



PDC ENERGY, INC.

E&P Waste Management Plan

DJ Basin Operations

September 5, 2019

TABLE OF CONTENTS

REGULATORY FRAMEWORK - COGCC RULES..... 1

WATER-BASED BENTONITIC DRILLING FLUIDS & ASSOCIATED DRILL CUTTINGS 2

 BACKGROUND 2

 ESTIMATED AMOUNT OF MATERIAL..... 2

 LANDOWNER AGREEMENT FOR LAND APPLICATION SITES..... 2

 TRANSPORT AND HANDLING..... 3

 INCORPORATION OF DRILLING MUDS AND ASSOCIATED DRILL CUTTINGS..... 3

 SAMPLING AND ANALYSIS OF LAND APPLICATION SITES 3

 RECLAMATION OF LAND APPLICATION SITES..... 4

 FORM 4 – SUNDRY NOTICE 4

COMPLETION FLOW-BACK FLUIDS 4

PRODUCED WATER..... 5

IMPACTED SOIL AND/OR GROUNDWATER..... 5

OIL BASED DRILL CUTTING AND DRILLING FLUIDS 5

MANAGEMENT OF NON-E&P WASTE 6

APPENDICIES

- A: Land Application Site Facility List and Map
- B: Produced Water Disposal Facilities List and Map
- C: Authorized Non-Hazardous Disposal Facilities List

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-I, 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 site locations and a land application site list with location and current status is included in Appendix 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 horizontal well (surface hole and production hole) will generate 600 barrels of water-based bentonitic drilling mud and approximately 300-400 cubic yards of associated drill cuttings. Currently, oil & gas drilling rigs have the ability to drill up to 30 horizontal wells per year. To properly manage the beneficial reuse materials, a land application site is typically dedicated to accept either water-based drilling muds or associated drill cuttings from one or two oil & gas drilling rigs. Occasionally, a land application site may accept both water-based drilling muds and associated drill cuttings from an oil & gas drilling rig.

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 solids 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 are originated from PDC drilling operations. PDC will transport the water-based bentonitic drill fluids and associated drill cuttings to the land application sites for beneficial reuse via vacuum trucks and haul trucks, respectively. Loads will be transported primarily during normal business hours. Before transportation, the drill cuttings will not contain free liquids.

In accordance with Rule 907.b.(2), information about the drilling fluid and/or associated drill cuttings E&P waste transportation will include:

- Name and location of the well(s) where the material was generated,
- The type and volume of the material generated,
- The name of the material generator,
- Name of material transporter,
- The date of transport, and
- Name and location of the land application site.

INCORPORATION OF DRILLING MUDS AND ASSOCIATED DRILL CUTTINGS

Water-based drilling muds and associated drill cuttings are initially stock piled near the entrance of the land application site. No later than 10 days after beneficial reuse materials have been stock piled, they will be incorporated into the soil as a beneficial amendment to the native soils. The beneficial reuse materials are applied to the site at thickness no more than three inches.

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 reports. A representative sample is collected from each NRCS soil type. One percolation test (falling head test) is conducted at the site to measure hydraulic conductivity changes at the site. All 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, Sodium Adsorption Ratio, pH, and total metals listed in Table 910-1 (excluding boron).

PDC conducts post-application after the land application site use is complete, which is typically after three years. PDC will also sample each location 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 Benzene, Toluene, Ethylbenzene, and Xylenes (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.

A comprehensive list and map of PDC's land application sites are located in Appendix A. The location list summarizes the active, inactive, and closed land application sites status and map exhibits where PDC has incorporated or is currently incorporating drilling mud and/or associated drill cuttings. When PDC determines subsequent land application sites are no longer necessary, a closure request will be submitted, via Form 4-Sundry Notice, 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 on the location. As necessary, vacuum trucks will transport this fluid to the nearest commercial Class II injection well operated by NGL Water Solutions LLC for disposal (see Appendix B for facility list and location map). If the solid content for the flow-back fluids are above NGL's acceptable limits, the waste liquids are transported to a permitted commercial landfill that is permitted to solidify liquids (see Appendix C for a list of authorized liquid disposal locations). 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 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 NGL Water Solutions LLC for disposal (see Appendix B for facility list and location map). 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 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 NGL Water Solutions LLC for disposal (see Appendix B for facility list and location map). Impacted soils are typically removed and transported to a commercial landfill for disposal (see Appendix C for a list of PDC authorized disposal facilities).

OIL BASED DRILL CUTTING AND DRILLING FLUIDS

In accordance with Rule 907.e.(1), all oil based drill cuttings will be disposed at a permitted commercial solid waste disposal facility. The waste will be transported to a permitted commercial solid waste disposal facility via roll off containers or haul trucks. Before transportation, the oil based drill cuttings will be solidified to not contain any free liquids.

In accordance with Rule 907.d, oil based drilling fluids will be recycled and reused. Drilling fluids will be recycled and reused and if the disposal is required, the oil based drilling fluids will be disposed in accordance with 907.d.(2) at a Class II injection well that is permitted in accordance with Rule 325 or disposed at a permitted commercial solid waste disposal facility. The waste will be transported in a vacuum truck or similar vehicle designed to transport liquids.

PDC will transport all oil based drill cuttings under proper manifest as per Rule 907.b.(2), and PDC will retain each manifest for not less than five (5) years. The waste transportation manifest will include:

- Name and location of the well(s) where the material was generated,
- The name of the waste generator,
- The type and volume of the waste generated,
- Name of waste transporter,
- The date of waste transport, and

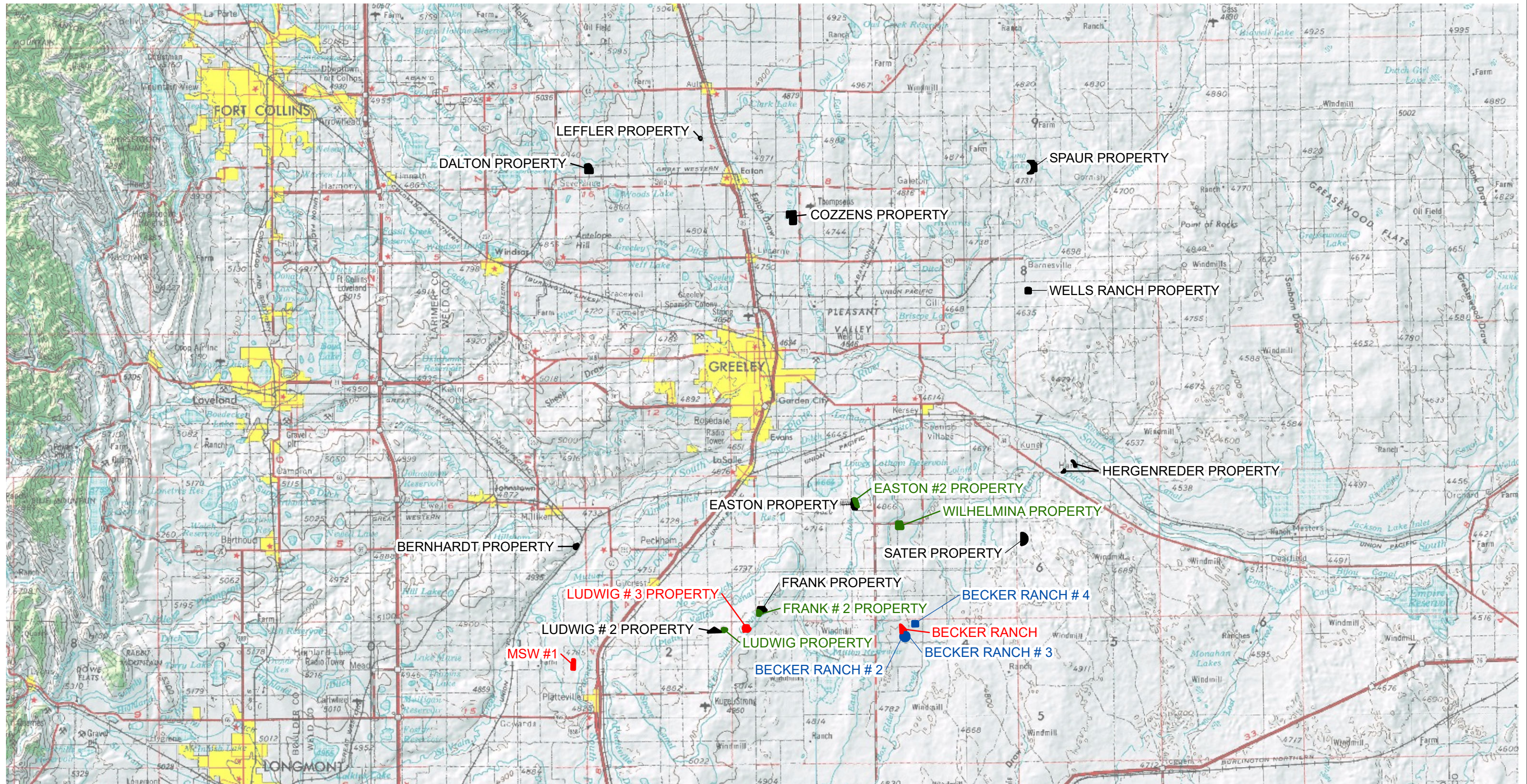
- Name and location of the permitted solid waste disposal facility.

MANAGEMENT OF NON-E&P WASTE

In accordance with Rule 907A, all non-E&P waste will be identified in accordance with state and federal regulations. Each non-E&P waste will be fully characterized including performing a hazardous waste determination. All non-hazardous E&P waste will be disposed in accordance with 6 C.C.R 1007-2.

APPENDIX A

LAND APPLICATION FACILITY LIST AND MAP



LEGEND

- ACTIVE LAND APPLICATION AREA
- INACTIVE LAND APPLICATION AREA
- INACTIVE LAND APPLICATION AREA - AWAITING RECLAMATION CLOSURE
- CLOSED LAND APPLICATION AREA



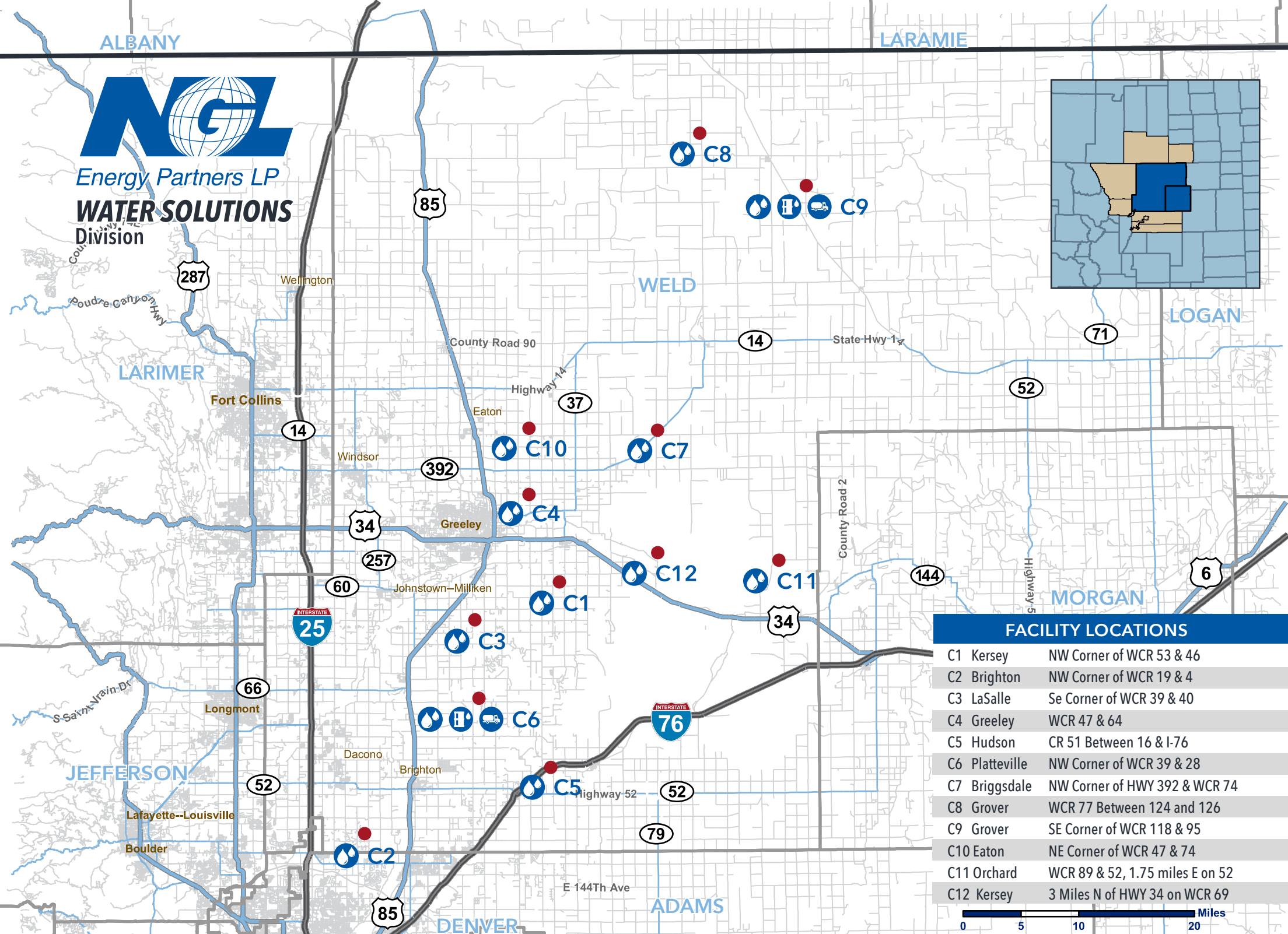
FIGURE 1
LAND APPLICATION FACILITY MAP
WELD COUNTY, COLORADO

PDC ENERGY, INC.



APPENDIX B

PRODUCED WATER DISPOSAL FACILITIES LIST AND MAP



3773 East Cherry Creek North Drive · Denver, CO 80209 // 303-815-1010 // www.nglep.com

APPENDIX C

AUTHORIZED NON-HAZARDOUS DISPOSAL FACILITIES LIST

Appendix C

LAND APPLICATION SITE LIST PDC ENERGY

FACILITY NAME	FACILITY ID	PDC ENERGY	Initial Waste Acceptance	CURRENT FACILITY STATUS
Becker Ranch #2 Beneficial Reuse Area	449950	SW 1/4 of Sec. 5 3N - 64W	6/13/2017	Active
Becker Ranch #3 Beneficial Reuse Area	461014	SW 1/4 of Sec. 5 3N - 64W	1/24/2019	Active
Becker Ranch #4 Beneficial Reuse Area	467042	NE 1/4 of Sec. 5 3N - 64W	9/27/2019	Active
MSW #1	448329	NESW 12 3N - 67W	5/1/2017	Inactive as of November 8, 2018
Ludwig #3 Beneficial Reuse Area	444255	SWNE 6 T3N - R65W	12/10/2015	Inactive as of November 5, 2018
Becker Ranch #1 Beneficial Reuse Area	159534	5 T3N - R64W	3/8/2015	Inactive as of March 3, 2018
Wilhelmina #1 Beneficial Reuse Area	436033	NWNW 17 - T4N - R64W	6/13/2014	Inactive - Received environmental closure (Doc # 401306719)
Frank #2 Beneficial Reuse Area	434889	NWSW 32 T4N - R65W	9/19/2013	Inactive - Received environmental closure (Doc # 401312448)
Ludwig #2 Beneficial Reuse Area	431183	NW 1 T3N - R66W	11/29/2012	Closed (Doc # 682402541)
Ludwig #1 Beneficial Reuse Area	430649	NW 1 T3N - R66W	10/12/2012	Inactive- Received environmental closure from the COGCC, awaiting final reclamation inspection
Easton #2 Beneficial Reuse Area	429629	NW 12 T4N - R65W	7/2/2012	Inactive- Received environmental closure from the COGCC, awaiting final reclamation inspection
Spaur Beneficial Reuse Area	425114	NE 31 T7N - R63W	2/25/2011	Closed 7/9/2013
Frank Beneficial Reuse Area	425112	NESW 32 T4N - R65W	10/14/2010	Closed 10/22/2014
Bernhardt Beneficial Reuse Area	425121	SE 13 T4N - R67W	7/8/2010	Closed 8/31/2011
Dalton Beneficial Reuse Area	425118	NW 31 T7N - R66W	2/24/2010	Closed 4/26/2011
Paul Sater Beneficial Reuse Area	425116	SW 18 T4N - R63W	11/19/2009	Closed 11/21/2013
Easton Beneficial Reuse Area	425115	NW 12 T4N - R65W	7/27/2009	Closed 1/27/2014
Well Ranch Beneficial Reuse Area	428254	30 T6N - R63W	10/15/2008	Closed 1/27/2014