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November 3, 2021

Savannah Richards
New Mexico Environment Department
Ground Water Quality Bureau
Voluntary Remediation & Brownfields Program
1190 St. Frances Drive
Santa Fe, New Mexico 87502

Dear Ms. Richards:

EA Engineering, Science, and Technology, Inc., PBC is submitting the Analysis of Brownfields Cleanup Alternatives report for the Former Aerex Refinery East and West Parcels located at the intersection of West Blanco boulevard and North 5th Street, Bloomfield, New Mexico. The report was completed in accordance with contract #20-667-2030-0008, Request for Cost Proposal (RFP) dated December 18, 2020, and the *Technical and Cost Proposal for Phase II Environmental Site Assessment (ESA), Revision 02* dated March 11, 2021.

Please let me know if you have any questions regarding the information provided in this report.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. Werth', written over a horizontal line.

David L Werth
Project Manager

A handwritten signature in black ink, appearing to read 'Teri McMillan', written in a cursive style.

Teri McMillan
Program Manager

Enclosure

Cc: Jason Thomas, City of Bloomfield
File



**ANALYSIS OF BROWNFIELDS CLEANUP
ALTERNATIVES
FORMER AEREX REFINERY
EAST AND WEST PARCELS
W. BLANCO BLVD. & N. 5TH ST.
BLOOMFILED, NEW MEXICO
QTRAK 21-246**

Prepared by:

EA Engineering, Science,
and Technology, Inc., PBC
320 Gold Avenue SW, Suite 1300
Albuquerque, New Mexico 87102

October 2021

EA Project No. 1607101



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1.0 INTRODUCTION AND BACKGROUND

1.1 Site Location

The Former Aerex Refinery East and West Parcels located at the intersection of West Blanco Boulevard and North 5th Street, Bloomfield, New Mexico.

1.2 Previous Site Use and Any Previous Cleanup/Remediation

The properties were historically part of the former Aerex Refinery, which operated from approximately 1932 to the 1960s and was dismantled in the late 1980s. Crude oil was refined from wells located in the Bloomfield area using fractional distillation to produce gasoline, kerosene, and other petroleum products. The following summarizes the background of each parcel:

West Parcel

The property is approximately 6.63 acres in size and is currently vacant, except for two concrete foundations, concrete debris, and two plugged oil wells (Figure 1). Three monitoring wells are present on the property associated with the Bloomfield Crude Station New Mexico Oil Conservation Division (OCD) release site. Well MW-7 periodically has non-aqueous phase liquid present. The Bloomfield Crude Station site is located adjacently north and east of the West Parcel. A Phase I Environmental Site Assessment was completed in 2019, which concluded that it was unknown whether subsurface features associated with the former refinery remain in place and that based on the previous site assessments on the East Parcel, which indicated petroleum contamination was present, that the West Parcel may be impacted as well.

East Parcel

The East Parcel is approximately 4.0 acres and includes no structures (Figure 1) but does contain concrete foundations and debris. This parcel was assessed in 1998 and 1990 by the New Mexico Environment Improvement Department. A soil vapor survey and three monitoring wells were installed. Soil with hydrocarbon staining were observed in boring MW-2 and heavy crude oil-stained soils, sheen and odor were observed in MW-3. Depth to water ranged from 6.17 to 6.34 feet (ft) below ground surface (bgs) in 1990. Soil and groundwater have been impacted with petroleum products based on previous site assessments.

In 1994, EPA completed a Site Inspection Prioritization at the East Parcel. It was concluded that since an oil refinery operated at the site, the onsite source of contamination and associated waste were excluded from the Comprehensive Environmental Response, Compensation, and Liability Act. The site was referred to the OCD.

In 2006, Kleinfelder completed a subsurface assessment of the East Parcel for the OCD (Kleinfelder 2006). Sixty-nine (69) direct push borings were advanced on the East Parcel within a grid pattern. Soil samples were collected continuously to depths ranging from 12 to 20 ft bgs to vertically delineate soil contamination. Soil samples were field screened and based on field

screening results, 20 soil samples were submitted for laboratory analysis for benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (TPH) full range. Three soil samples were analyzed for metals. MW-3 could not be located, and a new well MW-3K was installed within the same area. All three wells were sampled for volatile organic compounds and metals. LNAPL was present in MW-3K and in boring K-4. Only one well had concentrations above the New Mexico Water Quality Control Commission (NMWQCC) standard; well MW-3K had a total naphthalenes concentration of 180 micrograms per liter ($\mu\text{g/L}$) and magnesium at 9.8 milligrams per liter (mg/L).

The Kleinfelder subsurface assessment determined soil beneath the site consists of predominantly silty sands and clayey sands with clay layers. Soil contamination on the East Parcel was limited to four areas per the Kleinfelder report. However, following New Mexico Environment Department (NMED) Risk Assessment Guidance for Investigation and Remediation, soil concentrations were compared to NMED soil screening levels (SSLs). Based on this comparison, TPH concentrations for gasoline range organic (GRO) and diesel range organic (DRO) exceed residential SSLs in several borings. Soil analytical results indicated that BTEX and metals were below residential SSLs.

Phase II ESA

From May through October 2021, EA Engineering, Science, and Technology, Inc., PBC conducted Phase II ESA activities on both the East and West Parcels (EA 2021). The Phase II ESA included a ground penetrating radar (GPR) survey, passive soil gas (PSG) assessment and trenching on the West Parcel. On both the East and the West Parcel stockpile soil sampling, soil borings installation and associates soil sampling, groundwater sampling, and active soil gas (ASG) sampling were conducted.

1.3 Phase II ESA Findings

Findings from the Phase II ESA conducted in 2021 for each parcel are as follows:

General results:

- Soil encountered in the subsurface on the West and East Parcels was predominantly silty sand, clay, and poorly graded sand. Some clayey sand was also encountered. This would be classified as a Type B soil.
- No stockpile soil samples collected from either the East or West Parcels exceeded NMED SSLs.
- The GPR survey conducted on May 7, 2021, indicated the existence of several unknown underground anomalies. Upon trenching and potholing in the vicinity of the anomalies, no underground storage tanks or other intact structures were present. Only pieces of metal were observed.
- The PSG survey resulted in detections of toluene, ethylbenzene, isopropylbenzene, trimethylbenzenes, xylenes, and TPH in the soil gas of the West Parcel. Based on these results borings were installed and soil gas, soil and grab groundwater samples were collected.

West parcel soil and groundwater results:

- No soil samples collected from soil borings installed in the West Parcel exceeded the residential or construction worker pathway NMED SSLs (Figure 1). Sample WSB05-24.0 (24-foot interval) exceeded the dilution attenuation factor (DAF) 20 SSL for 1,1,2-trichloroethane with a concentration of 4.05 mg/kg. Groundwater was observed in WSB05 at approximately 26 feet below ground surface. However, 1,1,2-trichloroethane was not observed any groundwater samples collected in the west parcel.
- No ASG samples collected from the West Parcel exceeded any of the New Mexico VISLs.
- No groundwater samples collected from the monitoring wells or soil borings installed in the West Parcel exceeded the NMWQCC standards with respect to VOCs. However, NAPL has been observed periodically in well MW-7 (Figure 1). It appears, based on trenching and soil boring installation, that the NAPL associated with well MW-7 is a result of the release at the Bloomfield Crude Station.
- No groundwater samples collected from the monitoring wells or soil borings installed in the West Parcel exceeded the NMWQCC standards with respect to PAHs.
- Dissolved metals were present in all three monitoring wells sampled (MW-5, MW-6, and MW-7). Well MW-5 exceeded the NMWQCC standard with respect to manganese (9,200 µg/L). Well MW-6 exceeded NMWQCC standards with respect to arsenic (38 µg/L), iron (8,300 µg/L), and manganese (14,000 µg/L). Well MW-7 exceeded NMWQCC standards with respect to iron (1,100 µg/L) and manganese (3,600 µg/L). These metals are a result of reducing conditions associated with the petroleum hydrocarbons present which are attributed to the Bloomfield Crude Station release.

East parcel soil, soil gas, and groundwater results:

- No soil samples collected from soil borings installed in the East Parcel exceeded the NMED SSLs except for sample ESB01-8.0 (8-foot interval) which exceeded the Residential and Industrial SSLs for DRO and MRO with concentrations of 11,000 mg/kg and 6,170 milligrams per kilogram (mg/kg), respectively (Figure 1).
- No ASG samples collected from the East Parcel exceeded any of the New Mexico vapor intrusion screening levels (VISLs).
- Well MW-3K contained NAPL at the time of the assessment activities.
- Groundwater is present at approximately 12 feet below ground surface.
- No groundwater samples collected from the monitoring wells or soil borings installed in the East Parcel exceeded the NMWQCC standards with respect to VOCs except for benzene in sample ESB01 at a concentration of 12 µg/L (Figure 1).
- Groundwater sample ESB01 exceeded the NMWQCC standard for total naphthalenes with a combined concentration of 161.6 µg/L. No other groundwater samples collected from the monitoring well or soil borings installed in the East Parcel exceeded the NMWQCC standards with respect to PAHs.

- Monitoring wells were sampled for dissolved metals. Only manganese exceeded the NMWQCC standard in the wells sampled (MW-1 and MW-3K) with concentrations of 1,700 µg/L and 1,200 µg/L, respectively. These metals are attributable to reducing conditions associated with the petroleum hydrocarbons present.

Summary of Findings:

Based on the findings, the residential and construction/industrial worker pathways for the West Parcel are incomplete. The soil leaching to groundwater pathway is potentially complete in one boring; however, the analyte is not present in any groundwater sample collected. Since any release(s) is considered old, the soil leaching to groundwater pathway is considered incomplete based on direct observation. Contamination present in groundwater is a result of a release from the Bloomfield Crude Station site and is considered trespasser contamination. Further assessment or cleanup of the West Parcel is not required.

The East Parcel residential and construction/industrial worker pathways are complete. Groundwater has been impacted by the release of petroleum. Accordingly, cleanup alternatives will be evaluated for the East Parcel.

1.4 Project Goal

Currently, these parcels are vacant, and the project goal is to reuse the East and West Parcels of the site as a recreational area to include green space with mixed use recreational space. Cleanup objectives are to clear potential exposure pathways for construction workers and ultimately the general public. Future uses may include bike parking, walking/running trails, splash pad, landscaped areas, and playground. The transformation of these parcels into a recreational area would enhance this area of town and provide an outside space for residents and visitors to enjoy.

2.0 APPLICABLE REGULATIONS AND CLEANUP STANDARDS

2.1 Cleanup Oversight Responsibility

The City of Bloomfield is working closely with NMED and its environmental contractor (EA) to evaluate cleanup alternatives to achieve site conditions conducive of reaching project goals outlined in Section 1.4 above. NMED is the regulatory body overseeing the cleanup, and EA is readily able to provide personnel with professional licenses in fields including engineering and geology.

2.2 Cleanup Standards for Majority Contaminants

Cleanup standards for soil are documented in the NMED Risk Assessment Guidance for Site Investigations and Remediation and include SSLs for residential, industrial/occupational, and construction worker exposure pathways, soil leaching to groundwater pathway, and groundwater pathways.

Cleanup standards for groundwater are promulgated in New Mexico Administrative Code 20.6.2.3103, Standards for Ground Water of 10,000 mg/L TDS or less, developed by the New

Mexico Water Quality Control Commission (NMWQCC).

2.3 Laws and Regulations Applicable to Cleanup

Various federal, state, and local laws and regulations including EPA, NMED, and City are applicable to this project. Worker protection under OSHA will also be appropriate. Specifically, the Brownfields Revitalization and the Federal Davis-Bacon Acts are applicable to this cleanup. In addition, City projects receiving Federal funding, adhere to federal, state, and local laws regarding procurement of contractors, equal opportunity, and the participation of small, woman, and minority-owned businesses.

3.0 EVALUATION OF CLEANUP ALTERNATIVES

3.1 Cleanup Alternatives Considered

Cleanup is not required in the West Parcel. In the East Parcel, to address contamination, three different alternatives were considered. These include Alternative #1: No Action, Alternative #2: Excavate to 10 Feet, Long-Term Groundwater Monitoring, and Institutional Controls, and #3: Excavate to 15 Feet, Long-Term Groundwater Monitoring, and Institutional Controls. Alternative 1 does not reduce risk or toxicity, mobility, or volume of affected media. Alternative 2 eliminates shallow soil pathways but does not consider groundwater. Alternative 3 eliminates shallow soil pathways and provides source removal in and above the aquifer to facilitate aquifer restoration to standards.

3.2 Cost Estimate of Cleanup Alternatives

Tables 1 and 2 summarize the effectiveness, implementability, and cost of each Alternative and are discussed below:

Effectiveness

- Alternative #1—No Action. No action will not be effective in achieving soil SSLs or groundwater standards.
- Alternative #2—Excavate to 10 Feet, Long-Term Groundwater Monitoring, and Institutional Controls (Figure 2). Alternative #2 will be effective at eliminating shallow soil toxicity, mobility, and volume (TMV) and potentially complete/complete pathways. Recreational use will be protective upon completion with minor short-term risk to the public related to construction and over road waste hauling for disposal. However, this alternative allows for residual NAPL to remain in place, sourcing groundwater contamination for a long period of time. Accordingly, thirty years of long-term groundwater monitoring with institutional controls would be included accordingly.
- Alternative #3—Excavate to 15 Feet, Long-Term Groundwater Monitoring, and Institutional Controls (Figure 3). Alternative #3 will be effective at eliminating shallow soil TMV and potentially complete/complete pathways. Source NAPL and smear zone removal with this alternative would be final and permanent. Recreational use will be protective

upon completion with minor risk to the public related to construction and over road waste hauling for disposal. Attenuation of the groundwater plume will follow, and 5 years of long-term groundwater monitoring with institutional controls would be included accordingly. Alternative #3 affords the opportunity for site closure in a reasonable time frame.

Implementability

- Alternative #1—No Action is implementable.
- Alternative #2—Excavate to 10 Feet, Long-Term Groundwater Monitoring, and Institutional Controls is implementable.
- Alternative #3—Excavate to 15 Feet, Long-Term Groundwater Monitoring, and Institutional Controls is implementable.

Cost

- Alternative #1—No Action. There will be no costs under this alternative.
- Alternative #2—Excavate to 10 Feet, Long-Term Groundwater Monitoring, and Institutional Controls. Costs associated for this alternative are estimated to be \$324,502.
- Alternative #3—Excavate to 15 Feet, Long-Term Groundwater Monitoring, and Institutional Controls. Costs associated for this alternative are estimated to be \$393,125.

3.3 Recommended Cleanup Alternative

The recommended cleanup alternative is Alternative #3: Excavate to 15 Feet, Long-Term Groundwater Monitoring, and Institutional Controls. Alternative #3 is the only alternative that may result in site closure in a reasonable timeframe. The nominal added cost to complete source removal relative to Alternative #2 provides value. Removal of residual source materials at the point of release will result in attenuation of the solute plume over time.

Alternative #1: No Action cannot be recommended since it does not address site risks and does not reduce contaminant mass or volume. Alternative #2: Excavate to 10 Feet, Long-Term Groundwater Monitoring, and Institutional Controls would be less expensive; however, Alternative #2 would leave in place residual NAPL, sourcing groundwater contamination for a long period of time. Alternative #2 would require a longer term of groundwater monitoring, making it more difficult to implement than Alternative #3.

TABLES

**TABLE 1. ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES FOR EAST PARCEL
FORMER AEREX REFINERY, BLOOMFIELD, NEW MEXICO**

Clean up Alternative	Effectiveness				Implementability	Recreation Reuse	Cost
	Compliance with Standards	Short Term Effectiveness	Long-Term Effectiveness	Reduction in Toxicity, Mobility, and Volume			
No Action	Will not achieve SSLs or groundwater standards	Not effective	Not effective	No reduction in TMV	This alternative is implementable	No surface soil present so could be reused for recreational purposes. However, construction worker pathway is complete.	\$0.00
Alternative 2 Excavate to 10 feet; 30 years long term monitoring	Will achieve SSLs for shallow soil pathways. Will do little to achieve NMWQCC standards in affected groundwater.	Elimination of shallow soil TMV and potentially complete/complete pathways are final and permanent. Recreational reuse will be protective upon completion. Minor risk to public related construction and over road waste hauling to land farm.	Eliminates shallow soil potentially complete/complete pathways upon completion. Final and permanent. Allows residual NAPL to remain in place sourcing groundwater contamination for a long period of time. 30 years of long-term monitoring is included accordingly.	Eliminates TMV for shallow soil pathways. Allows residual NAPL to remain in smear, sourcing groundwater contamination for a long time.	This alternative is implementable.	Eliminates construction worker pathway and can be used for recreation purposes including installation of subsurface structures such as irrigation system and restroom and pavilion utilities and foundations.	\$324,502.00
Alternative 3 Excavate to 15 Feet 5 years long-term monitoring	Will achieve SSLs for shallow soil pathways. Will remove residual NAPL smear zone and restore source zone groundwater to near NMWQCC standards via emplacement of clean fill.	Elimination of shallow soil TMV and potentially complete/complete pathways are final and permanent. Source removal is final and permanent. Recreational reuse will be protective upon completion. Minor risk to public related construction and over road waste hauling to land farm.	Eliminates shallow soil potentially complete/complete pathways upon completion. Removes residual NAPL and eliminates future sourcing of contaminants to groundwater. Attenuation of solute plume will follow. 5 years of long-term monitoring is included.	Eliminates TMV for shallow soil pathways. Eliminates residual NAPL smear zone and contaminant mass source in source area. Will allow solute plume to attenuate once sourcing is removed.	This alternative is implementable.	Can be used for recreation purposes. Unlimited reuse including installation of subsurface structures such as irrigation system and restroom and pavilion utilities and foundations.	\$393,125.00

**TABLE 2. DETAILED COST ANALYSIS FOR ALTERNATIVES 2 AND 3
FORMER AEREX REFINERY, BLOOMFIELD, NEW MEXICO**

Alternative 2 Excavate to 10 feet - 4,520 CY Bank Excavation 1,482 CY Bank Waste (1,927 CY Swelled)					
	Rate	Units	Number	Extended	Notes
			Units	Price	
Equipment mobilization demobilization	\$ 5,000	LS	1	\$ 5,000	
Fencing, Barricades, Traffic Plans	\$ 5,000	LS	1	\$ 5,000	
Hydraulic Excavator, Operator and Fuel	\$ 200	Hour	72	\$ 14,400	500 CY per 8 hour day production rate
Loader, Operator, Fuel	\$ 120	Hour	72	\$ 8,640	Segrate waste, dress site, load trucks
Tipping fee at Land Farm	\$ 20	CY	1927	\$ 38,540	1,482 CY Waste Bank x 1.3 Swell
Twenty yard dump trucks, operator, fuel	\$ 120	Hour	193	\$ 23,160	Three hours roundtrip per 20 CY load and haul
Backfill and Compact, Loader, Operator, Fuel	\$ 120	Hour	72	\$ 8,640	500 CY per 8 hour day production rate
Confirmation sampling	\$ 120	Sample	12	\$ 1,440	Three samples per side wall
Sampling and Analysis per 100 CY	\$ 180	Sample	20	\$ 3,600	
Install monitoring wells	\$ 4,000	Each	3	\$ 12,000	Includes oversight, sampling and reporting
Repair monitoring well (MW-2)	\$ 1,000	Each	1	\$ 1,000	
Institutional Controls	\$ 3,500	LS	1	\$ 3,500	
Long-Term Monitoring (30-years)	\$ 78,402	LS	1	\$ 78,402	30-years LTM at present worth
			Construction Subtotal	\$ 203,322	
Plans and Coordination @ 10% Construction				\$ 20,332	
Construction Management and Oversight @ 15%				\$ 30,498	
Completion Report @ 8%				\$ 16,266	
				\$ 270,418	
			Contingency @ 20%	\$ 54,084	
				\$ 324,502	

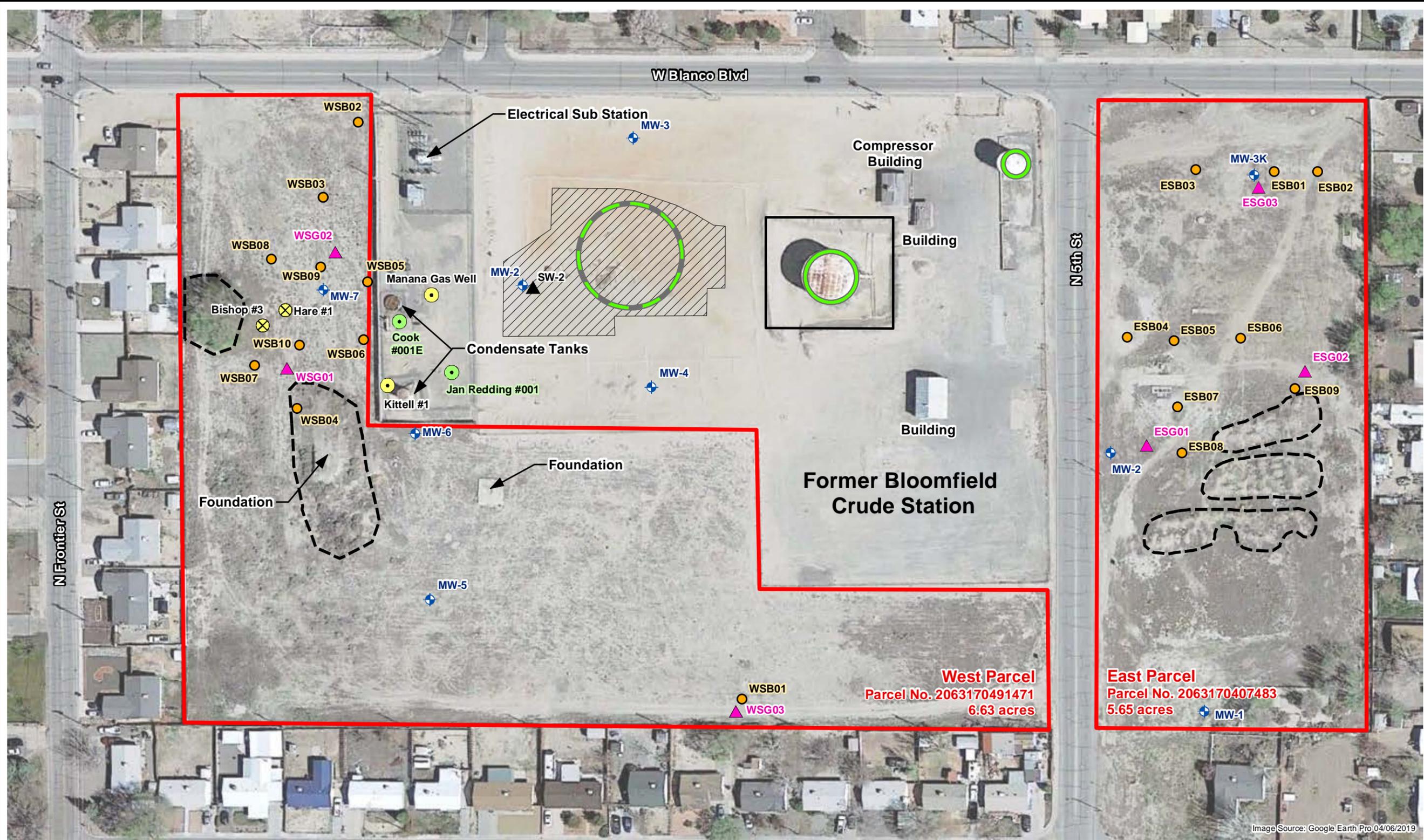
**TABLE 2. DETAILED COST ANALYSIS FOR ALTERNATIVES 2 AND 3
FORMER AEREX REFINERY, BLOOMFIELD, NEW MEXICO**

Alternative 3 Excavate to 15 Feet - 7,500 CY Bank Excavation 3,333 CY Bank Waste (4,333 CY Swelled)					
	Rate	Units	Number	Extended	Notes
			Units	Price	
Equipment mobilization demobilization	\$ 5,000	LS	1	\$ 5,000	
Fencing, Barricades, Traffic Plans	\$ 5,000	LS	1	\$ 5,000	
Hydraulic Excavator, Operator and Fuel	\$ 200	Hour	120	\$ 24,000	500 CY per 8 hour day production rate
Loader, Operator, Fuel	\$ 120	Hour	120	\$ 14,400	Segrate waste, dress site, load trucks
Tipping fee at Land Farm	\$ 20	CY	4,333	\$ 86,660	3,333 CY Waste Bank x 1.3 Swell
Twenty yard dump trucks, operator, fuel	\$ 120	Hour	434	\$ 52,080	Two hours roundtrip per 20 CY load and haul
Backfill and Compact, Loader, Operator, Fuel	\$ 120	Hour	120	\$ 14,400	500 CY per 8 hour day production rate
Confirmation samples	\$ 120	Sample	17	\$ 2,040	3 Samples per sidewall; one sample per 2,000 SF
Sampling and Analysis per 100 CY	\$ 180	Sample	44	\$ 7,920	
Install monitoring wells	\$ 4,000	Each	3	\$ 12,000	Includes oversight, sampling and reporting
Repair monitoring well (MW-2)	\$ 1,000	Each	1	\$ 1,000	
Institutional Controls	\$ 3,500	LS	1	\$ 3,500	
Long-Term Monitoring (5 years)	\$ 18,319	LS	1	\$ 18,319	5-years LTM
			Construction Subtotal	\$ 246,319	
Plans and Coordination @ 10% Construction				\$ 24,632	
Construction Management and Oversight @ 15%				\$ 36,948	
Completion Report @ 8%				\$ 19,706	
			Subtotal	\$ 327,604	
			Contingency @ 20%	\$ 65,521	
			Total	\$ 393,125	

**TABLE 2. DETAILED COST ANALYSIS FOR ALTERNATIVES 2 AND 3
FORMER AEREX REFINERY, BLOOMFIELD, NEW MEXICO**

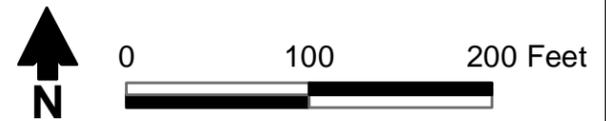
Present Worth Analysis Long-Term Monitoring					
Series Present Worth	$P = A \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$				
Year 0 Monitoring Costs (Semi-Annual)				\$	4,000 (includes reporting)
	A	i	n		
5 Years present worth 3% discount factor	\$ 4,000	0.03	5	\$	18,319
30 Years present worth 3% discount factor	\$ 4,000	0.03	30	\$	78,402
Notes:					
CY = Cubic yard(s)					
LS = Lump sum					
LTM = Long-term monitoring					
yr = Year					
P = Series Present Worth					
A = Yearly monitoring cost					
i = Discount Factor					
n = Number of years					

FIGURES



Explanation

- Monitoring Well
- Active Oil and Gas Well
- Active Soil Gas Sample
- Historic Oil and Gas Well
- Abandoned Oil and Gas Well - Approximate Location
- Sparge Well
- Debris Pile
- Soil Boring
- Above Ground Storage Tank
- Former Above Ground Storage Tank
- Containment Berm
- Former Excavation Area
- Former Aerex Refinery Property Boundary



	Phase II Environmental Site Assessment Bloomfield, San Juan County, New Mexico	Site Layout and Sample Locations Map
DESIGNED BY TM	DRAWN BY GM	PROJECT NO. 1607101.08
CHECKED BY TM		FIGURE 1
SCALE 1:1,200		DATE 10/27/2021



Explanation

-  Proposed New/Replacement Monitoring Well
-  Existing Monitoring Well
-  100'x100' Excavation Top
-  120'x120' Excavation Top
-  130'x130' Excavation Top

Note: Excavations assume OSHA Subpart P Excavations Type B soil with 1:1 side slopes



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TM

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GM

Phase II Environmental Site Assessment
Bloomfield, San Juan County, New Mexico

East Parcel Excavation
Alternatives 2 & 3

PROJECT NO.
1607101.08

FIGURE
2

DATE
10/27/2021

SCALE
1:1,200

CHECKED BY
TM