1R - 246

REPORTS

DATE:

1996

Holland and Associates
4918 King Richards Row
Midland, Texas 79707
915-520-2098

RISK ASSESSED SITE CLOSURE

SNYDER OIL CORPORATION
MALJAMAR NORTH UNIT
LEA COUNTY, NEW MEXICO

March 16, 1996

Copies of 'Snyder Oil Corporation's Risk Assessed Pit Closure' have been sent to the following:

Wayne Price - NMOCD District I Supervisor, Hobbs, N. M.
Roger Anderson - New Mexico Environmental Bureau Chief, Santa Fe, N. M.
Eric Nelson - New Mexico State Land Office, Hobbs, N. M.
John Nussbaumer - Snyder Oil Corporation, Evans, Co.
Sam Simpson - Snyder Oil Corporation, Denver, Co.
Andy Grubb - Snyder Oil Corporation, Ft. Worth, Tx.
Peter Lorenzen - Snyder Oil Corporation, Ft. Worth, Tx.

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1.0 INTRODUCTION

In the process of conducting a site assessment for the plugging and abandonment of three wells and associated tank battery at the North Maljamar Unit, Snyder Oil Corporation discovered an abandoned pit, once used for disposal of oilfield (hydrocarbon) material. Remedial actions were undertaken at the site in December of 1995. This report, herein, discusses the results of the remedial actions that were completed as part of the final closure for release at the site.

1.1 Site Location and Physical Setting

The North Maljamar Unit is situated on property owned by the State of New Mexico and is located approximately 4 miles east of Maljamar, just off and south of Hwy 82. The property location is within the North 1/2 of the Northwest 1/4 of Section 31, Township 16S, Range 33E of Lea County, New Mexico. G.P.S. location is N 32° 52.945', W 103° 42.414'.

Groundwater at and around the site is located at an average depth of 196 feet below ground surface according to information received from Mr. Johnny Hernandez, New Mexico State Engineer. (Reference Attachment I)

The soil survey from the Agriculture Soil Conservation Service indicates the surface soils at the site are classified as Kimbrough and Kimbrough-Lea Series. These soils are defined by the U. S. Department of Agriculture Soil Conservation Service as 'very shallow to shallow, loamy sediment layer over indurated caliche. These soils are about 4 inches to 8 inches thick. (See Appendix A.) Based on the results of a borehole drilled at the site, the site is underlain by a thick cemented sandstone layer from approximately 65 feet to 80 feet deep.

1.2 Background Information

The last production at this site was from the Maljamar North Unit #1 on 5/30/86. According to general knowledge of the location, the pit was dug in the early-1960's. Surface equipment remaining when plugging and clean-up operations commenced consisted of :
3 - 500 bbl welded steel tanks
2 - 30" x 10' separators, (1 out of service)
1 - 4' x 20' heater treater
3 - wellheads and associated flowlines for Maljamar North Unit #1, #2, and #4, respectively.
The site configuration is shown on Figure I. (Site facility map.)

2.0 SITE INVESTIGATION AND REMEDIATION

2.1 Excavation and Source Soils Removal

Remedial actions at the Maljamar site were initiated on 12-19-95. The pit was excavated to a depth of approximately 15 feet and 2,880 yards of contaminated source soils were hauled to CRI, Controlled Recovery, Inc., waste disposal facilities. With source contaminants removed, investigation started for a risk assessed closure plan. A soil sample was obtained by backhoe ten feet below pit bottom. This sample was tested by Cardinal Laboratories in Hobbs, New Mexico. Results indicated a TPH level of 14,134 mg/kg and BTEX levels of:

Benzene - 3.125 mg/kg
Toluene - 8.127 mg/kg
Ethyl Benzene - 5.625 mg/kg
Para-Xylene - 1.607 mg/kg
Meta-Xylene - 3.674 mg/kg
Ortho-Xylene - 2.479 mg/kg
(Reference Appendix B.)

On January 17, 1996, a hollow stem auger drilling rig operated by Atkins Engineering Associates was moved to the site for the purpose of determining the vertical and horizontal extent of the contamination. A field laboratory, operated by Environmental Spill Control was brought in to conduct on-site TPH (418.1) and BTEX (8020) tests, Due to extreme high wind conditions, the BTEX samples could not be run in the field. Split spoon samples were taken at regular intervals. See the boring log, (Attachment II), for soil descriptions. Table 1 summarizes samples and corresponding TPH analysis results. At critical depth, samples were split and taken to Cardinal Labs in Hobbs and Maxim Labs in Midland, Texas for comparison confirmation of data. Copies of all laboratory data, including the final results for determination of vertical extent of contamination, are contained in Appendix B.

The first borehole was drilled in the bottom of the pit to a depth of 89.5 feet below ground surface. Sampling of the soil began at a depth of 20 feet and proceeded at regular intervals until a thick layer of cemented sandstone was encountered at about 65 feet. The drilling rig experienced mechanical problems and operations shut down for repairs. Resumption of operations proved the cemented sandstone to be approximately 15 feet thick and an apparent barrier to migration of the contaminants. Final samples were taken at 84.5 feet and 89.5 feet. Maxim Labs reported TPH and BTEX at levels below detection limits. Cardinal Labs reported TPH at 93 mg/kg and 116 mg/kg with BTEX levels close to detection limits. Cardinal Lab results are not considered as reliable as Maxim Labs since the original report showed the sample type to be water instead of soil, which they corrected, and TPH levels are slightly higher at the greater depth.

TABLE 1
SAMPLING DATA FROM PIT BOREHOLE #1

Depth (ft) from G. L.	TPH (mg/kg) Lab Data	TPH (ppm) Field Lab Data	PID (ppm)	BENZENE	BTEX
5' to 10'	21,700				
14.5'	15,700				
25' (w/ backhoe)	14,134			3.125	24.63
29'		12,085			
35'		11,510	556		
45'		10,750	405		
60'		7,520	242		
65'		4,770	273		
80'		780			
84.5' **	93	45		0.082	BDL
85'		36			
84.5'	**BDL**			**BDL**	**BDL**
89.5' **	116			0.175	BDL

** *Cardinal Labs seems to have quality control problems which may have affected results. On the analysis report, the sample medium had to be corrected from water to soil.*
BDL - Below Detection Limits

It should be noted that the borehole was plugged back through the cemented sandstone with Bentonite to 41 feet from surface.

To determine the horizontal extent of contamination, three additional boreholes were drilled in a triangulated pattern and samples taken to 15 feet, which corresponds to the depth of the pit. Environmental Spill Control ran TPH analysis in their field lab. Results demonstrated TPH levels of 25 ppm or less in all samples. See Figure II for borehole locations.

TABLE 2
SAMPLING DATA FROM CORING AT ALTERNATE SITES

LOCATION	DEPTH (ft) from G.L.	TPH (ppm) Field Lab Data	TPH (mg/kg) Lab Data
Battery / Tank site	surface		5,580
Battery / Tank site	5'	3,910	
Battery / Tank site	10'	184	
Battery / Tank site	15'	28	
South Horizontal Extent / S-7	15'	23	
North East Horizontal Extent / S-8	15'	18	
North West Horizontal Extent / S-9	15'	25	
North Pit Wall - Composite	approx 10'	10,610	
West Pit Wall - Composite	approx 10'	14,460	
East Pit Wall - Composite	approx 10'	14,340	
South Pit Wall - Composite	approx 10'		11,485
Rock from Pit Wall	approx 10'		12,710
Stock Piled Soil - Composite	1' to 15'	2,600	
Stock Piled Soil - Composite	1' to 15'	2,850	

2.2 Sampling Techniques

Samples were obtained using a split spoon sampler. The sampler was decontaminated between sample points using a nonphosphate detergent and distilled water. Each sample was clearly marked with indelible ink. Samples taken to an off-site laboratory were maintained at approximately 40 degrees Fahrenheit and transported to the laboratory utilizing appropriate chain of custody control.

3.0 RISK ANALYSIS

3.1 Site Condition, Status and Land Use

Site Status

The wells associated with the site have been properly plugged and abandoned. Stock tanks and associated equipment have been removed. The following criteria apply to the present site.

A. The release has been abated. The source materials (tank bottoms and heavily contaminated soils) have been removed. Approximately 2,880 yards of contaminated material were hauled to CRI's reclamation and waste disposal facility located 37 miles west of Hobbs, New Mexico.

B. Public health and safety is neither impacted nor threatened. As will be discussed in the exposure assessment section, there are no exposure pathways that the public could come into contact with the remaining hydrocarbons at the site.

C. Contaminants are not discharged to surface waters or ground water. There is no discharge of dissolved-phase contaminants or phase-separated hydrocarbons to surface waters or ground water which was demonstrated to be 196 feet below ground surface.

D. The migration of the contaminant plume has ceased. The removal of the source material, the presence of the underlying layer of cemented sandstone, and the provision of the clay cap will inhibit any infiltration of surface water, thus effectively preventing further vertical plume migration.

3.2 Chemicals of Concern

In the Risk-Based Corrective Action for Leaking Storage Tank Sites developed by the Texas Natural Resource Conservation Commission, (TNRCC document # RG 36) clean-up levels for total petroleum hydrocarbons were not established due to the lack of toxicity values for TPH. Where no indicator compounds, i.e. benzene, as is the case here, do not exceed health-based levels, then the determination of the acceptable level of TPH will be based upon other factors. Those factors as defined by the TNRCC and their applicability to this site are discussed below:

A. No mobile product should be left in the soils. All mobile product and source material was removed from the pit.

B. The hydrocarbons should not generate vapors which exceed 25% of the LEL. With removal of the source and placement of a clay cap, there will be no vapors to the atmosphere.

C. The TPH contaminants should not harm vegetation, especially where the vegetation is a food source to animals. The pit closure will be consist of fifteen feet of clean fill covered by a one and one-half foot to two foot clay cap and one foot of top soil. Vegetation will not be in contact with any remaining impacted soil.

D. TPH should not exceed 0.5 mg/L in impacted water supply wells or water intakes unless it can be demonstrated that the compounds contributing to the TPH concentration have been specifically evaluated with another analytical method. There is no impact on the water supply.

E. The TPH concentration should not create any odor nuisance. Fifteen feet of backfill and a clay cap closure will prevent any odor nuisance.

F. Site monitoring should indicate that TPH values are stable or declining. The source of contamination, 2,880 yards of material in the upper portions of the pit have been removed. TPH levels at depth will naturally attenuate. As sampling results presented in Table 1 indicate, TPH values are decreasing with depth. TPH values less than the detectable limit were found at 84.5 feet from ground surface, suggesting the hydrocarbons have stabilized and declined with depth.

NOTE: BENZENE and BTEX levels as shown by sample results are not in significant quantities to be of a health concern.

3.3 Risk Assessment

Physical Setting

Direct human exposure to any remaining contamination will be virtually impossible. The contaminated source materials were removed to a depth of fifteen feet. Clean fill material will be placed in the pit to replace the impacted soils and clay cap (at 80 PCF) 1 1/2 to 2 feet thick will cover any remaining impacted soils. A one foot thick layer of top soil will be placed over the clay cap and the area revegetated. The area, centered with the backfilled pit, will be mounded to allow drainage away from the former pit location.

Water use in the area is agricultural in nature. The nearest water well in the area is approximately one mile away. The climate in the area is arid, with precipitation of fourteen inches per year average. Depth to ground water is 196 feet below ground surface as documented by the State Engineers Office.

Land use is for grazing. The area adjacent to the affected site is owned by the State of New Mexico and currently leased to Mr. Darr Angell. In all probability, future utilization of the land will continue to be for grazing.

Potentially Exposed Populations

The property is at least three miles from any residence and twenty miles from any municipality of significant size. Ground water in the area is at a depth of 196 feet, which is more than 100 feet below any remaining contaminated soil. There is a fifteen foot, cemented sandstone layer between the remaining impacted soil and the ground water. The top of this cemented sandstone layer is at a depth of 65 feet and provides a barrier to vertical migration.

Exposure Pathway Analysis

In order to have a complete exposure pathway, there must be a contaminant source area, an environmental transport media, an exposure point, and a route of exposure.

Contamination Source. The contamination source soils have been removed. Remaining impacted soils have been segregated from the surface by a clay cap and from the ground water by a cemented sandstone layer. Remaining hydrocarbons will naturally attenuate without impacting ground water or surface water in the area.

Environmental Transport Media. The only transport media is infiltration of surface water which has been eliminated by the clay cap.

Exposure Point Concentration. There will be no exposure point concentration as there will be no possibility of exposure by humans to the remaining impacted soil. The ground water, surface water and air are not affected by the impacted soil.

Toxicity Assessment. This is not necessary as there will be no exposure. Toxicity levels for TPH have not been established and BTEX are not present in sufficient quantities to be of concern.

Risk Characterization. Exposure pathways have been eliminated or shown not to be completed; therefore, risk is considered minimal.

Uncertainty. The assumptions made related to current and future land use were based on the present ownership and use of the land. Should the land use change, which is very unlikely given the remoteness of the location, there would be slight possibility of disturbance of the clay cap due to the building of a structure.

4.0 PROPOSAL

All source material was removed from the pit area to a depth of fifteen feet below ground surface. Approximately 2,880 yards of petroleum impacted soils were removed and hauled to CRI's facility. A soil boring was drilled to a depth of 89.5 feet to determine the vertical extent of contamination. At a depth of 65 feet, a fifteen foot layer of cemented sandstone was encountered. This cemented sandstone acted as a barrier, preventing further vertical contamination. Five feet below the cemented sandstone, a soil sample was collected and the results indicated TPH and BTEX at or below detectable levels. To determine the horizontal extent of contamination, three boreholes were drilled and sampled at a depth of fifteen feet. The TPH concentrations from these samples were 23 ppm, 18 ppm, and 25 ppm as detailed on Table 2 and Figure II.

Based on application of the TNRCC Risk Based Action Plan criteria, Snyder Oil Corporation believes that the overall risk is low. Reasons are as follows:

a) No detectable BTEX or TPH at depth
b) Source material excavated and removed to disposal
c) Installation of clay cap preventing further migration through infiltration of surface water
d) Depth to ground water is 196 feet from surface
e) A cemented sandstone barrier below impacted soils and over 100 feet above ground water
f) Demonstrated natural attenuation of remaining hydrocarbons

Snyder Oil is proposing to scrape the surface to a final areal dimension of approximately 150 feet by 160 feet as defined by the coring for horizontal extent. The soil at the battery location will be mixed and diluted to remediate on site. The pit will be backfilled with clean soil and a two foot thick clay cap will be mounded over the center of the pit, sloping to the outer edges of the identified remedial area to allow drainage away from the affected site. For clay specifications, see Appendix C. One foot of topsoil will be placed over the clay cap and revegetated. Once the above backfill, capping, and revegetation activities are completed, Snyder Oil Corporation considers the site to be effectively remediated in accordance with New Mexico Oil Conservation Division guidelines for risk assessed closure. Reference the attached Pit Remediation and Closure Report, Attachment III.

5.0 CLOSURE

All source material was removed from the pit area to a depth of fifteen feet below ground surface. Approximately 2,880 yards of petroleum impacted soils were removed and hauled to CRI's facility. A soil boring was drilled to a depth of 89.5 feet to determine the vertical extent of contamination. At a depth of 65 feet, a fifteen foot layer of cemented sandstone was encountered. This cemented sandstone acted as a barrier, preventing further vertical contamination. Five feet below the cemented sandstone, a soil sample was collected and the results indicated TPH and BTEX at or below detectable levels. To determine the horizontal extent of contamination, three boreholes were drilled and sampled at a depth of fifteen feet. The TPH concentrations from these samples were 23 ppm, 18 ppm, and 25 ppm as detailed on Table 2 and Figure II. The coring identified an area of containment 148 feet by 157 feet.
Reference Attachment V, NMOCD Remedial Action Plan Approval Letter.

Based on application of the TNRCC Risk Based Action Plan, the following criteria are met:
a) No detectable BTEX or TPH at depth
b) Source material excavated and removed to disposal
c) Installation of clay cap preventing further migration through infiltration of surface water
d) Depth to ground water is 196 feet from surface
e) A cemented sandstone barrier below impacted soils and over 100 feet above ground water
f) Demonstrated natural attenuation of remaining hydrocarbons

The pit area is backfilled with clean soil and a clay cap covered with topsoil placed over the surface to a final areal dimension of 150 feet by 160 feet. The clay cap is two foot thick over the center of the pit, with minimal thickness of eighteen inches at the outer edges of the identified remedial area. Mr. Wayne Price of the New Mexico Oil Conservation Division witnessed and approved the clay cap before the topsoil was overlaid. For clay specifications, see Appendix C.

The topsoil, one foot of dark sandy loam, is mounded over the center of the former pit to allow drainage away from the affected site. The soil at the battery location has been mixed and diluted with clean soil to remediate on site. See Figure III, Pit Closure Diagram.

Mr. Eric Nelson of the New Mexico State Land office has requested revegetation of the area be delayed until May, 1996 so optimal results will be achieved from the reseeding. Per Mr. Nelson's recommendation, a combination of native grasses, Blue Grama, Sand Drop Seed, and Side Oats Grama, will be broadcast in excess of five pounds per acre. In preparation, the former battery and closure area will be "scratched" and watered. Snyder Oil Corporation will revegetate the closure and battery site in early May and considers the site to be effectively remediated in accordance with New Mexico Oil Conservation Division guidelines for risk assessed closure. Reference the attached Pit Remediation and Closure Report, Attachment III.

DATE	WATER LEVEL MS		DATE	WATER LEVEL MS		DATE	WATER LEVEL MS		DATE	WATER LEVEL MS
MAR 30, 1966	209.17	R	SEP 01, 1976	205.29		JUN 16, 1981	212.74			
MAR 31, 1971	212.70	R	APR 07, 1981	212.77		JAN 24, 1986	205.18			

HIGHEST 205.18 JAN 24, 1986
LOWEST 212.77 APR 07, 1981

SITE ID: 325242103414901
LOCATION: 16S.33E.31.23321
OTHER ID: 12663
ELEVATION: 4242.00
USE: U
DEPTH: 256
GEO. UNIT: 1210GLL

WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL MS
MAR 31, 1971	196.66

ATTACHMENT
I
New Mexico State Engineers Office
Water Levels

SITE ID: 325238103405901
LOCATION: 16S.33E.32.14432
OTHER ID: 11074
ELEVATION: 4215.00
USE: H
DEPTH:
GEO. UNIT: 1210GLL

WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL MS
MAR 28, 1961	163.82

SITE ID: 325238103405902
LOCATION: 16S.33E.32.14432A
OTHER ID: 11075
ELEVATION: 4215.00
USE: H
DEPTH: 254
GEO. UNIT: 1210GLL

WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL MS		DATE	WATER LEVEL MS		DATE	WATER LEVEL MS		DATE	WATER LEVEL MS
FEB 10, 1966	168.22	P	MAY 14, 1976	171.68		JAN 24, 1986	175.21			
MAR 24, 1971	172.14	P	APR 07, 1981	174.47		DEC 14, 1990	175.51			

HIGHEST 171.68 MAY 14, 1976

ATTACHMENT II

Sheet 1 of 1

GEOLOGIC BORING LOG

BORING NO. 1 — CONTRACTOR: Atkins Engineering — DATE SPUD: 1/17/96
CLIENT: Snyder Oil Corp — RIG TYPE: Ingersall Rand — DATE CMPL: 1/22/96
JOB NO.: — DRLG METHOD: — ELEVATION:
LOCATION: Maljamar, N.M. — BORING DIA.: — TEMP.:
GEOLOGIST: — DRLG FLUID — WEATHER: Windy
COMMENTS: Drilling took place @ Bottom of Pit which is ~15' Below ground surface

Elev. (ft.)	Depth (ft.)	Profile	US CS	Geologic Description	Samples No.	Samples Depth (ft)	Sample Type	Penet. Res.	Remarks TIP = Blgrnd/Reading (type)
	10			sand f-m lt brn	51	10'	D		
	12			sandstone 2"					
	14			sand f-m & gravel	52	14'	D		
	20			sandstone sand	53	20'	D		11500 TPH
									556 PID
	30			Sand f-m lt brn	5-4	30'	CT		10750 TPH
				occasional small stones					405 PID
	35			Sand f-m					
									7520 TPH
	45			sand f-m & small stones	5-5		CT		242 PID
	50			sandy & small stones					4770 TPH
				starting into sandstone	5-6		CT		273 PID
	57			sandstone - Rig Break-down			CT		
				stop Drlg operations					
	65			sandstone, sand	7		CT		780 TPH
	70			sand f-m	8		CT		45 TPH
	75			sand f-m	9		CT		bahs
				Split final samples					
				Note: add 15' for true Depths					

— sl - slight; tr - trace; sm - some; & - and; @ - at; w - with
v - very; lt - light; dk - dark; bf - buff; brn - brown; blk - black
f - fine; m - medium; c - coarse; BH - Bore Hole; SAA - Same As Above

SAMPLE TYPE
D - DRIVE; C - CORE; G - GRAB
C Core recovery; CT Cuttings; Core lost

Water level drilled

ATTACHMENT III

District I
P.O. Box 1980, Hobbs, NM
District II
P.O. Drawer DD, Artesia, NM 88211
District III
1000 Rio Brazos Rd, Aztec, NM 87410

State of New Mexico
Energy, Minerals and Natural Resources Department

OIL CONSERVATION DIVISION
P.O. Box 2088
Santa Fe, New Mexico 87504-2088

SUBMIT 1 COPY TO APPROPRIATE DISTRICT OFFICE AND 1 COPY TO SANTA FE OFFICE

(Revised 3/9/94)

PIT REMEDIATION AND CLOSURE REPORT

Operator: Snyder Oil Corporation **Telephone:** 817-338-4043

Address: 777 Main, Ste 2500 Ft. Worth, TX 76102

Facility Or: Well Name Maljamar North Unit

Location: Unit or Qtr/Qtr Sec N½ NW¼ Sec 31 T 16S R 33E County LEA, N.M.

Pit Type: Separator ___ Dehydrator ___ Other Hydrocarbon - Production

Land Type: BLM ___, State ✓, Fee ___, Other ___

Pit Location: (Attach diagram)
Pit dimensions: length 40', width 40', depth 14.5'
Reference: wellhead ___, other Battery
Footage from reference: 275'
Direction from reference: 180° Degrees ✓ East North ___ of ___ West South ___

Depth To Ground Water: (Vertical distance from contaminants to seasonal high water elevation of ground water) @ 196'	Less than 50 feet 50 feet to 99 feet Greater than 100 feet	(20 points) (10 points) (0 Points)	0
Wellhead Protection Area: (Less than 200 feet from a private domestic water source, or; less than 1000 feet from all other water sources)	Yes No	(20 points) (0 points)	0
Distance To Surface Water: (Horizontal distance to perennial lakes, ponds, rivers, streams, creeks, irrigation canals and ditches)	Less than 200 feet 200 feet to 1000 feet Greater than 1000 feet	(20 points) (10 points) (0 points)	0
	RANKING SCORE (TOTAL POINTS):		0

Date Remediation Started: 12-19-95 **Date Completed:** 3-15-96

Remediation Method: (Check all appropriate sections) Excavation ✓ Approx. cubic yards 2,880

Landfarmed ___ Insitu Bioremediation ___

Other Risk Assessed Closure
Clay Cap

Remediation Location: (ie. landfarmed onsite, name and location of offsite facility) Onsite ___ Offsite CRI, Controlled Recovery, Inc. 37 miles West of Hobbs, N.M.

General Description Of Remedial Action: Contaminated source materials removed. Vertical Extent at or above 89.5 feet from ground level. Coring for horizontal extent identified an area of containment 150' x 160'. The pit was backfilled with clean soil, capped with clay 2' thick over center of pit overlaid with 1' of dark sandy loam. The topsoil is mounded at center of area and sloped to allow drainage away. In May, the area well be seeded with 5 lb/Ac native grasses.

Ground Water Encountered: No ✓ Yes ___ Depth ___

Final Pit: Closure Sampling: (if multiple samples, attach sample results and diagram of sample locations and depths)

Sample location See Attached Report
Table 1., Table 2, Appeddix B, and Figure II

Sample depth ___

Sample date ___ Sample time ___

Sample Results

Benzene(ppm) BDL.

Total BTEX(ppm) B.D.L.

Field headspace(ppm) —

TPH B.D.L. Below Detection Limits

Ground Water Sample: Yes ___ No ✓ (If yes, attach sample results)

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE B[illegible] OF MY KNOWLEDGE AND BELIEF

DATE 3-16-96

SIGNATURE Suzanne P. Holland PRINTED NAME AND TITLE SUZANNE P. HOLLAND Engineering Consultant

ATTACHMENT IV

+ Submit 5 copies to Appropriate District Office

DISTRICT I
P.O.Box 1980, Hobbs, NM 88241-1980

DISTRICT II
P.O. Drawer DD, Artesia, NM 88211-0719

DISTRICT III
1000 Rio Brazos Rd, Aztec, NM 87410

State of New Mexico
Energy, Minerals and Natural Resources Department

OIL CONSERVATION DIVISION

P.O. Box 2088
Santa Fe, New Mexico 87504-2088

Form C-117 A
Revised 4-1-91

PERMIT NO. H-18478

TANK CLEANING, SEDIMENT OIL REMOVAL, TRANSPORTATION OF MISCELLANEOUS HYDROCARBONS AND DISPOSAL PERMIT

Operator or Owner Snyder Oil Co. Address 4000 N. Big Spring

Lease or Facility Name Malyamar Northeast Location S31 T16S R33E
U.L. - Sec. - Twp. - Rge.

OPERATION TO BE PERFORMED:

☐ Tank Cleaning ☐ Sediment Oil Removal ☑ Transportation of Miscellaneous Hydrocarbons

Operator or Owner Representative authorizing work Suzanne Holland

Date Work to be Performed 12-19-95

okd by Jerry Sexton 12/21/95

TANK CLEANING DATA Tank Number _____ Volume _____

Tank Type _____ Volume Below Load Line _____

SEDIMENT OIL OR MISCELLANEOUS HYDROCARBON DATA

Sediment Oil from: ☐ Pit ☐ Cellar ☑ Other

MISCELLANEOUS OIL
Tank Bottoms From: ☐ Pipeline Station ☐ Crude Terminal ☐ Refinery ☑ Other*

Catchings From: ☐ Gasoline Plant ☐ Gathering Lines ☐ Salt Water Disposal System ☑ Other*

Pipeline Break Oil or Spill ☐

*Other (Explain) Tank Battery

VOLUME AND DESTINATION:

Estimated Volume 100 cyd 480 Bbls. Field test volume of good oil _____ Bbls.
(Not required prior to Division approval)

Destination (Name and Location of treating plant or other facility) Controlled Recovery INC.

DESTRUCTION OF SEDIMENT OIL BY: ☐ Burning ☐ Pit Disposal ☐ Use on Roads or firewalls ☐ Other

(Explain) _____

Location of Destruction _____

Justification of Destruction _____

CERTIFICATION: (APPLICATION MAY BE MADE BY EITHER OF THE FOLLOWING)

I hereby certify that the infomation above is true and complete to the best of my knowledge and belief.

Owner Snyder Oil Co.
By Suzanne Holland
Title _____
Date 12-19-95

Transporter Valley Construction
Address P.O. Box 390 - Artesia N.M. 88210
Signature Bill Marley
Title Manager Date 12-19-95

OIL CONSERVATION DIVISION

Approved By Bonnie Richard Title RC&E-Tech Date DEC 26 1995

A COPY OF THIS FORM MUST BE ON LOCATION DURING TANK CLEANING, REMOVAL OF SEDIMENT OIL OR MISCELLANEOUS HYDROCARBONS, AND MUST BE PRESENTED WITH TANK BOTTOMS, SEDIMENT OIL OR MISCELLANEOUS HYDROCARBONS AT THE TREATING PLANT TO WHICH IT IS DELIVERED.

DISTRIBUTION BY OCD	
	Santa Fe
	File
✓	Operator
	Transporter (2)

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
HOBBS DISTRICT OFFICE

Feb. 27, 1996

POST OFFICE BOX 1980
HOBBS, NEW MEXICO 88241-1980
(505) 393-6161

ATTACHMENT
V
NMOCD Remediation Action Plan
Approval Letter

John Nussbaumer, R.E.H.S.
Snyder Oil Corporation (SOCO)
3939 SOCO Parkway
Evans, Colorado 80620

Re: Proposal For Risk Assessed Site Closure
Snyder Oil Corp.-Maljamar North Unit
N/2 Nw/4 Sec 31-Ts16s-R33 e.

Dear Mr. Nussbaumer,

The New Mexico Oil Conservation Division (NMOCD) is in receipt of the Proposal For Risk Assessed Site Closure for the above referenced facility submitted on your behalf by Suzanne Holland.

The proposed plan and actions as of this date are hereby approved with the following conditions.

1. Please advise this office when completion of the clay cap is installed for our visual inspection and final closure activities are complete.

2. Please submit a final closure report. At a minimum it should contain a completed "Pit Remediation And Closure Report" form (attached). Please send one copy to the NMOCD Santa Fe Environmental Bureau, attention Mr. Roger Anderson.

Please be advised that NMOCD approval does not relieve (SOCO) of liability should remaining contaminates pose a future threat to ground water, surface water, human health or the environment. In addition, NMOCD approval does not relieve (SOCO) of responsibility for compliance with any other federal, state, or local laws and/or regulations.

If you have any questions, please contact this office at 505-393-6161.

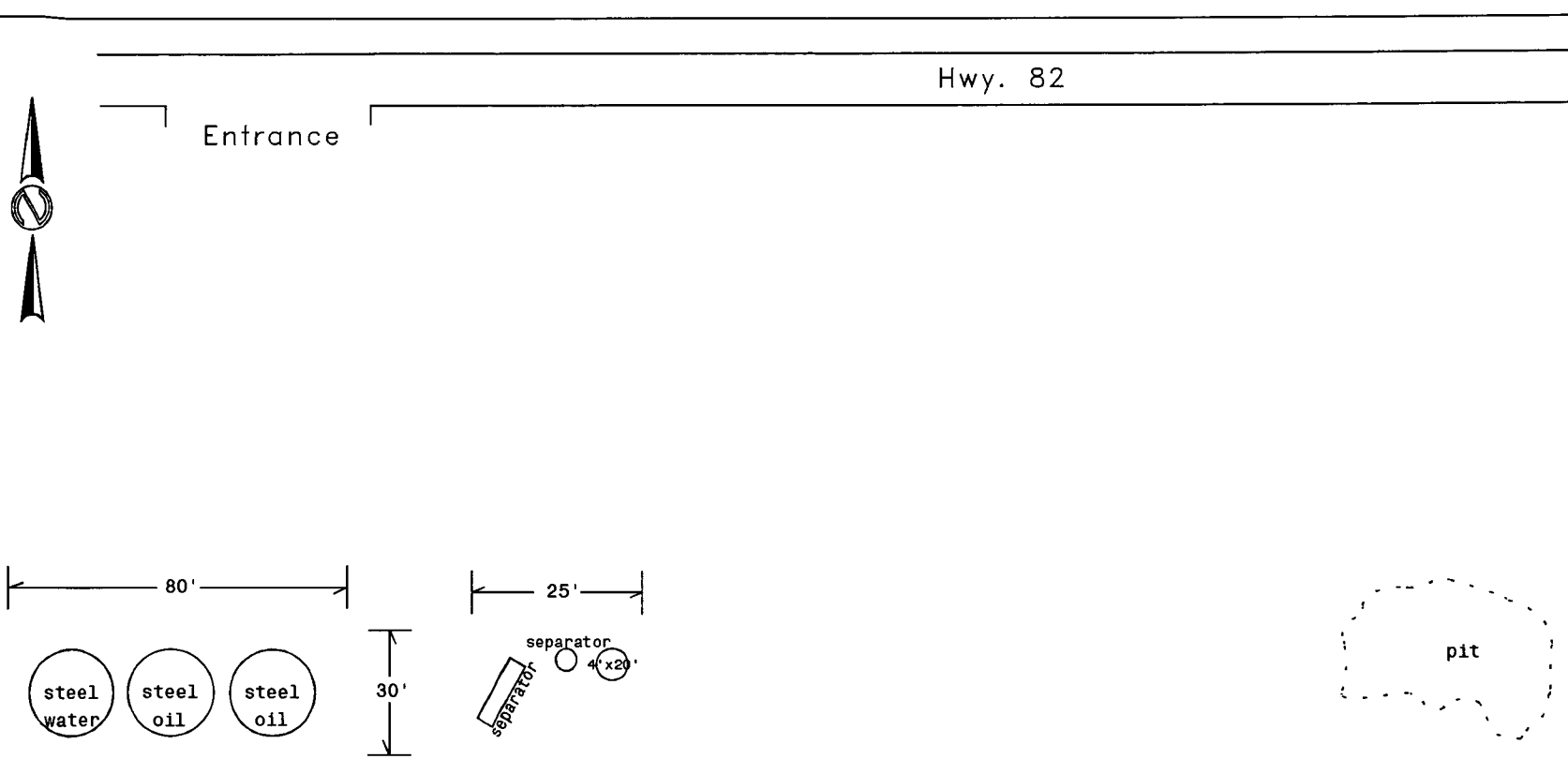
Sincerely yours,

Wayne Price

Wayne Price-Environmental Engineer

cc: Jerry Sexton-NMOCD District I Supervisor
Gary Wink-Field Rep. II
Roger Anderson-Environmental Bureau Chief
Suzanne Holland-Consultant
NM State Land Office-Hobbs

Attachments-1

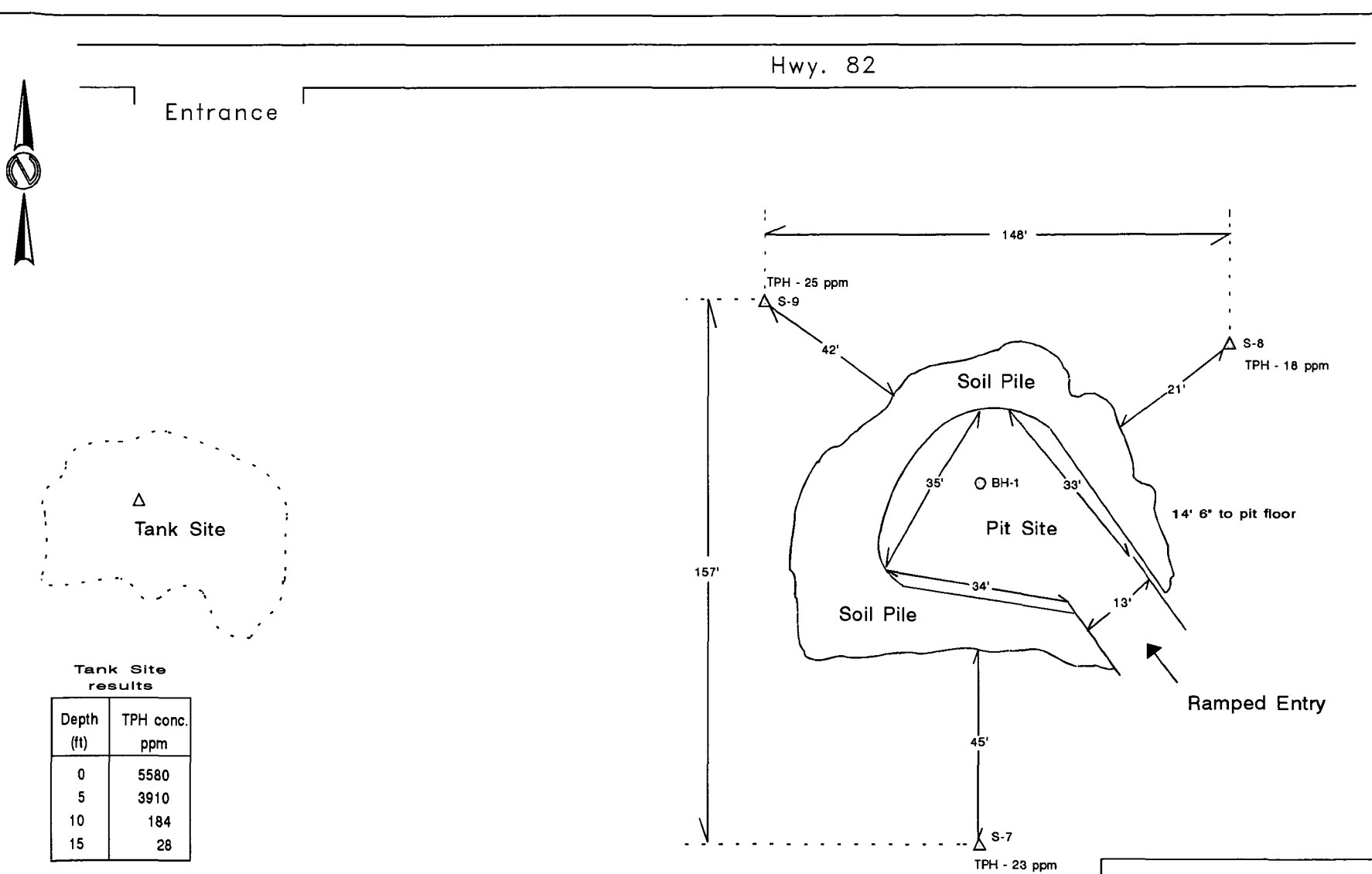


Not to Scale

Holland & Associates

Figure I

12/19/95
Site Facility Map
Snyder Oil Corporation
Maljamar North Unit
Lea Co., New Mexico



Tank Site results

Depth (ft)	TPH conc. ppm
0	5580
5	3910
10	184
15	28

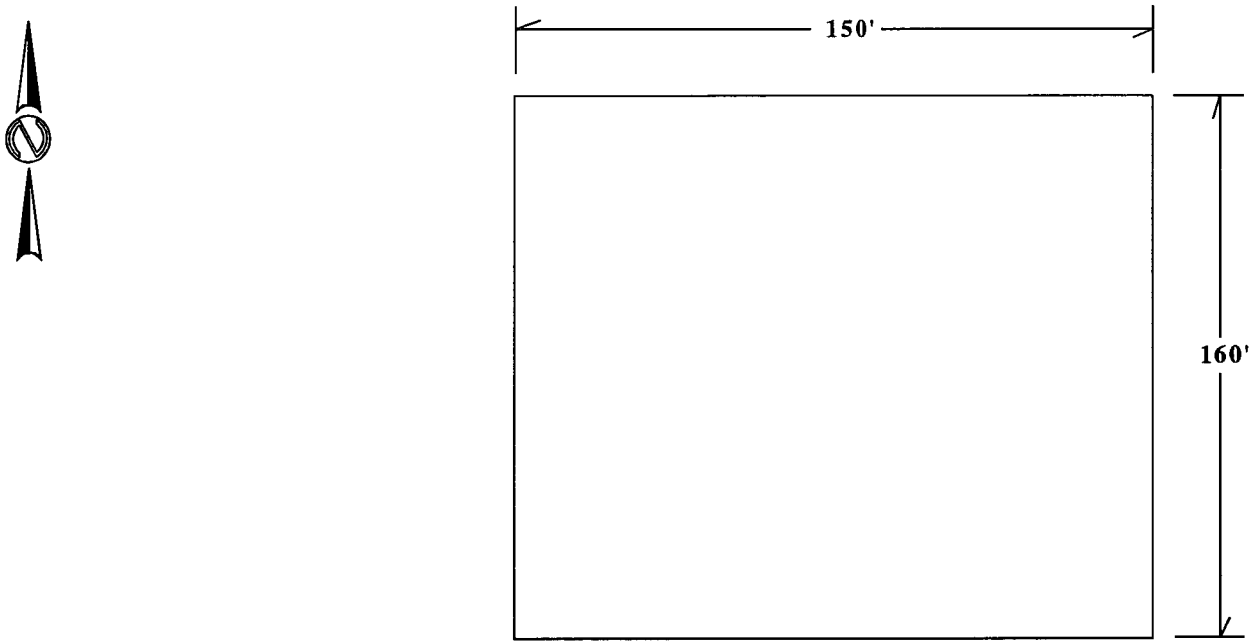
Legend
△ Coring Sites - 15' depth from G.L.
○ BH-1 - Pit Borehole #1

Not to Scale

Holland & Associates

Figure II

01/22/96
Remediation Site Diagram
Snyder Oil Corporation
Maljamar North Unit
Lea Co., New Mexico



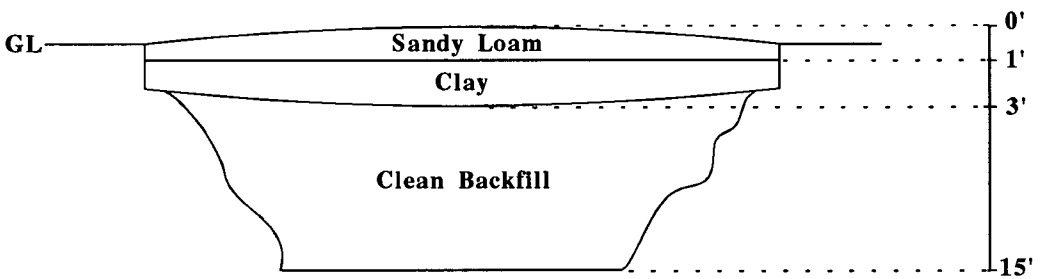


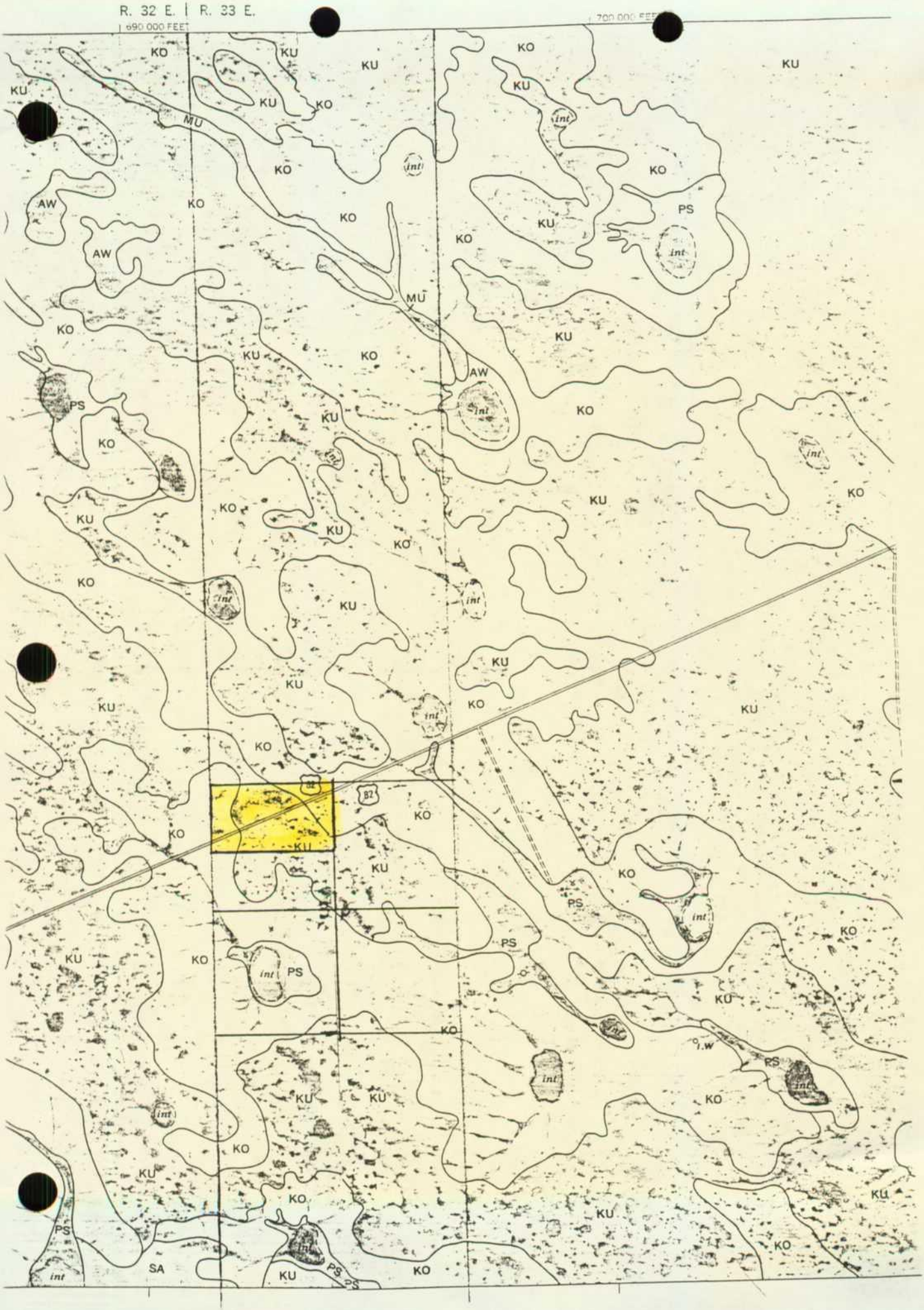
Figure III

03/16/96
Pit Closure Diagram
Snyder Oil Corporation
Maljamar North Unit
Lea Co., New Mexico

Holland & Associates

APPENDIX
A

U. S. Department of Agriculture
Soil Conservation Survey


R. 32 E.
R. 33 E.
690 000 FEET
700 000 FEET
KO
KU
MU
AW
PS
SA
int
I.W
82

CHEMICAL PROPERTIES OF THE SOILS
nontech

Map symbol and soil name	Depth	Clay	Cation exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
KU:								
Kimbrough	0-6	15-20	---	7.4-8.4	---	---	0-2	---
	6-10	---	---	---	---	---	---	---
Lea	0-10	18-27	---	6.6-7.3	---	---	---	---
	10-26	18-35	---	7.9-8.4	---	---	0-2	---
	26-30	---	---	---	---	---	---	---
KO:								
Kimbrough	0-6	15-20	---	7.4-8.4	---	---	0-2	---
	6-10	---	---	---	---	---	---	---

CHEMICAL PROPERTIES OF THE SOILS

Endnote -- CHEMICAL PROPERTIES OF THE SOILS

This report shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

CLAY as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this report, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

CATION EXCHANGE CAPACITY (CEC) is the total amount of cations held in a soil in such a way that they can be removed only by exchanging with another cation in the natural soil solution. CEC is a measure of the ability of a soil to retain cations, some of which are plant nutrients. Soils with low CEC hold few cations and may require more frequent applications of fertilizers than soils with high CEC. Soils with high CEC have the potential to retain cations, thus reducing the possibility of pollution of ground water.

SOIL REACTION is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

CALCIUM CARBONATE is the percentage by weight of calcium carbonate in the fine-earth material, less than 2 millimeters in size.

GYPSUM is the percentage by weight of hydrated calcium sulfates 20 millimeters or smaller in size, in the soil.

SALINITY is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils.

The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the report. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

SODIUM ADSORPTION RATIO (SAR) expresses the relative activity of sodium ions in exchange reactions in the soil. SAR is a measure of the amount of sodium relative to calcium and magnesium in the water extract from saturated soil paste.

PHYSICAL PROPERTIES OF SOILS
nontech

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodability index" apply only to the surface layer)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
KU:												
Kimbrough	0-6	15-20	1.35-1.45	0.60-2.00	0.12-0.14	Low	1.0-2.0	0.20	0.37	1	5	---
	6-10	---	---	---	---		---	---	---			
Lea	0-10	18-27	1.30-1.40	0.60-2.00	0.16-0.18	Low	1.0-2.0	0.37	0.37	2	6	---
	10-26	18-35	1.45-1.55	0.60-2.00	0.17-0.19	Moderate	---	0.37	0.37			
	26-30	---	---	---	---		---	---	---			
KO:												
Kimbrough	0-6	15-20	1.35-1.45	0.60-2.00	0.12-0.14	Low	1.0-2.0	0.20	0.37	1	5	---
	6-10	---	---	---	---		---	---	---			

PHYSICAL PROPERTIES OF SOILS

Endnote -- PHYSICAL PROPERTIES OF SOILS

This report shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

CLAY as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this report, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

MOIST BULK DENSITY is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this report, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

PERMEABILITY refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

AVAILABLE WATER CAPACITY refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

SHRINK-SWELL POTENTIAL is the potential for volume change in a soil with a loss or gain of moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils. If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed. Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are "Low," a change of less than 3 percent; "Moderate," 3 to 6 percent; and "High," more than 6 percent. "Very high," greater than 9 percent, is sometimes used.

PHYSICAL PROPERTIES OF SOILS

Endnote -- PHYSICAL PROPERTIES OF SOILS--Continued

ORGANIC MATTER is the plant and animal residue in the soil at various stages of decomposition. In report J, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

EROSION FACTOR K indicates the susceptibility of the whole soil (including rocks and rock fragments) to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

EROSION FACTOR Kf is like EROSION FACTOR K but it is for the fine-earth fraction of the soil. Rocks and rock fragments are not considered.

EROSION FACTOR T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

WIND ERODIBILITY GROUPS are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

PHYSICAL PROPERTIES OF SOILS

Endnote -- PHYSICAL PROPERTIES OF SOILS--Continued

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

The WIND ERODIBILITY INDEX is used in the wind erosion equation (WEQ). The index number indicates the amount of soil lost in tons per acre per year. The range of wind erodibility index numbers is 0 to 300.

SOIL FEATURES
nontech

Map symbol and soil name	Bedrock		Cemented pan		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Depth	Kind	Initial	Total		Uncoated steel	Concrete
	In		In		In	In			
KU:									
Kimbrough	>60	---	4-20	Thick	---	---		High	Low
Lea	>60	---	20-40	Thick	---	---	Low	High	Low
KO:									
Kimbrough	>60	---	4-20	Thick	---	---		High	Low

SOIL FEATURES

Endnote -- SOIL FEATURES

This report gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either "Soft" or "Hard". If the rock is "Soft" or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is "Hard" or massive, blasting or special equipment generally is needed for excavation.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as "Thin" or "Thick". A "Thin" pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A "Thick" pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. This report shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which usually is a result of oxidation. Not shown in the report is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer. For uncoated steel, the risk of corrosion, expressed as "Low", "Moderate", or "High", is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as "Low", "Moderate", or "High". It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

CONSTRUCTION MATERIALS
nontech

(The information in this report indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
KU:				
Kimbrough	Poor: cemented pan	Improbable: excess fines	Improbable: excess fines	Poor: cemented pan, small stones
Lea	Poor: cemented pan	Improbable: excess fines	Improbable: excess fines	Fair: cemented pan, too clayey, thin layer
KO:				
Kimbrough	Poor: cemented pan	Improbable: excess fines	Improbable: excess fines	Poor: cemented pan, small stones

CONSTRUCTION MATERIALS

Endnote -- CONSTRUCTION MATERIALS

This report gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated "Good", "Fair", or "Poor" as a source of roadfill and topsoil. They are rated as a "Probable" or "Improbable" source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this report, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments. The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The report entitled Engineering Index Properties is also available and it provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated "Good" contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet

Soils rated "Fair" are more than 35 percent silt- and clay-sized particles and have a plasticity of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet.

Soils rated "Poor" have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In this report only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the Engineering Index Properties report.

A soil rated as a "Probable" source has a layer of clean sand and gravel or a layer of sand or gravel that contains up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an "Improbable" source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

CONSTRUCTION MATERIALS

Endnote -- CONSTRUCTION MATERIALS--Continued

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rate "Good" have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated "Fair" are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rate "Poor" are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface. The surface layer of most soils is generally preferred for topsoil because of it organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

CLASSIFICATION OF THE SOILS
nontech

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Kimbrough	PETROCALCIC CALCIUSTOLLS, LOAMY, MIXED, THERMIC, SHALLOW
Lea	PETROCALCIC PALEUSTOLLS, FINE-LOAMY, MIXED, THERMIC

SOIL MAP LEGEND
nontech

Map symbol	Soil name
KU	Kimbrough-Lea complex
KO	Kimbrough gravelly loam, 0 to 3 percent slopes

ENGINEERING INDEX PROPERTIES
nontech

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
KU:												
Kimbrough	0-6	Gravelly loam	CL-ML	A-4	0	5-10	65-85	60-80	55-70	50-60	20-25	5-10
	6-10	Indurated			0	0	0	0	0	0	---	NP
Lea	0-10	Loam	CL	A-6	0	0	100	100	80-95	60-70	25-35	10-15
	10-26	Loam, clay loam, sandy clay loam	CL	A-6	0	0	100	100	80-95	55-75	25-40	10-20
	26-30	Indurated			0	0	0	0	0	0	---	NP
KO:												
Kimbrough	0-6	Gravelly loam	CL-ML	A-4	0	5-10	65-85	60-80	55-70	50-60	20-25	5-10
	6-10	Indurated			0	0	0	0	0	0	---	NP

ENGINEERING INDEX PROPERTIES

Endnote -- ENGINEERING INDEX PROPERTIES

This report gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

DEPTH to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the published Soil Survey for each soil series under "Soil Series and Their Morphology."

TEXTURE is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Soil Survey Glossary.

Classification of the soils is determined according to the Unified soil classification system and the system adopted by the American Association of State Highway and Transportation Officials.

The UNIFIED system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection. If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock FRAGMENTS larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage of soil particles passing designated sieves (PERCENTAGE PASSING SIEVE NUMBER--)is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

LIQUID LIMIT and PLASTICITY INDEX (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in this report.

NONTECHNICAL SOILS DESCRIPTION REPORT

NT

Map Symbol	Soil name and description
Kg	Kimbrough gravelly loam, 0 to 3 percent slopes Soil depth - shallow; Soil drainage - well drained; Surface layer - gravelly loam 6 inches thick; Permeability - moderate; AWC - very low; Effective rooting depth is 6 to 20 inches; Water erosion hazard - slight; Soil blowing hazard - severe; Capability subclass 6e (IRR) 7s (NIRR); T-1; WEG-5; I-56; limitation: depth to indurated caliche.
KU	Kimbrough-Lea complex KIMBROUGH: Soil depth - shallow; Soil drainage - well drained; Surface layer - gravelly loam 6 inches thick; Indurated caliche is at a depth of 6 inches; Permeability - moderate; AWC - very low; Effective rooting depth - 4 to 20 inches; Water erosion hazard - moderate; Soil blowing hazard - moderate; Capability subclass 7s (IRR) (UA) 7s (NIRR); T-5; WEG-5; I-56; Limitations: depth to indurated caliche and gravel content. LEA: Soil depth - moderately deep; Soil drainage - well drained; Surface layer - loam 4 inches thick; Substratum - loam 22 inches thick; Indurated caliche is at a depth of 26 inches; Permeability - moderate; AWC - low; Effective rooting depth is 20 to 40 inches; Water erosion hazard - moderate; Soil blowing hazard - severe; Capability subclass 4e (IRR) (UA) 6e (NIRR); T-2; WEG-6; I-48; Limitations: depth to indurated caliche, and high lime content above the indurated caliche.
KO	Kimbrough gravelly loam, 0 to 3 percent slopes

APPENDIX
B

Lab Reports of Soil Sample Analysis

MAXIM TECHNOLOGIES INC

1703 West Industrial P.O. Box 2150 * Midland, Texas 79701 * 915/683-3349 FAX 915/686-0492

Client Susan Holland
Snyder Oil Co.
4918 King Richard's
Midland, TX 79707

Client No. 4100200
Report No. M6-01-082
Report Date 01/30/96 16:42

Project MLJM Pit V.E.

Phone: 915/520-2098 Fax: 915/697-9926

Date Sampled 01/22/96

Sampled By Client

Sample Type Soil

Transported by Susan Holland

P.O. # _____

Date Received 01/22/96

Lab No.	Sample Identification
M6-01-082-01	MLJM Pit V.E. 84.6'

MAXIM DRAFT

_____
Reviewed By

_____
ALLAN B. JOHNSTON

TEST RESULTS BY SAMPLE

Sample: 01A MLJM Pit V.E. 84.6' Collected: 01/22/96 16:00 Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TOT.PET. HYDROCARBONS SOIL	EPA 418.1	< 4.67	mg/kg	4.67	01/29/96	SLS

TEST RESULTS BY SAMPLE

Sample Description: MLJM Pit V.E. 84.6'
Test Description: BTEX - SOIL SAMPLE
Collected: 01/22/96 16:00

Lab No: 01A
Method: SW-846, 8020 Test Code: BTEX_S
Category: S

Date Extracted	01/29/96	Date Started	01/29/96
Analyst	WJJ	Detection Limit	0.02
Units	mg/kg	Method	SW-846, 8020

Compound	Results
BENZENE	< 0.02
TOLUENE	< 0.02
ETHYLBENZENE	< 0.02
XYLENE	< 0.02

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240
PHONE (505) 326-4669 • 118 S. COMMERCIAL AVE. • FARMINGTON, NM 87401

TPH/BTEX ANALYSIS REPORT

Company: Snyder Oil Company
Address: 777 Main St. Ste.2500
City, State: Ft Worth, Texas 76102

Date: 01/26/96
Lab #: H2384

Project Name: Maljamar Pit
Location: Lovington-Artesia Hwy
Sampled by: ST
Analyzed by: MI
Sample Type: SOIL

Date: 1/22/96
Date: 1/24/96 Time: 09:00
Sample Condition: Intact
Units: mg/kg

Samp #	Field Code	TRPHC	BENZENE	TOLUENE	ETHYL BENZENE	PARA-XYLENE	META-XYLENE	ORTHO-XYLENE
1	Botton of Pit 84' 6"	93	0.082	<0.001	0.044	<0.001	0.019	0.068
2	Bottom of Pit 89' 6"	116	0.175	<0.001	<0.001	<0.001	<0.001	0.007
	QC Recovery	160	0.508	0.502	0.564	0.514	0.514	0.503
	QC Spike	172.4	0.534	0.525	0.528	0.525	0.523	0.519
	Accuracy	107.7%	95%	95%	107%	98%	98%	97%
	Air Blank	***	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Methods - GAS CHROMOTOGRAPHY; INFRARED SPECTROSCOPY
- EPA SW-846; 8020, 418.1, 3510, 3540 or 3550

Mitch Irvin

1-31-96
Date

ENVIRONMENTAL SPILL CONTROL, INC.
1203 West Dunnam
P.O. Box 5890
Hobbs, NM 88241
(505) 392-6167 (800) 390-6167

SOIL ANALYSIS REPORT

DATE: 01/29/96
CLIENT: Snyder Oil Corporation
SUPERVISOR: A. HODGE
S. THOMAS

FACILITY: North Maljamar Unit
Test Method: EPA 418.1
Matrix: Soil

	TPH		DEPTH	LOCATION
SAMPLE NO. 1:	12,085	PPM	14'-29'	15' depth from bottom of pit
SAMPLE NO. 2:	11,510	PPM	20'-35'	15' depth from bottom of pit
SAMPLE NO. 3:	10,750	PPM	30'-45'	15' depth from bottom of pit
SAMPLE NO. 4:	7,520	PPM	45'-60'	15' depth from bottom of pit
SAMPLE NO. 5:	4,770	PPM	50'-65'	15' depth from bottom of pit
SAMPLE NO. 6:	2,600	PPM		5 point composite from stock pile
SAMPLE NO. 7:	2,850	PPM		5 point composite "
SAMPLE NO. 8:		PPM		
SAMPLE NO. 9:		PPM		
SAMPLE NO. 10:		PPM		
SAMPLE NO. 11:		PPM		
SAMPLE NO. 12:		PPM		
SAMPLE NO. 13:		PPM		

COMMENTS: These samples were taken with split spoon from boring in bottom of pit. Sample six and seven were from stock pile material on-site.

ENVIRONMENTAL SPILL CONTROL, INC.
1203 West Dunnam
P.O. Box 5890
Hobbs, NM 88241
(505) 392-6167 (800) 390-6167

SOIL ANALYSIS REPORT

DATE: 01/29/96
CLIENT: Snyder Oil Corporation
SUPERVISOR: A. HODGE
S. THOMAS

FACILITY: North Maljamar Unit
Test Method: EPA 418.1
Matrix: Soil

	TPH		DEPTH	LOCATION
SAMPLE NO. 1:	780	PPM	65"	Center of pit
SAMPLE NO. 2:	45	PPM	70'	Center of pit
SAMPLE NO. 3:	36	PPM	70'	Center of pit
SAMPLE NO. 4:	14,460	PPM	Composite	West Wall
SAMPLE NO. 5:	10,610	PPM	Composite	North Wall
SAMPLE NO. 6:	14,340	PPM	Composite	East Wall
SAMPLE NO. 7:	23	PPM	15'	Outside surface / South side
SAMPLE NO. 8:	18	PPM	15'	North East side
SAMPLE NO. 9:	25	PPM	15'	North West side
SAMPLE NO. 10:	3,910	PPM	5'	West side
SAMPLE NO. 11:	184	PPM	10'	Tank battery pad removed
SAMPLE NO. 12:	28	PPM	15'	Tank battery pad removed

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240
PHONE (505) 326-4669 • 118 S. COMMERCIAL AVE. • FARMINGTON, NM 87401

TPH/BTEX ANALYSIS REPORT

Company: Snyder Oil Company
Address: 4918 King Richards Row
City, State: Midland, Texas 79707
Project Name: MLJM Pit Backhoe
Location: Maljamar, NM
Sampled by: SPH
Analyzed by: MI
Sample Type: soil

Date: 01/17/96
Lab #: H2376

Date: 1/16/96 Time: 12:30
Date: 1/16/96 Time: 15:59
Sample Condition: Intact

Units: mg/kg

Samp #	Field Code	TRPHC	BENZENE	TOLUENE	ETHYL BENZENE	PARA-XYLENE	META-XYLENE	ORTHO-XYLENE
1	Malj. Sand 25'	14,134	3.125	8.127	5.625	1.607	3.674	2.479
2	Malj. Black 9'	12,710	2.492	7.278	5.084	1.579	3.567	2.455
3	Malj. Wall 9'	11,485	1.936	3.459	2.840	1.797	0.414	2.820
	QC Recovery	478	0.435	0.416	0.471	0.421	0.432	0.436
	QC Spike	475	0.489	0.481	0.484	0.481	0.479	0.476
	Accuracy	100.9%	88%	86%	97	87%	89	91%
	Air Blank	***	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Methods - GAS CHROMOTOGRAPHY; INFRARED SPECTROSCOPY
- EPA SW-846; 8020, 418.1, 3510, 3540 or 3550

Mitch Irvin

1-17-96
Date

MAXIM TECHNOLOGIES INC

1703 West Industrial P.O. Box 2150 * Midland, Texas 79701 * 915/683-3349 FAX 915/686-0492

Client Suzanne Holland
Snyder Oil Co.
4918 King Richard's
Midland, TX 79707

Client No. 4100200
Report No. M6-01-021
Report Date 01/11/96 12:46

Project Pit Floor and Tank Site

Phone: 915/520-2098 Fax:

Date Sampled _____

Sampled By Client

Sample Type Soil

Transported by Mark Holland

P.O. # _____

Date Received 01/05/96

Lab No.	Sample Identification
M6-01-021-01	Pit Floor 2 - 20'
M6-01-021-02	Tank Site

MAXIM

ON
Reviewed By

ALLAN B. JOHNSTON

TEST RESULTS BY SAMPLE

Sample: 01A Pit Floor 2 - 20' Collected: Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TOT.PET. HYDROCARBONS SOIL	EPA 418.1	15700	mg/kg	52.4	01/10/96	SLS

Sample: 02A Tank Site Collected: Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TOT.PET. HYDROCARBONS SOIL	EPA 418.1	5580	mg/kg	40.2	01/10/96	SLS

MAXIM TECHNOLOGIES INC

1703 West Industrial P.O. Box 2150 * Midland, Texas 79701 * 915/683-3349 FAX 915/686-0492

Client Suzanne Holland
Snyder Oil Co.
4918 King Richard's
Midland, TX 79707

Client No.
Report No. M6-01-009
Report Date 01/03/96 16:13

Project Maljamar Pit #1

Phone: 915/520-2098 Fax:

Date Sampled 01/02/96

Sampled By Client

Sample Type Soil

Transported by Suzanne Holland

P.O. # _____

Date Received 01/03/96

Lab No.	Sample Identification
M6-01-009-01	Maljamar Pit #1

MAXIM

Reviewed By

ALLAN B. JOHNSTON

MAXIM

Order # M6-01-009
01/03/96 16:13
Client: Snyder Oil Co.

TEST RESULTS BY SAMPLE

Sample: 01A Maljamar Pit #1 Collected: 01/02/96 Category: S

Test Name	Method	Result	Units	Detection Limit	Date Started	Analyst
TOT.PET. HYDROCARBONS SOIL	EPA 418.1	21700	mg/kg	37.4	01/03/96	SLS

APPENDIX
C

Sundown Clay Specifications

PETTIGREW and ASSOCIATES
1110 N. GRIMES
HOBBS, NEW MEXICO 88240
(505) 393-9827

DEBRA P. HICKS, P.E.
WILLIAM M. HICKS, III, P.E.
RICHARD H. PETTIGREW, P.E.,P.S.

September 19, 1995

John West Engineering
412 N. Dal Paso
Hobbs, New Mexico 88240
ATTN: Phil Ross

RE: Sundown Pit

Dear Phil:

Enclosed please find the results for the permeability tests that you requested for Sundown Pit. This material was delivered to our lab on August 23, 1995. The average permeability values are as follows:

Initial		Final		Hydraulic Conductivity
Moisture (%)	Dry Density (PCF)	Moisture (%)	Dry Density (PCF)	(cm/sec)
25.2	80.4	37.8	82.2	1.8E-05
25.2	85.7	37.5	81.9	2.0E-05
25.2	91.0	33.9	87.0	3.3E-07

The 85 % sample compressed during testing and the 90 and 95 % samples swelled during the testing. This will influence the Hydraulic Conductivity results. Also enclosed please find the Moisture Density Determination results (ASTM D 698), the Plasticity Index results, Sieve Analysis and Soil Classification.

We appreciate the opportunity to be of service to you on this project. Please call if you have any questions.

Sincerely,

PETTIGREW and ASSOCIATES, P.A.

Eileen Robinett, E.T.
ER/aab

enclosures: as stated

LABORATORY TEST REPORT

PETTIGREW and ASSOCIATES

DEBRA P. HICKS, P.E.
WILLIAM M. HICKS, III, P.E.
RICHARD R. PETTIGREW, P.E.-P.S.

P.O. BOX 807
CLOVIS, NM 88102
(505) 762-3716

2110 N. GRIMES
HOBBS, NM 88240
(505) 393-9827

313 N. CANAL
CARLSBAD, NM 88220
(505) 885-4307

TO: John West Engineering
412 N. Dal Paso
Hobbs, New Mexico 88240

TYPE OF TEST: SIEVE ANALYSIS

TEST METHOD: AASHTO T-27

TYPE OF MATERIAL: Red Clay

PROJECT: Shadown Pit

LOCATION:

DATE OF TEST: August 25, 1995

TEST NO:

SCREEN SIZE	% PASSING	REQUIRED LIMITS
#4	100	
#10	99	
#40	98	
#80	97	
#200	90.4	
LL	48	
PL	23	
PI	25	

Classified as CL Moisture Density Determination: ASTM D698-95.0 @ 25.3%
Delivered 8/23/95 John West Engineering

LAB NO. 911-3803 3804

COPIES TO:
John West Engineering

PETTIGREW and ASSOCIATES

BY: F.T.

PETTIGREW & ASSOCIATES

CONSULTING ENGINEERS

CLIENT John West Engineering

PROJECT Sundown Pit

TYPE OF TEST: ASTM D 698

LOCATION

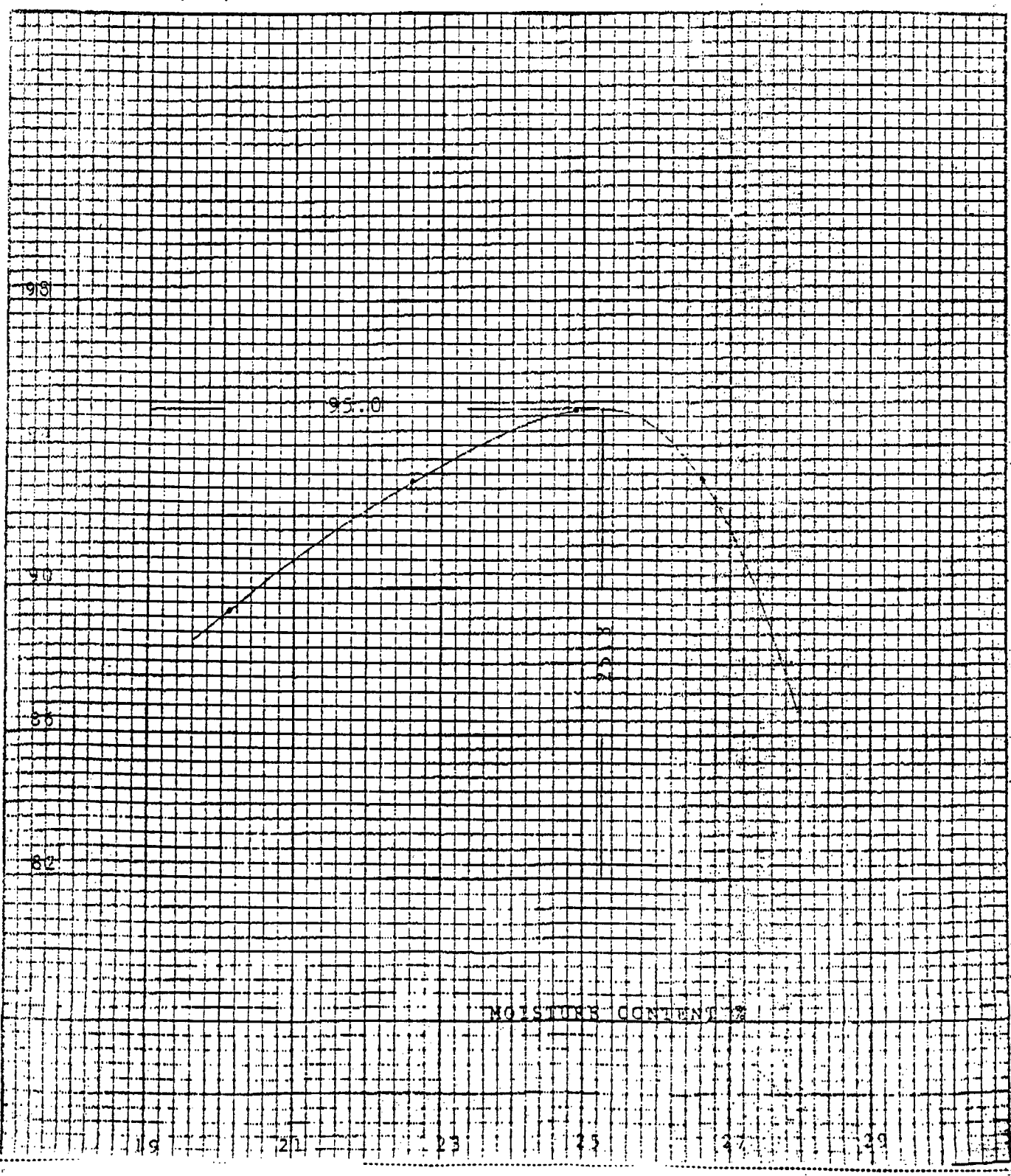
TYPE OF MATERIAL: Red Clay

DESCRIPTION

DATE 8/25/95 LAB NO. 5H-3803

BY

DELIVERED 8/23/95



90%

Flexible Wall Permeability

Project:	Pettigrew	Test setup date:		Sample (final):	
Spring Number:		Tested by:		Length, L(cm):	10.395
Sample Number:		Checked by:		Diameter, D(cm):	7.302
Depth		Cell Number:		Area, A(cm):	41.88
		Panel Number:		Volume, V(cm):	435.31
		Standpipe:		Wet Mass, W(gms):	786.10
		area (a in):	0.072	Wet Unit Weight, (gms/cc):	1.806
		area (a out):	0.070	Wet unit Weight (pcf):	112.68
				Moisture content, (%):	37.50
				Assumed Specific gravity (gms/cc):	2.72
				Volume of Solids, V(cc):	210.19
				Pore Volume, V(cc):	225.12
				Void Ratio, e:	1.07
				Percent Saturation (%):	95.23
				Confining Pressure: (psi):	5.00
				Value of C:	0.11
				C = ((a In)*(a out)*L)/((A)*(a in + a out))	

Sample (initial)

Length, L(cm):	10.149
Diameter, D(cm):	7.257
Area, (cm2):	41.36
Volume, Vo (cm3):	419.79
Wet Mass, Ww (gms):	721.60
Wet Unit Weight, (g/cc):	1.719
Wet Unit Weight, (pcf):	107.26
Moisture Content, (%):	25.20
Burette Length Correction	1.14

Month: Date: Day	Time: Hrs.	Min.	Press Diff. (PSI)	Head Bot. (cm)	Head Top (cm)	Total Head (cm)	Elapsed Time (sec)	Initial Gradient	Temp. degree C	Ln(h1/h2)	Perm K (cm/sec)	Flow Ratio
244.00	10.00	1.00	0.00	5.60	18.50	12.46						
244.00	10.00	12.00	0.00	6.20	15.70	10.86	660.00	1.23	23.50	1.37E-01	2.08E-05	1.33
244.00	10.00	23.00	0.00	6.80	15.10	9.49	660.00	1.07	23.50	1.35E-01	2.04E-05	1.00
244.00	10.00	36.00	0.00	7.40	14.40	8.00	780.00	0.93	23.50	1.70E-01	2.18E-05	1.17
244.00	10.00	49.00	0.00	7.90	13.90	6.86	780.00	0.79	23.50	1.54E-01	1.97E-05	1.00
244.00	11.00	10.00	0.00	8.50	13.20	5.37	1260.00	0.68	23.50	2.44E-01	1.93E-05	1.17

Flexible Wall Permeability

Project:	PETTIGREW	Test setup date:	9/5/95	Sample (final)	
Boring Number:		Tested by:	SG	Length, L(cm):	10.343
Sample Number:	1C	Checked by:	WLD	Diameter, D(cm):	7.337
Depth		Cell Number:		Area, A(cm):	42.28
		Panel Number:		Volume, V(cm):	437.29
		Standpipe:		Wet Mass, W(gms):	816.00
		area (a in):	0.118	Wet Unit Weight, (gms/cc):	1.866
		area (a out):	0.118	Wet unit Weight,(pcf):	116.44
Sample, (initial)				Moisture content, (%):	33.90
				Assumed Specific gravity, (gms/cc):	2.72
Length, L(cm):	10.153			Volume of Solids, V(cc):	224.05
Diameter, D(cm):	7.263			Pore Volume, V(cc):	213.25
Area, (cm2):	41.43			Void Ratio, e:	0.95
Volume, Vo (cm3):	421.06			Percent Saturation (%):	96.88
Wet Mass, Ww (gms):	768.70			Confining Pressure, (psi):	
Wet Unit Weight, (g/cc):	1.826			Value of C:	0.01
Wet Unit Weight, (pcf):	113.92			C=((a in)*(a out)*L)/((A)*(a in + a out))	
Moisture Content, (%):	25.20				
Burrette Length Correction	8.50				

Month:

Date: Day	Time: Hrs.	Min.	Press Diff. (PSI)	Head Bot. (cm)	Head Top (cm)	Total Head (cm)	Elapsed Time (sec)	Initial Gradient	Temp. degree C	Ln(h1/h2)	Perm K (cm/sec)	Flow Ratio
251.00	9.00	45.00	0.00	0.28	1.96	14.29						
251.00	10.00	10.00	0.00	0.32	1.89	13.35	1500.00	1.41	23.50	6.77E-02	5.97E-07	1.75
251.00	10.00	40.00	0.00	0.36	1.85	12.67	1800.00	1.31	23.50	5.23E-02	3.84E-07	1.00
251.00	11.00	29.00	0.00	0.42	1.80	11.73	2940.00	1.25	23.50	7.67E-02	3.45E-07	0.83
251.00	12.00	50.00	0.00	0.50	1.73	10.46	4860.00	1.15	23.50	1.15E-01	3.13E-07	0.88
251.00	13.00	55.00	0.00	0.55	1.67	9.52	3900.00	1.03	23.50	9.37E-02	3.17E-07	1.20

PETTIGREW & ASSOCIATES

CONSULTING ENGINEERS

CLIENT John West Engineering

PROJECT Sundown Pit

TYPE OF TEST: ASTM D 698

LOCATION

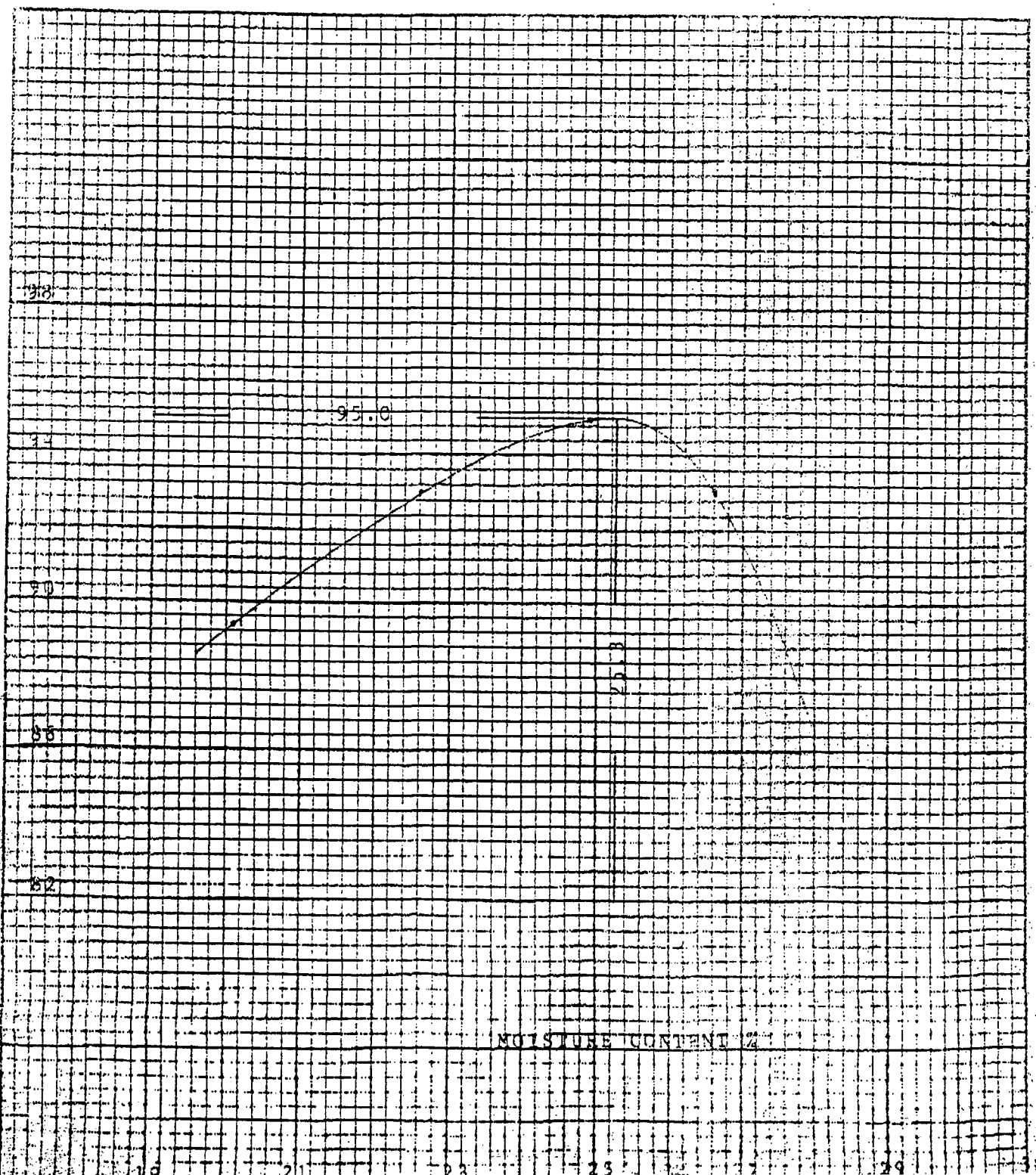
TYPE OF MATERIAL: Red Clay

DESCRIPTION

DATE 8/25/95 LAB NO. SH-3803

BY

DELIVERED 8/23/95



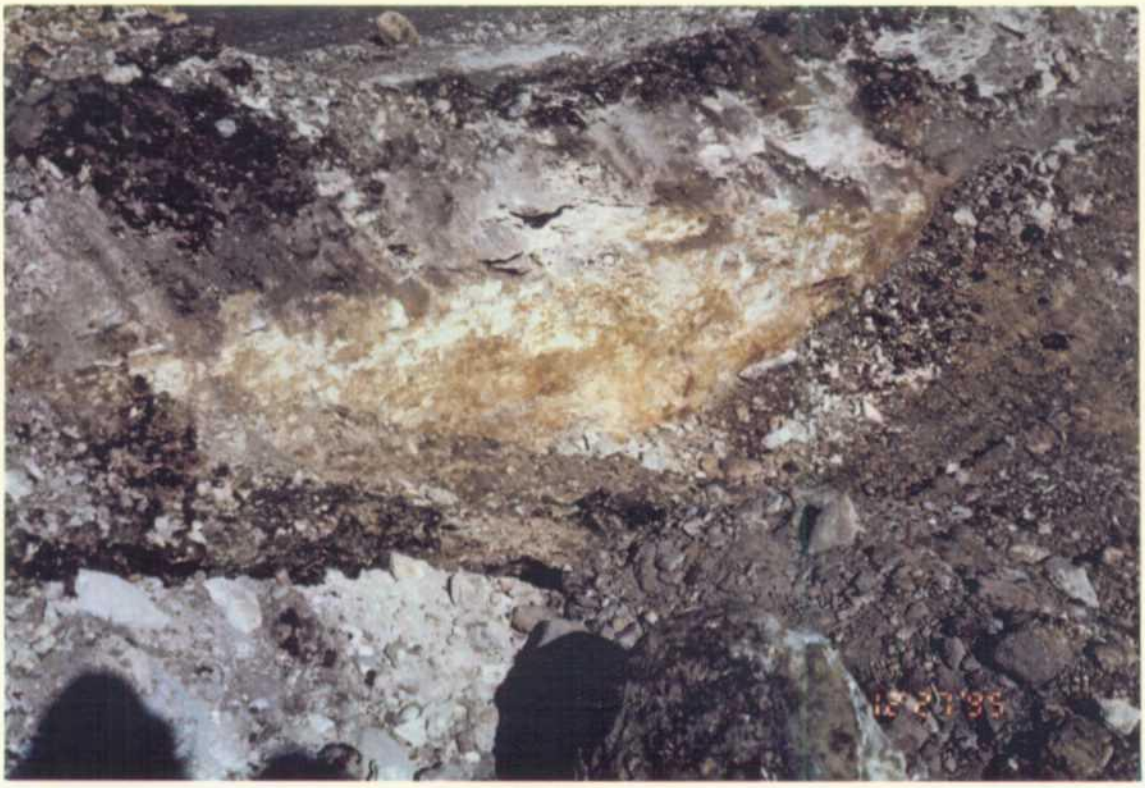
APPENDIX
D

Photographs of Site

Orig. pit location

Pre-excavation

Excavation of source



Excavation of source

Excavation of source

Boulders from pit

Pit site

Pit excavation 8'-12'

Pit excavation 8'-12'

Pit excavation 8'-12'

Boulders will need separate disposal

Pit @ 14'6''

Pit @ 14'6''

Pre-closure pit site

HC contam. @ battery site

Excavation of Pad

Soil - TPH 5580 ppm

Site of leaking tank.

Pad - TPH 3910 ppm

Leaking tank area / coring site

Backfill with clean soil.

Clay cap in progress.

Clay cap completed.

Top soil completed, ready for seeding.

Battery site remediated.

Line vent belonging to GPM.