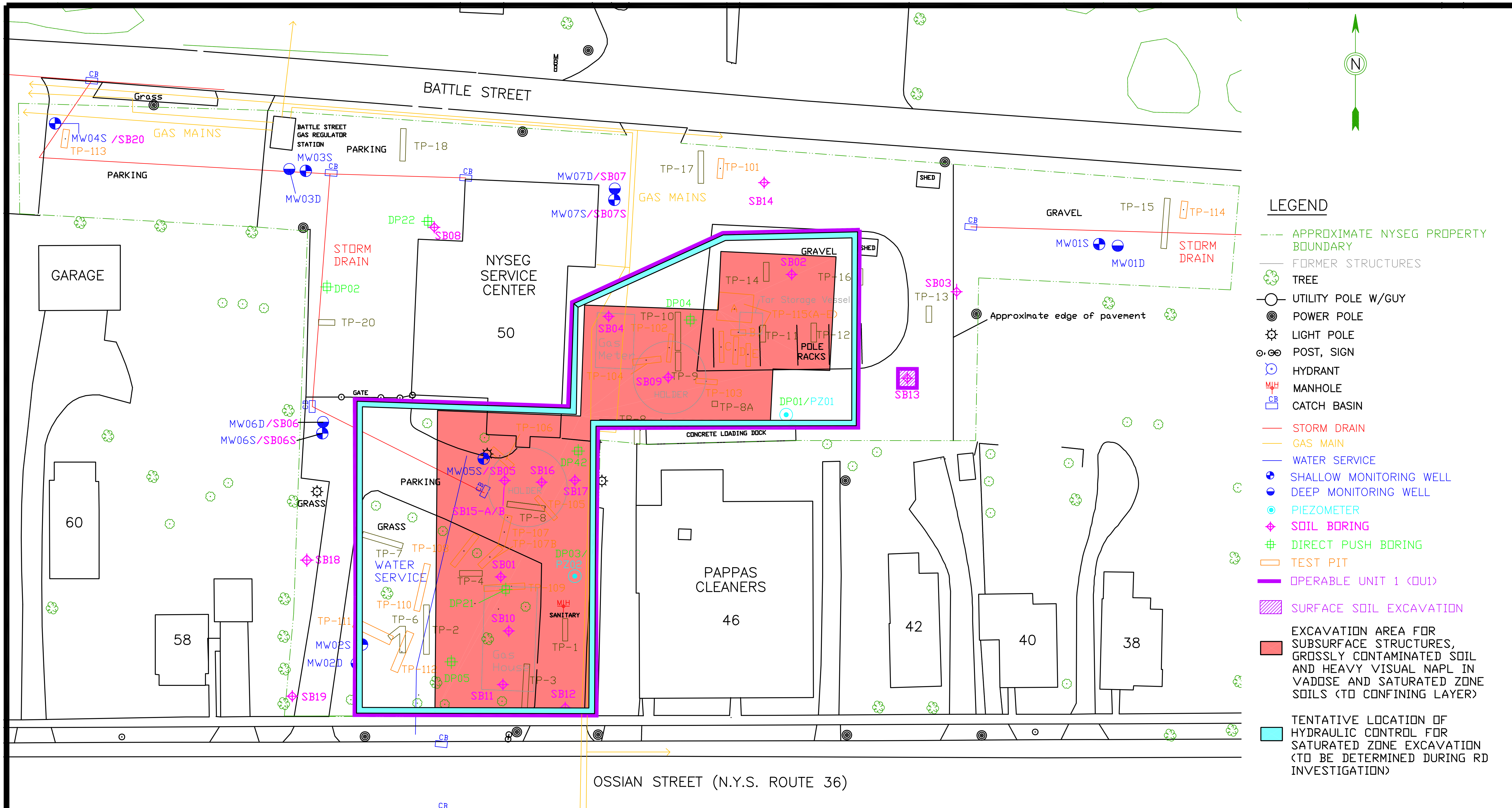
FIGURE 2

CONTAINMENT APPROACH FOR ALTERNATIVE 2

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 3/20/07 FILE NAME: DANSFIGURE2

ISH INC. / MTR, INC.



0 25 50 75
Scale SCALE REFERENCE Feet

Notes:

1) Alternative 3 includes excavation of subsurface structures, grossly contaminated soil and heavy visual NAPL in vadose and saturated zone soils, and institutional controls.

2) The proposed excavation areas and location of hydraulic controls are tentative at this time, and will be determined based on information obtained during remedial design investigation.

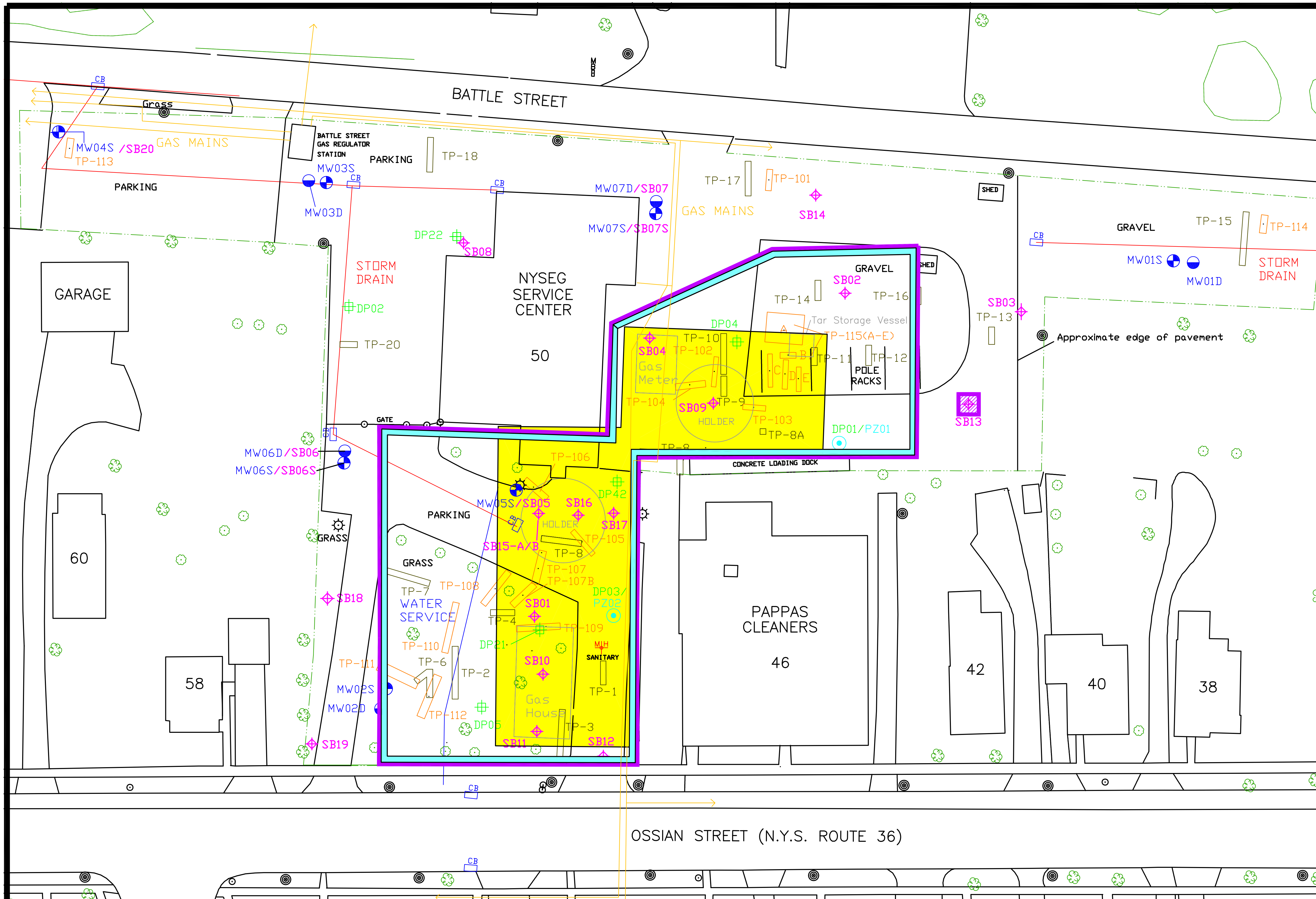
FIGURE 3

EXCAVATION AREAS FOR ALTERNATIVE 3

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 3/22/07 FILE NAME: DANSFIGURE3

ISH INC. / MTR, INC.



LEGEND

- APPROXIMATE NYSEG PROPERTY BOUNDARY
- FORMER STRUCTURES
- TREE
- UTILITY POLE W/GUY
- POWER POLE
- LIGHT POLE
- POST, SIGN
- HYDRANT
- MANHOLE
- CATCH BASIN
- STORM DRAIN
- GAS MAIN
- WATER SERVICE
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- PIEZOMETER
- SOIL BORING
- DIRECT PUSH BORING
- TEST PIT
- OPERABLE UNIT 1 (OU1)
- SURFACE SOIL EXCAVATION
- EXCAVATION AREA FOR SUBSURFACE STRUCTURES, GROSSLY CONTAMINATED SOIL AND HEAVY VISUAL NAPL IN VADOSE ZONE SOILS
- TENTATIVE PHYSICAL BARRIER LOCATION (TO BE DETERMINED DURING RD INVESTIGATION)

Notes:

1) Alternative 4 includes excavation of subsurface structures, grossly contaminated soil and heavy visual NAPL in vadose zone soils, containment using a physical barrier within OU1 with maintenance of surface cap/cover and institutional controls.

2) The proposed physical barrier location and excavation areas are tentative at this time, and will be determined based on information obtained during remedial design investigation.

FIGURE 4

EXCAVATION AREAS AND CONTAINMENT APPROACH FOR ALTERNATIVE 4

NYSEG FORMER MGP SITE
DANSVILLE, NEW YORK

DATE: 3/20/07 FILE NAME: DANSFIGURE4

ISH INC. / MTR, INC.