SPILL PREVENTION, CONTROL, AND COUNTERMEASURE PLAN

HIGH MESA WATER TREATMENT FACILITY

GARFIELD COUNTY, COLORADO

Prepared for:

Encana Oil & Gas (USA) Inc.

PARACHUTE, COLORADO

JANUARY 10, 2011 REV.1

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS

API	American Petroleum Institute
ARC	annual regulatory compliance
AST	above ground storage tank
ASTM	American Society for Testing and Materials
Bbl	barrel(s), US petroleum, 42 gallons
BLM	Bureau of Land Management, U.S. Department of the Interior
BMPs	Best Management Practices
BOP	blow out preventer
CDP	central delivery point
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
COGCC	Colorado Oil and Gas Conservation Commission
DAF	dissolved air floatation
EPA	U.S. Environmental Protections Agency
FRP	Facility Response Plan
IMS	Incident Management System
MOC	Management of Change System
OSCP	Oil Spill Contingency Plan
SIC	Standard Industrial Classification
SPCC	Spill Prevention, Control, and Countermeasures
STI	Steel Tank Institute
UL	Underwriters Laboratory, Inc.
UST	underground storage tank
WTF	water treatment facility

REGULATORY CROSS REFERENCE MATRIX

40 Code of Federal Regulations (CFR) Part	Requirement	SPCC Plan Section
112.3 (a)	Amend plan as necessary per updated regulations	1.1
112.3 (d)	Professional engineer certification	1.6
112.3 (e)	Maintain a copy of plan at facility (location of plan)	1.7
112.4(d)	Report certain discharges to EPA	7.2
112.5 (a)	Amend plan following significant changes to the facility	7.1
112.5 (b)	Review plan at least every five years and amend if appropriate	7.1
112.7	Management approval of plan	1.4
112.7	Provide a cross reference matrix to regulations	ii
112.7	Discuss needed facilities, equipment, or procedures not yet operational in separate paragraphs	9.0
112.7 (a)(1)	Discussion of facility's conformance with the regulations	9.0
112.7 (a)(2)	Equivalent environmental protection is allowed for deviations from portions of regulations. Reasons for non conformance must be stated.	9.0
112.7 (a)(3)	Describe the physical layout of the facility. Provide a facility diagram including tanks, underground tanks, storage areas for mobile containers, produced water containers, associated piping, transfer stations, connecting pipes and intra-facility gathering lines.	1.2, 2.1, 2.5, 2.6, Figure 1, Figure 2
112.7 (a)(3)(i)	Plan must include type of oil in each container and capacity of each container	2.2, 2.5, Table 2
112.7 (a)(3)(ii)	Discharge prevention measures including procedures for oil handling at loading/unloading areas	4.0, 4.2, 4.3
112.7 (a)(3)(iii)	Drainage control around containers and other equipment	2.3, 4.0, 4.4
112.7 (a)(3)(iv)	Countermeasures for discharge discovery, response and cleanup.	5.0, APP B
112.7 (a)(3)(v)	Methods of disposal of recovered materials	5.0, APP B
112.7 (a)(3)(vi)	Contact list including phone numbers	1.3, Table 1
112.7 (a)(4)	Discharge reporting procedures, information to be included	5.0, APP B
112.7 (a)(5)	Organize plan to make it useful in an emergency	APP B
112.7 (b)	Provide an equipment failure analysis including sources, quantity, direction, and rate of flow	2.4, Table 4
112.7 (c)	General secondary containment requirement (typical failure mode and most likely quantity) for areas from which a discharge could occur by at least one of eight specified measures	2.3, 2.4, 4.1
112.7 (d)	If necessary provide an explanation of impracticability of secondary containment, conduct periodic integrity testing of containers and periodic integrity and leak testing of valves and piping	2.6, 3.2.2, 9.0
112.7 (d)(1)	For impracticability, provide an oil spill contingency plan per part 109	5.0, APP B
112.7 (d)(2)	For impracticability, provide written commitment of manpower, equipment, and materials	5.0, 1.4
112.7 (e)	Written procedures for inspections and tests	3.1, 3.1.8
112.7 (e)	Records of inspections must be signed and kept with plan for three years	3.2, 8.0, APP C

40 Code of Federal Regulations (CFR) Part	Requirement	SPCC Plan Section
112.7 (f)(1)	Train oil handling personnel	6.0
112.7 (f)(2)	Designate an individual accountable for discharge prevention	1.4, 5.0
112.7 (f)(3)	Conduct an annual discharge prevention briefing	6.0
112.7 (g)	Security	N/A
112.7 (h)	Provide sized secondary containment (largest compartment on tanker) for loading/unloading racks	4.1
112.7 (h)	Provide systems to prevent truck departure before disconnection	4.1
112.7 (h)	Inspect truck prior to filling and departure	4.1
112.7 (i)	Evaluate field constructed containers for brittle fracture failure when containers are altered or repaired	3.1.1
112.7 (j)	Compliance with State requirements	9.0
112.7 (k)	Qualified oil-filled operational equipment – alternative to general secondary containment requirements	2.7
112.7 (k)	If no secondary containment -Prepare inspection procedures or monitoring program	2.7
112.7 (k)(2)(ii)	If no secondary containment –Provide an oil spill contingency plan per part 109	APP B
112.7 (k)(2)(ii)	If no secondary containment provide written commitment of resources	1.4
112.9 (b)(1)	Oil production facility drains of dikes must be kept closed. Inspect diked areas before draining water and remove accumulated oil.	4.4
112.9 (b)(2)	Inspect field drainage systems, oil traps, sumps or skimmers for oil. Remove accumulated oil	3.1.7
112.9 (c)(1)	Material and construction of containers must be compatible with stored material and conditions of storage	2.2
112.9 (c)(2)	Provide sized secondary containment (capacity of largest container plus precipitation) for tank battery, separation, and treating facility installations	2.3, 4.4,Table 3, APP G
112.9 (c)(2)	Confine drainage from undiked areas to catchment basin or holding pond	4.4
112.9 (c)(3)	Visually inspect containers, foundations, and supports periodically and on a regular schedule	3.1, 3.1.1, APP C
112.9 (c)(4)	Engineer tank batteries to prevent discharges	3.2.2
112.9 (c)(5)	Alternative to sized secondary containment for some flow through process vessels	3.1.3
112.9 (c)(5)(ii), (iii)	Take corrective action as indicated by inspections, tests or evidence of oil, remove or stabilize and remediate any accumulation of oil	5.0
112.9 (c)(6)	Alternative to sized secondary containment for some produced water containers	3.1.4, 3.1.8, 3.2.1,
112.9 (d)(1)	Periodically and regularly inspect aboveground valves, piping, drip pans, supports, and pumps associated with transfer operations	3.1.6, 3.1.7
112.9 (d)(2)	Inspect salt water disposal facilities	3.1.4
112.9 (d)(3)	For flowlines and intra-facility gathering lines without secondary containment provide:	2.6

40 Code of Federal Regulations (CFR) Part	Requirement	SPCC Plan Section
112.9 (d)(3)(i)	Oil spill contingency per Part 109 and	APP B
112.9 (d)(3)(ii)	Written commitment of resources	1.4
112.9(d)(4)	Prepare and implement a flowline maintenance program including:	3.2.1
112.9(d)(4)(i)	Ensure materials are compatible with fluids	3.2.1
112.9(d)(4)(ii)	Visually inspect or test flowlines and intra-facility gathering lines on a regular and periodic schedule. For lines not having secondary containment the frequency and type of testing must allow for prompt implementation of the contingency plan.	3.1.6, 3.1.7
112.9(d)(4)(iii)	Take corrective action as a result of inspections, tests, or evidence of a discharge	3.2.1
112.9(d)(4)(iv)	Promptly remove or stabilize and remediate oil discharges	APP B
112.20 (e) 112.20(f)(1)	Certification of the applicability of substantial harm criteria	1.5, APP A

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

Encana Oil & Gas (USA) Inc.'s (Encana's) High Mesa Water Treatment Facility (WTF) is a facility which collects, treats, and stores produced water from a series of natural gas wells in the southern Parachute area. As a by-product of the produced water, natural gas condensate is also collected and stored at the High Mesa WTF. The WTF is comprised of the liquid lines from the High Mesa Compressor Station to the WTF, the associated pipelines between the upper and lower levels of the WTF, the High Mesa Produced Water Ponds, the Dissolved Air Floatation (DAF) unit, and the produced water delivery system (including eight bulk storage tanks and all the flowlines from the source to the WTF).

The Oil Pollution Prevention Regulations (40 CFR 112) require preparation of a Spill Prevention, Control and Countermeasure (SPCC) plan for facilities that have discharged or could reasonably be expected to discharge oil into or on navigable waters of the United States or adjoining shorelines. A SPCC plan is required to be prepared if greater than 42,000 gallons of oil are stored in buried tanks or greater than 1,320 gallons of oil is stored in aboveground tanks. For the purposes of this Plan, the term "oil" refers to oil-containing liquid (which could include but not limited to produced water, condensate, hydraulic fluids, compressor oil, etc.). Produced water remains subject to this Plan until it is re-injected into the ground or shipped off-site. Because the High Mesa facility falls within the scope of one of the thresholds listed above, a SPCC plan is required to be prepared and implemented.

The purpose of this SPCC Plan (referred to herein as the Plan) is to describe engineering and administrative controls employed at or by a facility to comply with requirements set forth under 40 CFR 112 to prevent the discharge of oil to navigable waters as well as state-specific rules, regulations and guidelines pertaining to oil spill prevention, control and countermeasure. The contents of this Plan include all applicable requirements listed in 40 CFR 112 as noted in the cross-referencing table located in the Plan preface.

This Plan has been prepared in accordance with those regulations as amended by the Environmental Protection Agency's (EPA) November 13, 2009 final regulatory action and any more stringent state-specific requirements regarding the prevention, control or countermeasures associated with releases of oil to the environment.

1.2 LOCATION AND DEFINITION OF PLAN AREA

This plan covers the High Mesa Water Treatment Facility. The High Mesa WTF includes the associated piping connecting the WTF and the High Mesa Compressor Station, the associated pipelines which facilitate produced water transport between the bulk storage tanks, produced water ponds, onloading/offloading areas, and the DAF unit, the DAF unit, and the bulk storage tanks. Produced water is collected from various drilling and production locations within the South Parachute and Orchard Mesa area, treated by separation and the DAF unit, and stored for reuse or disposal. The amount of produced water/condensate processed at the High Mesa WTF makes these operations subject to 40 CFR 112 and, specifically, section 40 CFR 112.9 for onshore oil production facilities. The facility is located at SENW Section 36, T7S, R96W, 6th PM in Garfield County, Colorado. Figure 1 depicts the geographic extent of the facility for which this Plan has been developed and implemented.

This property is owned by Encana Oil & Gas (USA), Inc. with an office at 2717 County Road 215, Suite 100, Parachute, Colorado 81635.

1.3 CONTACT INFORMATION

Contact information specific to the Encana Oil & Gas (USA), Inc. facility for which this Plan has been drafted and implemented is provided in Table 1 - Contact Information, located in the Tables section of this Plan. Emergency notification procedures (including contact information and phone numbers for the National Response Center, state, local entities, and cleanup contractors) are described in detail in the Oil Spill Contingency Plan (OSCP) located in Appendix B.

1.4 MANAGEMENT APPROVAL AND COMMITMENT OF RESOURCES

Encana is committed to the prevention of discharges of oil to navigable waters and the environment through the implementation of spill prevention measures. This SPCC Plan is one part of that effort.

I approve this plan and the commitment of resources to implement the Plan at this facility. This resource commitment includes the manpower, equipment, and materials required to expeditiously control and remove any quantity of oil discharged that may be harmful.

Signature: _____ Date: _____

Printed Name: _____ Title: _____

The designated responsible person for spill prevention and cleanup at the facility is directly responsible for implementing this Plan and communicating the Plan to appropriate Encana personnel. This individual reports directly to Encana management and is identified below.

Facility: HIGH MESA WATER TREATMENT FACILITY

Name: MIKE CONN

Title: HIGH MESA WATER TREATMENT OPERATIONS SUPERVISOR

Contact Information: 970-285-2881 (OFFICE) OR 970-456-6405 (CELL)

1.5 SUBSTANTIAL HARM CERTIFICATION

A facility that could, because of its location, be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines is required to prepare and submit to the EPA Regional administrator a Facility Response Plan (FRP) in accordance with 40 CFR 112.20. The form certifying the applicability of the substantial harm criteria for this facility covered by this Plan is included in Appendix A. As noted on the completed form, the High Mesa WTF does not meet the criteria for substantial harm (Appendix C to Part 112) and thus a Facility Response Plan is not required for this facility.

1.6 PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I am familiar with the provisions of 40 CFR 112, that I have reviewed this High Mesa WTF SPCC Plan and additional information provided by Encana Oil & Gas (USA) Inc., and that I or my agent have visited and examined the facility that falls within the scope of this Plan. I attest that this Spill Prevention Control and Countermeasures Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards, and with the requirements of 40 CFR 112, that procedures for required inspections and testing have been established, and that the plan is adequate for the facility. I attest that for produced water containers subject to 40 CFR 112.9(c)(6), any procedure to minimize the amount of free-phase oil is designed to reduce the accumulation of free-phase oil and the procedures and

frequency for required inspections, maintenance, and testing have been established and are described in this Plan.

This certification constitutes an expression of professional opinion and does not constitute a warranty or guarantee, either expressed or implied.

	1/25/2011
Signature and Seal of Registered Professional Engineer	Date
James B. Cowart	5/31/2011
Printed Name of Registered Engineer	Registration Expiration Date

Encana acknowledges that the above certification in no way relieves the company of its duty to prepare and fully implement this Plan in accordance with 40 CFR 112.

1.7 PLAN LOCATION

A complete copy of this plan is maintained at High Mesa WTF office trailer. The Plan must be maintained at the facility if the facility is normally attended at least 4 hours per day. If not so attended, the Plan must be maintained at the nearest field office at 2717 County Road 215, Suite 100, Parachute, Colorado 81635. This Plan is available for on-site review during normal working hours at this location.

2.0 FACILITY DESCRIPTION

This section provides detailed information regarding oil storage at the High Mesa Water Treatment Facility. Figure 1 depicts the geographic extent of the scope of this Plan and Figure 2 show facility layout (Facility Site Diagram).

2.1 PHYSICAL LAYOUT, OPERATIONS, AND FACILITY DEFINITION

The High Mesa WTF collects, treats, and stores produced water from area natural gas production wells. The High Mesa WTF comprises two levels of area (topographically).

The lower level of the High Mesa WTF is the location of three produced water ponds, an offload pad, housing for transfer pumps, and a designated area for portable/temporary containers. One of the ponds is "divided" into two to provide initial storage of pretreated (blowback) produced water during completions/fracing operations. The produced water ponds range from approximately 65,800 barrels (bbl) to 74,000 bbl in size; each pond is double-lined impoundments inside earthen berms. The double liners have interstitial tubing to help monitor the integrity of the liners. The double liner is compatible with the stored liquid and is considered to be inherent secondary containment providing equivalent protection to traditional sized secondary containment structures much like a double-walled tank. Overfill protection is provided by several automated and manual systems on the ponds. The liquid level is constantly monitored by facility personnel. Two feet of free board is always maintained in the ponds per Colorado Oil and Gas Conservation Commission (COGCC) regulatory requirements. Excess water is piped to facilities outside of the Plan or transported via water truck. There is a gauged staff in each pond to serve as a visual check on water depth. Overfill protection is provided by automated around the clock monitoring of the water level. The lower level also has an offload area for water transfer and transport. The offload area has a concrete pad sloped to a containment sump.

The upper level of the High Mesa WTF is the location of eight bulk storage tanks, the DAF unit, and two offload areas. The bulk storage tanks are placed within synthetic lined metal walls serving as secondary containment (see section 2.2). The DAF unit is located within a building near the southeast corner of the facility. The DAF unit is designed to treat produced water before it is stored in the High Mesa Ponds. The treatment unit operates at an approximate rate of 1,500 bbl per day and removes suspended solids and petroleum hydrocarbons from the water. Overfill protection for the DAF unit is provided electronically with high level alarms. In addition, the

DAF unit has an emergency shut-down level switch that will shut down the DAF unit if triggered. A facility diagram for this facility is provided as Figure 2.

2.2 BULK STORAGE CONTAINER DATA

Bulk storage containers used at this facility for the storage of oil are compatible with the material stored and the conditions of storage. The eight primary bulk storage tanks are single-walled shop built steel tanks and hold 400 to 500 bbl of produced water/condensate. Secondary containment for the steel tanks consists of a synthetic liner inside steel containment walls sized to allow for a spill of the largest tank and precipitation (24-hour, 25-year storm event); in the event the containment(s) are not sufficient, the containment is connected to the produced water ponds. The steel tanks have overfill protection alarms and periodic visual inspections are performed. The overfill protection alarms has two high level switches and one low level switch. Water level data is reported through PLC logic and Cygnet which Encana Gas Control monitors around the clock. If levels get too high, water is sent to the High Mesa Ponds. The Table 2, Bulk Storage Containers, provides specific information regarding the containers in service at this facility and includes the type of oil in each fixed container and its storage capacity. All tables referenced in section 2.0 are located at the end of the Plan.

2.3 SECONDARY CONTAINMENT AND DRAINAGE CONTROL

General secondary containment is required, at a minimum, to contain the most likely quantity of oil discharged by the typical failure mode from areas storing or handling oil at the facility with the potential to discharge, such as bulk storage containers, tank batteries, treatment and separation installations, portable containers, oil-filled operational equipment, truck loading/unloading areas, and piping. The general secondary containment for the High Mesa WTF is achieved by the compacted earthen berm(s), retention basin(s), and other best management practices (BMPs).

The bulk storage containers are located within the synthetically lined steel walls. Sumps and drip pans are used at the truck loading/offloading areas. The secondary containment calculations for the synthetically lined steel walls are provided in Appendix F. Sorbent material and a drum spill kit are stored on the facility to mitigate spills of oil from portable sources.

The High Mesa WTF has perimeter control BMPs that restrict the flow of water (precipitation) onto the facility from the surrounding environment, and eliminate the discharge of sediment and other pollutants. The BMPs include compacted earthen berms, dikes, and retention (sediment)

basins. If a discharge of accumulated precipitation on a location is required, Encana environmental personnel visually inspect and conduct water quality analysis before approving discharge of the water. In the event of accumulation of oil or other water quality issue, liquids are removed using a vacuum truck and offloaded into the High Mesa WTF for treatment and disposal. All authorized discharges from a location are documented in accordance with applicable regulations and kept on file under customary business practice. The containment systems and procedures utilized are designed to be capable of containing oil and have been constructed so that any discharge from a container, such as a tank, will not escape the containment system before cleanup occurs.

Table 3, Secondary Containment, provides information regarding the types and capacities of secondary containment structures in place at the facility. Figure 2 shows the locations of all secondary containment structures and the general flow of surface drainage. Drainage from undiked areas within any tank battery, separation, and/or treating facility installations is confined in a catchment basement or holding pond until inspected and managed.

2.4 ANALYSIS OF EQUIPMENT FAILURE

Where experience has indicated a reasonable potential for equipment failure, an analysis of the typical modes of each type of major equipment failure has been performed. The results of the analysis have been recorded Table 4, Analysis of Equipment Failure. Although spills that occur within diked areas would likely be contained, predictions in the following table discount the presence of containment structures, per EPA guidance. In determining the method, design, and capacity of secondary containment structures, typical failure modes and the anticipated quantity of oil that may potentially be released were considered.

2.5 TEMPORARY, MOBILE, AND PORTABLE CONTAINERS

Mobile, portable, or temporary containers such as frac tanks and drums may be utilized throughout the facility for storage of oil-containing liquids. During standard facility operations, a various number of frac tanks may be present in any given area. The anticipated capacities of these containers are estimated at 500 bbl each and typically contain produced water. General secondary containment is provided for portable and temporary containers as required per 112.8(c) (11). The facility diagram provided as Figure 2 mark the storage areas where mobile, portable, and temporary containers are generally positioned when needed.

2.6 FLOWLINES, INTRA-FACILITY GATHERING LINES, AND PIPELINES

This facility utilizes flowlines, intra-facility gathering lines, and pipelines. Pipelines included in this facility are extensive (geographically). The pipelines include various piping between the upper level (DAF unit and storage tanks) and the High Mesa Ponds, and the piping at the truck loadout/offloading areas.

The installation of secondary containment is not practicable at this facility for some of the pipelines due to the extent of pipelines covering a large geographical area. As equivalent environmental protection, the lines are routinely inspected, and procedures have been implemented to closely monitor transfer operations. Sections 3.0 and 4.0 of this Plan describe the inspections and monitoring program in greater detail. In addition, an Oil Spill Contingency Plan (OSCP) has been implemented for this facility.

2.7 OIL-FILLED OPERATIONAL EQUIPMENT

There are two oil-filled electrical transformers located on the High Mesa WTF. General secondary containment for the oil in these transformers is provided by concrete catch basins beneath the transformers, and by the site drainage controls and retention basins. The electrical transformers are owned and maintained by Holy Cross electrical company.

3.0 INSPECTIONS, TESTING, AND MAINTENANCE

3.1 INSPECTIONS

All inspections conducted to fulfill the requirements of this Plan are performed in accordance with the equipment-specific procedures outlined in the following sections. Encana has implemented an Integrity Management Program which manages the risk associated with loss of containment by limiting the inherent exposure of assets to the following threats:

- Metal loss, including external and internal corrosion and erosion
- Cracking
- Manufacturing and Construction Defects
- Third Party damage
- Operational (including human error)
- Geotechnical

Encana's inspection and maintenance goals focus on constructing, operating, and maintaining assets using benchmark practices for integrity in the oil and gas sector. This focus is also to protect the public, employees, environment, and communities in which we operate. A copy of Encana's Integrity Management Program is located at the Parachute, Colorado office.

All inspections are performed by personnel who are knowledgeable in facility operations, the equipment being inspected, and the characteristics of the materials being processed, stored, or transferred. The following sections describe the periodic inspections to be conducted.

3.1.1 Field-Constructed Aboveground Containers

Field-constructed aboveground containers (i.e., tanks erected onsite) are not utilized at this facility.

3.1.2 Shop-Built Containers

This facility utilizes shop-built containers that store 55 gallons or more of an oil-containing product or material. Shop-fabricated containers in use at the facility will have routine visual inspections performed at least once per month per the Steel Tank Institute (STI) Standard SP001, Standard for Inspection of In-Service Shop-Fabricated Aboveground Storage Tanks for Storage of Combustible and Flammable Liquids. Once annually, a visual inspection will be performed on each shop-fabricated container subject to the requirements of this Plan. Shop-fabricated containers with over 5,000 gallons capacity shall also have a formal external inspection by a certified inspector at least once every 20 years.

The monthly inspections will be documented utilizing the Monthly Visual Inspection Form included in Appendix C. These inspections shall be performed by personnel who are knowledgeable in facility operations, the tanks and associated components, and the characteristics of the liquids stored. The annual inspections are conducted by an interdisciplinary team trained to identify site-specific compliance concerns related to company policy and pertinent regulatory requirements. This form is also included in Appendix C.

The EPA issued a SPCC Guidance for Regional Inspectors in November 2005. A section of that document (page 7-21, Section 7.3.4) states that for certain shop-built containers with a capacity of 30,000 gallons or less, the EPA considers visual inspection to be equivalent environmental protection to integrity testing. The containers must not be in contact with the soil; the containers may be elevated to make all sides, including the bottom, visible during inspection or be placed on adequately designed, maintained, and inspected barrier which would insure that a leak would be detected immediately.

3.1.3 Pressure Vessels

Pressure vessels are not utilized at this facility.

3.1.4 Produced Water Ponds

Produced water ponds are utilized at this facility. The High Mesa Ponds are inspected visually multiple times per day for evidence of surface oil. If surface oil is noted, the pond or pit will be skimmed and the oil removed within 24 hours from the time the condition was first observed and transferred to the sludge storage tanks for off-site disposal. In addition to the skimming that is conducted on an as-needed basis, each pond will be checked routinely for adequate freeboard. The COGCC requires two feet of freeboard. Inspection and skimming activities will be recorded in the work shift record log.

As applicable, the interstitial space between the liners of double-lined ponds will be checked for leakage on a weekly basis. Such routine liner inspections will be documented and inspection records retained as described in Section 3.1.8. On an annual basis, a visual inspection of the ponds will be performed and documented.

3.1.5 Portable Containers

This facility utilizes portable containers that have the capacity to store 55 gallons or more of an oil-containing product or material such as drums (for liquid storage from drip pans), diesel trailers, or produced water frac tanks. These containers may or may not be on location at any given time.

When in active use, portable containers will be visually inspected on a daily or weekly basis and, for longer-term projects, monthly basis in accordance with the inspection procedures described in Section 3.1.1 for aboveground field-constructed containers.

3.1.6 Pipelines

External visual inspections of facility piping including gathering lines and produced water delivery lines will be performed on a regular basis for aboveground portions of the lines. Appurtenances associated with the lines, such as pipe supports, valves, and rod stuffing boxes, are also evaluated during the line inspections. Pipelines, both temporary and permanent, that are actively being utilized to transfer oil-containing product or material will be inspected on a routine basis. Daily inspections occur by operations personnel to observe the lines and associated structures and equipment for conditions that could lead to a discharge. Underground sections of pipelines will be visually inspected whenever exposed during excavation work.

General procedures used during the above-referenced inspections include a visual evaluation of the lines and associated structures and equipment for:

- leaks or other oil discharges
- signs of corrosion
- loose bolts or missing plugs
- accumulation in drip pans
- general physical condition of the equipment.

3.1.7 Field Drainage Systems

Field drainage systems such as road ditches and drainage ditches, including any oil traps, sumps, or skimmers, will be inspected at regular intervals by operations personnel. Drainage ditches and other drainage-related structures, including catchment basins, weirs, culverts and sumps, as applicable, will be inspected for any problems that may impede drainage of storm waters and for any accumulations of oil. Accumulations of oil will be removed promptly. Facility drainage system inspections will be recorded, and the records maintained per the requirements of Section 8.0 of this Plan.

3.1.8 Inspection Schedule and Documentation

Inspection schedules for individual equipment items will be maintained at the High Mesa WTF office trailer. Monthly, annual and other documented visual inspections will be recorded on the forms included in Appendix C of this Plan. The inspection forms provide an outline of the procedures to be used during each visual inspection. Completed inspection records will be maintained with a copy of this Plan in accordance with Section 8.0 and will be available for review at the High Mesa WTF office trailer and the Encana office located in Parachute, Colorado. Corrective action will be taken when deficiencies are noted during any inspection or if evidence of a discharge is observed. All observed oil discharges will be promptly removed. Releases noted during routine inspections will be documented in Encana's Incident Management System (IMS).

3.2 MAINTENANCE AND TESTING

3.2.1 Pipeline Maintenance and Monitoring

To reduce the potential for discharges, Encana operates a program of pipeline monitoring and maintenance. Pipelines operated by the High Mesa WTF extend to the High Mesa Compressor Station, Water Treatment (DAF unit and ponds), and to the three disposal/reinjection wells (Orchard Federal Disposal wells #1, #2, and #3) located at well pads E28OU, C17OU, and F21OU. These lines are maintained in accordance with established facility integrity management protocols. Such management practices include standards for the selection, installation, monitoring, and maintenance of pipelines as well as associated valves, flanges, and other equipment. All maintenance activities are performed by personnel who are knowledgeable in facility operations and the equipment being maintained. Encana personnel will use the Integrity Management Program to assist in the repair and maintenance of the pipelines.

Procedures for the maintenance of pipelines subject to the requirements of this Plan include the following:

- Prior to installing, replacing, or repairing lines, valves, or associated equipment, facility personnel must ensure compatibility with the materials to be transferred and address potential concerns involving corrosive production fluids, volumes, pressure, and other conditions expected in the operational environment.
- Pipelines are identified on facility maps and are clearly marked in the field to facilitate access and inspection by facility personnel.
- Corrosion rates for pipelines are monitored utilizing weight loss corrosion coupons or equivalent measures as described in Encana's Internal Corrosion Control Guide. At 30% corrosion of the pipe wall thickness, the line is removed from service and replaced.
- Spot ultrasonic testing is conducted on pipelines in areas where the line can be accessed. Access cans are utilized where present to evaluate sections of lines that have been identified as having a potentially high corrosion rate. Ultrasonic testing may also be scheduled based on known corrosion issues and to verify the effectiveness of corrosion inhibiting treatment.
- Smart pigging is performed on larger diameter lines on an as-needed basis. The wall thickness measurements and corrosion rates provided by data from smart pigging are used to schedule maintenance activities.
- Where practicable:
    - pipelines are provided with an external epoxy coating and welded joints are taped,
    - pipelines are protected by treatment with corrosion inhibitor with feed rates of the inhibitor adjusted in proportion to well flows,
    - cathodic protection is provided on lateral lines from metering skids down, on third party lines from master meters down, and on main trunk lines,
    - pipeline pressure is monitored during transfers by personnel having the ability to remotely close isolation valves in the event of an emergency, and
    - buried flowlines may have been equipped with bolted flanges installed at set intervals along the length of the line, a dry sump is located on either side of the flange with a ½ inch valve that is manually opened on a periodic basis to check for moisture between the poly liner and the steel pipe wall.

- Where possible, electric water pumps automatically shut down when pressures reach a level that indicate a problem.
- As soon as practicable following the detection of a leak, the affected portion of the line is isolated and repaired or replaced.

The maintenance and testing procedures referenced above are performed on individual sections of lines at a frequency determined by the facility mechanical integrity department. The frequency for maintaining and testing lines located within secondary containment is based on several factors, including the age of the pipeline, known or suspected corrosion issues, materials used in construction, number of elbows, expansions, contractions, etc. The frequency and type of testing prescribed for pipelines that have not been provided with secondary containment will be executed so that the Oil Spill Contingency Plan (OSCP) (Appendix B) for the High Mesa WTF may be effectively implemented.

In the event that an inspection or test identifies either the need for repair or evidence of a discharge, corrective action shall be implemented accordingly. For example, any oil discharges associated with pipelines or associated equipment shall be promptly removed.

3.2.2 Container Maintenance and Testing

The installation of new tank batteries, or other containers subject to the requirements of this Plan, as well as updates to existing oil containers tanks must be performed in accordance with good engineering practice to prevent discharges. At least one of the following shall be provided for new containers or when updating existing containers:

- Container capacity adequate to assure that a container will not overfill if a pumper/gauger is delayed in making regularly scheduled rounds,
- Overflow equalizing lines between containers so that a full container can overflow to an adjacent container,
- Vacuum protection adequate to prevent container collapse during a pipeline run or other transfer of oil from the container, or
- High level sensors to generate and transmit an alarm signal to the computer where the facility is subject to a computer production control system.

3.2.3 Maintenance and Testing Schedule and Documentation

Maintenance and testing schedules for individual equipment will be maintained at the High Mesa WTF office trailer. Records of inspections, tests, and corrective actions will be maintained as described in Section 8.0 of this Plan. Releases resulting from the failure of containers, pipelines or other equipment will be documented in Encana's Incident Management System (IMS).

4.0 OIL HANDLING PROCEDURES

The following sections describe the discharge prevention measures that have been established and implemented at this facility to aid in preventing oil releases.

4.1 LOADING AND UNLOADING AREAS

This facility utilizes a loading and/or unloading area. The Facility Site Diagram (Figure 2) shows the locations.

Secondary containment for the loadout/offload areas consist of sized concrete containment basins with subgrade sumps. One of the offload areas has a lined earthen berm in place of a concrete containment area. A total of three offload areas are located within the High Mesa WTF. The containment structure has been designed to contain the maximum capacity of a single compartment of any tank truck that will be loaded/unloaded at the location and to maintain sufficient free board.

A system has been implemented to prevent tank trucks from departing before transfer lines have been completely disconnected. A system of physical barriers such as wheel chocks and vehicle brake interlocks are used in the area adjacent to the rack. Sign-in, sign-out protocols may also be used in conjunction with loadout procedures. In addition, prior to filling each tank truck or authorizing its release, the lowermost drain and all outlets will be inspected closely for discharges. If necessary, drains and outlets will be tightened, adjusted, or replaced to prevent liquid discharge while in transit.

4.2 LOADING AND UNLOADING PROCEDURES

As required by 112.7(c), loading and unloading areas located at the side where tank trucks deliver and pick up product, produced water, and condensate will be provided with general secondary containment.

General procedures implemented at the facility(s) for the routine loading and unloading of oil products (fuel, lubricating oils, etc.) and oil-containing materials (produced water, condensate, etc.) into and out of cargo vehicles are described below:

- Park vehicle (upwind of loading/unloading area, if possible) and set brakes
- Use wheel chocks or equivalent measures to prevent unexpected movement

- Connect ground cable to unpainted surface on vehicle frame
- Check hoses and couplings for damage
- Connect loading/unloading hose and vent line to vehicle; if vent line is absent, open all appropriate valves in storage tank and trailer
- Position spill bucket or similar drip catch
- Close valve to storage tank
- Loosen loading hose to allow enough air to drain loading hose dry
- Ensure that any drips from the hose drain into the spill bucket or drip catch
- Disconnect loading hose completely, close load valve, plug and fasten securely
- Ensure that any drips from the hose drain into the spill bucket or drip catch
- Close all valve caps, disconnect hoses, and safely manage any remaining liquids
- Replace all valve caps after pumping is finished and make sure all connections are isolated and capped, and install any required seals
- Disconnect ground cable
- Inspect lowermost drains and valves of the vehicle for discharges/leaks and ensure that they are tightened, adjusted, or replaced as needed to prevent discharges while vehicle is in transit.

4.3 INTRA-FACILITY TRANSFER PROCEDURES

General procedures implemented at the facility(s) for the routine transfer of oil products (fuel, lubricating oils, etc.) and oil-containing liquids (produced water, condensate, etc.) into and out of cargo vehicles are described below:

- Prior to transferring material from one vessel to another, check level readings to ensure there is adequate space available in the receiving tank
- Monitor all material transfer operations closely (checking lines, pumps, hoses, etc. for proper operation and signs of leakage)
- Prior to, during, and following their use, produced water delivery lines are inspected for leaks, oil discharges, corrosion, and other conditions that could lead to a discharge

- Use absorbent pads, pans, buckets, etc., as needed to prevent drips from contacting the ground.

4.4 DRAINAGE CONTROL PROCEDURES

Following a significant storm event, to ensure adequate capacity is available to contain a release where sized containment areas are present, operators overseeing the processes will work to minimize (to the maximum extent possible) the presence, extent, and duration of standing water within the structure. Procedures implemented at the facility(s) for the routine drainage of secondary containment structures and equipment includes the following:

- Prior to releasing accumulated water to the ground, field drainage system, or other location external to facility operations, visually inspect the water for signs of possible contamination (an accumulation of oil, visible sheen, unusual color change, etc.). If accumulated oil is observed, remove the water containing oil and return it to storage or disposed of it in accordance with legally approved methods (water containing oil must not be released).
- Manually control and secure secondary containment drainage valves (where present) in the closed position until a release has been authorized by a responsible member of management. Reseal bypass valves immediately following completion of drainage.
- Maintain adequate records of diked area drainage events.
- Manage material collected in portable secondary containment equipment such as drip pans and buckets appropriately and do not release to the ground.
- Facility drainage from undiked areas subject to spill events should if possible, flow into holding ponds or catchment basins designed to retain spills or return them to the facility. Catchment basins should not be located in areas subject to flooding.
- At tank batteries and separation and treating areas where there is a reasonable possibility of a discharge, maintain closed and sealed drains for dikes, ponds, sumps, and other such containment structures; except when draining non-impacted water.

5.0 COUNTERMEASURES AND SPILL RESPONSE

Facility-specific procedures for discharge discovery, response, and cleanup are provided in the Oil Spill Contingency Plan (OSCP) located in Appendix B. The OSCP provides information and procedures for reporting a discharge, for taking initial actions to mitigate the effects of the discharge, to determine if evacuation is needed, and for ensuring that recovered materials are disposed of in accordance with applicable legal requirements. Finally, the OSCP also identifies the person at the facility who is accountable for discharge prevention and who reports to facility management.

In response to a discharge, facility personnel utilize Encana's Incident Management System (IMS) to document and track the event. The IMS is a web-based application for reporting and managing all incidents electronically, including injuries, spills, motor vehicle accidents, and most other types of occurrences. IMS facilitates the centralized first report, the workflow process for investigating incidents and assigning corrective actions, and generates reports for analyzing the occurrence of incidents so that risks can be analyzed and preventive measures can be put in place.

6.0 TRAINING

Encana field staff receives general awareness training regarding oil spill prevention, control, and countermeasure planning as part of the company's orientation program for all new employees and contractors. In addition, facility management has identified personnel who, at the facility level, transfer or otherwise manage produced water or condensate, lubricating/compressor oils, used oil, or any other oil as part of their job function. Such employees have been designated as "oil-handling personnel" and are provided with additional training in the following:

- The operation and maintenance of equipment to prevent discharges
- Discharge procedure protocols
- Applicable pollution control laws, rules, and regulations (including local, state, and federal requirements)
- General facility operations
- The contents of this SPCC Plan.

In addition, at least once per year, oil-handling personnel are required to attend a discharge prevention briefing. The briefing must highlight and describe any known discharge that has occurred at the facility within the past year, equipment failures, malfunctioning components, and any recently developed precautionary measures. This briefing is intended to assure adequate understanding of the purpose, content, and use of the facility SPCC Plan.

Training is conducted through Encana's training and recordkeeping system, eCademy. Training records are maintained in the eCademy system for general awareness and oil-handling personnel training, discharge prevention briefings, or any additional training events performed in accordance with the requirements of this Plan.

7.0 PLAN MAINTENANCE

7.1 AMENDMENTS BY OWNERS OR OPERATORS

This Plan will be amended whenever there is a change in facility design, construction, operations, or maintenance that materially affects the facility's potential for a discharge of oil. An amendment to this Plan shall be prepared within six months of the change and implemented as soon as possible, but not later than six months following preparation of the amendment.

This Plan shall be reviewed and evaluated at least once every five years and amended to include more effective prevention and control technology, if such technology will significantly reduce the likelihood of a discharge event and has been proven in the field. Any amendment made for the reasons described in the prior sentence must be implemented as soon as possible, but not later than six months following preparation of the amendment.

The completion of all reviews and evaluations must be documented with a signed statement. The amendment log located in Appendix E shall include a statement that the reviewer has completed a review and evaluation of the SPCC Plan for the given facility on a specific date and that the Plan will or will not be amended as a result. All technical amendments made to this Plan shall be certified by a registered Professional Engineer.

Changes in facility equipment, operation, or arrangement are documented using Encana's Management of Change (MOC) system. Encana personnel responsible for the maintenance of the SPCC plan will be notified through the MOC system. Plan reviews and amendments to facility specific documentation will be recorded in Appendix E and scheduled and tracked using Encana's IMS.

7.2 AMENDMENTS BY REGIONAL ADMINISTRATOR

If either of the following occurs:

- The facility discharges more than 1,000 gallons of oil into or upon navigable waters or adjoining shorelines in a single event

  or

- The facility discharges more than 42 gallons of oil in each of two discharge events within any 12-month period,

The facility will submit within 60 days of the above event(s) the following information to the U.S. EPA Regional Administrator (EPA Region VIII) and the Colorado Department of Public Health and Environment:

- Name of facility
- Your name
- Location of facility
- Maximum storage or handling capacity of the facility and normal daily throughput
- Corrective action and countermeasures you have taken, including a description of equipment repairs and replacements
- An adequate description of the facility, including maps, flow diagrams, and topographical maps, as necessary
- The cause of such discharge, including a failure analysis of the system or subsystem in which the failure occurred
- Additional preventive measures you have taken or contemplated to minimize the possibility of recurrence
- Such other information as the Regional Administrator may reasonable require pertinent to the Plan or discharge.

This Plan shall be amended as required by the Regional Administrator as a result of review of the information submitted.

8.0 RECORDKEEPING

Written procedures associated with the inspection and testing activities conducted per the requirements of this Plan will be maintained within or as an attachment to this Plan. Along with the referenced procedures, records of inspections and tests required by this Plan will be signed by the appropriate supervisor or inspector and retained for a period of three years as routine and customary business practice. Inspection records and associated information will be maintained with a copy of this Plan at the office of the High Mesa Water Treatment Facility and the Encana offices located at 2717 County Road 215, Suite 100, Parachute, CO 81635.

Records of training events conducted in accordance with the requirements of this Plan are maintained in Encana's eCademy system.

9.0 CONFORMANCE WITH 40 CFR 112 AND STATE SPCC REQUIREMENTS AND NEEDED MODIFICATIONS

This section includes a discussion of the overall conformance of the facility and Plan with the requirements of 40 CFR 112 and any state rules, regulations, and guidelines pertaining to oil spill prevention, control, and countermeasure that provide additional or more stringent requirements than the federal rules.

9.1 CONFORMANCE WITH RULE REQUIREMENTS AND NEEDED MODIFICATIONS

The structures, equipment and operations associated with each facility(s) are identified in Section 2.1 of this Plan. The operations and equipment covered under this SPCC Plan comply with the requirement stated in 40 CFR 112, the Colorado Department of Public Health and Environment, and the Colorado Oil and Gas Commission.

The Oil Spill Contingency Plan for the High Mesa WTF and BMPs put in place for surface drainage control are sufficient alternatives to address potential oil discharges and spills.

9.2 CONFORMANCE WITH STATE-SPECIFIC SPCC REQUIREMENTS

Some states have established requirements applicable to SPCC that are more stringent than federal standards or require additional measures to be taken. In the State of Colorado, no state agencies govern the SPCC activities of the oil and gas industry. However, the COGCC provides specific guidelines for secondary requirements for oil storage containers located in “high” density areas (COGCC Series Safety Regulations 603-12). The requirement for secondary containment in high density areas is 150 percent compared to 110 percent for EPA SPCC. The High Mesa WTF is not located in a high density area.

TABLES

Table 1 – Contact List

Contact List		
Encana's 24-Hr Environmental On-call Service	Personnel must immediately report all spills and conditions which could lead to a spill to Encana's 24-hr Environmental On-call number.	970-319-9173
Encana's 24-Hr Safety On-call Service	Personnel must immediately report all incidents and conditions which could lead to an injury to Encana's 24-hr Safety On-call number.	970-210-8755
Facility	HIGH MESA WATER TREATMENT FACILITY	970-285-2881
Facility Supervisor	MIKE CONN	970-456-6405

Table 2 – Bulk Storage Containers

HIGH MESA WATER TREATMENT FACILITY					
Bulk Storage Container ID	**Location**	**Contents**	**Volume (BBL)***	**Construction Materials****	**Overfill Protection**
TANK 1	UPPER LEVEL	PRODUCED WATER/OIL	500	STEEL	HIGH ALARM(S)
TANK 2	UPPER LEVEL	PRODUCED WATER/CONDENSATE	400	STEEL	HIGH ALARM(S)
TANK 3	UPPER LEVEL	PRODUCED WATER/CONDENSATE	400	STEEL	HIGH ALARM(S)
TANK 4	UPPER LEVEL	PRODUCED WATER/CONDENSATE	400	STEEL	HIGH ALARM(S)
TANK 5	UPPER LEVEL	PRODUCED WATER/CONDENSATE	500	STEEL	HIGH ALARM(S)
TANK 6	UPPER LEVEL	PRODUCED WATER/CONDENSATE	500	STEEL	HIGH ALARM(S)
TANK 7	UPPER LEVEL	PRODUCED WATER/DAF SLUDGE	500	STEEL	HIGH ALARM(S)
TANK 8	UPPER LEVEL	PRODUCED WATER/CONDENSATE	500	STEEL	HIGH ALARM(S)
HIGH MESA POND #1	LOWER LEVEL	PRODUCED WATER	74000	EARTHEN BERMS, DUAL SYNTHETIC LINERS	PRESSURE TRANSMITTER, VISUAL GAUGE
HIGH MESA POND #2	LOWER LEVEL	PRODUCED WATER	67500	EARTHEN BERMS, DUAL SYNTHETIC LINERS	PRESSURE TRANSMITTER, VISUAL GAUGE
HIGH MESA POND #3	LOWER LEVEL	PRODUCED WATER	65800	EARTHEN BERM, DUAL SYNTHETIC LINERS	PRESSURE TRANSMITTER, VISUAL GAUGE

* If units differ (i.e. gallons vs. barrels, specify in each individual cell, or convert all to the same unit for the facility.
** Oil storage containers must be constructed appropriately and of materials that are compatible with the material stored and the conditions of storage

Table 3 – Secondary Containment

HIGH MESA WATER TREATMENT FACILITY			
Secondary Containment Structure	**Containers**	**Available Capacity (bbl)**	**Construction Material**
BULK STORAGE CONTAINMENT A & B (UPPER LEVEL)	PRODUCED WATER/CONDENSATE TANKS (TANK #1, #2, & #3)	998 BBL (2 SECONDARY CONTAINMENT STRUCTURES COMBINED COVERING 2395 SQUARE FEET)	SYNTHETIC LINED STEEL BERM
BULK STORAGE CONTAINMENT C (UPPER LEVEL)	PRODUCED WATER/CONDENSATE TANKS (TANK #4, #5, & #6)	946 BBL (PILL-SHAPED STRUCTURE COVERING 2292 SQUARE FEET)	SYNTHETIC LINED STEEL BERM
BULK STORAGE CONTAINMENT D (UPPER LEVEL)	PRODUCED WATER/CONDENSATE TANKS (TANK #7 & #8)	632 BBL (PILL-SHAPED STRUCTURE COVERING 1532 SQUARE FEET)	SYNTHETIC LINED STEEL BERM
DAF BUILDING CONTAINMENT	DAF UNIT	171 BBL (RECTANGLE-SHAPED STRUCTURE COVERING 2400 SQUARE FEET)	CONCRETE AND STEEL FORM

* Available capacity must account for freeboard for 24 hour, 25 year storm event

Secondary Containment Capacity and Calculations Data Sheets are located in Appendix F and checked and verified by a P.E..

Table 4 – Analysis of Equipment Failure

HIGH MESA WATER TREATMENT FACILITY			
Potential Failure	**Spill Direction (Cardinal Direction)**	**Potential Total Volume Released [gallons]**	**Potential Spill Rate [gallons/minute]**
Catastrophic failure of full tank (500 bbl)	West	21,000	3,000
Partial failure of tank	West	1,680	170
Tank overfill	West	200	20
Pipe fitting failure	West	50	15
Leaking fitting or valve	West	50	15
Pond Overfill	West	10,000	1,000
Pipe fitting failure	West	5,000	500
Leaking valve failure	West	1,000	100
Catastrophic failure of water pipeline	West	8,400	500
Slow pipeline leak	West	1,000	75

APPENDIX A

CERTIFICATION OF THE APPLICABILITY

OF SUBSTANTIAL HARM CRITERIA

CERTIFICATION OF THE APPLICABILITY

OF THE SUBSTANTIAL HARM CRITERIA CHECKLIST

FACILITY NAME: HIGH MESA WATER TREATMENT FACILITY

FACILITY ADDRESS: SENW, Section 36, T7S, R96W, 6th PM

1. Does the facility transfer oil over water to or from vessels and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons?
   Yes ____ No: __X__

2. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and does the facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank plus sufficient freeboard to allow for precipitation within any aboveground oil storage tank area?
   Yes ____ No: __X__

3. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the formula in Attachment C-III, Appendix C, 40 CFR 112 or a comparable formula) such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments? For further description of fish and wildlife and sensitive environments, see Appendices I, II, and III to DOC/NOAA's "Guidance for Facility and Vessel Response Environments" (Section 10, Appendix E, 40 CFR 112 for availability) and the applicable Area Contingency Plan.
   Yes _____ No: __X__

4. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula (Attachment C-III, Appendix C, 40 CFR 112 or a comparable formula1) such that a discharge from the facility would shut down a public drinking water intake2?
   Yes ____ No: __X__

5. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and has the facility experienced a reportable oil spill in an amount greater than or equal to 10,000 gallons within the last 5 years?
   Yes ____ No: __X__

CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate, and complete.

Name (please type or print): Signature:

_____ _____

Title: Date:

_____ _____

From 40 CFR 112 Appendix C, Attachment C-II

Footnotes:

1. If a comparable formula is used, documentation of the reliability and analytical soundness of the comparable formula must be attached to this form.
2. For the purposes of 40 CFR Part 112, public drinking water intakes are analogous to public water systems as described at 40 CFR 143.2(c).

APPENDIX B

OIL SPILL CONTINGENCY PLAN

APPENDIX C

INSPECTION FORMS

Monthly Aboveground Container Inspection Checklist

Inspection Date: _____ Inspector: _____

Area: _____ Signature: _____

Containers Inspected: _____

_____

_____

_____

Item	Yes	No	Remarks
Is there any sign of leakage?			
Is the external coating damaged?			
Is the tank rusted, pitted, or deteriorated?			
Are there shell distortions?			
Are welds cracked?			
Has the foundation settled or eroded?			
Have tank supports deteriorated or buckled?			
Are valves, fittings, or other appurtenances leaking?			
Has the secondary containment been damaged?			
Is there oil in secondary containment?			
Is there debris in secondary containment?			
Is there water in secondary containment?			
Are the drain valves for the secondary containment operable and in a closed position?			
Are valves locked if not in use?			

Comments:_____

_____

_____

_____

_____

_____

Annual Visual Inspection Checklist

Inspection Date: _____ Inspector: _____

Area: _____ Signature: _____

Containers Inspected: _____

_____

_____

_____

Item	Yes	No	Remarks
Evidence of paint failure?			
Evidence of corrosion or cracking?			
Any noticeable distortion, buckling denting, or bulging?			
Holes in roof?			
Standing water on roof?			
Vents free of obstructions?			
Is the liquid level gauge, if present, operable?			
Is the containment structure in satisfactory condition?			
Are the containment drainage valves and pipes fit for service?			
Evidence of tank settlement or foundation washout?			
Is there cracking or spalling of concrete pad?			
Are tank supports in satisfactory condition?			
Is water able to drain away from tank within containment?			
Is grounding strap secured and in good condition?			
Is associated piping in good condition?			
Is there any sign of leakage from the tank or associated piping or valves?			
Is piping properly supported?			

Comments:_____

_____

_____

_____

Monthly Portable Container Inspection Checklist

Inspection Date: _____ Inspector: _____

Area: _____ Signature: _____

Containers Inspected: _____

_____

_____

_____

Item	Yes	No	Remarks
Any visible sign of leakage from containers?			
Any oil within containment area?			
Noticeable container distortions, buckling, denting, or bulging?			
Are container lids secured?			
Is there water in the secondary containment?			
Are there drain valves for the secondary containment operable?			
Are the drain valves in a closed position?			
Is there debris in containment or storage area?			

Comments:_____

_____

_____

_____

_____

_____

_____

SPCC Periodic Visual Inspection Checklist

encana natural gas	SPCC PERIODIC VISUAL INSPECTION	Document No: Revised By - Date: Reviewed By - Date: Approved By - Date:

INSPECTION INFORMATION

Facility Name & SBU:

Inspector Name: **Inspection Date:**

Inspection Component Description	Yes	No	N/A	Comments and Notes (Use bottom of page 3 for extra space)
Tank Battery				
1. Are there produced water, condensate or oil tanks on-site? (List Service, Size, Serial Number and Manufacture Date)	☐	☐	☐	1. 2.
1a. Are all the tank thief hatches closed and latched?	☐	☐	☐	
1b. Are the gaskets on the thief hatches sealed properly?	☐	☐	☐	
1c. Are tanks properly labeled with liquid stored?	☐	☐	☐	
1d. Are exteriors free of paint chipping, pitting, rust, or corrosion?	☐	☐	☐	
1e. Are exteriors free of overflow, drip marks, or surface stains?	☐	☐	☐	
1f. Are tanks and foundation sitting flush and without gaps?	☐	☐	☐	
1g. Is tank construction material compatible with stored product?	☐	☐	☐	
2. Does tank battery have secondary containment?	☐	☐	☐	
2a. Is it free of spills and leaked materials?	☐	☐	☐	
2b. Within containment, is area free of oil stains?	☐	☐	☐	
2c. Outside containment, is area free of oil stains?	☐	☐	☐	
2d. Is rainwater present within secondary containment?	☐	☐	☐	
2e. Are other objects (debris, buckets, etc) inside containment that could affect holding capacity?	☐	☐	☐	
2f. Is there evidence of integrity issues with secondary containment?	☐	☐	☐	
2g. Are soil or other natural materials used for containment?	☐	☐	☐	
o Is there evidence of erosion or failure?	☐	☐	☐	
o Are there animal burrows or vegetation present?	☐	☐	☐	
2h. Are steel or other impervious dikes used for containment?	☐	☐	☐	
o Are holes, damage, gaps or corrosion/wear visible in panels?	☐	☐	☐	
o Is there evidence of faulty seam between panels?	☐	☐	☐	
2i. Is a secondary containment impervious liner present? (List Type)	☐	☐	☐	
o Are rips or tears visible?	☐	☐	☐	
2j. Is secondary containment equipped with drain line?	☐	☐	☐	
o Is the area around the drain valve free of oil stains?	☐	☐	☐	
o Is the drain valve plugged/closed and locked?	☐	☐	☐	
3. Are tank battery pipes, valves, and flanges in good condition?	☐	☐	☐	
3a. Are they free of leaks?	☐	☐	☐	
3b. Are they free of swelling, cracking, rust, and corrosion?	☐	☐	☐	
3c. Are bull plugs present on all valves?	☐	☐	☐	
3d. Are camlocks present on loading lines?	☐	☐	☐	
3e. Are pipelines properly supported?	☐	☐	☐	

Chemical Tank/Tote				
4. Are there chemical tanks/totes on-site (methanol, corrosion inhibitor, used oil/filters, etc.)? (List Type and Size)	☐	☐	☐	1. 2. 3. 4.
4a. Do chemical tanks/totes have secondary containment?	☐	☐	☐	
o Is secondary containment in good condition (i.e. free of cracks, missing drain plugs, etc.)?	☐	☐	☐	
o Is secondary containment adequate to hold contents of tank/tote plus sufficient freeboard?	☐	☐	☐	
4b. Are tanks/totes properly labeled?	☐	☐	☐	
4c. Are MSDS sheets available, current and legible?	☐	☐	☐	
Wellhead/Separator/Above-Ground Piping				
5. Are there wellheads or separators on-site? (List Number of Each)	☐	☐	☐	
5a. Is area around the wellhead free of oil stains?	☐	☐	☐	
5b. Is separator dump valve seating properly with no leaking?	☐	☐	☐	
5c. Is area around the separator free of oil stains?	☐	☐	☐	
5d. Are all raincaps securely attached?	☐	☐	☐	
6. Are all above-ground piping and components in good condition?	☐	☐	☐	
6a. Are they free of leaks?	☐	☐	☐	
6b. Are they free of swelling, cracking, rust, and corrosion?	☐	☐	☐	
6c. Are bull plugs present on all valves?	☐	☐	☐	
6d. Are pipelines properly supported?	☐	☐	☐	
Sump				
7. Are sumps present on-site? (List Location and Function)	☐	☐	☐	
7a. Is area around sump free of staining and any evidence of overflow?	☐	☐	☐	
7b. Does sump have an automatic discharge system (e.g. floats)?	☐	☐	☐	
o Is the float operating properly?	☐	☐	☐	
o Test high-level SCADA alarm, if present and verify it is working. Alert Encana before doing so.	☐	☐	☐	
7c. If feasible to inspect, is interior of sump in good condition?	☐	☐	☐	
Compressor Engine				
8. Are there any engines on-site? (List Make, Model, HP if Marked)	☐	☐	☐	
8a. Is engine skid free of accumulated oil?	☐	☐	☐	
8b. Is area around the engine skid free of oil staining?	☐	☐	☐	
8c. Are there fuel or lubricator service tanks? (List Type and Size)	☐	☐	☐	
8d. Do service tanks have secondary containment?	☐	☐	☐	
o Is secondary containment in good condition (i.e. free of cracks, missing drain plugs, etc.)?	☐	☐	☐	
o Is secondary containment adequate to hold contents of tank plus sufficient freeboard?	☐	☐	☐	
8e. Are service tanks properly labeled?	☐	☐	☐	
8f. Are MSDS sheets available, current and legible?	☐	☐	☐	
Cooler Engine				
9. Are there any engines on-site? (List Make, Model, HP if Marked)	☐	☐	☐	
9a. Is engine skid free of accumulated oil?	☐	☐	☐	
9b. Is area around the engine skid free of oil staining?	☐	☐	☐	
9c. Are there fuel or lubricator service tanks? (List Type and Size)	☐	☐	☐	
9d. Do service tanks have secondary containment?	☐	☐	☐	
o Is secondary containment in good condition (i.e. free of cracks, missing drain plugs, etc.)?	☐	☐	☐	

o Is secondary containment adequate to hold contents of tank plus sufficient freeboard?	☐	☐	☐	
9e. Are service tanks properly labeled?	☐	☐	☐	
9f. Are MSDS sheets available, current and legible?	☐	☐	☐	
Glycol Dehydrator				
10. Are there any dehydrators on-site?	☐	☐	☐	
10a. Is area around the dehydrator free of oil staining?	☐	☐	☐	
10b. Are there glycol tanks? (List Size)	☐	☐	☐	
10c. Do glycol tanks have secondary containment?	☐	☐	☐	
o Is secondary containment in good condition (i.e. free of cracks, missing drain plugs, etc.)?	☐	☐	☐	
o Is secondary containment adequate to hold contents of tank plus sufficient freeboard?	☐	☐	☐	
10d. Are glycol tanks properly labeled?	☐	☐	☐	
10e. Are MSDS sheets available, current and legible?	☐	☐	☐	
Line Heater/Heater Treater/Flare				
11. Is there a heater device or flare on-site?	☐	☐	☐	
11a. Is area around the heater device or flare free of oil staining?	☐	☐	☐	
Pit				
12. Are there any pits on-site? (List Contents)	☐	☐	☐	
12a. Is there at least 2 feet of freeboard present?	☐	☐	☐	
12b. Is there a liner installed? (List Type)	☐	☐	☐	
o Does liner show any signs of failure?	☐	☐	☐	
12c. Is the berm around pit in good condition?	☐	☐	☐	
12d. Is there a presence of oil in the pit?	☐	☐	☐	
12e. Is there visual evidence that sediment or pollution has been discharged off-site?	☐	☐	☐	
Stormwater				
13. Are stormwater or erosion controls present on or just beyond edges of site? (List Types)	☐	☐	☐	
13a. If yes, are erosion controls adequate to retain stormwater sediment on-site?	☐	☐	☐	
14. Are all culverts functioning within expected parameters, free of sediment deposits and accumulated oil?	☐	☐	☐	
15. Is there visual evidence that sediment or pollution has been discharged off-site?	☐	☐	☐	
Miscellaneous				
16. Are there any other potential discharge sources on-site? (List each and note any oil staining around equipment)	☐	☐	☐	1. 2.
17. Does the SPCC Site Plan for the facility match the field observations? If not, sketch update and take supporting photos. Provide documentation to Encana Environmental Field Coordinator.	☐	☐	☐	

Any active leaks or unsafe conditions are to be immediately notified to Encana.

Additional comments and notes from above:

Inspector Signature_____ Date_____

Inspection sheet will be provided to the designated Encana Environmental Field Coordinator within 7 days who will verify that all fields are marked and the comments do not require further clarification.

EFC Signature_____ Date Verified_____

Verified inspection sheet will be reviewed with the designated Encana Production Coordinator to discuss appropriate corrective actions within an additional 7 days. Inspection will be recorded in IMS with any corrective actions and due dates assigned. The need for an MOC will be determined.

IMS Inspection Number _____

PC Signature_____ Date Reviewed_____

Reviewed inspection sheet will be provided to the Encana Environmental Coordinator responsible for tracking and maintaining the SPCC inspection sheet, corresponding corrective actions, and updating the appropriate SPCC Plan as necessary. Corrective actions will be tracked through IMS. If necessary, SPCC Plan will be amended and signed within 6 months of qualified technical changes.

EC Signature_____ Date Amended_____

APPENDIX D

PLAN REVIEW AND AMENDMENT LOGS

Log of SPCC Plan Reviews

By signature below, the undersigned agree to the following:

"I have completed a review and evaluation of the SPCC plan on the date given below and the SPCC plan will or will not be amended (as indicated below) as a result of that review."

Review Date	Reviewer	Signature	Will Plan be amended? (Y/N)

Log of SPCC Plan Amendments

Amendment Date	Summary of Modifications	Management Approval (Signature)	PE Certification (as needed)

APPENDIX E

SPILL HISTORY LOG

Spill History Log

High Mesa Water Treatment Facility			
Date of Spill	**Structure and Volume Spilled**	**Actions Taken (control measures, agencies notified, etc.)**	**Reference Documentation**
(Note – as of the implementation of this SPCC Plan, no significant spills have been recorded)			

APPENDIX F

SECONDARY CONTAINMENT CALCULATIONS

SPILL PREVENTION, CONTROL, AND COUNTERMEASURE PLAN

HIGH MESA WATER TREATMENT FACILITY

GARFIELD COUNTY, COLORADO

Prepared for:

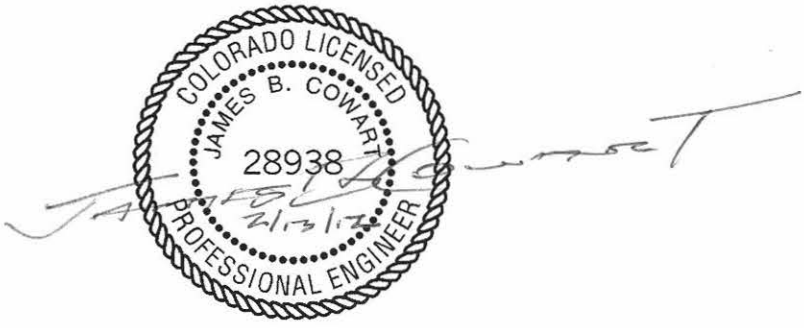
Encana Oil & Gas (USA) Inc.

PARACHUTE, COLORADO

FEBRUARY 13, 2012 REV. 2

frequency for required inspections, maintenance, and testing have been established and are described in this Plan.

This certification constitutes an expression of professional opinion and does not constitute a warranty or guarantee, either expressed or implied.



	2/13/2012
Signature and Seal of Registered Professional Engineer	Date
James B. Cowart	5/31/2013
Printed Name of Registered Engineer	Registration Expiration Date

Encana acknowledges that the above certification in no way relieves the company of its duty to prepare and fully implement this Plan in accordance with 40 CFR 112.

1.7 PLAN LOCATION

A complete copy of this plan is maintained at High Mesa WTF office trailer. The Plan must be maintained at the facility if the facility is normally attended at least 4 hours per day. If not so attended, the Plan must be maintained at the nearest field office at 2717 County Road 215, Suite 100, Parachute, Colorado 81635. This Plan is available for on-site review during normal working hours at this location.

Table 3 – Secondary Containment

HIGH MESA WATER TREATMENT FACILITY			
Secondary Containment Structure	**Containers**	**Available Capacity (bbl)**	**Construction Material**
BULK STORAGE CONTAINMENT A & B (UPPER LEVEL)	PRODUCED WATER/CONDENSATE TANKS (TANK #1, #2, & #3)	998 BBL (2 SECONDARY CONTAINMENT STRUCTURES COMBINED COVERING 2395 SQUARE FEET)	SYNTHETIC LINED STEEL BERM
BULK STORAGE CONTAINMENT C (UPPER LEVEL)	PRODUCED WATER, OIL SALES, AND SLUDGE(TANK #4, #5, #6, #7, & #8)	2952 BBL (RECTANGULAR-SHAPED STRUCTURE COVERING 9333 SQUARE FEET)**	SYNTHETIC LINED STEEL BERM
DAF BUILDING CONTAINMENT	DAF UNIT	171 BBL (RECTANGLE-SHAPED STRUCTURE COVERING 2400 SQUARE FEET)	CONCRETE AND STEEL FORM

* Available capacity must account for freeboard for 24 hour, 25 year storm event

** Available capacity is insufficient for containing largest volume tank, but installed drainage pipe which diverts spills to lower ponds provides adequate drainage for a spill of the largest volume tank. See Appendix F.

Secondary Containment Capacity and Calculations Data Sheets are located in Appendix F and checked and verified by a P.E.

Table 2 – Bulk Storage Containers

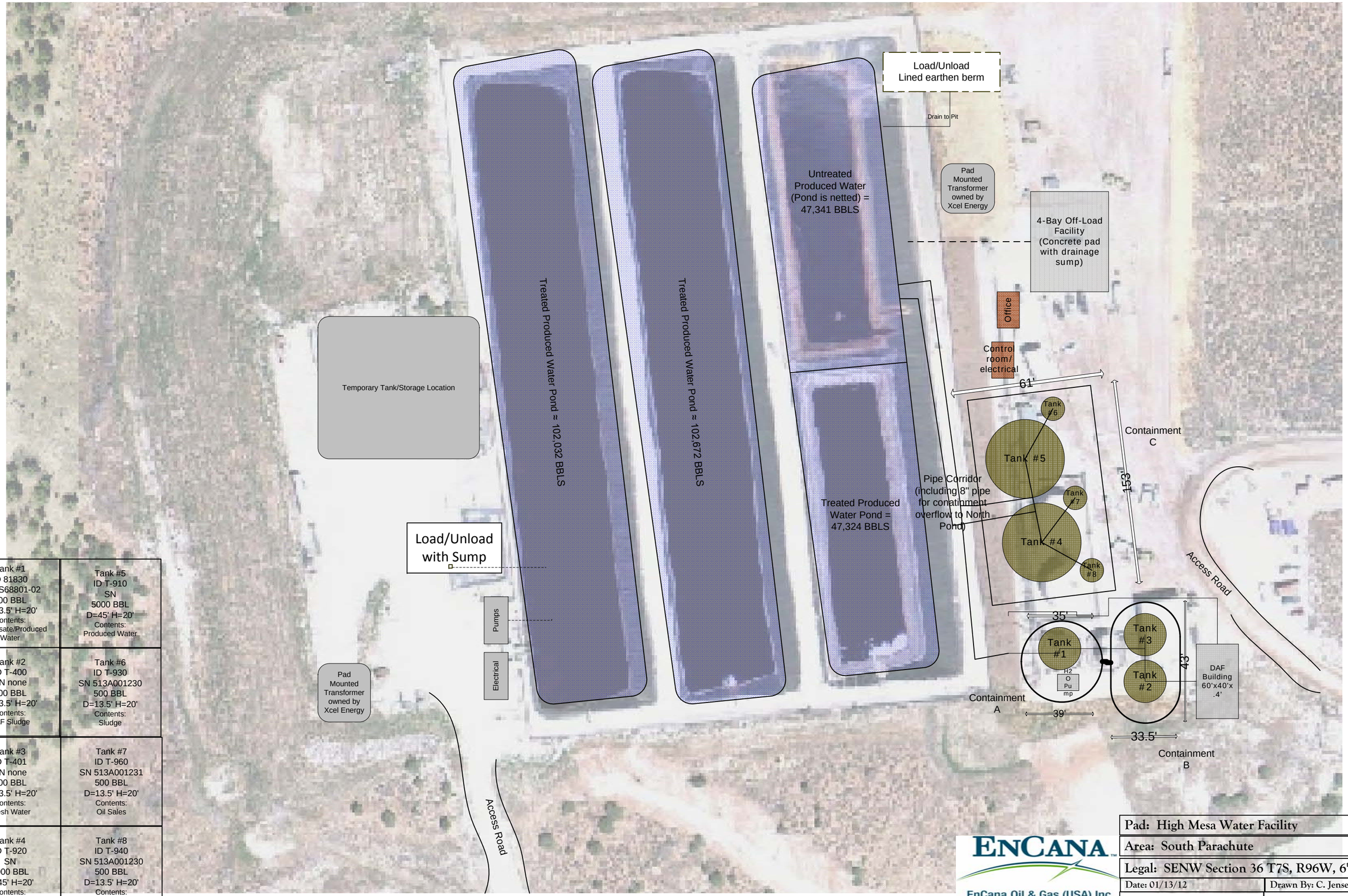
HIGH MESA WATER TREATMENT FACILITY					
Bulk Storage Container ID	**Location**	**Contents**	**Volume (BBL)***	**Construction Materials****	**Overfill Protection**
TANK 1	UPPER LEVEL	PRODUCED WATER/CONDENSATE	500	STEEL	HIGH ALARM(S)
TANK 2	UPPER LEVEL	DAF SLUDGE	500	STEEL	HIGH ALARM(S)
TANK 3	UPPER LEVEL	FRESH WATER (EXEMPT)	500	STEEL	HIGH ALARM(S)
TANK 4	UPPER LEVEL	PRODUCED WATER	5000	STEEL	HIGH ALARM(S)
TANK 5	UPPER LEVEL	PRODUCED WATER	5000	STEEL	HIGH ALARM(S)
TANK 6	UPPER LEVEL	SLUDGE	500	STEEL	HIGH ALARM(S)
TANK 7	UPPER LEVEL	OIL SALES	500	STEEL	HIGH ALARM(S)
TANK 8	UPPER LEVEL	SLUDGE	500	STEEL	HIGH ALARM(S)
HIGH MESA POND #1	LOWER LEVEL	PRODUCED WATER	102032	EARTHEN BERMS, DUAL SYNTHETIC LINERS	PRESSURE TRANSMITTER, VISUAL GAUGE
HIGH MESA POND #2	LOWER LEVEL	PRODUCED WATER	102672	EARTHEN BERMS, DUAL SYNTHETIC LINERS	PRESSURE TRANSMITTER, VISUAL GAUGE
HIGH MESA POND #3	LOWER LEVEL	PRODUCED WATER	47341	EARTHEN BERM, DUAL SYNTHETIC LINERS	PRESSURE TRANSMITTER, VISUAL GAUGE
HIGH MESA POND #4	LOWER LEVEL	PRODUCED WATER	47324	EARTHEN BERM, DUAL SYNTHETIC LINERS	PRESSURE TRANSMITTER, VISUAL GAUGE

* If units differ (i.e. gallons vs. barrels, specify in each individual cell, or convert all to the same unit for the facility.
** Oil storage containers must be constructed appropriately and of materials that are compatible with the material stored and the conditions of storage

Table 4 – Analysis of Equipment Failure

HIGH MESA WATER TREATMENT FACILITY			
Potential Failure	**Spill Direction (Cardinal Direction)**	**Potential Total Volume Released [gallons]**	**Potential Spill Rate [gallons/minute]**
Catastrophic failure of full tank (5000 bbl)	West	210,000	3,000
Partial failure of tank*	West	91,000	1,100
Tank overfill	West	200	20
Pipe fitting failure	West	50	15
Leak fitting or valve	West	50	15
Catastrophic failure of full tank (500 bbl)	West	21,000	3,000
Partial failure of tank	West	1,680	170
Tank overfill	West	200	20
Pipe fitting failure	West	50	15
Leaking fitting or valve	West	50	15
Pond Overfill	West	10,000	1,000
Pipe fitting failure	West	5,000	500
Leaking valve failure	West	1,000	100
Catastrophic failure of water pipeline	West	8,400	500
Slow pipeline leak	West	1,000	75

* See Appendix F Secondary Containment Calculations for assumptions.



Tank #1 ID 81830 SN 8S68801-02 500 BBL D=13.5' H=20' Contents: Condensate/Produced Water	Tank #5 ID T-910 SN 5000 BBL D=45' H=20' Contents: Produced Water
Tank #2 ID T-400 SN none 500 BBL D=13.5' H=20' Contents: DAF Sludge	Tank #6 ID T-930 SN 513A001230 500 BBL D=13.5' H=20' Contents: Sludge
Tank #3 ID T-401 SN none 500 BBL D=13.5' H=20' Contents: Fresh Water	Tank #7 ID T-960 SN 513A001231 500 BBL D=13.5' H=20' Contents: Oil Sales
Tank #4 ID T-920 SN 5000 BBL D=45' H=20' Contents: Produced Water	Tank #8 ID T-940 SN 513A001230 500 BBL D=13.5' H=20' Contents: Sludge

EnCana Oil & Gas (USA) Inc.

Pad: High Mesa Water Facility	
Area: South Parachute	
Legal: SENW Section 36 T7S, R96W, 6th PM	
Date: 01/13/12	Drawn By: C. Jensen
Revision Date:	Scale: none

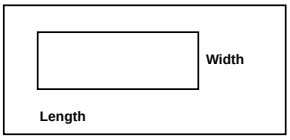
Log of SPCC Plan Amendments

Amendment Date	Summary of Modifications	Management Approval (Signature)	PE Certification (as needed)
2/13/2012	Secondary Containment (9 tank area) upgraded and provided with overflow pipe to ponds		

Secondary Containment Capacity Calculation (Rectangular)

Facility Name:	Middle Fork WTF (Containment C)

25-year 24-hour precipitation event: 2.20 inches



Tank Information

Largest Tank (bbl) (T1)	Tank Diameter (ft)	Tank Deduction (bbl)
5000	45	0.0

Tank #2 (bbl) (T2)	Tank #2 Diameter (ft)	Tank #2 Deduction (bbl)
5000	45	708.2

Tank #3 (bbl) (T3)	Tank #3 Diameter (ft)	Tank #3 Deduction (bbl)
500	13.5	63.7

Tank #4 (bbl) (T4)	Tank #4 Diameter (ft)*	Tank #4 Deduction (bbl)
500	13.5	63.7

Tank #5 (bbl) (T5)	Tank #5 Diameter (ft)	Tank #5 Deduction (bbl)
500	13.5	63.7

Tank #6 (bbl) (T6)	Tank #6 Diameter (ft)	Tank #6 Deduction (bbl)
		0.0

Tank #7 (bbl) (T7)	Tank #7 Diameter (ft)	Tank #7 Deduction (bbl)
		0.0

Tank #8 (bbl) (T8)	Tank #8 Diameter (ft)	Tank #8 Deduction (bbl)
		0.0

Tank #9 (bbl) (ID #1)	Tank #9 Diameter (ft)	Tank #9 Deduction (bbl)
		0.0

Tank #10 (bbl) (ID #1)	Tank Diameter (ft)	Tank #10 Deduction (bbl)
		0.0

Total Tank Deduction (bbl)
899.38

Containment Dimensions

$Length_1$ (ft)
153

$Width_1$ (ft)
61

Containment Height (ft)
2.5

Effective Containment Height (ft) (less 25-yr 24-hr Storm)
2.32

Containment Capacity

Gross Containment Capacity (bbl)
3850.9

Net Containment Capacity (bbl)
2951.6

Is Secondary Containment Adequate for the Largest Vessel = No

High Mesa WTF

Secondary Containment Drain Calculations

Calculations By: Luke Fitzgerald

Signature: _____ **Date:** 12/22/11

Checked By: Randy Potnam

Signature: _____ **Date:** 29 Dec 11

Approved By: James B. Cowart

Digitally signed by James B. Cowart
DN: cn=James B. Cowart, o=EnviroGroup Limited, ou, email=jcowart@envirogroup.com, c=US
Date: 2011.12.28 14:11:52 -07'00'

Signature: _____ **Date:** _____

EnviroGroup Limited
7009 S. Potomac Street, Suite 300
Centennial, CO 80112

High Mesa WTF Secondary Containment Drain Calculations

These calculations will determine if the secondary containment drain pipe at the High Mesa Water Treatment Facility is capable of draining a leak from the largest tank (capacity approx. 5665 bbl) in the containment area. The drainage pipe will transport excess liquid from the secondary containment to the onsite holding pond located downhill and to the west of the containment area. This scenario assumes a 4 in breach in the tank, and determines the maximum flow through this hole at the point that the liquid level inside of the containment reaches the drain pipe. The flow through this hole used the Orifice Flow Equation:

$$Q = A * \sqrt{2 * g * h}$$

Where A is the cross sectional area of the opening, g is gravity, and h is the height of liquid above the hole. (Orifice factor and density of produced water compared to pure water was ignored for this calculation).

The flow through the 8" containment drain pipe was calculated using the Chezy-Manning equation:

$$Q = A * \frac{k}{n} * R_h^{\frac{2}{3}} * \sqrt{S}$$

Where A is the cross sectional are of the pipe, k is the conversion factor constant (1.486 ft/m^1/3), n is the Glauckler-Manning coefficient (value of 0.01 for PVC pipe), R_h is the hydraulic radius (cross sectional area divided by wetted perimeter), and S is the slope (calculated using the change in elevation of the pipe from the inlet to the outlet divided by the horizontal distance traversed by pipe).

The flow through the breach in the tank was determined to be 2.46 ft^3/s, and the maximum flow through the drainage pipe was determined to be 7.65 ft^3/s. Therefore, if a breach of approximately 4" were to occur in the largest tank then the designed drainage pipe would be sufficient to drain excess liquid from the secondary containment to the onsite holding pond.

Calculation of Flow through Pipe

Volume Calculations

153	Length of secondary containment (ft)
61	Width of secondray containment (ft)
9333	Area of Containment (Sqft)
1.6	Height of overflow pipe in secondray containment (ft)
14932.8	Volume in secondary containment below pipe (cuft)
1031.95	Total tank displacement (cuft)
0.18	Depth of 24 hr precipitation event (ft)
1711.05	Volume of precipitation event inside secondary containment (cuft)
12189.80	Available volume below pipe (cuft)
45	Leaking tank Base (ft)
20	Height of liquid in tank (ft)
12.34	Height of liquid in tank when containment filled to overflow pipe(ft)

Displacement Calculations

Tank	Diameter (ft)	Displacement volume (to Pipe Height) cuft
1	45	810
2	13.6	73.98
3	13.6	73.98
4	13.6	73.98

Flow out of Tank (Q = A*sqrt(2*g*h))

4	Diameter of hole from potential tank failure (in)
0.09	Area of hole (sqft)
12.34	Height of water above hole (ft)
2.46	Flow through hole (cfs) <<<No Orifice Factor included

Flow Through Pipe (Mannings Eqn >>> V = (k/n)*(Rh^2/3)*sqrt(S))

0.01	Mannings Coefficient (For Poly Pipe)
1.486	k - constant
5990.6	Elevation at pipe inlet(ft)
5973	Elevation at pipe outlet (ft)
17.6	Delta h (ft)
74.3	Length of pipe (ft)
0.24	Slope (ft/ft)
8	Pipe diameter (in)
0.35	Cross sectional area of pipe (sqft)
2.09	Wetted Perimeter (ft)
0.17	Hydraulic Radius
21.90	Velocity through pipe (fps)
7.65	Flow through pipe (cfs)

Since flowrate through pipe is greater than maximum flow out of tank, pipe design should be sufficient