Wolcott Street Seeps
Remedial Alternatives Review

Former Lobell Refinery
WDEQ Orphan Site #57.004
Casper, Wyoming

Prepared for:

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1.0 INTRODUCTION

The former Lobell Refinery Orphan site is located near downtown Casper and is bordered by Center Street on the west, Wolcott Street on the east, East Collins Drive on the south and the former Northwestern Railroad tracks (currently a pathway) on the north (Figure 1). The site has been occupied by a number of different businesses and companies since its development just before the turn of the century. Pennsylvania Oil and Gas Company built and operated a refinery on the Site from 1895-1903, at which point it was bought by Lobell, who operated it until 1911. Sanborn maps from that period show the location of several tanks on the site extending onto the present location of Wolcott Street. Articles reviewed indicate that there was an open oil storage pit somewhere on site which was later filled in by the city because it was a public health hazard. None of the maps reviewed indicated the location of the pit. The Sanborn maps also indicate the presence of an acid storage area at the site.

The Wolcott Street area has experienced surface seeps in the street (primarily during warmer periods) and bordering sidewalk area for a number of years. The seeps are comprised of a tar like material and lesser amounts of a relatively clear liquid. Both of these materials exhibit pH measurements of less than 2 s.u.. Although the low pH does not classify the material as a hazardous waste since it is a solid waste, the low pH does present an exposure hazard and complicates disposal options. Since these materials are exposed at the surface there is a potential for dermal contact to people. Historically, the city of Casper has paved over the areas but the seeps reappear. The source of these materials appears to be the former Lobell Refinery tanks or the reported oil pit that was subsequently filled in with soil. The location of the oil pit has not been positively determined although Tetra Tech did conduct a ground penetrating radar survey, shallow direct push borings and test excavations in the Wolcott Street area.

The purpose of this report is to provide a review of potential remedial options for soil at the Wolcott Street site. The objective of the soil remediation is to eliminate the surface exposure pathway, preclude future migration of the hazardous constituents and provide a suitable substrate for the street and sidewalk areas. Additionally, a natural gas main line is present along the west side of Wolcott Street. Reportedly, the gas line is constructed of steel pipe wrapped with a protective coating. Based on past work at the site Tetra Tech has observed that the soils from the Wolcott Street aggressively corrode steel.

2.0 SITE USE

2.1 Past Use

As discussed above, the site has documented use as an oil refinery. Sanborn maps from 1903 and 1907 indicate the presence of various oil tanks and an acid storage area within or near present day Wolcott Street. Based on the Sanborn maps Wolcott Street was extended through the Site at some time between 1912 and 1918.

2.2 Existing Use

The site is currently a city maintained road with sidewalks on each side of the street. Commercial properties exist on each side of Wolcott Street (Figure 2).

2.3 Planned Use

The proposed use for the site is continued use as a city maintained roadway.

3.0 SITE SUBSURFACE CONDITIONS

3.1 Soil

Monitoring well MW-05 is located on the western portion of Wolcott Street. The lithologic log from this well shows the subsurface to be comprised of asphalt at the surface and from 1.5 to 4 feet below ground surface (bgs) a black, silty sand layer is present. This black interval is underlain by sands and gravel to the total depth of the boring (26.5 feet bgs). Field screening with a flame-ionization detector shows a trend of increasing values with depth.

A laboratory sample collected from the borehole (BH-2) for monitoring well MW-05 was submitted for volatile, semi-volatile, extractable petroleum hydrocarbons (diesel range) and pH analysis. The pH of this sample was 4.1 and the extractable petroleum hydrocarbons in the diesel range were 6,660 mg/kg.

In an effort to further evaluate the surface seeps at Wolcott Street several shallow direct push borings were installed followed by two test pit excavations. The objective of the direct push borings was to preliminarily evaluate the horizontal and vertical extent of the acidic hydrocarbon waste and the objective of the test pit excavations was to visually examine the orientation of the acidic hydrocarbon waste at a seep location.

The direct push soil borings revealed that the acidic hydrocarbon waste occurs near the surface in a fingered or spider web fashion. The test pit excavations revealed that the acidic hydrocarbon waste migrates upward along preferential pathways. Neither the test pits nor the direct push borings identified a single, massive source area such as the reported former oil pit.

3.2 Groundwater

Groundwater is present beneath the site at a depth of about 24 feet bgs. Based on available data to date the shallow groundwater flow direction is to the north-northeast at the Wolcott Street site.

Groundwater collected from monitoring well MW-05 was analyzed for volatile organics and semi-volatile organics. The results indicate the absence of volatile and semi-volatile organics at this location and the presence of extractable petroleum hydrocarbons in the diesel range at 512 µg/L. The field measurement for groundwater pH was 6.95. During a subsequent monitoring event 0.59 inches of light non-aqueous phase liquid (LNAPL) were measured at monitoring well MW-05. Based on the pH data it does not appear that groundwater at monitor well MW-05 has been affected by the Wolcott Street acidic hydrocarbon waste. The hydrocarbons at monitoring well MW-05 may be from other areas of the former Lobell Refinery or some other unknown source.

3.3 Data Gaps

There are gaps in the subsurface data. The net effect of the gaps is to introduce uncertainty into the remedial process determination and the associated costs for the reviewed options. The gaps include the following:

- The horizontal and vertical extent of the acidic hydrocarbon waste has not been completely defined. The migration of the acidic hydrocarbon waste appears to be in somewhat of a “spider web” pattern. A single source area has not been discovered based on the work

performed to date. Based on the soil borings installed to date and the location of the surface seeps the horizontal extent appears to extend throughout Wolcott Street from just south of the former railroad tracks to near the intersection of East Collins Street. Due to the "spider web" nature of the migration there is a potential for the hydrocarbon acidic waste to extend beyond these limits. The deepest observed extent of the waste is about 4 feet bgs. Additional investigative procedures to better define the waste occurrence would require closely spaced soil borings over the entire Wolcott Street area. Even with this information available there would remain some level of uncertainty with the volume of waste requiring remediation.

- The source area, if still present, of the hydrocarbon acidic waste has not been located.
- There is limited groundwater data from the Wolcott Street area. Existing data from a single monitor well, MW-05, indicates that the pH of the groundwater at this location is neutral. This suggests that the overlying acidic hydrocarbon waste is not responsible for the observed impacts to groundwater.

4.0 CLEANUP GOALS

The remedial goal for this site is to prevent the occurrence of seeps and the migration of hazardous constituents. Achieving these goals will eliminate the primary exposure pathway (dermal contact) and preclude other potential exposure pathways from becoming active pathways.

5.0 SOIL REMEDIAL OPTIONS

Tetra Tech considered the following remedial options for this site.

- No Action
- Excavation and Off-Site Disposal
- Excavation, pH Neutralization and Off-Site Disposal
- Excavation with On-Site Stabilization and On-Site Disposal
- Thermal Desorption
- Recycling with Incorporation into Asphalt Mix

The last two alternatives listed above, although feasible alternatives were excluded for inclusion herein. Thermal desorption was deemed cost prohibitive and the lack of area asphalt batch plants willing to accept the material for recycling eliminated these alternatives from the list of final alternatives. For each of the remaining options, the following sections provide a discussion of the method, its estimated cost, approximate timeframe and impact to the site. A summary of the discussion of all the soil remedial options is presented in Section 6. Figure 3 shows the potential remedial area for the Wolcott Street site.

Each of the active remedies below involves soil excavation and disposal. It must be emphasized that the cost estimate presented for each of these remedies is based on using only the observed to date lateral extent and depth of soil contamination to estimate the volume of contaminated soil requiring remediation. The actual volume of acidic hydrocarbon waste is not well defined and could be larger than the volume estimate on which the cost estimate is based. The cost of remediating the soil by excavation could increase above the tabulated estimate if the actual volume of contaminated soil is greater than the estimated volume. The remediation cost would increase in approximate proportion to the increase in volume of contaminated soil. Additionally, costs could increase due to complications from the presence of the natural gas main and fiber optic/communication utilities. The

estimated costs presented for each alternative are based on average contractor costs for this geographical region. The costs are not based on solicited bids and thus are subject to change based on actual project bidding.

5.1 Option 1– No Action

Under this option no remedial action would be implemented. The acidic hydrocarbon waste would remain in-place as currently exists. Under this scenario the surface seeps would be expected to continue and the exposure pathway for dermal contact at ground surface would remain. Asphalt repairs would be required, likely on an on-going basis similar to what has been experienced to date.

Since no remedial action would be implemented the cost to the WDEQ would be minimal. The City of Casper would experience costs for on-going asphalt repairs and utility owners may experience costs associated with utility repairs/replacement due to the acidic soils.

Advantages

- Little to no cost

Disadvantages

- Surface exposure pathway remains
- Degradation threat to subsurface utilities, including natural gas main
- On-going street repairs

5.2 Option 2– Excavation and Off-Site Disposal

Process

The existing street surface (asphaltic concrete and underlying concrete) would be removed and disposed as rubble or recycled. Excavation as proposed for the site would involve removal of soils with visible petroleum hydrocarbons and soil exhibiting low pH values. Soils not exhibiting low pH or visible petroleum hydrocarbons would remain in-place or be segregated on-site for subsequent backfill material. The soil would be excavated down to the extent of visible petroleum hydrocarbons (approximately 4 feet) under consultant oversight. The estimated volume is approximately 1,000 cubic yards. The excavated soil would be transported off-site and disposed at a Subtitle C disposal facility. Due to the low pH of the material, area and regional Subtitle D landfills have indicated they would not accept the material. Clean fill material would be placed in the excavation along with any clean, segregated material and compacted. During excavation the utility owners would be required to have representatives on-site for the safeguarding of their utilities. We are assuming the City of Casper would be responsible for the surface restoration of the street and any sidewalks (asphaltic concrete and concrete paving).

Recommended Additional Work

The only additional work required for this option would be the collection and laboratory analysis of waste material to facilitate off-site disposal. Due to the migration nature of the acidic hydrocarbon waste, additional soil borings to define the extent may be of limited value and thus are not proposed.

Effectiveness

This option would be expected to achieve a high rate of success since the affected soil would be removed from the site.

Potential Impacts to Planned Site Use
Excavation of the affected soils will allow continued use as a street and utility corridor.

Total Cleanup Time
Cleanup will be completed when sufficient contaminated soils have been removed. Cleanup rate will be limited by the rate of soil excavation and transportation off-site. The major remedial activities, soil excavation and backfilling, should be completed in approximately 7 days. The total project length from planning to final reporting would be about 4 months.

Implementation Schedule – Excavation and Off-Site Disposal

Task	Days to Completion	Days Since Project Start
Project Planning	45	45
Soil Sampling/Analyses	45	90
On-site Remedial Work	7	97
Remedial Report	30	127
	Project Length	**127 days**

Cost
The estimated cost for the work is provided in the table below:

Estimated Cost – Excavation and Off-Site Disposal

Task	Quantity	Unit Cost	Cost
Project Management	1	$9,500	$9,500
Additional Soil Analyses	3	$1,750	$5,250
Remedial Design/Plans	1	$7,500	$7,500
Construction Specs/Bidding	1	$7,500	$7,500
Excavation	1,200* cubic yards	$38/cubic yard	$45,600
Transportation & Disposal	1,000 cubic yards	$685/cubic yard	$685,000
Soil Backfill	1,000 cubic yards	$15/cubic yard	$15,000
Placement/Compaction	1,000 cubic yards	$17/cubic yard	$17,000
Construction Oversight	1	$18,000	$18,000
Confirmation Sampling	1	$9,500	$9,500
Remedial Report	1	$7,000	$7,000
		Total Estimated Cost	**$826,850**

* Includes pavement
Unit costs listed in this table include all anticipated costs such as labor, equipment, mobilization and travel costs. Surface restoration (paving) is not included.

Advantages
- Quick
- Effectively eliminate surface seeps and exposure pathways for use as a street

Disadvantages
- Highest Cost
- Cost uncertain; potentially more costly than estimate, due to uncertainty regarding contaminated soil volume.
- Potential delays associated with presence of natural gas main and fiber optic/communications cables may increase project costs.
- May not be able to reach all contamination if it extends under buildings or structures.

5.3 Option 3 – Excavation, On-Site pH Neutralization and Off-Site Disposal

Process

The existing street surface (asphaltic concrete and underlying concrete) would be removed and disposed as rubble or recycled. Excavation as proposed for the site would involve removal of soils with visible petroleum hydrocarbons and soil exhibiting low pH values. Soils not exhibiting low pH or visible petroleum hydrocarbons would remain in-place or be segregated on-site for subsequent backfill material. The soil would be excavated down to the extent of visible petroleum hydrocarbons (approximately 4 feet) under consultant oversight. The excavated soil would be treated on-site with a pH neutralizing compound (such as calcium oxide or fly ash) utilizing a Pug Mill or similar device for mixing. The treated soil would then be transported off-site and disposed as petroleum contaminated soil. Prior to implementing this option bench scale testing of pH neutralization and subsequent TCLP metals analyses would be required to facilitate disposal at a Subtitle D facility. Clean fill material would be placed in the excavation along with any clean, segregated material and compacted. During excavation the utility owners would be required to have representatives on-site for the safeguarding of their utilities. We are assuming the City of Casper would be responsible for the surface restoration of the street and any sidewalks (asphaltic concrete and concrete paving).

Recommended Additional Work

The only additional work required for this option would be the collection of waste material, bench scale pH neutralization testing, and subsequent laboratory analysis of waste material to facilitate off-site disposal. Due to the migration nature of the acidic hydrocarbon waste, additional soil borings to define the extent may be of limited value and thus are not proposed.

Effectiveness

This option would be expected to achieve a high rate of success since the affected soil would be removed from the site.

Potential Impacts to Planned Site Use

Excavation of the affected soils will allow continued use as a street and utility corridor.

Total Cleanup Time

Cleanup will be completed when sufficient contaminated soils have been removed. Cleanup rate will be limited by the rate of soil excavation, pH neutralization and subsequent off-site transport. The major remedial activities, soil excavation and backfilling, should be completed in approximately 15 days. The total project length from planning to final reporting would be about 5 months.

Implementation Schedule – Excavation, On-Site pH Neutralization and Off-Site Disposal

Task	Days to Completion	Days Since Project Start
Project Planning	60	60
Bench Scale Testing	45	105
Excavation and Disposal	20	125
Remedial Report	30	155
	Project Length	**155**

Cost
The estimated cost for the work is provided in the table below:

Estimated Cost – Excavation, On-Site pH Neutralization and Off-Site Disposal

Task	Quantity	Unit Cost	Cost
Project Management	1	$9,500	$9,500
Bench Scale Treatment Testing	1	$17,000	$17,000
Remedial Design/Plans	1	$9,500	$9,500
Construction Specs/Bidding	1	$7,500	$7,500
Mobilization	1	$75,000	$75,000
Excavation & pH Neutralization	1,000* cubic yards	$230/cubic yard	$230,000
Transportation & Disposal	1,000 cubic yards	$75/cubic yard	$75,000
Soil Backfill	1,000 cubic yards	$15/cubic yard	$15,000
Placement/Compaction	1,000 cubic yards	$17/cubic yard	$17,000
Construction Oversight	1	$25,000	$25,000
Confirmation Sampling	1	$9,500	$9,500
Remedial Report	1	$7,000	$7,000
Total Estimated Cost			**$497,000**

Unit costs listed in this table include all anticipated costs such as labor, equipment, mobilization and travel costs. Surface restoration (paving) is not included.

Advantages
- Quick
- Effectively eliminate surface seeps and exposure pathways for use as a street

Disadvantages
- Cost uncertain; potentially more costly than estimate, due to uncertainty regarding contaminated soil volume.
- Potential delays associated with presence of natural gas main and fiber optic/communications cables may increase project costs.
- May not be able to reach all contamination if it extends under buildings or structures.
- Dependant on acceptance of waste by landfill.

5.3 Option 4 – Excavation, On-Site Stabilization and On-Site Disposal

Process
The existing street surface (asphaltic concrete and underlying concrete) would be removed and disposed as rubble or recycled. Excavation as proposed for the site would involve removal of soils with visible petroleum hydrocarbons and soil exhibiting low pH values. Soils not exhibiting low pH or visible petroleum hydrocarbons would remain in-place or be segregated on-site for subsequent backfill material. The soil would be excavated down to the extent of visible petroleum hydrocarbons (approximately 4 feet) under consultant oversight. The excavated soil would be treated on-site with a pH neutralizing compound and other compounds to bind the petroleum hydrocarbons so the hydrocarbons are not leachable or mobile. This method is used to treat oil pits in the railroad and oil production industries. Prior to implementing this option bench scale testing would be required to verify the applicability and the required compounds to achieve stabilization. The treated soil would then be placed back in the excavation and compacted in-place. During excavation the utility owners would be required to have representatives on-site for the safeguarding of their utilities. We are assuming the City of Casper would be responsible for the surface restoration of the street and any sidewalks (asphaltic concrete and concrete paving).

Recommended Additional Work
The only additional work required for this option would be the collection, bench scale testing and subsequent laboratory analysis of treated material to verify stabilization and soil suitability for a municipal street. Due to the migration nature of the acidic hydrocarbon waste, additional soil borings to define the extent may be of limited value and thus are not proposed.

Effectiveness
The key to this option will be the effectiveness and completeness of the stabilization process.

Potential Impacts to Planned Site Use
The site would be suitable for continued use as a city street.

Total Cleanup Time
Cleanup time is estimated to be approximately 5 months from project start to finish.

Implementation Schedule – Excavation, On-Site pH Neutralization and On-Site Disposal

Task	Days to Completion	Days Since Project Start
Project planning	60	60
Bench Scale Testing	45	105
Excavation & Treatment	20	125
Remedial Report	30	155
	Project Length	**155 days**

Cost
The estimated cost for the work is provided in the table below:

Estimated Cost – Excavation, On-Site Stabilization and On-Site Disposal

Task	Quantity	Unit Cost	Cost
Project Management	1	$9,500	$9,500
Bench Scale Treatment Testing	1	$17,000	$17,000
Remedial Design/Plans	1	$7,500	$7,500
Construction Specs/Bidding	1	$7,500	$7,500
Mobilization	1	$30,000	$30,000
Pavement Removal/Disposal	1	$27,000	$27,000
Excavation & Treatment*	1,000 cubic yards	$155/cubic yard	$155,000
Backfill & Compaction	1,000 cubic yards	$17/cubic yard	$17,000
Construction Oversight	1	$25,000	$25,000
Confirmation Sampling	1	$14,000	$14,000
Remedial Report	1	$8,000	$8,000
Total Estimated Cost			**$317,500**

* Assumes treatment staging area at the site
Unit costs listed in this table include all anticipated ancillary costs such as oversight, related equipment and materials, mobilization and travel costs, etc.

Advantages
- Quick
- Effectively eliminate surface seeps and exposure pathways for use as a street
- Least expensive remedial alternative

Disadvantages
- Long-term structural stability of treated soil is not certain
- May require over excavation to account for volume increase of treated soil

- Hydrocarbons above standard are not removed and remain in-place (stabilized to preclude leaching)

6.0 CONCLUSIONS

Tetra Tech has examined a variety of feasible remedial options for soil at the Wolcott Street Seep site. The very low pH of the hydrocarbon waste limits the remedial options for the site and the high viscosity of the waste limits the treatment methods. The three active remedial alternatives presented herein are each based on excavation of the material. The variables between the alternatives are the treatment methods for pH and the disposal method.

Other potential alternatives that were investigated for this analysis included excavation and recycling of the material in asphalt mix and thermal desorption with pH treatment. The asphalt mix recycle alternative is a feasible method; however, discussions with area asphalt batch plants did not produce facilities willing to participate. Thermal desorption is a proven alternative however, for this site the technology was viewed to be cost prohibitive.

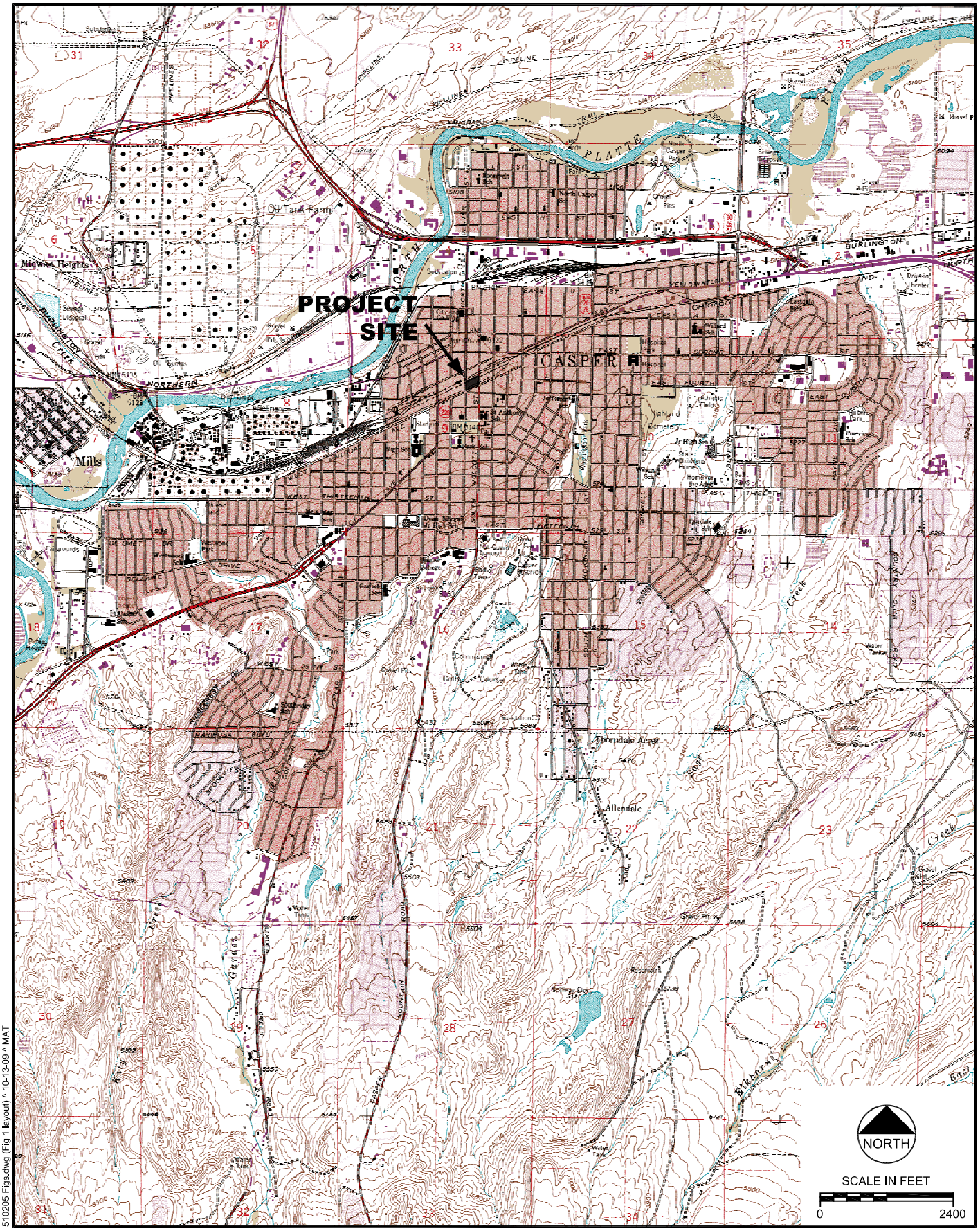
The options discussed herein are summarized in the table below.

Remedial Options Summary

Option	Estimated Cost	Cleanup Time Frame	Advantages	Disadvantages
Soil Remedial Options				
Excavation and Off-Site Disposal	$826,850	132 days	• Quick • Complete cleanup of soils above standards	• Highest cost
Excavation, On-site pH Neutralization and Off-Site Disposal	$497,000	150 days	• Relatively Quick • Complete cleanup of soils above standards	• Bench scale testing required to confirm applicability and effectiveness • Dependant on acceptance of waste by landfill
Excavation, On-Site Stabilization and On-Site Disposal	$317,500	155 days	• Relatively Quick • Lowest remedial cost	• Bench scale testing required to confirm applicability and effectiveness • Waste is replaced into excavation
No Action	Low	0 days	• Low cost	• Hydrocarbon acidic waste remains in-place and untreated • Exposure pathways remain • On-going repairs • Utilities at risk

Each of the active remedies discussed above hold a cost uncertainty since the volume of waste material is not well defined and could be substantially larger than the volume estimate on which the cost estimate is based. The cost of each of these remedies could increase above the tabulated estimate if the actual volume of contaminated soil is greater than the estimated volume. The remediation cost would increase in approximate proportion to the increase in volume of contaminated soil.

FIGURES



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October 2009

Figure 1
SITE VICINITY MAP
WDEQ VPR - Site Characterization - Former Lobell Refinery -Casper, Wyoming

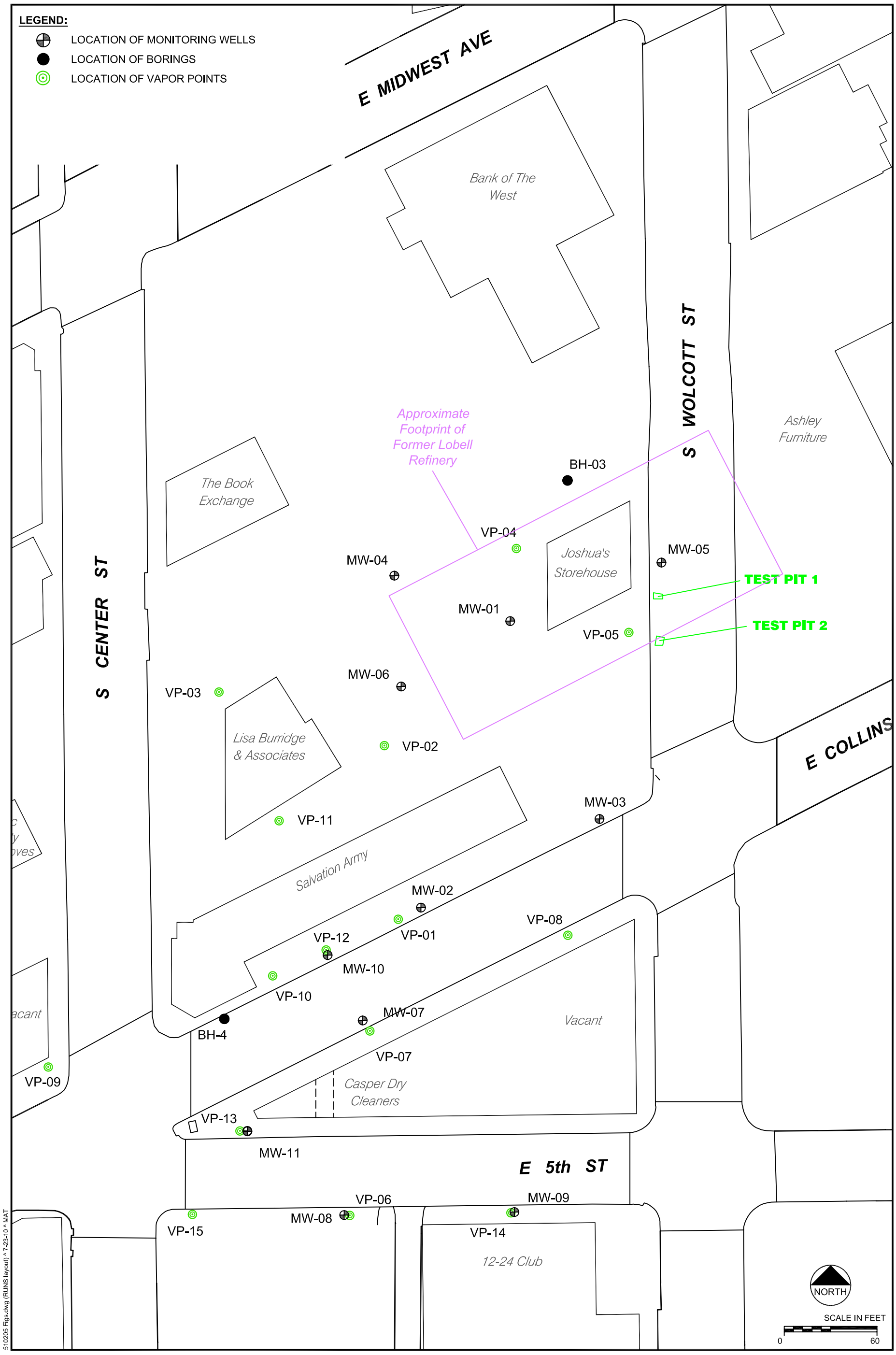

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Figure 2
SITE LAYOUT
WDEQ VRP - Site Characterization - Former Lobell Refinery - Casper, Wyoming

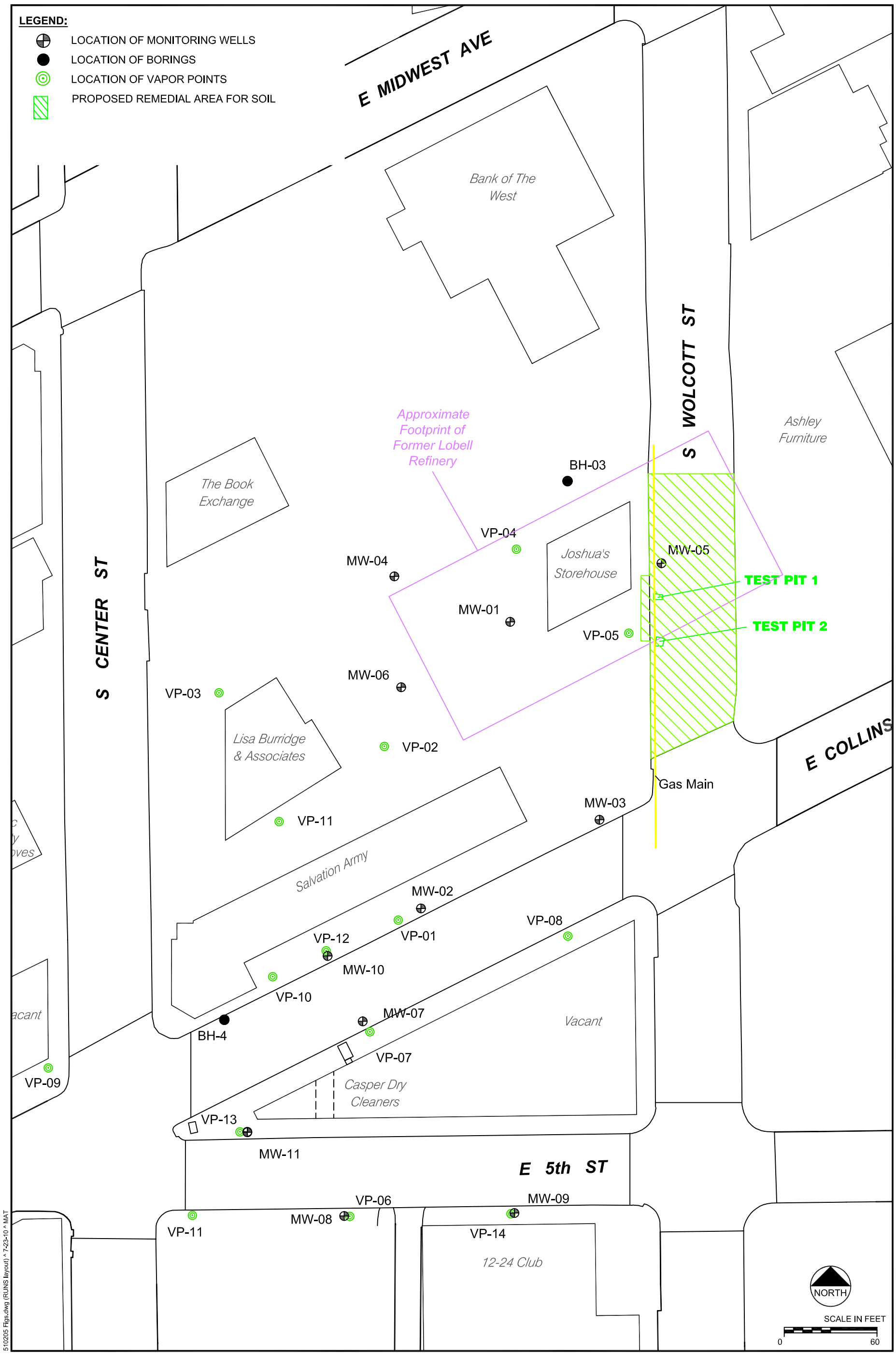

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Figure 3
SOUTH WOLCOTT STREET PROPOSED REMEDIAL AREA
WDEQ VRP - Site Characterization - Former Lobell Refinery - Casper, Wyoming