



**PDC ENERGY, INC.**

# E&P Waste Management Plan

DJ Basin Operations

November 1, 2013

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## 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 for E&P Waste Management 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 (CDPHE) has allowed remediation and oversight by the Commission.

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

### **907.a. General Requirements**

907.a.(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.*

907.a.(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.*

907.a.(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**

In regards to 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, PDC Energy, Inc. (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 classified as 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 by 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 map showing the locations of the sites (Figure 1) is included as Attachment A and a table listing the land application sites with location and current status (Table 1) is included as Attachment B. 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 up to 520 cubic yards of drill cuttings.

Currently, PDC has three (3) drilling rigs operating in the Greater Wattenberg Area of the DJ Basin. A fourth drilling rig is expected in December 2013 and a fifth drilling rig is tentatively expected during the spring of 2014. Current and future drilling rigs are anticipated to have closed loop drilling systems. 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 10-18 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 that have been introduced down-hole and returned to the surface with associated drill cuttings are E&P wastes 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 typically analyzed for Electrical Conductivity (EC), Sodium Adsorption Ratio (SAR), pH, and total metals listed in Table 910-1 (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 include 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 specifically 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.

The locations of all land application sites are also depicted on the attached Figure 1 (Attachment A). The attached Table 1 (See Attachment B) summarizes the active, inactive, and decommissioned land application sites where PDC has incorporated drilling mud and/or associated drill cuttings. If PDC determines subsequent land application sites are no longer necessary, a Sundry Form 4/closure request will be submitted for approval by COGCC staff. Should any new drill cuttings sites be created, a revised E&P Waste Management Plan will accompany the Form 4 – Sundry Notice regarding the proposed land application site.

#### **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 80-120 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 Figure 2) 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 a sodium-chloride type in the DJ Basin) is a waste by-product associated with oil and gas production. This waste stream is segregated at the tank battery by the separator and stored in designated tanks or in buried or partially buried vessels. Vacuum trucks with an approximate 80-120 barrel capacity make scheduled runs to these tank batteries to collect produced water. The fluid is then 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 34-60-130 C.R.S. and COGCC 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 Figure 2) for disposal.

**ATTACHMENT A**

**FIGURE 1 – MAP OF LAND APPLICATION SITES**



**ATTACHMENT B**

**TABLE 1 – LAND APPLICATION SITES**

**TABLE 1**  
**WATER-BASED BENTONITIC DRILLING FLUID & DRILL CUTTINGS LAND APPLICATION SITES**  
**WELD COUNTY, COLORADO**  
**PDC ENERGY, INC.**

| Site Name                         | Facility ID | Qtr/Qtr - Section Township Range | Baseline Sampling Date | Incorporated Material                | Current Status                      |
|-----------------------------------|-------------|----------------------------------|------------------------|--------------------------------------|-------------------------------------|
| Wells Ranch Beneficial Reuse Area | 428254      | NE Sec. 30 T6N R63W              | 10/15/2008             | Drilling Mud and Associated Cuttings | Inactive                            |
| Easton Beneficial Reuse Area      | 425115      | NW Sec. 12 T4N R65W              | 7/27/2009              | Drilling Mud and Associated Cuttings | Inactive                            |
| Paul Sater Beneficial Reuse Area  | 425116      | E/2 SW Sec. 18 T4N R63W          | 11/19/2009             | Drilling Mud                         | Inactive                            |
| Horgenredr Beneficial Reuse Area  | 425117      | NESW Sec. 33 T5N R63W            | 12/18/2009             | Drilling Mud                         | Inactive, Closed by COGCC 3/30/2012 |
| Dalton Beneficial Reuse Area      | 425118      | NW Sec. 31 T7N R66W              | 2/24/2010              | Drilling Mud                         | Inactive, Closed by COGCC 4/26/2011 |
| Cozzens Beneficial Reuse Area     | 425119      | NWNE Sec. 9 T6N R65W             | 3/10/2010              | Drilling Mud                         | Inactive, Closed by COGCC 3/29/2012 |
| Leffler Beneficial Reuse Area     | 425120      | NENE Sec. 26 T7N R66W            | 3/12/2010              | Drilling Mud                         | Inactive, Closed by COGCC 3/30/2012 |
| Bernhardt Beneficial Reuse Area   | 425121      | SE Sec. 13 T4N R67W              | 7/8/2010               | Drilling Mud                         | Inactive, Closed by COGCC 3/7/2012  |
| Frank Beneficial Reuse Area       | 425112      | NESW Sec. 32 T4N R65W            | 10/14/2010             | Drilling Mud and Associated Cuttings | Active                              |
| Spaur Beneficial Reuse Area       | 425114      | SE Sec. 31 T7N R63W              | 2/25/2011              | Drilling Mud and Associated Cuttings | Inactive, Closed by COGCC 7/9/2013  |
| Easton #2 Beneficial Reuse Area   | 429629      | NW Sec. 12 T4N R65W              | 7/2/2012               | Drilling Mud and Associated Cuttings | Active                              |
| Ludwig #1 Beneficial Reuse Area   | 430649      | NW Sec. 1 T3N R66W               | 10/12/2012             | Drilling Mud and Associated Cuttings | Active                              |
| Ludwig #2 Beneficial Reuse Area   | 431183      | NW Sec. 1 T3N R66W               | 11/29/2012             | Drilling Mud and Associated Cuttings | Active                              |
| Frank #2 Beneficial Reuse Area    | 434889      | W/2 SW Sec. 32 T4N R65W          | 9/19/2013              | Drilling Mud and Associated Cuttings | Active                              |



## **ATTACHMENT C**

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

**TABLE 2**  
**HIGH SIERRA WATER SERVICES DISPOSAL WELL INFORMATION SUMMARY**  
**WELD COUNTY, COLORADO**

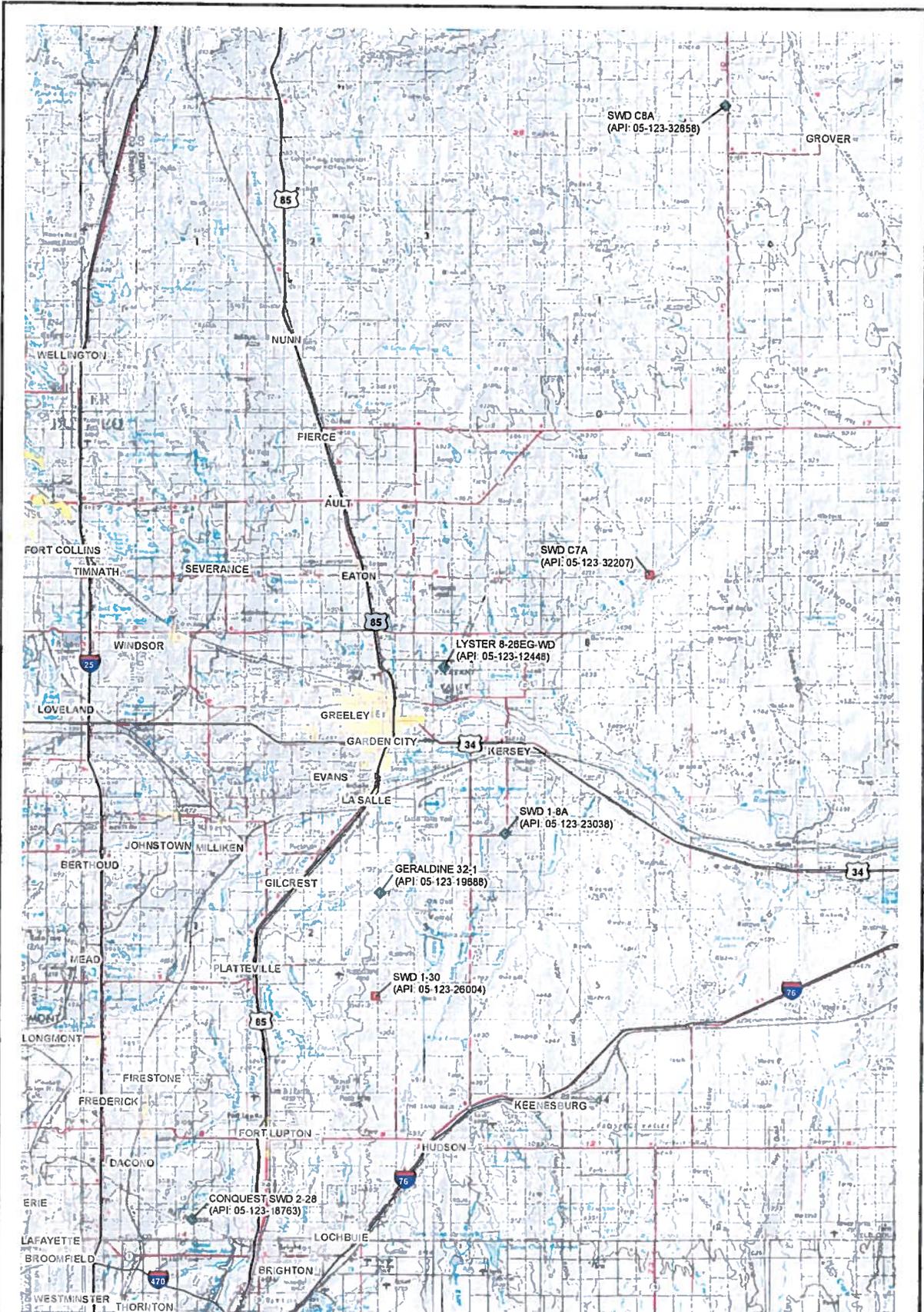
**PDC ENERGY, INC.**

| Well Name         | Facility Type | API Number   | Qtr/Qtr | Sec | Twp | Range | PM | Lat       | Long        |
|-------------------|---------------|--------------|---------|-----|-----|-------|----|-----------|-------------|
| LYSTER 8-26EG-WD  | Inj.          | 05-123-12448 | SWSE    | 26  | 6N  | 65W   | 6  | 40.451472 | -104.627806 |
| CONQUEST SWD 2-28 | Inj.          | 05-123-18763 | SESE    | 28  | 1N  | 67W   | 6  | 40.016564 | -104.887081 |
| GERALDINE 32-1    | Inj.          | 05-123-19688 | NWNW    | 32  | 4N  | 65W   | 6  | 40.273861 | -104.694278 |
| SWD 1-8A          | Inj.          | 05-123-23038 | SESE    | 8   | 4N  | 64W   | 6  | 40.320297 | -104.566164 |
| SWD 1-30          | Inj. / Recyc. | 05-123-26004 | SESE    | 30  | 3N  | 65W   | 6  | 40.192040 | -104.698970 |
| SWD C7A           | Inj. / Recyc. | 05-123-32207 | SESE    | 34  | 7N  | 63W   | 6  | 40.524140 | -104.416720 |
| SWD C8A           | Inj.          | 05-123-32858 | NESE    | 29  | 11N | 62W   | 6  | 40.893930 | -104.335530 |

Notes:

API - American Petroleum Institute  
 Inj. - Injection  
 Lat - Latitude  
 Long - Longitude  
 PM - Prime Meridian  
 Qtr/Qtr - Quarter/Quarter of a section  
 Recyc. - Recycling  
 Sec - Section  
 Twp - Township





**LEGEND**

- ◆ INJECTION FACILITY
  - INJECTION/RECYCLING FACILITY
- API: AMERICAN PETROLEUM INSTITUTE

IMAGE COURTESY OF USDA/NRCS, VARIOUS DATES



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



PDC ENERGY, INC.