



# **PETROLEUM DEVELOPMENT CORPORATION**

## **E&P Waste Management Plan** **DJ Basin Operations**

January 24, 2012

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- A: Land Application Sites
- B: Form 4 – Sundry Notices for Drill Cuttings Sites
- C: High Sierra Water Services, LLC Disposal Well Sites

## REGULATORY FRAMEWORK - COGCC RULES

As defined in the 100 Series rules, Exploration and Production Waste (E&P Waste) shall mean those wastes associated with operations to locate or remove oil or gas from the ground or to remove impurities from such substances and which are uniquely associated with and intrinsic to oil and gas exploration, development, or production operations that are exempt from regulation under Subtitle C of the Resource Conservation and Recovery Act (RCRA), 42 USC Sections 6921, et seq. For natural gas, primary field operations include those production-related activities at or near the wellhead and at the gas plant (regardless of whether or not the gas plant is at or near the wellhead), but prior to transport of the natural gas from the gas plant to market. In addition, uniquely associated wastes derived from the production stream along the gas plant feeder pipelines are considered E&P wastes, even if a change of custody in the natural gas has occurred between the wellhead and the gas plant. In addition, wastes uniquely associated with the operations to recover natural gas from underground storage fields are considered to be E&P waste.

The 900 Series rules establish the permitting, construction, operating and closure requirements for pits, methods of E&P waste management, procedures for spill/release response and reporting, and sampling and analysis for remediation activities. The 900 Series rules are applicable only to E&P waste, as defined in § 34-60-103(4.5), C.R.S., or other solid waste where the Colorado Department of Public Health And Environment has allowed remediation and oversight by the Commission.

Furthermore, Rule 907. sets forth the requirements for the Management of E&P Waste:

### 907.a. General requirements

(1) Operator obligations. Operators shall ensure that E&P waste is properly stored, handled, transported, treated, recycled, or disposed to prevent threatened or actual significant adverse environmental impacts to air, water, soil or biological resources or to the extent necessary to ensure compliance with the concentration levels in Table 910-1, with consideration to WQCC ground water standards and classifications.

(2) E&P waste management activities shall be conducted, and facilities constructed and operated, to protect the waters of the state from significant adverse environmental impacts from E&P waste, except as permitted by applicable laws and regulations.

(3) Reuse and recycling. To encourage and promote waste minimization, operators may propose plans for managing E&P waste through beneficial use, reuse, and recycling by submitting a written management plan to the Director for approval on a Sundry Notice, Form 4, if applicable. Such plans shall describe, at a minimum, the type(s) of waste, the proposed use of the waste, method of waste treatment, product quality assurance, and shall include a copy of any certification or authorization that may be required by other laws and regulations. The Director may require additional information.

## **WATER-BASED BENTONITIC DRILLING FLUIDS & ASSOCIATED DRILL CUTTINGS**

### **BACKGROUND**

To consider the transport and handling of E&P waste material off-site, the first consideration is compliance under the current Colorado Oil and Gas Conservation Commission (COGCC) Rules and Regulations. Rule 907.d.(3)B. sets forth the applicability, requirements and operator obligations for the land application of water-based bentonitic drilling fluids. Rule 907.d.(3)B.v. states that prior COGCC approval is not required if the drilling fluids are utilized as a soil amendment. However, Rule 907.d. does not address associated drill cuttings. As a result, Petroleum Development Corporation (PDC) has developed this E&P Waste Management Plan in accordance with Rule 907.a.(3) to encourage and promote waste minimization through beneficial use and reuse of water-based bentonitic drilling fluids and associated drill cuttings as a soil amendment.

The second consideration is whether the operation would be a Centralized E&P Waste Management Facility (CWMF) as defined in the COGCC Rules and Regulations. A facility is a CWMF if (1) it is used exclusively one owner or operator, or used by more than one operator under an operation agreement, *and* (2) is operatory for a period of greater than three (3) years; *and* (3) received for collection, treatment, temporary storage, and/or disposal of exempt E&P wastes from two or more production units or areas or from a set of commonly owned or operated leases. PDC's E&P Waste Management Plan for the land application of water-based bentonitic drilling mud and associated drill cuttings presented herein does not include more than one operator and anticipates operating each site for less than 3 years. Therefore, any individual drilling fluid or drill cuttings land application site will not qualify as a CWMF.

A table listing the land application sites with location and current status (Table 1) and a map showing the sites (Figure 1) is included as Attachment A. Should any new land application sites be utilized by PDC or if any of the current sites be de-commissioned, a revised E&P Waste Management Plan will be submitted accordingly.

### **ESTIMATED AMOUNT OF MATERIAL**

PDC estimates that each vertical well (surface hole and production hole) will generate approximately 250 cubic yards of drill cuttings. PDC estimates that each horizontal well (surface hole and production hole) will generate approximately 520 cubic yards of cuttings.

Currently, PDC has one (1) drilling rig operating in the Greater Wattenberg Area of the DJ Basin. Current and future drilling rigs are anticipated to have closed loop drilling systems. The most recent drilling schedule is for twenty-eight (28) horizontal wells to be drilled or spud by the end of 2012. However, changing economics or budgeting concerns may increase or decrease drilling activity.

#### LANDOWNER AGREEMENT FOR LAND APPLICATION SITES

As per Rule 907.d.(3).iii., written authorization is obtained from private surface owners prior to any land application of material. The agreement identifies the legal description of the land application site and the name of the well or wells and associated legal description of the drill site where the material was generated.

*Additionally, the agreement states that the "Owner acknowledges that the Colorado Oil and Gas Conservation Commission ("COGCC") has certain requirements for the disposal of water-based bentonitic drilling fluids (or drill cuttings if applicable) and that such requirements will be followed. Owner agrees to enhance biodegradation by disking, tilling, aerating, addition of nutrients, microbes, water, or other amendments to comply fully with the Rules and Regulations of the COGCC. Owner agrees to abide by the COGCC rules, as they may be amended, and discharges PDC from any and all claims arising from the land application of the drilling fluids."*

#### TRANSPORT AND HANDLING

Water-based bentonitic drilling fluids and associated drill cuttings will originate from PDC drilling operations only. PDC will transport the water-based bentonitic drill fluids to the land application sites by vacuum trucks. PDC will transport the drill cuttings to the land application sites by loading the material into 10-12 cubic yard dump trucks. Loads will be transported primarily during normal business hours. The drill cuttings material will not contain free liquids, thus the transportation will not impact local roads or users of the road.

Material will be unloaded from the trucks onto a pre-determined, designated location. In accordance with Rule 907.b.(2), information about the drilling fluid and/or drill cuttings E&P waste transportation will include:

- Name and location of the well(s) where the material was generated
- Volume of the material generated
- Name of material transporter
- Name and location of the land application site.

#### SAMPLING AND ANALYSIS OF LAND APPLICATION SITES

Water-based bentonitic drilling fluids and drill cuttings are an Exploration & Production (E&P) waste and as such, management must meet the requirements of Rule 907 of the COGCC Rules and Regulations. Rule 907.a.(1) indicates that the primary responsibility of the operator is to protect the environment and to comply with Table 910-1 which contains regulatory limits for metals, organics, and inorganics in soil and water.

Prior to any application of drilling fluids or drill cuttings at a land application site, PDC conducts baseline soil sampling and percolation tests. Each soil type at a particular site is identified through National Resource Conservation Service (NRCS) reports. Representative samples are collected from and percolation tests (falling hydrostatic head) performed on each NRCS soil type. Soil samples are composited vertically from ground surface to 18 inches using a hand auger. Standard analytical sampling protocols for soils will be followed; including collection procedures,

collection containers, holding times, and chain of custody. Each sample is analyzed for Electrical Conductivity (EC), Sodium Adsorption Ratio (SAR), pH, and total metals (excluding boron).

PDC will also sample each location on a periodic basis (typically annual) using the approximate sampling locations and percolation points as in the baseline program. Post-application analyses includes the same analyte list as in the baseline sampling program. Additionally, Total Petroleum Hydrocarbons (TPH) and BTEX constituents will be analyzed on all samples collected during post-application sampling events. Should post-application sampling results indicate conditions that exceed the Table 910-1 Concentration Levels, the COGCC will be notified to determine appropriate corrective action, if necessary.

#### RECLAMATION OF LAND APPLICATION SITES

Upon the decision to discontinue land application at a particular site, a final sampling and percolation event will be conducted to document closure conditions. Final analyses will include the same analyte list as in the baseline sampling program, as well as TPH and BTEX constituents. Should final sampling results indicate conditions that exceed the Table 910-1 Concentration Levels, the COGCC will be notified to determine appropriate corrective action, if necessary.

#### FORM 4 – SUNDRY NOTICE

As stated previously, Rule 907.d.(3) does not address the land application of associated drill cuttings. In accordance with Rule 907.a.(3), PDC has developed this E&P Waste Management Plan to also manage drill cuttings by land application as a soil amendment. As per COGCC requirements, a Form 4 – Sundry Notice will be submitted for consideration by the COGCC staff and will include a Site Location Map and a Soil Sample Location Map from the baseline sampling event of the proposed drill cuttings application site.

Currently, PDC is only utilizing the Frank Drill Cuttings Site (see Attachment B). The previously approved Spaur Drill Cuttings Site is being de-commissioned and appropriate documents will be submitted to the COGCC to close this facility. Should any new drill cuttings sites be approved, a revised E&P Waste Management Plan will be submitted accordingly.

#### **COMPLETION FLOW-BACK FLUIDS**

Flow-back fluids recovered during post-hydraulic fracturing operations are stored in temporary tanks (450 barrels or 500 barrels) on the location. As necessary, vacuum trucks with an approximate 80 barrel capacity will transport this fluid to the nearest commercial Class II injection well operated by High Sierra Water Services, LLC (see attached Table 2 and Figure2) for disposal. PDC will ensure that the completion flow-back fluids are properly transported, stored and handled to prevent adverse environmental impacts. PDC will maintain appropriate records of E&P waste that is transported to and from the facility in accordance with Rule 907.b.

## **PRODUCED WATER**

Produced water (predominately sodium-chloride in the DJ Basin) is a waste by-product associated with oil and gas production. This waste stream is segregated at the tank battery in the separator and stored in designated tanks or in buried or partially buried vessels. Vacuum trucks with an approximate 80 barrel capacity make scheduled runs to these tank batteries to collect produced water. The fluid will then be transported to the nearest commercial Class II injection well operated by High Sierra Water Services, LLC (see attached Table 2 and Figure 2) for disposal. PDC will ensure that the produced water is properly transported, stored and handled to prevent adverse environmental impacts. PDC will maintain appropriate records of E&P waste that is transported to and from the facility in accordance with Rule 907.b.

## **IMPACTED SOIL AND/OR GROUNDWATER**

As per Rule 906.a., spill/releases of E&P waste, including produced fluids, shall be controlled and contained immediately upon discovery. Impacts resulting from spill/releases shall be investigated and remediated as soon as practicable. Spill/releases shall be reported to the appropriate regulatory agencies in accordance with Rule 906.b. Impacted soils are typically removed and transported to a commercial landfill for disposal. Impacted groundwater or surface water that is recovered as a result of a spill is typically transported to the nearest commercial Class II injection well operated by High Sierra Water Services, LLC (see attached Table 2 and Figure2) for disposal.

## ATTACHMENT A

### TABLE 1 – LAND APPLICATION SITES FIGURE 1 – MAP OF LAND APPLICATION SITES

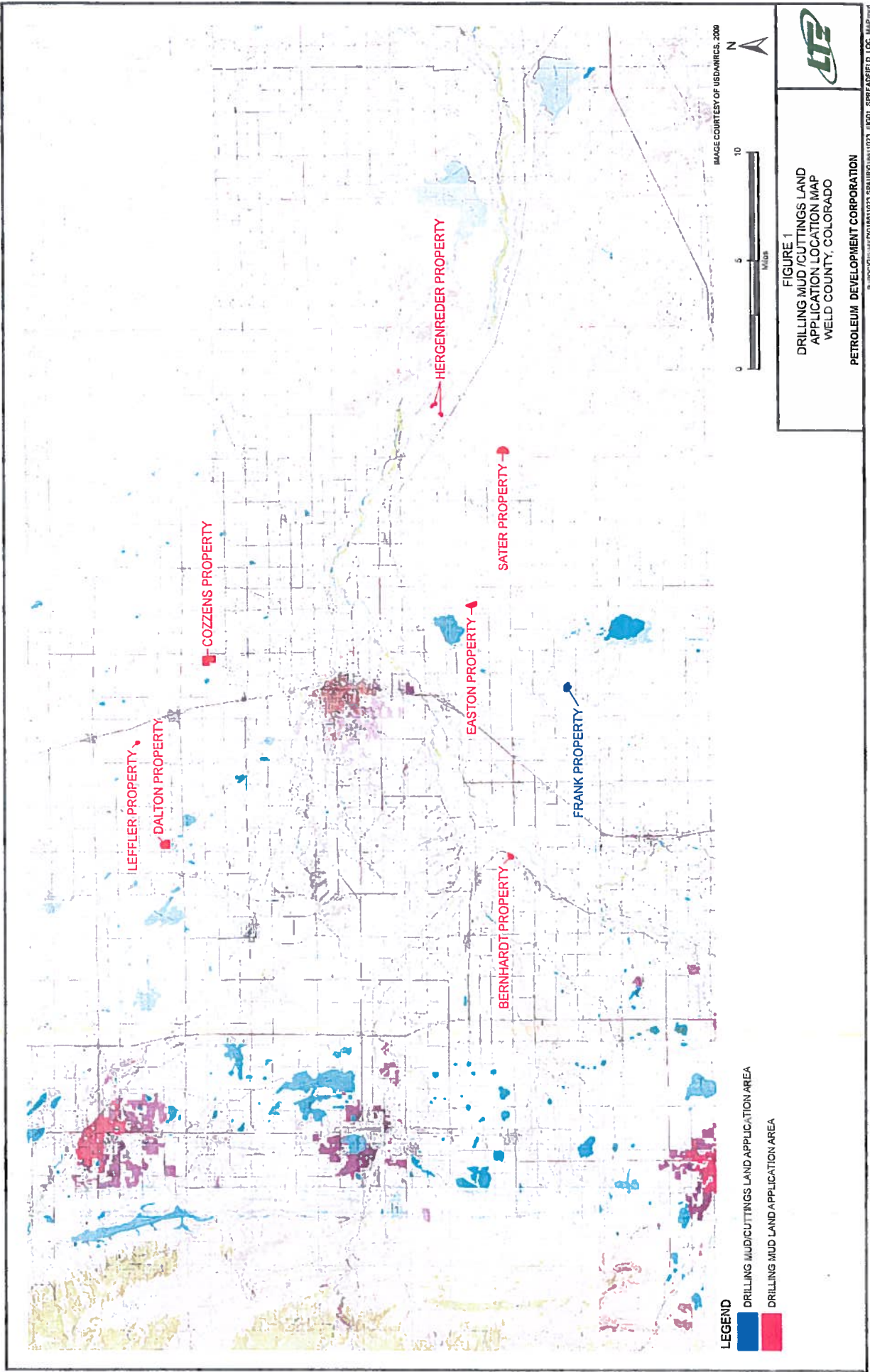


**TABLE 1****WATER-BASED BENTONITIC DRILLING FLUID & DRILL CUTTINGS LAND APPLICATION SITES****WELD COUNTY, COLORADO****PETROLEUM DEVELOPMENT CORPORATION**

	<b>Site Name</b>	<b>Section Township Range</b>	<b>Baseline Sampling Date</b>	<b>Current Status</b>
1	Easton Property	NW Section 12 T4N R65W	7/27/09	Drilling mud land application site.
2	Paul Sater Property	E/2 SW Section 18 T4N R63W	11/19/09	Drilling mud land application site.
3	Hergenreder Property	NESW Section 33 T5N R63W	12/18/09	Drilling mud land application site. Area is no longer active.
4	Dalton Property	NW Section 31 T7N R66W	2/24/10	Drilling mud land application site.
5	Cozzens Property	NWNE Section 9 T6N R65W	3/10/10	Drilling mud land application site. Area is no longer active.
6	Leffler Property	NENE Section 26 T7N R66W	3/12/10	Drilling mud land application site. Area is no longer active.
7	Bernhardt Property	SE Section 13 T4N R67W	7/8/10	Drilling mud land application site. Area is no longer active.
8	Frank Property	NESW Section 32 T4N R65W	10/14/10	Drill cuttings land application site.

- 1 - #425115
- 2 - #425116
- 3 - #425117
- 4 - #425118
- 5 - #425119
- 6 - #425120
- 7 - #425121
- 8 - #425112





## **ATTACHMENT B**

### **FORM 4 – SUNDRY NOTICES ASSOCIATED DRILL CUTTINGS SITES**

State of Colorado  
Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203 Phone: (303)894-2100 Fax: (303)894-2109



DOC # 1814962

SUNDRY NOTICE

Submit original plus one copy. This form is to be used for general, technical and environmental sundry information. For proposed or completed operations, describe in full on Technical Information Page (Page 2 of this form). Identify well or other facility by API Number or by OGCC Facility ID. Operator shall send an informational copy of all sundry notices for wells located in High Density Areas to the Local Government Designee (Rule 603b.)

1. OGCC Operator Number: 69175	4. Contact Name: Randall Ferguson	Complete the Attachment Checklist
2. Name of Operator: Petroleum Development Corporation	Phone: 303-860-5800	
3. Address: 1775 Sherman St., Ste. 3000	Fax: 303-831-3989	OP OGCC
City: Denver State: CO Zip: 80203		
5. API Number: 05-	OGCC Facility ID Number: 425112	Survey Plat
6. Well/Facility Name: Frank Drill Cuttings Site	7. Well/Facility Number	Directional Survey
8. Location (City, Sec, Twp, Rng, Meridian): NESW Section 32 - T4N - R6SW		Surface Equip. Diagram
9. County: WELD	10. Field Name:	Technical Info Page
11. Federal, Indian or State Lease Number:		Other

General Notice

☐ CHANGE OF LOCATION: Attach New Survey Plat (a change of surface title is substantive and requires a new permit)

Change of Surface Footage from Exterior Section Lines: ☐ ☐ ☐ ☐

Change of Surface Footage to Exterior Section Lines: ☐ ☐ ☐ ☐

Change of Bottomhole Footage from Exterior Section Lines: ☐ ☐ ☐ ☐

Change of Bottomhole Footage to Exterior Section Lines: ☐ ☐ ☐ ☐ attach directional survey

Bottomhole location City, Sec, Twp, Rng, Mer

Latitude: Distance to nearest property line Distance to nearest bldg, public rd, utility or RR

Longitude: Distance to nearest lease line Is location in a High Density Area (rule 603b)? Yes/No

Ground Elevation: Distance to nearest well same formation Surface owner consultation date:

GPS DATA:

Date of Measurement PDOP Reading Instrument Operator's Name

☐ CHANGE SPACING UNIT

Formation Formation Code Spacing order number Unit Acreage Unit configuration

☐ Remove from surface bond

Signed surface use agreement attached

☐ CHANGE OF OPERATOR (prior to drilling):

Effective Date:

Plugging Bond: ☐ Blanket ☐ Individual

☐ CHANGE WELL NAME

From: NUMBER

To:

Effective Date:

☐ ABANDONED LOCATION:

Was location ever built? ☐ Yes ☐ No

Is site ready for inspection? ☐ Yes ☐ No

Date Ready for Inspection:

☐ NOTICE OF CONTINUED SHUT IN STATUS

Date well shut in or temporarily abandoned:

Has Production Equipment been removed from site? ☐ Yes ☐ No

MIT required if shut in longer than two years. Date of last MIT

☐ SPUD DATE:

☐ REQUEST FOR CONFIDENTIAL STATUS (5 mos from date casing set)

☐ SUBSEQUENT REPORT OF STAGE, SQUEEZE OR REMEDIAL CEMENT WORK

\*submit cbl and cement job summaries

Method used Cementing tool setting/part depth Cement volume Cement top Cement bottom Date

☐ RECLAMATION: Attach technical page describing final reclamation procedures per Rule 1004.

Final reclamation will commence on approximately ☐ Final reclamation is completed and site is ready for inspection.

Technical Engineering/Environmental Notice

☐ Notice of Intent

Approximate Start Date:

☐ Report of Work Done

Date Work Completed:

Details of work must be described in full on Technical Information Page (Page 2 must be submitted)

☐ Intent to Recomplete (submit form 2)

☐ Request to Vent or Flare

☐ E&P Waste Disposal

☐ Change Drilling Plans

☐ Repair Well

☒ Beneficial Reuse of E&P Waste

☐ Gross Interval Changed?

☐ Rule 502 variance requested

☐ Status Update/Change of Remediation Plans for Spills and Releases

☐ Casing/Cementing Program Change

☐ Other:

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct and complete.

Signed: Randall Ferguson Date: 8/18/2011 Email: rferguson@petcd.com

Print Name: Randall Ferguson Title: Manager Environmental

OGCC Approved: [Signature] Title: EPS Date: 8/30/2011

CONDITIONS OF APPROVAL, IF ANY:

TECHNICAL INFORMATION PAGE



FOR OGCC USE ONLY

1. OGCC Operator Number: 69175 API Number: \_\_\_\_\_
2. Name of Operator: Petroleum Development Corporation OGCC Facility ID # \_\_\_\_\_
3. Well/Facility Name: Frank Drill Cuttings Site Well/Facility Number: \_\_\_\_\_
4. Location (QtrQtr, Sec, Twp, Rng, Meridian): NESW Section 32 - T4N - R65W

This form is to be completed whenever a Sundry Notice is submitted requiring detailed report of work to be performed or completed. This form shall be transmitted within 30 days of work completed as a "subsequent" report and must accompany Form 4, page 1.

5. DESCRIBE PROPOSED OR COMPLETED OPERATIONS

The subject site is located in Weld County and encompasses approximately 54 acres of cropland and rangeland. Drill Cuttings associated with PDC drilling operations are transported to the site and incorporated into the native soil as a soil amendment. In accordance with Rule 907 a.(3), see the attached E&P Waste Management Plan.



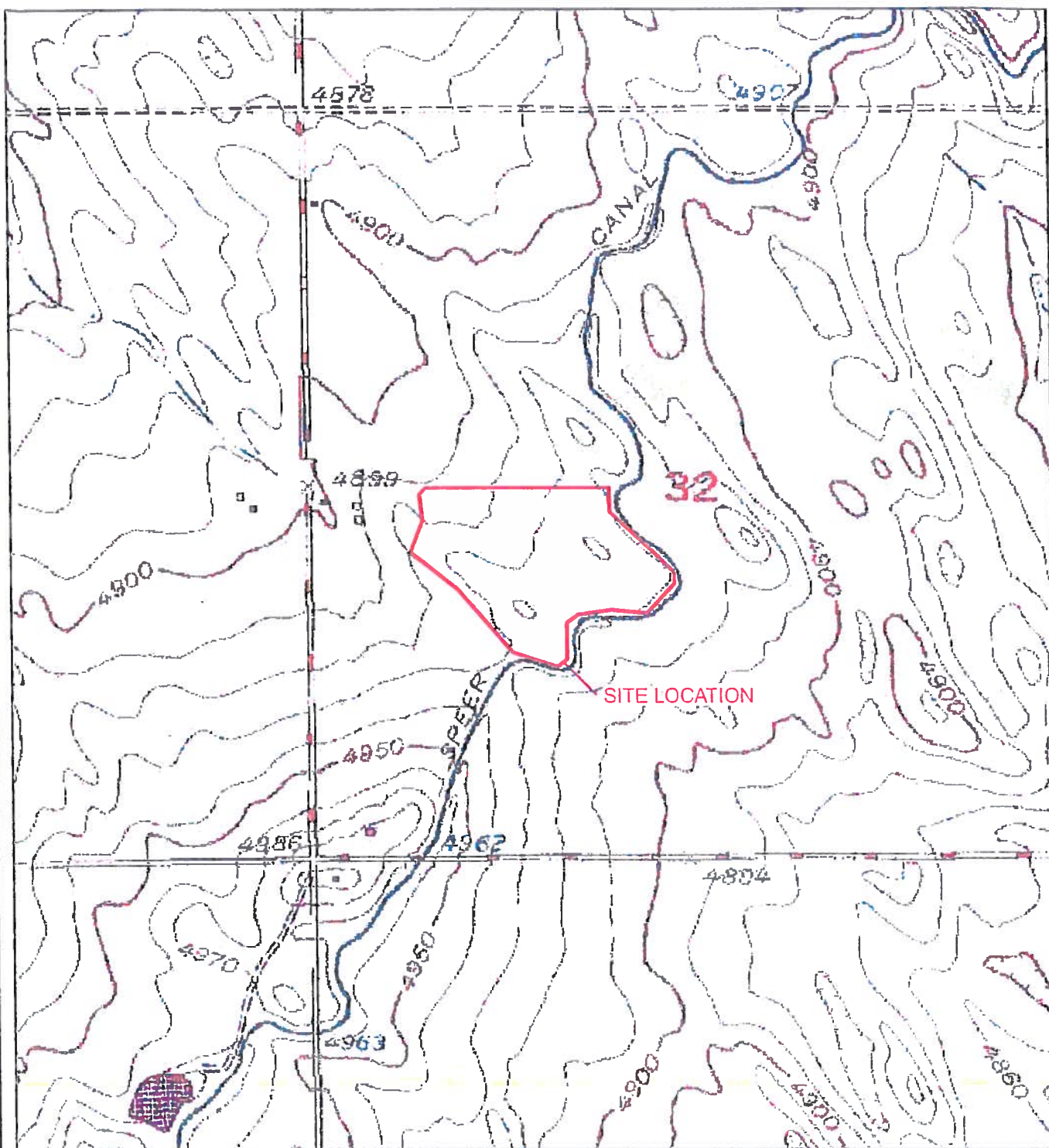


IMAGE COURTESY OF USDA/NRCS, VARIOUS DATES



#### LEGEND

SITE LOCATION

FIGURE 1  
SITE LOCATION MAP  
FRANK PROPERTY  
NESW SEC 32 T4N R65W  
WELD COUNTY, CO

PETROLEUM DEVELOPMENT CORPORATION





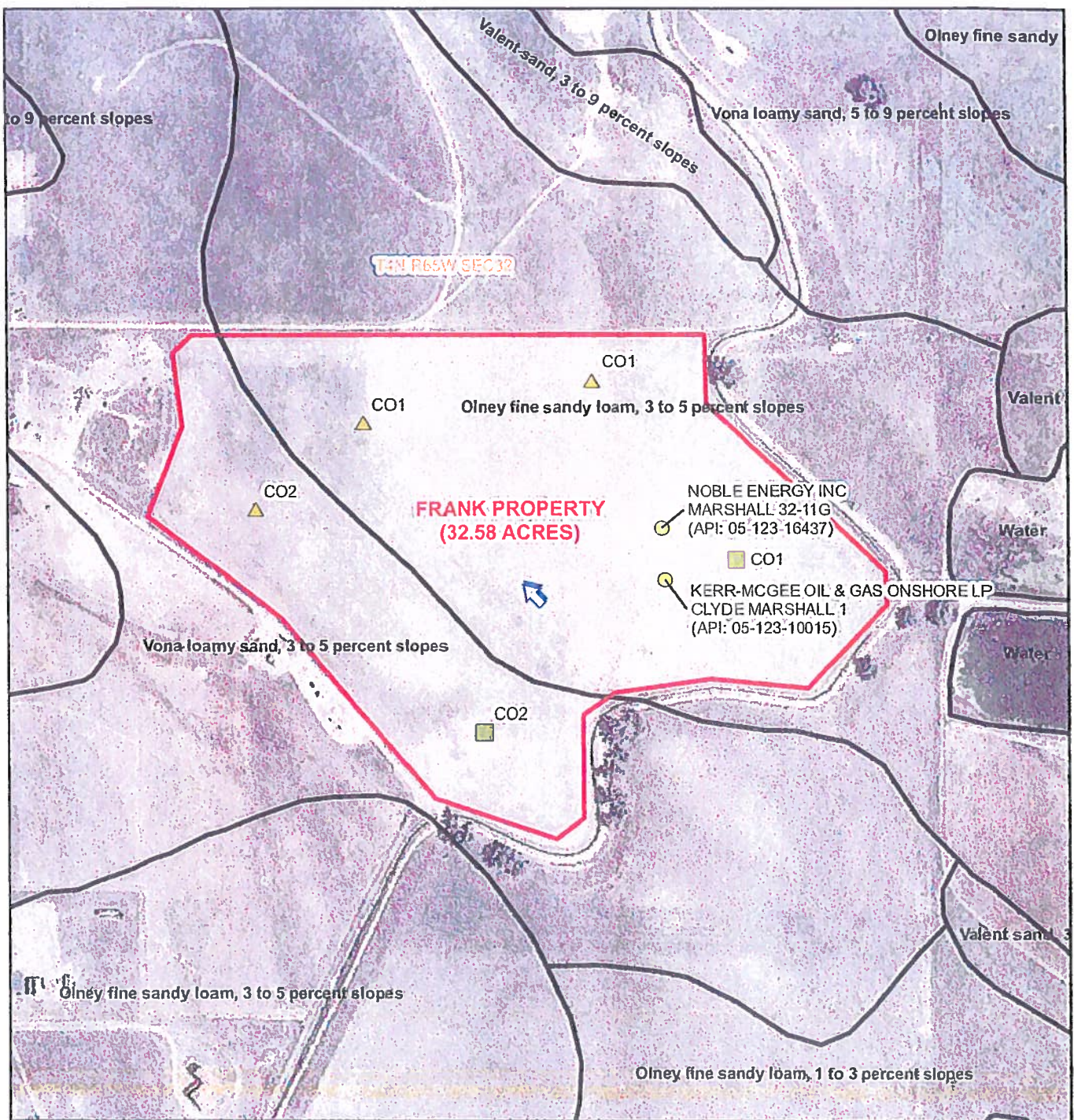


IMAGE COURTESY OF USDA/NRCS, 2009

# LEGEND

- ALIQUOT SAMPLE
- ALIQUOT SAMPLE & PERCOLATION TEST
- ESTIMATED GROUNDWATER FLOW DIRECTION
- POTENTIAL SPREAD AREA
- NRCS SOIL TYPE
- SECTION

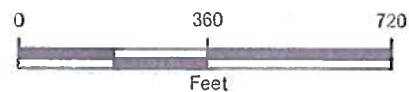


FIGURE 2  
PROPOSED SOIL SAMPLE LOCATION MAP  
FRANK PROPERTY  
NESW SEC 32 T4N R65W  
WELD COUNTY, CO  
PETROLEUM DEVELOPMENT CORPORATION



## ATTACHMENT C

### TABLE 2 – DISPOSAL WELL SITES FIGURE 2 – MAP OF DISPOSAL WELL SITES



**TABLE 2**

**HIGH SIERRA WATER SERVICES, LLC.  
SALT WATER DISPOSAL WELL INFORMATION SUMMARY  
WELD COUNTY, COLORADO**

**PETROLEUM DEVELOPMENT CORPORATION**

<b>Well Name</b>	<b>API Number</b>	<b>Qtr/Qtr</b>	<b>Sec</b>	<b>Twp</b>	<b>Range</b>	<b>PM</b>	<b>Lat</b>	<b>Long</b>
LYSTER 8-26EG-WD	05-123-12448	SWSE	26	6N	65W	6	40.451472	-104.627806
CONQUEST SWD 2-28	05-123-18763	SESE	28	1N	67W	6	40.016564	-104.887081
GERALDINE 32-1	05-123-19688	NWNW	32	4N	65W	6	40.273861	-104.694278
SWD 1-8A	05-123-23038	SESE	8	4N	64W	6	40.320297	-104.566164
SWD 1-30	05-123-26004	SESE	30	3N	65W	6	40.192040	-104.698970
SWD C7A	05-123-32207	SESE	34	7N	63W	6	40.524140	-104.416720

Notes:

API - American Petroleum Institute

Qtr/Qtr - Quarter/Quarter of a section

Sec - Section

Twp - Township

PM - Prime Meridian

Lat - Latitude

Long - Longitude



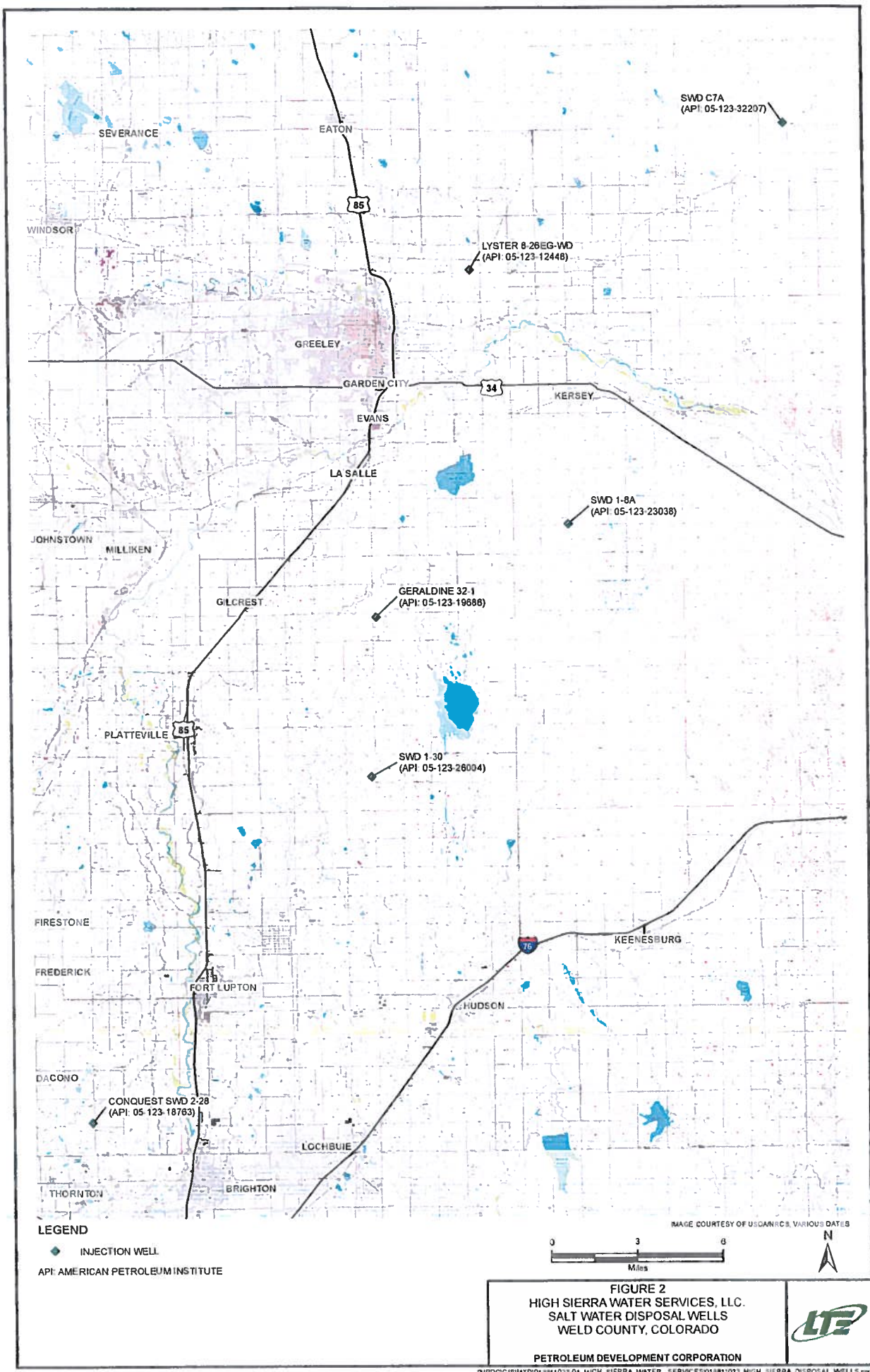


FIGURE 2  
HIGH SIERRA WATER SERVICES, LLC.  
SALT WATER DISPOSAL WELLS  
WELD COUNTY, COLORADO

PETROLEUM DEVELOPMENT CORPORATION