

1R - 324

REPORTS

DATE:

2002

4/10/02
OCD/Conoco Meeting



April 10, 2002
New Mexico Oil Conservation Division – Conoco Inc.
Joint Meeting, Santa Fe, New Mexico

Agenda

Maljamar Gas Plant Facility, Lea County, NM

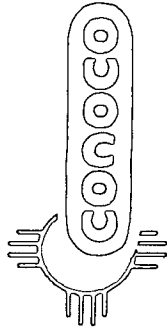
Apex Compressor Station, Lea County, NM

Reed A Pit Closure – Tuffy Cooper Ranch, Lea County, NM

Maljamar Gas Plant Facility/South Storage Area, Lea County, NM

PCA Junction, Eddy County, NM

Lockhart A27 Pit Closure – Cannan Ranch, Lea County, NM



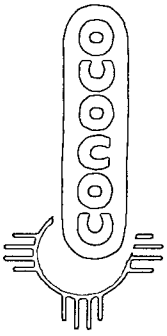
Maljamar Gas Plant Groundwater Investigation

April 10, 2002

New Mexico Oil Conservation
Division

Santa Fe, New Mexico

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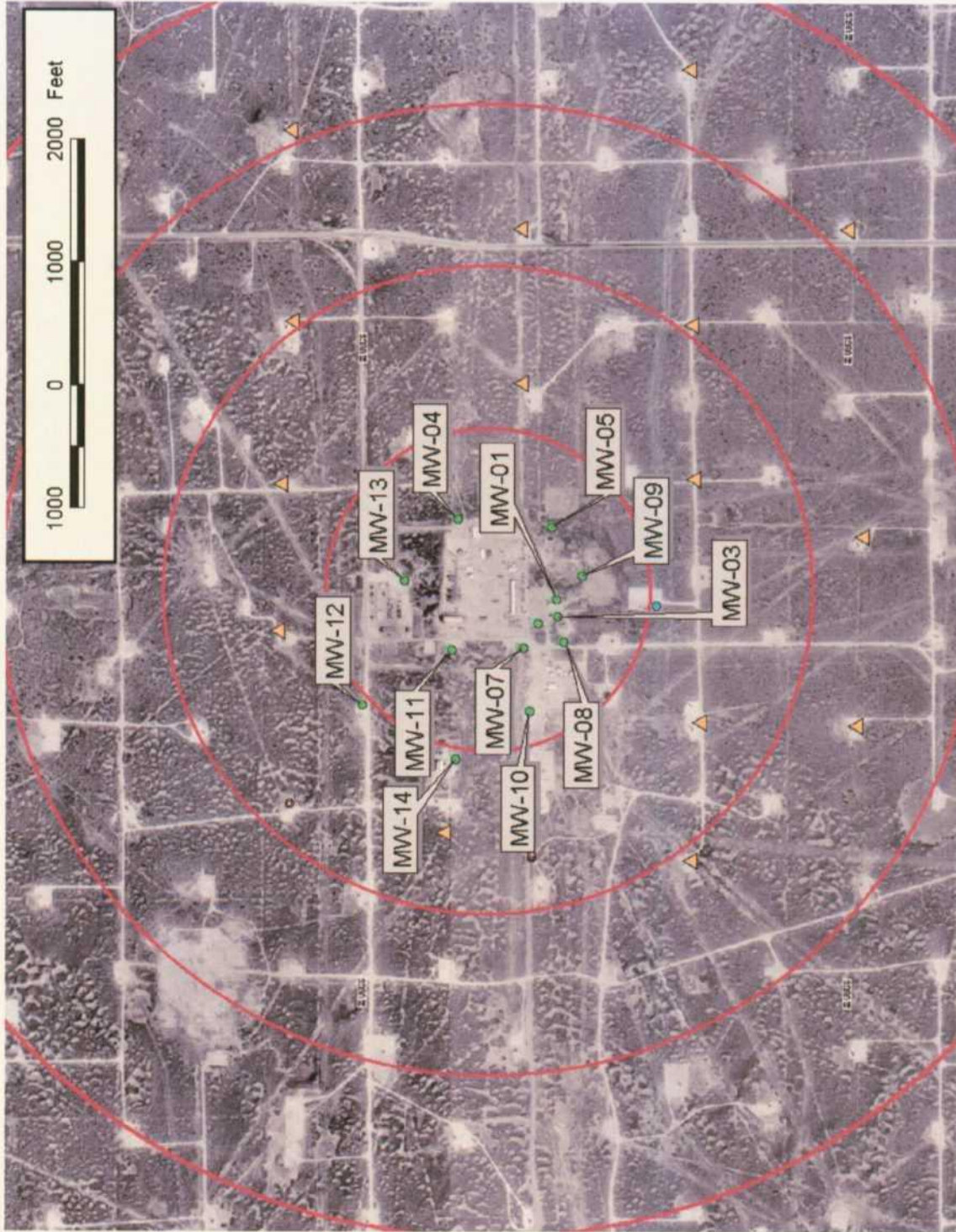
Maljamar

- **History**

- February 13, 2000 – 15 bbl Condensate Release at the Skimmer Basin
- April 27-28, 2000 Field Investigation (6 soil borings)
- June 21-22 Field Investigation (6 soil borings and MW-1)
1)
- September 28-29, 2000 Field Investigation (MW-2 and MW-3, limited trenching at skimmer basin)
- May 21-24, 2001 (MW-4, 5, 7, 8, and 9)
- December 3-5, 2001 (MW-10, 11, 12, and 13)
- Initiated Plume Containment – February 6, 2002
- March 20-22, 2002 (MW-14, and borings B1C & B2C)



CONOCO Maljamar Natural Gas Plant Maljamar, New Mexico.

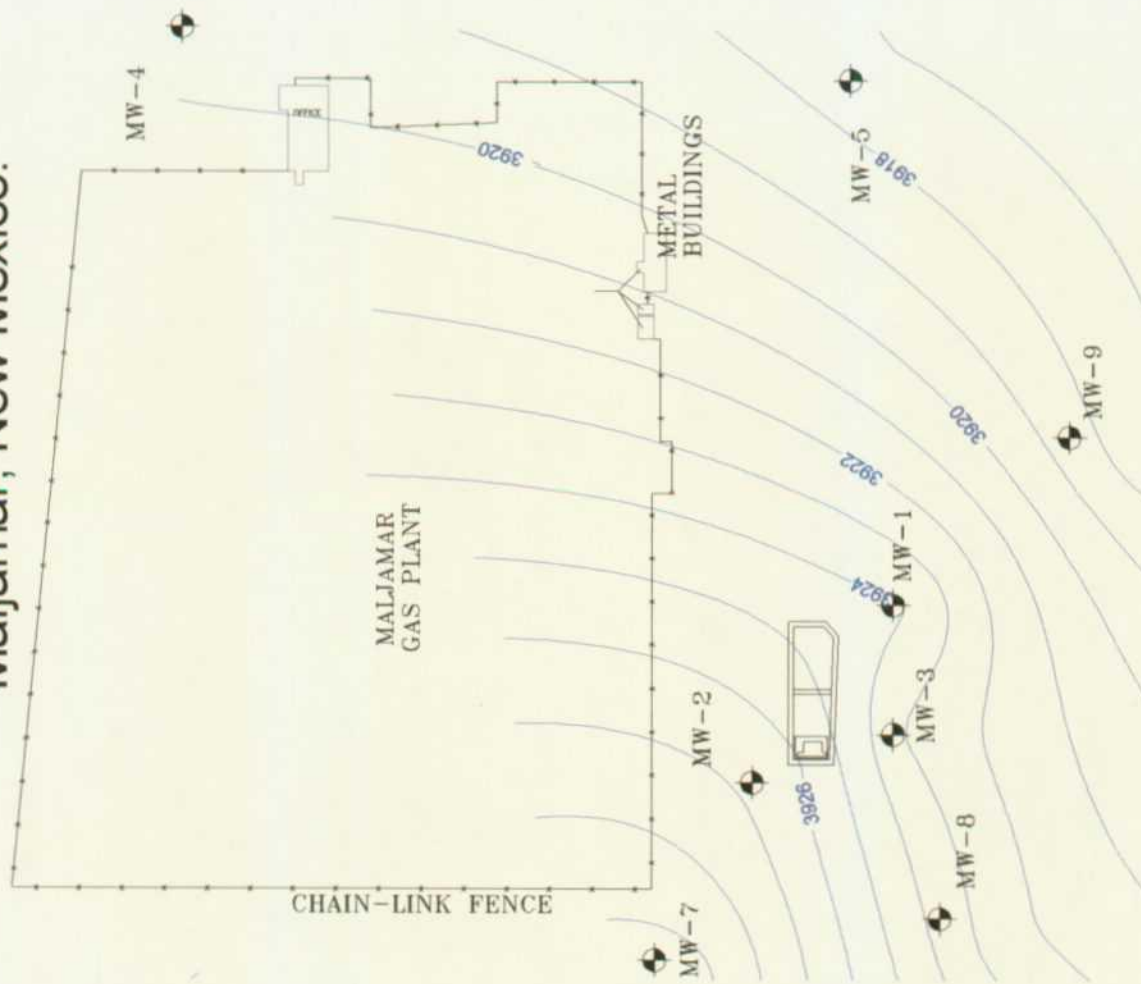


Site Map





CONOCO Maljamar Natural Gas Plant Maljamar, New Mexico.



0 ft 50

3930

Water Level Isopleth



MW-12

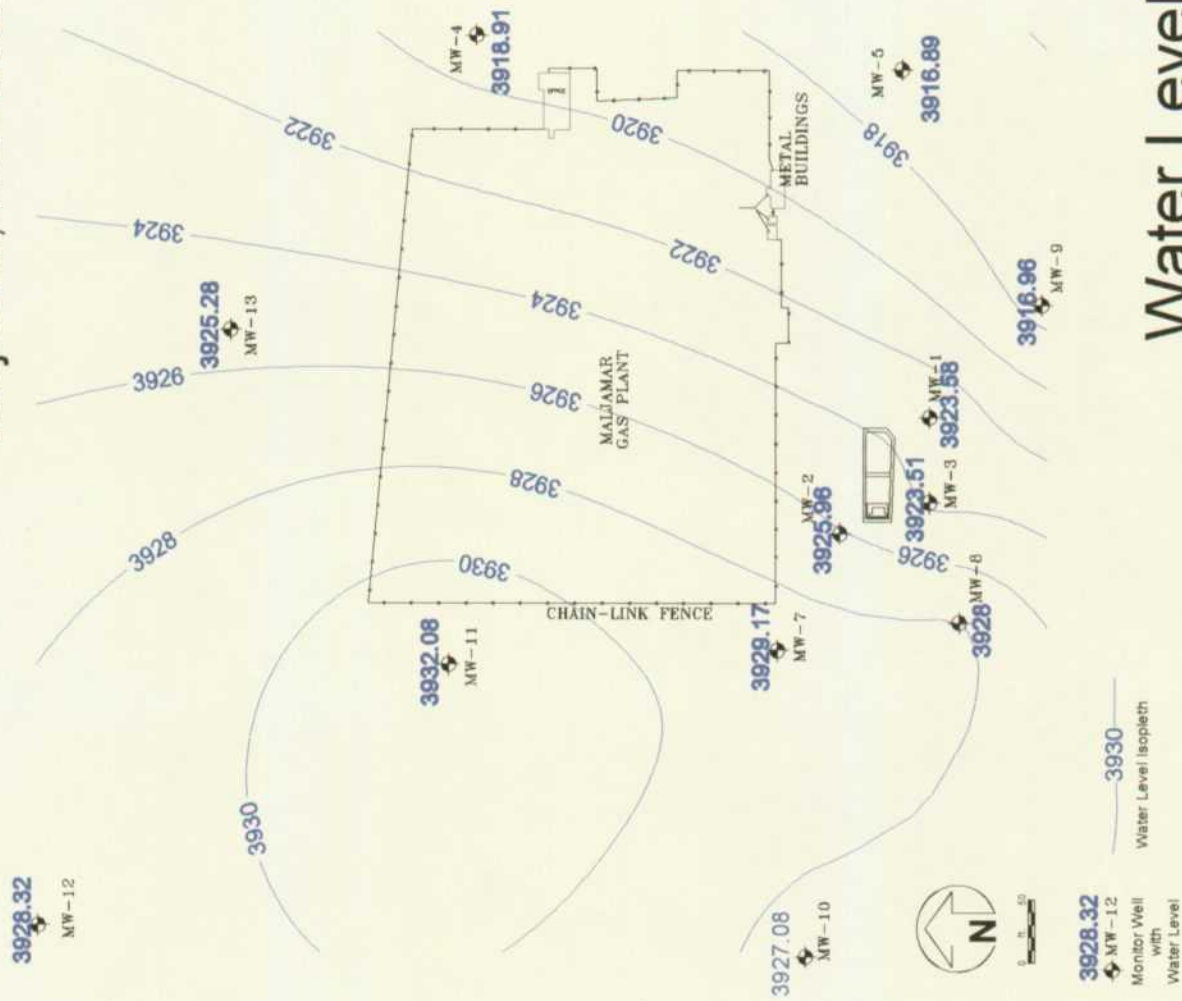
Monitor Well

Water Levels Using Data From May 25, 2001

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CONOCO Maljamar Natural Gas Plant Maljamar, New Mexico.



Water Levels Using Data
From December 7, 2001

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CONOCO Maljamar Natural Gas Plant Maljamar, New Mexico.



Former flare
pit

Water Levels Using Data
From March 25, 2002





ANALYTICAL RESULTS FROM DECEMBER 2001 SAMPLING EVENT
MALJAMAR GAS PLANT
LEA COUNTY, NEW MEXICO

Analytical Test Results - Groundwater

Well	Date	Benzene (µg/L)	Total Xylenes (µg/L)	Ethyl benzene (µg/L)	Toluene (µg/L)	Napthalene (µg/L)	TDS (mg/L)	Chloride (mg/L)	Arsenic (mg/L)	Lead (mg/L)	Barium (mg/L)	Chromium (mg/L)	Sodium (mg/L)	Sulfate (mg/L)
MW-1	12/05/2001	2400	36	76	93	ND	931	233	0.130	0.0086	1.10	0.018	107.0	20.3
MW-2	12/04/2001	33000E / 36000D	ND	440	10000 / 9500	ND	1310	328	0.024	0.011	1.5	0.017	62.8	33.5
MW-3	NS													
MW-4	12/05/2001	850E / 960D	74.7	150 390E / 480D	37	16 / 13	1080	448	0.066	ND	3.7	ND	84.5	ND
MW-5	12/05/2001	140	370		88	21F / 21	1180	312.0	0.055	ND	2.0	ND	171	14.3
MW-7	NS													
MW-8	12/05/2001	21000	ND	ND	1900	ND	922	332.0	0.049	ND	1.6	ND	46.9	22.2
MW-9	12/04/2001	460	22.4	31	260	12 / ND	748	151	0.160	0.0042	3.70	0.0089	166.0	19.7
MW-10	12/06/2001	73	6.6	6.7	35	ND	10,400	5,680	0.019	0.0160	0.46	0.024	1460	462.0
MW-11	12/06/2001	160	4.2	4.2	21	ND	1,780	837	0.011	0.0059	0.34	0.010	86.0	78.4
MW-11Dup	12/06/2001	190	ND	ND	ND	ND	1,600	844	ND	0.0063	0.33	0.017	91.4	84.0
MW-12	12/06/2001	ND	ND	ND	ND	ND	100,000	59,500	ND	ND	ND	ND	10600	1490
MW-13	12/06/2001	76	8.1	8.4	40	ND	940	208	0.042	0.0460	0.50	0.061	67.5	227.0
Action Levels*		10	620	750	750	10			0.1	0.05	1.0	0.05		

*NM Water Quality Control Commission

ND - not detected

NS - not sampled because of presence of free product

D - Result was obtained from the analysis of a dilution

E - Estimated result. Result concentration exceeds the calibration range

F - Reported value estimated due to interference. Co-elution with nontarget analyte

Napthalene reported from VOC List / SVOC List if detected

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Maljamar Analyses Summary

SPL Product Analyses				
ANALYTE	MW-3	MW-7	MCA-116	Lact Unit
Paraffin Wt%	29.232	25.303	38.739	40.958
Isoparaffin Wt%	28.946	29.34	21.393	22.059
Naphthenics Wt%	31.839	33.103	18.105	17.34
Aromatics Wt%	5.298	8.908	17.169	15.302
Olefins Wt%	1.995	1.985	1.559	1.482
Unknown Wt%	2.69	1.361	2.511	2.301
Research Octane	67.89	68.16	80.77	81.21
N-Hexane Wt%	5.382	6.624	2.5	2.646
Benzene Wt%	0.282	1.348	0.954	0.986
Ethylbenzene Wt%	0.647	0.967	1.815	1.142
Toluene Wt%	0.041	2.68	3.059	2.874
Total Xylenes Wt%	0.755	2.166	2.241	2.06
Specific Gravity @ 60oF	0.7587	0.7388	0.8319	0.8314
API Gravity @ 60oF	55	60	38.58	38.68
Color	Straw	Medium Straw	Dark Straw	Dark Straw
Odor	Condensate	Condensate	Crude	Crude
Carbon Range	C4-C20	C3-C25	C2-C25+	C2-C25+
Major Range	C6-C9	C5-C9	C5-C11	C5-C11
Napthalene Wt%	0.024	0.01	0.202	0.183
Mobile Analytical Product Analyses				
ANALYTE	MW-3	MW-7	MCA-116	Lact Unit
Carbon Range	C4-C16	C4-C12	C4-C35+	C4-C35+
Specific Gravity @ 60oF	0.7587	0.7436	0.8423	0.8309
API Gravity @ 60oF	55	58	36.5	38.8



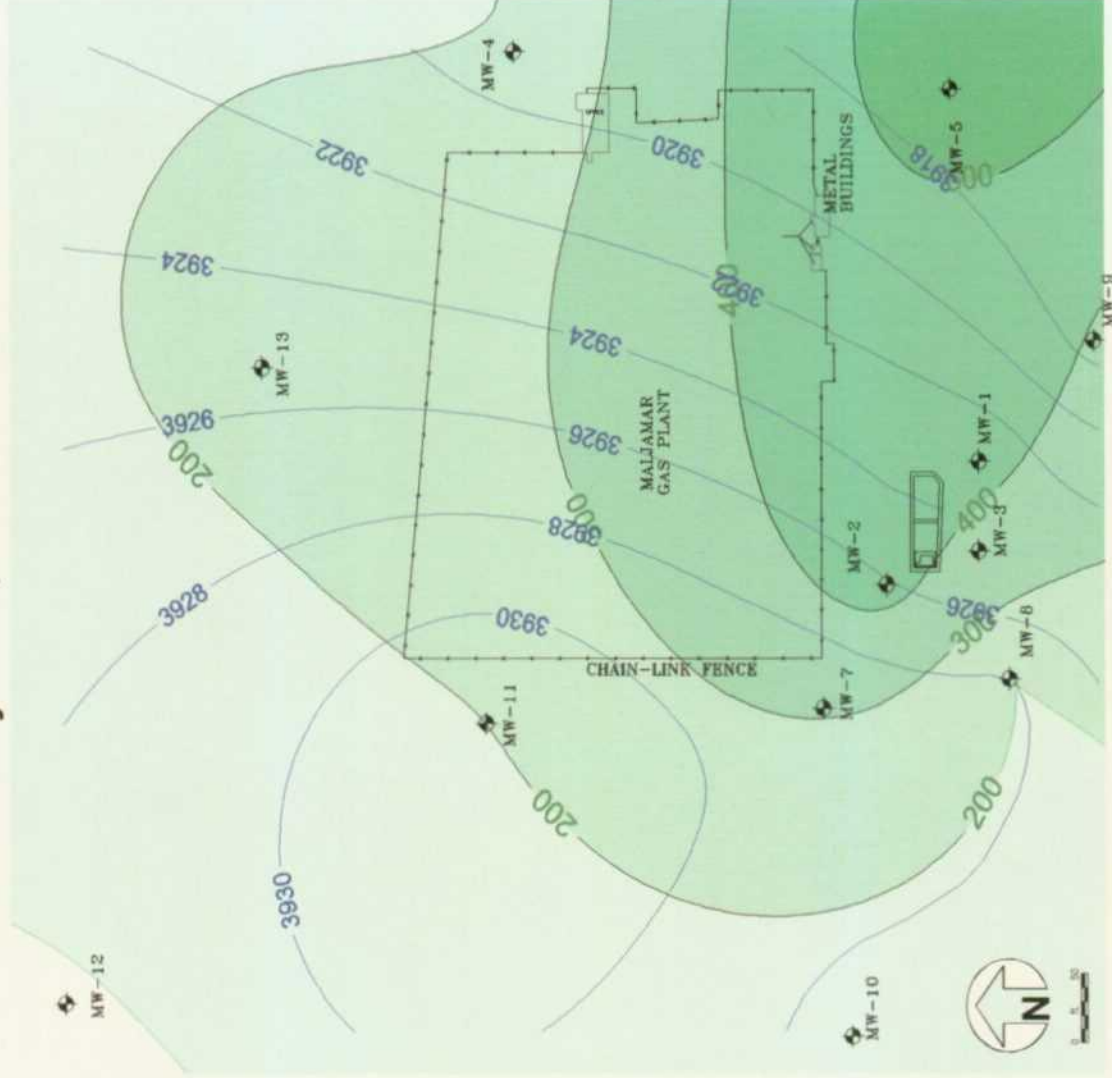
Maljamar Groundwater Analyses Summary

STL Water Analyses

ANALYTE	MW-12	MCA-67	Water Station	Water Well
Calcium (mg/L)	5830	2220	2100	191
Magnesium (mg/L)	1550	748	789	61.7
Sodium (mg/L)	10600	25500	26100	146
Chloride (mg/L)	59500	51600	53900	525
Sulfate (mg/L)	1490	3340	3490	182
Bicarbonate Alkalinity (mg/L)	81.9	1030	983	223
Benzene (ug/L)	<1	5800	6000	<1
Ethylbenzene (ug/L)	<1	660	700	2.7
Toluene (ug/L)	<1	3700	5200	<1
Total Xylenes (ug/L)	<1.5	1590	1870	1.1



CONOCO Maljamar Natural Gas Plant Maljamar, New Mexico.



Bicarbonate Concentration





CONOCO Maljamar Natural Gas Plant Maljamar, New Mexico.



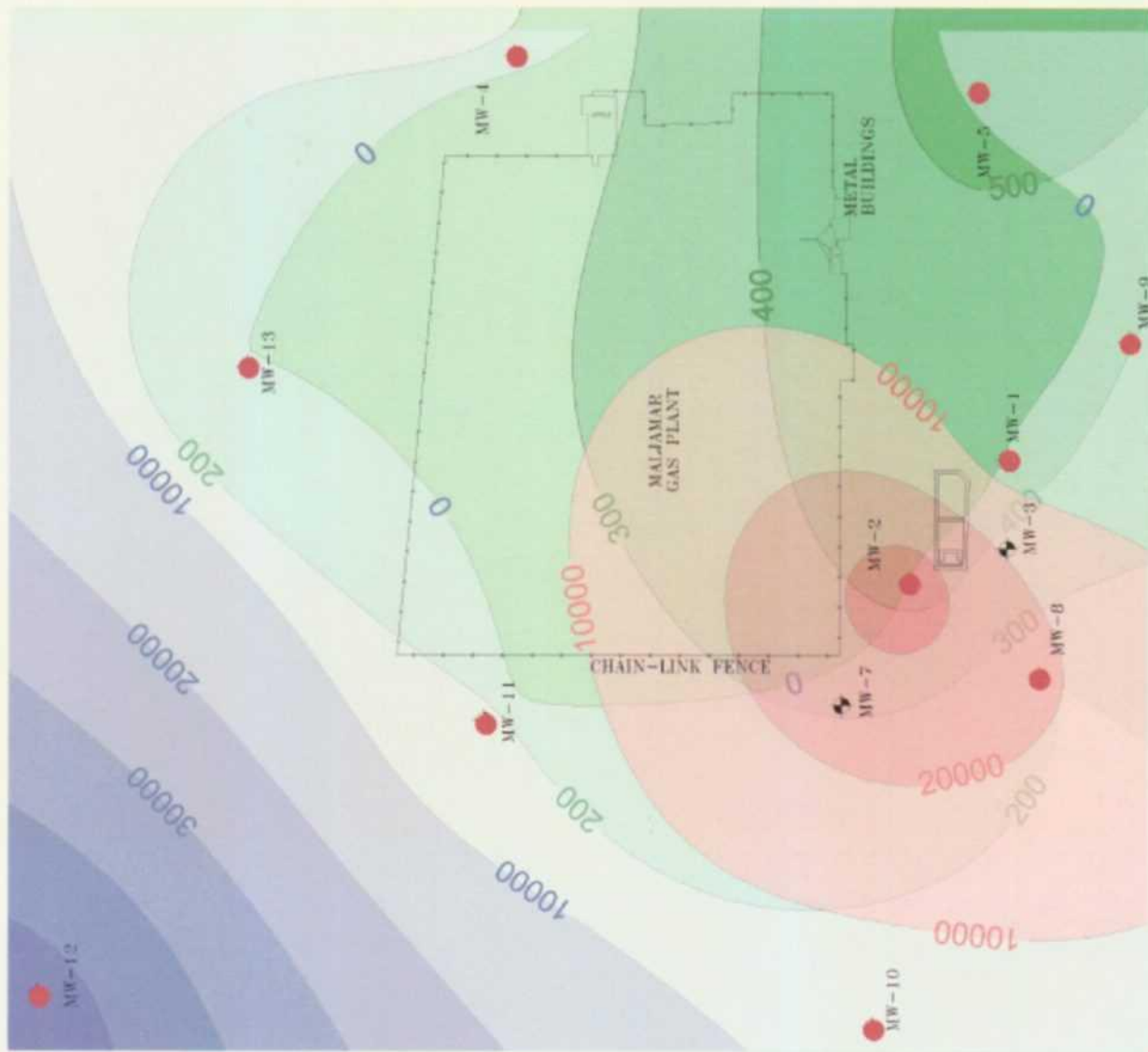
Chloride Concentration





CONOCO Maljamar
Natural Gas Plant
Maljamar, New Mexico.

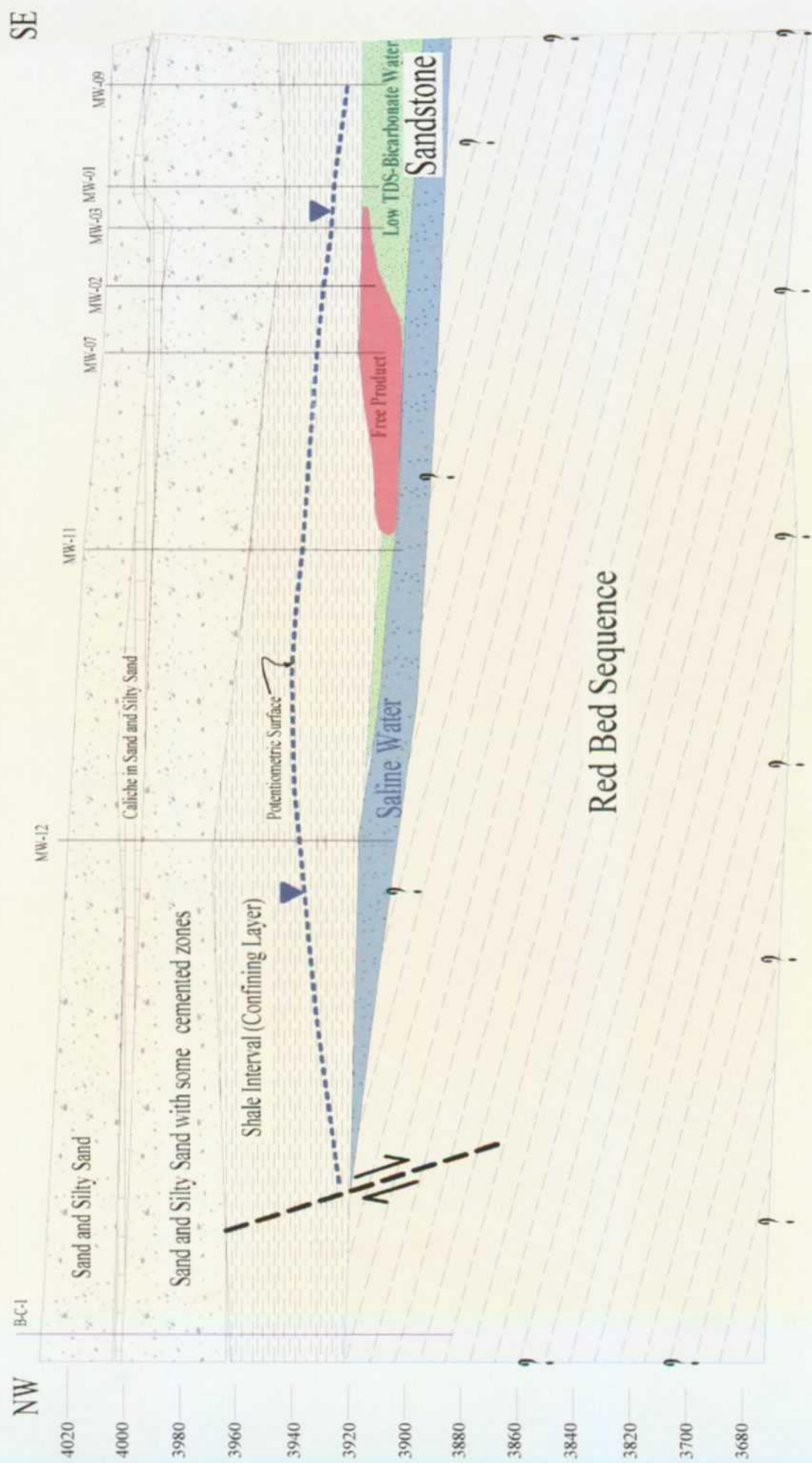
- Well with Concentration Data
- Red/Pink Isopleths = Benzene Concentrations (ug/L)
- Green Isopleths = Bicarbonate Concentrations (mg/L)
- Blue Isopleths = Chloride Concentrations (mg/L)



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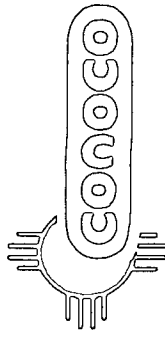


CONOCO Maljamar Natural Gas Plant Maljamar, New Mexico.



Conceptual Model

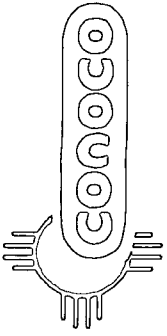




Maljamar

- **Status**

- State Notified of Presence of Free Product (6/00) & Elevated Chlorides (12/01)
- Product Samples From MW-7 and MW-3 Collected February 13, 2002 and Submitted For Laboratory Analyses (SPL & Mobile Labs)
- Product Recovery Initiated 2/02 - Bailing
- No Historic Oil/Gas Wells Were Identified In Immediate Area of Plant
- Free Product Migration, MW-7 (5/01), MW-3 (12/01), and MW-5 (3/02)
- Data Assessment Underway

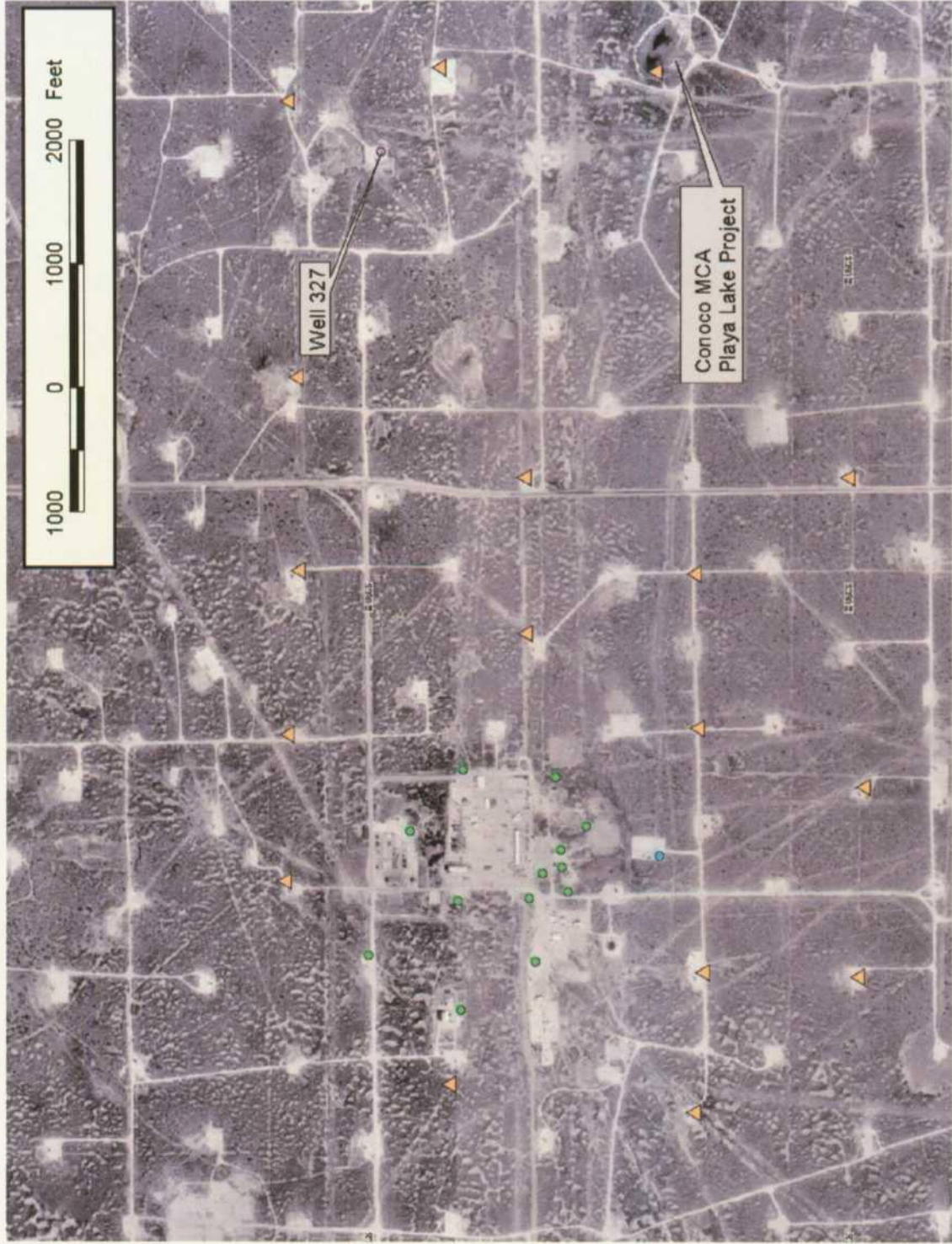


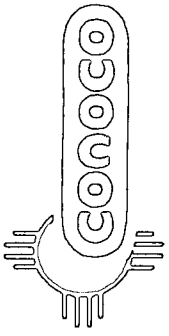
Maljamar

- Path Forward
 - Additional Monitor Wells to Define and Confirm Dissolved Phase Hydrocarbon, Elevated Chloride, & Extent of Confined Aquifer
 - Determine Overall Thickness and Geochemical Stratification of Saturated Horizon
 - Determine Downgradient Extent of Plume
 - United Approach with Oil Conservation Division To Approach BLM Regarding Land Clearances
 - Purpose of United Approach is to Expedite Investigatory Work



Maljamar Proposed Wells

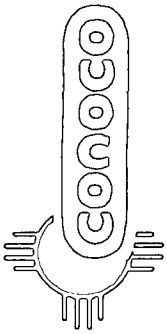




A Remediation Approach For Groundwater At Apex Compressor Station, Hobbs, New Mexico

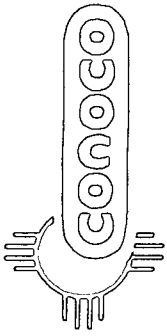
Calcium Nitrate Amendment Technology

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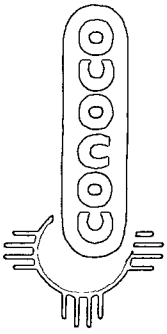
Key Constraints

- Caliche layers at 25-28 feet, 48-50 feet, and 62-65 feet.
- Water first encountered below caliche at 62-65 feet. Groundwater potentiometric surface at 60 feet.
- Highest groundwater BTEX concentrations on the order of 16 ppm.
- Area of the plume with benzene greater than 10 ppb = 80,000 sq. feet.
- No use of groundwater in the vicinity.
- Hydrocarbon source is uncertain (condensate tank? produced water pond?) but not active.
- Original investigation found little hydrocarbon in soil.
- Subsequent investigations found moderate levels of organic constituents in soils at upgradient locations. Organic constituents were not detected in groundwater at these locations.



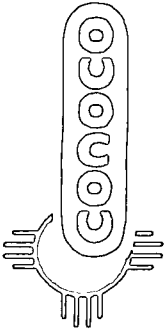
Implications

- Caliche layers may be aquitards/aquiludes and also may complicate movement of hydrocarbons to groundwater thereby complicating remediation.
- May not have vadose zone source characterized, so there is a possibility that organic material could bleed into groundwater for an unknown amount of time causing continued contaminant release and remediation efforts to fail.
- Vadose zone source remediation is difficult or impossible by traditional dig and haul due to caliche layers and depths of up to 60 feet.
- Pump and treat technology for groundwater requires long timeframe.
- SVE/Air Sparge may be problematic due to caliche layers.



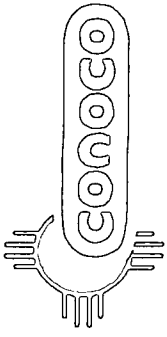
Remediation Options

- Monitored Natural Attenuation
 - Risk Assessment
 - Long term (15-20 years)
 - Analytical/labor costs high
 - Acceptance by regulators
- In-situ bioremediation
 - Regenis magnesium peroxide socks
 - Calcium nitrate bioremediation



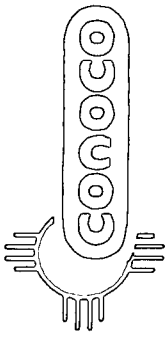
Regenis Magnesium Peroxide Socks (ORC)

- Won't work for vadose zone
- Remediation 2-3 years
- 7-12 four- to six-inch wells
- Chemical costs
- Analytical/labor costs
- Has been used - easier to approve



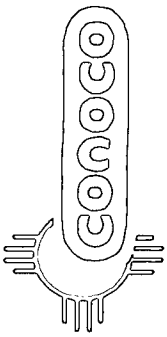
Calcium Nitrate Bioremediation

- Remediation in 1-2 years
- Might work for vadose zone
- 7-12 two-inch wells
- Chemical cost
- Analytical/labor costs
- Has not been used –regulatory approval?
- Use Regenix HRC barrier to ensure nitrate does not migrate



Calcium Nitrate Theory

- Nitrate's affinity for electrons is only slightly less than that of oxygen and it serves as a substitute for oxygen in the bioremediation process.
- The solubility of calcium nitrate is more than 8 lbs per gallon of cold water. This is equivalent to approximately 2,100 mg/L nitrate in solution.
- Oxygen solubility only about 7 mg/L.
- The primary reason that nitrate is not routinely used to remediate organic contamination, even though the nitrate is used up in the remediation process, is that it is itself an EPA listed contaminant



APPLICATION TO APEX GROUNDWATER

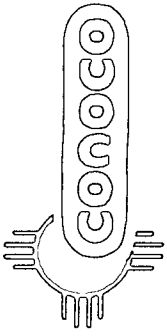
- Two inch wells can be effectively used for injection, in contrast to four or six inch wells required by Regenix socks (in order to bring treatment times down to a 2-3 year time frame).
- Site data indicates consumption of both nitrate and organic constituents by microbial activity.
- Maxim proposes the installation of six to nine two-inch injection wells in the highest concentrations of the plume.
- Injection of 4 to 10 gallons of calcium nitrate solution in each well, depending on location within the plume. *one film*
- Maxim proposes to install four two-inch wells at the downgradient edge of the plume and inject them with Regenix Hydrogen Release Compound (HRC®).



Chemical Evidence

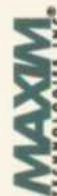
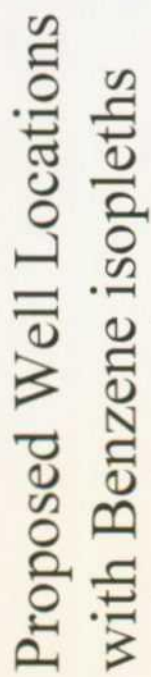
Results of laboratory analysis of groundwater samples for general chemistry, total dissolved solids, and RCRA metals, Apex Compressor Station, west of Hobbs, New Mexico. All concentrations reported in parts per million (ppm). Duplicate sample

	MMV-1	MMV-1 (Dup)	MMV-2	MMV-3	MMV-4	MMV-5	MMV-6	MMV-7	MMV-8	MMV-9	NM GW Standards
Arsenic	0.067	0.067	nd	0.075	0.012	nd	nd	0.026	0.026	0.017	0.1
Barium	2.5	2.5	0.21	4.5	0.2	nd	nd	0.24	0.8	0.32	1
Calcium	276	296	178	193	262	389	271	357	642	449	
Cadmium	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.01
Chromium	0.0054	0.0057	0.007	nd	0.01	0.014	nd	0.013	0.04	0.022	0.05
Magnesium	86.3	86	16.4	77.6	14.7	20.5	29.2	55.5	42.7	20.5	
Selenium	nd	nd	nd	nd	nd	nd	nd	nd	0.0059	nd	0.05
Sodium	200	203	38.7	192	36.8	66.6	107	232	38.8	37	
Lead	nd	nd	nd	nd	nd	nd	nd	nd	0.0058	0.0066	0.05
TDS	1430	1400	542	1120	486	597	1150	1530	440	400	1000
Chloride	448	451	23.8	209	20.2	43.3	170	249	31.4	24.6	250
Sulfate	1.5	1.6	49.7	nd	66.7	85.4	178	340	87.4	70.2	
Nitrate	nd	nd	2.4	nd	2.1	2.2	1.6	nd	2.9	2.6	100
Total Alkalinity	577	575	310	729	262	285	486	511	161	161	



Chemical Evidence

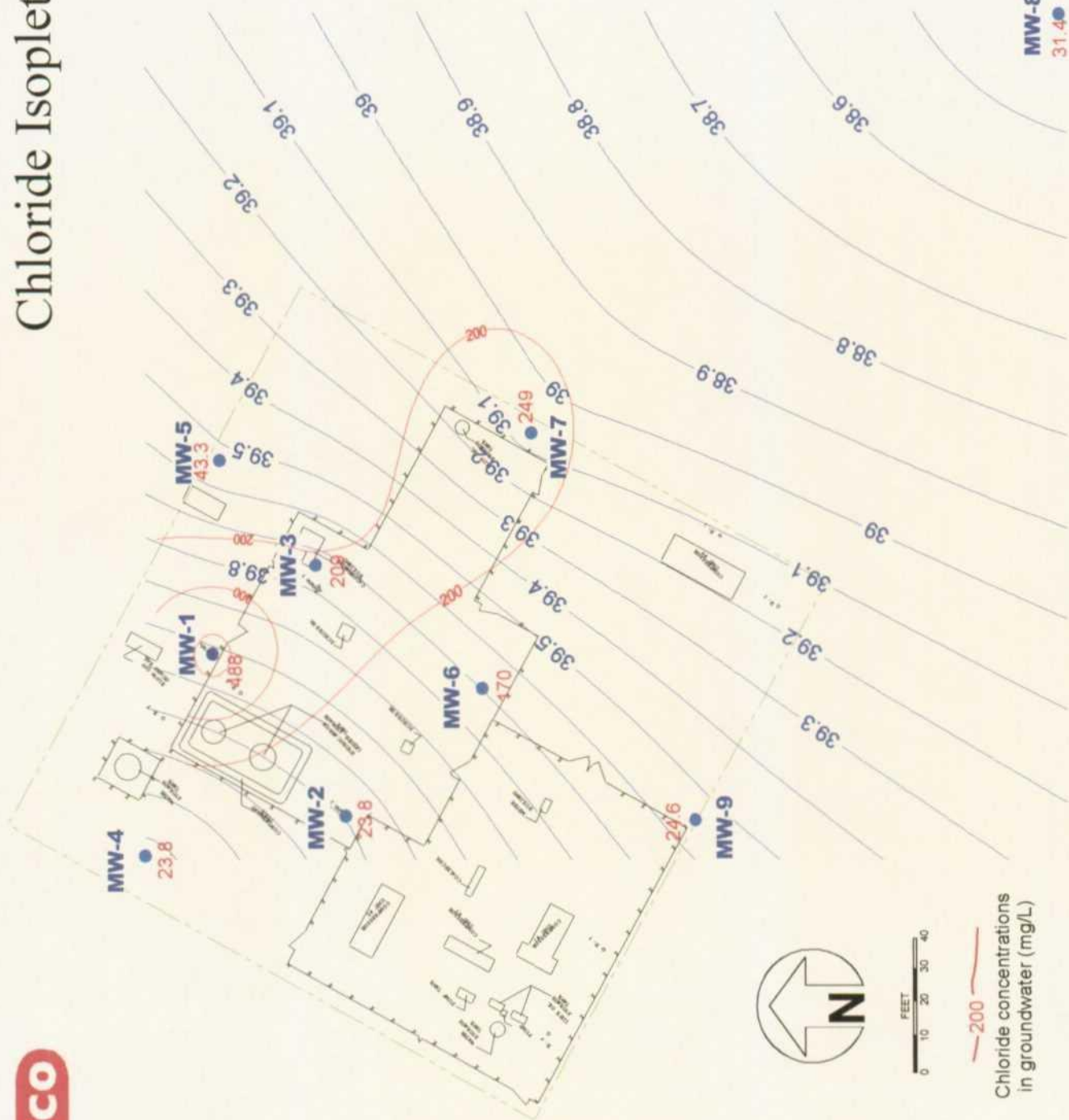
- Chloride = Indicator of impact. Background 20-40 mg/L, Plume 200-400 mg/L.
- Nitrate = Indicator of Biodegradation. Background 2-3 mg/L, Plume mostly gone.
- Alkalinity = Indicator of Biodegradation. Background 100-300 mg/L, Plume 500-700 mg/L. Organic $\rightarrow \text{CO}_2 \rightarrow \text{HCO}_3^-$
- Sulfate = Indicator of Biodegradation. Background 50-90 mg/L, Main plume mostly gone. Leading edge of plume = unstable system = sulfate dissolution 200-300 mg/L.
- Barium: $\text{BaSO}_4 \rightarrow \text{Ba}^{2+} + \text{SO}_4^{2-}$ removal of sulfate by biodegradation causes BaSO_4 dissolution, barium in solution = 2.5-4.5 mg/L. A little sulfate in solution = barium gone. Barium is removed from solution by precipitation of insoluble BaSO_4 .



⑧ MWs converge
from all treatment wells

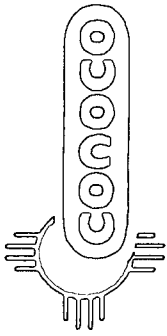


Chloride Isopleths



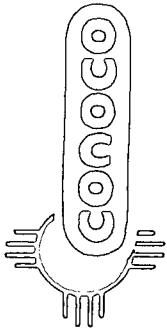
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Chloride concentrations
in groundwater (mg/L)



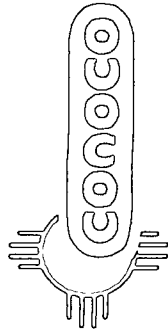
Reed A Site Site Investigation

April 10, 2002
New Mexico Oil Conservation
Division
Santa Fe, New Mexico



Reed A Site History

- Maxim first on site in March, 2001
- Noted two impact areas
 - North area appeared to be decommissioned tank battery
 - South area appeared to be vestigial pit
 - Excavation with standing water in South area
- Prepared PEPA in May, 2001
- Developed work plan in March, 2001

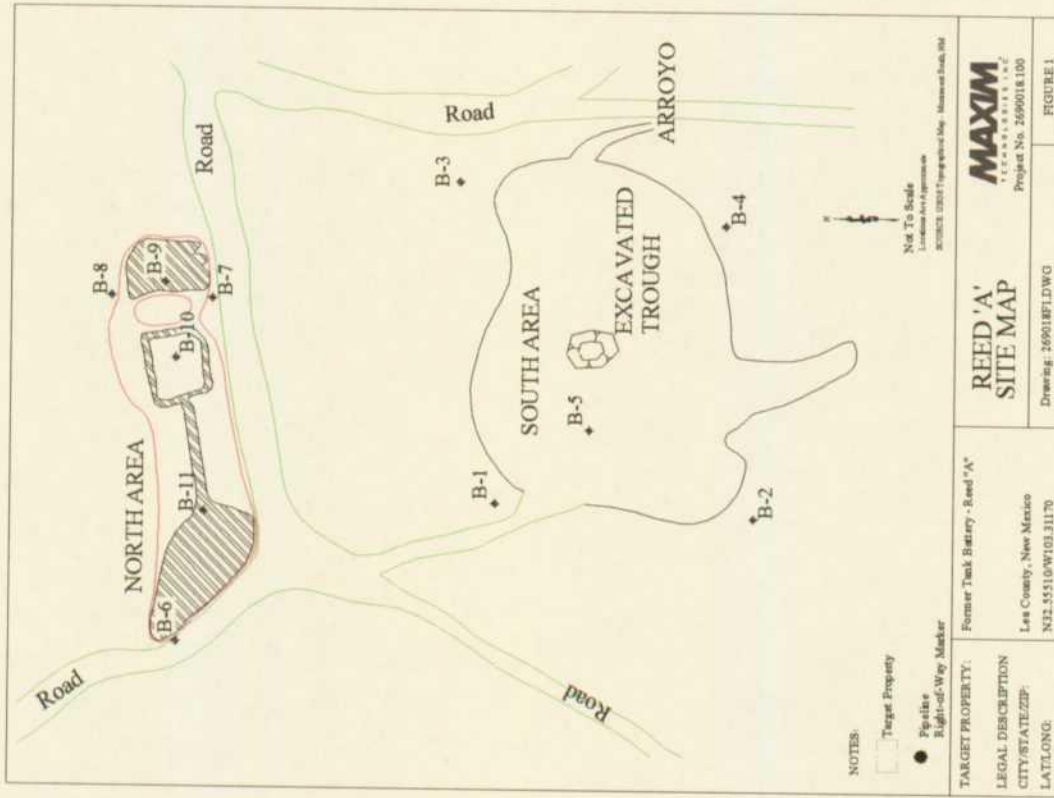


Reed A Site Field Work

- Commenced in March, 2002
- Drilled 11 shallow borings (max. 46' b.g.s)
 - 5 around and inside South area footprint
 - 6 around and inside North area footprint
- Dug 15 shallow backhoe pits in South area
- Observed 4 pits for water infiltration
 - No infiltration after approximately 24 hours
- Gathered soil samples (GRO, DRO, and CI)
- Gathered SPLP composites

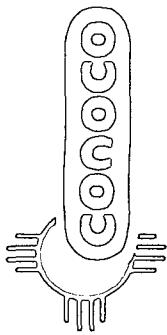


Site Map



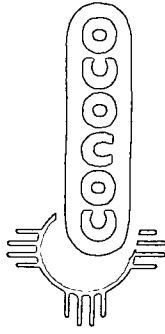


MAXIM



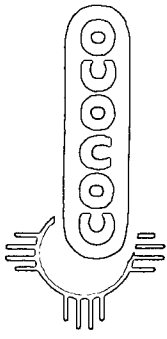
SPLP Sample Results

Sample ID	Date Sampled	Composite Collection Location	Results Reported in Parts Per Million (mg/kg)								
			EPA Method MCAWW 300.0A	EPA Method SW-846, 8260B					EPA Method SW-846, 8015B		
			Chloride	Benzene	Ethylbenzene	Toluene	Xylenes	Total BTEX	TPH-GRO	TPH-DRO	Total TPH
SPLP 1	03/12/02	Depression Area	8.9	<0.0010	<0.0010	<0.0010	<0.0020	<LDL	<0.100	1.1	1.1
SPLP 2	03/13/02	Former Tank Battery Area	<1.0	<0.0010	<0.0010	<0.0010	<0.0020	<LDL	<0.100	0.31	0.31
Applicable OCD Cleanup Levels			NE	10	NE	NE	NE	50	NE	NE	100
SPLP	= Synthetic precipitation leaching procedure										
TPH-GRO	= Total petroleum hydrocarbons - gasoline range organics										
TPH-DRO	= Total petroleum hydrocarbons - diesel range organics										
BTEX	= Benzene, toluene, ethylbenzene, and xylenes										
<LDL	= Less than laboratory detection limits										
NE	= Not established by OCD										
OCD	= Oil and Conservation Department										
EPA	= Environmental Protection Agency										
SPLP 1	= Composite sample obtained from excavations within natural depression area										
SPLP 2	= Composite sample obtained from borings located in former tank battery area										



Reed A Site Status

- Data assessment underway
- Preliminary results indicate:
 - South Area
 - Groundwater is deeper than 46 feet b.g.s.
 - Impacts noted to approximately 44 feet b.g.s.
 - North Area
 - No subsurface lateral migration noted
 - 60% of site impacted to approximately 12-15 feet b.g.s.
 - 40% of site impacted at surface (less than 3 feet b.g.s.)



Reed A Site Path Forward

- Develop work plan to dig and haul impacted soil from site.
- Identify site to receive impacted soil
- Identify contractor to remove and haul soil