



FAC#: 446561
Document #: 2225667
Date: 12/19/2016

Mr. Alex Fischer, P.G.
West Environmental Supervisor
Colorado Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801
Denver, Colorado 80203

December 1, 2016

Re: SG 31-32-796 Water Recycling Pit Permit Application
TEP Rocky Mountain, LLC (Operator Number 96850)
Form 28 and supporting documents
Facility ID 446561

Dear Mr. Fischer,

TEP Rocky Mountain, LLC (TEP) is submitting the Form 28 and attachments to request approval to extend the operating life of our previously permitted with a Form 15, SG 31-32-796 Water Recycling Pit (Recycling Pit). Additional operational changes are not anticipated from the original permitting submitted on 3/1/2013, via the Form 15, for the Recycling Pit. TEP is solely requesting to extend the operating life of the Recycling Pit via the Form 28 to allow continued water recycling support for completions and production activities associated with the Grand Valley Field assets.

TEP is requesting approval of the Recycling Pit via the Form 28 to provide continued support of the following:

- Currently existing Recycling Pit provides support of water recycling activities during completion and production operations and minimizes the need to use fresh water.
- The life of the Recycling Pit is expected to be for the life of the field, or as needed, after which the pit and associated disturbance will be fully reclaimed to regulatory standards.
- The facility will be operated year round to minimize impacts associated with natural gas exploration and production (E&P) activities.

TEP will maintain compliance with all federal, state, and county regulatory agencies. Thank you for your time reviewing this application. If you have any questions, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink that reads "Heather Foor". The signature is written in a cursive, flowing style.

Heather Foor
Environmental Specialist



State of Colorado
Oil and Gas Conservation Commission



FOR OGCC USE ONLY

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

CENTRALIZED E&P WASTE MANAGEMENT FACILITY PERMIT

Submit this Form and accompanying documents for each facility per Rule 908. Financial Assurance in the amount of \$50,000 is required to operate each facility.

Surety ID: _____

OGCC Operator Number: _____		Contact Name and Telephone: _____	
Name of Operator: _____		No: _____	
Address: _____		Fax: _____	
City: _____ State: _____ Zip: _____			
Surface Owner (if different than above): _____			
Address: _____			
City: _____ State: _____ Zip: _____ Phone: _____			
Facility Name: _____		Location (QtrQtr, Sec, Twp, Rng, Mer): _____	
Address: _____			
City: _____ State: _____ Zip: _____		Latitude: _____	
Phone: _____ Fax: _____		Longitude: _____	

	Operator	OGCC
Site description (topo, geol, hydro)		
Adjacent land use description		
Topographic map		
Site drainage map with structures		
Scaled drawing and survey map		
Facility design & engineering		
Operating plan		
Water analysis report		
Financial assurance		
Closure plan		
Local gov't zoning compliance		
Local gov't permits and notice		

1. Is the site in a sensitive area? <input type="checkbox"/> Y <input type="checkbox"/> N		2. What are the average annual precipitation and evaporation rates for the site? Precipitation: _____ inches/year Evaporation: _____ inches/year	
3. Has a description of the site's general topography, geology and hydrology been attached? <input type="checkbox"/> Y <input type="checkbox"/> N			
4. Has a description of the adjacent land use been attached? <input type="checkbox"/> Y <input type="checkbox"/> N		5. Has a 1:24,000 topographic map showing the site location been attached? <input type="checkbox"/> Y <input type="checkbox"/> N	
6. Has a site plan showing drainage patterns, diversion or containment structures, roads, fencing, tanks, pits, buildings and any other pertinent construction details been attached? <input type="checkbox"/> Y <input type="checkbox"/> N			
7. If site is not owned by the operator, is written authorization of the surface owner attached? <input type="checkbox"/> Y <input type="checkbox"/> N		8. Has a scaled drawing and survey showing the entire section(s) containing the proposed facility been attached? <input type="checkbox"/> Y <input type="checkbox"/> N	
9. What measures have been implemented to limit access to the facility by wildlife, domestic animals or by members of the public? Briefly explain. _____ _____			
10. Is there a planned firelane of at least 10 feet in width around the active treatment areas and within the perimeter fence? <input type="checkbox"/> Y <input type="checkbox"/> N		11. Is there an additional buffer zone of at least 10 feet within the perimeter firelane? <input type="checkbox"/> Y <input type="checkbox"/> N	
12. Have surface water diversion structures been constructed to accommodate a 100-year, 24-hour event? <input type="checkbox"/> Y <input type="checkbox"/> N		13. Has a waste profile been calculated according to Rule 908.b.6? <input type="checkbox"/> Y <input type="checkbox"/> N	
14. Has facility design and engineering been provided as required by Rule 908.b.7? <input type="checkbox"/> Y <input type="checkbox"/> N		15. Has an operating plan been completed as required by Rule 908.b.8? <input type="checkbox"/> Y <input type="checkbox"/> N	
16. Has ground water monitoring for the site been provided? <input type="checkbox"/> Y <input type="checkbox"/> N ***Attach Water Analysis Report, Form 25, for each monitoring well installed.***			
17. Has financial assurance been provided as required by Rule 704? <input type="checkbox"/> Y <input type="checkbox"/> N		18. Has a closure plan been provided? <input type="checkbox"/> Y <input type="checkbox"/> N	
19. Have local government requirements for zoning and construction been complied with? <input type="checkbox"/> Y <input type="checkbox"/> N		20. Have permits and notifications required by local governments and other agencies been provided? <input type="checkbox"/> Y <input type="checkbox"/> N	

Print Name: _____

Signed: Heather Jaro Title: _____ Date: _____

OGCC Approved: _____ Title: _____ Date: _____

CONDITIONS OF APPROVAL, IF ANY:

Facility Number: _____



Smith Gulch 31-32-796

Water Recycling Pit Permit Application

Form 28

COGCC Facility # 430110

TEP Rocky Mountain, LLC

1058 county road 215
Parachute, CO 81635
September, 2016

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Attachment 12 – Sensitive Area Determination Checklist
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1. Introduction

Terra Energy Partners Rocky Mountain, LLC (TEP) is submitting this Form 28 and attachments in order to request approval to extend the operating life of the existing, Form 15 permitted, Smith Gulch 31-32-796 Water Recycling Pit (Pit). Operational changes are not anticipated from those approved in the original permit submitted on April 18, 2013. See Attachment 2 for the approved Form 15. Terra is requesting only to extend the operating life of the Pit with the Form 28 to allow continued water recycling support for completions and production activities.

2. Pit Description – 908.a.

The Pit is a non-commercial facility intended for the temporary storage of produced water prior to reuse in hydraulic fracturing of new natural gas wells. The Pit is authorized to receive only produced water from Terra-operated wells. Terra will not provide waste management services to third parties, except as part of a unitized area, joint operating agreement, or in response to an emergency. This Pit facility will not include any land treatment or land application sites. This site is permitted and managed in compliance with local, state, and Federal requirements.

Flowback and produced water from other oil and gas operators may be received by this facility on a case-by-case basis through a Rule 502.b variance request and approval, water sharing agreement(s), and permits from other agencies or local entities, if required.

3. Historic Timeline of Use of the Pit Facility

The Pit was permitted in 2013 with a Form 2A (Document # 400387284, Attachment 1) and with a Form 15 (Document # 400386922, Attachment 2).

The sundry notification of the operation start date, June 21, 2013, was approved on December 26, 2013 (COGCC doc # 400447641, Attachment 3). The sundry notification with a 6-month pit life extension request was submitted to COGCC on September 9, 2016 (COGCC doc # 401115146, Attachment 4).

The Pit is constructed entirely in cut. The Pit excavation activities started in April of 2013. The pit construction activities were completed in June of 2013 when the lining system was installed (see Attachment 5 – Liner Specifications and Installation reports). After installation of fencing and netting (Attachment 6 – Netting and Fencing Drawings), the pit was filled and on June 20, 2013 passed a 72-hour hydrotest to confirm liner system integrity (see Attachment 7 – Hydrotest Results).

The Pit has been inspected daily since June 4, 2013. The inspection reports are included in Attachment 8.

There have been no major netting and fencing repairs at this facility. During snow storm events, the pit is monitored for the duration of the storm to prevent snow accumulation and potential netting damage. Routine netting and fencing repairs are completed during pit inspections. These repairs are not documented and are completed as needed.

There was one spill associated with the pit pad location:

- 12/17/2015 – 7 bbls of produced water was spilled on location due to equipment failure. COGCC document # 400956635.

4. General description of the site location

4.1 Surface owner information 908.b.(2)

Terra is the surface owner therefore a surface use agreement is not required. See Attachment 9 – Parcel Map.

4.2 Legal description – 908.b.(3) and 908.b.(5).B

The Pit is located in Garfield County in the NW ¼ NE ¼ of Section 32, Township 7 South, Range 96 West of the 6th P.M.; and at Latitude 39.398863 and Longitude -108.129210 NAD83. The Pit is located 275' from the north section line and 1021' from the east section line. The distances were measured at 90 degrees from the nearest section lines to facility boundary. The Pit location is accessed from State Highway 6 and dirt/gravel road. See Attachment 10 – Topo & Access Road Map.

4.3 Topographic Description- 908.b.(4).

The Smith Gulch Completions Pit facility is located on a bench at an elevation of 5138 ft. MSL adjacent to Smith Gulch. The site sits between the Roan Plateau to the north and the Colorado River approximately one mile to the south. The Roan Plateau rises to the north to an elevation of 8700 feet. The gradient from the facility slopes downward to the south/southeast at a 6 – 8% grade to the Colorado River at an elevation of approximately 4900 ft. MSL.

No natural drainages are located within the facility boundary. Smith Gulch is identified as an ephemeral drainage with a channel elevation approximately 12 – 20 feet below the facility elevation. The facility, topography and drainages are identified on the attached map entitled “Spruce Creek Facility – Surface Water Features Within 2 Miles. The map and data were obtained from the USGS National Hydrography Dataset.

A Topographic Map of a scale 1:24,000 showing the location is provided in Attachment 10 - Topo & Access Road Map.

4.4 Adjacent Land Use - 908.b.(4).

The subject area is located in Garfield County which has historically been used for cattle grazing, mining and natural gas extraction. Uses immediately adjacent to the facility include pasture irrigation, cattle grazing and natural gas extraction well pads. The surrounding area is currently utilized for active oil and gas development, pasture irrigation, cattle grazing and open rangeland.

The nearest structure that include oil and gas wells and associated production equipment and tanks are located on the SG 31-32 well pad (COGCC Location # 334395). The pad is located 350' west of the SG 31-32-796 water recycling pit. Any other buildings are located more than 1 mile away from the pit location. The nearest property lines are 540' on the south side, 260' on the north side, 4313' on the east side, and 1000' on the west side. See Attachment 11 – Adjacent Land Use Map.

4.5 Sensitive Area Determination

Based on the information collected by HRL Compliance Solutions (HRL) during the site investigation and desktop review, the Pit location is designated a non-sensitive area. An unnamed intermittent drainage is located less than 500 feet from the facility but due to ephemeral characteristics in the immediate vicinity and the fact that it terminates in a retention pond approximately ¼ mile to the southeast, the potential to impact live surface water has been deemed low. See Attachment 12 for the Sensitive Area Determination Checklist.

5. Geologic Data – 908. b.(7).A

5.1 Type and Thickness of Unconsolidated soils - 908.b.(7).A.ii

The NRCS identifies the dominate soils type within the boundary of the Smith Gulch Completion Pit facility as Arvada loam, comprising approximately 96% of the area, while Torriorthents-Camborthids-Rock outcrop complex comprises the remainder. The Arvada loam parent material is derived from alluvium of sandstone and shale, associated with terraces and alluvial fan landforms. The Torriorthents-Camborthids-Rock outcrop parent material is stony, basaltic alluvium derived from sandstone and shale, associated with mountainsides. The rock outcrop complex is primarily located to the immediate west of the facility boundary. A copy of the NRCS soil report for the area is attached.

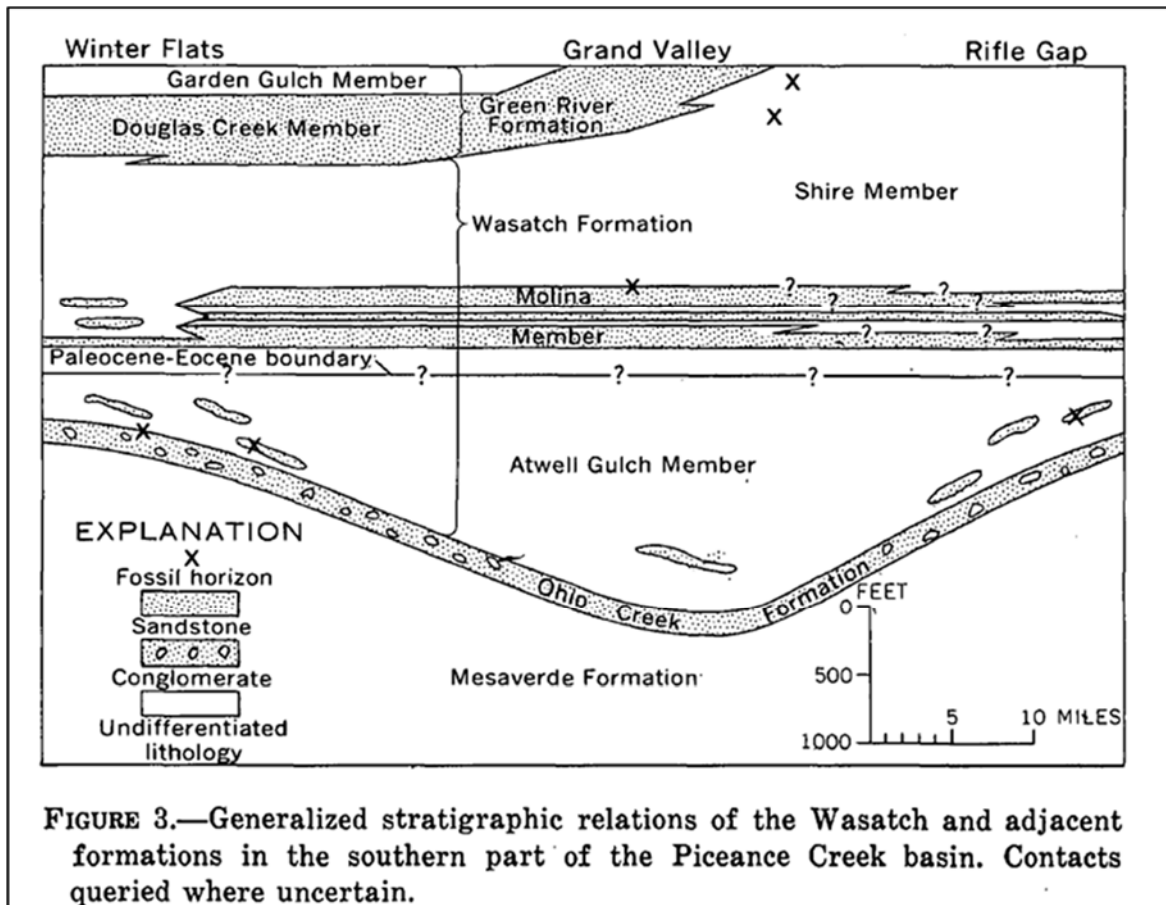
5.2 Type and Thickness of consolidated bedrock - 908.b.(7).A.ii

Bedrock was not encountered during the excavation of the pit associated with the facility. Based on the “Geologic Map of Colorado” compiled by Ogden Tweto, dated 1979, the area is geologically referred to as the Wasatch Formation classified as claystone, mudstone, sandstone and conglomerate. The bedrock is presumed to be or of a similar material and its thickness is unknown.

5.3 Local and Regional geologic structures - 908.b.(7).A.iii

Ogden Tweto in his "Geologic Map of Colorado", dated 1979, identifies the area geologically as the Wasatch Formation classified as claystone, mudstone, sandstone and conglomerate. USGS GEOLOGICAL SURVEY BULLETIN 1274-M entitled "Paleocene and Lower Eocene Units in the Southern Part of the Piceance Creek Basin"

by John R. Donnell, 1969, further identifies the underlying geology as the Douglas Creek Member of the Green River Formation and is graphical shown on the attached diagram. Donnell describes the Green River Formation as sedimentary rock. Tweto describes the Green River Formation as marlstone, sandstone and oil shale.



5.4 Geologic Hazards - 908.b.(7).A.iv

The Smith Gulch Completions Pit facility is located on a bench at an elevation of 5138 ft. MSL adjacent to Smith Gulch. The site sits between the Roan Plateau to the north and the Colorado River approximately one mile to the south. The Roan Plateau rises to the north to an elevation of 8700 feet. The gradient from the facility slopes downward to the south/southeast at 6 – 8% grade.

The Colorado State Legislature in 1974 passed House Bill 1041 defining geologic hazards that, if present, may pose a threat to life or property. For the purposes of this report, geologic hazards, as outlined in House Bill 1041, are discussed below.

1. **Radioactivity:** Although no radiological testing was conducted, there were no reported or observed conditions that indicate naturally occurring radioactive material or tailings on the site that would affect the design or operations of the facility.

2. **Seismic Considerations:** The 2000 Uniform Building Code locates the site in seismic zone 1 - least susceptible to earthquakes. Tweto's geologic map identifies several faults approximately 12 – 15 miles south of the facility near Plateau Creek. There are however, no indications of recent activity. It does not appear that significant hazard from seismic activity exists at the site to impact the design or operations of the facility.

3. **Ground Subsidence:** The site was constructed entirely in cut or below natural grade. Groundwater was not encountered during construction and no embankments or fills were utilized. Ground subsidence does not appear to be a significant hazard at this site.

4. **Landslides:** The facility is located on bench with on a natural 6 - 8 % slope consisting of grasses and sage brush. It appears that landslide hazard does not exist or is low at the facility.

5. **Avalanche:** The facility is located at a relatively low elevation of 5138 ft. on the north side a valley with excellent exposure sun to the south. These areas are not prone to avalanches and the risk appears low for this site.

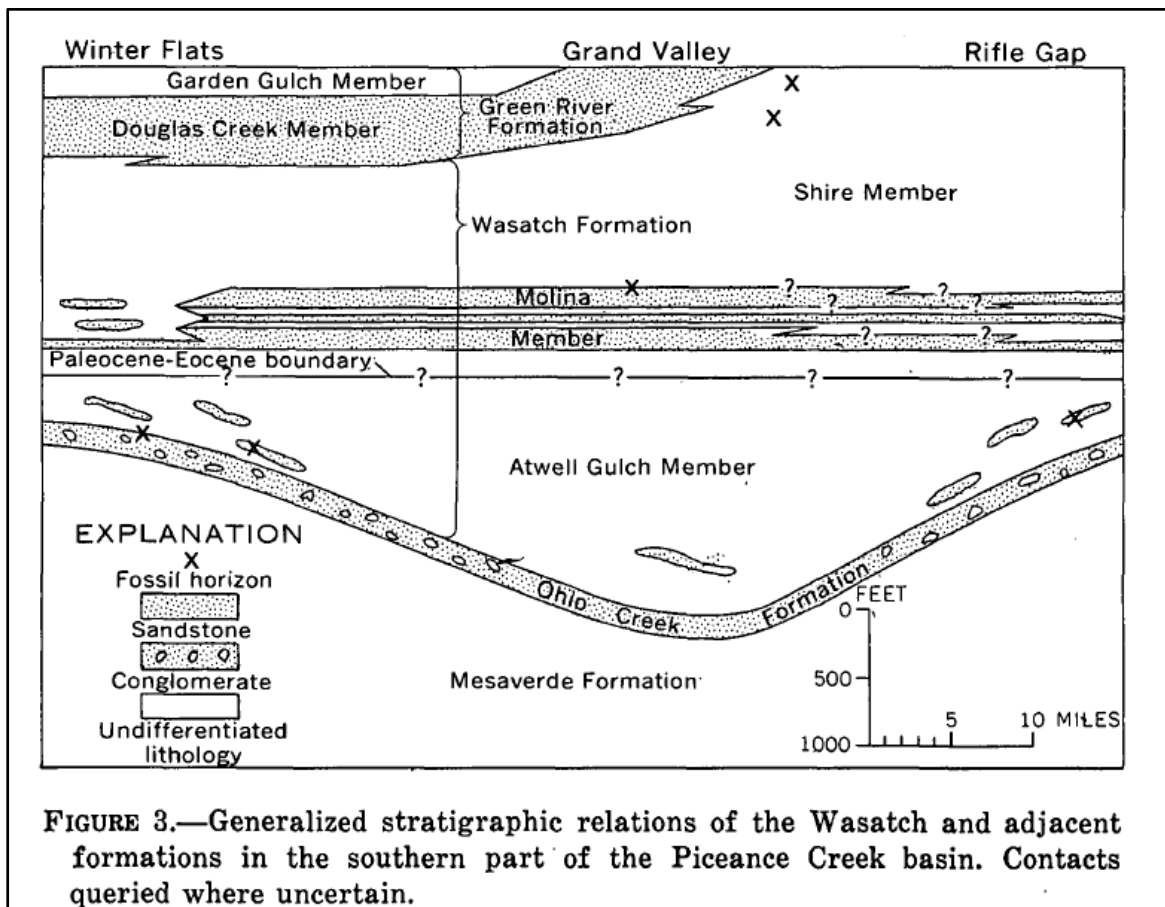
6. **Rockfall:** The facility is adjacent to slopes on the west side that vary from 30 to 60% grades. As identified in the NRSC soils report, these slopes are identified as Torriorthents-Camborthids-Rock outcrop parent material comprised of stoney, basaltic alluvium derived from sandstone and shale, associated with mountainsides. Field investigations revealed limited rock outcropping. The western side of the facility is protected by a large runon diversion ditch capable of terminating rock falls should they occur. The risk appears low for this site.

7. **Flood:** No significant natural drainages are located within the facility boundary. The NRCS soil report indicates the Flood Frequency Class for the facility location is "None" for the site. The site may be subject to sheet flow from precipitation events, however, storm water best management practices are in place to mitigate or prevent storm water from entering the facility and disrupting operations. Flood risk appears low for this site.

8. **Mudflow and Debris Fans:** No significant natural drainages are located within the facility boundary. The NRCS soil report indicates the Flood Frequency Class for the facility location is “None” for the site.

9. **Expansive Soil and Rock:** The NRCS reports the surface soil at the facility, as classified under the Uniform Soils Classification System, is CL – clay, low plastic. The proposed uses, design and operations at the facility are not impacted by expansive soils or rock.

10. **Slopes:** The facility is located on a bench at an elevation of 5138 ft. MSL. The gradient from the facility slopes downward to the south/southeast at a 6 – 8% grade. There are no moderate or severe slopes within the facility. Slope risk appears low for this site.



Taken from USGS GEOLOGICAL SURVEY BULLETIN 1274-M entitled “Paleocene and Lower Eocene Units in the Southern Part of the Piceance Creek Basin” by John R. Donnell, 1969.

6. Hydrologic Data - 908.b.(7).B

The Smith Gulch Completions Pit facility is located on a bench at an elevation of 5138 ft. MSL adjacent to Smith Gulch. The site sits between the Roan Plateau to the north and the Colorado River approximately one mile to the south. The Roan Plateau rises to the north to an elevation of 8700 feet. The gradient from the facility slopes downward to the south/southeast at a 6 – 8% grade to the Colorado River at an elevation of approximately 4900 ft. MSL.

No natural drainages are located within the facility boundary. Smith Gulch is identified as an ephemeral drainage with a channel elevation approximately 12 – 20 feet below the facility elevation. The facility, topography and drainages are identified on the attached map entitled “Spruce Creek Facility – Surface Water Features Within 2 Miles. The map and data were obtained from the USGS National Hydrography Dataset.

6.1 Surface Water Features – 908.b.(7).B.i

Surface water features are identified on the map entitled “Smith Gulch Completions Facility – Surface Water Features Within 2 Miles’ included in Attachment 14. The map and data were obtained from the USGS National Hydrography Dataset.

6.2 Depth to Groundwater and Major Aquifers - 908.b.(7).B.ii

Groundwater and bedrock were not encountered during the excavation of the pit associated with the facility. Based on the “Geologic Map of Colorado” compiled by Ogden Tweto, dated 1979, the area is geologically referred to as the Wasatch Formation classified as claystone, mudstone, sandstone and conglomerate.

USGS GEOLOGICAL SURVEY BULLETIN 1274-M entitled “Paleocene and Lower Eocene Units in the Southern Part of the Piceance Creek Basin” by John R. Donnell, 1969, further identifies the underlying geology as the Douglas Creek Member of the Green River Formation and is graphical shown on the attached diagram. Donnell describes the Green River Formation as sedimentary rock. Tweto describes the Green River Formation as marlstone, sandstone and oil shale.

The bedrock is presumed to be or of a similar material and its thickness. Donnell shows the Douglas Creek Member as having a thickness of 400 to 500 feet. Major aquifers are not present at the site and the depth to groundwater, if any, is unknown.

6.3 Water Wells Within One Mile - 908.b.(7).B.iii

Water wells of record within a one mile radius of the facility are identified on the attached map entitled Plat 5C – Hydrology. The well location, permit number, depth, screened interval, yields and aquifer name

were obtained from the Colorado Division of Water Resources files and are summarized in the table below.

6.4 Water Wells and Information of Record - 908.b.(7).B.iv

Water Wells Within 1 Mile of Smith Gulch Completions Facility						
Well Number	Well Depth (ft)	Depth to Water (ft)	Screened Interval (ft)	Yield (gpm)	Aquifer	Comment
28654-MH						Well Permit Canceled - No data
192819	12	6	8 - 12'	11	Alluvium	No data

*Source: Colorado Division of Water Resources

6.5 Hydrologic Properties - 908.b.(7).B.iv

Groundwater and bedrock were not encountered during the excavation of the pit associated with the facility. Based on the “Geologic Map of Colorado” compiled by Ogden Tweto, dated 1979, the area is geologically referred to as the Wasatch Formation classified as claystone, mudstone, sandstone and conglomerate. The bedrock is presumed to be or of a similar material and its thickness is unknown.

Smith Gulch is designated as an ephemeral stream by the USGS indicating that the Gulch only flows after a precipitation event. Major aquifers appear to not be present at the site and the depth to groundwater, if any, is unknown.

No significant natural drainages are located within the facility boundary. The NRCS soil report indicates the Flood Frequency Class for the facility location is “None” for the site. The site may be subject to sheet flow from precipitation events, however, storm water best management practices are in place to mitigate or prevent storm water from entering the facility and disrupting operations.

6.6 Site Location in Relation to Floodplain - 908.b.(7).B.v.

The Smith Gulch Completions Pit facility is located on a bench at an elevation of 5138 ft. MSL adjacent to Smith Gulch. The site sits between the Roan Plateau to the north and the Colorado River approximately one mile to the south. The Roan Plateau rises to the north to an elevation of 8700 feet. The gradient from the facility slopes downward to the south/southeast at a 6 – 8% grade to the Colorado River at an elevation of approximately 4900 ft. MSL.

No natural drainages are located within the facility boundary. The NRCS soil report indicates the Flood Frequency Class for the facility location is “None” for the site. The site may be subject to sheet flow from precipitation events, however, storm water best management practices are in place to mitigate or prevent

storm water from entering the facility and disrupting operations. Smith Gulch is identified as an ephemeral drainage with a channel elevation approximately 12 – 20 feet below the facility elevation. The facility, topography and drainages are identified on the map entitled Spruce Creek Facility – Surface Water Features Within 2 Miles. The map and data were obtained from the USGS National Hydrography Dataset.

6.7 Existing Quality of Shallow Groundwater - 908.b.(7).B.vi

Based on published geology reports, it appears that major aquifers and shallow groundwater are not present at the site. As no development exists up gradient of the facility, the ephemeral flows in Smith Gulch from area precipitation may be uncontaminated.

6.8 Evaluation of Potential Impacts to Surface and Groundwater - 908.b.(7).B.vii.

The primary function of the facility is to store produced water extracted from TEP's natural gas wells. The facility's storage impoundment structure was permitted by the COGCC through the Form 15 process. The approved liner system consists of a 60 mil HDPE primary liner, a 200 mil geogrid, 40 mil secondary HPDE liner, and a tertiary geosynthetic clay liner. The geogrid is located in the interstitial space between the primary and secondary liner. A monitoring sump provides for observation of water levels, if present, in the interstitial space, and allows for the removal of any accumulated liquids that passes through the primary liner so that hydraulic heads on the secondary liner are kept to a minimum. Installation of the liner system included double welded fusion seams that were subjected to quality control pressure and integrity testing. Periodic hydrostatic tests are conducted to verify liner integrity.

Storm water controls are in place to eliminate or diminish surface related releases.

6.9 Annual Precipitation and Evaporation - 908.b.(4)

Average annual precipitation, based on precipitation records from Little Hills, Colorado weather station is 13.83 inches. Average annual gross evaporation, based on NOAA Technical Report NWS – 33 is estimated to be 40.0 inches. Monthly distributions are provided below.

<u>Month</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Annual</u>
Average Annual Precipitation (in.)*	0.74	0.78	1.23	1.42	1.36	1.12	1.25	1.60	1.13	1.27	0.99	0.94	13.83
Average Annual Evaporation (in.)**	0.40	1.20	2.40	3.60	5.00	6.20	6.40	5.20	4.40	3.00	1.60	0.60	40.00
* Precipitation Data from Western Regional Climate Center - Little Hills Weather Station													
**NOAA Technical Report NWS 33 - Map 3 'Free Water Surface Evaporation 1956 - 1970'													

7. Waste Profile - 908.b.(6)

7.1 Produced Water

The primary function of the Pit is to manage produced water that is reused for remote hydraulic fracturing operations. Currently, the Pit services 2028 wells between the South Grand Valley, Grand Valley and South Parachute Fields. Flows from individual wells range from 1-50 bbls per day (see Attachment 18 - Produced Water Profile and MSDS). The list of wells serviced by the Pit is included in Attachment 19 – Form 26. The well pad locations are included in Attachment 20 – Service Area Map.

The chloride concentrations of produced water in the Pit are around 11878 ppm. The chloride concentrations ideal for fracturing operations range between 10,000 and 12,000 ppm. Therefore, produced water stored in the Pit can be used for fracturing operations as long as the wells producing to the Pit are in active production. Before fracturing operations, produced water will be removed from the Pit, sampled and amended. The only in-pit treatment potentially needed is the application of biocide in the summer months to prevent bacteria growth and potential associated odor concerns.

If there is excess water in the Pit that is not needed for hydraulic fracturing operations, the excess water will be injected into the following injection wells:

- SG 924-29D – COGCC Facility ID # 159974
- SG 334-32 – COGCC Facility ID # 159971
- SG 922-32D – COGCC Facility ID # 159960
- SG 914-32D – COGCC Facility ID # 159981

7.2 Condensate

Produced water that is trucked from a production facility flows through the 500 bbl gun barrel tank where free phase hydrocarbons (condensate) are gravity separated. Condensate is transferred through a pipe to a 300 bbl condensate tank and produced water is managed in the Pit. Any produced water that is pumped to location goes directly into the pit as it has already been through a gun barrel or treatment process.

On a monthly average basis, 200 bbls of condensate is separated into the condensate tank. See Attachment 22 for Condensate Profile and MSDS.

8. Facility Design and Engineering – 908.b.(7)C.

The Pit facility includes:

- one HDPE lined Pit
- One 500 bbl gun barrel tank
- One 300 bbl condensate tank

- pump building
- filter and injection pump building
- loading station

The pit has a capacity of 124,730 barrels; working volume with 2' of freeboard is 105,230 barrels. The pit dimensions are 350 ft. in length by 160 ft. wide and 16 ft. deep.

The Pit was constructed entirely below natural grade and synthetically lined with high density polyethylene. The liner system consists of a 60 mil primary liner and a 40 mil secondary liner underlain with 12-ounce geotextile underlayment. An interstitial leak detection geonet is located between the primary and secondary liners. No embankment fills were employed in the construction of the surface impoundment.

The facility tank battery consists of two steel aboveground tanks; one 500-barrel tank that separates produced water from condensate (gun barrel) and one 300-barrel tank that stores condensate. The tank battery is contained within a lined secondary containment structure meeting the requirements of the SPCC regulations, 40 CFR Part 120. SPCC details are provided in Attachment 17. A PE certified as-constructed drawing is included in Attachment 23. The as-constructed drawing shows the facility design, cross sections, pit volume calculations, and elevations.

The Pit is enclosed in a 6-foot chain link fence to prevent incidental access and is covered by netting to prevent wildlife access. The fence perimeter is depicted in the Attachment 23, As Constructed drawing. Netting and fencing details are included in Attachment 6.

Produced water is pumped via pipeline or trucked to the Pit from nearby TEP well pads. Details for the pipeline design are provided in section 8.6 Pipeline Design and Maintenance. A map showing the location and type of pipeline is included in Attachment 24 – Water Line System. Pipeline specifications are included as Attachment 25.

Produced water is pumped from the Pit utilizing three pumps: submersible pump and two transfer pumps located inside the pump building. Water is transferred from the pump building to the injection pump where it's transferred to one of the injection wells for disposal. See section 7.1 for list of injection wells. .

8.1 Liner Specifications and Installation Report

The Pit's primary liner is a 60 mil HDPE synthetic liner that cover the bottom and interior sides of the pit with the edges secured with at least a 12-inch anchor trench around the pit perimeter. As an alternative to a 24-inch compacted clay soil foundation outlined in Rule 904.d (2), TEP Energy elected to install an alternate system, as allowed in Rule 904.d (3), consisting of a BentoMatDN geosynthetic bentonite liner covered with a 40 mil HDPE liner. The liner system specifications, installation, and seam testing reports are included in Attachment 5.

After complete installation of the liner system and prior to putting the pit into operation, the liners were tested by conducting hydrostatic tests. The hydrostatic testing report is included in Attachment 7.

8.2 Leak Detection

The approved liner system consists of a 60 mil HDPE primary liner, a 200 mil geogrid, 40 mil secondary HPDE liner, and a geosynthetic bentonite liner. The geogrid is located in the interstitial space between the primary and secondary liner. A leak detection system (monitoring sump) provides for observation of water levels, if present, in the interstitial space, and allows for the removal of any accumulated liquids that passes through the primary liner so that hydraulic heads on the secondary liner are kept to a minimum. Installation of the liner system included double welded fusion seams that were subjected to quality control pressure and integrity testing. See Attachment 7 for details.

8.3 Liner Maintenance

The liner manufacturer does not have written recommendations for the liner maintenance because of the varying applications of their product. However, the liner installation company provided generic liner maintenance recommendations. Attachment 27 includes the maintenance recommendations along with the liner manufacturer's product and installation quality assurance manuals. In addition, TEP has implemented internal policies for the liner maintenance:

- Hoses are not allowed to be placed directly onto the pit liner
- Water is transported to the pit via gravity-fed pipeline
- If water needs to be delivered to the location via vacuum trucks, it is unloaded at the unloading station
- Water is pumped out of the pit utilizing unloading station
- The pit liner is inspected at least semi-weekly for any liner damage

Pit inspection reports are included in Attachment 8.

8.4 Fire Lane – 908.b.(5).D.

In accordance with the COGCC Rule 908.b.(5)D, "Centralized facilities shall have a fire lane of at least 10 feet in width around the active treatment areas and within the perimeter fence. In addition a buffer zone of at least 10 feet shall be maintained within the perimeter fire lane". The Pit does not have the 10 foot wide road or the 10 foot buffer zone around the entire perimeter of the pit. To address this requirement, TEP personnel met with the Grand Valley Deputy Fire Chief and evaluated the site for accessibility. A letter from the Fire Chief summarizing the visit along with a draft Fire Buffer Zone variance request is included in Attachment 28.

8.5 Surface Water Diversion Structures – 908.b.(5).E.

Surface water diversion structures have been constructed at the facility to accommodate the 100-year 24-hour precipitation event. A run-on control system has been designed and constructed to prevent surface runoff flow from entering the facility during peak discharges from a 100-yr 24-hr precipitation event and a run-off control system to contain accumulated precipitation volume within the facility during a 25-year 24-hour storm event.

The National Oceanic and Atmospheric Administration, NOAA Atlas 2 - Volume III, reports the 100-year 24-hour and 25-year 24-hour rainfall depth at the facility locations to be approximately 2.60 and 2.15 inches, respectively. Utilizing NOAA Atlas 2 regression and nomograph methodologies, the resulting rainfall intensities for various return periods, including the 100-year and 25-year events, are summarized below.

NOAA Atlas 2 Volume III Precipitation Computations

Region 2: San Juan, Upper Rio Grande, Upper Colorado, and Gunnison River Basins, and
Green River Basin below Confluence with the Yampa River

Project Location: Garfield County - Smith Gulch Completion Pit

Rainfall Depth-Duration-Frequency Table*

Return Period	Rainfall Depth in Inches at Time Duration*								
	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr*	24-hr*
	compute	compute	compute	compute	compute	compute	compute	inputs	inputs
2-yr	0.18	0.28	0.36	0.49	0.62	0.72	0.78	0.90	1.20
5-yr	0.26	0.40	0.50	0.70	0.88	0.98	1.05	1.18	1.52
10-yr	0.29	0.45	0.57	0.79	1.00	1.13	1.21	1.37	1.81
25-yr	0.34	0.53	0.67	0.92	1.17	1.32	1.41	1.60	2.15
50-yr	0.41	0.64	0.81	1.12	1.42	1.56	1.65	1.83	2.38
100-yr	0.48	0.74	0.94	1.31	1.66	1.77	1.85	2.00	2.60

* Note: Refer to NOAA Atlas 2 Volume III isopleth maps for 6-hr and 24-hr rainfall events and rainfall depths at time durations.

Rainfall Intensity-Duration-Frequency Table

Return Period	Rainfall Intensity in Inches Per Hour at Time Duration								
	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	24-hr
	compute	compute	compute	compute	compute	compute	compute	compute	compute
2-yr	2.17	1.69	1.42	0.99	0.43	0.36	0.26	0.15	0.05
5-yr	3.07	2.38	2.01	1.39	0.88	0.49	0.35	0.20	0.06
10-yr	3.48	2.70	2.28	1.58	1.00	0.56	0.40	0.23	0.07
25-yr	4.07	3.16	2.67	1.85	1.17	0.66	0.47	0.27	0.09
50-yr	4.94	3.83	3.24	2.24	1.42	0.78	0.55	0.31	0.10
100-yr	5.76	4.47	3.77	2.62	1.30	0.89	0.62	0.33	0.10

* Note: Refer to NOAA Atlas 2 Volume III isopleth maps for 6-hr and 24-hr rainfall events and rainfall depths at time durations.

As noted on the Controls Analysis drawing, the Manning-Chezy equation was utilized to estimate the flow capacity of the diversion ditches. This empirical formula incorporates the ditch configuration, slope and a roughness coefficient to estimate capacities.

The Rational Method was utilized to estimate peak discharge flows from tributary areas. This methodology incorporates rainfall intensity from the 100-yr precipitation event assuming a time of concentration of 30 minutes, a run-off coefficient and the contributing tributary surface area. Control structure estimated capacities and peak tributary run-offs are summarized on the Controls Analysis drawing.

The NRCS identifies the dominate soils type within the boundary of the Smith Gulch Completion Pit facility as Arvada loam, comprising approximately 96% of the area, while Torriorthents-Camborthids-Rock outcrop complex comprises the remainder. The Arvada loam parent material is derived from alluvium of sandstone and shale, associated with terraces and alluvial fan landforms. The Torriorthents-Camborthids-Rock outcrop parent material is stoney, basaltic alluvium derived from sandstone and shale, associated with mountainsides.

The Arvada loam soil has a hydrologic group rating of C. Group C soils generally have a slow infiltration rate when thoroughly wet. The majority of runoff, associated with disturbed construction areas, is from Arvada Loam soil. The estimated pre-construction runoff coefficient is 0.1 with the post-construction runoff coefficient estimated at 0.3.

The Torriorthents-Camborthids-Rock outcrop soil complex has a hydrologic group rating of C and D. Group D soils generally have very slow infiltration rates when thoroughly wet. The majority of runoff, tributary to the facility, is from Torriorthents-Camborthids-Rock outcrop soil complex. The estimated runoff coefficient from undisturbed areas is 0.5.

A number of best management practices and diversion structures have been designed to control runoff and runoff resulting from the 100-yr 24-hr event, inclusive of the 25-yr 24-hr event. Specific best management practices ("BMPs"), including erosion and sediment control structures, are identified in TEP's Field Wide Stormwater Management Plan. BMPs are shown on the attached storm water management plan drawing and are analyzed on the attached drawing entitled "Smith Gulch Completion Pit Storm Water Controls Analysis".

The surface impoundment structure or pit freeboard will be maintained at a minimum of 2 ft. below finished pad grade per COGCC regulations. The freeboard provides sufficient capacity to contain the 100-

yr 24-hr event of 2.6 inches. Additionally, the pit's synthetic liner and/or berm will extend 4" - 6" above finished pad grade to prevent runoff into the pit.

8.6 Pipeline Design and Maintenance

The Pit was constructed to manage produced water for disposal and/or reuse in hydraulic fracturing operations by collecting production water that is trucked from 339 well pads located in the South Grand Valley, Grand Valley and South Parachute Fields. Currently, the Pit services 2028 wells. See the Operating Plan, Attachment 20 – Service Area Map for well pad, pipeline locations, and pipeline material.

The produced water pipelines were installed, designed, and maintained in accordance with the COGCC 1100 Series Rules. The pipeline material and sizes are identified in Attachment 24 – Water Line System.

The manufacturer specifications for FlexSteel, Flexpipe, and stainless steel lines are included in Attachment 25.

Before being put into service, the main water transfer pumps were pressure tested. All pressure test reports are included in Attachment 29. The pipeline pressure testing procedures are included in Attachment 30.

9. Operating plan - 908.b.(8)

An Operating Plan is provided in Attachment 31.

10. Groundwater and Surface Water Monitoring - 908.b.(9) and 908.b.(10)

As required by the Form 15 COA #20, prior to the Pit use, TEP conducted baseline surface water sampling. To date, TEP has completed 5 sampling events:

- 6/03/2013 – Initial baseline samples were collected from Van Hoose Spring and the Colorado River. (Attachment 32)
- 9/16/2013 – Annual sampling event, samples were collected from from Van Hoose Spring and the Colorado River. (Attachment 33)
- 8/28/2014 – Annual sampling event, samples were collected from from Van Hoose Spring and the Colorado River. (Attachment 34)
- 7/27/2015 – Annual sampling event, samples were collected from from Van Hoose Spring and the Colorado River. (Attachment 35)
- 4/19/2016 - Annual samples were collected from from Van Hoose Spring and the Colorado River. (Attachment 36)

Prior to this Form 28 permit application, baseline water quality evaluation was completed. The baseline water quality evaluation considered all water wells within a 1.0-mile radius of the referenced pit. The Baseline Water Quality Evaluation is included in Attachment 43.

11. Contingency Plan – 908.b.(8).E. and 908.b.(11)

In the event of an immediate threat to human health and the environment, please refer to the SG 31-32-796 Emergency Response Plan (Attachment 38) and TEP Spill Prevention and Response Plan (Attachment 39). The TEP Energy Emergency Contact Card will be updated when changes in personnel are made. Both plans are maintained at TEP's Parachute office.

12. Facility Modifications – 908.e.

Throughout the life of the facility, Terra will submit proposed modifications to the facility design, operating plan, permit data, or permit conditions to the Director for prior approval.

13. Annual Permit Review – 908.f.

To facilitate the annual review, TEP will submit an annual report summarizing operations including the following information:

- types and volumes of waste handled at the facility
- volumes of fluids recycled in fracturing, injected, shared, or disposed of at a centralized E&P WMF
- the addition of new wells or the elimination of wells that contribute produced water to this facility
- pipeline upgrades and pressure testing results

14. Financial Assurance – 908.d

Financial assurance cost estimate for proper closure and reclamation is provided in Attachment 40. TEP already provided an estimated \$913,455.94 bond as requested by COGCC; see Attachment 41 – Performance Bond, Form 3.

15. Closure – 908.g

The Reclamation Plan is included in Attachment 42. A detailed Site Investigation and Remediation Workplan, Form 27, will be submitted for COGCC approval, prior to pit closure activities.

16. Recordkeeping – 908.b.(8)F.

Records will be maintained at TEP's Parachute, Colorado field office. TEP maintains inspection forms, maintenance documentation, throughput calculations, and analytical sample data within the facility's data management system, which may include use of multiple databases, spreadsheets, log sheets, and sampling results. These records will be maintained for a period of five (5) years and made available for review upon request from COGCC.

17. Local Requirements – 908.h.

In Garfield County, remote surface facilities used to support hydraulic fracturing for the purpose of advancing the well bore are a use-by-right in the rural zoning district under Article 15, Definitions, and Article 3, Zoning, per the Garfield County Land Use and Development Code. Garfield County defers to COGCC for the permitting of this location.