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ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES AND REMEDIAL ACTION PLAN

UNDERGROUND STORAGE TANK REMOVAL AND SOIL REMEDIATION PROJECT 28-36 BRIDGE STREET WILLIMANTIC, CONNECTICUT

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1.0 INTRODUCTION

The Willimantic Whitewater Partnership is the owner of property located at 28-36 Bridge Street in Willimantic, Connecticut, and has received a cleanup grant from the Connecticut Department of Economic Development (DECD) as part of supplemental funding from the U.S. Environmental Protection Agency (USEPA) to DECD's Brownfield Remediation Revolving Loan Fund. The financing will help finance the removal of three underground storage tanks (USTs) and cleanup of associated petroleum-impacted soil.

The purpose of this document is to analyze potentially feasible remedial strategies, select the best available remedial strategy, and present a detailed plan of action for the remediation. In accordance with instructions from DECD, this document serves as the Analysis of Brownfields Cleanup Alternatives (ABCA) and the Remedial Action Plan (RAP) for the UST removal and associated soil remediation. This document is not intended to be used for remediation of other areas of concern (AOCs) present at the Site.

The Connecticut Department of Environmental Protection (CTDEP) has instructed that the UST removal and soil cleanup are to be conducted in accordance with the Connecticut UST Regulations (RCSA Sections 22a-449(d)-1 and 22a-449(d)-101 through 113) and associated CTDEP regulations and guidance as prevailing standards. Moreover, because the site will be entered into the Connecticut Voluntary Remediation Program (VRP – Conn. Gen. Stat. 22a-133x), the UST removal and cleanup are to be consistent with the relevant conditions of the VRP program.

1.1 Site Description and History

The Site is located at 28-36 Bridge Street in the City of Willimantic (Town of Windham), Windham County, Connecticut. A portion of the United States Geological Survey (USGS) topographic map showing the Site location is provided as Figure 1. The Site property is an irregular, 3.45-acre parcel located on the east side of Bridge Street in Willimantic (Town of Windham), The Site is bounded by property owned by Yankee Gas Services and the Willimantic River to the east, railroad tracks of the Central Vermont Railroad to the north, and Bridge Street to the west. The southern part of the site includes a section of the Willimantic River channel and the southern site boundary is along the southern bank of the Willimantic River. A Site Plan is shown on Figure 2.

Adjacent properties are primarily commercial; both residential and commercial properties are located across the Willimantic River to the south. One 16- by 30-foot concrete block building remains on the Site; this building was reportedly used as the office building for the former gas station, but is now vacant. Other buildings, including a carwash and mill buildings, were formerly located at the Site, but have been removed. The remainder of the Site includes partly paved and gravel-surfaced areas in the western part of the Site, nearest Bridge Street and the former gas station building. Wooded and brushy overgrown areas are located in the eastern part of the Site and a narrow strip of trees is located along the bank of the Willimantic River. The Site is level or gently sloping toward the Willimantic River, except along the River banks, which are steep; along the northern bank of the Willimantic

River, the Riverbank is partly constructed of cut stone and stone-and-mortar bulkheads; the southern property boundary is marked by the high water mark of the southern River bank, which consists of steep banks and a nearly vertical bedrock outcrop.

The Site has a long industrial and commercial history. A cotton mill was constructed on the Site in the 1820s, and a variety of mill buildings existed on the Site from the 1820s through the 1950s, when the mill complex was razed. In the early 1960's, the Site was redeveloped as a gasoline service station and car wash. The Site was most recently used as a gas station, car wash, and storage facility. Two above ground storage tanks (ASTs) located on the Site during the Phase I/II Environmental Site Assessment (Pinecrest, 2007) have been removed. The three underground storage tanks (USTs) located on the Site during the 2007 Phase I/II ESA remain on the Site. These include two 10,000-gallon gasoline tanks and one 20,000-gallon heating oil tank. The removal of these tanks and associated soil contamination is the subject of this Plan.

1.2 Area History and Resources

The property is located in an urban setting that has included industrial, commercial and residential land uses for at least 200 years. Today, most properties in the area are developed with commercial, light industrial and residential uses. Public water and sewer systems are available throughout the area; no private or public drinking water wells or intakes are known to exist on the site or in the vicinity.

The Willimantic River is the only mapped wetland on the site, it is a perennial stream with rapids and falls at a historical dam that is partially breached. Adjacent riparian areas consist of bedrock outcrops and constructed stone and mortar retaining walls/bulkheads that are remnants of the foundations of the textile mills that were formerly located on the Site. According to the CTDEP map of State and Federal Listed Species and Significant Natural Communities for Windham, Connecticut (December 2010), there are no listed species or natural communities located within the vicinity of the site.

1.3 Proposed Site Redevelopment

The Willimantic Whitewater Partnership plans to redevelop the Site as the hub of a linear park system that will incorporate rivers, parks, and trails. The Site property includes the adjacent Willimantic River and breached dam. The property is contiguous to the East Coast Greenway and will serve as a trailhead for the Greenway. Redevelopment will include aesthetic improvements that will make the property a visible gateway into the City.

1.4 Applicable Cleanup Standards

The UST removals are regulated under Sections 22a-449(d)-1 and 22a-449(d)-101 through 113 of the Regulations of Connecticut State Agencies (RCSA), collectively referred to as the "UST Regulations." Releases associated with the UST systems must be remediated to achieve compliance with the Connecticut Remediation Standard Regulations ("RSRs" - Section 22a-133(k)-1 through 22a-133(k)-3 of RCSA). However, as instructed by DECD

and CTDEP, the objective of the soil cleanup for this project will be to achieve compliance with the soil quality standards only; groundwater contamination associated with the release(s) from the UST systems, if any, will be addressed under the site-wide Voluntary Remediation Program, which is being conducted as a separate project.

The analytical data for soil samples obtained from the remedial excavations will be compared the numerical soil quality criteria of the RSRs (January 30, 1996) and to the standards presented in an addendum to the RSRs entitled "Approved Criteria for Additional Polluting Substances" dated April 30, 1999. However, the RSRs allow other strategies to achieve compliance with the DEC, besides the use of the baseline numerical soil standards; these strategies include site-specific alternative DEC, institutional controls such as environmental land-use restrictions (ELURs), and engineering controls such as soil caps, that may be used to protect human health and the environment.

The RSRs have two categories of soil quality criteria:

1. *Direct Exposure Criteria* (DEC) - intended to protect human health from risks associated with direct exposure to pollutants in soil. The DEC are developed based on human health risks associated with ingestion, inhalation or dermal exposure to the pollutants. Because the potential risk associated with such exposure differs, depending on the setting, the DEC are divided into residential standards (ResDEC) and industrial/commercial standards (I/C DEC). The use of less stringent I/C DEC is appropriate only when a property has an environmental land use restriction (ELUR) which precludes residential activities and uses. For this project, the more stringent ResDEC are appropriate because of the intended use of the Site as a public park. The DEC generally apply to soils within 15 feet of the ground surface.

2. *Pollutant Mobility Criteria* (PMC) - intended to protect groundwater quality from pollutants which may leach from unsaturated soils to the water table. The PMC are divided into two categories, depending on the groundwater quality classification of the area under the "Connecticut Water Quality Standards." The Water Quality Standards are established by CTDEP under Section 22a-426 of the Connecticut General Statutes. Groundwater classified as "GA" is designated for use as a private or public water drinking water supply, without treatment; thus, soil release areas in GA areas must meet the "GAPMC." Groundwater classified as "GB" is assumed to be unsuitable for use as a drinking water source without treatment, as a result of contamination resulting from long-term urban and/or industrial land use. GB groundwater is designated for non-drinking water uses, and the numerical GBPMC for most contaminants are less stringent than the GAPMC. The groundwater at the Site is classified as "GB," and there are no known water supply wells in the area (Fuss & O'Neill, 2010); therefore, the "GBPMC" will apply. The PMC for GB areas generally apply to soils above the seasonal high water table. As with the DEC, it is possible to use institutional controls and/or engineered controls to manage impacted soil and achieve compliance with the PMC. Furthermore, there are variances in the RSRs for contaminants associated with the presence of widespread polluted fill and fill materials that contain asphalt fragments, coal fragments, coal ash or wood ash.

2.0 SITE ENVIRONMENTAL CONDITIONS

2.1 Previous Environmental Investigations

Previous environmental investigations on the Site are summarized below:

Date	Prepared By	Title
March 2007	Pinecrest Environmental Services, LLC	Phase I Environmental Site Assessment and Phase II Field Investigation for Property at 28-36 Bridge Street, Willimantic, Connecticut
July, 2010	Fuss & O'Neill, Inc.	Phase III Environmental Site Assessment Historical Textile Mill Operations Area 28-36 Bridge Street, Willimantic, Connecticut, July, 2010

No other environmental investigations are reported to have been conducted at the Site.

The Phase I ESA identified eight areas of concern (AOCs) at the Site:

AOC-0l - Historical Mill Operations and Fill Areas
AOC-02 – Former Gasoline Dispensing Activities
AOC-03 – Gasoline UST Area
AOC-04 – Fuel Oil Distribution Activities
AOC-05 – 20,000-Gallon Fuel Oil UST
AOC-06 - Former Car Wash Building 13
AOC-07 - Historical Waste House 14
AOC-08 - Former Boiler House Area

The Phase II Field Investigation (Pinecrest, 2007) included soil testing in each of these AOCs. In addition, AOC-01, AOC-06, AOC-07 and AOC-08 were further investigated during the subsequent Phase III Assessment (Fuss & O'Neill, 2010). The findings of these studies are discussed in the corresponding reports, and the releases at these areas of concern will be addressed separately under the sitewide VRP.

The Phase II Field Investigation (Pinecrest, 2007) identified releases of petroleum to soils in each of the areas of concern associated with the petroleum storage and dispensing activities: AOC-02, AOC-03, AOC-04 and AOC-05. These release areas were not investigated during the subsequent Phase III Assessment (Fuss & O'Neill, 2010).

2.2 Site Environmental Regulatory History

The Site was used for petroleum storage and commercial retailing from the early 1960s through the 1990s. According to the Phase I ESA (Pinecrest, 2007), a number of regulatory actions were taken at the Site, primarily in relation to the petroleum storage facilities, or in response to releases of gasoline or oil, as described below.

2.2.1 CTDEP Oil and Chemical Spills Division Files

Files of oil and chemical spill reports at the CTDEP indicated that a number of spills of gasoline or fuel oil had occurred at the Site. In summary:

- February, 2000 – heating oil release at the Site. The amount of oil released and associated remediation is not specified, but the incident is listed as "closed" by the CTDEP.

- March 1991 – release of approximately 10 gallons of gasoline to a paved surface. The spill was reportedly contained and removed and the spill is listed as closed by the CTDEP.

- February, 1990 spills correspondence was found consisting of a letter from ChemTech Environmental Waste Management, Inc. to CTDEP indicating that the company had completed the removal and replacement of underground tanks at the Site. The letter indicated that all work was completed in accordance with CTDEP standards and the manufacturers' and National Fire Protection Association recommendations and specifications.

- A November, 1988 spill report was for the release of gasoline associated with a leaking 7,000-gallon gasoline underground storage tank at the Site (listed as Cooperative Oil). Contaminated soil was being removed and stockpiled at the time of the report filing. The spill status was listed as "open;" there was no other information regarding this release.

- A February, 1988 Willimantic Fire Department Violation Order cited two violations of statutes regarding fire prevention/safety at the Site. The violations related to failure to notify of a release and failure to abate the release hazard. A response letter from Cooperative Oil (Robert Boland) to the Fire Marshal's office indicated that the facility would no longer receive any regular gasoline until the tank "vent" pipe "problem" was resolved.

- Six spill reports between 1973 and 1974 related to the discovery and monitoring of oil seeping out of a stone retaining wall and into the Willimantic River near the Bridge. The earliest (August,1973) CTDEP internal correspondence indicated that a compliant had been filed with CTDEP for the oil problem along the River at the plaza. Based on the Phase I ESA, this oil release was attributed to conditions on the property across Bridge Street to the west (the "plaza" property), and not from the Site itself.

2.2.2 CTDEP UST Files

The Site is included in the CTDEP Underground Storage Tank Registration database. According to the Phase I ESA (Pinecrest, 2007), the CTDEP UST registration file for the Site includes two tank registration forms (1986 and 1998), tank testing documentation, tank location maps, and various correspondence. The 1986 UST Registration form indicates four underground tanks on the Site including a 20,000-gallon #2 heating oil tank, and three gasoline storage tanks of 2,000, 4,000 and 10,000-gallon capacity. The tanks were each listed as having been installed in 1965 and were of steel construction. A map in the registration files indicated that the USTs were located generally north and northwest of the gasoline station office building.

Correspondence from 1998 indicates that the four former tanks were removed in 1989 and contaminated soil encountered in the tank excavations was removed and disposed of to the satisfaction of the CTDEP. A UST registration form indicated that the four earlier tanks were removed and replaced with a 20,000-gallon heating oil UST, and two, 10,000-gallon gasoline USTs. The tanks were listed as coated/cathodically protected steel tanks. A 1998 cathodic protection test record is also provided which shows that all three tanks passed the test. An attached sketch indicated the three current tank locations; (this sketch was used to develop the map included herein as Figure 3).

A site summary letter indicates a gasoline spill occurred in 1990 or 1991 during a delivery. The delivery company reportedly remediated the spill in consultation with CTDEP.

A February, 2000 complaint letter regarding the Site was also in the UST file, indicating that the Site had a 21,000-gallon heating oil tank "buried next to the river" with a loading rack no longer in use. The letter stated that the there is no spill protection for the system and that the tank was not being monitored.

2.2.3 CTDEP LUST Files

According to the Phase I ESA (Pinecrest, 2007), the Site is listed as a Leaking Underground Storage Tank (LUST) site for the reported gasoline/heating fuel underground tank failure reported in November of 1988. According to the Phase I report, the CTDEP database listing indicates that clean-up of this LUST release was initiated, but no further documentation was found on file.

The Phase I ESA identified other AOCs at the Site, primarily associated with the former mill buildings, former car wash and fill materials; these AOCs are to be addressed by the separate site-wide remedial action under the Voluntary Remediation Program (CGS 22a-133x).

2.3 Potential Risks to the Public Health and the Environment

The UST systems and associated petroleum impacted soil present potential risks to human health and the environment. The USTs present a potential contaminant risk if any petroleum remains inside them. The contaminated soil in the petroleum release area(s) present a risk to human health via direct exposure if this soil is brought to the surface as a result of future activities, such as construction. This impacted soil also presents a potential

risk to the environment by leaching to groundwater, by groundwater migration to the Willimantic River, and by potential erosion of petroleum-impacted soil. Any vapors from contaminated soil and/or groundwater presents a potential risk to human health via inhalation if the existing building is reused or a new building is constructed over the impacted area.

3.0 REMEDIATION ALTERNATIVES ANALYSIS

3.1 Identification and Evaluation of Potentially Feasible Alternatives

The following remedial alternatives were identified as potentially feasible, based on technical and financial considerations.

1. No action
2. In-situ soil remediation
3. Ex-situ soil remediation
4. Engineered control and environmental land use restriction
5. Direct excavation and removal of the USTs and petroleum-contaminated soil

Each of these alternatives is evaluated below

3.1.1 Alternative 1: No Action

Previous investigations documented the presence of petroleum-impacted soil associated with the two 10,000-gallon gasoline USTs and the 20,000 fuel oil UST. Concentrations of petroleum constituents in some samples exceed the applicable numerical cleanup criteria of the RSRs. A no-action approach would rely on natural attenuation (primarily biodegradation) to reduce the concentrations of hydrocarbons to levels that comply with the RSR criteria. However, the petroleum contamination includes large molecular-weight hydrocarbons that do not readily degrade in the environment; thus, a no action approach is not considered feasible for the timely removal of residual petroleum contamination in soil. Moreover, the tanks themselves represent a liability and potential impediment to future land use, and should be removed.

3.1.2 Alternative 2: In-situ Soil Remediation

In-situ soil remediation provides a potentially feasible approach to clean up the soil release. Petroleum-impacted soil may be cleaned up using a variety of methods to promote oxidation and/or biodegradation in the subsurface. These methods include various technologies, as described and evaluated below:

1. *Natural Attenuation*: this approach relies on naturally-occurring processes such as dilution, dispersion, volatilization and biodegradation to reduce hydrocarbon concentrations in the subsurface. Although natural attenuation occurs in virtually all petroleum releases, its efficacy varies considerably depending on the contaminants present and subsurface conditions as soil type, soil permeability and air exchange.

2. *Soil Vapor Extraction (SVE)*: this technology can effectively remove lower molecular weight hydrocarbons that can volatilize and be drawn from the subsurface in the gaseous phase, but is less effective at removing heavier hydrocarbons, and does not remove lead or other heavy metals.

3. *Bioremediation*: this technology removes hydrocarbon by promoting subsurface microbial activity that will degrade petroleum hydrocarbons. Enhanced bioremediation can be accomplished through a variety of means that improve the conditions for bacteria, such as increasing oxygen concentrations or nutrient amendments. Like natural attenuation, bioremediation requires extensive characterization of the subsurface to ensure that all portions of the release area can be effectively remediated. Bioremediation will not remove lead or other metals.

4. *Chemical Oxidation*: a variety of methods exist that are capable of oxidizing subsurface petroleum contaminants. These include the use of peroxides, permanganate and other chemical oxidants. Each of these require mechanisms to efficiently deliver the oxidant to the subsurface, which in turn, requires careful characterization of the subsurface conditions. Chemical oxidation will not remove lead or other metals from the subsurface.

These *in-situ* methods each rely on the movement of air or other fluids through the subsurface, and therefore, may be limited in applicability. Moreover, each requires careful characterization of subsurface conditions such that fluid flow can be predicted, and the remediation systems can be tailored to these conditions. Finally, each *in situ* method is unable to remove lead from the subsurface soils. Thus, residual lead that may be present as a result of historical releases of leaded gasoline, for example, will not be remediated by an *in situ* approach. Based on these factors, *in situ* remediation is not considered the most favorable remediation method.

3.1.3 Alternative 3: Ex-situ Soil Treatment Remediation

Ex-situ remediation involves excavation and soil treatment at the surface, and replacement of the soil. Treatments for petroleum hydrocarbons may be accomplished by a variety of means, including thermal desorption, landfarming, etc. Unlike *in situ* methods, *ex situ* methods allow ready access to the materials and control of soil conditions. However, *ex situ* methods use a lot of energy (such as thermal treatment), require additions of chemicals (such as chemical oxidizers), or require securing the site and protecting the remediation system for extensive periods of time (such as with landfarming).

The Site is not considered conducive to *ex situ* remediation because its setting makes the property difficult to secure. Any excavation to remove impacted soil would have to remain open until the soil treatment was complete and the materials could be returned to the excavation. Because the remediation area is in an urban area alongside a major road, it would be necessary to protect passersby and motorists from the hazards associated with the open excavations. Such safeguards would have to include fencing and traffic barriers, and would be cost-prohibitive. For these reasons, *ex situ* remediation is not considered favorable for this project.

3.1.4 Alternative 4: Engineered Control and Environmental Land Use Restriction

An engineered control (e.g., soil cap) and ELUR may be used to prevent direct human exposure to the contaminated soil. However, this approach will not result in UST removal, and so, does not accomplish the project objectives. Furthermore, an engineered control is expensive to implement, may impede future site construction activities and requires maintenance of the engineered control. For these reasons, the use of an ELUR and Engineered Control is not considered a feasible remedial alternative for this project.

However, an ELUR implemented in conjunction with the selected remedy may provide a valuable option that will improve the overall efficiency and effectiveness of the remediation, as discussed below.

3.1.5 Alternative 5: Soil Excavation, Off-Site Recycling/Disposal and ELUR

When the gasoline and fuel oil USTs are excavated for removal, the associated petroleum contaminated soil will be exposed. Thus, the tank removal affords an ideal opportunity to remove the impacted soil at the same time. Soil excavation will remove not only the residual petroleum impacts, but also any lead that remains at concentrations greater than the applicable cleanup standards.

Knowledge of the source of the petroleum contamination, coupled with field screening and laboratory analyses, have shown that the petroleum contaminated soil associated with the USTs is likely suitable for offsite treatment and/or recycling. Several facilities that are permitted to treat and recycle petroleum-impacted soil are located within a 90-minute drive of the Site.

An ELUR that prohibits excavation below four feet of the ground surface will allow the Site to be redeveloped, but would avoid the need to excavate soil that exceeds only the ResDEC. Thus, if the results of confirmatory soil testing following the excavation of the tanks indicate that soils exceeding the ResDEC (but not the GBPMC) remain, an ELUR may prove to be a more cost-effective means to comply with the RSRs.

3.2 Selection of Remedial Alternative

Based on the assessment of remedial alternatives, Alternative 5 was selected as the best available technology. This alternative employs excavation and removal of the USTs and associated petroleum impacted soil, and implementation of an ELUR. This selection was based on the following advantages over other alternatives:

- Only approach that will permanently eliminate the USTs from the Site
- Offers the most expeditious method of removing petroleum impacted soil, minimizing the time during which site security must be maintained
- Only method that removes non-degradable contaminants such as heavy metals
- Can provide definitive determination that soil remedial goals have been achieved, without additional subsurface exploration (as required with in situ methods)

- Requires only commonly available equipment and therefore, provides for favorable competitive bidding of contractors
- Removes contaminants that may be recalcitrant to in situ methods such as in situ bioremediation, soil vapor extraction or chemical oxidation
- Provides for potential recycling of petroleum-impacted soil into asphalt pavement, which is both cost effective and environmentally sound
- The use of an ELUR offers flexibility to leave certain contaminants below four feet if the only exceedances is of the ResDEC

None of the other potentially feasible alternatives provides all of these advantages.

A cost analysis of each remedial alternative has not been prepared. However, as discussed above, most remedial alternatives would not achieve the project goal of UST removal; therefore, cost analyses of these alternatives are not warranted. Furthermore, removing the USTs and excavating the petroleum impacted soils is presumed to be the most cost-effective approach because

- the site is readily accessible for these activities
- the work will not require unusual equipment, electrical power or specialty materials
- the rapid completion of the work will eliminate the need for long-term monitoring, site controls and security

Based on experience with similar projects in this region, an order-of-magnitude estimate for the removal of the three USTs and ancillary equipment, along with site security fencing and lighting is $45,000 to $75,000. The cost for remediation of petroleum-contaminated soil cannot be determined because the amount of contaminated soil is not known. However, the unit cost for excavation, loading, transportation and recycling (or disposal) of petroleum impacted soil is estimated to be $100 to $150 per ton.

Additional investigations could be conducted in advance of the UST removal, to more completely characterize the degree and extent of petroleum contamination in Site soils. However, such characterization is more efficiently conducted in conjunction with the UST removal, which will allow simultaneous remediation of impacted soils.

The methods of implementation of the selected remedial alternative, and the rationale for these methods, are described in the following Remedial Action Plan.

4.0

5.0 REMEDIAL ACTION PLAN

This Remedial Action Plan (RAP) provides the methods for removing the three underground storage tanks (USTs) and associated contaminated soil. This RAP does not address other AOCs or contaminant release areas, which are to be addressed under a sitewide VRP.

Remediation will be conducted by a licensed, experienced contractor under the on-site direction of an engineer/environmental professional. All work will be overseen by a Connecticut Licensed Environmental Professional (LEP).

5.1 Permanent Tank Closure

Three USTs are to be removed, including two 10,000-gallon gasoline USTs, and one 20,000-gallon fuel oil UST. These tanks were installed in 1988, and are of double-walled steel, cathodically protected steel construction. The tanks are located in an area where the ground surface is paved with concrete and/or asphalt. The approximate locations of the tanks are shown on the site plan in Figure 2.

The three USTs shall be closed in accordance with the applicable standards for permanent closure under the Connecticut Underground Storage Tank Regulations (RCSA Sections 22a-449(d)-1, and Sections 22a-449(d) 101-113), and with:

- American Petroleum Institute (API) Recommended Practice 1604, ``*Removal and Disposal of Used Underground Petroleum Storage Tanks*''
- National Fire Protection Association (NFPA) *Flammable and Combustible Liquids Code* (NFPA 30).

In summary, the permanent tank closure will include the following procedures:

Each tank and associated piping shall be emptied and cleaned by removing all product, pumpable liquids and accumulated sludges. The following cleaning and closure procedures may be used: 22a-449 (d)-107 (b) of the Connecticut UST Regulations, and the American Petroleum Institute Publication 2015, ``*Cleaning Petroleum Storage Tanks*.'' Materials removed from the tanks must be properly handled and disposed of in accordance with applicable rules and regulations. These materials shall only be stored on site in secured containers and only while awaiting testing, and completion of the proper shipping manifests (if necessary).

All materials coming into contact with the tank or near the excavation, such as shovels, slings and tools, shall be of the non-sparking type. Excavation shall expose the top and sides of each tank and the tops of buried piping. Uncontaminated soil above the tanks and piping shall be stockpiled separately for later use as backfill. Before removing a tank from the ground, the tank atmosphere shall be purged or made inert in accordance with API RP 1604. The tank atmosphere shall be continuously monitored for combustible vapors if the tank is purged, or continuously monitored for oxygen if the tank is inerted. All piping and ancillary equipment shall be disconnected from the tank, and all connections shall be securely capped, except those connections necessary to purge or inert the tank or to continually test the tank atmosphere.

Excavation shall completely remove tank piping and other ancillary equipment, except in the case where piping extends beneath buried utilities or beneath the Site building. Concrete deadmen or other tank anchoring equipment need not be excavated unless the deadmen impede the removal of the UST system components or contaminated soil. The piping exterior and ancillary equipment shall be cleaned to remove all soil and inspected for signs of

corrosion and leakage. The tank shall be removed from the excavation and the exterior cleaned to remove soil; the tank will be inspected for signs of corrosion, structural damage, or leakage.

After removal from the excavation, the tank shall be labeled as directed in API RP 1604, placed on wood blocks on a level surface to prevent movement during cutting. Tanks, piping and other ancillary equipment will be hauled off-site for recycling as soon as possible.

5.2 Soil Remediation

5.2.1 Soil Excavation and Handling

After the tank has been removed, the adjacent and underlying soil and structures will be examined and tested by the engineer/environmental professional for evidence of leakage. The engineer/environmental professional will determine the extent of the contaminated soil or structures to be removed from each tank excavation, based on visual appearance, odors and field screening with a photoionization detector (PID). Contaminated soil shall be removed and stockpiled as directed by the on-site engineer/environmental professional. After readily apparent contaminated soil is removed, the excavation will be sampled for confirmatory analysis. If the analytical results indicate that RSR compliance has not been achieved, the engineer/environmental professional may direct the removal and stockpiling of additional soil, and shall conduct supplemental confirmatory soil sampling.

Soil shall be removed from the exterior of the tank, piping, and associated equipment to prevent soil from falling off of the tank during transportation, to ensure that markings will adhere to the surfaces; and to simplify tank cutting. Soil shall be removed using non-sparking tools.

After soil known to be contaminated has been removed or after soil excavation is complete, the excavation shall be sampled by the Engineer. The Contractor, if requested, shall obtain samples using a backhoe. Sample results will be available within five days of the date they were collected. The tank area and any other excavations shall be backfilled only after the soil analytical results have been approved. The tanks removed shall be disposed of at an approved facility. Each tank disposed of in this manner shall be manifested as required by the State of Connecticut to document delivery and acceptance at the disposal facility. Tank and piping sections shall be recycled or disposed of in a State-approved off-site disposal facility. Soil excavations will not be backfilled until the results of confirmatory sample analyses (Section 4.2.2) have demonstrated that remediation goals have been achieved.

5.2.2 Confirmatory Sampling and Analysis

Soil samples will be collected for laboratory analysis to confirm the limits of remediation have achieved compliance with the applicable RSR criteria. Sidewall soil confirmatory samples will be collected every 20 feet, or a minimum of one sample for each side excavation wall. The samples will be biased toward stained soils, soils with odors, and elevated organic vapor readings as measured using a photoionization detector (PID) equipped with a 10.6 electron volt lamp. The bottom excavation soil samples will be collected such that one sample will be collected for approximately 200 square feet.

Confirmatory soil samples will be submitted to a CTDPH laboratory for analysis of constituents of concern, as follows:

Analytical Parameters
Confirmatory Soil Testing

Area of Concern	Analytical Parameters
AOC-02, AOC-03 (areas of presumed gasoline release)	• Aromatic volatile organic compounds (VOCs) by USEPA Method 8260 (soils collected and preserved using CTDEP-specified Method 5035) • Extractable total petroleum hydrocarbons (CTDEP Modified USEPA Method 8100) • Lead by SW 6010
AOC-04, AOC-05 (areas of presumed No. 2 fuel oil release)	• Extractable total petroleum hydrocarbons (CTDEP Modified USEPA Method 8100) • Polynuclear aromatic hydrocarbons (PAHs) by modified USEPA Method 8100

Laboratory analysis will be conducted using CTDEP's Reasonable Confidence Protocols (RCPs).

Soil analytical results will be used to assess compliance with the applicable RSR criteria – the ResDEC and GBPMC. If soils exceeding the mass-based GBPMC for ETPH or PAHs remain, these samples may be analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) and these results compared to the applicable GBPMC. If soils exceeding ResDEC remain, the licensed environmental professional will determine whether additional excavation is warranted, or whether an ELUR restricting future digging on the Site, may be the most appropriate option to comply with the RSRs.

It should also be noted that previous environmental investigations identified asphalt paving fragments, coal, coal ash and wood ash in the fill material at the Site. These substances in soil samples can cause concentrations of ETPH, PAH and some metals to be greater than background levels; these contaminants may be erroneously attributed to petroleum impacts, and could result in more soil removal than is necessary. To minimize this problem, care must be taken during sampling and analysis. Soils containing obvious asphalt fragment, coal or ash should be avoided unless observations and/or PID screening indicate the soil has also been impacted by petroleum. In addition, a sample of Site fill materials (collected away from the UST areas) containing coal and wood ash should be analyzed for ETPH and the results compared to other soil analytical results collected as part of the UST remediation process. The chromatographs of the different materials (petroleum, asphalt, coal, ash) will be distinctive. This site-specific "hydrocarbon fingerprinting" can be used to distinguish between petroleum-impacted soil and urban fill materials, resulting in a more accurate assessment of the release areas resulting from the leaking UST systems. This distinction is important when planning remediation of the UST areas because the pollutant mobility criteria of the Connecticut RSRs do not apply to polluted fill if the exceedances of those criteria are due only to the presence of coal, coal ash or wood ash. For the purposes of this RAP, it is assumed that these fill materials will be addressed during the site-wide voluntary remediation program.

5.2.3 Target Areas for Soil Remediation

Contaminated subsurface soils have been identified in the area of the underground oil and gasoline storage tanks (Pinecrest, 2007). However, the extent and degree of contamination has not been completely determined. It will be most efficient to establish the limits of soil cleanup upon removal of the USTs. Soils shallower than four feet are assumed to meet the RSR requirements because they were not impacted by releases from the USTs; these soils will be stockpiled separately and used to partially backfill the remedial excavations. Soils from approximately four feet deep to the seasonal high water table shall be evaluated for contamination and possible remediation.

5.2.4 Utility Clearance

Buried public utilities in the vicinity of the remediation areas will be marked out ahead of any subsurface activities using the statewide utility locating service, Call-Before-You-Dig. The public utilities (gas, electric, telecommunications, water, sewer) will be contacted to confirm that no active service connections to the site are in operation. In the event that the presence or location of on-site buried utilities may remain uncertain, a private utility locating service will be contracted to mark out on-site buried utilities prior to remedial excavation.

5.2.5 Site Health and Safety and Site Security

The site is subject to the provisions of the federal OSHA Hazardous Waste Operations statutes (the "Hazwoper standard" - 40 CFR 1910.120). All remediation activities must be conducted in accordance with a site-specific Health and Safety Plan (HASP) that conforms to the Hazwoper standard, and which provides for the protection of the health and safety of all site workers.

In addition, the Site is located in an urban area adjacent to a heavily traveled road. The Site is unfenced, and so, site security must be adequate to protect the public from exposure to contaminated soil, and from the physical hazards of the heavy equipment and open excavations. A temporary chain-link fence should be installed to completely encircle the area of activities, and be used to prevent access to the Site by unauthorized personnel. The approximate location of the perimeter fencing is shown on Figure

5.2.6 Permits and Approvals

This Remedial Action Plan is subject to approval of the Connecticut DEP and the USEPA. Upon approval of the USEPA, the WWP will notify the Building Department of the Town of Windham and the Fire Marshal's office and determine if a demolition permit is required. Approval of these officials shall be obtained before work will proceed.

5.2.7 Survey Control

The UST removal and soil remediation requires only approximate measurements of horizontal and vertical control. Measurements of the limits of excavation shall be made relative to surveyed points such as existing building corners, utility poles, and monitoring wells. The depths of excavations will be measured relative to the existing ground surface, which will afford an estimate of actual elevation, relative to the existing ground surface contour mapping. This information will be used to update existing site mapping (e.g., the base map for Figure 2) and included in the UST Closure Report. This information will also

be made available for the site-wide Voluntary Remediation, (to be conducted by others under a separate project).

5.2.8 Waste Management

The steel tanks and any associated buried piping will be loaded directly into roll-off containers or trucks for removal from the Site. Soils removed from the excavation which are obviously contaminated with petroleum will be immediately stockpiled on plastic sheeting or placed in sealed roll-off containers or sealed trucks to await transportation off-site. Soils that are suspected of containing contamination at concentrations greater than the applicable RSR criteria will be stockpiled and samples collected for analysis.

All stockpiled soils will be covered with tarps and/or 10 mil plastic sheeting to prevent rainfall from falling on the soil and to prevent entrainment and transport of soil by wind. Tarps or plastic sheeting used to cover stockpiled soil will be tied or adequately weighted down to prevent exposure of these soils to the weather. Any stockpiled soils that are placed on the ground shall be placed in an area not subject to significant overland runoff.

Stockpiled soils, debris and equipment shall be maintained within a fenced area to impede access to the remediation area by the public.

5.2.9 Excavation Backfill

Backfill material shall be widely graded sand and gravel, free of clay, organic matter, surface coatings and other foreign materials, and conforming to the following gradation requirements.

Sieve Size	Percent Passing by Weight
6 inches	100
3 inches	80 – 100
No. 4	20 – 100
No. 100	0 - 10
No. 200	0 - 5

The backfill material shall also meet the following chemical clean criteria. One sample of each 1,000 tons of backfill shall be collected and analyzed.

1. No VOCs (EPA Method 8260) (detection limit 10 micrograms per kilogram (ug/kg)
2. No PCBs (EPA Method 8082) (detection limit 50 ug/kg)
3. No metals (total RCRA-8 metals plus copper, zinc, and nickel) at concentrations greater than ResDEC
4. No semi-volatile organic compounds (EPA Method 8270) (detection limit 100 ug/kg)
5. No ETPH (detection limit 25 mg/kg)

The backfill shall be placed in horizontal layers and compacted after each layer to minimize settlement.

5.2.10 Erosion and Sedimentation Control

The area of activity is generally flat and paved or graveled. As such there is potential for stormwater run-on to the remediation area, and potential stormwater erosion of any stockpiled materials. Therefore, the following actions will be taken to prevent erosion and sedimentation:

1. To the extent practicable, conduct the UST removal and soil excavation work during a period of dry weather
2. Establish soil stockpiles only in areas that are not subject to significant overland flow during storm events
3. Install barriers around the active remediation area to prevent overland flow run-on during storm events from washing into the area of excavation and soil stockpiles.
4. Ensure proper management of waste soil stockpiles, including covering, as described under "Waste Management" below
5. Maintain a clean working area; use equipment and practices to minimize spillage of contaminated soil onto the ground surface and immediately sweep up any spilled soil

5.2.11 Dust Control

Dust generation should be minimized by working efficiently, avoiding work during periods of excessive wind, and ensuring that disturbed soils are protected through the use of weighted tarps or covered rolloff containers. If necessary, sprayed water will be used to prevent mobilization of dust by wind. Calcium chloride may also be used, as necessary, to control dust in freshly disturbed or recently restored areas of the site.

5.2.12 Air Monitoring

Ambient air around the perimeter of the remediation area shall be monitored for volatile organic compounds using a photoionization detector (PID) equipped with a 10.6 eV (electron volt) lamp.

5.2.13 Site Restoration

All materials excavated from the subsurface will be removed from the site, with the exception that material identified as clean fill from 0 to 4 feet deep can be reused to backfill the excavations. Site grade will be restored with approved backfill material. Stockpile areas and other areas where soil may have been spilled will be swept clean to remove dirt and dust. Pavement disturbed during the remediation will not be restored.

5.2.14 Excavation Dewatering

Dewatering is not anticipated for this project. If any dewatering becomes necessary for completion of this project, it is expected that the water removed from the excavation will be treated and discharged to the public sanitary sewer in accordance with the provisions of the CTDEP *General Permit for Discharge of Groundwater Remediation Wastewater to the Sanitary Sewer*

5.2.15 Site Security

Site security will be afforded by the chain link fencing, and any temporary lighting that is necessary to maintain a fully lit working area during the night. "No Trespassing" signs shall be posted around the perimeter of the fenced area. Any vehicles or heavy equipment left on

site during non-working hours shall be securely locked and parked inside the chain link fence enclosure.

5.2.16 Decontamination

On-site decontamination of heavy equipment will be performed as necessary to minimize fugitive dust emissions and unintentional transport of contaminated soil. Dry decontamination methods will typically be used on trucks and heavy equipment to remove soil from wheels, equipment tracks, loader buckets, etc. Decontamination will be performed within the work area and soils removed during the decontamination process will be stockpiled and disposed/recycled with other contaminated material.

5.2.17 Waste Characterization Sampling

A minimum of two soil samples will be collected from waste soil stockpiles, and submitted to a CTDPH-certified testing laboratory for analysis of constituents of concern and waste profile parameters. The exact parameter list will be determined based on the intended receiving facility for the soil, but is expected to include the following:

- extractable total petroleum hydrocarbons (Connecticut Method ETPH)
- volatile organic compounds (VOCs) by USEPA Method 8260
- flashpoint
- pH
- reactivity
- polychlorinated biphenyls (PCBs)
- heavy metals, including arsenic, cadmium, chromium, mercury and lead

Care will be taken to ensure that samples are representative of the soil stockpile and the methods of sample collection and analysis are consistent with the requirements of the receiving facility's operating permits. All analyses will be consistent with the applicable Connecticut RCP standards.

5.2.18 Quality Assurance/Quality Control

A separate Quality Assurance Project Plan (QAPP) will be prepared that will guide the data collection activities of this project. In summary, samples will be analyzed and evaluated by an environmental laboratory certified by the Connecticut Department of Public Health using CTDEP's Reasonable Confidence Protocols (RCP). Quality assurance/quality control (QA/QC) samples will also be collected and analyzed; the results of the QA/QC samples and all other analytical data will be evaluated with respect to project-specific data quality objectives (DQOs) to ensure that data are of adequate quality to meet the project objectives and applicable and relevant standards and guidelines of the UST Regulations and the VRP.

5.3 Documentation and Reporting

5.3.1 Field Documentation

Field activities will be directed and documented by personnel trained and experienced in UST Closure activities and remediation of petroleum-impacted soil in Connecticut. Documentation will include detailed field notes, scaled site maps showing approximate areas of remediation, sample collection logs, sample chains-of-custody, and photodocumentation.

5.3.2 Post-Remediation Reporting

Following completion of field activities, a UST Closure Report will be prepared in accordance with CTDEP regulations and guidance. This Report will be submitted to the CTDEP or designated agency for review. The UST Closure Report will document that cleanup is complete and is protective of human health and the environment. The Closure Report will identify any institutional controls used and recommendations for long-term groundwater monitoring requirements (to be conducted under the site-wide VRP)..

5.3.3 Post-Remediation Monitoring Requirements

Following remediation, groundwater monitoring will be required in accordance with the RSRs. As instructed by DECD and CTDEP, these monitoring activities will be conducted in conjunction with the site-wide voluntary remediation.

6.0 PROJECT SCHEDULE

The schedule for implementing the remedial actions described in this RAP is dependent on the schedule of approval of this document and of the separate QAPP document, and on the completion of the Community Relations Plan and associated administrative tasks. A project schedule for the field activities work will be completed upon receipt of the necessary approvals and receipt of contractor bids.

7.0 REFERENCES

Connecticut Department of Environmental Protection, 2010. *Site Characterization Guidance Document*, December, 2010

Connecticut Department of Environmental Protection, 2002, *Water Quality Standards*; CTDEP, 2002

Fuss & O'Neill, Inc., July 2010, *Phase III Environmental Site Assessment, Historical Textile Mill Operations Area, 28-36 Bridge Street, Willimantic, Connecticut.*

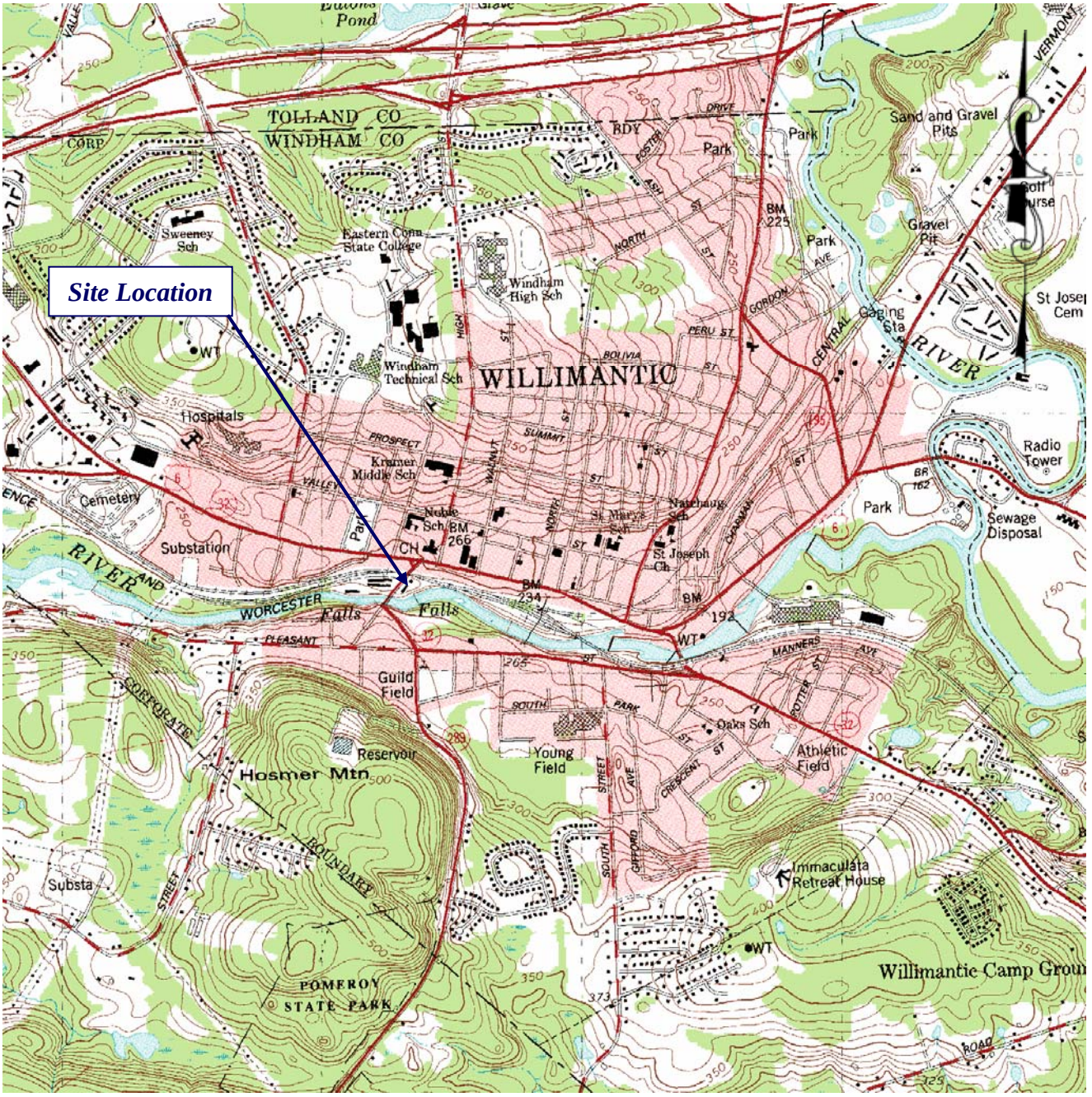
Pinecrest Environmental Services, LLC. *Phase I Environmental Site Assessment/Phase II Field Investigation* for property at 28-36 Bridge Street Willimantic, Connecticut March 2007.

Rodgers, J., 1985, *Bedrock Geological Map of Connecticut*; CTDEP, Natural Resources Center, Connecticut Geological and Natural History Survey, in cooperation with the United States Department of the Interior, U.S. Geological Survey.

Stone, J. R., Schafer, J. P., London, E.H. and Thompson, W.B., 1992, Surficial Materials Map of Connecticut; prepared in cooperation with CTDEP, Geological and Natural History Survey.

United States Geological Survey, Willimantic Quadrangle Connecticut - Windham County, 7.5-Minute Series Topographic Map; United States Department of the Interior, U.S. Geological Survey, 1984.

FIGURES



Scale=1:24000

0 1/2 1 Mile

0 2000 4000

MAP REFERENCE
THIS MAP WAS PREPARED FROM THE FOLLOWING 7.5 MINUTE SERIES TOPOGRAPHIC MAP:
WILLMANTIC, CONN, 1984

DRAFT

Figure 1
Site Location Map
Analysis of Brownfields Cleanup Alternatives and Remedial Action Plan
28-36 Bridge Street, Willimantic, CT

CME Project #2010113 Dated: June 2011

CME Associates, Inc.

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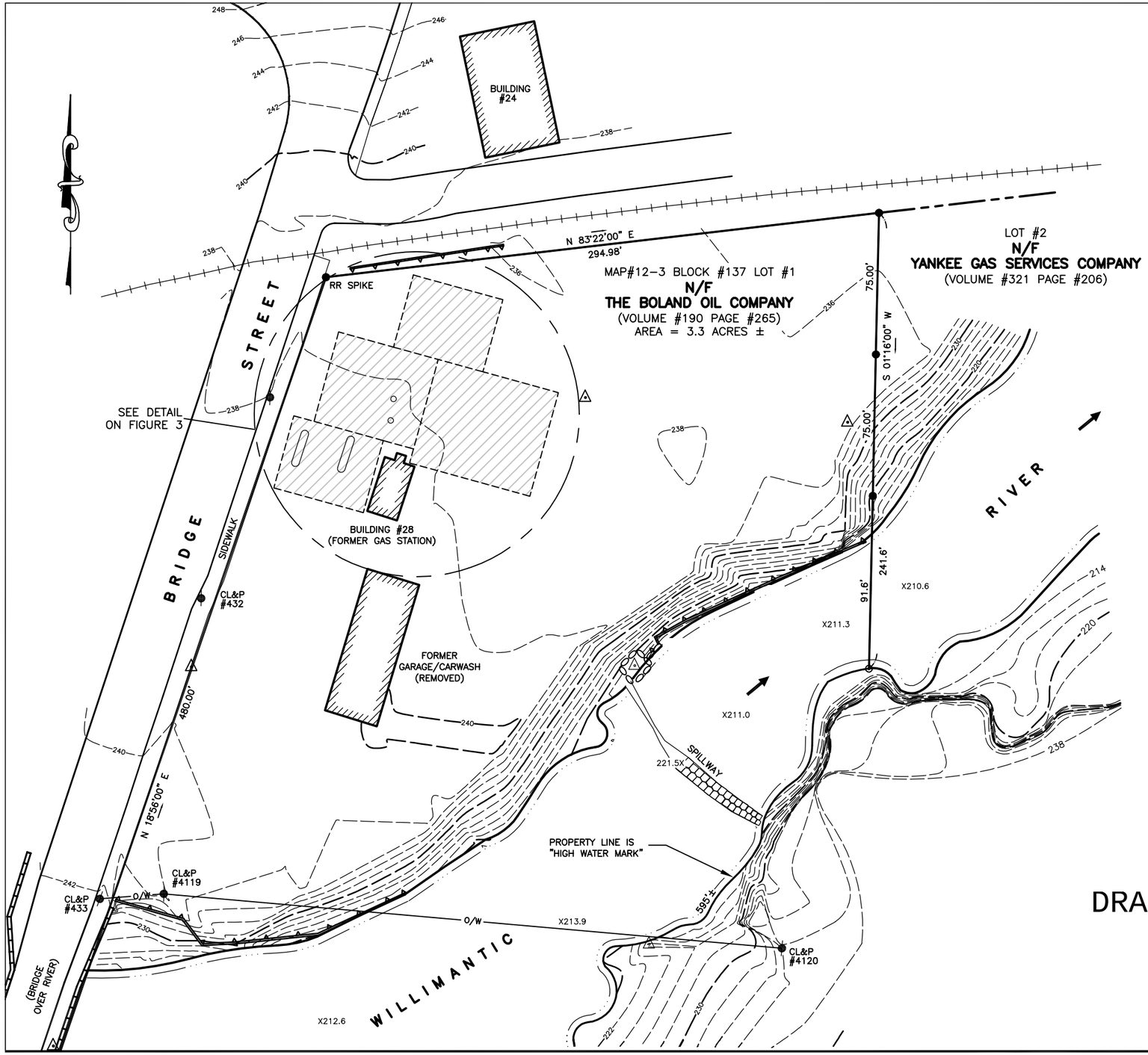

NOTES

1. THE VERTICAL DATUM DEPICTED HEREON IS BASED ON CTGS DISK BENCHMARK STATION 2210 (NAVD '88).

2. BASE MAP FROM "PERIMETER SURVEY PREPARED FOR WILLIMANTIC WHITEWATER PARTNERSHIP, INC." BY CME ASSOCIATES, INC. 2007.

LEGEND

PROPERTY LINE	
EDGE OF PAVEMENT	
EXISTING CONTOUR (NAVD '88)	232
RETAINING WALL	
OVERHEAD WIRES	
RAILROAD TRACKS	
SURVEY CONTROL POINT	
IRON MONUMENT	
UTILITY POLE	
NOW OR FORMERLY	N/F

DRAFT

FIGURE 2
SITE PLAN
ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES AND REMEDIAL ACTION PLAN
THE WILLIMANTIC WHITEWATER PARTNERSHIP, INC.
UNDERGROUND STORAGE TANK REMOVAL AND SOIL REMEDIATION PROJECT
#28 BRIDGE STREET
WILLIMANTIC, CONNECTICUT

QUALITY CONTROL CERTIFICATION		
GROUP	REVIEWED	DATE
PROJECT MANAGER		
SURVEY		
ENVIRONMENTAL		
CIVIL		
STRUCTURAL		
ARCHITECTURAL		

JOB DATA	
PROJECT	2010113
BOOK NO.	–
DESIGNED	–
DRAWN	MFS/RAC
CHECKED	–
COGO	–
FILE	2010113 STP.dwg

REVISIONS		
NO.	DATE	DESCRIPTION

60 30 0 60
GRAPHIC SCALE IN FEET

DATE: 06/17/2011
SCALE: 1" = 60'
SHEET: 1 OF 1

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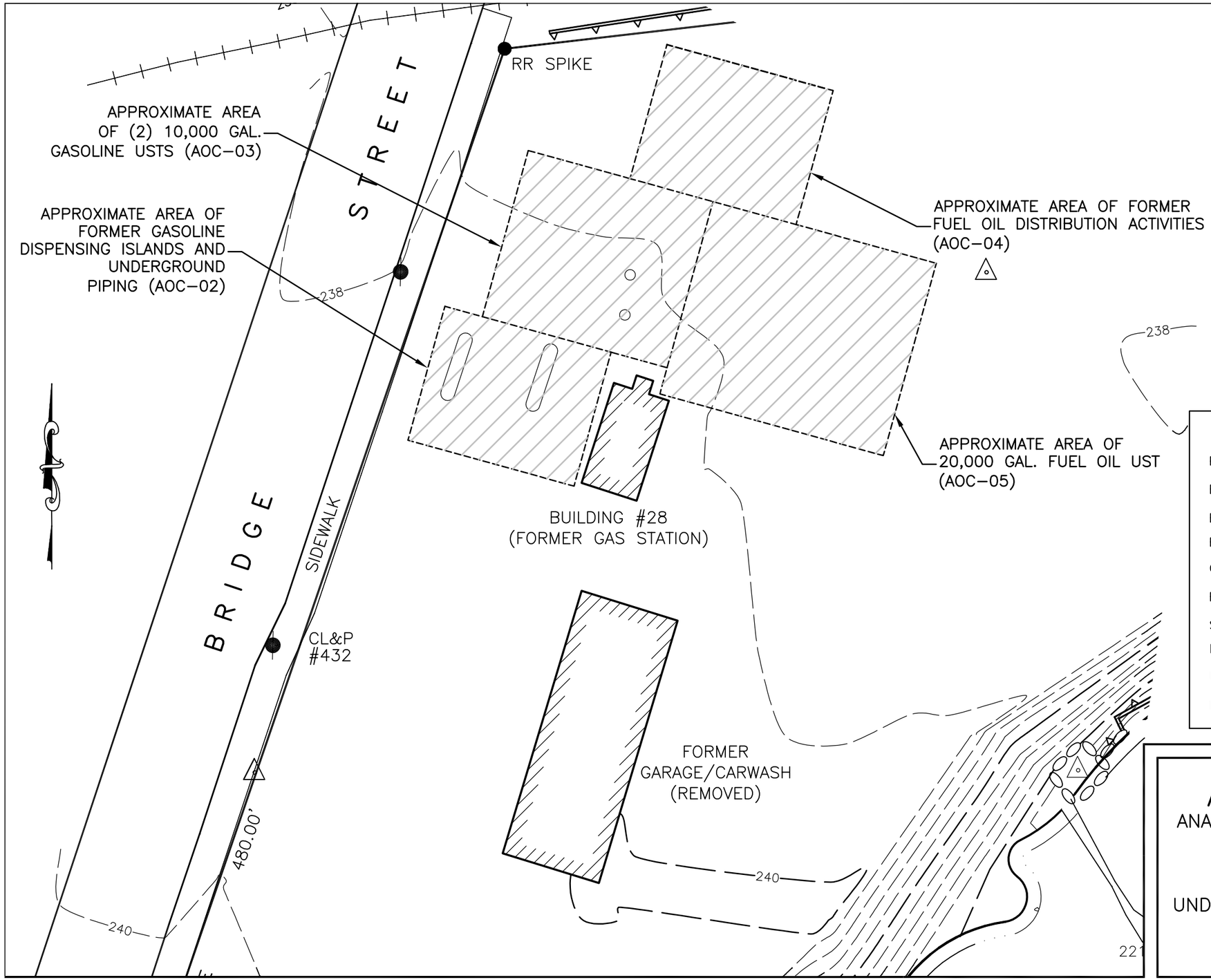

NOTES

1. THE VERTICAL DATUM DEPICTED HEREON IS BASED ON CTGS DISK BENCHMARK STATION 2210 (NAVD '88).
2. BASE MAP FROM "PERIMETER SURVEY PREPARED FOR WILLIMANTIC WHITEWATER PARTNERSHIP, INC." BY CME ASSOCIATES, INC. 2007.
3. AOCs IDENTIFIED BASED ON INFORMATION IN PREVIOUS STUDIES (PINECREST, 2007).
4. AREAS OF REMEDIATION ANTICIPATED TO LIE WITHIN AOCs.

DRAFT

LEGEND

PROPERTY LINE	
EDGE OF PAVEMENT	
EXISTING CONTOUR (NAVD '88)	232
RETAINING WALL	
OVERHEAD WIRES	
RAILROAD TRACKS	
SURVEY CONTROL POINT	
IRON MONUMENT	
UTILITY POLE	
NOW OR FORMERLY	N/F

FIGURE 3
APPROXIMATE AREAS OF REMEDIATION
ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES AND REMEDIAL ACTION PLAN
THE WILLIMANTIC WHITEWATER PARTNERSHIP, INC.
UNDERGROUND STORAGE TANK REMOVAL AND SOIL REMEDIATION PROJECT
#28 BRIDGE STREET
WILLIMANTIC, CONNECTICUT

QUALITY CONTROL CERTIFICATION		
GROUP	REVIEWED	DATE
PROJECT MANAGER		
SURVEY		
ENVIRONMENTAL		
CIVIL		
STRUCTURAL		
ARCHITECTURAL		

JOB DATA	
PROJECT	2010113
BOOK NO.	–
DESIGNED	–
DRAWN	MFS/RAC
CHECKED	–
COGO	–
FILE	2010113 STP.dwg

REVISIONS		
NO.	DATE	DESCRIPTION

30 15 0 30
GRAPHIC SCALE IN FEET

DATE: 06/17/2011
SCALE: 1" = 30'
SHEET: 1 OF 1

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