

FLOWLINE MANAGEMENT PLAN

**MAMM CREEK FIELD
PICEANCE BASIN**

DECEMBER 2018

Prepared for:

**VANGUARD OPERATING, LLC
Silt, Colorado**



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Prepared by:

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TABLE OF CONTENTS

1.0 INTRODUCTION	4
1.1 PURPOSE	4
1.2 PLAN REVIEW AND REVISION PROCESS	4
2.0 REGISTRATION	6
2.1 OFF-LOCATION FLOWLINE REGISTRATION	6
2.1.1 Flowlines Constructed on Or After May 1, 2018	6
2.1.2 Flowline Constructed Before May 1, 2018	6
2.2 DOMESTIC TAP REGISTRATION	7
2.3 PRODUCED WATER TRANSFER SYSTEM REGISTRATION	7
2.3.1 Registration	7
2.3.1.1 Produced Water Transfer System Constructed Before May 1, 2018	7
2.3.1.2 Produced Water Transfer System Constructed After May 1, 2018.....	8
2.3.1.3 Documentation Executed After May 1, 2018	8
3.0 FLOWLINES	9
3.1 MATERIALS	9
3.2 TECHNICAL STANDARDS	9
3.3 DESIGN	9
3.4 INSTALLATION	10
3.5 COVER FOR SUBSURFACE FLOWLINE	11
3.6 TOP SOIL MANAGEMENT AND RECLAMATION	11
3.7 MARKING	12
3.8 MAINTENANCE	12
3.9 REPAIR	12
3.10 OPERATION	12
3.11 CORROSION CONTROL	13
3.11.1 Internal Corrosion.....	13
3.11.2 Cathodic Protection	13
3.12 RECORD KEEPING	13
3.13 ONE CALL	13
3.14 NOTIFICATION OF NOT IN SERVICE LINE	14
4.0 FLOWLINE VALVES	15
4.1 ANNUAL MAINTENANCE OPERATIONS	15

TABLE OF CONTENTS (continued)

4.2	OPERATIONS	15
4.2.1	Isolation Valves.....	15
4.2.2	Check Valves.....	15
5.0	INTEGRITY MANAGEMENT	17
5.1	PRESSURE TESTING	17
5.1.1	Pressure Testing Health & Safety	17
5.1.2	Initial Pressure Testing.....	17
5.1.2.1	Vanguard Initial Pressure Testing Procedure.....	18
5.1.3	Annual and Triennial Pressure Testing	18
5.1.4	Continuous Pressure Monitoring.....	19
5.1.5	Testing Upon Request	19
5.2	BELOW-GROUND DUMP LINES	19
5.3	ABOVE-GROUND ON-LOCATION FLOWLINES	19
5.4	BELOW-GROUND ON-LOCATION FLOWLINES	19
5.5	OFF-LOCATION FLOWLINES	20
5.6	LEAK PROTECTION, DETECTION, AND MONITORING	20
5.6.1	Spill Prevention, Control, and Countermeasure.....	20
5.6.2	Leak Detection Devices.....	20
5.6.3	Emergency Response	21
5.6.4	Root Cause Analysis	21
5.7	AUDIO, VISUAL, OLFACTORY DETECTION SURVEY AND ALTERNATIVE SURVEYS	21
5.8	GAS LEAK REPORTING	21
6.0	ABANDONMENT	23
6.1	LOCKOUT/TAGOUT	23
6.2	ABANDONMENT ACTIVITIES	23
6.3	NOTIFICATION OF ABANDONMENT	23

FIGURES

FIGURE 1 VANGUARD MAMM CREEK FIELD MAP

TABLE OF CONTENTS (continued)

APPENDICES

APPENDIX A	VANGUARD OPERATING, LLC FLOWLINE INSPECTION FORM
APPENDIX B	VANGUARD OPERATING, LLC OFF-LOCATION PRESSURE TESTING FORM
APPENDIX C	VANGUARD OPERATING, LLC ON-LOCATION PRESSURE TESTING FORM
APPENDIX D	VANGUARD FLOWLINE TESTING PROCEDURE

1.0 INTRODUCTION

1.1 PURPOSE

Vanguard Operating, LLC (Vanguard) operates flowlines in the Mamm Creek Field in the Piceance Basin in Colorado. The Vanguard flowline assets are managed and operated in Silt, Colorado. Vanguard does not operate any crude oil transfer lines, so all requirements in the Colorado Oil and Gas Conservation Commission (COGCC) Flowline Rules regarding these lines are not presented in this plan.

The purpose of this plan is to provide Vanguard employees with corporate guidelines on how to comply with the COGCC Flowline Rules which regulates installation, reclamation, operations, maintenance, repair, and abandonment of flowlines.

The primary goal of this plan is to maintain the structural integrity of all pipelines by minimizing those risks that could result in failure of the pipeline and establish appropriate preventative and mitigative actions to protect human health and the environment. This plan will integrate all available information and data in a structured approach to prevent leaks and mitigate the impact of leaks that could impact human health and the environment.

1.2 PLAN REVIEW AND REVISION PROCESS

The Area Engineer is responsible for implementation, review and or revision of this plan. The Operations Manager (or his designee) will review the contents of this plan on an annual basis or when changes to regulation, operations, or maintenance warrant additional review. Plan reviews/revisions will be noted on the Plan Review/Revision Log on page 5 of this plan.

Any revisions to this plan will be immediately distributed to the Integrity Management Team (IMT) for comments or suggestions and approval before being distributed to personnel responsible for pipeline operations. The IMT includes the following Vanguard personnel:

- Area Engineer
- Construction Foreman
- Area Superintendent
- Senior Production Foreman
- Senior Environmental Health and Safety (EHS)/Regulatory Specialist

2.0 REGISTRATION

2.1 OFF-LOCATION FLOWLINE REGISTRATION

Vanguard will register all off-location flowlines constructed on or after May 1, 2018, by submitting a Flowline Report, Form 44, to the COGCC Director (Director) within 30 days after the flowline is placed into service.

An off-location flowline in existence prior to May 1, 2018, will be registered by October 31, 2019. An off-location flowline registered as part of a produced water transfer system is not subject to this requirement.

Within 30 days of modifying the alignment of a registered off-location flowline, Vanguard will report the change to the Director by submitting a Flowline Report, Form 44.

If a document is executed after May 1, 2018, that grants a right of access or easement to locate an off-location flowline on lands, then either the document itself or a memorandum or notice of such document will be recorded by Vanguard in the office of the county clerk and recorder of the county where the lands are located. If the document contains a legal description or map of the access or easement, then the memorandum or notice will include the legal description or map. Upon the surface owner's request, Vanguard shall provide a copy of the recorded document to the surface owner.

2.1.1 Flowlines Constructed on Or After May 1, 2018

Vanguard will include the following information during flowline registration:

- A geodatabase containing the pipeline alignment in the North American Datum of 1983 (NAD 83) with the following attributes: fluid type, material type and pipe size in a format approved by the Director;
- Bedding materials used in construction;
- Pipe material;
- Maximum flowline diameter;
- Fluids that will be transferred;
- Maximum anticipated operating pressure, testing pressure, test date and chart of successful pressure test;
- A layout drawing sufficient to identify the alignment of the flowline, associated oil and gas locations, and existing and proposed pipelines related to the oil and gas locations; and
- Identify and describe the starting and ending oil and gas locations.

2.1.2 Flowline Constructed Before May 1, 2018

Vanguard will include relevant records in its possession or its immediate predecessor in its registration:

- the information required in §2.1.1, and
- the latitude and longitude of the risers.

2.2 DOMESTIC TAP REGISTRATION

Vanguard does not own or operate any domestic taps.

2.3 PRODUCED WATER TRANSFER SYSTEM REGISTRATION

2.3.1 Registration

At least 10 days before beginning construction of a produced water transfer system, Vanguard will register it by submitting a Flowline Report, Form 44, to the Director. The submittal will include a layout drawing sufficient to show its route, its crossings of public by-ways, road crossings, sensitive wildlife habitats, sensitive areas and natural and manmade watercourses and the surrounding topography.

2.3.1.1 Produced Water Transfer System Constructed Before May 1, 2018

Vanguard will register a produced water transfer system by submitting a Flowline Report, Form 44, to the Director by October 31, 2019. The submittal will include the information specified below, to the extent such information is or becomes known by Vanguard or can be acquired from such relevant records in the possession of Vanguard or its immediate predecessor in interest.

- A layout drawing of the facility that sufficiently shows the surrounding topography, location of all associated above-ground equipment and the pipeline centerline from the point of origin to the termination point;
- A geodatabase containing the pipeline alignment and isolation valves in the North American Datum of 1983 (NAD 83) with the following attributes: fluid type, material type and pipe size in a format approved by the Director;
- Specifications:
 - Bedding materials used in construction;
 - Fluids that will be transferred;
 - The maximum anticipated operating pressure, testing pressure, test date, and chart of successful pressure test;
 - The pipe description (i.e., maximum size, grade, wall thickness, coating, standard dimension ratio, and material);
 - The burial depth of the produced water transfer system;
 - Description of corrosion protection;
 - Description of the integrity management system utilized in accordance with COGCC Flowline Rulemaking Final Adopted Rules §1104.f.;

- Description of the construction method used for public by-ways, road crossings, sensitive wildlife habitats, sensitive areas and natural and manmade watercourses (i.e., open trench, bored and cased, or bored only); and
- An affidavit of completion stating Vanguard designed and installed the produced water transfer system in compliance with the COGCC Flowline Rulemaking Final Adopted Rules §1100 Series rules

2.3.1.2 Produced Water Transfer System Constructed After May 1, 2018

Vanguard will submit a Flowline Report, Form 44, within 30 days of placing it into service to include the following information as listed above in § 2.3.1.1.

2.3.1.3 Documentation Executed After May 1, 2018

If a document is executed after May 1, 2018, that grants a right of access or easement to locate a produced water system on lands, then either the document itself or a memorandum or notice of such document will be recorded by Vanguard in the office of the county clerk and recorder of the county where the lands are located. If the document contains a legal description or map of the access or easement, then the memorandum or notice will include the legal description or map. Upon the surface owner's request, Vanguard shall provide a copy of the recorded document to the surface owner.

3.0 FLOWLINES

3.1 MATERIALS

Materials for pipe and pipe components will be able to maintain the structural integrity of the flowline under anticipated operating temperature, pressure, and other operating conditions compatible with the substances to be transported.

3.2 TECHNICAL STANDARDS

Each component of a flowline installed or repaired on or after May 1, 2018, will meet one of the following standards appropriate for the component:

- American Society of Mechanical Engineers (ASME), Pipeline Transportation Systems for Liquids and Slurries, 2016 Edition (ASME B31.4-2016);
- ASME Gas Transmission and Distribution Piping Systems, 2016 Edition (ASME B31.8-2016);
- ASME Process Piping, 2016 Edition (ASME 31.3-2016);
- API Specification 15S, Spool-able Reinforced Plastic Line Pipe, Second Edition, March 2016 (API Specification 15S);
- API Specification 15HR, High-pressure Fiberglass Line Pipe, Fourth Edition, February 2016 (API Specification 15HR); or
- API Specification 15LR (R2013), Low Pressure Fiberglass Line Pipe and Fittings, Seventh Edition, August 2001(API Specification 15LR).

Hard copies of the above standards are located in the Vanguard office in Silt, Colorado. Later editions of the above standards will not be used as technical standards.

3.3 DESIGN

Each component of a flowline will be designed to:

- Prevent failure by minimizing internal or external corrosion and the effects of transported fluids;
- Withstand maximum anticipated operating pressures and other internal loadings without impairment;
- Withstand anticipated external pressures and loads that will be imposed on the pipe after installation;
- Allow for line maintenance, periodic line cleaning, and integrity testing; and
- Have adequate controls and protective equipment to prevent it from operating above the maximum operating pressure.

3.4 INSTALLATION

Installation crews will be trained in flowline installation practices for which they are tasked to perform.

All workers performing welding on steel lines in pressure service, will be certified in accordance with:

- API Standard 1104, Welding of Pipelines and Related Facilities, Twenty First Edition, September 2013; and,
- ASME BPV Code 2017 Section IX -Welding, Brazing and Fusing Qualification.

Hard copies of the above standards are located in the Vanguard office in Silt, Colorado. Later editions of the above standards will not be used as technical standards.

Non-destructive testing of welds for newly constructed steel off-location flowlines will be done in accordance with one of the following:

- Those standards established by the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration pursuant to 49 C.F.R. § 192.243 and 49 C.F.R. § 195.234, in existence as of the date of this regulation, and no later amendments; or,
- One of the standards set forth in COGCC Flowline Rulemaking Final Adopted Rules §1102.b. or 1102.d (2) A. and B.

Hard copies of the above standards are located in the Vanguard office in Silt, Colorado.

Non-destructive testing is not required for repairs of existing steel off-location flowlines.

No pipe or other component may be installed unless it has been visually inspected at the site of installation to ensure that it is not damaged.

Pipes will be locatable by a tracer line or location device placed adjacent to or in the trench of a buried nonmetallic flowline.

Flowlines will be installed in a manner that minimizes interference with agriculture, road and utility construction, the introduction of secondary stresses, and the possibility of damage to the pipe.

The pipe will be handled in a manner that minimizes stress and avoids physical damage to the pipe during stringing, joining, or lowering in. During the lowering in process the pipe string will be properly supported so as not to induce excess stresses on the pipe or the pipe joints or cause weakening or damage to the outer surface of the pipe.

Flowlines that cross a municipality, county, or state graded road will be bored unless the responsible governing agency specifically permits Vanguard to open cut the road.

Flowlines will be installed pursuant to the manufacturer's procedures and practices. In the absence of applicable manufacturer's procedures, the following requirements apply:

- Pipeline trenches will be constructed to allow the pipeline to rest on undisturbed native soil and provide continuous support along the length of the pipe;
- Trench bottoms will be free of rocks greater than two inches in diameter, debris, trash, and other foreign material not required for pipeline installation; and
- Over excavated trench bottoms will be backfilled with appropriate material and compacted prior to installation of the pipe to provide continuous support along the length of the pipe.

The width of the trench will provide adequate clearance on each side of the pipe. Trench walls will be excavated to ensure minimal sluffing of sidewall material into the trench. Subsoil from the excavated trench will be stockpiled separately from previously stripped topsoil.

A flowline trench will be backfilled in a manner that provides firm support under the pipe and prevents damage to the pipe and pipe coating from equipment or from the backfill material. Sufficient backfill material will be placed in the pipe springline to provide long-term support for the pipe. Backfill material that will be within two feet of the pipe will be free of rocks greater than two inches in diameter and foreign debris. Backfilling material will be compacted as appropriate during placement in a manner that provides support for the pipe and reduces the potential for damage to the pipe and pipe joints.

Flowlines that traverse sensitive wildlife habitats or sensitive areas, such as wetlands, streams, or other surface waterbodies, must be installed in a manner that minimizes impacts to these areas.

3.5 COVER FOR SUBSURFACE FLOWLINE

All installed flowlines will have cover sufficient to protect them from damage. On cropland, all flowlines will have a minimum cover of three feet.

Where an underground structure, geologic, or other uncontrollable condition prevents a flowline from being installed with minimum cover, or when there is a written agreement between the surface owner and Vanguard specifying flowline cover depth, it may be installed with less than minimum cover or above-ground.

3.6 TOP SOIL MANAGEMENT AND RECLAMATION

When flowlines cross croplands, unless waived by the surface owner, Vanguard will segregate topsoil while trenching, and backfill trenches so that the soils will be returned to their original relative positions and contour. This requirement to segregate and backfill topsoil does not apply to trenches which are 12 inches or less in width. Vanguard will make reasonable efforts to install flowlines parallel to crop irrigation rows on flood irrigated land.

All trenches will be maintained to correct subsidence and reasonably minimize erosion.

Interim and final reclamation, including revegetation, will be performed in accordance with the applicable COGCC Flowline Rulemaking Final Adopted Rules §1000 Series rules.

3.7 MARKING

In Designated Setback Locations, and where crossing public rights-of-way or utility easement crossings, Vanguard will install and maintain markers that identify the location of flowlines. These markers will be placed in a manner to reduce the possibility of damage or interference with surface use but need not be placed where impracticable or if the landowner does not grant permission.

The marker will include the following language:

"Warning", "Caution" or "Danger" followed by the words "gas or petroleum (or name of gas or fluid transported) in the flowline" along with "Vanguard" and the On-Call phone number. The letters will be legible, written on a background of sharply contrasting color and on each side with at least one inch high with one-quarter inch stroke.

3.8 MAINTENANCE

Vanguard will take reasonable precautions to prevent failures and leakage, and minimize corrosion of flowlines.

Whenever Vanguard discovers any condition that could adversely affect the safe and proper operation of a flowline, Vanguard will correct the condition as soon as possible. However, if the condition presents an immediate hazard to persons or property, Vanguard may not operate the affected segment until the condition has been corrected.

Any flowline not actively in use will have isolation valves locked and tagged out.

3.9 REPAIR

Vanguard will make repairs in a safe manner that prevents injury to persons and damage to equipment and property.

Vanguard may not use any pipe, valve, or fitting to repair a flowline unless the component meets the installation requirements of the COGCC Flowline Rulemaking Final Adopted §1100 Series rules for the repaired segment. For a flowline installed prior to May 1, 2018 that undergoes a major modification or change in service after May 1, 2018, the segment repaired will satisfy all applicable requirements of the COGCC Flowline Rulemaking Final Adopted §1100 Series rules before Vanguard can return the flowline to service.

Vanguard may not use any pipe, valve, or fitting for replacement or repair of a flowline unless it is designed to the maximum anticipated operating pressure.

3.10 OPERATION

No flowline may be operated until it has demonstrated compliance with COGCC Flowline Rulemaking Final Adopted Rules §1104, Integrity Management and §5.0 of this plan.

The maximum operating pressure for a flowline may not exceed the manufacturer's specifications of the pipe or the manufacturer's specifications of any other component of it, whichever is less.

3.11 CORROSION CONTROL

3.11.1 Internal Corrosion

All coated pipe for underground service will be electronically inspected prior to installation using coating deficiency (i.e. scratch, bubble, and “holiday”) detectors to check for any faults not observable by visual examination. The detector will operate in accordance with manufacturer's instructions and at a voltage level appropriate for the electrical characteristics of the pipeline being tested. Corrosion and metal loss detection tools may include, but are not limited to high resolution magnetic flux leakage (MFL), transverse MFL, and ultrasonic (compressed wave).

During installation all joints, fittings, and tie-ins will be coated with materials compatible with the coatings on the pipe. Coating materials will:

- Be designed to mitigate corrosion of the buried pipe;
- Have sufficient adhesion to the metal surface to prevent under film migration of moisture;
- Be sufficiently ductile to resist cracking;
- Have enough strength to resist damage due to handling and soil stress;
- Support any supplemental cathodic protection; and
- If the coating is an insulating type, have low moisture absorption and provide high electrical resistance.

Vanguard will take prompt remedial action to correct any abnormal internal corrosion. Remedial action may include increased pigging, using corrosion inhibitors, coating the internal pipeline (e.g. an epoxy paint or other plastic liner), replacing the section of pipe, or a combination of these actions. All observations and measurements will be documented in the Flowline Inspection Field Form (Appendix A).

3.11.2 Cathodic Protection

Cathodic protection systems will meet or exceed the minimum criteria set forth in the National Association of Corrosion Engineers (NACE) standard practice SP0169-2007 (formerly RP0169), Control of External Corrosion on Underground or Submerged Metallic Piping Systems, 2007 Edition (NACE SP0169-2007), and no later editions of the standard.

3.12 RECORD KEEPING

Vanguard will maintain records of flowline size, route, materials, maximum anticipated operating pressure, pressure or other integrity test results, inspections, repairs, and integrity management documentation for the life of the flowline (including idle flowlines) in the Vanguard GIS system. These records are to be transferred with a change of operator.

3.13 ONE CALL

Vanguard is a Tier One member of the Utility Notification Center of Colorado (UNCC) and participates in Colorado's One Call notification system.

Vanguard will include its UNCC member code (VNGRDOP1) when submitting an Operator Registration, Form 1, Change of Operator, Form 10, Gas Facility Registration, Form 12, or Flowline Report, Form 44.

Within 30 days of completing an asset purchase, a transfer, construction, or relocation of a flowline, Vanguard will update the location information with the UNCC.

Vanguard's registration with the Commission grants the Director permission to access information Vanguard submits to UNCC about its oil and gas facilities.

3.14 NOTIFICATION OF NOT IN SERVICE LINE

Vanguard will submit a Flowline Report, Form 44, to the Director identifying the off-location flowline or segment thereof that has been removed from service for more than one year. The Form 44 will be submitted within 30 days after the one-year anniversary of Vanguard removing the line from service.

4.0 FLOWLINE VALVES

4.1 ANNUAL MAINTENANCE OPERATIONS

Vanguard will annually conduct one of the following maintenance operations on all isolation valves:

- Perform a function test, or
- Maintain the isolation valve in accordance with its manufacturer's specifications.

Vanguard will repair or replace isolation valves that are not fully operable.

On-location manifold, peripheral and process piping flowlines are exempt from the annual maintenance operations.

4.2 OPERATIONS

Any valve, flange, fitting or other component installed after May 1, 2018 that is connected to a flowline will have a manufacturer's rating that is equal to or greater than the maximum anticipated operating pressure.

4.2.1 Isolation Valves

For all flowlines constructed after May 1, 2018, an isolation valve will be installed at each of the following locations before operation:

- On the suction end and the discharge end of a pump station in a manner that permits isolation of the pump station equipment in the event of an emergency;
- On each flowline entering or leaving a breakout tank in a manner that permits isolation of the breakout tank from other facilities;
- At locations along a flowline that will minimize damage or pollution from accidental discharge of hydrocarbons or Exploration and Production (E&P) Waste, as appropriate for the terrain in open country or for populated areas;
- On each side of a flowline crossing a Rule 317B Public Water System defined water supply or a waterbody that is more than 100 feet (30 meters) wide from high-water mark to high-water mark; and
- On each side of a flowline crossing a reservoir storing water for human consumption.

Flowlines constructed before May 1, 2018, will be retrofitted with isolation valves at each of the locations identified in the list above by October 31, 2019. On-location manifold, peripheral and process piping flowlines are exempt from the retrofit provisions set forth in this section.

4.2.2 Check Valves

1. Where Vanguard produces two or more wells through a common flowline, separator, or manifold, Vanguard will equip each flowline leading from a well to the common

flowline, separator, or manifold with a check valve or other comparable reverse flow prevention mechanism.

2. The check valve or other comparable reverse flow prevention mechanism will be installed to permit fluids to move from the well to the common flowline, separator, or manifold and to prevent any fluid from entering the well through the flowline.
3. Vanguard will keep all check valves or other comparable reverse flow mechanisms in good working order.
4. Upon the Director's request, Vanguard will test the operation of the check valve or other comparable reverse flow mechanism.

The requirements set forth in subsection (1) and (2) above, apply only to those check valves or comparable reverse flow mechanisms installed after May 1, 2018. Existing check valves or comparable reverse flow mechanisms will comply with subsection (3) and (4) above.

5.0 INTEGRITY MANAGEMENT

5.1 PRESSURE TESTING

The Flowline Testing Procedure for flowline pressure testing is located at the Vanguard office in Silt, Colorado and a copy of this procedure is included in Appendix D. Pressure test data is kept at the Vanguard office in Silt, Colorado.

Whenever possible, testing should be conducted during period of stable temperature and atmospheric pressure. Testing during morning and evening hours should be avoided.

If conducting initial pressure test by hydrostatic testing, contact the Vanguard EHS representative prior to discharge or disposal of any hydrostatic test water to ensure proper disposal methods are used.

5.1.1 Pressure Testing Health & Safety

The following health and safety measures are in place during pressure testing:

- The facility will remain manned at all times during the testing.
- Spill response materials (spill kits and hand tools) will be on location at all times during the test.
- Means of immediate communication such as cell phone or radio must be present on location at all times.
- Contact Supervisor and EHS representative immediately, if any indication of a leak is discovered during the test.
- If pressure test fails, the pressure source and flowline will immediately be shut in and leak inspection activities will commence.

5.1.2 Initial Pressure Testing

Prior to operating any newly installed segment of flowline, Vanguard will test the line to at least maximum anticipated operating pressure and demonstrate integrity. In conducting tests, Vanguard will ensure that reasonable precautions are taken to protect its employees and the general public. Vanguard may use a hydrostatic test or conduct the test using inert gas or wellhead pressure sources and well bore fluids, including gas, in accordance with one of the applicable standards below:

- American Society of Mechanical Engineers (ASME), Process Piping, 2016 Edition (ASME 31.3-2016);
- ASME Pipeline Transportation Systems for Liquids and Slurries, 2016 Edition (ASME B31.4-2016);
- ASME Gas Transmission and Distribution Piping Systems, 2016 Edition (ASME B31.8-2016);

- API Specification 15S, Spoolable Reinforced Plastic Line Pipe, Second Edition, March 2016 (API Specification 15S);
- API Specification 15LR (R2013), Low Pressure Fiberglass Line Pipe and Fittings, Seventh Edition, August 2001(API Specification 15LR);
- API RP 1110, Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide (6th Ed., February 1, 2013) (API RP 1110); or
- ASTM F2164-13, Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure, or manufacturer's recommendations and will test the line to at least maximum anticipated operating pressure.

Hard copies of the above standards are located in the Vanguard office in Silt, Colorado. No earlier editions will be used for the above applicable standards.

5.1.2.1 Vanguard Initial Pressure Testing Procedure

The basic steps for an initial pressure test consist of the following:

1. Establish test pressure by determining maximum anticipated operating pressure for the flow line segment to be tested.
2. The duration of the pressure test must be at least 30 minutes only after the flow line pressure has stabilized.
3. Pressurize the line to maximum anticipated operating pressure, allow line pressure to stabilize and monitor pressure for prescribed duration of the test.
4. Compare results to pressure test acceptance criteria. The pressure loss shall not exceed 10% and the pressure must be stable for the last five minutes of the test to be deemed a successful test.
5. Document test results in Off-Location Flowline Pressure Testing Form (APPENDIX B) and On-Location Flowline Pressure Testing Form (APPENDIX C).
6. Maintain test records in Vanguard facility in Silt, Colorado.

5.1.3 Annual and Triennial Pressure Testing

For annual or triennial pressure tests conducted to meet the following requirements:

- A pressure test will test to at least the maximum operating pressure (MOP) and run for 30 minutes once the pressure has stabilized.
- The test fluid will be well fluids, natural gas or fresh water.
- A successful test will demonstrate the line does not leak, that pressure loss does not exceed 10% for the 30 minutes test, and the fluid pressure is stable for the last five minutes of the pressure test.

5.1.4 Continuous Pressure Monitoring

In some instances, Vanguard uses supervisory control and data acquisition (SCADA) for continuous pressure monitoring. The program ensures:

- Pressure data are monitored continuously, i.e., 24 hours per day and 7 days a week, and the monitoring is sufficiently sophisticated to identify flowline integrity or pressure anomalies;
- Systems are capable of being shut-in for repairs immediately upon discovery of a suspected leak, either through automation or a documented, manual process; and
- Vanguard documents the continuous monitoring program, including suspected or identified integrity.

5.1.5 Testing Upon Request

Vanguard will conduct an integrity test of any segment of flowline at any time upon request of the Director.

5.2 BELOW-GROUND DUMP LINES

Vanguard will verify integrity of below-ground dump lines by performing an annual pressure test to maximum anticipated operating pressure and a monthly audio, visual, olfactory (AVO) detection survey of the entire line. Documentation of the AVO surveys are entered into the Field Data Gathering software program.

5.3 ABOVE-GROUND ON-LOCATION FLOWLINES

Vanguard will verify the integrity of above-ground on-location flowlines by performing a monthly AVO detection survey of the entire line. Documentation of the AVO surveys are entered into the Field Data Gathering software program.

5.4 BELOW-GROUND ON-LOCATION FLOWLINES

For any below-ground on-location flowlines not subject to §5.2 or 5.3 above, Vanguard will adhere to one of the following integrity management programs:

- Pressure test to maximum anticipated operating pressure every three years;
- Continuous pressure monitoring; or
- Annual instrument monitoring conducted pursuant to COGCC Flowline Rulemaking Final Adopted Rules §1104.j.(2).

If Vanguard elects to use smart pigging to comply with this section, the smart pig will be able to measure flowline wall thickness, and measure for flowline defects that could affect integrity, including measurement of metal loss. If no geodatabase file of the flowline exists, the smart pig will have GPS capabilities to the extent such capabilities do not materially compromise the ability of the smart pig to conduct the integrity testing required by this section.

5.5 OFF-LOCATION FLOWLINES

For all off-location flowlines, but not including off-location produced water flowlines, Vanguard will adhere to one of the following integrity management programs:

- An annual pressure test to maximum anticipated operating pressure;
- Continuous pressure monitoring;
- Smart pigging conducted every three years; or
- Annual instrument monitoring conducted pursuant to COGCC Flowline Rulemaking Final Adopted Rules §Rule 1104.j.(2).

For off-location below ground produced water flowlines, Vanguard will adhere to one of the following integrity management programs:

- An annual pressure test to maximum anticipated operating pressure;
- Continuous pressure monitoring; or
- Smart pigging conducted every three years.

For above ground off-location produced water flowlines, Vanguard may use any of the options listed in COGCC Flowline Rulemaking Final Adopted Rules §1104.f.(2), or monthly AVO inspections.

If Vanguard elects to use smart pigging to comply with this section, the smart pig will be able to measure flowline wall thickness, and measure for flowline defects that could affect integrity, including measurement of metal loss. If no geodatabase file of the flowline exists, the smart pig will have GPS capabilities to the extent such capabilities do not materially compromise the ability of the smart pig to conduct the integrity testing required by this section.

5.6 LEAK PROTECTION, DETECTION, AND MONITORING

Vanguard does not own or operate any crude oil transfer lines and thus a Leak Protection and Monitoring Plan is not attached.

5.6.1 Spill Prevention, Control, and Countermeasure

Vanguard has developed a Spill Prevention, Control, and Countermeasure (SPCC) program and plans are kept at the Vanguard office in Silt, Colorado. SPCC inspections are conducted on an annual basis and any time there is an equipment change at a facility.

5.6.2 Leak Detection Devices

Vanguard conducts soap tests and FLIR camera inspections to detect leaks on existing pipelines. A holiday detector is used to detect holes or discontinuities in the pipe coating on newly installed lines before burial.

5.6.3 Emergency Response

Vanguard works to prevent emergency situations from occurring, by following safe operating procedures, preventive maintenance procedures, and good housekeeping procedures. Plans, resources, and execution remain the key elements of emergency preparedness.

Vanguard has a spill response trailer strategically placed in the field at all times. Vanguard can address smaller spills. Third party contractors specializing in larger scale releases and repair are contracted through Vanguard.

5.6.4 Root Cause Analysis

In the event of a release and after emergency response has been conducted, Vanguard will conduct a Root Cause Analysis (RCA). The primary aim of RCA is to:

- Identify the factor(s) that resulted in the nature, the magnitude, the location, and the timing of the release;
- Determine what behaviors, actions, inactions, or conditions need to be changed; to prevent recurrence of similar outcomes; and
- Identify lessons that may promote the achievement of better consequences.

5.7 AUDIO, VISUAL, OLFACTORY DETECTION SURVEY AND ALTERNATIVE SURVEYS

When performing an AVO detection survey on all on-location flowlines, Vanguard will survey the entire flowline length using audio, visual and olfactory techniques to detect integrity failures, leaks, spills, or releases, or signs of a leak, spill, or release like stressed vegetation or soil discoloration. AVO detection surveys are conducted on a monthly basis at minimum or more frequently in some cases. Documentation of the AVO surveys are entered into the Field Data Gathering software program.

Where the regulations permit, Vanguard also may conduct a survey using an instrument monitoring method (IMM) capable of detecting integrity failures, leaks, spills or releases, or signs of a leak, spill or release.

For either survey method, Vanguard will document the date and time of the survey, the detection methodology, if any, used and the name of the employee who conducted the survey in the Field Data Gathering software.

5.8 GAS LEAK REPORTING

Vanguard will initially report a Grade 1 Gas Leak from a flowline to the Director and to the local governmental designee of the jurisdiction in which the Grade 1 Gas Leak occurred verbally or in writing using a Flowline Report, Form 44, as soon as practicable, but no more than six hours after discovery.

The initial report to the Director and to the local governmental designee will include, at a minimum, the location of the gas leak and any additional information related to the leak's cause, status, or impacts known to Vanguard.

If Vanguard initially reported the leak verbally, Vanguard will submit a Flowline Report, Form 44, that includes at a minimum, the location of the gas leak and any additional information related to the leak's cause, status, or impacts as soon as practicable but not later than 72 hours after discovery of the gas leak unless extended by the Director.

Within 10 calendar days of discovering the gas leak, Vanguard will provide a supplemental report by submitting a Flowline Report, Form 44, to the Director and to the local governmental designee. The supplemental report will include:

- A topographic map showing the governmental section and location of the leak or an aerial photograph showing the location of the leak;
- All pertinent information about the gas leak known to Vanguard that has not been reported previously in writing, including corrective actions; and
- Information relating to the initial mitigation, site investigation, and remediation measures conducted by Vanguard.

The Director may require further supplemental reports or additional information.

6.0 ABANDONMENT

A flowline remains subject to all of the requirements in Rules 1101 through 1104 until Vanguard completes all abandonment requirements set forth below.

6.1 LOCKOUT/TAGOUT

Upon removing a flowline from service, Vanguard will immediately lockout or tag out the risers while Vanguard is in the process of abandoning the pipeline. Lockout and tagout devices will stay in place at all times during the process of abandoning the flowline until Vanguard removes the riser.

A tagout device is a prominent warning device, such as a tag, that will not deteriorate or become illegible with exposure to weather conditions or wet and damp locations. The tagout device will include:

- An instruction to not operate the equipment;
- Date of the last successful integrity test;
- Reason for tagging out the equipment; and
- Be color coded per ASME Scheme for the Identification of Piping Systems, 2015 Edition (A13.1- 2015), and no later editions of the standard.

6.2 ABANDONMENT ACTIVITIES

For abandonment, Vanguard will permanently remove a flowline from service by physically separating it from all sources of fluids or pressure within the time frame set forth in COGCC Flowline Rulemaking Final Adopted Rules §1004.a. Abandonment will also comply with one of the following:

- Abandonment in place. Vanguard will:
 - Purge the flowline of any liquids;
 - Deplete the flowline to atmospheric pressure;
 - Cut the flowline's risers to three (3) feet below grade or to the depth of the flowline, whichever is shallower;
 - Seal the ends of the flowline below grade; and
 - Remove above-ground cathodic protection and equipment associated with the riser.
- Vanguard will remove the flowline and its risers, the riser associated with cathodic protection, and above-ground equipment.

6.3 NOTIFICATION OF ABANDONMENT

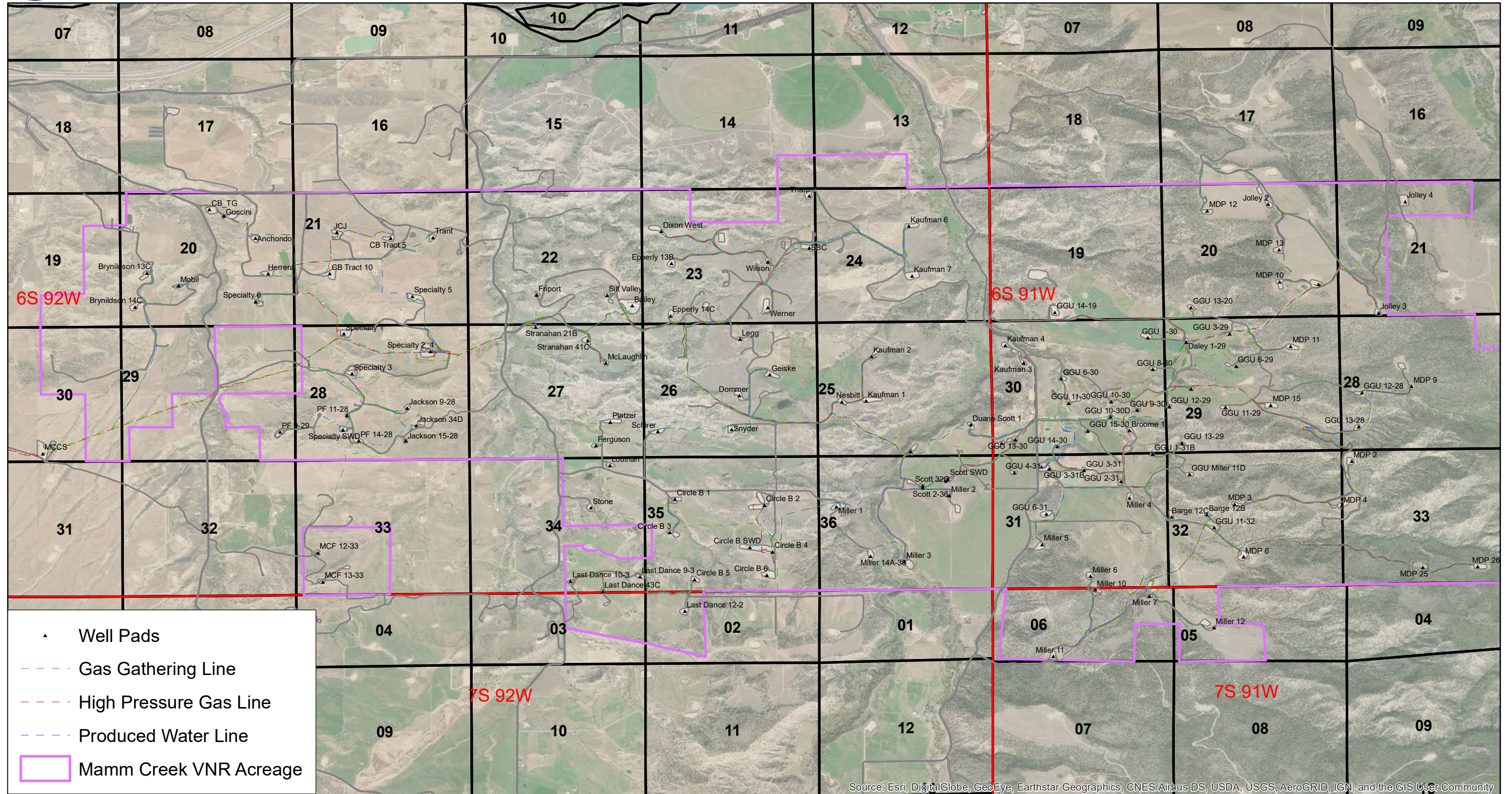
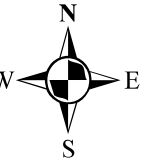
Within 30 days of Vanguard completing abandonment requirements for an off-location flowline Vanguard will submit a Flowline Report, Form 44, to the Director. If Vanguard abandons an off-

location flowline and has not submitted latitude and longitude for the flowline's risers, the Flowline Report, Form 44, will include this information.

The Director will provide a Flowline Report, Form 44, for an off-location flowline abandonment to the appropriate Local Governmental Designee and UNCC.

FIGURE
VANGUARD MAMM CREEK FIELD MAP

Piceance Mamm Creek Field



- ▲ Well Pads
- - - Gas Gathering Line
- - - High Pressure Gas Line
- - - Produced Water Line
- Mamm Creek VNR Acreage

APPENDIX A

VANGUARD FLOWLINE INSPECTION FIELD FORM

Vanguard Operating, LLC. Flowline Inspection Field Form

Section 1: Site Information

Pipeline Section:		Latitude:		Longitude:		Section, Township, Range:	
Date of Inspection:		Inspection Type:	<input type="checkbox"/> Initial <input type="checkbox"/> Periodic				
Method used for inspection (i.e. Method 21, IR Camera, AVO, etc.):							
Name of person completing inspection:				Title:		Phone:	

Section 2: AVO and FLIR Inspection Details

Auditory, Visual, and Olfactory Inspection (circle all that apply):

Auditory	hissing	clanking	Other:
Visual	staining	dead vegetation	Other:
	external corrosion	ground disturbance	
Olfactory	HS Odor	H2S Odor	Other:

FLIR Inspection:

FLIR Calibration:		Date:	
		Time:	
4-Gas Calibration:		Date:	
		Time:	
Calibration Gas		Calibration Reading	
O ₂	18%	O ₂	
CO	50 ppm	CO	
LEL	50%	LEL	
H ₂ S	10 ppm	H ₂ S	

Section 3: Summary of Leaking Components

Summary of Leaking Components	# Leaks
Component Type:	
Valves:	
Connections:	
Flanges:	
Pressure Regulations:	
Pressure Relief Devices (PRD):	
Other:	
TOTAL:	

Section 4: Leaking Components Details

Monitoring and Repair of Leaking Components

Component ID	Description of Leaking Components	Monitoring Method Used	FLIR Video ID	FID (ppm)	Date(s) of Repair	Date(s) of Remonitoring	Result(s) of Remonitoring	Date of Successful Repair	Repair Delayed?
									<input type="checkbox"/>
									<input type="checkbox"/>
									<input type="checkbox"/>
									<input type="checkbox"/>
									<input type="checkbox"/>
									<input type="checkbox"/>



APPENDIX B

VANGUARD OFF-LOCATION FLOWLINE PRESSURE TESTING FORM

Vanguard Operating, LLC

Off-Location Flowline Pressure Testing Form

Section 1: Site Information

Pipeline Section:	Latitude:	Longitude:	Section, Township, Range:
Date of Pressure Testing:	Contents of Pipe:		<input type="checkbox"/> Initial <input type="checkbox"/> Annual <input type="checkbox"/> Other
Name of person completing testing:	Title:	Phone:	

Section 2: Pressure Test Details

Type of Pressure Test:			
Line size:	Maximum Allowable Operating Pressure (MAOP):		
Test Duration:	Test Pressure:		

Section 3: Pressure Test Results

Pressure Loss:			
10% of MAOP:			
Successful Test?:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Actions taken if not successful test:			

*Pressure testing data are recorded in Microsoft Excel and kept at the Vanguard facility in Silt, Colorado.



APPENDIX C

VANGUARD ON-LOCATION FLOWLINE PRESSURE TESTING FORM

APPENDIX D
VANGUARD FLOWLINE TESTING PROCEDURE



Flowline Testing Procedure

Mamm Creek Field

Piceance Basin

Garfield County, Colorado

January 22, 2015

Revision 1: January 3rd, 2017

Revision 2: June 13th, 2018

Introduction and Purpose

The Flowline Integrity Testing Procedure was developed in accordance with Colorado Oil and Gas Conservation Commission (COGCC) 1100 series and COGCC Operator Guidance documents. This document outlines the procedures to conduct pressure tests of both new and existing flowlines in gas or oil service and should be used in accordance with regular visual observations of flow line condition and operation. The basic steps to be followed in an initial, annual or triennial test consist of the following:

- Establish test pressure by determining maximum anticipated operating pressure (MAOP) or maximum operating pressure (MOP) for the flow line segment to be tested;
- The duration of the pressure test must be at least 30 minutes only after the flow line pressure has stabilized;
- Pressurize the line to the MAOP or MOP, allow line pressure to stabilize and monitor pressure for prescribed duration of the test;
- Compare results to pressure test acceptance criteria. The pressure loss shall not exceed 10% and the pressure must be stable for the last five minutes of the test to be deemed a successful test;
- Document test results in Off-Location Flowline Pressure Testing Form (APPENDIX B of the Flowline Management Plan) and On-Location Flowline Pressure Testing Form (APPENDIX C of the Flowline Management Plan); and
- Maintain test records in Vanguard facility in Silt, Colorado.

The intent of this pressure testing protocol is designed as a leak detection test. The pressure testing described in this protocol is not designed to establish MAOP or other operating pressure limits.

Determination of Test Pressure

Flowlines shall be pressure tested at or above MOP. MOP shall be determined for each flow line segment based on historical operating data. For new installations, MAOP shall be determined based on operational data from nearby operating facilities and/or operational knowledge.

Determination of Test Duration

All tests will be 30 minutes in duration once the pressure has stabilized.

Acceptance Criteria

The pressure loss shall not exceed 10% and the pressure must be stable for the last five minutes of the test to be deemed a successful test.

Additional Considerations

- Whenever possible testing should be conducted during periods of stable temperature and atmospheric pressure. Testing during morning and evening hours should be avoided;
- If conducting initial pressure test by hydrostatic testing, contact EHS representative prior to discharge or disposal of any hydrostatic test water to ensure proper disposal methods are utilized;
- Facilities must remain manned at all times during testing;
- Spill response materials (e.g. spill kits and hand tools) must be on location at all times during leak testing;
- Means of immediate communication such as cell phone or radio must be present on location at all times; and
- Contact Supervisor and EHS representatives immediately, if any indication of a leak is discovered during the test.

Testing Procedures

1. Locate valves that will isolate the section of pipeline to be pressure tested. Ensure valves have appropriate rating and integrity.
2. Install a calibrated pressure gauge or utilize calibrated pressure transducer near the upstream valve that will be shut-in when pressure builds to MOP.
3. Gradually close downstream valve and let the well (or pump in case of initial pressure test) gradually pressurize the flow line to MOP. Shut well in (if flowing), artificial lift system, or pump when desired pressure is attained.
4. Shut-in the upstream valve to isolate the section being tested.
5. Allow time for the flow line pressure to stabilize prior to beginning the test. Liquid flow lines with entrained gas or air may take longer to stabilize.
6. Monitor pressure gauge or SCADA trending for prescribed duration of the test. Document test results in Off-Location Flowline Pressure Testing Form (APPENDIX B of the Flowline Management Plan) and On-Location Flowline Pressure Testing Form (APPENDIX C of the Flowline Management Plan).
7. If, at any time, a pressure drop in excess of the allowable decrease is identified, terminate the test, shut in the well, and immediately contact Supervisor and EHS representative.
8. Repeat procedure for each segment of flowline up to delivery point or custody transfer.

9. Open downstream valve.
10. Open upstream valve.
11. Remove pressure gauge and replace cap or plug.
12. Open well and/or start artificial lift equipment and return well to production.
13. Turn in testing forms to your supervisor.

Flowline Inspections

- Each facility is visited on a daily basis as part of our production operations. During these daily visits, each facility and the associated flowlines are inspected to ensure normal operating conditions;
- Audio, Visual, Olfactory (AVO) detection surveys are to be conducted on a monthly basis at minimum or more frequently in some cases. Documentation of the AVO surveys must be entered into the Field Data Gathering software program;
- Monthly inspections (excluding winter months) are performed by supervisory staff to ensure overall compliance and look for any signs of leaks and or potential leaks;
- Annual SPCC inspections are performed for every location and include examining flow line path for signs of leaks; and
- FLIR surveys are performed twice per year and used to identify any leaks from the both on and off location flowlines.

Recordkeeping

Records of all flowline tests and any necessary repairs will be kept in Vanguard's Silt, Colorado office. Any spills of E&P fluids associated with a flowline release or leak that reach or are suspected to reach a reportable quantity, will be reported to the appropriate agencies. The release will be investigated to determine a root cause and the actions will be taken to reduce or prevent reoccurrences.